

Oracle® Database

PL/SQL Packages and Types Reference



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Preface

This Preface contains these topics:

- [Audience](#)
- [Related Documents](#)
- [Conventions](#)

Audience

Oracle Database PL/SQL Packages and Types Reference is intended for programmers, systems analysts, project managers, and others interested in developing database applications. This manual assumes a working knowledge of application programming and familiarity with SQL to access information in relational database systems. Some sections also assume a knowledge of basic object-oriented programming.

Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc>.

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Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info> or visit <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs> if you are hearing impaired.

Related Documents

For more information, see the following documents:

- *Oracle Database Development Guide*
- *Oracle Database PL/SQL Language Reference*

Many of the examples in this book use the sample schemas, which are installed by default when you select the Basic Installation option with an Oracle Database installation. Refer to *Oracle Database Sample Schemas* for information on how these schemas were created and how you can use them yourself.

Printed documentation is available for sale in the Oracle Store at

<http://shop.oracle.com/>

To download free release notes, installation documentation, technical briefs, or other collateral, please visit the Oracle Technology Network (OTN).

<http://docs.oracle.com/>

Conventions

This section describes the conventions used in the text and code examples of this documentation set. It describes:

- [Conventions in Text](#)
- [Conventions in Code Examples](#)

Conventions in Text

We use various conventions in text to help you more quickly identify special terms. The following table describes those conventions and provides examples of their use.

Convention	Meaning	Example
Bold	Bold typeface indicates terms that are defined in the text or terms that appear in a glossary, or both.	When you specify this clause, you create an index-organized table .
<i>Italics</i>	Italic typeface indicates book titles or emphasis.	<i>Oracle Database Concepts</i> Ensure that the recovery catalog and target database do <i>not</i> reside on the same disk.
UPPERCASE monospace (fixed-width) font	Uppercase monospace typeface indicates elements supplied by the system. Such elements include parameters, privileges, datatypes, RMAN keywords, SQL keywords, SQL*Plus or utility commands, packages and methods, as well as system-supplied column names, database objects and structures, usernames, and roles.	You can specify this clause only for a NUMBER column. You can back up the database by using the BACKUP command. Query the TABLE_NAME column in the USER_TABLES data dictionary view. Use the DBMS_STATS.GENERATE_STATS procedure.
lowercase monospace (fixed-width) font	Lowercase monospace typeface indicates executable programs, filenames, directory names, and sample user-supplied elements. Such elements include computer and database names, net service names and connect identifiers, user-supplied database objects and structures, column names, packages and classes, usernames and roles, program units, and parameter values. <i>Note:</i> Some programmatic elements use a mixture of UPPERCASE and lowercase. Enter these elements as shown.	Enter sqlplus to start SQL*Plus. The password is specified in the orapwd file. Back up the datafiles and control files in the / disk1/oracle/dbs directory. The department_id, department_name, and location_id columns are in the hr.departments table. Set the QUERY_REWRITE_ENABLED initialization parameter to true. The JRepUtil class implements these methods.
lowercase italic monospace (fixed-width) font	Lowercase italic monospace font represents placeholders or variables.	You can specify the <i>parallel_clause</i> . Run <i>old_release.SQL</i> where <i>old_release</i> refers to the release you installed prior to upgrading.

Conventions in Code Examples

Code examples illustrate SQL, PL/SQL, SQL*Plus, or other command-line statements. They are displayed in a monospace (fixed-width) font and separated from normal text as shown in this example:

```
SELECT username FROM dba_users WHERE username = 'MIGRATE';
```

The following table describes typographic conventions used in code examples and provides examples of their use.

Convention	Meaning	Example
[]	Anything enclosed in brackets is optional.	DECIMAL (<i>digits</i> [, <i>precision</i>])
{ }	Braces are used for grouping items.	{ENABLE DISABLE}
	A vertical bar represents a choice of two options.	{ENABLE DISABLE} [COMPRESS NOCOMPRESS]
...	Ellipsis points mean repetition in syntax descriptions. In addition, ellipsis points can mean an omission in code examples or text.	CREATE TABLE ... AS <i>subquery</i> ; SELECT <i>col1</i> , <i>col2</i> , ... , <i>coln</i> FROM employees;
Other symbols	You must use symbols other than brackets ([]), braces ({}), vertical bars (), and ellipsis points (...) exactly as shown.	acctbal NUMBER(11,2); acct CONSTANT NUMBER(4) := 3;
<i>Italics</i>	Italicized text indicates placeholders or variables for which you must supply particular values.	enter <i>password</i> DB_NAME = <i>database_name</i>
UPPERCASE	Uppercase typeface indicates elements supplied by the system. We show these terms in uppercase in order to distinguish them from terms you define. Unless terms appear in brackets, enter them in the order and with the spelling shown. Because these terms are not case sensitive, you can use them in either UPPERCASE or lowercase.	SELECT last_name, employee_id FROM employees; SELECT * FROM USER_TABLES; DROP TABLE hr.employees;
lowercase	Lowercase typeface indicates user-defined programmatic elements, such as names of tables, columns, or files. Note: Some programmatic elements use a mixture of UPPERCASE and lowercase. Enter these elements as shown.	SELECT last_name, employee_id FROM employees; sqlplus hr/hr CREATE USER mjones IDENTIFIED BY ty3MU9;

Changes in This Release for Oracle Database PL/SQL Packages and Types Reference

This preface contains:

- [Changes in this Release](#)

Changes in this Release

Review changes in this release of *Oracle Database PL/SQL Packages and Types Reference*.

- [New Features](#)
- [Deprecated Features](#)
- [Desupported Features](#)

New Features

This section lists the major new features in Oracle Database release 23ai *PL/SQL Packages and Types Reference*.

The following features are new in this release:

- [DBMS_AUTOIM](#) provides functions to manage the execution of the Automatic In-Memory feature.
- [DBMS_SPM](#) supports the SQL plan management feature by providing an interface for the DBA or other users to perform controlled manipulation of plan history and SQL plan baselines maintained for various SQL statements.
- [DBMS_INMEMORY_ADVISE](#) enables you to determine if a workload can benefit from Oracle's Database In-Memory feature.
- The [DBMS_VECTOR](#) package is a lightweight package that simplifies common operations with Oracle AI Vector Search, such as chunking and embedding data, generating text for prompts, or creating vector indexes.

[DBMS_VECTOR](#)

- The [DBMS_VECTOR_CHAIN](#) package enables advanced operations with Oracle AI Vector Search, such as chunking and embedding data, generating text for prompts along with text processing and end-to-end similarity search.

[DBMS_VECTOR_CHAIN](#)

- [DBMS_DICTIONARY_CHECK](#) is a read-only and lightweight PL/SQL package procedure that helps you identify database dictionary inconsistencies.

DBMS_DICTIONARY_CHECK

- The UTL_HTTP package supports digest SHA-256.

UTL_HTTP

- The UTL_I18N package supports three new procedures that detect the most likely Oracle languages and Oracle character sets for a given data sample: DETECT_CHARSET, DETECT_LANGUAGE, and DETECT_LANGUAGE_CHARSET.

UTL_I18N

- The DBMS_SAGA_ADM package provides a collection of saga administration functions and procedures to define and manage saga participants, coordinators, and brokers.

DBMS_SAGA_ADM

- The DBMS_SAGA package provides a collection of saga functions and procedures to initiate and finalize sagas.

DBMS_SAGA

- The DBMS_FLASHBACK_ARCHIVE package includes the [GET_CURRENT_LIFESPAN_DIGEST Function](#) that generates the current lifespan digest for the specified row in a user table, and the [VERIFY_BLOCKCHAIN_LIFESPAN Procedure](#) that verifies the contents of the current lifespans, historical lifespans, or all lifespans of the user table rows that are protected using blockchain Flashback Archive.

- The DBMS_KAFKA package provides a PL/SQL interface for enabling Oracle SQL access to topics in Kafka clusters.

- The DBMS_SEARCH package enables you to create, maintain, and query ubiquitous search indexes.

DBMS_SEARCH

- The DBMS_SQL_FIREWALL package enables users to administer SQL Firewall.

DBMS_SQL_FIREWALL

- The DBMS_CRYPTO package has the following new features.

DBMS_CRYPTO

- New APIs for elliptic-curve Diffie–Hellman (ECDH) operations
 - * ECDH_GENKEYPAIR: This function generates an EC public/private key pair
 - * ECDHDERIVE_SHAREDSECRET: This function derives shared secret using private key of local application and public key from the remote application.
- New PKENCRYPT/PKDECRYPT algorithm: PKENCRYPT_RSA_PKCS1_OAEP_SHA2
- New chain modes GCM CCM
- New DBMS_CRYPTO block cipher suites AES_CCM_NONE and AES_GCM_NONE
- New signature and verification algorithms:
 - * SIGN_SHA224_ECDSA
 - * SIGN_SHA256_ECDSA
 - * SIGN_SHA384_ECDSA
 - * SIGN_SHA512_ECDSA
 - * SIGN_ECDSA

- The `DBMS_SCHEDULER` package has a new `DUMP_IN_MEMORY_TRACE` procedure that dumps the scheduler in-memory trace buffer of the specified process state object address into the current trace file of the requester process.

[DBMS_SCHEDULER](#)

- The `DBMS_SQL` and `DBMS_TF` packages are updated to support the ISO SQL standard-compliant `BOOLEAN` data type.

[DBMS_SQL](#)

[DBMS_TF](#)

- The `DBMS_COMPRESSION` package is updated to support the Advanced Low Index Compression for IOTs.

[DBMS_COMPRESSION](#)

- The `DBMS_SHARDING_DIRECTORY` package is added to support the Oracle Globally Distributed Database directory-based data distribution method.

[DBMS_SHARDING_DIRECTORY](#)

- The `DBMS_AUTO_CLUSTERING` package is added to support the automatic clustering and zone mapping.

[DBMS_AUTO_CLUSTERING](#)

- The `DBMS_AUTO_INDEX` package has a new parameter `AUTO_INDEX_INCLUDE_DML_COST` for the `DBMS_AUTO_INDEX.CONFIGURE` procedure.

[DBMS_AUTO_INDEX](#)

- The `DBMS_BLOCKCHAIN_TABLE` package has enhancements related to Blockchain Table User Chains, Blockchain Table Delegate Signer, and Blockchain Table Countersignature.

[DBMS_BLOCKCHAIN_TABLE](#)

- The `DBMS_DATA_MINING` package is enhanced to support the following settings:
 - `IMPORT_ONNX_MODEL` procedure. To learn more, see [IMPORT_ONNX_MODEL Procedure](#).
 - `DROP_ONNX_MODEL` procedure. To learn more, see [DROP_ONNX_MODEL Procedure](#).

Generalized Linear Model setting:

- `GLMS_LINK_FUNCTION`. See [DBMS_DATA_MINING — Algorithm Settings: Generalized Linear Model](#).

XGBoost settings:

- `xgboost_interaction_constraints`
- `xgboost_decrease_constraints`
- `xgboost_increase_constraints`
- `objective: survival:aft`
- `xgboost_aft_loss_distribution`
- `xgboost_aft_loss_distribution_scale`
- `xgboost_aft_right_bound_column_name`

See [DBMS_DATA_MINING — Algorithm Settings: XGBoost](#).

Explicit Semantic Analysis settings:

- ESAS_EMBEDDINGS
- ESAS_EMBEDDING_SIZE

See [DBMS_DATA_MINING — Algorithm Settings: Explicit Semantic Analysis](#).

Expectation Maximization setting:

- EMCS_OUTLIER_RATE

See [DBMS_DATA_MINING — Algorithm Settings: Expectation Maximization](#).

Exponential Smoothing settings:

- EXSM_SERIES_LIST
- EXSM_INITVL_OPTIMIZE

See [DBMS_DATA_MINING — Algorithm Settings: Exponential Smoothing](#).

k-Means setting:

- KMNS_WINSORIZE

See [DBMS_DATA_MINING — Algorithm Settings: k-Means](#).

Global settings:

- ODMS_BOXCOX
- ODMS_EXPLOSION_MIN_SUPP

See [DBMS_DATA_MINING — Global Settings](#).

- The `DBMS_USERDIAG` package is a new package that allows you to perform a limited set of diagnosis operations on the PDB, such as establish trace operations. Most of the regular diagnostic mechanisms available in a CDB have been restricted out of security concerns.

See [DBMS_USERDIAG](#).

- The `DBMS_PIPE` package has been enhanced to support singleton pipes as well as persistent messaging using Cloud Object stores.

[DBMS_PIPE](#)

- The `DBMS_MLE` package is updated to support the use of JavaScript modules.

[DBMS_MLE](#)

- The `DBMS_AQMIGTOOL` package simplifies migration from Oracle Database Advanced Queuing (AQ) to Transactional Event Queue (TxEventQ) with orchestration automation, source and target compatibility diagnostics and remediation, and a unified user experience.

[DBMS_AQMIGTOOL](#)

- The `DBMS_XMLSCHEMA_UTIL` package provides an interface for XML schema validation.

[DBMS_XMLSCHEMA_UTIL](#)

- The `DBMS_SPACE` package provides an interface for analyzing and shrinking a bigfile tablespace.

[DBMS_SPACE](#)

- [DBMS_CACHEUTIL](#) has new `TRUE_CACHE_KEEP` and `TRUE_CACHE_UNKEEP` procedures to manage assignments to the `KEEP` buffer pool for Oracle True Cache.

- The following new procedures are introduced in the `DBMS_APP_CONT` package to enhance the Application Continuity functionality:
 - `APPLY_REPLAY_RULE`
 - `GET_REPLAY_RULES`
 - `RESET_REPLAY_RULES`
- The following new procedures are introduced in the `DBMS_APP_CONT_ADMIN` package to enhance the Application Continuity protection check:
 - `ENABLE_AC`
 - `ENABLE_TAC`
 - `ACCHK_SET_FILTER`
 - `ACCHK_SHOW_FILTERS`
 - `ACCHK_CLEAR_FILTER`
 - `DISABLE_FAILOVER`
 - `ENABLE_RESET_STATE`
 - `MODIFY_SERVICE`
 - `SET_DRAINING`
 - `SET_LOAD_BALANCING`

Deprecated Features

Review this list of deprecated features in Oracle Database release 23ai *Oracle Database PL/SQL Packages and Types Reference*.

Oracle recommends that you do not use deprecated features or values in new applications. Support for deprecated features is for backward compatibility only. For more information about deprecated features, see *Oracle Database Upgrade Guide*.

Deprecation of the `mkstore` wallet management command line tool

The `mkstore` wallet management command line tool is deprecated with Oracle Database 23ai, and can be removed in a future release.

To manage wallets, Oracle recommends that you use the `orapki` command line tool.

Deprecation of `DBMS_RESULT_CACHE` Function Names

Oracle is changing the names of several `DBMS_RESULT_CACHE` function names in Oracle Database 23ai.

The following functions and procedures are deprecated:

- `BLACK_LIST` function. Use `BLOCK_LIST` function.
- `BLACK_LIST_ADD` procedure. Use `BLOCK_LIST_ADD` procedure.
- `BLACK_LIST_CLEAR` procedure. Use `BLOCK_LIST_CLEAR` procedure.
- `BLACK_LIST_REMOVE` procedure. Use `BLOCK_LIST_REMOVE` procedure.
- `OBJECT_BLACK_LIST` function. Use `OBJECT_BLOCK_LIST` function.

- OBJECT_BLACK_LIST_ADD procedure. Use OBJECT_BLOCK_LIST_ADD procedure.
- OBJECT_BLACK_LIST_CLEAR procedure. Use OBJECT_BLOCK_LIST_CLEAR procedure.
- OBJECT_BLACK_LIST_REMOVE procedure. Use OBJECT_BLOCK_LIST_REMOVE procedure.

Deprecation of DBMS_XMLSTORE

The PL/SQL package `DBMS_XMLSTORE` is deprecated in Oracle Database 23ai.

`DBMS_XMLSTORE` is a non-standard Oracle-proprietary package that enables you to store and manipulate XML data in Oracle Database. This package is deprecated, and can be desupported in a future release. Oracle recommends that you use regular SQL DML and with standard XQuery and SQL/XML to store and manage XML data. Using standard functionality provides future-proof way to store and manipulate XML data.

Deprecation of DBMS_XMLGEN PL/SQL Package

The PL/SQL package `DBMS_XMLGEN` is deprecated in Oracle Database 23ai.

`DBMS_XMLGEN` is a non-standard Oracle-proprietary package that is provided to generate and convert XML documents from SQL queries or with PL/SQL. This package is deprecated, and can be desupported in a future release. Oracle recommends that you use SQL/XML operators to generate XML from relational columns instead. Using ANSI SQL/XML operators for any generation and modification of XML documents provides a standardized and future-proof way to work with XML documents.

Deprecation of XML DB Repository

The Oracle XML DB Repository is deprecated with Oracle Database 23ai.

Oracle recommends that you replace any functionality used in XML DB Repository with alternative technologies.

Deprecation of DBMS_HANG_MANAGER Package

The `DBMS_HANG_MANAGER` package is deprecated in Oracle Database 23ai. Use `DBMS_BLOCKER_RESOLVER` instead.

The `DBMS_HANG_MANAGER` package provides a method of changing some configuration parameters and constraints to address session issues. This package is being replaced with `DBMS_BLOCKER_RESOLVER`. `DBMS_HANG_MANAGER` can be removed in a future release.

Deprecation of Traditional Auditing Packages and Functions

Traditional auditing packages and functions are deprecated in Oracle Database 23ai.

With the desupport of traditional auditing, the PL/SQL packages and functions associated with traditional auditing are deprecated. This deprecation includes the packages and functions `INIT_CLEANUP`, `DEINIT_CLEANUP`, and `IS_CLEANUP_INITIALIZED`. While these packages or functions continue to operate in Oracle Database 23ai, you can neither add to or modify traditional auditing configurations.

Related Topics

- Oracle Database Changes Desupports and Deprecations in *Oracle Database Upgrade Guide*

Desupported Features

This section lists the desupported features in Oracle Database Release 23ai *Oracle Database PL/SQL Packages and Types Reference*.

For more information about desupported features in this release, see *Oracle Database Upgrade Guide*.

The following features are desupported in this release:

Desupport of Oracle Enterprise Manager Database Express

Oracle Enterprise Manager Database Express (EM Express) is desupported in Oracle Database Release 23ai.

EM Express is a web-based database management tool that is built inside Oracle Database. It supports key performance management and basic database administration functions. EM Express was deprecated in Oracle Database 21c. Many of EM Express's capabilities are now available in Oracle Cloud Infrastructure (OCI) Database Management service, Oracle Enterprise Manager Cloud Control, or Oracle SQL Developer.

Desupport of Service Attribute Value `SESSION_STATE_CONSISTENCY = STATIC` Parameter

The service attribute values `FAILOVER_TYPE = TRANSACTION` with `SESSION_STATE_CONSISTENCY = STATIC` are no longer a supported service attribute combination.

In previous releases, you could use the service parameter `SESSION_STATE_CONSISTENCY` to manage session state automatically using Application Continuity by setting `SESSION_STATE_CONSISTENCY` to `DYNAMIC` or `STATIC`. However, starting with Oracle Database 23ai, you can no longer use the `STATIC` option. Instead, use one of the following failover options:

- `FAILOVER_TYPE = AUTO` with `SESSION_STATE_CONSISTENCY = AUTO`
- `FAILOVER_TYPE = TRANSACTION` with `SESSION_STATE_CONSISTENCY = DYNAMIC`

These configurations enforce session state tracking in Oracle Database, ensuring that session state is preserved at session migration and session failover.

Desupport of Oracle Wallet Manager (OWM)

Starting with Oracle Database 23ai, the Oracle Wallet Manager (OWM) is desupported.

Oracle recommends using the `orapki` command line tool to replace OWM.

Desupport of Oracle OLAP

Analytic workspaces, the OLAP DML programming language, financial reporting, and the OLAP Java API are desupported in Oracle Database 23ai.

For new applications requiring advanced analytic capabilities, Oracle recommends that you consider analytic views (a feature of Oracle Database), or Oracle Essbase for forecasting and what-if analysis. Oracle analytic views are a feature of every Oracle Database edition. If your application uses OLAP for dimensional query and reporting applications, then Oracle recommends that you consider Oracle analytic views as a replacement for OLAP. Analytic views provide a fast and efficient way to create

analytic queries of data stored in existing database tables and views. With Oracle analytic views, you obtain a dimensional query model and supporting metadata without requiring a "cube build/update" process. The elimination of the cube build/update process relieves scalability constraints (model complexity and data volume), simplifies the data preparation pipeline, and reduces or eliminates data latency.

The following OLAP packages are desupported:

- DBMS_AW_STATS
- DBMS_CUBE
- DBMS_CUBE_ADVISE
- DBMS_CUBE_LOG

Related Topics

- Oracle Database Changes Desupports and Deprecations in *Oracle Database Upgrade Guide*

1

Introduction to Oracle Supplied PL/SQL Packages & Types

Oracle supplies many PL/SQL packages with the Oracle server to extend database functionality and provide PL/SQL access to SQL features. You can use the supplied packages when creating your applications or for ideas in creating your own stored procedures.

This manual covers the packages provided with the Oracle database server. Packages supplied with other products, such as Oracle Developer or the Oracle Application Server, are not covered.

Note that not every package or type described in this manual or elsewhere in the Oracle Database Documentation Library is installed by default. In such cases, the documentation states this and explains how to install the object. Run this query as a suitably privileged user:

```
SELECT DISTINCT Owner, Object_Type, Object_Name FROM DBA_Objects_AE
WHERE Owner IN (
  'SYS', 'OUTLN', 'SYSTEM', 'CTXSYS', 'DBSNMP',
  'LOGSTDBY_ADMINISTRATOR', 'ORDSYS',
  'ORDPLUGINS', 'OEM_MONITOR', 'MDSYS', 'LBACSYS',
  'DMSYS', 'WMSYS', 'OLAPDBA', 'OLAPSVR', 'OLAP_USER',
  'OLAPSYS', 'EXFSYS', 'SYSMAN', 'MDDATA',
  'SI_INFORMTN_SCHEMA', 'XDB', 'ODM')
AND Object_Type IN ('PACKAGE', 'TYPE')
ORDER BY Owner, Object_Type, Object_Name
```

This lists every Oracle-supplied package and type that is currently installed in the database. Note that it lists a number of objects not mentioned in the Oracle Database Documentation Library. This is deliberate. Some of the Oracle-supplied packages and types are intended to be used only by other Oracle-supplied components. Any package or type that is not described in the Oracle Database Documentation Library is not supported for direct customer use.

This chapter contains the following topics:

- [Package Overview](#)
- [Summary of Oracle Supplied PL/SQL Packages and Types](#)

See Also:

Oracle Database Development Guide for information on how to create your own packages

1.1 Package Overview

A *package* is an encapsulated collection of related program objects stored together in the database. Program objects are procedures, functions, variables, constants, cursors, and exceptions.

1.1.1 Package Components

PL/SQL packages have two parts: the specification and the body, although sometimes the body is unnecessary. The specification is the interface to your application; it declares the types, variables, constants, exceptions, cursors, and subprograms available for use. The body fully defines cursors and subprograms, and so implements the specification.

Unlike subprograms, packages cannot be called, parameterized, or nested. However, the formats of a package and a subprogram are similar:

```
CREATE PACKAGE name AS -- specification (visible part)
    -- public type and item declarations
    -- subprogram specifications
END [name];
```

```
CREATE PACKAGE BODY name AS -- body (hidden part)
    -- private type and item declarations
    -- subprogram bodies
[BEGIN
    -- initialization statements]
END [name];
```

The specification holds public declarations that are visible to your application. The body holds implementation details and private declarations that are hidden from your application. You can debug, enhance, or replace a package body without changing the specification. You can change a package body without recompiling calling programs because the implementation details in the body are hidden from your application.

1.1.2 Using Oracle Supplied Packages

Most Oracle supplied packages are automatically installed when the database is created. Certain packages are not installed automatically. Special installation instructions for these packages are documented in the individual chapters.

To call a PL/SQL function from SQL, you must either own the function or have `EXECUTE` privileges on the function. To select from a view defined with a PL/SQL function, you must have `SELECT` privileges on the view. No separate `EXECUTE` privileges are needed to select from the view. Instructions on special requirements for packages are documented in the individual chapters.

1.1.3 Creating New Packages

To create packages and store them permanently in an Oracle database, use the `CREATE PACKAGE` and `CREATE PACKAGE BODY` statements. You can execute these statements interactively from SQL*Plus or Enterprise Manager.

To create a new package, do the following:

1. Create the package specification with the `CREATE PACKAGE` statement.

You can declare program objects in the package specification. Such objects are called *public* objects. Public objects can be referenced outside the package, as well as by other objects in the package.

 **Note:**

It is often more convenient to add the `OR REPLACE` clause in the `CREATE PACKAGE` statement. But note that `CREATE PACKAGE` warns you if you are about to overwrite an existing package with the same name while `CREATE OR REPLACE` just overwrites it with no warning.

2. Create the package body with the `CREATE PACKAGE BODY` statement.

You can declare and define program objects in the package body.

- You must define public objects declared in the package specification.
- You can declare and define additional package objects, called *private* objects. Private objects are declared in the package body rather than in the package specification, so they can be referenced only by other objects in the package. They cannot be referenced outside the package.

 **See Also:**

- *Oracle Database PL/SQL Language Reference*
- *Oracle Database Development Guide* for more information on creating new packages
- *Oracle Database Concepts*
for more information on storing and executing packages

1.1.3.1 Separating the Specification and Body

The specification of a package declares the public types, variables, constants, and subprograms that are visible outside the immediate scope of the package. The body of a package defines the objects declared in the specification, as well as private objects that are not visible to applications outside the package.

Oracle stores the specification and body of a package separately in the database. Other schema objects that call or reference public program objects depend only on the package specification, not on the package body. Using this distinction, you can change the definition of a program object in the package body without causing Oracle to invalidate other schema objects that call or reference the program object. Oracle invalidates dependent schema objects only if you change the declaration of the program object in the package specification.

1.1.3.1.1 Creating a New Package: Example

The following example shows a package specification for a package named `EMPLOYEE_MANAGEMENT`. The package contains one stored function and two stored procedures.

```
CREATE PACKAGE employee_management AS
  FUNCTION hire_emp (name VARCHAR2, job VARCHAR2,
    mgr NUMBER, hiredate DATE, sal NUMBER, comm NUMBER,
    deptno NUMBER) RETURN NUMBER;
  PROCEDURE fire_emp (emp_id NUMBER);
  PROCEDURE sal_raise (emp_id NUMBER, sal_incr NUMBER);
END employee_management;
```

The body for this package defines the function and the procedures:

```
CREATE PACKAGE BODY employee_management AS
  FUNCTION hire_emp (name VARCHAR2, job VARCHAR2,
    mgr NUMBER, hiredate DATE, sal NUMBER, comm NUMBER,
    deptno NUMBER) RETURN NUMBER IS
```

The function accepts all arguments for the fields in the employee table except for the employee number. A value for this field is supplied by a sequence. The function returns the sequence number generated by the call to this function.

```
    new_empno    NUMBER(10);

  BEGIN
    SELECT emp_sequence.NEXTVAL INTO new_empno FROM dual;
    INSERT INTO emp VALUES (new_empno, name, job, mgr,
      hiredate, sal, comm, deptno);
    RETURN (new_empno);
  END hire_emp;

  PROCEDURE fire_emp(emp_id IN NUMBER) AS
```

The procedure deletes the employee with an employee number that corresponds to the argument `emp_id`. If no employee is found, then an exception is raised.

```
  BEGIN
    DELETE FROM emp WHERE empno = emp_id;
    IF SQL%NOTFOUND THEN
      raise_application_error(-20011, 'Invalid Employee
        Number: ' || TO_CHAR(emp_id));
    END IF;
  END fire_emp;

  PROCEDURE sal_raise (emp_id IN NUMBER, sal_incr IN NUMBER) AS
```

The procedure accepts two arguments. `Emp_id` is a number that corresponds to an employee number. `Sal_incr` is the amount by which to increase the employee's salary.

```
  BEGIN

    -- If employee exists, then update salary with increase.

    UPDATE emp
      SET sal = sal + sal_incr
      WHERE empno = emp_id;
    IF SQL%NOTFOUND THEN
```

```

        raise_application_error(-20011, 'Invalid Employee
        Number: ' || TO_CHAR(emp_id));
    END IF;
END sal_raise;
END employee_management;
```

 **Note:**

If you want to try this example, then first create the sequence number `emp_sequence`. You can do this using the following SQL*Plus statement:

```
SQL> CREATE SEQUENCE emp_sequence
> START WITH 8000 INCREMENT BY 10;
```

1.1.4 Referencing Package Contents

When you want to reference the types, items, and subprograms declared in a package specification, use the dot notation.

For example:

```
package_name.type_name
package_name.item_name
package_name.subprogram_name
```

1.2 Summary of Oracle Supplied PL/SQL Packages and Types

PL/SQL packages are supplied with the Oracle server that extend database functionality and provide PL/SQL access to SQL features.

These packages, listed in the following table, run as the invoking user, rather than the package owner. Unless otherwise noted, the packages are callable through public synonyms of the same name.

 **Note:**

- The procedures and functions provided in these packages and their external interfaces are reserved by Oracle and are subject to change.
- Modifying Oracle supplied packages can cause internal errors and database security violations. Do not modify supplied packages.

Table 1-1 Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
APEX_APPLICATION through APEX_ZIP	For a complete description of all the packages that ship with Oracle Application Express, see <i>Oracle Application Express API Reference</i>
CTX_ADM	Lets you administer servers and the data dictionary

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
CTX_ANL	The CTX_ANL package is used with AUTO_LEXER and provides procedures for adding and dropping a custom dictionary from the lexer.
CTX_CLS	Lets you generate CTXRULE rules for a set of documents
CTX_DDL	Lets you create and manage the preferences, section lists and stopgroups required for Text indexes
CTX_DOC	Lets you request document services
CTX_ENTITY	The CTX_ENTITY package enables you to search for terms that are unknown to you without specifying a particular search text.
CTX_OUTPUT	Lets you manage the index log
CTX_QUERY	Lets you generate query feedback, count hits, and create stored query expressions
CTX_REPORT	Lets you create various index reports
CTX_THES	Lets you to manage and browse thesauri
CTX_ULEXER	For use with the user-lexer
DBMS_ADDM	Facilitates the use of Advisor functionality regarding the Automatic Database Diagnostic Monitor
DBMS_ADVANCED_REWRITE	Contains interfaces for advanced query rewrite users to create, drop, and maintain functional equivalence declarations for query rewrite
DBMS_ADVISOR	Part of the SQLAccess Advisor, an expert system that identifies and helps resolve performance problems relating to the execution of SQL statements
DBMS_AUTOIM	Provides functions to manage the execution of the AIM feature
DBMS_ALERT	Provides support for the asynchronous notification of database events
DBMS_APP_CONT	The DBMS_APP_CONT package provides an interface to determine if the in-flight transaction on a now unavailable session committed or not, and if the last call on that session completed or not.
DBMS_APP_CONT_ADMIN	This package provides a collection dba level admin operations in relation to Application Continuity
DBMS_APP_CONT_REPORT	This procedure generates a report of ACCHK trace collected while ACCHK_SET(TRUE)
DBMS_APPLICATION_INFO	Lets you register an application name with the database for auditing or performance tracking purposes
DBMS_APPLY_ADM	Provides administrative procedures to start, stop, and configure an apply process
DBMS_AQ	Lets you add a message (of a predefined object type) onto a queue or to dequeue a message
DBMS_AQADM	Lets you perform administrative functions on a queue or queue table for messages of a predefined object type

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_AQELM	Provides procedures to manage the configuration of Advanced Queuing asynchronous notification by e-mail and HTTP
DBMS_AQIN	Plays a part in providing secure access to the Oracle JMS interfaces
DBMS_AQMIGTOOL	The DBMS_AQMIGTOOL package provides procedures for migrating AQ queues to Transactional Event Queues (TxEventQ)
DBMS_ASSERT	Provides an interface to validate properties of the input value
DBMS_AUDIT_UTIL	The DBMS_AUDIT_UTIL package provides functions that enable you to format the output of queries to the DBA_FGA_AUDIT_TRAIL, DBA_AUDIT_TRAIL, UNIFIED_AUDIT_TRAIL, and V\$XML_AUDIT_TRAIL views.
DBMS_AUDIT_MGMT	The DBMS_AUDIT_MGMT package provides subprograms to manage audit trail records. These subprograms enable audit administrators to manage the audit trail.
DBMS_AUTO_REPORT	The DBMS_AUTO_REPORT package provides an interface to view SQL Monitoring and Real-time Automatic Database Diagnostic Monitor (ADDM) data that has been captured into Automatic Workload Repository (AWR). It also provides subprograms to control the behavior of how these data are captured to AWR.
DBMS_AUTO_SQLTUNE	The DBMS_AUTO_SQLTUNE package is the interface for managing the Automatic SQL Tuning task
DBMS_AUTO_INDEX	The DBMS_AUTO_INDEX package provides the interface for managing auto indexes in an Oracle database
DBMS_AUTO_MV	The DBMS_AUTO_MV contains subprograms for configuring automatic materialized views.
DBMS_AUTO_TASK_ADMIN	Used by the DBA as well as Enterprise Manager to access the AUTOTASK controls
DBMS_AUTO_ZONEMAP	The DBMS_AUTO_ZONEMAP package provides autonomous maintenance and creation of zonemap
DBMS_AVTUNE	The DBMS_AVTUNE package analyzes query access levels and aggregation workloads for each auto-cache enabled analytic view (AV) and creates or drops AV auto-caches to improve the overall performance of the SQL queries on that AV.
DBMS_AW_STATS	Contains a subprogram that generates and stores optimizer statistics for cubes and dimensions
DBMS_BLOCKCHAIN_TABLE	A blockchain table is an append-only table designed for centralized blockchain applications.
DBMS_BLOCKER_RESOLVER	The DBMS_BLOCKER_RESOLVER package provides a method of changing some Blocker Resolver configuration parameters.
DBMS_CACHEUTIL	Provides an interface to control object-level cache fusion locking policies in an Oracle Real Application Clusters (Oracle RAC) environment and to manage assignments to the KEEP buffer pool for Oracle True Cache.

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_CAPTURE_ADM	Describes administrative procedures to start, stop, and configure a capture process; used in Replication
DBMS_CLOUD	The DBMS_CLOUD package provides comprehensive support for working with data in ObjectStorage
DBMS_COMPARISON	Provides interfaces to compare and converge database objects at different databases
DBMS_COMPRESSION	Provides an interface to facilitate choosing the correct compression level for an application
DBMS_CONNECTION_POOL	Provides an interface to manage the Database Resident Connection Pool
DBMS_CQ_NOTIFICATION	Is part of a set of features that clients use to receive notifications when result sets of a query have changed. The package contains interfaces that can be used by mid-tier clients to register objects and specify delivery mechanisms.
DBMS_CREDENTIAL	The DBMS_CREDENTIAL package provides an interface for authenticating and impersonating EXTPROC callout functions, as well as external jobs, remote jobs and file watchers from the SCHEDULER.
DBMS_CRYPT	Lets you encrypt and decrypt stored data, can be used in conjunction with PL/SQL programs running network communications, and supports encryption and hashing algorithms
DBMS_CSX_ADMIN	Provides an interface to customize the setup when transporting a tablespace containing binary XML data
DBMS_CUBE	Contains subprograms that create OLAP cubes and dimensions, and that load and process the data for querying
DBMS_CUBE_ADVISE	Contains subprograms for evaluating cube materialized views to support log-based fast refresh and query rewrite
DBMS_CUBE_LOG	DBMS_CUBE_LOG contains subprograms for creating and managing logs for cubes and cube dimensions.
DBMS_DATA_MINING	Implements the Oracle Data Mining interface for creating, evaluating, and managing mining models
DBMS_DATA_MINING_TRANSFORM	Provides subroutines that can be used to prepare data for Oracle Data Mining
DBMS_DATAPUMP	Lets you move all, or part of, a database between databases, including both data and metadata
DBMS_DB_VERSION	The DBMS_DB_VERSION package specifies the Oracle version numbers and other information useful for simple conditional compilation selections based on Oracle versions.
DBMS_DBCOMP	The DBMS_DBCOMP package performs block comparison to detect lost writes or database inconsistencies between a primary database and one or more physical standby databases.
DBMS_DBFS_CONTENT	Provides an interface comprising a file system-like abstraction backed by one or more Store Providers

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_DBFS_CONTENT_SPI	Provides the Application Programming Interface (API) specification for DBMS_DBFS_CONTENT service providers
DBMS_DBFS_HS	Provides users the ability to use tape or Amazon S3 Web service as a storage tier when doing Information Lifecycle Management for their database tables
DBMS_DBFS_SFS	Provides an interface to operate a SecureFile-based store (SFS) for the content interface described in the DBMS_DBFS_CONTENT package
DBMS_DDL	Provides access to some SQL DDL statements from stored procedures, and provides special administration operations not available as DDLs
DBMS_DEBUG	Implements server-side debuggers and provides a way to debug server-side PL/SQL program units
DBMS_DEBUG_JDWP	The DBMS_DEBUG_JDWP provides the interface to initiate and control the debugging of PL/SQL stored procedures and Java stored procedures over Java Debug Wire Protocol (JDWP).
DBMS_DEBUG_JDWP_CUSTOM	The DBMS_DEBUG_JDWP_CUSTOM package is a PL/SQL package that provides database users a means to perform custom handling of a debug connection request of a database session to a debugger using the Java Debug Wire Protocol (JDWP).
DBMS_DESCRIBE	Describes the arguments of a stored procedure with full name translation and security checking
DBMS_DG	Allows applications to notify the primary database in an Oracle Data Guard broker environment to initiate a fast-start failover when the application encounters a condition that warrants a failover
DBMS_DICTIONARY_CHECK	Enables you to identify Oracle Database dictionary inconsistencies.
DBMS_DIMENSION	Enables you to verify dimension relationships and provides an alternative to the Enterprise Manager Dimension Wizard for displaying a dimension definition
DBMS_DISTRIBUTED_TRUST_ADMIN	Maintains the Trusted Database List, which is used to determine if a privileged database link from a particular server can be accepted
DBMS_DNFS	The DBMS_DNFS package provides an interface to assists in creating a database using files in the backup set.
DBMS_DST	The DBMS_DST package provides an interface to apply the Daylight Saving Time (DST) patch to the Timestamp with Time Zone datatype.
DBMS_EDITIONS_UTILITIES	The DBMS_EDITIONS_UTILITIES package provides helper functions for edition related operations.
DBMS_EPG	Implements the embedded PL/SQL gateway that enables a Web browser to invoke a PL/SQL stored procedure through an HTTP listener

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_ERRLOG	Provides a procedure that enables you to create an error logging table so that DML operations can continue after encountering errors rather than abort and roll back
DBMS_FGA	Provides fine-grained security functions
DBMS_FILE_TRANSFER	Lets you copy a binary file within a database or to transfer a binary file between databases
DBMS_FLASHBACK	Lets you flash back to a version of the database at a specified wall-clock time or a specified system change number (SCN)
DBMS_FLASHBACK_ARCHIVE	Contains procedures for disassociation and re-association of a Flashback Data Archive (FDA) enabled table from/with its underlying FDA archive respectively
DBMS_FLASHBACK_ARCHIVE_MIGRATE	Enables you to export and import the Flashback Archive base tables along with their history to another database using the Transportable Tablespaces
DBMS_FREQUENT_ITEMSET	Enables frequent itemset counting
DBMS_FS	The DBMS_FS package for performing operations on an Oracle file system (make, mount, unmount and destroy operations) in an Oracle database.
DBMS_GOLDENGATE_ADM	The DBMS_GOLDENGATE_ADM package provides subprograms to configure and manage Oracle GoldenGate conflict detection and resolution
DBMS_GOLDENGATE_AUTH	The DBMS_GOLDENGATE_AUTH package provides subprograms for granting privileges to and revoking privileges from GoldenGate administrators.
DBMS_HADOOP	The DBMS_HADOOP package provides a PL/SQL procedure called CREATE_EXTDDL_FOR_HIVE(), that creates an Oracle external table for a given hive table.
DBMS_HEAT_MAP	The DBMS_HEAT_MAP package provides an interface to externalize heatmaps at various levels of storage including block, extent, segment, object and tablespace.
DBMS_HIERARCHY	Contains functions and procedures for validating the data in tables used by analytic views and hierarchies and for creating a log table.
DBMS_HM	Contains constants and procedure declarations for health check management
DBMS_HPROF	Provides an interface for profiling the execution of PL/SQL applications
DBMS_HS_PARALLEL	Enables parallel processing for heterogeneous targets access
DBMS_HS_PASSTHROUGH	Lets you use Heterogeneous Services to send pass-through SQL statements to non-Oracle systems
DBMS_ILM	The DBMS_ILM package provides an interface for implementing Information Lifecycle Management (ILM) strategies using Automatic Data Optimization (ADO) policies.
DBMS_ILM_ADMIN	The DBMS_ILM_ADMIN package provides an interface to customize Automatic Data Optimization (ADO) policy execution.

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_IMMUTABLE_TABLE	The DBMS_IMMUTABLE_TABLE package allows you to delete the expired rows in an immutable table and add interval partitioning
DBMS_INMEMORY	The DBMS_INMEMORY package provides an interface for In-Memory Column Store (IM column store) functionality.
DBMS_INMEMORY_ADMIN	The DBMS_INMEMORY_ADMIN package provides interfaces for managing an In-Memory FastStart (IM FastStart) area and In-Memory Expressions (IM expressions).
DBMS_IOT	Creates a table into which references to the chained rows for an Index Organized Table can be placed using the ANALYZE command
DBMS_JAVA	Provides a PL/SQL interface for accessing database functionality from Java
DBMS_JAVASCRIPT	The DBMS_JAVASCRIPT package provides a PL/SQL procedure for running DBMS-residing JavaScript code from the location identified by its argument
DBMS_JOB	Schedules and manages jobs in the job queue (Deprecated)
DBMS_JSON	Provides an interface for data-guide operations
DBMS_KAFKA	The DBMS_KAFKA package provides a PL/SQL interface for enabling Oracle SQL access to topics in Kafka clusters
DBMS_KAFKA_ADM	The DBMS_KAFKA_ADM package provides a PL/SQL interface to create cluster definitions, which you can then use to grant access to Kafka cluster data for applications
DBMS_LDAP	Provides functions and procedures to access data from LDAP servers
DBMS_LDAP_UTL	Provides the Oracle Extension utility functions for LDAP
DBMS_LIBCACHE	Prepares the library cache on an Oracle instance by extracting SQL and PL/SQL from a remote instance and compiling this SQL locally without execution
DBMS_LOB	Provides general purpose routines for operations on Oracle Large Object (LOBs) datatypes - BLOB, CLOB (read/write), and BFILES (read-only)
DBMS_LOCK	Lets you request, convert and release locks through Oracle Lock Management services
DBMS_LOGMNR	Provides functions to initialize and run the log reader
DBMS_LOGMNR_D	Queries the dictionary tables of the current database, and creates a text based file containing their contents
DBMS_LOGSTDBY	Describes procedures for configuring and managing the logical standby database environment
DBMS_LOGSTDBY_CONTEXT	You can use the procedures provided in the DBMS_LOGSTDBY_CONTEXT package to set and retrieve various parameters associated with LSBY_APPLY_CONTEXT.
DBMS_MEMOPTIMIZE	The DBMS_MEMOPTIMIZE package provides the interface for managing the Memoptimized Rowstore data buffered in the large pool and the memoptimize pool

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_MEMOPTIMIZE_ADMIN	The DBMS_MEMOPTIMIZE_ADMIN package provides the interface for flushing the Memoptimized Rowstore data buffered in the large pool to disk
DBMS_METADATA	Lets callers easily retrieve complete database object definitions (metadata) from the dictionary
DBMS_METADATA_DIFF	Contains the interfaces for comparing two metadata documents in SXML format. The result of the comparison is an SXML difference document. This document can be converted to other formats using the DBMS_METADATA submit interface and the CONVERT API.
DBMS_MGD_ID_UTL	Provides a set of utility subprograms
DBMS_MGWADM	Describes the Messaging Gateway administrative interface; used in Advanced Queuing
DBMS_MGWMSG	Describes object types (used by the canonical message types to convert message bodies) and helper methods, constants, and subprograms for working with the Messaging Gateway message types; used in Advanced Queuing.
DBMS_MLE	The DBMS_MLE package allows users to execute JavaScript code inside the Oracle Database and exchange data seamlessly between PL/SQL and JavaScript.
DBMS_MONITOR	Let you use PL/SQL for controlling additional tracing and statistics gathering
DBMS_MVIEW	Lets you refresh snapshots that are not part of the same refresh group and purge logs. DBMS_SNAPSHOT is a synonym.
DBMS_MVIEW_STATS	The DBMS_MVIEW_STATS package provides an interface to manage the collection and retention of statistics for materialized view refresh operations.
DBMS_NETWORK_ACL_ADMIN	Provides the interface to administer the network Access Control List (ACL)
DBMS_NETWORK_ACLUTILITY	The DBMS_NETWORK_ACLUTILITY package provides the utility functions to facilitate the evaluation of access control list (ACL) assignments governing TCP connections to network hosts.
DBMS_ODCI	Returns the CPU cost of a user function based on the elapsed time of the function
DBMS_OPTIM_BUNDLE	This package is used to manage the installed but disabled module bug fixes that cause an execution plan change.
DBMS_OUTLN	Provides the interface for procedures and functions associated with management of stored outlines Synonymous with OUTLN_PKG
DBMS_OUTPUT	Accumulates information in a buffer so that it can be retrieved later
DBMS_PARALLEL_EXECUTE	Enables the user to incrementally update table data in parallel
DBMS_PART	The DBMS_PART package provides an interface for maintenance and management operations on partitioned objects.

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_PCLXUTIL	Provides intra-partition parallelism for creating partition-wise local indexes
DBMS_PDB	The DBMS_PDB package provides an interface to examine and manipulate data about pluggable databases (PDBs) in a multitenant container database (CDB). It also contains an interface specify which database objects are application common objects.
DBMS_PDB_ALTER_SHARING	In an application container with a pre-installed application, the DBMS_PDB_ALTER_SHARING package provides an interface to set database objects as application common objects or to specify that a database object is not an application common object.
DBMS_PERF	The DBMS_PERF package provides and interface to generate active reports for monitoring database performance.
DBMS_PIPE	Provides a DBMS pipe service which enables messages to be sent between sessions
DBMS_PLSQL_CODE_COVERAGE	The DBMS_PLSQL_CODE_COVERAGE package provides an interface for the collection of code coverage data of PL/SQL applications at the basic block level.
DBMS_PREDICTIVE_ANALYTICS	Provides subroutines that implement automatic data mining operations for predict, explain, and profile
DBMS_PREPROCESSOR	Provides an interface to print or retrieve the source text of a PL/SQL unit in its post-processed form
DBMS_PRIVILEGE_CAPTURE	The DBMS_PRIVILEGE_CAPTURE package provides an interface to database privilege analysis.
DBMS_PROCESS	The DBMS_PROCESS package provides an interface to manage the prespawnd servers.
DBMS_PROFILER	Provides a Probe Profiler API to profile existing PL/SQL applications and identify performance bottlenecks
DBMS_PROPAGATION_ADM	Provides administrative procedures for configuring propagation from a source queue to a destination queue
DBMS_QOPATCH	The DBMS_QOPATCH package provides an interface to view the installed database patches.
DBMS_RANDOM	Provides a built-in random number generator
DBMS_REDACT	The DBMS_REDACT package provides an interface to Oracle Data Redaction, which enables you to mask (redact) data that is returned from queries issued by lowprivileged users or an application.
DBMS_REDEFINITION	Lets you perform an online reorganization of tables
DBMS_REFRESH	Lets you create groups of snapshots that can be refreshed together to a transactionally consistent point in time Requires the Distributed Option
DBMS_REPAIR	Provides data corruption repair procedures
DBMS_RESCONFIG	Provides an interface to operate on the Resource Configuration List, and to retrieve listener information for a resource

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_RESOURCE_MANAGER	Maintains plans, consumer groups, and plan directives; it also provides semantics so that you may group together changes to the plan schema
DBMS_RESOURCE_MANAGER_PRIVS	Maintains privileges associated with resource consumer groups
DBMS_RESULT_CACHE	Provides an interface to operate on the Result Cache
DBMS_RESUMABLE	Lets you suspend large operations that run out of space or reach space limits after executing for a long time, fix the problem, and make the statement resume execution
DBMS_RLS	Provides row level security administrative interface
DBMS_ROLLING	The <code>DBMS_ROLLING</code> PL/SQL package is used to implement the Rolling Upgrade Using Active Data Guard feature, which streamlines the process of upgrading Oracle Database software in a Data Guard configuration in a rolling fashion.
DBMS_ROWID	Provides procedures to create rowids and to interpret their contents
DBMS_RULE	Describes the subprograms that enable the evaluation of a rule set for a specified event
DBMS_RULE_ADM	Provides the subprograms for creating and managing rules, rule sets, and rule evaluation contexts
DBMS_SAGA_ADM	The <code>DBMS_SAGA_ADM</code> package provides a collection of saga administration functions and procedures to define and manage saga participants, coordinators, and brokers.
DBMS_SAGA	The <code>DBMS_SAGA</code> package provides a collection of saga functions and procedures to initiate and finalize sagas.
DBMS_SCHEDULER	Provides a collection of scheduling functions that are callable from any PL/SQL program
DBMS_SEARCH	Enables the indexing of multiple schema objects in a single index
DBMS_SERVER_ALERT	Lets you issue alerts when some threshold has been violated
DBMS_SERVICE	Lets you create, delete, activate and deactivate services for a single instance
DBMS_SESSION	Provides access to SQL <code>ALTER SESSION</code> statements, and other session information, from stored procedures
DBMS_SFW_ACL_ADMIN	The <code>DBMS_SFW_ACL_ADMIN</code> package provides interfaces for administering and managing access control policies for the "database service firewall" feature
DBMS_SHARED_POOL	Lets you keep objects in shared memory, so that they will not be aged out with the normal LRU mechanism
DBMS_SHARDED_DIRECTORY	Provides procedures to manage an Oracle Globally Distributed Database (sharded database) created with directory-based data distribution.
DBMS_SODA	Implements Simple Oracle Document Access (SODA) which allows you to use the Oracle Database as a NoSQL document store.

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_SPACE	Provides segment space information not available through standard SQL
DBMS_SPACE_ADMIN	Provides tablespace and segment space administration not available through the standard SQL
DBMS_SPD	The DBMS_SPD package provides subprograms for managing SQL plan directives (SPD).
DBMS_SPM	Supports the SQL plan management feature by providing an interface for the DBA or other user to perform controlled manipulation of plan history and SQL plan baselines maintained for various SQL statements
DBMS_SQL	Lets you use dynamic SQL to access the database
DBMS_SQL_FIREWALL	Lets you monitor users and prevent them from performing SQL injection attacks
DBMS_SQL_MONITOR	The DBMS_SQL_MONITOR package provides information about Real-time SQL Monitoring and Real-time Database Operation Monitoring.
DBMS_SQL_TRANSLATOR	The DBMS_SQL_TRANSLATOR package provides an interface for creating, configuring, and using SQL translation profiles.
DBMS_SQLDIAG	Provides an interface to the SQL Diagnosability functionality
DBMS_SQLPA	Provides an interface to implement the SQL Performance Analyzer
DBMS_SQLQ	The DBMS_SQLQ package provides the interface for configuring quarantine thresholds for execution plans of SQL statements
DBMS_SQLSET	The DBMS_SQLSET package provides an interface to manage SQL tuning sets
DBMS_SQLTUNE	Provides the interface to tune SQL statements
DBMS_STAT_FUNCS	Provides statistical functions
DBMS_STATS	Provides a mechanism for users to view and modify optimizer statistics gathered for database objects
DBMS_STORAGE_MAP	Communicates with FMON to invoke mapping operations
DBMS_SYNC_REFRESH	The DBMS_SYNC_REFRESH package provides an interface to perform a synchronous refresh of materialized views.
DBMS_TABLE_DATA	The DBMS_TABLE_DATA package provides procedures that can be used to retrieve the byte value of a single column, or a series of columns, in any table.
DBMS_TDB	Reports whether a database can be transported between platforms using the RMAN CONVERT DATABASE command. It verifies that databases on the current host platform are of the same endian format as the destination platform, and that the state of the current database does not prevent transport of the database.
DBMS_TF	The DBMS_TF package contains utilities for POLYMORPHIC TABLE functions (PTFs) implementation. You can use DBMS_TF subprograms to consume and produce data, and get information about its execution environment..

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_TNS	The <code>DBMS_TNS</code> package provides the <code>RESOLVE_TNSNAME</code> function to resolve a TNS name and return the corresponding Oracle Net8 connection string.
DBMS_TRACE	Provides routines to start and stop PL/SQL tracing
DBMS_TRANSACTION	Provides access to SQL transaction statements from stored procedures and monitors transaction activities
DBMS_TRANSFORM	Provides an interface to the message format transformation features of Oracle Advanced Queuing
DBMS_TSDP_MANAGE	The <code>DBMS_TSDP_MANAGE</code> package provides an interface to import and manage sensitive columns and sensitive column types in the database.
DBMS_TSDP_PROTECT	The <code>DBMS_TSDP_PROTECT</code> package provides an interface to configure transparent sensitive data protection (TSDP) policies in conjunction with the <code>DBMS_TSDP_MANAGE</code> package. The <code>DBMS_TSDP_PROTECT</code> package is available with the Enterprise Edition only.
DBMS_TTS	Checks if the transportable set is self-contained
DBMS_TYPES	Consists of constants, which represent the built-in and user-defined types
DBMS_UMF	The <code>DBMS_UMF</code> package provides an interface for deploying the Remote Management Framework (RMF) for an Oracle Database. The RMF is used for collecting performance statistics for an Oracle Database.
DBMS_USER_CERTS	The <code>DBMS_USER_CERTS</code> package allows you add and delete certificates.
DBMS_UTILITY	Provides various utility routines.
DBMS_VECTOR	Simplifies common operations with Oracle AI Vector Search, such as chunking and embedding data, generating text for prompts, or creating vector indexes.
DBMS_VECTOR_CHAIN	Enables advanced operations with Oracle AI Vector Search, such as chunking and embedding data, generating text for prompts along with text processing and end-to-end similarity search.
DBMS_WARNING	Provides the interface to query, modify and delete current system or session settings.
DBMS_WM	Describes how to use the programming interface to Oracle Database Workspace Manager to work with long transactions
DBMS_WORKLOAD_CAPTURE	Configures the Workload Capture system and produce the workload capture data.
DBMS_WORKLOAD_REPLAY	Provides an interface to replay and report on a record of a workload on a production or test system
DBMS_WORKLOAD_REPOSITORY	Lets you manage the Workload Repository, performing operations such as managing snapshots and baselines
DBMS_XA	Contains the XA/Open interface for applications to call XA interface in PL/SQL

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_XDB	Describes Resource Management and Access Control interface for PL/SQL
DBMS_XDB_ADMIN	Provides an interface to implement XMLIndex administration operation
DBMS_XDB_CONFIG	The DBMS_XDB_CONFIG package provides an interface for configuring Oracle XML DB and its repository.
DBMS_XDB_CONSTANTS	The DBMS_XDB_CONSTANTS package provides an interface to commonly used constants.
DBMS_XDB_REPOS	The DBMS_XDB_REPOS package provides an interface to operate on the Oracle XML database Repository.
DBMS_XDBRESOURCE	Provides an interface to operate on the XDB resource's metadata and contents
DBMS_XDB_VERSION	Describes the versioning interface
DBMS_XDBZ	Controls the Oracle XML DB repository security, which is based on Access Control Lists (ACLs)
DBMS_XEVENT	Provides event-related types and supporting subprograms
DBMS_XMLDOM	Explains access to XMLType objects
DBMS_XMLGEN	Converts the results of a SQL query to a canonical XML format
DBMS_XMLINDEX	Provides an interface to implement asynchronous indexing and apply node referencing
DBMS_XMLPARSER	Explains access to the contents and structure of XML documents
DBMS_XMLSCHEMA	Explains procedures to register and delete XML schemas
DBMS_XMLSCHEMA_ANNOTATE	The DBMS_XMLSCHEMA_ANNOTATE package provides an interface to manage and configure the structured storage model, mainly through the use of pre-registration schema annotations
DBMS_XMLSCHEMA_UTIL	The DBMS_XMLSCHEMA_UTIL package provides an interface for XML schema validation
DBMS_XMLSTORAGE_MANAGE	The DBMS_XMLSTORAGE_MANAGE package provides an interface to manage and modify XML storage after schema registration has been completed
DBMS_XMLSTORE	Provides the ability to store XML data in relational tables
DBMS_XMLTRANSLATIONS	Provides an interface to perform translations so that strings can be searched or displayed in various languages
DBMS_XPLAN	Describes how to format the output of the EXPLAIN PLAN command
DBMS_XSTREAM_ADM	The DBMS_XSTREAM_ADM package provides interfaces for streaming database changes between an Oracle database and other systems
DBMS_XSTREAM_AUTH	The DBMS_XSTREAM_AUTH package provides subprograms for granting privileges to and revoking privileges from XStream administrators

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
DBMS_XSLPROCESSOR	Explains access to the contents and structure of XML documents
DEBUG_EXTPROC	Lets you debug external procedures on platforms with debuggers that attach to a running process
HTF	Hypertext functions generate HTML tags
HTP	Hypertext procedures generate HTML tags
OWA_CACHE	Provides an interface that enables the PL/SQL Gateway cache to improve the performance of PL/SQL Web applications
OWA_COOKIE	Provides an interface for sending and retrieving HTTP cookies from the client's browser
OWA_CUSTOM	Provides a Global PLSQL Agent Authorization callback function
OWA_IMAGE	Provides an interface to access the coordinates where a user clicked on an image
OWA_OPT_LOCK	Contains subprograms that impose optimistic locking strategies so as to prevent lost updates
OWA_PATTERN	Provides an interface to locate text patterns within strings and replace the matched string with another string
OWA_SEC	Provides an interface for custom authentication
OWA_TEXT	Contains subprograms used by OWA_PATTERN for manipulating strings. They are externalized so you can use them directly.
OWA_UTIL	Contains utility subprograms for performing operations such as getting the value of CGI environment variables, printing the data that is returned to the client, and printing the results of a query in an HTML table
SDO_CS	Provides functions for coordinate system transformation
SDO_CSW_PROCESS	Contains subprograms for various processing operations related to support for Catalog Services for the Web (CSW)
SDO_GCDR	Contains the Oracle Spatial geocoding subprograms, which let you geocode unformatted postal addresses
SDO_GEOM	Provides functions implementing geometric operations on spatial objects
SDO_GEOR	Contains functions and procedures for the Spatial GeoRaster feature, which lets you store, index, query, analyze, and deliver raster image data and its associated Spatial vector geometry data and metadata
SDO_GEOR_ADMIN	Contains subprograms for administrative operations related to GeoRaster.
SDO_GEOR_AGGR	The SDO_GEOR_AGGR package provides an interface to the SDO_GEOR_AGGR package for performing aggregate operations on GeoRaster objects
SDO_GEOR_RA	The SDO_GEOR_RA package provides an interface to the SDO_GEOR_RA package for performing raster algebra and analytic operations related to GeoRaster

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
SDO_GEOR_UTL	Contains utility functions and procedures for the Spatial GeoRaster feature, including those related to using triggers with GeoRaster data
SDO_LRS	Provides functions for linear referencing system support
SDO_MIGRATE	Provides functions for migrating spatial data from previous releases
SDO_NET	Provides functions and procedures for working with data modeled as nodes and links in a network
SDO_NET_MEM	Contains functions and procedures for performing editing and analysis operations on network data using a network memory object
SDO_NFE	The <code>SDO_NFE</code> package contains functions and procedures for performing network feature editing
SDO_OLS	Contains functions and procedures for performing editing and analysis operations on network data using a network memory object
SDO_PC_PKG	Contains subprograms to support the use of point clouds in Spatial
SDO_SAM	Contains functions and procedures for spatial analysis and data mining
SDO_TIN_PKG	Contains subprograms to support the use of triangulated irregular networks (TINs) in Spatial
SDO_TOPO	Provides procedures for creating and managing Spatial topologies
SDO_TOPO_MAP	Contains subprograms for editing Spatial topologies using a cache (TopoMap object)
SDO_TUNE	Provides functions for selecting parameters that determine the behavior of the spatial indexing scheme used in Oracle Spatial
SDO_UTIL	Provides utility functions and procedures for Oracle Spatial
SDO_WFS_LOCK	Contains subprograms for WFS support for registering and unregistering feature tables
SDO_WFS_PROC	Provides utility functions and procedures for Oracle Spatial
SEM_APIS	Contains subprograms for working with the Resource Description Framework (RDF) and Web Ontology Language (OWL) in an Oracle database.
SEM_OLS	The <code>SEM_OLS</code> package provides an interface to the <code>SEM_OLS</code> package for providing triple-level security to RDF data, using Oracle Label Security (OLS)
SEM_PERF	Contains subprograms for examining and enhancing the performance of the Resource Description Framework (RDF) and Web Ontology Language (OWL) support in an Oracle database
SEM_RDFCTX	Contains subprograms for managing extractor policies and semantic indexes created for documents

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
SEM_RDFSA	Contains subprograms for providing fine-grained access control to RDF data, using either a virtual private database (VPD) or Oracle Label Security (OLS)
UTL_CALL_STACK	The UTL_CALL_STACK package provides an interface to provide information about currently executing subprograms
UTL_COLL	Enables PL/SQL programs to use collection locators to query and update
UTL_COMPRESS	Provides a set of data compression utilities
UTL_ENCODE	Provides functions that encode RAW data into a standard encoded format so that the data can be transported between hosts
UTL_FILE	Enables your PL/SQL programs to read and write operating system text files and provides a restricted version of standard operating system stream file I/O
UTL_HTTP	Enables HTTP callouts from PL/SQL and SQL to access data on the Internet or to call Oracle Web Server Cartridges
UTL_I18N	Provides a set of services (Oracle Globalization Service) that help developers build multilingual applications
UTL_INADDR	Provides a procedure to support internet addressing
UTL_IDENT	Specifies which database or client PL/SQL is running
UTL_LMS	Retrieves and formats error messages in different languages
UTL_MAIL	A utility for managing email which includes commonly used email features, such as attachments, CC, BCC, and return receipt
UTL_MATCH	The UTL_MATCH package facilitates matching two records. This is typically used to match names, such as two First Names or two Last Names
UTL_NLA	Exposes a subset of the BLAS and LAPACK (Version 3.0) operations on vectors and matrices represented as VARRAYs
UTL_RAW	Provides SQL functions for manipulating RAW datatypes
UTL_RECOMP	Recompiles invalid PL/SQL modules, invalid views, Java classes, indextypes and operators in a database, either sequentially or in parallels
UTL_REF	Enables a PL/SQL program to access an object by providing a reference to the object
UTL_SMTP	Provides PL/SQL functionality to send emails
UTL_RPADV	Provides subprograms to collect and analyze statistics for the Oracle Replication components in a distributed database environment
UTL_TCP	Provides PL/SQL functionality to support simple TCP/IP-based communications between servers and the outside world
UTL_URL	Provides escape and unescape mechanisms for URL characters

Table 1-1 (Cont.) Summary of Oracle Supplied PL/SQL Packages

Package Name	Description
WPG_DOCLOAD	Provides an interface to download files, both BLOBs and BFILEs
ANYDATA TYPE	A self-describing data instance type containing an instance of the type plus a description
ANYDATASET TYPE	Contains a description of a given type plus a set of data instances of that type
ANYTYPE TYPE	Contains a type description of any persistent SQL type, named or unnamed, including object types and collection types; or, it can be used to construct new transient type descriptions
Oracle Database Advanced Queuing Types	Describes the types used in Advanced Queuing
DBFS Content Interface Types	Describes public types defined to support the DBMS_DBFS_CONTENT interface.
Database URI Type	Contains URI Support, UriType Super Type, UriType Subtype, DBUriType Subtype, XDBUriType Subtype, UriFactory Package
JMS TYPES	Describes JMS types so that a PL/SQL application can use JMS queues of JMS types
LOGICAL CHANGE RECORD TYPES	Describes LCR types, which are message payloads that contain information about changes to a database.
MG_ID Package Types	Provides an extensible framework that supports current RFID tags with the standard family of EPC bit encodings for the supported encoding types
POLYMORPHIC TABLE FUNCTION (PTF) Package Types	Describes types defined in the DBMS_TF package to support PTF
RULES TYPES	Describes the types used with rules, rule sets, and evaluation contexts
SODA Types	Describes the SODA Types.
UTL Streams Types	Describes abstract streams types used with Oracle XML functionality
XMLType	Describes the types and functions used for native XML support in the server

2

Oracle Application Express Packages APEX_APPLICATION Through APEX_ZIP

The Oracle Application Express supplies PL/SQL packages for application developers who are building database-centric web applications using Oracle Application Express.

For a complete description of all the packages that ship with Oracle Application Express, see the *Oracle Application Express API Reference*.

3

CTX_ADM

The `CTX_ADM` package lets you administer the Oracle Text data dictionary.

Note that you must install this package in order to use it.

For a complete description of this package within the context of Oracle Text, see `CTX_ADM` in the Oracle Text Reference.

4

CTX_ANL

The `CTX_ANL` package is used with `AUTO_LEXER` and provides procedures for adding and dropping a custom dictionary from the lexer.

A custom dictionary might be one that you develop for a special field of study or for your industry. In most cases, the dictionaries supplied for the supported languages with Oracle Text are more than sufficient to handle your requirements.

For a complete description of this package within the context of Oracle Text, see `CTX_ANL` in the Oracle Text Reference.

4.1 GET_COMPRESSION_RATIO Procedure

Use this procedure to estimate the storage space that you can save by enabling the compression feature for an existing SecureFile LOB. It analyzes the compression ratio of a table or an index and gives information about compressibility of the object. You can provide various parameters to selectively analyze different compression types.

In Oracle Database 23ai, this procedure has been enhanced to estimate the compression ratio faster for LOBs while using less space. Now you can also estimate the compression ratio for BasicFile LOBs. This helps you decide upfront whether you want to compress BasicFile LOBs, before migrating BasicFile LOBs to SecureFile LOBs. You can also estimate the compression ratio at the LOB byte level and the time taken, in hours, to compress the LOB data in the table.

The compression ratio is estimated for the number of rows in the LOB column that you specify. For example, let's consider that the compression ratio is 2.33. It indicates that after you enable the compression feature, you can save around half of the space for the sampled rows in the LOB column.

Disclaimer: The compression ratio is an approximate value, which is calculated based on the sampled rows in the LOB column. The actual space that you save when you enable compression for the complete table may be different.

Syntax

The syntax to get the compression ratio differs for objects, LOBs, IOTs, and indexes on a table.

- Syntax to get the compression ratio for an object (table or index, default is table).

```
DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
  scratchtbsname      IN      VARCHAR2,
  ownname             IN      VARCHAR2,
  objname             IN      VARCHAR2,
  subobjname         IN      VARCHAR2,
  comptype           IN      NUMBER,
  blkcnt_cmp         OUT     PLS_INTEGER,
  blkcnt_uncmp       OUT     PLS_INTEGER,
  row_cmp            OUT     PLS_INTEGER,
  row_uncmp          OUT     PLS_INTEGER,
```

```

cmp_ratio          OUT   NUMBER,
comptype_str       OUT   VARCHAR2,
block_compr_ratio OUT   PLS_INTEGER,
byte_comp_ratio    OUT   NUMBER,
subset_numrows     IN    NUMBER DEFAULT COMP_RATIO_MINROWS,
objtype            IN    PLS_INTEGER DEFAULT OBJTYPE_TABLE);

```

- Syntax to get compression ratio for BasicFile and SecureFile LOBs:

```

DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
  scratchtbsname  IN    VARCHAR2,
  tabowner        IN    VARCHAR2,
  tablename       IN    VARCHAR2,
  lobname         IN    VARCHAR2,
  partname        IN    VARCHAR2,
  comptype        IN    NUMBER,
  blkcnt_cmp      OUT   PLS_INTEGER,
  blkcnt_uncmp    OUT   PLS_INTEGER,
  lobcnt          OUT   PLS_INTEGER,
  cmp_ratio       OUT   NUMBER,
  comptype_str    OUT   VARCHAR2,
  byte_comp_ratio OUT   NUMBER,
  total_time      OUT   NUMBER
  subset_numrows  IN    NUMBER DEFAULT COMP_RATIO_LOB_MAXROWS);

```

- Syntax to get the compression ratio for all indexes on a table. The compression ratios are returned as a collection.

```

DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
  scratchtbsname  IN    VARCHAR2,
  ownname         IN    VARCHAR2,
  tablename       IN    VARCHAR2,
  comptype        IN    NUMBER,
  index_cr        OUT   DBMS_COMPRESSION.COMPRECLIST,
  comptype_str    OUT   VARCHAR2,
  subset_numrows  IN    NUMBER DEFAULT COMP_RATIO_INDEX_MINROWS);

```

- Syntax to get the compression ratio for IOTs.

```

DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
  scratchtbsname  IN    VARCHAR2,
  ownname         IN    VARCHAR2,
  objname         IN    VARCHAR2,
  subobjname      IN    VARCHAR2,
  comptype        IN    NUMBER,
  iotcomp_cr      OUT   DBMS_COMPRESSION.COMPRECLIST,
  comptype_str    OUT   VARCHAR2,
  subset_numrows  IN    NUMBER DEFAULT COMP_RATIO_INDEX_MINROWS);

```

Parameters

Table 4-1 GET_COMPRESSION_RATIO Procedure Parameters

Parameter	Description
scratchtbsname	Temporary scratch tablespace that can be used for analysis
ownname / tabowner	Schema of the table to analyze
tablename	Name of the table to analyze
objname	Name of the object

Table 4-1 (Cont.) GET_COMPRESSION_RATIO Procedure Parameters

Parameter	Description
subobjname	Name of the partition or sub-partition of the object
comptype	Compression types for which analysis should be performed When the object is an index, only the following compression types are valid: COMP_INDEX_ADVANCED_HIGH (value 1024) and COMP_INDEX_ADVANCED_LOW (value 2048). Note: The following compression types cannot be specified in this parameter for any type of object: COMP_BLOCK (value 64) and COMP_BASIC (value 4096).
blkcnt_cmp	Number of blocks used by compressed sample of the table
blkcnt_uncmp	Number of blocks used by uncompressed sample of the table
row_cmp	Number of rows in a block in compressed sample of the table
row_uncmp	Number of rows in a block in uncompressed sample of the table
cmp_ratio	Compression ratio, blkcnt_uncmp divided by blkcnt_cmp. It provides the ratio of blocks occupied by the uncompressed data to the blocks occupied by the compressed data.
comptype_str	String describing the compression type
subset_numrows	Number of rows sampled to estimate compression ratio.
objtype	Type of the object, either OBJTYPE_TABLE or OBJTYPE_INDEX
lobname	Name of the LOB column
partname	In case of partitioned tables, the related partition name
lobcnt	Number of lobs actually sampled to estimate compression ratio
byte_comp_ratio	Provides the ratio of bytes of uncompressed data to the bytes of compressed data for LOBs.
index_cr	List of indexes and their estimated compression ratios
iotcomp_cr	Compression ratio for the IOT The first object contains the compression ratio for the whole IOT. The second object contains the compression ratio only for the top index section of the IOT (excludes the overflow segment).
total_time	Provides an estimate of the time taken, in hours, to compress the LOB data in the table.

Example: Estimate the compression ratio for inline and out-of-line LOBs

The following example shows how to estimate the compression ratio for LOBs.

```

SET SERVEROUTPUT ON
DECLARE
    bcmp                INTEGER;
    buncmp              INTEGER;
    lobcmp              INTEGER;
    cr                  NUMBER;
    byte_cr             NUMBER;
    cstr                VARCHAR2(2000);
    total_time          NUMBER;

```

```
l_segment_name          VARCHAR2(30);
l_segment_size_blocks   NUMBER;
l_segment_size_bytes    NUMBER;
l_used_blocks           NUMBER;
l_used_bytes            NUMBER;
l_expired_blocks        NUMBER;
l_expired_bytes         NUMBER;
l_unexpired_blocks     NUMBER;
l_unexpired_bytes      NUMBER;
BEGIN
  DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
    scratchtbsname      => 'LOBTBSP',
    tabowner            => 'CMPADV',
    tabname             => p_tablename,
    lobname             => 'C',
    partname            => NULL,
    comptype            => 256,
    blkcnt_cmp          => bcmp,
    blkcnt_uncmp        => buncmp,
    lobcnt              => lobcmp,
    cmp_ratio           => cr,
    comptype_str        => cstr,
    subset_numrows      => 1000,
    byte_comp_ratio     => byte_cr,
    total_time          => total_time
  );
  DBMS_OUTPUT.put_line('Estimated ratio of blocks used by the
uncompressed data to the compressed data : ' || cr);
  DBMS_OUTPUT.put_line('Estimated ratio of bytes used by the
uncompressed data to the compressed data : ' || byte_cr);
END;
/
```

To understand the output of this procedure, let's consider `tab_inline`, an inline table, and `tab_outofline`, an out-of-line table as shown in the following example.

```
CREATE TABLE tab_inline
(
  a NUMBER,
  c CLOB
)
LOB(c) STORE AS SECUREFILE (ENABLE STORAGE IN ROW CACHE LOGGING);

CREATE TABLE tab_outofline
(
  a NUMBER,
  c CLOB
)
LOB(c) STORE AS SECUREFILE (DISABLE STORAGE IN ROW CACHE LOGGING);
```

Data is stored in different ways in `tab_inline` and `tab_outofline`. In the `tab_inline` table, if the LOB is less than 4K, then data is stored in the table segment; otherwise, it

is stored in the LOB segment. For the `tab_outofline` table, data of all sizes is stored in the LOB segment.

Let's consider that you have inserted 1000 LOBs of 3K each in both the tables, and then calculate the compression ratios. You can use the `dbms_space.space_usage` procedure to calculate the space used by the data that is stored in the LOB segments.

Sample output of compression ratio for inline LOBs.

```
Estimated block compression ratio : 1
Estimated byte compression ratio      : 57.6
Space used(in bytes)                  : 0
space used(in blocks)                 : 0
```

Sample output of compression ratio for out-of-line LOBs.

```
Estimated block compression ratio : 1
Estimated byte compression ratio      : 56.1
Space used(in bytes)                  : 8 MB
space used(in blocks)                 : 1000
```

In this example, even though the estimated byte and block compression ratios are almost the same for inline and out-of-line LOBs, the space that is used is different. In the case of `tab_inline`, LOB segment is not used so the space used is 0. In both cases, the data is approximately 3KB, which is small. Therefore, the data before and after compression uses the same number of blocks (that is 1 block), so the block compression ratio is 1. However, the byte level compression ratio, `byte_comp_ratio`, which compares the actual number of bytes used by the LOBs before and after compression is 57.6 or 56.1.

Example: Estimate the compression ratio for indexes on a table with low compression type

The following example shows how to estimate the compression ratio for advanced index compression (low):

```
SET SERVEROUTPUT ON
DECLARE
  l_blkcnt_cmp      PLS_INTEGER;
  l_blkcnt_uncmp    PLS_INTEGER;
  l_row_cmp         PLS_INTEGER;
  l_row_uncmp       PLS_INTEGER;
  l_cmp_ratio       NUMBER;
  l_comptype_str    VARCHAR2(32767);
BEGIN
  DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
    scratchtbsname => 'USERS' ,
    ownname         => 'TEST' ,
    objname         => 'SALES_IDX' ,
    subobjname      => NULL ,
    comptype        => DBMS_COMPRESSION.COMP_INDEX_ADVANCED_LOW,
    blkcnt_cmp      => l_blkcnt_cmp,
    blkcnt_uncmp    => l_blkcnt_uncmp,
    row_cmp         => l_row_cmp,
    row_uncmp       => l_row_uncmp,
```

```

        cmp_ratio      =>      1_cmp_ratio,
        comptype_str   =>      1_comptype_str,
        subset_numrows =>      DBMS_COMPRESSION.comp_ratio_minrows,
        objtype        =>      DBMS_COMPRESSION.objtype_index
    );
    DBMS_OUTPUT.put_line( 'Number of blocks used by the compressed sample
of the object      : ' || 1_blkcnt_cmp);
    DBMS_OUTPUT.put_line( 'Number of blocks used by the uncompressed
sample of the object : ' || 1_blkcnt_uncmp);
    DBMS_OUTPUT.put_line( 'Number of rows in a block in compressed sample
of the object      : ' || 1_row_cmp);
    DBMS_OUTPUT.put_line( 'Number of rows in a block in uncompressed
sample of the object : ' || 1_row_uncmp);
    DBMS_OUTPUT.put_line( 'Estimated Compression Ratio of
Sample              : ' || 1_cmp_ratio);
    DBMS_OUTPUT.put_line( 'Compression
Type                 : ' || 1_comptype_str);
END;
/

```

Output of compression advisor estimate for advanced index compression (Low):

```

Number of blocks used by the compressed sample of the object      : 243
Number of blocks used by the uncompressed sample of the object    : 539
Number of rows in a block in compressed sample of the object      : 499
Number of rows in a block in uncompressed sample of the object    : 145
Estimated Compression Ratio of Sample                            : 2.2
Compression Type                                                 : "Compress Advanced Low"

```

Example: Estimate the compression ratio for LOBs with medium compression type

The following example shows how to estimate the compression ratio for advanced LOB compression (medium):

```

SET SERVEROUTPUT ON
DECLARE
    1_blkcnt_cmp      PLS_INTEGER;
    1_blkcnt_uncmp    PLS_INTEGER;
    1_row_cmp         PLS_INTEGER;
    1_lobcnt          PLS_INTEGER;
    1_cmp_ratio       NUMBER;
    1_comptype_str    VARCHAR2(32767);
BEGIN
    DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
        scratchtbsname => 'USERS' ,
        tabowner       => 'TEST' ,
        tablename      => 'PARTS' ,
        lobname        => 'PART_DESCRIPTION' ,
        partname       => NULL ,
        comptype       => DBMS_COMPRESSION.COMP_LOB_MEDIUM,
        blkcnt_cmp     => 1_blkcnt_cmp,
        blkcnt_uncmp   => 1_blkcnt_uncmp,
        row_cmp        => 1_row_cmp,
        lobcnt         => 1_lobcnt,
        cmp_ratio      => 1_cmp_ratio,

```

```

        comptype_str => 1_comptype_str,
        subset_numrows => DBMS_COMPRESSION.comp_ratio_lob_maxrows
    );
DBMS_OUTPUT.put_line( 'Number of blocks used by the compressed sample of the
object      : ' || 1_blkcnt_cmp);
DBMS_OUTPUT.put_line( 'Number of blocks used by the uncompressed sample of
the object  : ' || 1_blkcnt_uncmp);
DBMS_OUTPUT.put_line( 'Number of rows in a block in compressed sample of the
object      : ' || 1_row_cmp);
DBMS_OUTPUT.put_line( 'Number of LOBS actually
sampled      : ' || 1_lobcnt);
DBMS_OUTPUT.put_line( 'Estimated Compression Ratio of
Sample       : ' || 1_cmp_ratio);
DBMS_OUTPUT.put_line( 'Compression
Type                                                : ' || 1_comptype_str);
END;
/

```

Output of compression advisor estimate for advanced LOB compression (Medium):

```

Number of blocks used by the compressed sample of the object      : 199
Number of blocks used by the uncompressed sample of the object    : 389
Number of rows in a block in compressed sample of the object     : 293
Number of LOBS actually sampled                                  : 55
Estimated Compression Ratio of Sample                           : 1.9
Compression Type                                                : "Compress Medium"

```

Example: Estimate the compression ratio for IOTs

The following example shows how to estimate the compression ratio for IOTs:

```

SET SERVEROUTPUT ON
DECLARE
    bcmp          INTEGER;
    buncmp        INTEGER;
    rowcmp         INTEGER;
    rowuncmp       INTEGER;
    cr             NUMBER;
    cstr           VARCHAR2(2000);
    iotcomp_cr    DBMS_COMPRESSION.COMPRECLIST;
BEGIN
    DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
        scratchtbsname => 'USERS',
        ownname         => 'TEST',
        objname         => 'SALES',
        subobjname      => NULL,
        comptype        => DBMS_COMPRESSION.COMP_INDEX_ADVANCED_LOW,
        iotcomp_cr      => iotcomp_cr,
        comptype_str    => cstr,
        subset_numrows  => DBMS_COMPRESSION.COMP_RATIO_ALLROWS
    );
    --information about the index and the overflow segment
    DBMS_OUTPUT.put_line( 'Number of blocks used by the compressed sample of
the IOT table           : ' ||
iotcomp_cr(1).blkcnt_cmp);
    DBMS_OUTPUT.put_line( 'Number of blocks used by the uncompressed sample of

```

```

the IOT table                               : ' ||
iotcomp_cr(1).blkcnt_uncmp);
  DBMS_OUTPUT.put_line( 'Average number of rows in a block in the
compressed sample of the IOT table           : ' ||
iotcomp_cr(1).row_cmp);
  DBMS_OUTPUT.put_line( 'Average number of rows in a block in the
uncompressed sample of the IOT table         : ' ||
iotcomp_cr(1).row_uncmp);
  DBMS_OUTPUT.put_line( 'Estimated Compression Ratio of the
sample                                       : ' ||
iotcomp_cr(1).cmp_ratio);
  --information about the index segment
  DBMS_OUTPUT.put_line( 'Number of blocks used by the compressed sample
of the index segment of the IOT table       : ' ||
iotcomp_cr(2).blkcnt_cmp);
  DBMS_OUTPUT.put_line( 'Number of blocks used by the uncompressed
sample of the index segment of the IOT table : ' ||
iotcomp_cr(2).blkcnt_uncmp);
  DBMS_OUTPUT.put_line( 'Average number of rows in a block in the
compressed sample of the index segment of the IOT table : ' ||
iotcomp_cr(2).row_cmp);
  DBMS_OUTPUT.put_line( 'Average number of rows in a block in the
uncompressed sample of the index segment of the IOT table : ' ||
iotcomp_cr(2).row_uncmp);
  DBMS_OUTPUT.put_line( 'Estimated Compression Ratio of the
sample                                       : ' ||
iotcomp_cr(2).cmp_ratio);
  END;
/

```

Output of the compression ratio for IOTs:

```

Number of blocks used by the compressed sample of the IOT
table                               : 5027
Number of blocks used by the uncompressed sample of the IOT
table                               : 7950
Average number of rows in a block in the compressed sample of the IOT
table                               : 199
Average number of rows in a block in the uncompressed sample of the IOT
table                               : 126
Estimated Compression Ratio of the
sample                               : 1.58
Number of blocks used by the compressed sample of the index segment of the IOT
table                               : 3238
Number of blocks used by the uncompressed sample of the index segment of the IOT
table                               : 6161
Average number of rows in a block in the compressed sample of the index segment
of the IOT table : 309
Average number of rows in a block in the uncompressed sample of the index
segment of the IOT table : 162
Estimated Compression Ratio of the
sample                               : 1.9

```

Usage Notes

- The procedure creates different tables in the scratch tablespace and runs analysis on these objects. It does not modify anything in the user-specified tables.

- From 23ai onwards, this feature has been enhanced to estimate the compression ratio faster for LOBs while using less space. To get a more accurate result, run the following command to switch to the old method. The older method to calculate the compression ratio takes more time to return the results and uses more space.

```
alter session set "_kdlf_new_compression_adv"= FALSE;
```

- To understand the impact of compression, use the value of the byte compression ratio for inline LOBs and for out-of-line LOBs, use the value of the block compression ratio and space used.
- You can get more benefits when you compress large volume of data as compared to small volumes of data. If you want to compress small volumes of data, look at the byte ratio instead of the block ratio to understand the impact of compression.

5

CTX_DDL

The `CTX_DDL` package lets you create and manage the preferences, section groups, and stoplists required for Text indexes.

Note that you must install this package in order to use it.

For complete description of this package within the context of Oracle Text, see `CTX_DDL` in the Oracle Text Reference.

6

CTX_CLS

The `CTX_CLS` package enables generation of CTXRULE rules for a set of documents.

For a complete description of this package within the context of Oracle Text, see `CTX_CLS` in the Oracle Text Reference.

7

CTX_DOC

The `CTX_DOC` package lets you request document services.

Note that you must install this package in order to use it.

For a complete description of this package within the context of Oracle Text, see `CTX_DOC` in the Oracle Text Reference.

8

CTX_ENTITY

The `CTX_ENTITY` package enables you to search for terms that are unknown to you without specifying a particular search text.

It does this by identifying names, places, dates, and other objects when they are mentioned in a document and by tagging each occurrence (called a mention) with its type and subtype. This process enables you to produce a structured view of a document that can later be used for text and data mining and more comprehensive intelligence analysis.

For the complete description of this package within the context of Oracle Text, see `CTX_ENTITY` in the *Oracle Text Reference*.

9

CTX_OUTPUT

This Oracle Text package lets you manage the index log.

Note that you must install this package in order to use it.

For a complete description of this package within the context of Oracle Text, see `CTX_OUTPUT` in the Oracle Text Reference.

10

CTX_QUERY

This Oracle Text package lets you generate query feedback, count hits, and create stored query expressions.

Note that you must install this package in order to use it.

For a complete description of this package within the context of Oracle Text, see `CTX_QUERY` in the Oracle Text Reference.

11

CTX_REPORT

This Oracle Text package lets you create various index reports.

Note that you must install this package in order to use it.

For a complete description of this package within the context of Oracle Text, see `CTX_REPORT` in the Oracle Text Reference.

12

CTX_THES

This Oracle Text package lets you to manage and browse thesauri.

Note that you must install this package in order to use it.

For a complete description of this package within the context of Oracle Text, see `CTX_THES` in the Oracle Text Reference.

13

CTX_ULEXER

This Oracle Text package is for use with the user-lexer.

Note that you must install this package in order to use it.

For a complete description of this package within the context of Oracle Text, see [CTX_ULEXER](#) in the Oracle Text Reference.

14

DBMS_ACTIVITY

DBMS_ACTIVITY contains functions and procedures allowing authorized users to control the activity information captured by OATS.

This package is owned by SYS, so EXECUTE package privilege is required of the non-SYS users. Users with DBA role are granted the EXECUTE privilege on this package.

This chapter contains the following topics:

- [Using DBMS_ACTIVITY](#)
- [Summary of DBMS_ACTIVITY Subprograms](#)

14.1 Using DBMS_ACTIVITY

Object Activity Tracking System (OATS) is a generic RDBMS based tracking service that provides information about various types of activities associated with different database objects. An activity represents a user or system-initiated action such as scanning or loading a table. Most of the activities are tracked in the form of frequencies (i.e. counts over fixed time intervals) such as the number of scans of a table in 15 minutes.

The database objects whose activities are tracked include tables and materialized views. Different types of activities include row insert, delete and update, table scan, load and truncate, partition maintenance operations (create, drop, move, split, merge, and exchange), materialized view rewrite and refresh.

Another important class of activities is related to the usage or non-usage of auxiliary structures such as MVs, indexes and zone maps.

Depending on the type of activity the tracking technique can be precise, approximate, or probabilistic. Most of the activities are tracked approximately mostly for efficiency reasons.

Depending on the type of activity and its usage by different clients a certain tracking technique would be more suitable than others. For example, counters are useful for tracking the index and materialized view usage. Counters are maintained for fixed time intervals in order to capture the object usage pattern over time. The same technique can be used to track the update activity of table columns by maintaining update counters for each. Setting bits in a bitvector is another form of tracking technique which is suitable for registering the occurrence of a certain activity within a time interval without saying how many times that activity occurred.

Precise Tracking: an activity is accounted for with 100% accuracy. Some form of atomic update or some latching is required to get precise tracking in a multi-processor environment. OATS generally avoids precise tracking, unless a client needs that kind of precision.

Approximate Tracking: an activity is accounted for in almost all cases but with rare exceptions. An example of approximate tracking is the dirty update of activity counters. Dirty updating is very efficient because no locking or latching is performed and atomic operations are not used when counters are changed. However, dirty updating can result in lost updates

leading to under counting. If lost updates are rare then dirty updating is a very efficient technique for approximate tracking.

Probabilistic Tracking: an activity is sampled with a certain probability, and it is accounted for when it becomes part of the sample. Probabilistic tracking produces activity data that is less accurate but it prevents frequent tracking actions.

Occurrence Tracking: records certain activity as having occurred within a time interval. Specifically, occurrence tracking provides information that says that certain object activity occurred at least once in a given time interval without saying how many times it occurred. The use of bitvector is a popular technique for occurrence tracking. Depending on how the bits are set in a bitvector the occurrence tracking can be either precise (no collisions) or approximate (possible collisions).

Counter Effects of Transactions and Rollback: Except for the precise tracking counters, none of the other types of counters is transactional or affected by rollback. This means that if a transaction fails, the approximate counters may still record any actions from that transaction. And when the database is rolled back to a save point, the approximate counters are not set back to their previous state.

14.2 Summary of DBMS_ACTIVITY Subprograms

DBMS_ACTIVITY uses the CONFIGURE, CREATE_SNAPSHOT, and DELETE_SNAPSHOTS procedures.

Table 14-1 DBMS_ACTIVITY Package Subprograms

Subprogram	Description
CONFIGURE Procedure	Allows an authorized user to set configuration parameters for OATS in parameter/value format.
CREATE_SNAPSHOT Procedure	Allows an authorized user to manually create an activity snapshot on local instance or on all database instances by flushing the activity information maintained in memory to disk
DELETE_SNAPSHOT Procedure	Allows an authorized user to manually delete all older snapshots based on an input snapshot id called BEFORE_SNAP_ID.
DELETE_SNAPSHOTS	Allows an authorized user to manually delete all older snapshots based on an input timestamp value called BEFORE_TIME.

14.2.1 CONFIGURE Procedure

This procedure allows an authorized user to set configuration parameters for OATS in parameter/value format.

This function can be called numerous times, each time setting a different configuration parameter, or same parameter but with different value. The parameter setting applies to the indicated database or the local database.

Syntax

```
DBMS_ACTIVITY.CONFIGURE (
    PARAMETER_NAME      IN VARCHAR2
    PARAMETER_VALUE     IN NUMBER,
    CON_DBNAME          IN VARCHAR2 := NULL
);
```


Parameters

Table 14-2 CONFIGURE Procedure Parameters

Parameter	Description
PARAMETER_NAME	Name of the configuration parameter to set. Parameters available: <ul style="list-style-type: none"> ACTIVITY_INTERVAL_MINUTES: The interval in minutes for maintaining activity information before it is flushed and reset. The default is 15. Other values: 30, 60, 120, 180, 240, 360, 480, 720, 1440 ACTIVITY_RETENTION_DAYS: the number of days to maintain the activity information before it is purged. The default is 400. From 8 to 2000. ACTIVITY_SPACE_PERCENT: soft limit in percent of the SYSAUX space for storing the activity information. The default is 5. From 1 to 25.
PARAMETER_VALUE	Value of the configuration parameter to use.
CON_DBNAME	Name of a container in the consolidated database (CDB). It is either root or a pluggable database. When omitted, the default is the local database.

 **Note:**

The current CDB or PDB name is the only non-null value supported.

Usage Notes

The user must be SYS, or must have the DBA role, or granted the EXECUTE package privilege.

14.2.2 CREATE_SNAPSHOT Procedure

This procedure allows an authorized user to manually create an activity snapshot on local instance or on all database instances by flushing the activity information maintained in memory to disk.

Syntax

```
DBMS_ACTIVITY.CREATE_SNAPSHOT(
  ALL_INSTANCES      IN BOOLEAN := TRUE,
  CON_DBNAME         IN VARCHAR2 := NULL
);
```


Parameters

Table 14-3 CREATE_SNAPSHOT Procedure Parameters

Parameter	Description
ALL_INSTANCES	Specify FALSE if activity snapshot should be created only for the local instance. The default is to create snapshot on all database instances.

Table 14-3 (Cont.) CREATE_SNAPSHOT Procedure Parameters

Parameter	Description
CON_DBNAME	Name of a container in the consolidated database (CDB). It is either root or a pluggable database. When omitted, the default is the local database.

 **Note:**
The current CDB or PDB name is the only non-null value supported.

Usage Notes

The SNAP_ID of snapshot created.

The user must be SYS, or must have the DBA role, or granted the EXECUTE package privilege.

14.2.3 DELETE_SNAPSHOT Procedure

This procedure allows an authorized user to manually delete all older snapshots based on an input snapshot id called BEFORE_SNAP_ID.


Syntax

```
DBMS_ACTIVITY.DELETE_SNAPSHOT (
    BEFORE_SNAP_ID    IN NUMBER,
    CON_DBNAME        IN VARCHAR2 := NULL
);
```

Parameters

Table 14-4 DELETE_SNAPSHOT Procedure Parameters

Parameter	Description
BEFORE_SNAP_ID	All snapshots with SNAP_ID value less than this argument value is removed from the disk storage (SYS_AUX).
CON_DBNAME	Name of a container in the consolidated database (CDB). It is either root or a pluggable database. When omitted, the default is the local database.

 **Note:**
The current CDB or PDB name is the only non-null value supported.

Usage Notes

Returns `TRUE` if one or more snapshots were deleted; `FALSE` otherwise.

The user must be `SYS`, or must have the `DBA` role, or granted the `EXECUTE` package privilege.

14.2.4 DELETE_SNAPSHOT Procedure

This procedure allows an authorized user to manually delete all older snapshots based on an input timestamp value called `BEFORE_TIME`.

Syntax

```
DBMS_ACTIVITY.DELETE_SNAPSHOT (
    BEFORE_TIME      IN TIMESTAMP,
    CON_DBNAME       IN VARCHAR2 := NULL
);
```

Parameters

Table 14-5 DELETE_SNAPSHOT Procedure Parameters

Parameter	Description
<code>BEFORE_TIME</code>	All snapshots associated with a time less than this argument value are removed from the disk storage (SYSAUX).
<code>CON_DBNAME</code>	Name of a container in the consolidated database (CDB). It is either root or a pluggable database. When omitted, the default is the local database.

 **Note:**

The current CDB or PDB name is the only non-null value supported.

Usage Notes

Returns `TRUE` if one or more snapshots were deleted; `FALSE` otherwise.

The user must be `SYS`, or must have the `DBA` role, or granted the `EXECUTE` package privilege.

15

DBMS_ADDM

The `DBMS_ADDM` package facilitates the use of Advisor functionality regarding the Automatic Database Diagnostic Monitor.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

This chapter contains the following topics:

- [Security Model](#)
- [Summary of DBMS_ADDM Subprograms](#)

See Also:

- *Oracle Real Application Clusters Administration and Deployment Guide* for more information about "Automatic Workload Repository in Oracle Real Application Clusters Environments"
- *Oracle Database Performance Tuning Guide* for more information about "Automatic Performance Diagnostics"

15.1 DBMS_ADDM Security Model

The `DBMS_ADDM` package runs with the caller's permission, not the definer's, and then applies the security constraints required by the `DBMS_ADVISOR` package.

See Also:

The `DBMS_ADVISOR` package for more information about "[Security Model](#)".

15.2 Summary of DBMS_ADDM Subprograms

The table in this topic lists and describes the `DBMS_ADDM` subprograms.

Table 15-1 DBMS_ADDM Package Subprograms

Subprogram	Description
ANALYZE_DB Procedure	Creates an ADDM task for analyzing in database analysis mode and executes it
ANALYZE_INST Procedure	Creates an ADDM task for analyzing in instance analysis mode and executes it.
ANALYZE_PARTIAL Procedure	Creates an ADDM task for analyzing a subset of instances in partial analysis mode and executes it
COMPARE_CAPTURE_REPLAY_REPORT Function	Produces a Compare Period ADDM report comparing the performance of a capture to a replay
COMPARE_DATABASES Function	Produces a Compare Period ADDM report for a database-wide performance comparison
COMPARE_INSTANCES Function	Produces a Compare Period ADDM report for an instance-level performance comparison
COMPARE_REPLAY_REPLAY_REPORT Function	Produces a Compare Period ADDM report comparing the performance of a replay to another replay
DELETE Procedure	Deletes an already created ADDM task (of any kind)
DELETE_FINDING_DIRECTIVE Procedure	Deletes a finding directive
DELETE_PARAMETER_DIRECTIVE Procedure	Deletes a parameter directive
DELETE_SEGMENT_DIRECTIVE Procedure	Deletes a segment directive
DELETE_SQL_DIRECTIVE Procedure	Deletes a SQL directive
FAILED_AUTO_TASKS_REPORT Function	Creates a plain text, user-readable report for the failed tasks registered in the <code>DBA_ADDM_PENDING_AUTOTASKS</code> views.
GET_ASH_QUERY Function	Returns a string containing the SQL text of an ASH query identifying the rows in ASH with impact for the finding
GET_REPORT Function	Retrieves the default text report of an executed ADDM task
INSERT_FINDING_DIRECTIVE Procedure	Creates a directive to limit reporting of a specific finding type.
INSERT_PARAMETER_DIRECTIVE Procedure	Creates a directive to prevent ADDM from creating actions to alter the value of a specific system parameter
INSERT_SEGMENT_DIRECTIVE Procedure	Creates a directive to prevent ADDM from creating actions to "run Segment Advisor" for specific segments
INSERT_SQL_DIRECTIVE Procedure	Creates a directive to limit reporting of actions on specific SQL
REAL_TIME_ADDM_REPORT Function	Produces a real-time report of ADDM activity
REEXECUTE_FAILED_AUTOTASKS Procedure	Re-executes the tasks registered in the <code>DBA_ADDM_PENDING_AUTOTASKS</code> views.

15.2.1 ANALYZE_DB Procedure

This procedure creates an ADDM task for analyzing in database analysis mode and executes it.

Syntax

```
DBMS_ADDM.ANALYZE_DB (
    task_name          IN OUT VARCHAR2,
    begin_snapshot     IN      NUMBER,
    end_snapshot       IN      NUMBER,
    read_only_type_override IN  VARCHAR2,
    db_id              IN      NUMBER := NULL);
```

Parameters

Table 15-2 ANALYZE_DB Procedure Parameters

Parameter	Description
task_name	Name of the task to be created.
begin_snapshot	Number of the snapshot that starts the analysis period.
end_snapshot	Number of the snapshot that ends the analysis period.
read_only_type_override	Overrides the type of CDB ADDM determines for analysis. The possible values are: <ul style="list-style-type: none"> • READ-WRITE—a regular database or the primary database in a data guard configuration • READ-ONLY—a database open in read-only mode, such as an active data guard standby • AUTO—allows ADDM to decide the type of CDB to override based on the data
db_id	Database ID for the database you to analyze. By default, this is the database currently connected.

Return Values

The name of the created task is returned in the `task_name` parameter. It may be different from the value that is given as input (only in cases that name is already used by another task).

Examples

To create an ADDM task in database analysis mode and execute it, with its name in variable `tname`:

```
var tname VARCHAR2(60);
BEGIN
    :tname := 'my_database_analysis_mode_task';
    DBMS_ADDM.ANALYZE_DB(:tname, 1, 2);
END
```

To see a report:

```
SET LONG 100000
SET PAGESIZE 50000
SELECT DBMS_ADDM.GET_REPORT(:tname) FROM DUAL;
```

Note that the return type of a report is a CLOB, formatted to fit line size of 80.

15.2.2 ANALYZE_INST Procedure

This procedure creates an ADDM task for analyzing in instance analysis mode and executes it.

Syntax

```
DBMS_ADDM.ANALYZE_INST (
    task_name          IN OUT VARCHAR2,
    begin_snapshot     IN      NUMBER,
    end_snapshot       IN      NUMBER,
    cdb_type_override  IN      VARCHAR2,
    read_only_type_override IN  VARCHAR2,
    instance_number    IN      NUMBER := NULL,
    db_id              IN      NUMBER := NULL);
```

Parameters

Table 15-3 ANALYZE_INST Procedure Parameters

Parameter	Description
task_name	Name of the task to be created
begin_snapshot	Number of the snapshot that starts the analysis period
end_snapshot	Number of the snapshot that ends the analysis period
cdb_type_override	Overrides the type of CDB that ADDM determines for doing analysis. The possible values are: <ul style="list-style-type: none"> AUTONOMOUS OLTP—autonomous OLTP inside a PDB AUTONOMOUS DATA WAREHOUSE—autonomous data warehouse (ADWH) inside a PDB PDB <ul style="list-style-type: none"> —a regular PDB CDB ROOT <ul style="list-style-type: none"> —the root of a CDB NON-CDB <ul style="list-style-type: none"> —a system that is not CDB or PDB AUTO <ul style="list-style-type: none"> —allows ADDM to decide the type of CDB to override based on the data
read_only_type_override	Overrides the type of CDB ADDM determines for analysis. The possible values are: <ul style="list-style-type: none"> READ-WRITE—a regular database or the primary database in a data guard configuration READ-ONLY—a database open in read-only mode, such as an active data guard standby AUTO—allows ADDM to decide the type of CDB to override based on the data
instance_number	Number of the instance to analyze. By default it is the instance currently connected
db_id	Database ID for the database you to analyze. By default, this is the database currently connected

Return Values

The name of the created task is returned in the `task_name` parameter. It may be different from the value that is given as input (only in cases that name is already used by another task).

Usage Notes

On single instance systems (when not using Oracle RAC) the resulting task is identical to using the `ANALYZE_DB` procedure.

Examples

To create an ADDM task in instance analysis mode and execute it, with its name in variable `tname`:

```
var tname VARCHAR2(60);
BEGIN
  :tname := 'my_instance_analysis_mode_task';
  DBMS_ADDM.ANALYZE_INST(:tname, 1, 2);
END
```

To see a report:

```
SET LONG 100000
SET PAGESIZE 50000
SELECT DBMS_ADDM.GET_REPORT(:tname) FROM DUAL;
```

Note that the return type of a report is a `CLOB`, formatted to fit line size of 80.

15.2.3 ANALYZE_PARTIAL Procedure

This procedure creates an ADDM task for analyzing a subset of instances in partial analysis mode and executes it.

Syntax

```
DBMS_ADDM.ANALYZE_PARTIAL (
  task_name           IN OUT VARCHAR2,
  instance_numbers   IN     VARCHAR2,
  begin_snapshot     IN     NUMBER,
  end_snapshot       IN     NUMBER,
  cdb_type_override  IN     VARCHAR2,
  read_only_type_override IN VARCHAR2,
  db_id              IN     NUMBER := NULL);
```

Parameters

Table 15-4 ANALYZE_PARTIAL Procedure Parameters

Parameter	Description
<code>task_name</code>	Name of the task to be created
<code>instance_numbers</code>	Comma separated list of instance numbers to analyze
<code>begin_snapshot</code>	Number of the snapshot that starts the analysis period
<code>end_snapshot</code>	Number of the snapshot that ends the analysis period

Table 15-4 (Cont.) ANALYZE_PARTIAL Procedure Parameters

Parameter	Description
<code>cdb_type_override</code>	<p>Overrides the type of CDB that ADDM determines for doing analysis. The possible values are:</p> <ul style="list-style-type: none"> • <code>AUTONOMOUS OLTP</code>—autonomous OLTP inside a PDB • <code>AUTONOMOUS DATA WAREHOUSE</code>—autonomous data warehouse (ADWH) inside a PDB • <code>PDB</code> —a regular PDB • <code>CDB ROOT</code> —the root of a CDB • <code>NON-CDB</code> —a system that is not CDB or PDB • <code>AUTO</code> —allows ADDM to decide the type of CDB to override based on the data
<code>read_only_type_override</code>	<p>Overrides the type of CDB ADDM determines for analysis. The possible values are:</p> <ul style="list-style-type: none"> • <code>READ-WRITE</code>—a regular database or the primary database in a data guard configuration • <code>READ-ONLY</code>—a database open in read-only mode, such as an active data guard standby • <code>AUTO</code>—allows ADDM to decide the type of CDB to override based on the data
<code>db_id</code>	<p>Database ID for the database you to analyze. By default, this is the database currently connected</p>

Return Values

The name of the created task is returned in the `task_name` parameter. It may be different from the value that is given as input (only in cases that name is already used by another task).

Examples

To create an ADDM task in partial analysis mode and execute it, with its name in variable `tname`:

```
var tname VARCHAR2(60);
BEGIN
    :tname := 'my_partial_analysis_modetask';
    DBMS_ADDM.ANALYZE_PARTIAL(:tname, '1,2,3', 1, 2);
END
```

To see a report:

```
SET LONG 100000
SET PAGESIZE 50000
SELECT DBMS_ADDM.GET_REPORT(:tname) FROM DUAL;
```

Note that the return type of a report is a CLOB, formatted to fit line size of 80.

15.2.4 COMPARE_CAPTURE_REPLAY_REPORT Function

This function produces a Compare Period ADDM report comparing the performance of a capture to a replay.

The AWR data must reside in the same database, but it can originate from different databases. The function generates a report in either XML or HTML(Active Report) format.

Syntax

```
DBMS_ADDM.COMPARE_CAPTURE_REPLAY_REPORT (
    replay_id          IN NUMBER,
    cdb_type_override  IN VARCHAR2,
    read_only_type_override  IN VARCHAR2,
    report_type        IN VARCHAR2 := 'HTML')
RETURN CLOB;
```

Parameters

Table 15-5 COMPARE_CAPTURE_REPLAY_REPORT Function Parameters

Parameter	Description
replay_id	Replay ID to use as the base period. The base period is the baseline period to compare in order to determine improvement or regression.
cdb_type_override	Overrides the type of CDB that ADDM determines for doing analysis. The possible values are: <ul style="list-style-type: none"> AUTONOMOUS OLTP—autonomous OLTP inside a PDB AUTONOMOUS DATA WAREHOUSE—autonomous data warehouse (ADWH) inside a PDB PDB <ul style="list-style-type: none"> —a regular PDB CDB ROOT <ul style="list-style-type: none"> —the root of a CDB NON-CDB <ul style="list-style-type: none"> —a system that is not CDB or PDB AUTO <ul style="list-style-type: none"> —allows ADDM to decide the type of CDB to override based on the data
read_only_type_override	Overrides the type of CDB ADDM determines for analysis. The possible values are: <ul style="list-style-type: none"> READ-WRITE—a regular database or the primary database in a data guard configuration READ-ONLY—a database open in read-only mode, such as an active data guard standby AUTO—allows ADDM to decide the type of CDB to override based on the data
report_type	HTML (the default) for an HTML active report, 'XML' for an XML report

Return Values

A CLOB containing a compare period ADDM report

15.2.5 COMPARE_DATABASES Function

This function produces a Compare Period ADDM report comparing the performance of a database over two different time periods or the performance of two different databases over two different time periods.

The AWR data must reside in the same database, but it can originate from different databases. The function generates a report in either XML or HTML(Active Report) format.

Syntax

```
DBMS_ADDM.COMPARE_DATABASES (
  base_dbid          IN NUMBER := NULL,
  base_begin_snap_id IN NUMBER,
  base_end_snap_id   IN NUMBER,
  comp_dbid          IN NUMBER := NULL,
  comp_begin_snap_id IN NUMBER,
  comp_end_snap_id   IN NUMBER,
  cdb_type_override  IN   VARCHAR2,
  read_only_type_override IN   VARCHAR2,
  report_type        IN VARCHAR2 := 'HTML')
RETURN CLOB;
```

Parameters

Table 15-6 COMPARE_DATABASES Function Parameters

Parameter	Description
base_dbid	Database id (DBID) of the base period. The base period is the baseline period that we compare to in order to determine improvement or regression.
base_begin_snap_ids	Begin AWR snapshot ID of the base period.
base_end_snap_id	End AWR snapshot ID of the base period.
comp_dbid	Database id (DBID) of the comparison period. The comparison period is the period we compare to the base period.
comp_begin_snap_id	Begin AWR snapshot ID of the comparison period
comp_end_snap_id	End AWR snapshot ID of the comparison period

Table 15-6 (Cont.) COMPARE_DATABASES Function Parameters

Parameter	Description
<code>cdb_type_override</code>	<p>Overrides the type of CDB that ADDM determines for doing analysis. The possible values are:</p> <ul style="list-style-type: none"> <code>AUTONOMOUS OLTP</code>—autonomous OLTP inside a PDB <code>AUTONOMOUS DATA WAREHOUSE</code>—autonomous data warehouse (ADWH) inside a PDB <code>PDB</code> —a regular PDB <code>CDB ROOT</code> —the root of a CDB <code>NON-CDB</code> —a system that is not CDB or PDB <code>AUTO</code> —allows ADDM to decide the type of CDB to override based on the data
<code>read_only_type_override</code>	<p>Overrides the type of CDB ADDM determines for analysis. The possible values are:</p> <ul style="list-style-type: none"> <code>READ-WRITE</code>—a regular database or the primary database in a data guard configuration <code>READ-ONLY</code>—a database open in read-only mode, such as an active data guard standby <code>AUTO</code>—allows ADDM to decide the type of CDB to override based on the data
<code>report_type</code>	'HTML' (the default) for an HTML active report, 'XML' for an XML report

Return Values

A CLOB containing a compare period ADDM report

15.2.6 COMPARE_INSTANCES Function

This function produces a Compare Period ADDM report comparing the performance of a single instance over two different time periods or the performance of two different instances over two different time periods.

The AWR data must reside in the same database, but it can originate from different databases. The function generates a report in either XML or HTML(Active Report) format.

Syntax

```
DBMS_ADDM.COMPARE_INSTANCES (
  base_dbid           IN NUMBER := NULL,
  base_instance_id    IN NUMBER,
  base_begin_snap_id  IN NUMBER,
  base_end_snap_id    IN NUMBER,
  comp_dbid           IN NUMBER := NULL,
  comp_instance_id    IN NUMBER,
  comp_begin_snap_id  IN NUMBER,
  comp_end_snap_id    IN NUMBER,
  cdb_type_override   IN VARCHAR2,
```

```

read_only_type_override IN VARCHAR2,
report_type             IN VARCHAR2 := 'HTML')
RETURN CLOB;

```

Parameters

Table 15-7 COMPARE_INSTANCES Function Parameters

Parameter	Description
base_dbid	Database id (DBID) of the base period. The base period is the baseline period that we compare to in order to determine improvement or regression.
base_instance_id	Instance number of the database instance to include from the base period
base_begin_snap_id	Begin AWR snapshot ID of the base period.
base_end_snap_id	End AWR snapshot ID of the base period.
comp_dbid	Database id (DBID) of the comparison period. The comparison period is the period we compare to the base period.
comp_instance_id	Instance number of the database instance to include from the comparison period
comp_begin_snap_id	Begin AWR snapshot ID of the comparison period
comp_end_snap_id	End AWR snapshot ID of the comparison period
cdb_type_override	Overrides the type of CDB that ADDM determines for doing analysis. The possible values are: <ul style="list-style-type: none"> AUTONOMOUS OLTP—autonomous OLTP inside a PDB AUTONOMOUS DATA WAREHOUSE—autonomous data warehouse (ADWH) inside a PDB PDB <ul style="list-style-type: none"> —a regular PDB CDB ROOT <ul style="list-style-type: none"> —the root of a CDB NON-CDB <ul style="list-style-type: none"> —a system that is not CDB or PDB AUTO <ul style="list-style-type: none"> —allows ADDM to decide the type of CDB to override based on the data
read_only_type_override	Overrides the type of CDB ADDM determines for analysis. The possible values are: <ul style="list-style-type: none"> READ-WRITE—a regular database or the primary database in a data guard configuration READ-ONLY—a database open in read-only mode, such as an active data guard standby AUTO—allows ADDM to decide the type of CDB to override based on the data
report_type	'HTML' (the default) for an HTML active report, 'XML' for an XML report

Return Values

A CLOB containing a compare period ADDM report

15.2.7 COMPARE_REPLAY_REPLAY_REPORT Function

This function produces a Compare Period ADDM report comparing the performance of a replay to another replay.

The AWR data must reside in the same database, but it can originate from different databases. The function generates a report in either XML or HTML(Active Report) format.

Syntax

```
DBMS_ADDM.COMPARE_CAPTURE_REPLAY_REPORT (
    replay_id1          IN    NUMBER,
    replay_id2          IN    NUMBER,
    cdb_type_override   IN    VARCHAR2,
    read_only_type_override IN  VARCHAR2,
    report_type         IN    VARCHAR2 := 'HTML')
RETURN CLOB;
```

Parameters

Table 15-8 COMPARE_REPLAY_REPLAY_REPORT Function Parameters

Parameter	Description
replay_id1	Replay ID to use as the base period. The base period is the baseline period to compare in order to determine improvement or regression.
replay_id2	Replay ID to use as the comparison period. The comparison period is the period to compare to the base period in order to determine improvement or regression.
cdb_type_override	Overrides the type of CDB that ADDM determines for doing analysis. The possible values are: <ul style="list-style-type: none"> AUTONOMOUS OLTP—autonomous OLTP inside a PDB AUTONOMOUS DATA WAREHOUSE—autonomous data warehouse (ADWH) inside a PDB PDB <ul style="list-style-type: none"> —a regular PDB CDB ROOT <ul style="list-style-type: none"> —the root of a CDB NON-CDB <ul style="list-style-type: none"> —a system that is not CDB or PDB AUTO <ul style="list-style-type: none"> —allows ADDM to decide the type of CDB to override based on the data
read_only_type_override	Overrides the type of CDB ADDM determines for analysis. The possible values are: <ul style="list-style-type: none"> READ-WRITE—a regular database or the primary database in a data guard configuration READ-ONLY—a database open in read-only mode, such as an active data guard standby AUTO—allows ADDM to decide the type of CDB to override based on the data
report_type	'HTML' (the default) for an HTML active report, 'XML' for an XML report

Return Values

A CLOB containing a compare period ADDM report

15.2.8 DELETE Procedure

This procedure deletes an already created ADDM task (of any kind). For database analysis mode and partial analysis mode this deletes the local tasks associated with the main task.

Syntax

```
DBMS_ADDM.DELETE (
    task_name          IN VARCHAR2);
```

Parameters**Table 15-9 DELETE Procedure Parameters**

Parameter	Description
task_name	Name of the task to be deleted

Examples

```
BEGIN
    DBMS_ADDM.DELETE ('my_partial_analysis_mode_task');
END
```

15.2.9 DELETE_FINDING_DIRECTIVE Procedure

This procedure deletes a finding directive.

Syntax

```
DBMS_ADDM.DELETE_FINDING_DIRECTIVE (
    task_name          IN VARCHAR2,
    dir_name           IN VARCHAR2);
```

Parameters**Table 15-10 DELETE_FINDING_DIRECTIVE Procedure Parameters**

Parameter	Description
task_name	Name of the task this directive applies to. If the value is NULL, it is a system directive.
dir_name	Name of the directive. All directives must be given unique names.

15.2.10 DELETE_PARAMETER_DIRECTIVE Procedure

This procedure deletes a parameter directive. This removes a specific system directive for parameters. Subsequent ADDM tasks are not affected by this directive.

Syntax

```
DBMS_ADDM.DELETE_PARAMETER_DIRECTIVE (  
    task_name          IN VARCHAR2,  
    dir_name           IN VARCHAR2);
```

Parameters

Table 15-11 DELETE_PARAMETER_DIRECTIVE Procedure Parameters

Parameter	Description
task_name	Name of the task this directive applies to. If the value is NULL, it is a system directive.
dir_name	Name of the directive. All directives must be given unique names.

Examples

```
BEGIN  
    DBMS_ADDM.DELETE_PARAMETER_DIRECTIVE (NULL, 'my Parameter directive');  
END;
```

15.2.11 DELETE_SEGMENT_DIRECTIVE Procedure

This procedure deletes a segment directive.

Syntax

```
DBMS_ADDM.DELETE_SEGMENT_DIRECTIVE (  
    task_name          IN VARCHAR2,  
    dir_name           IN VARCHAR2);
```

Parameters

Table 15-12 DELETE_SEGMENT_DIRECTIVE Procedure Parameters

Parameter	Description
task_name	Name of the task this directive applies to. If the value is NULL, it is a system directive.
dir_name	Name of the directive. All directives must be given unique names.

15.2.12 DELETE_SQL_DIRECTIVE Procedure

This procedure deletes a SQL directive.

Syntax

```
DBMS_ADDM.DELETE_SQL_DIRECTIVE (  
    task_name      IN VARCHAR2,  
    dir_name       IN VARCHAR2);
```

Parameters

Table 15-13 DELETE_SQL_DIRECTIVE Procedure Parameters

Parameter	Description
task_name	Name of the task this directive applies to. If the value is NULL, it is a system directive.
dir_name	Name of the directive. All directives must be given unique names.

15.2.13 FAILED_AUTO_TASKS_REPORT Function

This function creates a plain text, user-readable report for the failed tasks registered in the DBA_ADDM_PENDING_AUTOTASKS views.

Syntax

```
DBMS_ADDM.FAILED_AUTO_TASKS_REPORT(  
    instance_number  IN  NUMBER :=NULL,  
    begin_snapshot   IN  NUMBER :=NULL,  
    end_snapshot     IN  NUMBER :=NULL,  
    dbid             IN  NUMBER :=NULL)
```

Parameters

Table 15-14 FAILED_AUTO_TASKS_REPORT Function Parameters

Parameter	Description
instance_number	Instance number for the tasks to be reported.
begin_snapshot	Earliest begin snapshot ID for the tasks to be reported.
end_snapshot	Latest end snapshot ID for the tasks to be reported.
dbid	Database ID for the tasks to be reported.

15.2.14 GET_ASH_QUERY Function

The function returns a string containing the SQL text of an ASH query identifying the rows in ASH with impact for the finding.

For most types of findings this identifies the exact rows in ASH corresponding to the finding. For some types of findings the query is an approximation and should not be used for exact identification of the finding's impact or the finding's specific activity.

Syntax

```
DBMS_ADDM.GET_ASH_QUERY (
    task_name          IN  VARCHAR2,
    finding_id        IN  NUMBER)
RETURN VARCHAR2;
```

Parameters

Table 15-15 GET_ASH_QUERY Function Parameters

Parameter	Description
task_name	Name of the task
finding	ID of the finding within the task

Return Values

A VARCHAR containing an ASH query identifying the rows in ASH with impact for the finding

15.2.15 GET_REPORT Function

This function retrieves the default text report of an executed ADDM task.

Syntax

```
DBMS_ADDM.GET_REPORT (
    task_name          IN  VARCHAR2)
RETURN CLOB;
```

Parameters

Table 15-16 GET_REPORT Function Parameters

Parameter	Description
task_name	Name of the task

Examples

```
Set long 1000000
Set pagesize 50000
SELECT DBMS_ADDM.GET_REPORT('my_partial_analysis_mode_task') FROM DUAL;
```

15.2.16 INSERT_FINDING_DIRECTIVE Procedure

This procedure creates a directive to limit reporting of a specific finding type. The directive can be created for a specific task (only when the task is in `INITIAL` status), or for all subsequently created ADDM tasks (such as a system directive).

Syntax

```
DBMS_ADDM.INSERT_FINDING_DIRECTIVE (
  task_name          IN VARCHAR2,
  dir_name           IN VARCHAR2,
  finding_name       IN VARCHAR2,
  min_active_sessions IN NUMBER := 0,
  min_perc_impact    IN NUMBER := 0);
```

Parameters

Table 15-17 INSERT_FINDING_DIRECTIVE Procedure Parameters

Parameter	Description
task_name	Name of the task this directive applies to. If the value is NULL, it applies to all subsequently created ADDM Tasks.
dir_name	Name of the directive. All directives must be given unique names.
finding_name	Name of an ADDM finding to which this directive applies. All valid findings names appear in the NAME column of view DBA_ADVISOR_FINDING_NAMES.
min_active_sessions	Minimal number of active sessions for the finding. If a finding has less than this number, it is filtered from the ADDM result.
min_perc_impact	Minimal number for the "percent impact" of the finding relative to total database time in the analysis period. If the finding's impact is less than this number, it is filtered from the ADDM result.

Examples

A new ADDM task is created to analyze a local instance. However, it has special treatment for 'Undersized SGA' findings. The result of `GET_REPORT` shows only an 'Undersized SGA' finding if the finding is responsible for at least 2 average active sessions during the analysis period, and this constitutes at least 10% of the total database time during that period.

```
var tname VARCHAR2(60);
BEGIN
  DBMS_ADDM.INSERT_FINDING_DIRECTIVE(
    NULL,
    'Undersized SGA directive',
    'Undersized SGA',
    2,
    10);
  :tname := 'my_instance_analysis_mode_task';
  DBMS_ADDM.ANALYZE_INST(:tname, 1, 2);
END;
```

To see a report containing 'Undersized SGA' findings regardless of the directive:

```
SELECT DBMS_ADVISOR.GET_TASK_REPORT(:tname, 'TEXT', 'ALL') FROM DUAL;
```

15.2.17 INSERT_PARAMETER_DIRECTIVE Procedure

This procedure creates a directive to prevent ADDM from creating actions to alter the value of a specific system parameter. The directive can be created for a specific task (only when the task is in `INITIAL` status), or for all subsequently created ADDM tasks (such as a system directive).

Syntax

```
DBMS_ADDM.INSERT_PARAMETER_DIRECTIVE (
    task_name          IN VARCHAR2,
    dir_name           IN VARCHAR2,
    parameter_name     IN VARCHAR2);
```

Parameters

Table 15-18 INSERT_PARAMETER_DIRECTIVE Procedure Parameters

Parameter	Description
task_name	Name of the task this directive applies to. If the value is <code>NULL</code> , it applies to all subsequently created ADDM Tasks.
dir_name	Name of the directive. All directives must be given unique names.
parameter_name	Specifies the parameter to use. Valid parameter names appear in <code>V\$PARAMETER</code> .

Examples

A new ADDM task is created to analyze a local instance. However, it has special treatment for all actions that recommend modifying the parameter `'sga_target'`. The result of `GET_REPORT` does not show these actions.

```
var tname varchar2(60);
BEGIN
    DBMS_ADDM.INSERT_PARAMETER_DIRECTIVE(
        NULL,
        'my Parameter directive',
        'sga_target');
    :tname := 'my_instance_analysis_mode_task';
    DBMS_ADDM.ANALYZE_INST(:tname, 1, 2);
END;
```

To see a report containing all actions regardless of the directive:

```
SELECT DBMS_ADVISOR.GET_TASK_REPORT(:tname, 'TEXT', 'ALL') FROM DUAL;
```

15.2.18 INSERT_SEGMENT_DIRECTIVE Procedure

This procedure creates a directive to prevent ADDM from creating actions to "run Segment Advisor" for specific segments. The directive can be created for a specific task (only when the

task is in `INITIAL` status), or for all subsequently created ADDM tasks (such as a system directive).

Syntax

```
DBMS_ADDM.INSERT_SEGMENT_DIRECTIVE (
    task_name          IN VARCHAR2,
    dir_name           IN VARCHAR2,
    owner_name         IN VARCHAR2,
    object_name        IN VARCHAR2 := NULL,
    sub_object_name    IN VARCHAR2 := NULL);
```

```
DBMS_ADDM.INSERT_SEGMENT_DIRECTIVE (
    task_name          IN VARCHAR2,
    dir_name           IN VARCHAR2,
    object_number      IN NUMBER);
```

Parameters

Table 15-19 INSERT_SEGMENT_DIRECTIVE Procedure Parameters

Parameter	Description
<code>task_name</code>	Name of the task this directive applies to. If the value is <code>NULL</code> , it applies to all subsequently created ADDM Tasks.
<code>dir_name</code>	Name of the directive. All directives must be given unique names.
<code>owner_name</code>	Specifies the owner of the segment/s to be filtered. A wildcard is allowed in the same syntax used for "like" constraints.
<code>object_name</code>	Name of the main object to be filtered. Again, wildcards are allowed. The default value of <code>NULL</code> is equivalent to a value of <code>'%'</code> .
<code>sub_object_name</code>	Name of the part of the main object to be filtered. This could be a partition name, or even sub partitions (separated by a <code>'.'</code>). Again, wildcards are allowed. The default value of <code>NULL</code> is equivalent to a value of <code>'%'</code> .
<code>object_number</code>	Object number of the <code>SEGMENT</code> that this directive is to filter, found in views <code>DBA_OBJECTS</code> or <code>DBA_SEGMENTS</code>

Examples

A new ADDM task is created to analyze a local instance. However, it has special treatment for all segments that belong to user `SCOTT`. The result of `GET_REPORT` does not show actions for running Segment advisor for segments that belong to `SCOTT`.

```
var tname VARCHAR2(60);
BEGIN
    DBMS_ADDM.INSERT_SEGMENT_DIRECTIVE(NULL,
                                       'my Segment directive',
                                       'SCOTT');
    :tname := 'my_instance_analysis_mode_task';
    DBMS_ADDM.ANALYZE_INST(:tname, 1, 2);
END;
```

To see a report containing all actions regardless of the directive:

```
SELECT DBMS_ADVISOR.GET_TASK_REPORT(:tname, 'TEXT', 'ALL') FROM DUAL;
```

15.2.19 INSERT_SQL_DIRECTIVE Procedure

This procedure creates a directive to limit reporting of actions on specific SQL. The directive can be created for a specific task (only when the task is in `INITIAL` status), or for all subsequently created ADDM tasks (such as a system directive).

Syntax

```
DBMS_ADDM.INSERT_SQL_DIRECTIVE (
    task_name          IN VARCHAR2,
    dir_name           IN VARCHAR2,
    sql_id             IN VARCHAR2,
    min_active_sessions IN NUMBER := 0,
    min_response_time  IN NUMBER := 0);
```

Parameters

Table 15-20 INSERT_SQL_DIRECTIVE Procedure Parameters

Parameter	Description
task_name	Name of the task this directive applies to. If the value is <code>NULL</code> , it applies to all subsequently created ADDM Tasks.
dir_name	Name of the directive. All directives must be given unique names.
sql_id	Identifies which SQL statement to filter. A valid value contains exactly 13 characters from '0' to '9' and 'a' to 'z'.
min_active_sessions	Minimal number of active sessions for the SQL. If a SQL action has less than this number, it is filtered from the ADDM result.
min_response_time	Minimal value for response time of the SQL (in microseconds). If the SQL had lower response time, it is filtered from the ADDM result.

Examples

A new ADDM task is created to analyze a local instance. However, it has special treatment for SQL with id 'abcd123456789'. The result of `GET_REPORT` shows only actions for that SQL (actions to tune the SQL, or to investigate application using it) if the SQL is responsible for at least 2 average active sessions during the analysis period, and the average response time was at least 1 second.

```
var tname VARCHAR2(60);
BEGIN
    DBMS_ADDM.INSERT_SQL_DIRECTIVE (
        NULL,
        'my SQL directive',
        'abcd123456789',
        2,
        1000000);
    :tname := 'my_instance_analysis_mode_task';
    DBMS_ADDM.ANALYZE_INST(:tname, 1, 2);
END;
```

To see a report containing all actions regardless of the directive:

```
SELECT DBMS_ADVISOR.GET_TASK_REPORT(:tname, 'TEXT', 'ALL') FROM DUAL;
```

15.2.20 REAL_TIME_ADDM_REPORT Function

This function produces a real-time ADDM report for ADDM-related activity for the last five minutes. In an Oracle Real Application Clusters (Oracle RAC) environment, the function assumes that executing SQL over `GV$` is possible.

Syntax

```
DBMS_ADDM.REAL_TIME_ADDM_REPORT (
  cdb_type_override      IN   VARCHAR2,
  read_only_type_override IN   VARCHAR2)
RETURN CLOB;
```

Parameters

Table 15-21 REAL_TIME_ADDM_REPORT Function Parameters

Parameter	Description
<code>cdb_type_override</code>	<p>Overrides the type of CDB that ADDM determines for doing analysis. The possible values are:</p> <ul style="list-style-type: none"> <code>AUTONOMOUS OLTP</code>—autonomous OLTP inside a PDB <code>AUTONOMOUS DATA WAREHOUSE</code>—autonomous data warehouse (ADWH) inside a PDB <code>PDB</code>—a regular PDB <code>CDB ROOT</code>—the root of a CDB <code>NON-CDB</code>—a system that is not CDB or PDB <code>AUTO</code>—allows ADDM to decide the type of CDB to override based on the data
<code>read_only_type_override</code>	<p>Overrides the type of CDB ADDM determines for analysis. The possible values are:</p> <ul style="list-style-type: none"> <code>READ-WRITE</code>—a regular database or the primary database in a data guard configuration <code>READ-ONLY</code>—a database open in read-only mode, such as an active data guard standby <code>AUTO</code>—allows ADDM to decide the type of CDB to override based on the data

Return Values

CLOB containing a real-time ADDM report

15.2.21 REEXECUTE_FAILED_AUTO_TASKS Procedure

This procedure re-executes the tasks registered in the `DBA_ADDM_PENDING_AUTOTASKS` views.

This API can be called from both the CDB and PDB level. The user specifies the range for the snapshots or a time interval. The duration of the re-execution is time

constrained by a user-specified parameter or a default value. Once a task has executed successfully, its corresponding row is removed from the `DBA_ADDM_PENDING_AUTOTASKS` view.

Syntax

```
DBMS_ADDM.REEXECUCUTE_FAILED_AUTO_TASKS (  
  instance_number      IN  NUMBER :=NULL,  
  begin_snapshot      IN  NUMBER :=NULL,  
  end_snapshot        IN  NUMBER :=NULL,  
  dbid                IN  NUMBER :=NULL,  
  time_budget_in_sec  IN  NUMBER :=NULL,  
  max_attempts        IN  NUMBER :=NULL);
```

Parameters

Table 15-22 REEXECUTE_FAILED_AUTO_TASKS Function Parameters

Parameter	Description
<code>instance_number</code>	Instance number for the tasks to be re executed.
<code>begin_snapshot</code>	Earliest begin snapshot ID for the tasks to be re executed.
<code>end_snapshot</code>	Latest end snapshot ID for the tasks to be re executed.
<code>dbid</code>	Database ID for the tasks to be re executed.
<code>time_budget_in_sec</code>	Forced time out to run the procedure after exiting.
<code>max_attempts</code>	Maximum number of attempts to re execute a task.

16

DBMS_ADVANCED_REWRITE

`DBMS_ADVANCED_REWRITE` contains interfaces for advanced query rewrite users. Using this package, you can create, drop, and maintain functional equivalence declarations for query rewrite.



See Also:

Oracle Database Data Warehousing Guide for more information about query rewrite

This chapter contains the following topics:

- [DBMS_ADVANCED_REWRITE Security Model](#)
- [Summary of DBMS_ADVANCED_REWRITE Subprograms](#)

16.1 DBMS_ADVANCED_REWRITE Security Model

Default privileges are not granted to anyone for access to `DBMS_ADVANCED_REWRITE` Security Model procedures. To gain access to these procedures, you must connect as `SYSDBA` and explicitly grant execute access to the desired database administrators.

You can control security on this package by granting the `EXECUTE` privilege to selected database administrators or roles. For example, the user `er` can be given access to use this package by the following statement, executed as `SYSDBA`:

```
GRANT EXECUTE ON DBMS_ADVANCED_REWRITE TO er;
```

You may want to write a separate cover package on top of this package for restricting the alert names used. Instead of granting the `EXECUTE` privilege on the `DBMS_ADVANCED_REWRITE` package directly, you can then grant it to the cover package.

In addition, similar to the privilege required for regular materialized views, the user should be granted the privilege to create an equivalence. For example, the user `er` can be granted this privilege by executing the following statement as `SYSDBA`:

```
GRANT CREATE MATERIALIZED VIEW TO er;
```

16.2 Summary of DBMS_ADVANCED_REWRITE Subprograms

This table lists the `DBMS_ADVANCED_REWRITE` subprograms and briefly describes them.

Table 16-1 DBMS_ADVANCED_REWRITE Package Subprograms

Subprogram	Description
ALTER_REWRITE_EQUIVALENCE Procedure	Changes the mode of the rewrite equivalence declaration to the mode you specify
BUILD_SAFE_REWRITE_EQUIVALENCE Procedure	Enables the rewrite of top-level materialized views using submaterialized views. Oracle Corporation does not recommend you directly use this procedure
DECLARE_REWRITE_EQUIVALENCE Procedures	Creates a declaration indicating that <code>source_stmt</code> is functionally equivalent to <code>destination_stmt</code> for as long as the equivalence declaration remains enabled, and that <code>destination_stmt</code> is more favorable in terms of performance
DROP_REWRITE_EQUIVALENCE Procedure	Drops the specified rewrite equivalence declaration
VALIDATE_REWRITE_EQUIVALENCE Procedure	Validates the specified rewrite equivalence declaration using the same validation method as described with the <code>validate</code> parameter

16.2.1 ALTER_REWRITE_EQUIVALENCE Procedure

This table list the all the package subprograms in alphabetical order.

Syntax

```
DBMS_ADVANCED_REWRITE.ALTER_REWRITE_EQUIVALENCE (
    name          VARCHAR2,
    rewrite_mode  VARCHAR2);
```

Parameters

Table 16-2 ALTER_REWRITE_EQUIVALENCE Procedure Parameters

Parameter	Description
<code>name</code>	A name for the equivalence declaration to alter. The name can be of the form <code>owner.name</code> , where <code>owner</code> complies with the rules for a schema name, and <code>name</code> complies with the rules for a table name. Alternatively, a simple name that complies with the rules for a table name can be specified. In this case, the rewrite equivalence is altered in the current schema. The invoker must have the appropriate alter materialized view privileges to alter an equivalence declaration outside their own schema.

Table 16-2 (Cont.) ALTER_REWRITE_EQUIVALENCE Procedure Parameters

Parameter	Description
<code>rewrite_mode</code>	<p>The following modes are supported, in increasing order of power:</p> <p><code>disabled</code>: Query rewrite does not use the equivalence declaration. Use this mode to temporarily disable use of the rewrite equivalence declaration.</p> <p><code>text_match</code>: Query rewrite uses the equivalence declaration only in its text match modes. This mode is useful for simple transformations.</p> <p><code>general</code>: Query rewrite uses the equivalence declaration in all of its transformation modes against the incoming request queries. However, query rewrite makes no attempt to rewrite the specified <code>destination_query</code>.</p> <p><code>recursive</code>: Query rewrite uses the equivalence declaration in all of its transformation modes against the incoming request queries. Moreover, query rewrite further attempts to rewrite the specified <code>destination_query</code> for further performance enhancements whenever it uses the equivalence declaration.</p> <p>Oracle recommends you use the least powerful mode that is sufficient to solve your performance problem.</p>

16.2.2 BUILD_SAFE_REWRITE_EQUIVALENCE Procedure

This procedure enables the rewrite and refresh of top-level materialized views using submaterialized views. It is provided for the exclusive use by scripts generated by the `DBMS_ADVISOR.TUNE_MVIEW` procedure.

It is required to enable query rewrite and fast refresh when `DBMS_ADVISOR.TUNE_MVIEW` decomposes a materialized view into a top-level materialized view and one or more submaterialized views.

Oracle does not recommend you directly use the `BUILD_SAFE_REWRITE_EQUIVALENCE` procedure. You should use either the `DBMS_ADVISOR.TUNE_MVIEW` or the `DBMS_ADVANCED_REWRITE.CREATE_REWRITE_EQUIVALENCE` procedure as appropriate.

16.2.3 DECLARE_REWRITE_EQUIVALENCE Procedures

This procedure creates a declaration indicating that `source_stmt` is functionally equivalent to `destination_stmt` for as long as the equivalence declaration remains enabled, and that `destination_stmt` is more favorable in terms of performance.

The scope of the declaration is system wide. The query rewrite engine uses such declarations to perform rewrite transformations in `QUERY_REWRITE_INTEGRITY = trusted` and `stale_tolerated` modes.

Because the underlying equivalences between the source and destination statements cannot be enforced by the query rewrite engine, queries can be only rewritten in `trusted` and `stale_tolerated` integrity modes.

Syntax

```
DBMS_ADVANCED_REWRITE.DECLARE_REWRITE_EQUIVALENCE (
    name          VARCHAR2,
```

```

source_stmt          VARCHAR2,
destination_stmt     VARCHAR2,
validate             BOOLEAN := TRUE,
rewrite_mode         VARCHAR2 := 'TEXT_MATCH');

DBMS_ADVANCED_REWRITE.DECLARE_REWRITE_EQUIVALENCE (
  name                VARCHAR2,
  source_stmt         CLOB,
  destination_stmt    CLOB,
  validate            BOOLEAN := TRUE,
  rewrite_mode        VARCHAR2 := 'TEXT_MATCH');

```

Parameters

Table 16-3 DECLARE_REWRITE_EQUIVALENCE Procedure Parameters

Parameter	Description
name	<p>A name for the equivalence declaration. The name can be of the form <code>owner.name</code>, where <code>owner</code> complies with the rules for a schema name, and <code>name</code> complies with the rules for a table name.</p> <p>Alternatively, a simple name that complies with the rules for a table name can be specified. In this case, the rewrite equivalence is created in the current schema. The invoker must have the appropriate <code>CREATE MATERIALIZED VIEW</code> privileges to alter an equivalence declaration.</p>
source_stmt	A sub- <code>SELECT</code> expression in either <code>VARCHAR2</code> or <code>CLOB</code> format. This is the query statement that is the target of optimization.
destination_stmt	A sub- <code>SELECT</code> expression in either <code>VARCHAR2</code> or <code>CLOB</code> format.
validate	A Boolean indicating whether to validate that the specified <code>source_stmt</code> is functionally equivalent to the specified <code>destination_stmt</code> . If <code>validate</code> is specified as <code>TRUE</code> , <code>DECLARE_REWRITE_EQUIVALENCE</code> evaluates the two sub- <code>SELECT</code> s and compares their results. If the results are not the same, <code>DECLARE_REWRITE_EQUIVALENCE</code> does not create the rewrite equivalence and returns an error condition. If <code>FALSE</code> , <code>DECLARE_REWRITE_EQUIVALENCE</code> does not validate the equivalence.

Table 16-3 (Cont.) DECLARE_REWRITE_EQUIVALENCE Procedure Parameters

Parameter	Description
<code>rewrite_mode</code>	<p>The following modes are supported, in increasing order of power:</p> <ul style="list-style-type: none"> <code>disabled</code>: Query rewrite does not use the equivalence declaration. Use this mode to temporarily disable use of the rewrite equivalence declaration. <code>text_match</code>: Query rewrite uses the equivalence declaration only in its text match modes. This mode is useful for simple transformations. <code>general</code>: Query rewrite uses the equivalence declaration in all of its transformation modes against the incoming request queries. However, query rewrite makes no attempt to rewrite the specified <code>destination_query</code>. <code>recursive</code>: Query rewrite uses the equivalence declaration in all of its transformation modes against the incoming request queries. Moreover, query rewrite further attempts to rewrite the specified <code>destination_query</code> for further performance enhancements whenever it uses the equivalence declaration. <p>Oracle recommends you use the least powerful mode that is sufficient to solve your performance problem.</p>

Exceptions

Table 16-4 DECLARE_REWRITE_EQUIVALENCE Procedure Exceptions

Exception	Description
ORA-30388	Name of the rewrite equivalence is not specified
ORA-30391	The specified rewrite equivalence does not exist
ORA-30392	The checksum analysis for the rewrite equivalence failed
ORA-30393	A query block in the statement did not write
ORA-30396	Rewrite equivalence procedures require the <code>COMPATIBLE</code> parameter to be set to 10.1 or greater

Usage Notes

Query rewrite using equivalence declarations occurs simultaneously and in concert with query rewrite using materialized views. The same query rewrite engine is used for both. The query rewrite engine uses the same rewrite rules to rewrite queries using both equivalence declarations and materialized views. Because the rewrite equivalence represents a specific rewrite crafted by a sophisticated user, the query rewrite engine gives priority to rewrite equivalences over materialized views when it is possible to perform a rewrite with either a materialized view or a rewrite equivalence. For this same reason, the cost-based optimizer (specifically, cost-based rewrite) will not choose an unrewritten query plan over a query plan that is rewritten to use a rewrite equivalence even if the cost of the un-rewritten plan appears more favorable. Query rewrite matches properties of the incoming request query against the equivalence declaration's `source_stmt` or the materialized view's defining statement, respectively, and derives an equivalent relational expression in terms of the equivalence declaration's `destination_stmt` or the materialized view's container table, respectively.

16.2.4 DROP_REWRITE_EQUIVALENCE Procedure

This procedure drops the specified rewrite equivalence declaration.

Syntax

```
DBMS_ADVANCED_REWRITE.DROP_REWRITE_EQUIVALENCE (
    name          VARCHAR2);
```

Parameters

Table 16-5 DROP_REWRITE_EQUIVALENCE Procedure Parameters

Parameter	Description
name	A name for the equivalence declaration to drop. The name can be of the form <code>owner.name</code> , where <code>owner</code> complies with the rules for a schema name, and <code>name</code> complies with the rules for a table name. Alternatively, a simple name that complies with the rules for a table name can be specified. In this case, the rewrite equivalence is dropped in the current schema. The invoker must have the appropriate drop materialized view privilege to drop an equivalence declaration outside their own schema.

16.2.5 VALIDATE_REWRITE_EQUIVALENCE Procedure

This procedure validates the specified rewrite equivalence declaration.

It uses the same validation method as described with the `VALIDATE` parameter in "[VALIDATE_REWRITE_EQUIVALENCE Procedure](#)".

Syntax

```
DBMS_ADVANCED_REWRITE.VALIDATE_REWRITE_EQUIVALENCE (
    name          VARCHAR2);
```

Parameters

Table 16-6 VALIDATE_REWRITE_EQUIVALENCE Procedure Parameters

Parameter	Description
name	A name for the equivalence declaration to validate. The name can be of the form <code>owner.name</code> , where <code>owner</code> complies with the rules for a schema name, and <code>name</code> complies with the rules for a table name. Alternatively, a simple name that complies with the rules for a table name can be specified. In this case, the rewrite equivalence is validated in the current schema. The invoker must have sufficient privileges to execute both the <code>source_stmt</code> and <code>destination_stmt</code> of the specified equivalence declaration.

17

DBMS_ADVISOR

DBMS_ADVISOR is part of the server manageability suite of advisors, a set of expert systems that identifies and helps resolve performance problems relating to database server components.

Some advisors have their own packages. For these advisors, Oracle recommends that you use the advisor-specific package rather than DBMS_ADVISOR. Each of the following advisors has its own package, tailored to its specific functionality:

- Automatic Database Diagnostic Monitor (DBMS_ADDM)
- SQL Performance Analyzer (DBMS_SQLPA)
- SQL Repair Advisor (DBMS_SQLDIAG)
- SQL Tuning Advisor (DBMS_SQLTUNE)
- Compression Advisor (DBMS_COMPRESSION.GET_COMPRESSION_RATIO)

SQL Access Advisor and Segment Advisor are the only advisors with common use cases for DBMS_ADVISOR. Undo Advisor and Compression Advisor do not support DBMS_ADVISOR subprograms.

This chapter contains the following topics:

- [DBMS_ADVISOR Deprecated Subprograms](#)
- [DBMS_ADVISOR Security Model](#)
- [Summary of DBMS_ADVISOR Subprograms](#)

See Also:

- *Oracle Database Administrator's Guide* to learn about Segment Advisor
- *Oracle Database Get Started with Performance Tuning* to learn how to use SQL Access Advisor in Enterprise Manager
- *Oracle Database SQL Tuning Guide* to learn more about SQL Access Advisor

17.1 DBMS_ADVISOR Deprecated Subprograms

The section lists programs that are deprecated with Oracle Database 11g.

Note:

Oracle recommends that you do not use deprecated procedures in new applications. Support for deprecated features is for backward compatibility only.

The following subprograms are deprecated:

- [ADD_SQLWKLD_REF Procedure](#)
- [CREATE_SQLWKLD Procedure](#)
- [DELETE_SQLWKLD Procedure](#)
- [DELETE_SQLWKLD_REF Procedure](#)
- [DELETE_SQLWKLD_STATEMENT Procedure](#)
- [IMPORT_SQLWKLD_SCHEMA Procedure](#)
- [IMPORT_SQLWKLD_SQLCACHE Procedure](#)
- [IMPORT_SQLWKLD_STS Procedure](#)
- [IMPORT_SQLWKLD_SUMADV Procedure](#)
- [IMPORT_SQLWKLD_USER Procedure](#)
- [RESET_SQLWKLD Procedure](#)
- [SET_SQLWKLD_PARAMETER Procedure](#)
- [UPDATE_SQLWKLD_ATTRIBUTES Procedure](#)
- [UPDATE_SQLWKLD_STATEMENT Procedure](#)

17.2 DBMS_ADVISOR Security Model

The `ADVISOR` privilege is required to use the `DBMS_ADVISOR` package.

17.3 Summary of DBMS_ADVISOR Subprograms

This topic lists and describes the subprograms in the `DBMS_ADVISOR` package.

In the following table, the `Used in` column lists advisors relevant for each subprogram, but excludes ADDM, SQL Performance Analyzer, SQL Repair Advisor, and SQL Tuning Advisor because these advisors have their own packages.

Table 17-1 DBMS_ADVISOR Package Subprograms

Subprogram	Description	Used in
ADD_SQLWKLD_REF Procedure	Adds a workload reference to an Advisor task (Caution: Deprecated Subprogram)	SQL Access Advisor
ADD_SQLWKLD_STATEMENT Procedure	Adds a single statement to a workload	SQL Access Advisor
ADD_STS_REF Procedure	Establishes a link between the current SQL Access Advisor task and a SQL tuning set	SQL Access Advisor
CANCEL_TASK Procedure	Cancels a currently executing task operation	Segment Advisor, SQL Access Advisor
COPY_SQLWKLD_TO_STS Procedure	Copies the contents of a SQL workload object to a SQL tuning set	SQL Access Advisor

Table 17-1 (Cont.) DBMS_ADVISOR Package Subprograms

Subprogram	Description	Used in
CREATE_FILE Procedure	Creates an external file from a PL/SQL CLOB variable, which is useful for creating scripts and reports	SQL Access Advisor
CREATE_OBJECT Procedure	Creates a new task object	Segment Advisor
CREATE_SQLWKLD Procedure	Creates a new workload object (Caution: Deprecated Subprogram)	SQL Access Advisor
CREATE_TASK Procedures	Creates a new Advisor task in the repository	Segment Advisor, SQL Access Advisor
DELETE_SQLWKLD Procedure	Deletes an entire workload object (Caution: Deprecated Subprogram)	SQL Access Advisor
DELETE_SQLWKLD_REF Procedure	Deletes an entire workload object (Caution: Deprecated Subprogram)	SQL Access Advisor
DELETE_SQLWKLD_STATEMENT Procedure	Deletes one or more statements from a workload (Caution: Deprecated Subprogram)	SQL Access Advisor
DELETE_STSEF Procedure	Removes a link between the current SQL Access Advisor task and a SQL tuning set object	SQL Access Advisor
DELETE_TASK Procedure	Deletes the specified task from the repository	SQL Access Advisor
EXECUTE_TASK Procedure	Executes the specified task	Segment Advisor, SQL Access Advisor
GET_REC_ATTRIBUTES Procedure	Retrieves specific recommendation attributes from a task	SQL Access Advisor
GET_TASK_REPORT Function	Creates and returns a report for the specified task	
GET_TASK_SCRIPT Function	Creates and returns an executable SQL script of the Advisor task's recommendations in a buffer	SQL Access Advisor
IMPLEMENT_TASK Procedure	Implements the recommendations for a task	SQL Access Advisor
IMPORT_SQLWKLD_SCHEMA Procedure	Imports data into a workload from the current SQL cache (Caution: Deprecated Subprogram)	SQL Access Advisor
IMPORT_SQLWKLD_SQLCACHE Procedure	Imports data into a workload from the current SQL cache (Caution: Deprecated Subprogram)	SQL Access Advisor
IMPORT_SQLWKLD_STS Procedure	Imports data from a SQL tuning set into a SQL workload data object (Caution: Deprecated Subprogram)	SQL Access Advisor
IMPORT_SQLWKLD_SUMADV Procedure	Imports data into a workload from the current SQL cache (Caution: Deprecated Subprogram)	SQL Access Advisor
IMPORT_SQLWKLD_USER Procedure	Imports data into a workload from the current SQL cache (Caution: Deprecated Subprogram)	SQL Access Advisor

Table 17-1 (Cont.) DBMS_ADVISOR Package Subprograms

Subprogram	Description	Used in
INTERRUPT_TASK Procedure	Stops a currently executing task, ending its operations as it would at a normal exit, so that the recommendations are visible	Segment Advisor, SQL Access Advisor
MARK_RECOMMENDATION Procedure	Sets the <code>annotation_status</code> for a particular recommendation	Segment Advisor, SQL Access Advisor
QUICK_TUNE Procedure	Performs an analysis on a single SQL statement	SQL Access Advisor
RESET_SQLWKLDT Procedure	Resets a workload to its initial starting point (Caution: Deprecated Subprogram)	SQL Access Advisor
RESET_TASK Procedure	Resets a task to its initial state	Segment Advisor, SQL Access Advisor
SET_DEFAULT_SQLWKLD_PARAMETER Procedure	Imports data into a workload from schema evidence	SQL Access Advisor
SET_DEFAULT_TASK_PARAMETER Procedure	Modifies a default task parameter	Segment Advisor, SQL Access Advisor
SET_SQLWKLD_PARAMETER Procedure	Sets the value of a workload parameter	SQL Access Advisor
SET_TASK_PARAMETER Procedure	Sets the specified task parameter value	Segment Advisor, SQL Access Advisor
TUNE_MVIEW Procedure	Shows how to decompose a materialized view into two or more materialized views or to restate the materialized view in a way that is more advantageous for fast refresh and query rewrite	SQL Access Advisor
UPDATE_OBJECT Procedure	Updates a task object	Segment Advisor
UPDATE_RECOMMENDATION_ATTRIBUTES Procedure	Updates an existing recommendation for the specified task	SQL Access Advisor
UPDATE_SQLWKLD_ATTRIBUTES Procedure	Updates a workload object	SQL Access Advisor
UPDATE_SQLWKLD_STATEMENTS Procedure	Updates one or more SQL statements in a workload	SQL Access Advisor
UPDATE_TASK_ATTRIBUTES Procedure	Updates a task's attributes	Segment Advisor, SQL Access Advisor

17.3.1 ADD_SQLWKLD_REF Procedure

This procedure establishes a link between the current SQL Access Advisor task and a SQL Workload object.



Note:

This procedure is deprecated starting in Oracle Database 11g.

The link allows an advisor task to access interesting data for doing an analysis. The link also provides a stable view of the data. Once a connection between a SQL Access Advisor task and a SQL Workload object is made, the workload is protected from removal or modification.

Users should use `ADD_STS_REF` instead of `ADD_SQLWKLD_REF` for all SQL tuning set-based advisor runs. This function is only provided for backward compatibility.

Syntax

```
DBMS_ADVISOR.ADD_SQLWKLD_REF (
  task_name          IN VARCHAR2,
  workload_name      IN VARCHAR2,
  is_sts             IN NUMBER :=0);
```

Parameters

Table 17-2 ADD_SQLWKLD_REF Procedure Parameters

Parameter	Description
<code>task_name</code>	The SQL Access Advisor task name that uniquely identifies an existing task.
<code>workload_name</code>	The name of the workload object to be linked. Once a object has been linked to a task, it becomes read-only and cannot be deleted. There is no limit to the number of links to workload objects. To remove the link to the workload object, use the procedure <code>DELETE_REFERENCE</code> .
<code>is_sts</code>	Indicates the type of workload source. Possible values are: <ul style="list-style-type: none"> 0 - SQL workload object 1 - SQL tuning set

Examples

```
DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
  workload_name VARCHAR2(30);
BEGIN
  task_name := 'My Task';
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
```

```

DBMS_ADVISOR.ADD_SQLWKLD_REF(task_name, workload_name, 1);
END;
/

```

17.3.2 ADD_SQLWKLD_STATEMENT Procedure

This procedure adds a single statement to the specified workload.



Note:

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```

DBMS_ADVISOR.ADD_SQLWKLD_STATEMENT (
  workload_name      IN VARCHAR2,
  module             IN VARCHAR2,
  action             IN VARCHAR2,
  cpu_time           IN NUMBER := 0,
  elapsed_time       IN NUMBER := 0,
  disk_reads         IN NUMBER := 0,
  buffer_gets        IN NUMBER := 0,
  rows_processed     IN NUMBER := 0,
  optimizer_cost     IN NUMBER := 0,
  executions         IN NUMBER := 1,
  priority           IN NUMBER := 2,
  last_execution_date IN DATE := 'SYSDATE',
  stat_period        IN NUMBER := 0,
  username           IN VARCHAR2,
  sql_text           IN CLOB);

```

Parameters

Table 17-3 ADD_SQLWKLD_STATEMENT Procedure Parameters

Parameter	Description
workload_name	The workload name that uniquely identifies an existing workload.
module	An optional business application module that will be associated with the SQL statement.
action	An optional application action that will be associated with the SQL statement.
cpu_time	The total CPU time in seconds that is consumed by the SQL statement.
elapsed_time	The total elapsed time in seconds that is consumed by the SQL statement.
disk_reads	The total disk-read operations that are consumed by the SQL statement.

Table 17-3 (Cont.) ADD_SQLWKLD_STATEMENT Procedure Parameters

Parameter	Description
<code>buffer_gets</code>	The total buffer-get operations that are consumed by the SQL statement.
<code>rows_processed</code>	The average number of rows processed by the SQL statement.
<code>optimizer_cost</code>	The cost value calculated by the optimizer.
<code>executions</code>	The total execution count of the SQL statement. This value should be greater than zero.
<code>priority</code>	The relative priority of the SQL statement. The value must be one of the following: 1-HIGH, 2-MEDIUM, or 3-LOW.
<code>last_execution_date</code>	The date and time at which the SQL statement last executed. If the value is NULL, then the database uses the current date and time.
<code>stat_period</code>	Time interval in seconds from which statement statistics were calculated.
<code>username</code>	The database user that executed the SQL statement. Because a user name is an Oracle identifier, the <code>username</code> value must be entered exactly as it is stored in the server. For example, if the user SCOTT is the executing user, then you must provide the user identifier SCOTT in all uppercase letters. It will not recognize the user <code>scott</code> or <code>Scott</code> as a match for SCOTT.
<code>sql_text</code>	The complete SQL statement. To increase the quality of a recommendation, the SQL statement should not contain bind variables.

Usage Notes

You cannot modify or delete a workload when it is currently referenced by an active task. A task is considered active if it is not in its initial state. See [RESET_TASK Procedure](#) for directions on setting a task to its initial state.

The `ADD_SQLWKLD_STATEMENT` procedure accepts several parameters that may be ignored by the caller. The database only uses the `disk_reads`, `buffer_gets`, and `optimizer_cost` parameters to sort workload data when actual analysis occurs. Therefore, actual values are only necessary when the `order_list` task parameter references a particular statistic.

To determine what statistics to provide when adding a new SQL statement to a workload, examine or set the task parameter `order_list`. The `order_list` parameter accepts any combination of the keys:

- `cpu_time`
- `elapsed_time`
- `buffer_gets`
- `optimizer_cost`
- `disk_reads`
- `executions`
- `priority`

The `optimizer_cost` key, which is a typical setting of `priority`, indicates that SQL Access Advisor sorts the workload data by `priority` and `optimizer_cost`, and processes the highest

cost statements first. Any statements that you add to the workload must include appropriate `priority` and `optimizer_cost` values. All other statistics can be defaulted or set to zero.

For the statistical keys referenced by the `order_list` task parameter, the actual parameter values should be reasonably accurate since they will be compared to other statements in the workload. If the caller is unable to estimate values, then choose values that would determine its importance relative to other statements in the workload. For example, if the current statement is considered the most critical query in your business, then an appropriate value would be anything greater than all other values for the same statistic found in the workload.

Examples

```
DECLARE
    workload_name VARCHAR2(30);
BEGIN
    workload_name := 'My Workload';

    DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');
    DBMS_ADVISOR.ADD_SQLWKLD_STATEMENT(workload_name, 'MONTHLY',
    'ROLLUP',
                                100,400,5041,103,640445,680000,2,
                                1,SYSDATE,1,'SH','SELECT
AVG(amount_sold) FROM sh.sales');
END;
/
```

17.3.3 ADD_STS_REF Procedure

This procedure establishes a link between the current SQL Access Advisor task and a SQL tuning set.

The link enables an advisor task to access data for the purpose of doing an analysis. The link also provides a stable view of the data. Once a connection between a SQL Access Advisor task and a SQL tuning set is made, the STS is protected from removal or modification.

Use `ADD_STS_REF` for any STS-based advisor runs. The older method of using `ADD_SQLWKLD_REF` with parameter `IS_STS=1` is only supported for backward compatibility. Furthermore, the `ADD_STS_REF` function accepts a SQL tuning set owner name, whereas `ADD_SQLWKLD_REF` does not.

Syntax

```
DBMS_ADVISOR.ADD_STS_REF(
    task_name          IN VARCHAR2 NOT NULL,
    sts_owner          IN VARCHAR2,
    workload_name      IN VARCHAR2 NOT NULL);
```

Parameters

Table 17-4 ADD_STG_REF Procedure Parameters

Parameter	Description
<code>task_name</code>	The SQL Access Advisor task name that uniquely identifies an existing task.
<code>sts_owner</code>	The owner of the SQL tuning set. The value of this parameter may be <code>NULL</code> , in which case the advisor assumes the SQL tuning set to be owned by the currently logged-in user.
<code>workload_name</code>	The name of the workload to be linked. A workload consists of one or more SQL statements, plus statistics and attributes that fully describe each statement. The database stores a workload as a SQL tuning set. After a workload has been linked to a task, it becomes read-only and cannot be deleted. There is no limit to the number of links to workloads. To remove the link to the workload, use the procedure <code>DBMS_ADVISOR.DELETE_STG_REF</code> .

Examples

```
DBMS_ADVISOR.ADD_STG_REF ('My Task', 'SCOTT', 'My Workload');
```

17.3.4 CANCEL_TASK Procedure

This procedure causes a currently executing operation to terminate.

This call performs a soft interrupt. It will not break into a low-level database access call like a hard interrupt such as `Ctrl-C`. The SQL Access Advisor periodically checks for soft interrupts and acts appropriately. As a result, this operation may take a few seconds to respond to a call.

Syntax

```
DBMS_ADVISOR.CANCEL_TASK (
    task_name      IN  VARCHAR2);
```

Parameters

Table 17-5 CANCEL_TASK Procedure Parameter

Parameter	Description
<code>task_name</code>	A valid Advisor task name that uniquely identifies an existing task.

Usage Notes

A cancel command restores the task to its condition prior to the start of the canceled operation. Therefore, a canceled task or data object cannot be resumed.

Because all Advisor task procedures are synchronous, to cancel an operation, you must use a separate database session.

Examples

```
DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
  workload_name VARCHAR2(30);
BEGIN
  task_name := 'My Task';
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
  DBMS_ADVISOR.CANCEL_TASK('My Task');
END;
/
```

17.3.5 COPY_SQLWKLD_TO_STS Procedure

This procedure copies the contents of a SQL workload object to a SQL tuning set.

Syntax

To use this procedure, the caller must have privileges to create and modify a SQL tuning set.

```
DBMS_ADVISOR.COPY_SQLWKLD_TO_STS (
  workload_name      IN VARCHAR2,
  sts_name           IN VARCHAR2,
  import_mode        IN VARCHAR2 := 'NEW');
```

Parameters

Table 17-6 COPY_SQLWKLD_TO_STS Procedure Parameter

Parameter	Description
workload_name	The SQL Workload object name to copy.
sts_name	The SQL tuning set name into which the SQL Workload object will be copied.

Table 17-6 (Cont.) COPY_SQLWKLD_TO_STS Procedure Parameter

Parameter	Description
import_mode	<p>Specifies the handling of the target SQL tuning set. Possible values are:</p> <ul style="list-style-type: none"> APPEND Causes SQL Workload data to be appended to the target SQL tuning set. NEW Indicates the SQL tuning set can only contain the copied contents. If the SQL tuning set exists and has data, an error will be reported. REPLACE Causes any existing data in the target SQL tuning set to be purged prior to the workload copy. <p>In all cases, if the specified SQL tuning set does not exist, it will be created.</p>

Usage Notes

To use this procedure, the caller must have privileges to create and modify a SQL tuning set.

Examples

```
BEGIN
  DBMS_ADVISOR.COPY_SQLWKLD_TO_STS('MY_OLD_WORKLOAD', 'MY_NEW_STS', 'NEW');
END;
/
```

17.3.6 CREATE_FILE Procedure

This procedure creates an external file from a PL/SQL CLOB variable, which is used for creating scripts and reports.

Syntax

```
DBMS_ADVISOR.CREATE_FILE (
  buffer      IN  CLOB,
  location    IN  VARCHAR2,
  filename    IN  VARCHAR2);
```

Parameters

Table 17-7 CREATE_FILE Procedure Parameters

Parameter	Description
buffer	A CLOB buffer containing report or script information.
location	<p>The name of the directory that will contain the output file.</p> <p>You must use the alias as defined by the CREATE DIRECTORY statement. The Advisor translates the alias into the actual directory location.</p>

Table 17-7 (Cont.) CREATE_FILE Procedure Parameters

Parameter	Description
filename	The name of the output file. The file name can only contain the name and an optional file type of the form filename.filetype.

Usage Notes

You must embed all formatting within the CLOB.

The database restricts file access within stored procedures. This means that file locations and names must adhere to the known file permissions in the server.

Examples

```
CREATE DIRECTORY MY_DIR as '/homedir/user4/gssmith';
GRANT READ,WRITE ON DIRECTORY MY_DIR TO PUBLIC;
```

```
DECLARE
  v_task_id NUMBER;
  v_task_name VARCHAR2(30);
  v_workload_name VARCHAR2(30);
BEGIN
  v_task_name := 'My Task';
  v_workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_TASK(
    advisor_name => DBMS_ADVISOR.SQLACCESS_ADVISOR
  ,   task_id      => v_task_id
  ,   task_name    => v_task_name );
  DBMS_ADVISOR.CREATE_SQLWKLD(
    workload_name => v_workload_name
  ,   description  => 'My Workload' );
  DBMS_ADVISOR.ADD_SQLWKLD_REF(
    task_name      => v_task_name
  ,   workload_name => v_workload_name);
  DBMS_ADVISOR.ADD_SQLWKLD_STATEMENT(
    workload_name  => v_workload_name
  ,   module       => 'MONTHLY'
  ,   action       => 'ROLLUP'
  ,   cpu_time     => 100
  ,   elapsed_time => 400
  ,   disk_reads   => 5041
  ,   buffer_gets  => 103
  ,   rows_processed => 640445
  ,   optimizer_cost => 680000
  ,   executions   => 2
  ,   priority     => 1
  ,   last_execution_date => SYSDATE
  ,   stat_period  => 1
  ,   username     => 'SH'
  ,   sql_text     => 'SELECT AVG(amount_sold) FROM sh.sales' );
```

```

DBMS_ADVISOR.EXECUTE_TASK(v_task_name);
DBMS_ADVISOR.CREATE_FILE(
    buffer => DBMS_ADVISOR.GET_TASK_SCRIPT(v_task_name)
,   location => 'MY_DIR'
,   filename => 'script.sql' );
END;
/

```

17.3.7 CREATE_OBJECT Procedure

This procedure creates a new task object.

Syntax

```

DBMS_ADVISOR.CREATE_OBJECT (
    task_name          IN VARCHAR2,
    object_type        IN VARCHAR2,
    attr1              IN VARCHAR2 := NULL,
    attr2              IN VARCHAR2 := NULL,
    attr3              IN VARCHAR2 := NULL,
    attr4              IN CLOB      := NULL,
    attr5              IN VARCHAR2 := NULL,
    object_id          OUT NUMBER,
    attr6              IN VARCHAR2 := NULL,
    attr7              IN VARCHAR2 := NULL,
    attr8              IN VARCHAR2 := NULL,
    attr9              IN VARCHAR2 := NULL,
    attr10             IN VARCHAR2 := NULL);

```

Parameters

Table 17-8 CREATE_OBJECT Procedure Parameters

Parameter	Description
task_name	A valid Advisor task name that uniquely identifies an existing task.
object_type	Specifies the external object type.
attr1	Advisor-specific data.
attr2	Advisor-specific data.
attr3	Advisor-specific data.
attr4	Advisor-specific data.
attr5	Advisor-specific data.
object_id	The advisor-assigned object identifier.
attr6	Advisor-specific data.
attr7	Advisor-specific data.
attr8	Advisor-specific data.
attr9	Advisor-specific data.
attr10	Advisor-specific data.

The attribute parameters have different values depending upon the object type. See *Oracle Database Administrator's Guide* for details regarding these parameters and object types.

Return Values

Returns the new object identifier.

Usage Notes

Task objects are typically used as input data for a particular advisor. Segment advice can be generated at the object, segment, or tablespace level. If for the object level, advice is generated on all partitions of the object (if the object is partitioned). The advice is not cascaded to any dependent objects. If for the segment level, advice can be obtained on a single segment, such as the partition or subpartition of a table, index, or LOB column. If for a tablespace level, target advice for every segment in the tablespace will be generated.

See *Oracle Database Administrator's Guide* for further information regarding the Segment Advisor.

Examples

```
DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
  obj_id NUMBER;
BEGIN
  task_name := 'My Task';

  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
  DBMS_ADVISOR.CREATE_OBJECT (task_name, 'SQL', NULL, NULL, NULL, 'SELECT
* FROM TEST_TAB', NULL, obj_id, NULL, NULL, NULL, NULL, NULL);
END;
/
```

17.3.8 CREATE_SQLWKLD Procedure

This procedure creates a new private SQL Workload object for the user.

A SQL Workload object manages a SQL workload on behalf of the SQL Access Advisor. A SQL Workload object must exist prior to performing any other SQL Workload operations, such as importing or updating SQL statements.



Note:

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```
DBMS_ADVISOR.CREATE_SQLWKLD (
  workload_name      IN OUT VARCHAR2,
  description        IN VARCHAR2 := NULL,
  template           IN VARCHAR2 := NULL,
  is_template        IN VARCHAR2 := 'FALSE');
```

Parameters

Table 17-9 CREATE_SQLWKLD Procedure Parameters

Parameter	Description
workload_name	A name that uniquely identifies the created workload. If not specified, the system will generate a unique name. Names can be up to 30 characters long.
description	Specifies an optional workload description. Descriptions can be up to 256 characters.
template	An optional SQL Workload name of an existing workload data object or data object template.
is_template	An optional value that enables you to set the newly created workload as a template. Valid values are TRUE and FALSE.

Return Values

The SQL Access Advisor returns a unique workload object identifier number that must be used for subsequent activities within the new SQL Workload object.

Usage Notes

By default, workload objects are created using built-in default settings. To create a workload using the parameter settings of an existing workload or workload template, the user may specify an existing workload name.

After a SQL Workload object is present, it can then be referenced by one or more SQL Access Advisor tasks using the `ADD_SQLWKLD_REF` procedure.

Examples

```
DECLARE
  workload_name VARCHAR2(30);
BEGIN
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');
END;
/
```

17.3.9 CREATE_TASK Procedures

This procedure creates a new Advisor task in the repository.

Syntax

```
DBMS_ADVISOR.CREATE_TASK (
  advisor_name      IN VARCHAR2,
  task_id           OUT NUMBER,
  task_name         IN OUT VARCHAR2,
  task_desc         IN VARCHAR2 := NULL,
  template          IN VARCHAR2 := NULL,
  is_template       IN VARCHAR2 := 'FALSE',
  how_created       IN VARCHAR2 := NULL);
```

```
DBMS_ADVISOR.CREATE_TASK (
  advisor_name      IN VARCHAR2,
  task_name         IN VARCHAR2,
  task_desc         IN VARCHAR2 := NULL,
  template          IN VARCHAR2 := NULL,
  is_template       IN VARCHAR2 := 'FALSE',
  how_created       IN VARCHAR2 := NULL);
```

```
DBMS_ADVISOR.CREATE_TASK (
  parent_task_name  IN VARCHAR2,
  rec_id            IN NUMBER,
  task_id           OUT NUMBER,
  task_name         IN OUT VARCHAR2,
  task_desc         IN VARCHAR2,
  template          IN VARCHAR2);
```

Parameters

Table 17-10 CREATE_TASK Procedure Parameters

Parameter	Description
advisor_name	Specifies the unique advisor name as defined in the view DBA_ADVISOR_DEFINITIONS.
task_id	A number that uniquely identifies the created task. The number is generated by the procedure and returned to the user.
task_name	Specifies a new task name. Names must be unique among all tasks for the user. When using the second form of the CREATE_TASK syntax listed above (with OUT), a unique name can be generated. Names can be up to 30 characters long.
task_desc	Specifies an optional task description. Descriptions can be up to 256 characters in length.
template	An optional task name of an existing task or task template. To specify built-in SQL Access Advisor templates, use the template name as described earlier.

Table 17-10 (Cont.) CREATE_TASK Procedure Parameters

Parameter	Description
is_template	An optional value that allows the user to set the newly created task as template. Valid values are: TRUE and FALSE.
how_created	An optional value that identifies how the source was created.

Return Values

Returns a unique task ID number and a unique task name if one is not specified.

Usage Notes

A task must be associated with an advisor, and once the task has been created, it is permanently associated with the original advisor. By default, tasks are created using built-in default settings. To create a task using the parameter settings of an existing task or task template, the user may specify an existing task name.

For the SQL Access Advisor, use the identifier `DBMS_ADVISOR.SQLACCESS_ADVISOR` as the `advisor_name`.

The SQL Access Advisor provides three built-in task templates, using the following constants:

- `DBMS_ADVISOR.SQLACCESS_OLTP`
Parameters are preset to favor an OLTP application environment.
- `DBMS_ADVISOR.SQLACCESS_WAREHOUSE`
Parameters are preset to favor a data warehouse application environment.
- `DBMS_ADVISOR.SQLACCESS_GENERAL`
Parameters are preset to favor a hybrid application environment where both OLTP and data warehouse operations may occur. For the SQL Access Advisor, this is the default template.

Examples

```
DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
BEGIN
  task_name := 'My Task';
  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
END;
/
```

17.3.10 DELETE_SQLWKLD Procedure

This procedure deletes an existing SQL Workload object from the repository.



Note:

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```
DBMS_ADVISOR.DELETE_SQLWKLD (  
    workload_name          IN VARCHAR2);
```

Parameters

Table 17-11 DELETE_SQLWKLD Procedure Parameters

Parameter	Description
workload_name	The workload object name that uniquely identifies an existing workload. The wildcard % is supported as a WORKLOAD_NAME. The rules of use are identical to the LIKE operator. For example, to delete all tasks for the current user, use the wildcard % as the WORKLOAD_NAME. If a wildcard is provided, the DELETE_SQLWKLD operation will not delete any workloads marked as READ_ONLY or TEMPLATE.

Usage Notes

A workload cannot be modified or deleted if it is currently referenced by an active task. A task is considered active if it is not in its initial state. See the [RESET_TASK Procedure](#) to set a task to its initial state.

Examples

```
DECLARE  
    workload_name VARCHAR2(30);  
BEGIN  
    workload_name := 'My Workload';  
  
    DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');  
    DBMS_ADVISOR.DELETE_SQLWKLD(workload_name);  
END;  
/
```


17.3.11 DELETE_SQLWKLD_REF Procedure

This procedure removes a link between the current SQL Access task and a SQL Workload data object.



Note:

This procedure is deprecated starting in Oracle Database 11g.

Use `DELETE_STS_REF` instead of `DELETE_SQLWKLD_REF` for all SQL tuning set-based advisor runs. This function is only provided for backward compatibility.

Syntax

```
DBMS_ADVISOR.DELETE_SQLWKLD_REF (
  task_name          IN VARCHAR2,
  workload_name     IN VARCHAR2,
  is_sts            IN NUMBER :=0);
```

Parameters

Table 17-12 DELETE_SQLWKLD_REF Procedure Parameters

Parameter	Description
task_name	The SQL Access task name that uniquely identifies an existing task.
workload_name	The name of the workload object to be unlinked. The wildcard % is supported as a workload_name. The rules of use are identical to the LIKE operator. For example, to remove all links to workload objects, use the wildcard % as the workload_name.
is_sts	Indicates the type of workload source. Possible values are: <ul style="list-style-type: none"> 0 - SQL workload object 1 - SQL tuning set

Examples

```
DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
  workload_name VARCHAR2(30);
BEGIN
  task_name := 'My Task';
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
  DBMS_ADVISOR.ADD_SQLWKLD_REF(task_name, workload_name);
  DBMS_ADVISOR.DELETE_SQLWKLD_REF(task_name, workload_name);
```

```
END;
/
```

17.3.12 DELETE_SQLWKLD_STATEMENT Procedure

This procedure deletes one or more statements from a workload.



Note:

This procedure has been deprecated.

Syntax

```
DBMS_ADVISOR.DELETE_SQLWKLD_STATEMENT (
  workload_name      IN VARCHAR2,
  sql_id             IN NUMBER);
```

```
DBMS_ADVISOR.DELETE_SQLWKLD_STATEMENT (
  workload_name      IN VARCHAR2,
  search             IN VARCHAR2,
  deleted            OUT NUMBER);
```

Parameters

Table 17-13 DELETE_SQLWKLD_STATEMENT Procedure Parameters

Parameter	Description
workload_name	The workload object name that uniquely identifies an existing workload.
sql_id	The Advisor-generated identifier number that is assigned to the statement. To specify all workload statements, use the constant <code>ADVISOR_ALL</code> .
search	Disabled.
deleted	Returns the number of statements deleted by the searched deleted operation.

Usage Notes

A workload cannot be modified or deleted if it is currently referenced by an active task. A task is considered active if it is not in its initial state. See the [RESET_TASK Procedure](#) to set a task to its initial state.

Examples

```
DECLARE
  workload_name VARCHAR2(30);
  deleted NUMBER;
  id NUMBER;
BEGIN
```

```

workload_name := 'My Workload';

DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');
DBMS_ADVISOR.ADD_SQLWKLD_STATEMENT(workload_name, 'YEARLY', 'ROLLUP',
                                     100,400,5041,103,640445,680000,2,
                                     1,SYSDATE,1,'SH','SELECT
AVG(amount_sold)
                                     FROM sh.sales');

SELECT sql_id INTO id FROM USER_ADVISOR_SQLW_STMTS
WHERE workload_name = 'My Workload';

DBMS_ADVISOR.DELETE_SQLWKLD_STATEMENT(workload_name, id);
END;
/

```

17.3.13 DELETE_STS_REF Procedure

This procedure removes a link between the current SQL Access Advisor task and a SQL tuning set.

Use `DELETE_STS_REF` for any STS-based advisor runs. The older method of using `DELETE_SQLWKLD_REF` with parameter `IS_STS=1` is only supported for backward compatibility. Furthermore, the `DELETE_STS_REF` function accepts an STS owner name, whereas `DELETE_SQLWKLD_REF` does not.

Syntax

```

DBMS_ADVISOR.DELETE_STS_REF (
  task_name      IN VARCHAR2 NOT NULL,
  sts_owner      IN VARCHAR2,
  workload_name  IN VARCHAR2 NOT NULL);

```

Parameters

Table 17-14 DELETE_STS_REF Procedure Parameters

Parameter	Description
task_name	The SQL Access Advisor task name that uniquely identifies an existing task.
sts_owner	The owner of the SQL tuning set. The value of this parameter may be <code>NULL</code> , in which case the advisor assumes the SQL tuning set to be owned by the currently logged-in user.
workload_name	The name of the workload to be unlinked. A workload consists of one or more SQL statements, plus statistics and attributes that fully describe each statement. The database stores a workload as a SQL tuning set. The wildcard <code>%</code> is supported as a workload name. The rules of use are identical to the SQL <code>LIKE</code> operator. For example, to remove all links to SQL tuning set objects, use the wildcard <code>%</code> as the <code>STS_NAME</code> .

Examples

```
DBMS_ADVISOR.DELETE_STS_REF ('My task', 'SCOTT', 'My workload');
```

17.3.14 DELETE_TASK Procedure

This procedure deletes an existing task from the repository.

Syntax

```
DBMS_ADVISOR.DELETE_TASK (
    task_name          IN VARCHAR2);
```

Parameters

Table 17-15 DELETE_TASK Procedure Parameters

Parameter	Description
task_name	A single Advisor task name that will be deleted from the repository. The wildcard % is supported as a TASK_NAME. The rules of use are identical to the LIKE operator. For example, to delete all tasks for the current user, use the wildcard % as the TASK_NAME. If a wildcard is provided, the DELETE_TASK operation will not delete any tasks marked as READ_ONLY or TEMPLATE.

Examples

```
DECLARE
    task_id NUMBER;
    task_name VARCHAR2(30);
BEGIN
    task_name := 'My Task';

    DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
    DBMS_ADVISOR.DELETE_TASK(task_name);
END;
/
```

17.3.15 EXECUTE_TASK Procedure

This procedure performs the Advisor analysis or evaluation for the specified task. The procedure is overloaded.

The execution-related arguments are optional and you do not need to set them for advisors that do not allow their tasks to be executed multiple times.

Advisors can execute a task multiple times and use the results for further processing and analysis.

Syntax

```
DBMS_ADVISOR.EXECUTE_TASK (
    task_name          IN VARCHAR2);
```

```
DBMS_ADVISOR.EXECUTE_TASK (
    task_name          IN VARCHAR2,
    execution_type     IN VARCHAR2          := NULL,
    execution_name     IN VARCHAR2          := NULL,
    execution_params   IN dbms_advisor.argList := NULL,
    execution_desc     IN VARCHAR2          := NULL,
    RETURN VARCHAR2;
```

Parameters

Table 17-16 EXECUTE_TASK Procedure Parameters

Parameter	Description
task_name	The task name that uniquely identifies an existing task.
execution_type	The type of action to be performed by the function. If NULL, it will default to the value of the <code>DEFAULT_EXECUTION_TYPE</code> parameter. As an example, the SQL Performance Analyzer accepts the following possible values: <ul style="list-style-type: none"> <code>EXPLAIN PLAN</code>: Generate an explain plan for a SQL statement. This is similar to an <code>EXPLAIN PLAN</code> command. The resulting plans will be stored in the advisor framework in association with the task. <code>TEST EXECUTE</code>: Test execute the SQL statement and collect its execute plan and statistics. The resulting plans and statistics are stored in the advisor framework. <code>ANALYZE PERFORMANCE</code>: Analyze and compare two versions of SQL performance data. The performance data is generated by test executing a SQL statement or generating its explain plan.
execution_name	A name to qualify and identify an execution. If not specified, it will be generated by the Advisor and returned by function.
execution_params	A list of parameters (name, value) for the specified execution. Note that execution parameters are real task parameters, but they affect only the execution they are specified for. As an example, consider the following: <pre>DBMS_ADVISOR.ARGLIST('time_limit', 12, 'username', 'hr')</pre>
execution_desc	A 256-length string describing the execution.

Usage Notes

Task execution is a synchronous operation. Control will not be returned to the caller until the operation has completed, or a user-interrupt was detected.

Upon return, you can check the `DBA_ADVISOR_LOG` table for the execution status.

Examples

```

DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
  workload_name VARCHAR2(30);
BEGIN
  task_name := 'My Task';
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
  DBMS_ADVISOR.ADD_SQLWKLD_REF(task_name, workload_name);
  DBMS_ADVISOR.EXECUTE_TASK(task_name);
END;
/

```

17.3.16 GET_REC_ATTRIBUTES Procedure

This procedure retrieves a specified attribute of a new object as recommended by Advisor analysis.

Syntax

```

DBMS_ADVISOR.GET_REC_ATTRIBUTES (
  workload_name      IN VARCHAR2,
  rec_id             IN NUMBER,
  action_id          IN NUMBER,
  attribute_name     IN VARCHAR2,
  value              OUT VARCHAR2,
  owner_name         IN VARCHAR2 := NULL);

```

Parameters

Table 17-17 GET_REC_ATTRIBUTES Procedure Parameters

Parameter	Description
task_name	The task name that uniquely identifies an existing task.
rec_id	The Advisor-generated identifier number that is assigned to the recommendation.
action_id	The Advisor-generated action identifier that is assigned to the particular command.
attribute_name	Specifies the attribute to change.
value	The buffer to receive the requested attribute value.
owner_name	Optional owner name of the target task. This permits access to task data not owned by the current user.

Return Values

The requested attribute value is returned in the VALUE argument.

Examples

```

DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
  workload_name VARCHAR2(30);
  attribute VARCHAR2(100);
BEGIN
  task_name := 'My Task';
  workload_name := 'My Workload';
  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');
  DBMS_ADVISOR.ADD_SQLWKLD_REF(task_name, workload_name);
  DBMS_ADVISOR.ADD_SQLWKLD_STATEMENT(workload_name, 'MONTHLY', 'ROLLUP',
                                     100,400,5041,103,640445,680000,2,
                                     1,SYSDATE,1,'SH','SELECT
AVG(amount_sold)
                                     FROM sh.sales WHERE promo_id = 10');
  DBMS_ADVISOR.EXECUTE_TASK(task_name);
  DBMS_ADVISOR.GET_REC_ATTRIBUTES(task_name, 1, 1, 'NAME', attribute);
END;
/

```

17.3.17 GET_TASK_REPORT Function

This function creates and returns a report for the specified task.

Syntax

```

DBMS_ADVISOR.GET_TASK_REPORT (
  task_name      IN VARCHAR2,
  type           IN VARCHAR2 := 'TEXT',
  level          IN VARCHAR2 := 'TYPICAL',
  section        IN VARCHAR2 := 'ALL',
  owner_name     IN VARCHAR2 := NULL,
  execution_name IN VARCHAR2 := NULL,
  object_id      IN NUMBER   := NULL)
RETURN CLOB;

```

Parameters

Table 17-18 GET_TASK_REPORT Function Parameters

Parameter	Description
task_name	The name of the task from which the script will be created.
type	The only valid value is TEXT.
level	The possible values are BASIC, TYPICAL, and ALL.
section	Advisor-specific report sections.

Table 17-18 (Cont.) GET_TASK_REPORT Function Parameters

Parameter	Description
owner_name	Owner of the task. If specified, the system will check to see if the current user has read privileges to the task data.
execution_name	An identifier of a specific execution of the task. It is needed only for advisors that allow their tasks to be executed multiple times.
object_id	An identifier of an advisor object that can be targeted by the script.

Return Values

Returns the buffer receiving the script.

17.3.18 GET_TASK_SCRIPT Function

This function creates a SQL*Plus-compatible SQL script and sends the output to a file.

The output script contains all of the accepted recommendations from the specified task.

Syntax

```
DBMS_ADVISOR.GET_TASK_SCRIPT (
    task_name          IN VARCHAR2
    type              IN VARCHAR2 := 'IMPLEMENTATION',
    rec_id            IN NUMBER   := NULL,
    act_id            IN NUMBER   := NULL,
    owner_name        IN VARCHAR2 := NULL,
    execution_name    IN VARCHAR2 := NULL,
    object_id         IN NUMBER   := NULL)
RETURN CLOB;
```

Parameters

Table 17-19 GET_TASK_SCRIPT Function Parameters

Parameter	Description
task_name	The task name that uniquely identifies an existing task.
type	Specifies the type of script to generate. The possible values are IMPLEMENTATION and UNDO.
rec_id	An optional recommendation identifier number that can be used to extract a subset of the implementation script. A zero or the value DBMS_ADVISOR.ADVISOR_ALL indicates all accepted recommendations would be included. The default is to include all accepted recommendations for the task.
act_id	Optional action identifier number that can be used to extract a single action as a DDL command. A zero or the value DBMS_ADVISOR.ADVISOR_ALL indicates all actions for the recommendation would be included. The default is to include all actions for a recommendation.

Table 17-19 (Cont.) GET_TASK_SCRIPT Function Parameters

Parameter	Description
owner_name	An optional task owner name.
execution_name	An identifier of a specific execution of the task. It is needed only for advisors that allow their tasks to be executed multiple times.
object_id	An identifier of an advisor object that can be targeted by the script.

Return Values

Returns the script as a CLOB buffer.

Usage Notes

Though the script is ready to execute, Oracle recommends that the user review the script for acceptable locations for new materialized views and indexes.

For a recommendation to appear in a generated script, it must be marked as accepted.

Examples

```

DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
  workload_name VARCHAR2(30);
  buf CLOB;
BEGIN
  task_name := 'My Task';
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');
  DBMS_ADVISOR.ADD_SQLWKLD_REF(task_name, workload_name);
  DBMS_ADVISOR.ADD_SQLWKLD_STATEMENT(workload_name, 'MONTHLY', 'ROLLUP',
                                     100,400,5041,103,640445,680000,2,
                                     1,SYSDATE,1,'SH','SELECT
AVG(amount_sold)
                                     FROM sh.sales');
  DBMS_ADVISOR.EXECUTE_TASK(task_name);
  buf := DBMS_ADVISOR.GET_TASK_SCRIPT(task_name);
END;
/

```

17.3.19 IMPLEMENT_TASK Procedure

This procedure implements the recommendations of the specified Advisor task.

Syntax

```

DBMS_ADVISOR.IMPLEMENT_TASK (
  task_name          IN VARCHAR2,

```

```

rec_id          IN NUMBER := NULL,
exit_on_error   IN BOOLEAN := NULL);

```

Parameters

Table 17-20 IMPLEMENT_TASK Procedure Parameters

Parameter	Description
task_name	The name of the task.
rec_id	An optional recommendation ID.
exit_on_error	An optional Boolean to exit on the first error.

17.3.20 IMPORT_SQLWKLD_SCHEMA Procedure

This procedure constructs and loads a SQL workload based on schema evidence. The workload is also referred to as a hypothetical workload.



Note:

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```

DBMS_ADVISOR.IMPORT_SQLWKLD_SCHEMA (
  workload_name      IN VARCHAR2,
  import_mode        IN VARCHAR2 := 'NEW',
  priority           IN NUMBER := 2,
  saved_rows         OUT NUMBER,
  failed_rows        OUT NUMBER);

```

Parameters

Table 17-21 IMPORT_SQLWKLD_SCHEMA Procedure Parameters

Parameter	Description
workload_name	The workload object name that uniquely identifies an existing workload.

Table 17-21 (Cont.) IMPORT_SQLWKLD_SCHEMA Procedure Parameters

Parameter	Description
<code>import_mode</code>	<p>Specifies the action to be taken when storing the workload. Possible values are:</p> <ul style="list-style-type: none"> • <code>APPEND</code> Indicates that the collected workload will be added to any existing workload in the task. • <code>NEW</code> Indicates that the collected workload will be the exclusive workload for the task. If an existing workload is found, an exception will be thrown. • <code>REPLACE</code> Indicates the collected workload will be the exclusive workload for the task. If an existing workload is found, it will be deleted prior to saving the new workload. <p>The default value is <code>NEW</code>.</p>
<code>priority</code>	<p>Specifies the application priority for each statement that is saved in the workload object. The value must be one of the following: 1-HIGH, 2-MEDIUM, or 3-LOW.</p>
<code>failed_rows</code>	<p>Returns the number of rows that were not saved due to syntax or validation errors</p>
<code>saved_rows</code>	<p>Returns the number of rows actually saved in the repository.</p>

Return Values

This call returns the number of rows saved and failed as output parameters.

Usage Notes

To successfully import a hypothetical workload, the target schemas must contain dimensions.

If the `VALID_TABLE_LIST` parameter is not set, the search space may become very large and require a significant amount of time to complete. Oracle recommends that you limit your search space to specific set of tables.

If a task contains valid recommendations from a prior run, adding or modifying task will mark the task as invalid, preventing the viewing and reporting of potentially valuable recommendation data.

Examples

```

DECLARE
  workload_name VARCHAR2(30);
  saved NUMBER;
  failed NUMBER;
BEGIN
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');

  DBMS_ADVISOR.SET_SQLWKLD_PARAMETER(workload_name, 'VALID_TABLE_LIST', 'SH.%');
  DBMS_ADVISOR.IMPORT_SQLWKLD_SCHEMA(workload_name, 'REPLACE', 1, saved,
    failed);
END;
/

```

17.3.21 IMPORT_SQLWKLD_SQLCACHE Procedure

This procedure creates a SQL workload from the current contents of the server's SQL cache.



Note:

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```
DBMS_ADVISOR.IMPORT_SQLWKLD_SQLCACHE (
  workload_name      IN VARCHAR2,
  import_mode        IN VARCHAR2 := 'NEW',
  priority           IN NUMBER := 2,
  saved_rows         OUT NUMBER,
  failed_rows        OUT NUMBER);
```

Parameters

Table 17-22 IMPORT_SQLWKLD_SQLCACHE Procedure Parameters

Parameter	Description
workload_name	The workload object name that uniquely identifies an existing workload.
import_mode	Specifies the action to be taken when storing the workload. Possible values are: <ul style="list-style-type: none"> APPEND Indicates that the collected workload will be added to any existing workload in the task. NEW Indicates that the collected workload will be the exclusive workload for the task. If an existing workload is found, an exception will be thrown. REPLACE Indicates the collected workload will be the exclusive workload for the task. If an existing workload is found, it will be deleted prior to saving the new workload. The default value is NEW.
priority	Specifies the application priority for each statement that is saved in the workload object. The value must be one of the following 1-HIGH, 2-MEDIUM, or 3-LOW.
saved_rows	Returns the number of rows saved as output parameters.
failed_rows	Returns the number of rows that were not saved due to syntax or validation errors.

Return Values

This call returns the number of rows saved and failed as output parameters.

Usage Notes

A workload cannot be modified or deleted if it is currently referenced by an active task. A task is considered active if it is not in its initial state. See [RESET_TASK Procedure](#) to set a task to its initial state.

Examples

```

DECLARE
  workload_name VARCHAR2(30);
  saved NUMBER;
  failed NUMBER;
BEGIN
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');

  DBMS_ADVISOR.SET_SQLWKLD_PARAMETER(workload_name, 'VALID_TABLE_LIST', 'SH.%');
  DBMS_ADVISOR.IMPORT_SQLWKLD_SQLCACHE(workload_name, 'REPLACE', 1, saved,
    failed);
END;
/

```

17.3.22 IMPORT_SQLWKLD_STS Procedure

This procedure loads a SQL workload from an existing SQL tuning set. A SQL tuning set is typically created from the server workload repository using various time and data filters.



Note:

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```

DBMS_ADVISOR.IMPORT_SQLWKLD_STS (
  workload_name      IN VARCHAR2,
  sts_name           IN VARCHAR2,
  import_mode        IN VARCHAR2 := 'NEW',
  priority            IN NUMBER := 2,
  saved_rows         OUT NUMBER,
  failed_rows        OUT NUMBER);

```

```

DBMS_ADVISOR.IMPORT_SQLWKLD_STS (
  workload_name      IN VARCHAR2,
  sts_owner          IN VARCHAR2,
  sts_name           IN VARCHAR2,
  import_mode        IN VARCHAR2 := 'NEW',
  priority            IN NUMBER := 2,

```

```

saved_rows          OUT NUMBER,
failed_rows         OUT NUMBER);

```

Parameters

Table 17-23 IMPORT_SQLWKLD_STIS Procedure Parameters

Parameter	Description
workload_name	The workload object name that uniquely identifies an existing workload.
sts_owner	The optional owner of the SQL tuning set.
sts_name	The name of an existing SQL tuning set workload from which the data will be imported. If the sts_owner value is not provided, the owner will default to the current user.
import_mode	Specifies the action to be taken when storing the workload. Possible values are: <ul style="list-style-type: none"> APPEND Indicates that the collected workload will be added to any existing workload in the task. NEW Indicates that the collected workload will be the exclusive workload for the task. If an existing workload is found, an exception will be thrown. REPLACE Indicates the collected workload will be the exclusive workload for the task. If an existing workload is found, it will be deleted prior to saving the new workload. The default value is NEW.
priority	Specifies the application priority for each statement that is saved in the workload object. The value must be one of the following: 1-HIGH, 2-MEDIUM, or 3-LOW. The default value is 2.
saved_rows	Returns the number of rows actually saved in the repository.
failed_rows	Returns the number of rows that were not saved due to syntax or validation errors.

Return Values

This call returns the number of rows saved and failed as output parameters.

Usage Notes

A workload cannot be modified or deleted if it is currently referenced by an active task. A task is considered active if it is not in its initial state. See [RESET_TASK Procedure](#) to set a task to its initial state.

Examples

```

DECLARE
  workload_name VARCHAR2(30);
  saved NUMBER;
  failed NUMBER;
BEGIN
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');

```

```
DBMS_ADVISOR.SET_SQLWKLD_PARAMETER(workload_name, 'VALID_TABLE_LIST', 'SH.%');
  DBMS_ADVISOR.IMPORT_SQLWKLD_STS(workload_name, 'MY_SQLSET', 'REPLACE', 1,
    saved, failed);
END;
/
```

17.3.23 IMPORT_SQLWKLD_SUMADV Procedure

This procedure collects a SQL workload from a Summary Advisor workload.

This procedure is intended to assist Oracle9i Database Summary Advisor users in the migration to SQL Access Advisor.

 **Note:**

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```
DBMS_ADVISOR.IMPORT_SQLWKLD_SUMADV (
  workload_name      IN VARCHAR2,
  import_mode        IN VARCHAR2 := 'NEW',
  priority            IN NUMBER := 2,
  sumadv_id          IN NUMBER,
  saved_rows         OUT NUMBER,
  failed_rows        OUT NUMBER);
```

Parameters

Table 17-24 IMPORT_SQLWKLD_SUMADV Procedure Parameters

Parameter	Description
workload_name	The workload object name that uniquely identifies an existing workload.
import_mode	Specifies the action to be taken when storing the workload. Possible values are: <ul style="list-style-type: none"> • APPEND Indicates that the collected workload will be added to any existing workload in the task. • NEW Indicates that the collected workload will be the exclusive workload for the task. If an existing workload is found, an exception will be thrown. • REPLACE Indicates the collected workload will be the exclusive workload for the task. If an existing workload is found, it will be deleted prior to saving the new workload. The default value is NEW .

Table 17-24 (Cont.) IMPORT_SQLWKLD_SUMADV Procedure Parameters

Parameter	Description
priority	Specifies the default application priority for each statement that is saved in the workload object. If a Summary Advisor workload statement contains a priority of zero, the default priority will be applied. If the workload statement contains a valid priority, then the Summary Advisor priority will be converted to a comparable SQL Access Advisor priority. The value must be one of the following: 1-HIGH, 2-MEDIUM, or 3-LOW.
sumadv_id	Specifies the Summary Advisor workload identifier number.
saved_rows	Returns the number of rows actually saved in the repository.
failed_rows	Returns the number of rows that were not saved due to syntax or validation errors.

Return Values

This call returns the number of rows saved and failed as output parameters.

Usage Notes

A workload cannot be modified or deleted if it is currently referenced by an active task. A task is considered active if it is not in its initial state. See [RESET_TASK Procedure](#) to set a task to its initial state.

Examples

```

DECLARE
  workload_name VARCHAR2(30);
  saved NUMBER;
  failed NUMBER;
  sumadv_id NUMBER;
BEGIN
  workload_name := 'My Workload';
  sumadv_id := 394;

  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');

  DBMS_ADVISOR.SET_SQLWKLD_PARAMETER(workload_name, 'VALID_TABLE_LIST', 'SH
.%');
  DBMS_ADVISOR.IMPORT_SQLWKLD_SUMADV(workload_name, 'REPLACE', 1,
sumadv_id,
  saved, failed);
END;
/

```


17.3.24 IMPORT_SQLWKLD_USER Procedure

This procedure collects a SQL workload from a specified user table.



Note:

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```
DBMS_ADVISOR.IMPORT_SQLWKLD_USER (  
  workload_name      IN VARCHAR2,  
  import_mode        IN VARCHAR2 := 'NEW',  
  owner_name         IN VARCHAR2,  
  table_name         IN VARCHAR2,  
  saved_rows         OUT NUMBER,  
  failed_rows        OUT NUMBER);
```

Parameters

Table 17-25 IMPORT_SQLWKLD_USER Procedure Parameters

Parameter	Description
workload_name	The workload object name that uniquely identifies an existing workload.
import_mode	Specifies the action to be taken when storing the workload. Possible values are: <ul style="list-style-type: none">• APPEND Indicates that the collected workload will be added to any existing workload in the task.• NEW Indicates that the collected workload will be the exclusive workload for the task. If an existing workload is found, an exception will be thrown.• REPLACE Indicates the collected workload will be the exclusive workload for the task. If an existing workload is found, it will be deleted prior to saving the new workload. The default value is NEW.
owner_name	Specifies the owner name of the table or view from which workload data will be collected.
table_name	Specifies the name of the table or view from which workload data will be collected.
saved_rows	Returns the number of rows actually saved in the workload object.
failed_rows	Returns the number of rows that were not saved due to syntax or validation errors.

Return Values

This call returns the number of rows saved and failed as output parameters.

Usage Notes

A workload cannot be modified or deleted if it is currently referenced by an active task. A task is considered active if it is not in its initial state. See [RESET_TASK Procedure](#) to set a task to its initial state.

Examples

```
DECLARE
  workload_name VARCHAR2(30);
  saved NUMBER;
  failed NUMBER;
BEGIN
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');

  DBMS_ADVISOR.SET_SQLWKLD_PARAMETER(workload_name, 'VALID_TABLE_LIST', 'SH
.%');
  DBMS_ADVISOR.IMPORT_SQLWKLD_USER(workload_name, 'REPLACE', 'SH',
  'USER_WORKLOAD', saved, failed);
END;
/
```

17.3.25 INTERRUPT_TASK Procedure

This procedure stops a currently executing task.

The task will end its operations as it would at a normal exit. The user will be able to access any recommendations that exist to this point.

Syntax

```
DBMS_ADVISOR.INTERRUPT_TASK (
  task_name          IN VARCHAR2);
```

Parameters

Table 17-26 INTERRUPT_TASK Procedure Parameters

Parameter	Description
task_name	A single Advisor task name that will be interrupted.

Examples

```
DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
BEGIN
  task_name := 'My Task';
```

```

    DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
    DBMS_ADVISOR.EXECUTE_TASK(task_name);
END;
/

```

While this session is executing its task, you can interrupt the task from a second session using the following statement:

```

BEGIN
    DBMS_ADVISOR.INTERRUPT_TASK('My Task');
END;
/

```

17.3.26 MARK_RECOMMENDATION Procedure

This procedure marks a recommendation for import or implementation.

Syntax

```

DBMS_ADVISOR.MARK_RECOMMENDATION (
    task_name          IN VARCHAR2
    id                  IN NUMBER,
    action              IN VARCHAR2);

```

Parameters

Table 17-27 MARK_RECOMMENDATION Procedure Parameters

Parameter	Description
task_name	Name of the task.
id	The recommendation identifier number assigned by the Advisor.
action	The recommendation action setting. The possible actions are: <ul style="list-style-type: none"> ACCEPT Marks the recommendation as accepted. With this setting, the recommendation will appear in implementation and undo scripts. IGNORE Marks the recommendation as ignore. With this setting, the recommendation will not appear in an implementation or undo script. REJECT Marks the recommendation as rejected. With this setting, the recommendation will not appear in any implementation or undo scripts.

Usage Notes

For a recommendation to be implemented, it must be marked as accepted. By default, all recommendations are considered accepted and will appear in any generated scripts.

Examples

```

DECLARE
    task_id NUMBER;
    task_name VARCHAR2(30);
    workload_name VARCHAR2(30);

```

```

attribute VARCHAR2(100);
rec_id NUMBER;
BEGIN
  task_name := 'My Task';
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');
  DBMS_ADVISOR.ADD_SQLWKLD_REF(task_name, workload_name);
  DBMS_ADVISOR.ADD_SQLWKLD_STATEMENT(workload_name, 'MONTHLY',
'ROLLUP',
                                100,400,5041,103,640445,680000,2,
                                1,SYSDATE,1,'SH','SELECT
AVG(amount_sold)
                                FROM sh.sales WHERE promo_id =
10');
  DBMS_ADVISOR.EXECUTE_TASK(task_name);

  rec_id := 1;
  DBMS_ADVISOR.MARK_RECOMMENDATION(task_name, rec_id, 'REJECT');
END;
/

```

17.3.27 QUICK_TUNE Procedure

This procedure performs an analysis and generates recommendations for a single SQL statement.

This provides a shortcut method of all necessary operations to analyze the specified SQL statement. The operation creates a task using the specified task name. The task will be created using a specified Advisor task template. Finally, the task will be executed and the results will be saved in the repository.

Syntax

```

DBMS_ADVISOR.QUICK_TUNE (
  advisor_name      IN VARCHAR2,
  task_name         IN VARCHAR2,
  attr1             IN CLOB,
  attr2             IN VARCHAR2 := NULL,
  attr3             IN NUMBER := NULL,
  template         IN VARCHAR2 := NULL,
  implement         IN BOOLEAN := FALSE,
  description       IN VARCHAR2 := NULL);

```

Parameters

Table 17-28 QUICK_TUNE Procedure Parameters

Parameter	Description
advisor_name	Name of the Advisor that will perform the analysis.

Table 17-28 (Cont.) QUICK_TUNE Procedure Parameters

Parameter	Description
task_name	Name of the task.
attr1	Advisor-specific attribute in the form of a CLOB variable.
attr2	Advisor-specific attribute in the form of a VARCHAR2 variable.
attr3	Advisor-specific attribute in the form of a NUMBER.
template	Name of an existing task or template from which the initial settings need to be copied.
implement	Flag specifying whether to implement the task.
description	Description of the task.

Usage Notes

If indicated by the user, the final recommendations can be implemented by the procedure.

The task will be created using either a specified SQL Access task template or the built-in default template of `SQLACCESS_GENERAL`. The workload will only contain the specified statement, and all task parameters will be defaulted.

`attr1` must be the single SQL statement to tune. For the SQL Access Advisor, `attr2` is the user who would execute the single statement. If omitted, the current user will be used.

Examples

```

DECLARE
  task_name VARCHAR2(30);
BEGIN
  task_name := 'My Task';

  DBMS_ADVISOR.QUICK_TUNE(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_name,
    'SELECT AVG(amount_sold) FROM sh.sales WHERE promo_id=10');
END;
/

```

17.3.28 RESET_SQLWKLD Procedure

This procedure resets a workload to its initial starting point.

Resetting the workload has the effect of removing all journal and log messages, and recalculating necessary volatility and usage statistics.

Note:

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```
DBMS_ADVISOR.RESET_SQLWKLD (
    workload_name          IN VARCHAR2);
```

Parameters**Table 17-29** RESET_SQLWKLD Procedure Parameters

Parameter	Description
workload_name	The SQL Workload object name that uniquely identifies an existing workload.

Usage Notes

RESET_SQLWKLD should be executed after any workload adjustments such as adding or removing SQL statements.

Examples

```
DECLARE
    workload_name VARCHAR2(30);
BEGIN
    workload_name := 'My Workload';

    DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');
    DBMS_ADVISOR.ADD_SQLWKLD_STATEMENT(workload_name, 'MONTHLY',
    'ROLLUP',
                                100,400,5041,103,640445,680000,2,
                                1,SYSDATE,1,'SH','SELECT
AVG(amount_sold)
                                FROM sh.sales WHERE promo_id =
10');

    DBMS_ADVISOR.RESET_SQLWKLD(workload_name);
END;
/
```

17.3.29 RESET_TASK Procedure

This procedure re-initializes the metadata for the specified task. The task status will be set to INITIAL.

Syntax

```
DBMS_ADVISOR.RESET_TASK (
    task_name              IN VARCHAR2);
```

Parameters

Table 17-30 RESET_TASK Procedure Parameters

Parameter	Description
task_name	The task name that uniquely identifies an existing task.

Examples

```

DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
  workload_name VARCHAR2(30);
BEGIN
  task_name := 'My Task';
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
  DBMS_ADVISOR.ADD_SQLWKLD_REF(task_name, workload_name);
  DBMS_ADVISOR.EXECUTE_TASK(task_name);
  DBMS_ADVISOR.RESET_TASK(task_name);
END;
/

```

17.3.30 SET_DEFAULT_SQLWKLD_PARAMETER Procedure

This procedure modifies the default value for a user parameter within a SQL Workload object or SQL Workload object template.

A user parameter is a simple variable that stores various attributes that affect workload collection, tuning decisions and reporting. When a default value is changed for a parameter, workload objects will inherit the new value when they are created.

**Note:**

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```

DBMS_ADVISOR.SET_DEFAULT_SQLWKLD_PARAMETER (
  parameter      IN VARCHAR2,
  value          IN VARCHAR2);

```

```

DBMS_ADVISOR.SET_DEFAULT_SQLWKLD_PARAMETER (
  parameter      IN VARCHAR2,
  value          IN NUMBER);

```

Parameters

Table 17-31 SET_DEFAULT_SQLWKLD_PARAMETER Procedure Parameters

Parameter	Description
parameter	The name of the data parameter to be modified. Parameter names are not case sensitive. Parameter names are unique to the workload object type, but not necessarily unique to all workload object types. Various object types may use the same parameter name for different purposes.
value	The value of the specified parameter. The value can be specified as a string or a number. If the value is DBMS_ADVISOR.DEFAULT, the value will be reset to the default value.

Usage Notes

A parameter will only affect operations that modify the workload collection. Therefore, parameters should be set prior to importing or adding new SQL statements to a workload. If a parameter is set after data has been placed in a workload object, it will have no effect on the existing data.

Examples

```
BEGIN

DBMS_ADVISOR.SET_DEFAULT_SQLWKLD_PARAMETER('VALID_TABLE_LIST', 'SH.%');
END;
/
```

17.3.31 SET_DEFAULT_TASK_PARAMETER Procedure

This procedure modifies the default value for a user parameter within a task or a template.

A user parameter is a simple variable that stores various attributes that affect various Advisor operations. When a default value is changed for a parameter, tasks will inherit the new value when they are created.

A default task is different from a regular task. The default value is the initial value that will be inserted into a newly created task, while setting a task parameter with SET_TASK_PARAMETER sets the local value only. Thus, SET_DEFAULT_TASK_PARAMETER has no effect on an existing task.

Syntax

```
DBMS_ADVISOR.SET_DEFAULT_TASK_PARAMETER (
    advisor_name      IN VARCHAR2
    parameter         IN VARCHAR2,
    value             IN VARCHAR2);
```

```
DBMS_ADVISOR.SET_DEFAULT_TASK_PARAMETER (
    advisor_name      IN VARCHAR2
```



```
parameter      IN VARCHAR2,
value          IN NUMBER);
```

Parameters

Table 17-32 SET_DEFAULT_TASK_PARAMETER Procedure Parameters

Parameter	Description
advisor_name	Specifies the unique advisor name as defined in the view DBA_ADVISOR_DEFINITIONS.
parameter	The name of the task parameter to be modified. Parameter names are not case sensitive. Parameter names are unique to the task type, but not necessarily unique to all task types. Various task types may use the same parameter name for different purposes.
value	The value of the specified task parameter. The value can be specified as a string or a number.

Examples

```
BEGIN
  DBMS_ADVISOR.SET_DEFAULT_TASK_PARAMETER(DBMS_ADVISOR.SQLACCESS_ADVISOR,
    'VALID_TABLE_LIST', 'SH.%');
END;
```

17.3.32 SET_SQLWKLD_PARAMETER Procedure

This procedure modifies a user parameter within a SQL Workload object or SQL Workload object template.

A user parameter is a simple variable that stores various attributes that affect workload collection, tuning decisions and reporting.



Note:

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```
DBMS_ADVISOR.SET_SQLWKLD_PARAMETER (
  workload_name      IN VARCHAR2,
  parameter          IN VARCHAR2,
  value              IN VARCHAR2);
```

```
DBMS_ADVISOR.SET_SQLWKLD_PARAMETER (
  workload_name      IN VARCHAR2,
  parameter          IN VARCHAR2,
  value              IN NUMBER);
```

Parameters

Table 17-33 SET_SQLWKLD_PARAMETER Procedure Parameters

Parameter	Description
workload_name	The SQL Workload object name that uniquely identifies an existing workload.
parameter	The name of the data parameter to be modified. Parameter names are not case sensitive.
value	The value of the specified parameter. The value can be specified as a string or a number. If the value is DBMS_ADVISOR.DEFAULT, the value will be reset to the default value.

Usage Notes

A parameter will only affect operations that modify the workload collection. Therefore, parameters should be set prior to importing or adding new SQL statements to a workload. If a parameter is set after data has been placed in a workload object, it will have no effect on the existing data.

Examples

```
DECLARE
  workload_name VARCHAR2(30);
BEGIN
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');
  DBMS_ADVISOR.SET_SQLWKLD_PARAMETER(workload_name,
  'VALID_TABLE_LIST', 'SH.%');
END;
/
```

17.3.33 SET_TASK_PARAMETER Procedure

This procedure modifies a user parameter within an Advisor task or a template. A user parameter is a simple variable that stores various attributes that affect workload collection, tuning decisions and reporting.

Syntax

```
DBMS_ADVISOR.SET_TASK_PARAMETER (
  task_name          IN VARCHAR2
  parameter          IN VARCHAR2,
  value              IN VARCHAR2);
```

```
DBMS_ADVISOR.SET_TASK_PARAMETER (
  task_name          IN VARCHAR2
  parameter          IN VARCHAR2,
  value              IN NUMBER);
```

Parameters

Table 17-34 SET_TASK_PARAMETER Procedure Parameters

Parameter	Description
<code>task_name</code>	The Advisor task name that uniquely identifies an existing task.
<code>parameter</code>	The name of the task parameter to be modified. Parameter names are not case sensitive. Parameter names are unique to the task type, but not necessarily unique to all task types. Various task types may use the same parameter name for different purposes.
<code>value</code>	The value of the specified task parameter. The value can be specified as a string or a number. If the value is <code>DEFAULT</code> , the value will be reset to the default value.

Usage Notes

A task cannot be modified unless it is in its initial state. See [RESET_TASK Procedure](#) to set a task to its initial state. See your Advisor-specific documentation for further information on using this procedure.

SQL Access Advisor Task Parameters

[Table 17-35](#) lists SQL Access Advisor task parameters.

Table 17-35 SQL Access Advisor Task Parameters

Parameter	Description
ANALYSIS_SCOPE	<p>A comma-separated list that specifies the tuning artifacts to consider during analysis.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • ALL Short name for specifying INDEX, MVIEW, TABLE, and PARTITION. • EVALUATION Causes a read-only evaluation of the specified workload. No new recommendations will be made. Can only be specified alone. • INDEX Allows the SQL Access Advisor to recommend index structure changes. • MVIEW Allows the SQL Access Advisor to recommend materialized view and log changes. • PARTITION Allows the SQL Access Advisor to recommend partition options. Use this in conjunction with the INDEX, MVIEW, and TABLE options. • TABLE Allows the SQL Access Advisor to make base-table recommendations. In this release, the only base-table recommendation is partitioning. <p>Using the new keywords, the following combinations are valid:</p> <ul style="list-style-type: none"> • INDEX • MVIEW • INDEX, PARTITION • INDEX, MVIEW, PARTITION • INDEX, TABLE, PARTITION • MVIEW, PARTITION • MVIEW, TABLE, PARTITION • INDEX, MVIEW, TABLE, PARTITION • TABLE, PARTITION • EVALUATION <p>The default value is INDEX. The data type is STRINGLIST.</p>
CREATION_COST	<p>When set to true (default), the SQL Access Advisor will weigh the cost of creation of the access structure (index or materialized view) against the frequency of the query and potential improvement in the query execution time. When set to false, the cost of creation is ignored. The data type is STRING.</p>
DAYS_TO_EXPIRE	<p>Specifies the expiration time in days for the current SQL Access Advisor task. The value is relative to the last modification date. Once the task expires, it will become a candidate for removal by an automatic purge operation.</p> <p>Specifies the expiration time in days for the current Access Advisor task. The value is relative to the last modification date. The data type is NUMBER.</p> <p>Once the task expires, it becomes a candidate for removal by an automatic purge operation.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • an integer in the range of 0 to 2147483647 • ADVISOR_UNLIMITED • ADVISOR_UNUSED <p>The default value is 30.</p>
DEF_EM_TEMPLATE	<p>Contains the default task or template name from which the Enterprise Manager SQL Access Advisor Wizard reads its initial values.</p> <p>The default value is SQLACCESS_EMTASK. The data type is STRING.</p>

Table 17-35 (Cont.) SQL Access Advisor Task Parameters

Parameter	Description
DEF_INDEX_OWNER	<p>Specifies the default owner for new index recommendations. When a script is created, this value will be used to qualify the index name.</p> <p>Possible values are:</p> <ul style="list-style-type: none">Existing schema name. Quoted identifiers are supported.ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is STRING.</p>
DEF_INDEX_TABLESPACE	<p>Specifies the default tablespace for new index recommendations. When a script is created, this value will be used to specify a tablespace clause.</p> <p>Possible values are:</p> <ul style="list-style-type: none">Existing tablespace name. Quoted identifiers are supported.ADVISOR_UNUSED No tablespace clause will be present in the script for indexes. <p>The default value is ADVISOR_UNUSED. The data type is STRING.</p>
DEF_MVIEW_OWNER	<p>Specifies the default owner for new materialized view recommendations. When a script is created, this value will be used to qualify the materialized view name.</p> <p>Possible values are:</p> <ul style="list-style-type: none">Existing schema name. Quoted identifiers are supported.ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is STRING.</p>
DEF_MVIEW_TABLESPACE	<p>Specifies the default tablespace for new materialized view recommendations. When a script is created, this value will be used to specify a tablespace clause.</p> <p>Possible values are</p> <ul style="list-style-type: none">Existing tablespace name. Quoted identifiers are supported.ADVISOR_UNUSED. No tablespace clause will be present in the script for materialized view logs. <p>The default value is ADVISOR_UNUSED. The data type is STRING.</p>
DEF_MVLOG_TABLESPACE	<p>Specifies the default tablespace for new materialized view log recommendations. When a script is created, this value will be used to specify a tablespace clause.</p> <p>Possible values are:</p> <ul style="list-style-type: none">Existing tablespace name. Quoted identifiers are supported.ADVISOR_UNUSED. No tablespace clause will be present in the script for materialized view logs. <p>The default value is ADVISOR_UNUSED. The data type is STRING.</p>
DEF_PARTITION_TABLESPACE	<p>Specifies the default tablespace for new partitioning recommendations. When a script is created, this value will be used to specify a tablespace clause.</p> <p>Possible values are:</p> <ul style="list-style-type: none">Existing tablespace name. Quoted identifiers are supported.ADVISOR_UNUSED. No tablespace clause will be present in the script for materialized views. <p>The default value is ADVISOR_UNUSED. The data type is STRING.</p>

Table 17-35 (Cont.) SQL Access Advisor Task Parameters

Parameter	Description
DML_VOLATILITY	<p>When set to <code>TRUE</code>, the SQL Access Advisor will consider the impact of index maintenance and materialized view refresh in determining the recommendations. It will limit the access structure recommendations involving columns or tables that are frequently updated. For example, if there are too many DML statements on a column, then it may favor a B-tree index over a bitmap index on that column. For this process to be effective, the workload must include DML (insert/update/delete/merge/direct path inserts) statements that represent the update behavior of the application. The data type is <code>STRING</code>.</p> <p>See the related parameter <code>refresh_mode</code>.</p>
END_TIME	<p>Specifies an end time for selecting SQL statements. If the statement did not execute on or before the specified time, it will not be processed.</p> <p>Each date must be in the standard Oracle form of <code>MM-DD-YYYY HH24:MI:SS</code>, where:</p> <ul style="list-style-type: none"> • DD is the numeric date • MM is the numeric month • YYYY is the numeric year • HH is the hour in 24 hour format • MI is the minute • SS is the second <p>The data type is <code>STRING</code>.</p>
EVALUATION_ONLY	<p>This parameter is maintained for backward compatibility. All values will be translated and placed into the <code>ANALYSIS_SCOPE</code> task parameter.</p> <p>If set to <code>TRUE</code>, causes SQL Access Advisor to analyze the workload, but only comment on how well the current configuration is supporting it. No tuning recommendations will be generated.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> • <code>FALSE</code> • <code>TRUE</code> <p>The default value is <code>FALSE</code>. The data type is <code>STRING</code>.</p>
EXECUTION_TYPE	<p>This parameter is maintained for backward compatibility. All values will be translated and placed into the <code>ANALYSIS_SCOPE</code> task parameter.</p> <p>The translated values are:</p> <ul style="list-style-type: none"> • <code>FULL => FULL</code> • <code>INDEX_ONLY => INDEX</code> • <code>MVIEW_ONLY => MVIEW</code> • <code>MVIEW_LOG_ONLY => MVIEW_LOG_ONLY</code> <p>The type of recommendations that is desired. Possible values:</p> <ul style="list-style-type: none"> • <code>FULL</code> All supported recommendation types will be considered. • <code>INDEX_ONLY</code> The SQL Access Advisor will only consider index solutions as recommendations. • <code>MVIEW_ONLY</code> The SQL Access Advisor will consider materialized view and materialized view log solutions as recommendations. • <code>MVIEW_LOG_ONLY</code> The SQL Access Advisor will only consider materialized view log solutions as recommendations. <p>The default value is <code>FULL</code>. The data type is <code>STRINGLIST</code>.</p>

Table 17-35 (Cont.) SQL Access Advisor Task Parameters

Parameter	Description
IMPLEMENT_EXIT_ON_ERROR	<p>When performing an IMPLEMENT_TASK operation, this parameter will control behavior when an action fails to implement. If set to TRUE, IMPLEMENT_TASK will stop on the first unexpected error.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • TRUE • FALSE <p>The default value is TRUE. The data type is STRING.</p>
INDEX_NAME_TEMPLATE	<p>Specifies the method by which new index names are formed.</p> <p>If the TASK_ID is omitted from the template, names generated by two concurrently executing SQL Access Advisor tasks may conflict and cause undesirable effects. So it is recommended that you include the TASK_ID in the template. Once formatted, the maximum size of a name is 30 characters.</p> <p>Valid keywords are:</p> <ul style="list-style-type: none"> • Any literal value up to 22 characters. • TABLE Causes the parent table name to be substituted into the index name. If the name is too long, it will be trimmed to fit. • TASK_ID Causes the current task identifier number to be inserted in hexadecimal form. • SEQ Causes a sequence number to be inserted in hexadecimal form. Because this number is used to guarantee uniqueness, it is a required token. <p>The default template is <i>table_IDX\$\$_task_idsequence</i>. The data type is STRING.</p>
INVALID_ACTION_LIST	<p>Contains a fully qualified list of actions that are not eligible for processing in a SQL workload object. The list elements are comma-delimited, and quoted names are supported.</p> <p>An action can be any string. If an action is not quoted, it will be changed to uppercase lettering and stripped of leading and trailing spaces. An action string is not scanned for correctness.</p> <p>During a task execution, if a SQL statement's action matches a name in the action list, it will not be processed by the task. An action name is case sensitive.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • single action • comma-delimited action list • ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is STRINGLIST.</p>

Table 17-35 (Cont.) SQL Access Advisor Task Parameters

Parameter	Description
INVALID_MODULE_LIST	<p>Contains a fully qualified list of modules that are not eligible for processing in a SQL workload object. The list elements are comma-delimited, and quoted names are supported.</p> <p>A module can be any string. If a module is not quoted, it will be changed to uppercase lettering and stripped of leading and trailing spaces. A module string is not scanned for correctness.</p> <p>During a task execution, if a SQL statement's module matches a name in the list, it will not be processed by the task. A module name is case sensitive.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • single application • comma-delimited module list • ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is STRINGLIST.</p>
INVALID_SQLSTRING_LIST	<p>Contains a fully qualified list of text strings that are not eligible for processing in a SQL workload object. The list elements are comma-delimited, and quoted values are supported.</p> <p>A SQL string can be any string. If a string is not quoted, it will be changed to uppercase lettering and stripped of leading and trailing spaces. A SQL string is not scanned for correctness.</p> <p>During a task execution, if a SQL statement contains a string in the SQL string list, it will not be processed by the task.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • single string • comma-delimited string list • ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is STRINGLIST.</p>
INVALID_USERNAME_LIST	<p>Contains a fully qualified list of user names that are not eligible for processing in a SQL workload object. The list elements are comma-delimited, and quoted names are supported.</p> <p>During a task execution, if a SQL statement's user name matches a name in the user name list, it will not be processed by the task. A user name is not case sensitive unless it is quoted.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • single user name • comma-delimited user name list • ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is STRINGLIST.</p>

Table 17-35 (Cont.) SQL Access Advisor Task Parameters

Parameter	Description
JOURNALING	<p>Controls the logging of messages to the journal (<code>DBA_ADVISOR_JOURNAL</code> and <code>USER_ADVISOR_JOURNAL</code> views). The higher the setting, the more information is logged to the journal.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> • <code>UNUSED</code>: no journal messages • <code>FATAL</code>: explanation of fatal conditions • <code>ERROR</code>: explanation of errors • <code>WARNING</code>: explanation of warnings • <code>INFORMATION</code>: information message • <code>INFORMATION2</code>: common information • <code>INFORMATION3</code>: common information • <code>INFORMATION4</code>: common information • <code>INFORMATION5</code>: common information • <code>INFORMATION6</code>: common information <p>Each journal value represents all recorded messages at that level or lower. For example, when choosing <code>WARNING</code>, all messages marked <code>WARNING</code> as well as <code>ERROR</code> and <code>FATAL</code> will be recorded in the repository.</p> <p><code>INFORMATION6</code> represents the most thorough message recording and <code>UNUSED</code> is the least.</p> <p>The default value is <code>INFORMATION</code>. The data type is <code>NUMBER</code>.</p>
LIMITED_PARTITION_SCHEMES	<p>User can suggest that the Partition Expert cut off the number of partitioning schemes to investigate. This can help with cutting down the run time of the advisor.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> • An integer in the range of 1 to 10 • <code>ADVISOR_UNUSED</code> <p>The default value is <code>ADVISOR_UNUSED</code>. The data type is <code>NUMBER</code>.</p>
MAX_NUMBER_PARTITIONS	<p>Limits the number of partitions the advisor will recommend for any base table, index, or materialized view.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> • An integer in the range of 1 to 4294967295 • <code>ADVISOR_UNLIMITED</code> • <code>ADVISOR_UNUSED</code> <p>The default value is <code>ADVISOR_UNLIMITED</code>. The data type is <code>NUMBER</code>.</p>
MODE	<p>Specifies the mode by which Access Advisor will operate during an analysis.</p> <p>Valid values are:</p> <ul style="list-style-type: none"> • <code>LIMITED</code> Indicates the Advisor will attempt to a quick job by limiting the search-space of candidate recommendations, and correspondingly, the results may be of a low quality. • <code>COMPREHENSIVE</code> Indicates the Advisor will search a large pool of candidates that may take long to run, but the resulting recommendations will be of the highest quality. <p>The default value is <code>COMPREHENSIVE</code>. The data type is <code>STRING</code>.</p>

Table 17-35 (Cont.) SQL Access Advisor Task Parameters

Parameter	Description
MVIEW_NAME_TEMPLATE	<p>Specifies the method by which new materialized view names are formed. If the <i>TASK_ID</i> is omitted from the template, names generated by two concurrently executing SQL Access Advisor tasks may conflict and cause undesirable effects. So it is recommended that you include the <i>TASK_ID</i> in the template.</p> <p>The format is any combination of keyword tokens and literals. However, once formatted, the maximum size of a name is 30 characters.</p> <p>Valid tokens are:</p> <ul style="list-style-type: none"> Any literal value up to 22 characters. <i>TASK_ID</i> Causes the current task identifier number to be inserted in hexadecimal form. <i>SEQ</i> Causes a sequence number to be inserted in hexadecimal form. Because this number is used to guarantee uniqueness, it is a required token. <p>The default template is: <i>MV\$\$_task_idsequence</i>. The data type is <code>STRING</code>.</p>
ORDER_LIST	<p>This parameter has been deprecated.</p> <p>Contains the primary natural order in which the Access Advisor processes workload elements during the analysis operation. To determine absolute natural order, Access Advisor sorts the workload using <code>ORDER_LIST</code> values. A comma must separate multiple order keys.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> <code>BUFFER_GETS</code> Sets the order using the SQL statement's buffer-get count value. <code>CPU_TIME</code> Sets the order using the SQL statement's CPU time value. <code>DISK_READS</code> Sets the order using the SQL statement's disk-read count value. <code>ELAPSED_TIME</code> Sets the order using the SQL statement's elapsed time value. <code>EXECUTIONS</code> Sets the order using the SQL statement's execution frequency value. <code>OPTIMIZER_COST</code> Sets the order using the SQL statement's optimizer cost value. <code>I/O</code> Sets the order using the SQL statement's I/O count value. <code>PRIORITY</code> Sets the order using the user-supplied business priority value. <p>All values are accessed in descending order, where a high value is considered more interesting than a low value.</p> <p>The default value is <code>PRIORITY, OPTIMIZER_COST</code>. The data type is <code>STRINGLIST</code>.</p>

Table 17-35 (Cont.) SQL Access Advisor Task Parameters

Parameter	Description
PARTITION_NAME_TEMPLATE	<p>Specifies the method by which new partition names are formed. The format is any combination of keyword tokens and literals. However, once formatted, the maximum size of a name is 30 characters.</p> <p>Valid tokens are:</p> <ul style="list-style-type: none"> Any literal value up to 22 characters. <i>table</i> - Causes the parent table name to be substituted into the partition name. If the name is too long, it will be trimmed to fit. <i>task_id</i> - Causes the current task identifier number to be inserted in hexadecimal form. <i>sequence</i> - Causes a sequence number to be inserted in hexadecimal form. Because this number is used to guarantee uniqueness, it is a required token. <p>The default template is <code>PTN\$\$_table_task_idsequence</code>. The data type is <code>STRING</code>.</p>
PARTITIONING_GOAL	<p>Specifies the approach used to make partitioning recommendations. One possible value is <code>PERFORMANCE</code>, which is the default. The data type is <code>STRING</code>.</p>
PARTITIONING_TYPES	<p>Specifies the type of partitioning used. Possible values are <code>RANGE</code> and <code>HASH</code>. The data type is <code>STRING</code>.</p>
RANKING_MEASURE	<p>Contains the primary natural order in which the SQL Access Advisor processes workload elements during the analysis operation. To determine absolute natural order, SQL Access Advisor sorts the workload using <code>RANKING_MEASURE</code> values. A comma must separate multiple order keys.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> <code>BUFFER_GETS</code> Sets the order using the SQL statement's buffer-get count value. <code>CPU_TIME</code> Sets the order using the SQL statement's CPU time value. <code>DISK_READS</code> Sets the order using the SQL statement's disk-read count value. <code>ELAPSED_TIME</code> Sets the order using the SQL statement's elapsed time value. <code>EXECUTIONS</code> Sets the order using the SQL statement's elapsed time value. <code>OPTIMIZER_COST</code> Sets the order using the SQL statement's optimizer cost value. <code>PRIORITY</code> Sets the order using the user-supplied business priority value. <p>All values are accessed in descending order, where a high value is considered more interesting than a low value.</p> <p>The default value is <code>PRIORITY, OPTIMIZER_COST</code>. The data type is <code>STRINGLIST</code>.</p>
RECOMMEND_MV_EXACT_TEXT_MATCH	<p>When considering candidate materialized views, exact text match solutions will only be included if this parameter contains <code>TRUE</code>.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> <code>TRUE</code> <code>FALSE</code> <p>The default value is <code>TRUE</code>. The data type is <code>STRING</code>.</p>

Table 17-35 (Cont.) SQL Access Advisor Task Parameters

Parameter	Description
RECOMMENDED_TABLESPACES	<p>Allows the SQL Access Advisor to recommend optimal tablespaces for any partitioning scheme. If this is not set, the SQL Access Advisor will simply recommend a partitioning method but give no advice on physical storage.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> • TRUE • FALSE (the default) <p>The data type is STRING.</p>
REFRESH_MODE	<p>Specifies whether materialized views are refreshed ON_DEMAND or ON_COMMIT. This will be used to weigh the impact of materialized view refresh when the parameter dml_volatility is set to TRUE.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> • ON_DEMAND • ON_COMMIT <p>The default value is ON_DEMAND. The data type is STRING.</p>
REPORT_DATE_FORMAT	<p>This is the default date and time formatting template. The default format is DD/MM/YYYYHH24:MI. The data type is STRING.</p>
SHOW_RETAINS	<p>Controls the display of RETAIN actions within an implementation script and the SQL Access Advisor wizard.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • TRUE • FALSE <p>The default value is TRUE. The data type is STRING.</p>
SQL_LIMIT	<p>Specifies the number of SQL statements to be analyzed. The SQL_LIMIT filter is applied after all other filters have been applied. For example, if only statements referencing the table hr.employees are to be accepted, the SQL_LIMIT value will be only apply to those statements.</p> <p>When used in conjunction with the parameter ORDER_LIST, SQL Access Advisor will process the most interesting SQL statements by ordering the statements according to the specified sort keys.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • An integer in the range of 1 to 2147483647 • ADVISOR_UNLIMITED • ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is NUMBER.</p>
START_TIME	<p>Specifies a start time for selecting SQL statements. If the statement did not execute on or before the specified time, it will not be processed.</p> <p>Each date must be in the standard Oracle form of MM-DD-YYYY HH24:MI:SS, where:</p> <ul style="list-style-type: none"> • DD is the numeric date • MM is the numeric month • YYYY is the numeric year • HH is the hour in 24 hour format • MI is the minute • SS is the second <p>The data type is STRING.</p>

Table 17-35 (Cont.) SQL Access Advisor Task Parameters

Parameter	Description
STORAGE_CHANGE	<p>Contains the amount of space adjustment that can be consumed by SQL Access Advisor recommendations. Zero or negative values are only permitted if the workload scope is marked as FULL.</p> <p>When the SQL Access Advisor produces a set of recommendations, the resultant physical structures must be able to fit into the budgeted space. A space budget is computed by adding the STORAGE_CHANGE value to the space quantity currently used by existing access structures. A negative STORAGE_CHANGE value may force SQL Access Advisor to remove existing structures in order to shrink space demand.</p> <p>Possible values:</p> <ul style="list-style-type: none"> Any valid integer including negative values, zero and positive values. <p>The default value is ADVISOR_UNLIMITED. The data type is NUMBER.</p>
TIME_LIMIT	<p>Specifies the time in minutes that the SQL Access Advisor can use to perform an analysis operation. If the SQL Access Advisor reaches a specified recommendation quality or all input data has been analyzed, processing will terminate regardless of any remaining time.</p> <p>Possible values:</p> <ul style="list-style-type: none"> An integer in the range of 1 to 10,000 ADVISOR_UNLIMITED <p>The default value is 720 (12 hours). The data type is NUMBER.</p> <p>Note that specifying ADVISOR_UNLIMITED has the same effect as setting the parameter to the maximum of 10,000 (about one week). The SQL Access Advisor will never run for more than 10,000 minutes.</p>
VALID_ACTION_LIST	<p>Contains a fully qualified list of actions that are eligible for processing in a SQL workload object. The list elements are comma-delimited, and quoted names are supported.</p> <p>An action can be any string. If an action is not quoted, it will be changed to uppercase lettering and stripped of leading and trailing spaces. An action string is not scanned for correctness.</p> <p>During a task execution, if a SQL statement's action does not match a name in the action list, it will not be processed by the task. An action name is case sensitive.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> single action comma-delimited action list ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is STRINGLIST.</p>

Table 17-35 (Cont.) SQL Access Advisor Task Parameters

Parameter	Description
VALID_MODULE_LIST	<p>Contains a fully qualified list of application modules that are eligible for processing in a SQL workload object. The list elements are comma-delimited, and quoted names are supported.</p> <p>A module can be any string. If a module is not quoted, it will be changed to uppercase lettering and stripped of leading and trailing spaces. A module string is not scanned for correctness.</p> <p>During a task execution, if a SQL statement's module does not match a name in the module list, it will not be processed by the task. A module name is case sensitive.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • single application • comma-delimited module list • ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is STRINGLIST.</p>
VALID_SQLSTRING_LIST	<p>Contains a fully qualified list of text strings that are eligible for processing in a SQL workload object. The list elements are comma-delimited, and quoted names are supported.</p> <p>A SQL string can be any string. If a string is not quoted, it will be changed to uppercase lettering and stripped of leading and trailing spaces. A SQL string is not scanned for correctness.</p> <p>During a task execution, if a SQL statement does not contain string in the SQL string list, it will not be processed by the task.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • single string • comma-delimited string list • ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is STRINGLIST.</p>
VALID_TABLE_LIST	<p>Contains a fully qualified list of tables that are eligible for tuning. The list elements are comma-delimited, and quoted identifiers are supported. Wildcard specifications are supported for tables. The default value is all tables within the user's scope are eligible for tuning. Supported wildcard character is %. A % wildcard matches any set of consecutive characters.</p> <p>When a SQL statement is processed, it will not be accepted unless at least one referenced table is specified in the valid table list. If the list is unused, then all table references within a SQL statement are considered valid.</p> <p>The valid syntax for a table reference is:</p> <ul style="list-style-type: none"> • schema.table • schema • schema.% (equivalent to schema) • comma-delimited action list • ADVISOR_UNUSED <p>The possible values are:</p> <ul style="list-style-type: none"> • single table reference • comma-delimited reference list • ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is TABLELIST.</p>

Table 17-35 (Cont.) SQL Access Advisor Task Parameters

Parameter	Description
VALID_USERNAME_LIST	<p>Contains a fully qualified list of user names that are eligible for processing in a SQL workload object. The list elements are comma-delimited, and quoted names are supported.</p> <p>During a task execution, if a SQL statement's user name does not match a name in the user name list, it will not be processed by the task. A user name is not case sensitive unless it is quoted.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • single user name • comma-delimited user name list • ADVISOR_UNUSED <p>The default value is ADVISOR_UNUSED. The data type is STRINGLIST.</p>
WORKLOAD_SCOPE	<p>Describes the level of application coverage the workload represents. Possible values are FULL and PARTIAL.</p> <p>FULL Should be used if the workload contains all interesting application SQL statements for the targeted tables.</p> <p>PARTIAL (default) Should be used if the workload contains anything less than a full representation of the interesting application SQL statements for the targeted tables.</p> <p>The data type is STRING.</p>

Segment Advisor Parameters

Table 17-36 lists the input task parameters that can be set in the Segment Advisor using the SET_TASK_PARAMETER procedure.

Table 17-36 Segment Advisor Task Parameters

Parameter	Description
MODE	<p>The data to use for analysis. The default value is COMPREHENSIVE, and the possible values are:</p> <ul style="list-style-type: none"> • LIMITED: Analysis restricted to statistics available in the Automatic Workload Repository • COMPREHENSIVE: Analysis based on sampling and Automatic Workload Repository statistics
TIME_LIST	<p>The time limit for which the Advisor should run. It is specified in seconds, and the default and possible values are UNLIMITED.</p>
RECOMMEND_ALL	<p>Whether to generate recommendations for all segments.</p> <p>The default value is TRUE. If set to TRUE, it generates recommendations all segments specified by the user. If set to FALSE, it generates recommendations for only those objects that are eligible for shrink.</p>

Examples

```
DECLARE
    task_id NUMBER;
    task_name VARCHAR2(30);
BEGIN
```

```

task_name := 'My Task';

DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
DBMS_ADVISOR.SET_TASK_PARAMETER(task_name, 'VALID_TABLELIST',
'SH.%,SCOTT.EMP');
END;
/

```

Undo Advisor Task Parameters

[Table 17-37](#) lists the input task parameters that can be set in the Undo Advisor using the `SET_TASK_PARAMETER` procedure.

Table 17-37 Undo Advisor Task Parameters

Parameter	Description
TARGET_OBJECTS	The undo tablespace of the system. There is no default value, and the possible value is UNDO_TBS.
START_SNAPSHOT	The starting time for the system to perform analysis using the snapshot numbers in the AWR repository. There is no default value and the possible values are the valid snapshot numbers in the AWR repository.
END_SNAPSHOT	The ending time for the system to perform analysis using the snapshot numbers in the AWR repository. There is no default value and the possible values are the valid snapshot numbers in the AWR repository.
BEGIN_TIME_SEC	The number of seconds between the beginning time of the period and now. Describes a period of time for the system to perform analysis. BEGIN_TIME_SEC should be greater than END_TIME_SEC. There is no default value and the possible values are any positive integer.
END_TIME_SEC	The number of seconds between the ending time of the period and now. END_TIME_SEC should be less than BEGIN_TIME_SEC. There is no default value and the possible values are any positive integer.

Examples

```

DECLARE
    tname VARCHAR2(30);
    oid   NUMBER;
BEGIN
    DBMS_ADVISOR.CREATE_TASK('Undo Advisor', tid, tname, 'Undo
Advisor Task');
    DBMS_ADVISOR.CREATE_OBJECT(tname, 'UNDO_TBS', null, null, null,
'null', oid);
    DBMS_ADVISOR.SET_TASK_PARAMETER(tname, 'TARGET_OBJECTS', oid);
    DBMS_ADVISOR.SET_TASK_PARAMETER(tname, 'START_SNAPSHOT', 1);
    DBMS_ADVISOR.SET_TASK_PARAMETER(tname, 'END_SNAPSHOT', 2);
    DBMS_ADVISOR.SET_TASK_PARAMETER(tname, 'INSTANCE', 1);
    DBMS_ADVISOR.EXECUTE_TASK(tname);

```



```

END;
/

```

Automatic Database Diagnostic Monitor (ADDM) Task Parameters

Table 17-38 lists the input task parameters that can be set in ADDM using the `SET_TASK_PARAMETER` procedure.

Table 17-38 ADDM Task Parameters

Parameter	Description
START_SNAPSHOT	The starting time for the system to perform analysis using the snapshot numbers in the AWR repository. There is no default value, and the possible values are the valid snapshot numbers in the AWR repository.
END_SNAPSHOT	The ending time for the system to perform analysis using the snapshot numbers in the AWR repository. There is no default value, and the possible values are the valid snapshot numbers in the AWR repository.
DB_ID	The database for <code>START_SNAPSHOT</code> and <code>END_SNAPSHOT</code> . The default value is the current database ID.
INSTANCE	The instance for <code>START_SNAPSHOT</code> and <code>END_SNAPSHOT</code> . The default value is 0 or <code>UNUSED</code> , and the possible values are all positive integers. By default, all instances are analyzed.
INSTANCES	If the <code>INSTANCE</code> parameter has been set, <code>INSTANCES</code> is ignored. The default value is <code>UNUSED</code> , and the possible values are comma-separated list of instance numbers (for example, "1, 3, 5"). By default, all instances are analyzed.
DBIO_EXPECTED	The average time to read the database block in microseconds. The default value is 10 milliseconds, and the possible values are system-dependent.

Examples

The following creates and executes an ADDM task for the current database and an AWR snapshot range between 19 and 26. Note that this example will analyze all instances, whether you have only one or an Oracle RAC database.

```

DECLARE
    tid      NUMBER;
    tname    VARCHAR2(30) := 'ADDM_TEST';
BEGIN
    DBMS_ADVISOR.CREATE_TASK('ADDM', tid, tname, 'my test');
    DBMS_ADVISOR.SET_TASK_PARAMETER(tname, 'START_SNAPSHOT', '19');
    DBMS_ADVISOR.SET_TASK_PARAMETER(tname, 'END_SNAPSHOT', '26');
    DBMS_ADVISOR.EXECUTE_TASK(tname);
END;
/

```

 **See Also:**

- *Oracle Database Performance Tuning Guide* to learn more about using ADDM
- The [DBMS_ADDM](#) package for details on how to create and execute ADDM tasks

SQL Tuning Advisor Task Parameters

See the [DBMS_SQLTUNE](#) package and *Oracle Database SQL Tuning Guide* for more information.

17.3.34 TUNE_MVIEW Procedure

This procedure shows how to decompose a materialized view into multiple views and to restate the materialized view to be optimized for fast refresh and query rewrite. It also shows how to fix materialized view logs and to enable query rewrite.

Syntax

```
DBMS_ADVISOR.TUNE_MVIEW (
    task_name          IN OUT VARCHAR2,
    mv_create_stmt     IN      [CLOB | VARCHAR2]);
```

Parameters**Table 17-39 TUNE_MVIEW Procedure Parameters**

Parameter	Description
task_name	The task name for querying the results in a catalog view. If not specified, the database generates a task name, and then returns.
mv_create_stmt	The original materialized view creation statement.

Usage Notes

Executing `TUNE_MVIEW` generates two sets of output results: one for the implementation, and the other for undoing the implementation. The output is accessible through `USER_TUNE_MVIEW` and `DBA_TUNE_MVIEW` views. You can also use `DBMS_ADVISOR.GET_TASK_SCRIPT` and `DBMS_ADVISOR.CREATE_FILE` to print the `TUNE_MVIEW` results into a script file for later execution.

Table 17-40 USER_TUNE_MVIEW and DBA_TUNE_MVIEW Views

Column Name	Column Description
OWNER	The name of the materialized view owner.
TASK_NAME	The name of the task. This name serves as a key to access the set of recommendations.

Table 17-40 (Cont.) USER_TUNE_MVIEW and DBA_TUNE_MVIEW Views

Column Name	Column Description
SCRIPT_TYPE	Recommendation ID that indicates whether the row is for the IMPLEMENTATION or UNDO script.
ACTION_ID	Action ID used as the command order number.
STATEMENT	For TUNE_MVIEW output, this column represents the following statements, and includes statement properties such as REFRESH and REWRITE options: <ul style="list-style-type: none"> • CREATE MATERIALIZED VIEW LOG • ALTER MATERIALIZED VIEW LOG FORCE • [CREATE DROP] MATERIALIZED VIEW

Examples

The following example shows how to use TUNE_MVIEW to optimize a CREATE MATERIALIZED VIEW statement:

```

DECLARE
  v_tname VARCHAR2(30);
BEGIN
  v_tname := 'mview_task';
  DBMS_ADVISOR.TUNE_MVIEW(
    task_name      => v_tname
  , mv_create_stmt =>
    'CREATE MATERIALIZED VIEW omv REFRESH WITH ROWID AS SELECT * FROM
orders');
END;

```

You can view the results by querying USER_TUNE_MVIEW or DBA_TUNE_MVIEW as the following example (sample output included):

```

SET LINESIZE 120
COL TASK_NAME FORMAT a20
COL STATEMENT FORMAT a40

SELECT *
FROM   USER_TUNE_MVIEW
WHERE  TASK_NAME='mview_task'
AND    SCRIPT_TYPE='IMPLEMENTATION';

TASK_NAME          ACTION_ID SCRIPT_TYPE    STATEMENT
-----
mview_task          1 IMPLEMENTATION CREATE MATERIALIZED VIEW LOG
ON "OE"."ORDERS" WITH ROWID

mview_task          2 IMPLEMENTATION ALTER MATERIALIZED VIEW LOG
FORCE ON "OE"."ORDERS" ADD ROWID

```

```
mview_task          3 IMPLEMENTATION CREATE MATERIALIZED
VIEW OE.OMV REFRESH
                                FAST WITH ROWID DISABLE
QUERY REWRITE
```

Alternatively, you can save the output results in an external script file as in the following example:

```
CREATE DIRECTORY TUNE_RESULTS_DIR AS '/tmp';
GRANT READ, WRITE ON DIRECTORY TUNE_RESULTS_DIR TO PUBLIC;
BEGIN
  DBMS_ADVISOR.CREATE_FILE(
    buffer      => DBMS_ADVISOR.GET_TASK_SCRIPT( task_name =>
'mview_task')
  , location   => 'TUNE_RESULTS_DIR'
  , filename   => 'mview_create.sql' );
END;
```

The preceding statement will save the results in /tmp/mview_create.sql.



See Also:

Oracle Database SQL Tuning Guide for more information about using the TUNE_MVIEW procedure

17.3.35 UPDATE_OBJECT Procedure

This procedure updates an existing task object.

Task objects are typically used as input data for a particular advisor. Segment advice can be generated at the object, segment, or tablespace level.

Syntax

```
DBMS_ADVISOR.UPDATE_OBJECT (
  task_name      IN VARCHAR2
  object_id      IN NUMBER,
  attr1          IN VARCHAR2 := NULL,
  attr2          IN VARCHAR2 := NULL,
  attr3          IN VARCHAR2 := NULL,
  attr4          IN CLOB := NULL,
  attr5          IN VARCHAR2 := NULL);
```

Parameters

Table 17-41 UPDATE_OBJECT Procedure Parameters

Parameter	Description
task_name	A valid advisor task name that uniquely identifies an existing task.
object_id	The advisor-assigned object identifier.
attr1	Advisor-specific data. If set to NULL, there will be no effect on the target object.
attr2	Advisor-specific data. If set to NULL, there will be no effect on the target object.
attr3	Advisor-specific data. If set to NULL, there will be no effect on the target object.
attr4	Advisor-specific data. If set to NULL, there will be no effect on the target object.
attr5	Advisor-specific data. If set to null, there will be no effect on the target object.

The attribute parameters have different values depending upon the object type. See *Oracle Database Administrator's Guide* for details regarding these parameters and object types.

Usage Notes

If for the object level, advice is generated on all partitions of the object (if the object is partitioned). The advice is not cascaded to any dependent objects. If for the segment level, advice can be obtained on a single segment, such as the partition or subpartition of a table, index, or lob column. If for a tablespace level, target advice for every segment in the tablespace will be generated.

Examples

```

DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
  obj_id NUMBER;
BEGIN
  task_name := 'My Task';

  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
  DBMS_ADVISOR.CREATE_OBJECT (task_name, 'SQL', NULL, NULL, NULL,
                              'SELECT * FROM SH.SALES', obj_id);
  DBMS_ADVISOR.UPDATE_OBJECT (task_name, obj_id, NULL, NULL, NULL,
                              'SELECT count(*) FROM SH.SALES');
END;
/

```

 **See Also:**

Oracle Database Administrator's Guide for further information regarding the Segment Advisor

17.3.36 UPDATE_REC_ATTRIBUTES Procedure

This procedure updates the owner, name, and tablespace for a recommendation.

Syntax

```
DBMS_ADVISOR.UPDATE_REC_ATTRIBUTES (
  task_name          IN VARCHAR2
  rec_id             IN NUMBER,
  action_id         IN NUMBER,
  attribute_name     IN VARCHAR2,
  value             IN VARCHAR2);
```

Parameters

Table 17-42 UPDATE_REC_ATTRIBUTES Procedure Parameters

Parameter	Description
task_name	The task name that uniquely identifies an existing task.
rec_id	The Advisor-generated identifier number that is assigned to the recommendation.
action_id	The Advisor-generated action identifier that is assigned to the particular command.
attribute_name	Name of the attribute to be changed. The valid values are: <ul style="list-style-type: none"> owner The new owner of the object. name The new name of the object. tablespace The new tablespace for the object.
value	Specifies the new value for the recommendation attribute.

Usage Notes

Recommendation attributes cannot be modified unless the task has successfully executed.

Examples

```
DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
  workload_name VARCHAR2(30);
  attribute VARCHAR2(100);
BEGIN
  task_name := 'My Task';
  workload_name := 'My Workload';
```

```

DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');
DBMS_ADVISOR.ADD_SQLWKLD_REF(task_name, workload_name);
DBMS_ADVISOR.ADD_SQLWKLD_STATEMENT(workload_name, 'MONTHLY', 'ROLLUP',
100,400,5041,103,640445,680000,2,
1,SYSDATE,1,'SH','SELECT
AVG(amount_sold)
FROM sh.sales WHERE promo_id = 10');
DBMS_ADVISOR.EXECUTE_TASK(task_name);

attribute := 'SH';

DBMS_ADVISOR.UPDATE_REC_ATTRIBUTES(task_name, 1, 3, 'OWNER', attribute);
END;
/

```

17.3.37 UPDATE_SQLWKLD_ATTRIBUTES Procedure

This procedure changes various attributes of a SQL Workload object or template.



Note:

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```

DBMS_ADVISOR.UPDATE_SQLWKLD_ATTRIBUTES (
workload_name      IN VARCHAR2,
new_name           IN VARCHAR2 := NULL,
description        IN VARCHAR2 := NULL,
read_only          IN VARCHAR2 := NULL,
is_template        IN VARCHAR2 := NULL,
how_created        IN VARCHAR2 := NULL);

```

Parameters

Table 17-43 UPDATE_SQLWKLD_ATTRIBUTES Procedure Parameters

Parameter	Description
workload_name	The workload object name that uniquely identifies an existing workload.
new_name	The new workload object name. If the value is NULL or contains the value ADVISOR_UNUSED, the workload will not be renamed. A task name can be up to 30 characters long.
description	A new workload description. If the value is NULL or contains the value ADVISOR_UNUSED, the description will not be changed. Names can be up to 256 characters long.

Table 17-43 (Cont.) UPDATE_SQLWKLD_ATTRIBUTES Procedure Parameters

Parameter	Description
read_only	Set to TRUE so it cannot be changed.
is_template	TRUE if workload is to be used as a template.
how_created	Indicates a source application name that initiated the workload creation. If the value is NULL or contains the value ADVISOR_UNUSED, the source will not be changed.

Examples

```

DECLARE
  workload_name VARCHAR2(30);
BEGIN
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');
  DBMS_ADVISOR.ADD_SQLWKLD_STATEMENT(workload_name, 'MONTHLY',
'ROLLUP',
                                100,400,5041,103,640445,680000,2,
                                1,SYSDATE,1,'SH','SELECT
AVG(amount_sold)
                                FROM sh.sales WHERE promo_id =
10');
  DBMS_ADVISOR.UPDATE_SQLWKLD_ATTRIBUTES(workload_name,'New workload
name');
END;
/

```

17.3.38 UPDATE_SQLWKLD_STATEMENT Procedure

This procedure updates an existing SQL statement in a specified SQL workload.



Note:

This procedure is deprecated starting in Oracle Database 11g.

Syntax

```

DBMS_ADVISOR.UPDATE_SQLWKLD_STATEMENT (
  workload_name      IN VARCHAR2,
  sql_id             IN NUMBER,
  application        IN VARCHAR2 := NULL,
  action            IN VARCHAR2 := NULL,
  priority           IN NUMBER := NULL,
  username          IN VARCHAR2 := NULL);

```

```

DBMS_ADVISOR.UPDATE_SQLWKLD_STATEMENT (

```



```

workload_name    IN VARCHAR2,
search           IN VARCHAR2,
updated          OUT NUMBER,
application      IN VARCHAR2 := NULL,
action           IN VARCHAR2 := NULL,
priority         IN NUMBER := NULL,
username        IN VARCHAR2 := NULL);

```

Parameters

Table 17-44 UPDATE_SQLWKLD_STATEMENT Procedure Parameters

Parameter	Description
workload_name	The SQL Workload object name that uniquely identifies an existing workload.
sql_id	The Advisor-generated identifier number that is assigned to the statement. To specify all workload statements, use the constant DBMS_ADVISOR.ADVISOR_ALL.
updated	Returns the number of statements changed by a searched update.
application	Specifies a business application name that will be associated with the SQL statement. If the value is NULL or contains the value ADVISOR_UNUSED, then the column will not be updated in the repository.
action	Specifies the application action for the statement. If the value is NULL or contains the value ADVISOR_UNUSED, then the column will not be updated in the repository.
priority	The relative priority of the SQL statement. The value must be one of the following: 1 - HIGH, 2 - MEDIUM, or 3 - LOW. If the value is NULL or contains the value ADVISOR_UNUSED, then the column will not be updated in the repository.
username	The Oracle user name that executed the SQL statement. If the value is NULL or contains the value ADVISOR_UNUSED, then the column will not be updated in the repository. Because a user name is an Oracle identifier, the username value must be entered exactly like it is stored in the database. For example, if the user SCOTT is the executing user, then you must provide the user identifier SCOTT in all uppercase letters. The database does not recognize the user scott as a match for SCOTT.
search	Disabled.

Usage Notes

A workload cannot be modified or deleted if it is currently referenced by an active task. A task is considered active if it is not in its initial state. See [RESET_TASK Procedure](#) to set a task to its initial state.

Examples

```

DECLARE
  workload_name VARCHAR2(30);
  updated NUMBER;
  id NUMBER;

```

```

BEGIN
  workload_name := 'My Workload';

  DBMS_ADVISOR.CREATE_SQLWKLD(workload_name, 'My Workload');
  DBMS_ADVISOR.ADD_SQLWKLD_STATEMENT(workload_name, 'MONTHLY',
'ROLLUP',
                                100,400,5041,103,640445,680000,2,
                                1,SYSDATE,1,'SH','SELECT
AVG(amount_sold)
                                FROM sh.sales WHERE promo_id =
10');

  SELECT sql_id INTO id FROM USER_ADVISOR_SQLW_STMTS
  WHERE workload_name = 'My Workload';

  DBMS_ADVISOR.UPDATE_SQLWKLD_STATEMENT(workload_name, id);
END;
/

```

17.3.39 UPDATE_TASK_ATTRIBUTES Procedure

This procedure changes various attributes of a task or a task template.

Syntax

```

DBMS_ADVISOR.UPDATE_TASK_ATTRIBUTES (
  task_name      IN VARCHAR2
  new_name       IN VARCHAR2 := NULL,
  description    IN VARCHAR2 := NULL,
  read_only     IN VARCHAR2 := NULL,
  is_template    IN VARCHAR2 := NULL,
  how_created    IN VARCHAR2 := NULL);

```

Parameters

Table 17-45 UPDATE_TASK_ATTRIBUTES Procedure Parameters

Parameter	Description
task_name	The Advisor task name that uniquely identifies an existing task.
new_name	The new Advisor task name. If the value is NULL or contains the value ADVISOR_UNUSED, the task will not be renamed. A task name can be up to 30 characters long.
description	A new task description. If the value is NULL or contains the value ADVISOR_UNUSED, the description will not be changed. Names can be up to 256 characters long.
read_only	Sets the task to read-only. Possible values are: TRUE and FALSE. If the value is NULL or contains the value ADVISOR_UNUSED, the setting will not be changed.

Table 17-45 (Cont.) UPDATE_TASK_ATTRIBUTES Procedure Parameters

Parameter	Description
is_template	Marks the task as a template. Physically, there is no difference between a task and a template; however, a template cannot be executed. Possible values are: TRUE and FALSE. If the value is NULL or contains the value ADVISOR_UNUSED, the setting will not be changed.
how_created	Indicates a source application name that initiated the task creation. If the value is NULL or contains the value ADVISOR_UNUSED, the source will not be changed.

Examples

```
DECLARE
  task_id NUMBER;
  task_name VARCHAR2(30);
BEGIN
  task_name := 'My Task';

  DBMS_ADVISOR.CREATE_TASK(DBMS_ADVISOR.SQLACCESS_ADVISOR, task_id,
task_name);
  DBMS_ADVISOR.UPDATE_TASK_ATTRIBUTES(task_name, 'New Task Name');
  DBMS_ADVISOR.UPDATE_TASK_ATTRIBUTES('New Task Name', NULL, 'New
description');
END;
/
```

18

DBMS_AUTOIM

This API provides functions to manage the execution of the AIM feature.

18.1 Using DBMS_AUTOIM

Automatic In-Memory Management (AIM) is an In-Memory column store feature that optimizes the column store through actions such as evicting cold data, populating frequently accessed data, and compressing cold columns.

The DBMS_AUTOIM package provides APIs to manage the execution of the AIM feature. These are procedures to get and set AIM parameters as well as a reporting function.

18.2 Summary of DBMS_AUTOIM Subprograms

The table in this topic lists and describes the DBMS_AUTOIM subprograms.

Table 18-1 DBMS_AUTOIM Subprograms

Subprogram	Description
SET_PARAMETER	Sets the value of one of the available parameters: <code>AUTO_IM_PERF_TASK</code> , <code>INTERVAL</code> , or <code>AIM_STATWINDOW_DAYS</code> .
ACTIVITY_REPORT	Reports AIM task activity within the specified time interval for the given feature or for all features.

18.2.1 SET_PARAMETER Procedure

Use this DBMS_AUTOIM procedure to set configuration parameter values for AIM features.

Syntax

```
DBMS_AUTOIM.SET_PARAMETER( parameter_name IN VARCHAR2, parameter_value IN VARCHAR2 );
```

Parameters

The parameters for DBMS_AUTOIM.SET_PARAMETER are as follows.

Table 18-2 SET_PARAMETER Procedure Parameters

Parameter	Description
aim_task	Turns the automatic IM automatic performance feature creation task on or off. Values: enable, disable.
interval	Controls the statistics time window used by AIM to compute decisions. Value: Any positive integer representing the time window in seconds. The default is 900 seconds.

18.2.2 ACTIVITY_REPORT Function

Use this function to generate a report on the automatic creation of IM performance features. These features include Autonomous Join Groups, Autonomous Bloom Filter Optimization, Autonomous Optimized Arithmetic, and Autonomous Vector Optimization.

Syntax

```
DBMS_AUTOIM.ACTIVITY_REPORT( feature_id IN NUMBER, start_time IN
TIMESTAMP, end_time IN TIMESTAMP, type IN VARCHAR2, level IN VARCHAR2 )
```

Table 18-3 ACTIVITY_REPORT Function Parameters

Parameter	Type	Description
feature_id	integer	A NULL feature_id generates report on all AIM features. The default is NULL. You can get the feature_id for each feature from the view V\$AIM_FEATURES .
start_time	timestamp	Start of the time window in which AIM activities are considered for the report. A NULL start_time returns the report for last execution. Default is NULL.
end_time	timestamp	End of time window in which AIM activities are considered for the report. A NULL end_time returns the report for last execution. Default is NULL.
type	varchar2	Type of the report. Possible values are: 'TEXT', 'HTML', 'XML'. Default is 'TEXT'.
level	varchar2	Level of verbosity. Possible values are 'BASIC' and 'DETAILED'. Default is 'BASIC'.

Example 18-1 ACTIVITY_REPORT function

Create an AIM activity report for the previous day in TEXT format. The return type is CLOB.

```
declare
  report clob := null;
begin
```

```
    report := DBMS_AUTOIM.activity_report();  
end;
```



Note:

See the view V\$AIM_FEATURES to obtain the `feature_id` for each feature.

19

DBMS_ALERT

DBMS_ALERT supports asynchronous notification of database events (alerts). By appropriate use of this package and database triggers, an application can notify itself whenever values of interest in the database are changed.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Restrictions](#)
- [Exceptions](#)
- [Operational Notes](#)
- [Examples](#)
- [Summary of DBMS_ALERT Subprograms](#)

19.1 DBMS_ALERT Overview

This scenario describes a possible use of the DBMS_ALERT package.

Suppose a graphics tool is displaying a graph of some data from a database table. The graphics tool can, after reading and graphing the data, wait on a database alert (`WAITONE`) covering the data just read. The tool automatically wakes up when the data is changed by any other user. All that is required is that a trigger be placed on the database table, which performs a signal (`SIGNAL`) whenever the trigger is fired.

19.2 DBMS_ALERT Security Model

Security on this package can be controlled by granting `EXECUTE` on this package to selected users or roles. You might want to write a cover package on top of this one that restricts the alert names used. `EXECUTE` privilege on this cover package can then be granted rather than on this package.

19.3 DBMS_ALERT Constants

The DBMS_ALERT package uses the constants listed and described in this topic.

Table 19-1 DBMS_ALERT Constants

Name	Type	Value	Description
MAXWAIT	INTEGER	86400000	The maximum time to wait for an alert (1000 days which is essentially forever).

19.4 DBMS_ALERT Restrictions

Because database alerters issue commits, they cannot be used with Oracle Forms. For more information on restrictions on calling stored procedures while Oracle Forms is active, refer to your Oracle Forms documentation.

19.5 DBMS_ALERT Exceptions

DBMS_ALERT raises the application error -20000 on error conditions.

Table 19-2 shows the messages and the procedures that can raise them.

19.6 DBMS_ALERT Operational Notes

This topic lists notes related to general and specific applications. Also, a list of DBMS_ALERT error messages is provided.

- Alerts are transaction-based. This means that the waiting session is not alerted until the transaction signalling the alert commits. There can be any number of concurrent signalers of a given alert, and there can be any number of concurrent waiters on a given alert.
- A waiting application is blocked in the database and cannot do any other work.
- An application can register for multiple events and can then wait for any of them to occur using the `WAITANY` procedure.
- An application can also supply an optional `timeout` parameter to the `WAITONE` or `WAITANY` procedures. A `timeout` of 0 returns immediately if there is no pending alert.
- The signalling session can optionally pass a message that is received by the waiting session.
- Alerts can be signalled more often than the corresponding application wait calls. In such cases, the older alerts are discarded. The application always gets the latest alert (based on transaction commit times).
- If the application does not require transaction-based alerts, the `DBMS_PIPE` package may provide a useful alternative.



See Also:

[DBMS_PIPE](#)

- If the transaction is rolled back after the call to `SIGNAL`, no alert occurs.
- It is possible to receive an alert, read the data, and find that no data has changed. This is because the data changed after the *prior* alert, but before the data was read for that *prior* alert.
- Usually, Oracle is event-driven; this means that there are no polling loops. There are two cases where polling loops can occur:

- Shared mode. If your database is running in shared mode, a polling loop is required to check for alerts from another instance. The polling loop defaults to five seconds and can be set by the `SET_DEFAULTS` procedure.
- `WAITANY` procedure. If you use the `WAITANY` procedure, and if a signalling session does a signal but does not commit within one second of the signal, a polling loop is required so that this uncommitted alert does not camouflage other alerts. The polling loop begins at a one second interval and exponentially backs off to 30-second intervals.

Table 19-2 DBMS_ALERT Error Messages

Error Message	Procedure
ORU-10001 lock request error, status: N	SIGNAL
ORU-10015 error: N waiting for pipe status	WAITANY
ORU-10016 error: N sending on pipe 'X'	SIGNAL
ORU-10017 error: N receiving on pipe 'X'	SIGNAL
ORU-10019 error: N on lock request	WAIT
ORU-10020 error: N on lock request	WAITANY
ORU-10021 lock request error; status: N	REGISTER
ORU-10022 lock request error, status: N	SIGNAL
ORU-10023 lock request error; status N	WAITONE
ORU-10024 there are no alerts registered	WAITANY
ORU-10025 lock request error; status N	REGISTER
ORU-10037 attempting to wait on uncommitted signal from same session	WAITONE

19.7 DBMS_ALERT Examples

In this example, suppose that you want to graph average salaries by department, for all employees. Your application needs to know whenever `EMP` is changed.

Your application would look similar to this code:

```
DBMS_ALERT.REGISTER('emp_table_alert');
<<readagain>>:
/* ... read the emp table and graph it */
DBMS_ALERT.WAITONE('emp_table_alert', :message, :status);
if status = 0 then goto <<readagain>>; else
/* ... error condition */
```

The `EMP` table would have a trigger similar to this:

```
CREATE TRIGGER emptrig AFTER INSERT OR UPDATE OR DELETE ON emp
BEGIN
DBMS_ALERT.SIGNAL('emp_table_alert', 'message_text');
END;
```

When the application is no longer interested in the alert, it makes this request:

```
DBMS_ALERT.REMOVE('emp_table_alert');
```

This reduces the amount of work required by the alert signaller. If a session exits (or dies) while registered alerts exist, the alerts are eventually cleaned up by future users of this package.

The example guarantees that the application always sees the latest data, although it may not see every intermediate value.

19.8 Summary of DBMS_ALERT Subprograms

This table lists the DBMS_ALERT subprograms and briefly describes them.

Table 19-3 DBMS_ALERT Package Subprograms

Subprogram	Description
REGISTER Procedure	Receives messages from an alert
REMOVE Procedure	Disables notification from an alert
REMOVEALL Procedure	Removes all alerts for this session from the registration list
SET_DEFAULTS Procedure	Sets the polling interval
SIGNAL Procedure	Signals an alert (send message to registered sessions)
WAITANY Procedure	Waits <code>timeout</code> seconds to receive alert message from an alert registered for session
WAITONE Procedure	Waits <code>timeout</code> seconds to receive message from named alert

19.8.1 REGISTER Procedure

This procedure lets a session register interest in an alert.

Syntax

```
DBMS_ALERT.REGISTER (
    name      IN  VARCHAR2,
    cleanup   IN  BOOLEAN DEFAULT TRUE);
```

Parameters

Table 19-4 REGISTER Procedure Parameters

Parameter	Description
<code>name</code>	Name of the alert in which this session is interested
<code>cleanup</code>	Specifies whether to perform cleanup of any extant orphaned pipes used by the DBMS_ALERT package. This cleanup is only performed on the first call to REGISTER for each package instantiation. The default for the parameter is TRUE.

⚠ WARNING:

Alert names beginning with 'ORA\$' are reserved for use for products provided by Oracle. Names must be 30 bytes or less. The name is case insensitive.

Usage Notes

A session can register interest in an unlimited number of alerts. Alerts should be deregistered when the session no longer has any interest, by calling `REMOVE`.

19.8.2 REMOVE Procedure

This procedure enables a session that is no longer interested in an alert to remove that alert from its registration list. Removing an alert reduces the amount of work done by signalers of the alert.

Syntax

```
DBMS_ALERT.REMOVE (  
    name IN VARCHAR2);
```

Parameters**Table 19-5 REMOVE Procedure Parameters**

Parameter	Description
name	Name of the alert (case-insensitive) to be removed from registration list.

Usage Notes

Removing alerts is important because it reduces the amount of work done by signalers of the alert. If a session dies without removing the alert, that alert is eventually (but not immediately) cleaned up.

19.8.3 REMOVEALL Procedure

This procedure removes all alerts for this session from the registration list. You should do this when the session is no longer interested in any alerts.

This procedure is called automatically upon first reference to this package during a session. Therefore, no alerts from prior sessions which may have terminated unusually can affect this session.

This procedure always performs a commit.

Syntax

```
DBMS_ALERT.REMOVEALL;
```

19.8.4 SET_DEFAULTS Procedure

In case a polling loop is required, use the `SET_DEFAULTS` procedure to set the polling interval.

Syntax

```
DBMS_ALERT.SET_DEFAULTS (
    sensitivity IN NUMBER);
```

Parameters

Table 19-6 SET_DEFAULTS Procedure Parameters

Parameter	Description
<code>sensitivity</code>	Polling interval, in seconds, to sleep between polls. The default interval is five seconds.

19.8.5 SIGNAL Procedure

This procedure signals an alert. The effect of the `SIGNAL` call only occurs when the transaction in which it is made commits. If the transaction rolls back, `SIGNAL` has no effect.

All sessions that have registered interest in this alert are notified. If the interested sessions are currently waiting, they are awakened. If the interested sessions are not currently waiting, they are notified the next time they do a wait call.

Multiple sessions can concurrently perform signals on the same alert. Each session, as it signals the alert, blocks all other concurrent sessions until it commits. This has the effect of serializing the transactions.

Syntax

```
DBMS_ALERT.SIGNAL (
    name      IN VARCHAR2,
    message   IN VARCHAR2);
```

Parameters

Table 19-7 SIGNAL Procedure Parameters

Parameter	Description
<code>name</code>	Name of the alert to signal.
<code>message</code>	Message, of 1800 bytes or less, to associate with this alert. This message is passed to the waiting session. The waiting session might be able to avoid reading the database after the alert occurs by using the information in the message.

19.8.6 WAITANY Procedure

Call this procedure to wait for an alert to occur for any of the alerts for which the current session is registered.

Syntax

```
DBMS_ALERT.WAITANY (
    name      OUT  VARCHAR2,
    message   OUT  VARCHAR2,
    status    OUT  INTEGER,
    timeout   IN   NUMBER DEFAULT MAXWAIT);
```

Parameters

Table 19-8 WAITANY Procedure Parameters

Parameter	Description
name	Returns the name of the alert that occurred.
message	Returns the message associated with the alert. This is the message provided by the <code>SIGNAL</code> call. If multiple signals on this alert occurred before <code>WAITANY</code> , the message corresponds to the most recent <code>SIGNAL</code> call. Messages from prior <code>SIGNAL</code> calls are discarded.
status	Values returned: 0 - alert occurred 1 - timeout occurred
timeout	Maximum time to wait for an alert. If no alert occurs before <code>timeout</code> seconds, this returns a status of 1.

Usage Notes

An implicit `COMMIT` is issued before this procedure is executed. The same session that waits for the alert may also first signal the alert. In this case remember to commit after the signal and before the wait; otherwise, `DBMS_LOCK.REQUEST` (which is called by `DBMS_ALERT`) returns status 4.

Exceptions

-20000, ORU-10024: there are no alerts registered.

19.8.7 WAITONE Procedure

This procedure waits for a specific alert to occur.

An implicit `COMMIT` is issued before this procedure is executed. A session that is the first to signal an alert can also wait for the alert in a subsequent transaction. In this case, remember to commit after the signal and before the wait; otherwise, `DBMS_LOCK.REQUEST` (which is called by `DBMS_ALERT`) returns status 4.

Syntax

```
DBMS_ALERT.WAITONE (
  name      IN  VARCHAR2,
  message   OUT VARCHAR2,
  status    OUT  INTEGER,
  timeout   IN  NUMBER DEFAULT MAXWAIT);
```

Parameters

Table 19-9 WAITONE Procedure Parameters

Parameter	Description
name	Name of the alert to wait for.
message	Returns the message associated with the alert. This is the message provided by the SIGNAL call. If multiple signals on this alert occurred before WAITONE, the message corresponds to the most recent SIGNAL call. Messages from prior SIGNAL calls are discarded.
status	Values returned: 0 - alert occurred 1 - timeout occurred
timeout	Maximum time to wait for an alert. If the named alert does not occurs before timeout seconds, this returns a status of 1.

20

DBMS_APP_CONT

The `DBMS_APP_CONT` package provides an interface to determine if the in-flight transaction on a now unavailable session committed or not, and if the last call on that session completed or not.

See Also:

Oracle Database Development Guide for explanations of application continuity and Transaction Guard, and the relationship between these two features:

- "Using Transaction Guard"

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_APP_CONT Subprograms](#)

20.1 DBMS_APP_CONT Overview

The `DBMS_APP_CONT` package can be used to solve this example issue.

Problem Description

One of the fundamental problems for recovering applications after an outage is that the commit message that is sent back to the client is not durable. If there is a break between the client and the server, the client sees an error message indicating that the communication failed. This error does not inform the application whether the submission executed any commit operations or if a procedural call, ran to completion executing all expected commits and session state changes or failed part way through or yet worse, is still running disconnected from the client.

GET_LTXID_OUTCOME

The purpose of the [GET_LTXID_OUTCOME Procedure](#) is to determine if the in-flight transaction on a now unavailable session completed or not. It is used when the original session returned an error due to unavailability. Situations that can cause such session unavailability may occur at the session, instance, server, or network, and result from planned or unplanned outages. When such an outage occurs, the application receives a disconnection error. Such an error provides no insight as to whether the transaction committed. It also does not reveal what the application might have been expecting from that commit if it had returned.

**See Also:**

Oracle Database Concepts for explanation of Logical Transaction ID

20.2 DBMS_APP_CONT Security Model

Applications must have the `EXECUTE` privilege on the `DBMS_APP_CONT` package.

To grant this privilege, ask your database administrator to run the following SQL statement:

```
GRANT execute on DBMS_APP_CONT to application user ;
```

20.3 Summary of DBMS_APP_CONT Subprograms

The `DBMS_APP_CONT` package contains the `GET_LTXID_OUTCOME` Procedure.

Table 20-1 DBMS_APP_CONT Package Subprograms

Subprogram	Description
ADD_SQL_CONNECTION_TEST Procedure	This procedure adds a new connection test that is used during draining sessions before planned maintenance begins. Use this procedure when the SQL connection test is not covered by standard tests. The test is enabled when added.
APPLY_REPLAY_RULE Procedure	This procedure activates a new replay rule that is inherited by any sub-routine unless it is overwritten by a new rule applied to that sub-routine.
DELETE_SQL_CONNECTION_TEST Procedure	This procedure deletes a connection test that is no longer needed for planned draining. Removing a test applies immediately to all RAC instances where the PDB is open.
DISABLE_CONNECTION_TEST Procedure	This procedure disables usage of a connection test during draining of sessions. Disabling a test applies immediately to all RAC instances where the PDB is open.
ENABLE_CONNECTION_TEST Procedure	This procedure enables usage of a connection test for draining database sessions before planned maintenance. Enabling a test applies immediately to all RAC instances where the PDB is open.
GET_LTXID_OUTCOME Procedure	Lets customer applications and third party application servers determine the transactional status of the last session when that session becomes unavailable.
GET_REPLAY_RULES Function	This function returns a list of the replay rules. From the results, you can test if any rule target is replayable with bit and function.
RESET_REPLAY_RULES Procedure	This procedure resets all existing replay rules. When you call this procedure, it clears all locally defined rules in the specified scope and restores them to the original state when they were inherited from their parent scope, or the service if parent scope is not specified.

20.3.1 ADD_SQL_CONNECTION_TEST Procedure

This procedure adds a new connection test that is used during draining sessions before planned maintenance begins. Use this procedure when the SQL connection test is not covered by standard tests. The test is enabled when added. If the optional service name qualifier is provided, the test only applies only to that service name.

Syntax

```
DBMS_SESSION.ADD_SQL_CONNECTION_TEST (
    connection_test      IN VARCHAR2
    service_name         IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 20-2 ADD_SQL_CONNECTION_TEST Procedure Parameters

Parameter	Description
CONNECTION_TEST	The SQL text used to test and drain connections.
SERVICE_NAME	Optional service name qualifier.

Usage Notes

The `ADD_SQL_CONNECTION_TEST` Procedure adds a connection test for the purpose of draining sessions before planned maintenance begins. The connection test is used by the application to test connections that are marked for draining. Sessions are set for draining at stop and relocate operations for services or PDBs. When set the RDBMS closes the connection while draining so the application sees no errors during planned maintenance. You can enter as many CONNECTION TESTs as needed. They are used only during planned maintenance. The tests apply to all RAC instances.

Check online documentation for latest updates on service qualifier availability.

Added connection can be viewed by querying the view `DBA_CONNECTION_TESTS`.

This procedure is owned by `SYS` and is granted to users for execution at `CDB$ROOT` or `PDB` levels, or when not multitenant, at dictionary level.

20.3.2 APPLY_REPLAY_RULE Procedure

This procedure activates a new replay rule that is inherited by any sub-routine unless it is overwritten by a new rule applied to that sub-routine.

A replay rule activated in a PL/SQL block loses its effect when `reset_replay_rules` is called or the block returns.

Note:

Calling this procedure in a sub-block of a procedure, function, or anonymous block applies the rule to its parent scope. When the sub-block returns, the rule will not lose its effect. Thus, you are not recommended to call this procedure in a sub-block.

Syntax

```
DBMS_APP_CONT.APPLY_REPLAY_RULE (
    replayable IN BOOLEAN,
    targets     IN BINARY_INTEGER,
    scope      IN BINARY_INTEGER DEFAULT DBMS_APP_CONT.SCOPE_CURRENT);
```

Parameters

Table 20-3 *APPLY_REPLAY_RULE Procedure Parameters*

Parameter	Description
replayable	TRUE or FALSE, depending on whether the rule is replayable or not.
targets	Target effects on which this rule is applied. If multiple effects are desired, pass them as bit or as individual effects, such as: dbms_app_cont.side_effects + dbms_app_cont.autonomous_transactions
scope	Scope of the rule, either dbms_app_cont.scope_current (default) or dbms_app_cont.scope_parent.

20.3.3 DELETE_SQL_CONNECTION_TEST Procedure

This procedure deletes a connection test that is no longer needed for planned draining. Removing a test applies immediately to all RAC instances where the PDB is open.

Syntax

```
DBMS_SESSION.DELETE_SQL_CONNECTION_TEST (
    connection_test IN VARCHAR2
    service_name    IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 20-4 *DELETE_SQL_CONNECTION_TEST Procedure Parameters*

Parameter	Description
CONNECTION_TEST	The SQL text used to test and drain connections.
SERVICE_NAME	Optional service name qualifier. If the optional SERVICE_NAME qualifier is provided, only the test for that service name is deleted.

Usage Notes

If you are not certain if a test should be deleted, you can disable the test using DISABLE_CONNECTION_TEST Procedure. Only custom SQL tests can be deleted. Predefined tests cannot be deleted. Check for latest updates on service qualifier availability.

This procedure is owned by SYS at CDB\$ROOT or PDB level, or SYS for when not multitenant.

Connection tests and their status can be checked by querying the view DBA_CONNECTION_TESTS.

20.3.4 DISABLE_CONNECTION_TEST Procedure

This procedure disables usage of a connection test during draining of sessions. Disabling a test applies immediately to all RAC instances where the PDB is open.

Syntax

```
DBMS_SESSION.DISABLE_CONNECTION_TEST (
  connection_test_type    IN VARCHAR2,
  connection_test         IN VARCHAR2,
  service_name            IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 20-5 DISABLE_CONNECTION_TEST Procedure Parameters

Parameter	Description
CONNECTION_TEST_TYPE	The permitted values are: <ul style="list-style-type: none"> DBMS_SESSION.SQL_TEST DBMS_SESSION.PING_TEST DBMS_SESSION.ENDREQUEST_TEST
CONNECTION_TEST	The SQL text used to test and drain connections. This parameter is allowed only if the value of CONNECTION_TEST_TYPE is SQL_TEST.
SERVICE_NAME	Optional service name qualifier. If the optional service name qualifier is provided, only the test for that service name is enabled. A disable at service name level takes precedence over an enable at PDB level. That is the PDB can be enabled, and the service disabled.

Usage Notes

This procedure is owned by SYS and is granted to users for execution at CDB\$ROOT or PDB levels, or when not multitenant, at dictionary level.

Connection tests and their status can be checked by querying the view DBA_CONNECTION_TESTS.

20.3.5 ENABLE_CONNECTION_TEST Procedure

This procedure enables usage of a connection test for draining database sessions before planned maintenance. Enabling a test applies immediately to all RAC instances where the PDB is open.

Syntax

```
DBMS_SESSION.ENABLE_CONNECTION_TEST (
  connection_test_type    IN VARCHAR2,
```

```

connection_test      IN VARCHAR2,
service_name         IN VARCHAR2  DEFAULT NULL);

```

Parameters

Table 20-6 ENABLE_CONNECTION_TEST Procedure Parameters

Parameter	Description
CONNECTION_TEST_TYPE	The connection type used when managing connection tests for draining before planned maintenance. See ADD, DELETE, ENABLE, DISABLE procedures for connection tests. The permitted values are: <ul style="list-style-type: none"> DBMS_SESSION.SQL_TEST DBMS_SESSION.PING_TEST DBMS_SESSION.ENDREQUEST_TEST
CONNECTION_TEST	The SQL text used to test and drain connections at the RDBMS before planned maintenance starts. This parameter is allowed only if the value of CONNECTION_TEST_TYPE is SQL_TEST.
SERVICE_NAME	Optional service name qualifier. If the optional service name qualifier is provided, only the test for that service name is enabled. An enable at service name level overrides any higher-level disables. That is, the PDB can be disabled, and the service enabled.

Usage Notes

- This procedure is owned by SYS and is granted to users for execution at CDB\$ROOT or PDB levels, or when not multitenant, at dictionary level
- ENABLE_CONNECTION_TEST enables a connection test for draining sessions during planned maintenance. The enable operation applies to all RAC instances where the PDB is open. It persists across database restarts.
- This procedure is owned by SYS and is granted to users for execution at CDB\$ROOT or PDB levels, or when not multitenant, at dictionary level.

20.3.6 GET_LTXID_OUTCOME Procedure

This procedure lets customer applications and third party application servers determine the transactional status of the last session when that session becomes unavailable.

Syntax

```

DBMS_APP_CONT.GET_LTXID_OUTCOME (
  client_ltxid      IN    RAW,
  committed        OUT   BOOLEAN,
  user_call_completed OUT  BOOLEAN)

```

Parameters

Table 20-7 GET_LTXID_OUTCOME Procedure Parameters

Parameter	Description
client_ltxid	Client-side logical transaction ID. Obtain the LTXID from the previous failed session using the client driver provided APIs - getLTXID for JDBC, and LogicalTransactionId for ODP.net., and OCI_ATTR_GET with LTXID for OCI.
committed	Returns TRUE if the transaction with the named logical LTXID has COMMITTED. Returns FALSE if the logical LTXID has not COMMITTED. When returning FALSE, the procedure blocks the LTXID from further use so that there is no possibility of previous in-flight work committing this LTXID.
user_call_completed	Whether all information has been returned to the client. Examples of such messages are the number of rows processed when using autocommit or commit on success, parameter and function results when calling PL/SQL, or PL/SQL with more work to do after the COMMIT. Applications that expect to use data returned from the commit in order to function correctly must look at this second parameter.

Exceptions

Table 20-8 GET_LTXID_OUTCOME Procedure Exceptions

Exception	Description
ORA-14950 - SERVER_AHEAD	The server is ahead so the transaction is both an old transaction and one which has already committed. This is an error as the application is passing an older LTXID that is the not the last used for that session. The purpose of GET_LTXID_OUTCOME is to return the current transaction outcome for that session after a recoverable outage.
ORA-14951 - CLIENT_AHEAD	The client is ahead of the server. This can happen if the server has been flashed backed, recovered using media recovery, or is a standby that has opened earlier with data loss.
ORA-14906 - SAME_SESSION	Executing GET_LTXID_OUTCOME is not supported on the session owning the LTXID as it blocks further processing on that session after a recoverable outage.
ORA-14909 - COMMIT_BLOCKED	Your session has been blocked from committing by another user with the same username using GET_LTXID_OUTCOME. GET_LTXID_OUTCOME should only be called on dead sessions. Please check with your application administrator.
ORA-14952 - ERROR	The outcome cannot be determined. During processing an error happened. The error stack shows the error detail.

20.3.7 GET_REPLAY_RULES Function

This function returns a list of the replay rules. From the results, you can test if any rule target is replayable with bit and function.

Syntax

```
DBMS_APP_CONT.GET_REPLAY_RULES (
  replayable BOOLEAN,
  scope      IN BINARY_INTEGER DEFAULT DBMS_APP_CONT.SCOPE_CURRENT)
RETURN      BINARY_INTEGER;
```

Parameters

Table 20-9 *GET_REPLAY_RULES Procedure Parameters*

Parameter	Description
replayable	TRUE or FALSE, depending on whether the rule is replayable or not.
scope	Scope of the rules, either <code>dbms_app_cont.scope_current</code> (default) or <code>dbms_app_cont.scope_parent</code> .

20.3.8 RESET_REPLAY_RULES Procedure

This procedure resets all existing replay rules. When you call this procedure, it clears all locally defined rules in the specified scope and restores them to the original state when they were inherited from their parent scope, or the service if parent scope is not specified.

Syntax

```
DBMS_APP_CONT.RESET_REPLAY_RULES (
  targets IN BINARY_INTEGER DEFAULT NULL,
  scope   IN BINARY_INTEGER DEFAULT DBMS_APP_CONT.SCOPE_CURRENT);
```

Parameters

Table 20-10 *RESET_REPLAY_RULES Procedure Parameters*

Parameter	Description
targets	Target effects on which you want to reset the rules.
scope	Scope of the rule, either <code>dbms_app_cont.scope_current</code> (default) or <code>dbms_app_cont.scope_parent</code> .

21

DBMS_APP_CONT_ADMIN

This package provides a collection dba level admin operations in relation to Application Continuity.

This chapter contains the following topics:

- [DBMS_APP_CONT_ADMIN Security Model](#)
- [Summary of DBMS_APP_CONT_ADMIN Subprograms](#)

21.1 DBMS_APP_CONT_ADMIN Security Model

Applications must have the `EXECUTE` privilege on the `DBMS_APP_CONT_ADMIN` package.

21.2 Summary of DBMS_APP_CONT_ADMIN Subprograms

This topic lists the `DBMS_APP_CONT_ADMIN` subprograms in alphabetical order and briefly describes them.

Table 21-1 DBMS_APP_CONT_ADMIN Package Subprograms

Subprogram	Description
ACCHK_CLEAR_FILTER Procedure	This procedure clears an ACCHK filter by providing a filter type and filter name.
ACCHK_SET Procedure	This procedure enables or disables data collection for acchk protection for your application when using Application Continuity or Transparent Application Continuity. The <code>DISABLE_TIME</code> parameter is used to extend the runtime. Default is 5 minutes.
ACCHK_SET_FILTER Procedure	This procedure sets ACCHK filtering options for acchk protection analysis by service name, module name, program name, and machine name.
ACCHK_SHOW_FILTERS Procedure	This procedure uses a cursor to show ACCHK filters ordered by service, program, module, and machine name.
ADD_SQL_CONNECTION_TEST Procedure	This procedure adds a new connection test that is used during draining sessions before planned maintenance begins.
DELETE_SQL_CONNECTION_TEST Procedure	This procedure deletes a connection test that is no longer needed for planned draining. Removing a test applies immediately to all RAC instances where the PDB is open.
DISABLE_CONNECTION_TEST Procedure	This procedure disables usage of a connection test during draining of sessions.
DISABLE_FAILOVER Procedure	This procedure disables failover on a given service.
ENABLE_AC Procedure	This procedure enables Application Continuity (AC) on a given service.
ENABLE_CONNECTION_TEST Procedure	This procedure enables usage of a connection test for draining database sessions before planned maintenance. Enabling a test applies immediately to all RAC instances where the PDB is open.

Table 21-1 (Cont.) DBMS_APP_CONT_ADMIN Package Subprograms

Subprogram	Description
ENABLE_RESET_STATE Procedure	This procedure enables clearing the session state usage between requests, so that each new request starts clean (usage web and stateless applications).
ENABLE_TAC Procedure	This procedure enables Transparent Application Continuity (TAC) on a given service.
MODIFY_SERVICE Procedure	This procedure modifies a database service using the given parameters.
SET_DRAINING Procedure	This procedure configures draining options for your service, such as timeout value and stop option.
SET_LOAD_BALANCING Procedure	This procedure configures load balancing options for your service.

21.2.1 ACCHK_CLEAR_FILTER Procedure

This procedure clears an ACCHK filter by providing a filter type, filter name, or all the filters.

- You should call `ACCHK_CLEAR_FILTER` before `ACCHK_SET`, which loads the filters.
- `ACCHK_CLEAR_FILTER` is set at the PDB level.

Syntax

```
DBMS_APP_CONT_ADMIN.ACCHK_CLEAR_FILTER (
    filter_type IN NUMBER    DEFAULT NULL,
    filter_name IN VARCHAR2 DEFAULT NULL,
    purge_all   IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 21-2 ACCHK_CLEAR_FILTER Procedure Parameters

Parameter	Description
<code>filter_type</code>	Type of the filter, which can be one of the constants <code>SERVICE_FILTER</code> , <code>PROGRAM_FILTER</code> , <code>MODULE_FILTER</code> , or <code>MACHINE_FILTER</code> from the <code>DBMS_APP_CONT_ADMIN</code> package.
<code>filter_name</code>	Name of the filter that you want to delete when <code>purge_all</code> is <code>FALSE</code> .
<code>purge_all</code>	This parameter is used to delete all the filters. <ul style="list-style-type: none"> • <code>TRUE</code>- enables deletion of all the filters. • <code>FALSE</code>- disables deletion of all the filters. When this parameter is set to <code>FALSE</code> , then only the specified filter is deleted.

Error Messages

Table 21-3 ACCHK_CLEAR_FILTER Procedure Error Messages

Error Code	Description
ORA-20000	Provided filter name exceeds maximum number of characters.
ORA-20000	Invalid filter type value.
ORA-20000	Filter name is not specified.

Examples

The following examples illustrate how to clear an ACCHK service filter:

```
SQL> execute
dbms_app_cont_admin.acchk_clear_filter(DBMS_APP_CONT_ADMIN.SERVICE_FILTER,
'ORACLE.Service1');
```

21.2.2 ACCHK_SET Procedure

This procedure enables or disables data collection for `acchk` protection reports for your application when using Application Continuity or Transparent Application Continuity. The `DISABLE_TIME` parameter is used to extend the runtime. Default value is 10 minutes.

Enabling or disabling data collection applies to the level connected, that is, a CDB or a PDB.

- `acchk` is enabled/disabled at your CDB if connected to the container.
- `acchk` is enabled/disabled at your PDB only when connected to the PDB.

Data collection applies to new sessions only.

Once enabled, data is collected for the workload run under this service. You can then view this data in the `ACCHK_REPORTS` and can also be mined in the `ACCHK` views.

Syntax

```
DBMS_APP_CONT_ADMIN.ACCHK_SET (
    enabled          IN BOOLEAN,
    disable_time_in_seconds DEFAULT 600);
```

Parameters

Table 21-4 ACCHK_SET Procedure Parameters

Parameter	Description
<code>enabled</code>	This parameter is used to enable or disable data collection at a CDB or PDB level. <ul style="list-style-type: none"> • <code>TRUE</code>-enables data collection at this level. • <code>FALSE</code>-explicitly disables data collection.

Table 21-4 (Cont.) ACCHK_SET Procedure Parameters

Parameter	Description
<code>disable_time_in_seconds</code>	Optional parameter used to disable ACCHK tracing automatically in a given number of seconds. The maximum value that you can specify is 3600 seconds. The default value is 600 seconds.

Usage Notes

- This procedure is owned by SYS at CDB\$ROOT or PDB level, or by SYS when not multitenant
- The `acchk` activation is enabled across all instances of RAC supporting that service.
- Enabling is persistent to allow for failover and restart tests, that is, implementation uses `ALTER SESSION SET EVENTS ... SCOPE=BOTH`. The enable is per database. For Data Guard, enable and disable must be at each database.

Examples

Application Continuity Protection Check is not enabled by default. Follow this procedure to enable or disable ACCHK and generate reports to check protection level for the applications.

1. Grant read access to the users, who will run the Application Continuity Protection Check report and views, using the `ACCHK_READ` role:

```
GRANT ACCHK_READ TO USER;
```

2. Enable Application Continuity tracing for your applications using the `dbms_app_cont_admin.acchk_set(true)` procedure:

```
SQL> execute dbms_app_cont_admin.acchk_set(true);
```

By default, ACCHK is disabled automatically after 600 seconds. You can specify a lower number to reduce the auto disable time. For example, to disable ACCHK after 300 seconds:

```
SQL> dbms_app_cont_admin.acchk_set(true,300);
```

The `dbms_app_cont_admin.acchk_set(true)` procedure enables Application Continuity tracing at the database level to which you are connected. If you are connected at the CDB level, then tracing is enabled for the CDB, and if you are connected at the PDB level, then tracing is enabled for the PDB.

Note:

Set the `COMPATIBLE` parameter to 12.2.0 or greater.

- To disable Application Continuity tracing for new sessions in your applications:

```
SQL> execute dbms_app_cont_admin.acchk_set(false);
```

 **Note:**

The tracing will not be disabled for the current sessions until the sessions are terminated.

21.2.3 ACCHK_SET_FILTER Procedure

This procedure sets ACCHK filtering options for `acchk` protection analysis by service name, module name, program name, and machine name.

Filter options are cumulative by multiple calls of this procedure.

- You should call `ACCHK_SET_FILTER` before `ACCHK_SET`, which loads the filters.
- `ACCHK_SET_FILTER` is set at the PDB level.

Syntax

```
DBMS_APP_CONT_ADMIN.ACCHK_SET_FILTER (
    filter_type IN NUMBER,
    filter_name IN VARCHAR2);
```

Parameters

Table 21-5 ACCHK_SET_FILTER Procedure Parameters

Parameter	Description
<code>filter_type</code>	Type of the filter, which can be one of the constants <code>SERVICE_FILTER</code> , <code>PROGRAM_FILTER</code> , <code>MODULE_FILTER</code> , or <code>MACHINE_FILTER</code> from the <code>DBMS_APP_CONT_ADMIN</code> package.
<code>filter_name</code>	Name of the filter, which must match a service name, program name, module name, or machine name.

Error Messages

Table 21-6 ACCHK_SET_FILTER Procedure Error Messages

Error Code	Description
ORA-20000	Provided filter name exceeds maximum number of characters.
ORA-20000	Service <code>service_name</code> does not exist.
ORA-20000	Invalid filter type value.
ORA-20000	Filter name is not specified.

Table 21-6 (Cont.) ACCHK_SET_FILTER Procedure Error Messages

Error Code	Description
ORA-20000	The limit has been reached, only 1024 filters are allowed.
ORA-20000	Filter name already exists.

Examples

The following examples illustrate how to set filters for ACCHK constants:

- To set a service filter:

```
SQL> execute
dbms_app_cont_admin.acchk_set_filter(DBMS_APP_CONT_ADMIN.SERVICE_FILTER, 'ORACLE.Service1');
```

- To set a program filter:

```
SQL> execute
dbms_app_cont_admin.acchk_set_filter(DBMS_APP_CONT_ADMIN.PROGRAM_FILTER, 'Oracle.Program');
```

- To set a module filter:

```
SQL> execute
dbms_app_cont_admin.acchk_set_filter(DBMS_APP_CONT_ADMIN.MODULE_FILTER, 'Oracle.Module');
```

21.2.4 ACCHK_SHOW_FILTERS Procedure

This procedure uses a cursor to show ACCHK filters ordered by service, program, module, and machine name.

Syntax

```
DBMS_APP_CONT_ADMIN.ACCHK_SHOW_FILTERS;
```

Examples

The following examples illustrate how to show ACCHK filters:

```
SQL> execute dbms_app_cont_admin.acchk_show_filters;
ResultSet TYPE  FILTER_NAME  SERVICE          PROGRAM
MODULE
#1              oracle.service1  oracle.program
oracle.module
```

21.2.5 ADD_SQL_CONNECTION_TEST Procedure

This procedure adds a new connection test that is used during draining sessions before planned maintenance begins. Use this procedure when the SQL connection

test is not covered by standard tests. The test is enabled when added. If the optional service name qualifier is provided, the test only applies only to that service name.

Syntax

```
DBMS_APP_CONT_ADMIN.ADD_SQL_CONNECTION_TEST (
    connection_test      IN VARCHAR2
    service_name         IN VARCHAR2   DEFAULT NULL);
```

Parameters

Table 21-7 ADD_SQL_CONNECTION_TEST Procedure Parameters

Parameter	Description
CONNECTION_TEST	The SQL text used to test and drain connections.
SERVICE_NAME	Optional service name qualifier.

Usage Notes

The `ADD_SQL_CONNECTION_TEST` Procedure adds a connection test for the purpose of draining sessions before planned maintenance begins. The connection test is used by the application to test connections that are marked for draining. Sessions are set for draining at stop and relocate operations for services or PDBs. When set the RDBMS closes the connection while draining so the application sees no errors during planned maintenance. You can enter as many CONNECTION TESTs as needed. They are used only during planned maintenance. The tests apply to all RAC instances.

Check online documentation for latest updates on service qualifier availability.

Added connection can be viewed by querying the view `DBA_CONNECTION_TESTS`.

This procedure is owned by `SYS` and is granted to users for execution at `CDB$ROOT` or `PDB` levels, or when not multitenant, at dictionary level.

21.2.6 DELETE_SQL_CONNECTION_TEST Procedure

This procedure deletes a connection test that is no longer needed for planned draining. Removing a test applies immediately to all RAC instances where the PDB is open.

Syntax

```
DBMS_APP_CONT_ADMIN.DELETE_SQL_CONNECTION_TEST (
    connection_test      IN VARCHAR2
    service_name         IN VARCHAR2   DEFAULT NULL);
```

Parameters

Table 21-8 DELETE_SQL_CONNECTION_TEST Procedure Parameters

Parameter	Description
CONNECTION_TEST	The SQL text used to test and drain connections.
SERVICE_NAME	Optional service name qualifier. If the optional <code>SERVICE_NAME</code> qualifier is provided, only the test for that service name is deleted.

Usage Notes

If you are not certain if a test should be deleted, you can disable the test using `DISABLE_CONNECTION_TEST` Procedure. Only custom SQL tests can be deleted. Predefined tests cannot be deleted. Check for latest updates on service qualifier availability.

This procedure is owned by `SYS` at `CDB$ROOT` or `PDB` level, or `SYS` for when not multitenant.

Connection tests and their status can be checked by querying the view `DBA_CONNECTION_TESTS`.

21.2.7 DISABLE_CONNECTION_TEST Procedure

This procedure disables usage of a connection test during draining of sessions. Disabling a test applies immediately to all RAC instances where the PDB is open.

Syntax

```
DBMS_APP_CONT_ADMIN.DISABLE_CONNECTION_TEST (
    connection_test_type    IN VARCHAR2,
    connection_test         IN VARCHAR2,
    service_name            IN VARCHAR2    DEFAULT NULL);
```

Parameters

Table 21-9 `DISABLE_CONNECTION_TEST` Procedure Parameters

Parameter	Description
<code>CONNECTION_TEST_TYPE</code>	The permitted values are: <ul style="list-style-type: none"> <code>DBMS_APP_CONT_ADMIN.SQL_TEST</code> <code>DBMS_APP_CONT_ADMIN.PING_TEST</code> <code>DBMS_APP_CONT_ADMIN.ENDREQUEST_TEST</code>
<code>CONNECTION_TEST</code>	The SQL text used to test and drain connections. This parameter is allowed only if the value of <code>CONNECTION_TEST_TYPE</code> is <code>SQL_TEST</code> .
<code>SERVICE_NAME</code>	Optional service name qualifier. If the optional service name qualifier is provided, only the test for that service name is enabled. A disable at service name level takes precedence over an enable at PDB level. That is the PDB can be enabled, and the service disabled.

Usage Notes

This procedure is owned by `SYS` and is granted to users for execution at `CDB$ROOT` or `PDB` levels, or when not multitenant, at dictionary level.

Connection tests and their status can be checked by querying the view `DBA_CONNECTION_TESTS`.

21.2.8 DISABLE_FAILOVER Procedure

This procedure disables failover on a given service.

Syntax

```
DBMS_APP_CONT_ADMIN.DISABLE_FAILOVER (
    service_name IN VARCHAR2);
```

Parameters

Table 21-10 DISABLE_FAILOVER Procedure Parameters

Parameter	Description
SERVICE_NAME	Optional service name qualifier. If the optional service name qualifier is provided, then failover is disabled only for that service name.

Usage Notes

- You must have the PDBADMIN user permissions to use this procedure.
- Use the full service name on which you want to disable the failover.

Examples

The following example illustrates how to disable failover for a service:

```
SQL> execute dbms_app_cont_admin.disable_failover('TPURGENT');
```

21.2.9 ENABLE_AC Procedure

This procedure enables Application Continuity (AC) on a given service.

Syntax

```
DBMS_APP_CONT_ADMIN.ENABLE_AC (
    service_name          IN VARCHAR2,
    failover_restore      IN VARCHAR2          DEFAULT 'LEVEL1'
    replay_initiation_timeout IN BINARY_INTEGER DEFAULT 300);
```

Parameters

Table 21-11 ENABLE_AC Procedure Parameters

Parameter	Description
SERVICE_NAME	Optional service name qualifier. If the optional service name qualifier is provided, AC is enabled only for the specified service. An enable at service name level overrides any higher-level disables. That is, the PDB can be disabled, and the service enabled.

Table 21-11 (Cont.) ENABLE_AC Procedure Parameters

Parameter	Description
FAILOVER_RESTORE	Failover restore. Possible values are NONE or LEVEL1.
REPLAY_INITIATION_TIMEOUT	Replay timeout that specifies how many seconds after a request is submitted to allow that request to replay.

Usage Notes

- You must have the PDBADMIN user permissions to use this procedure.
- Use the full service name on which you want to enable AC.

Examples

The following example illustrates how to enable Application Continuity for your service:

```
SQL> execute dbms_app_cont_admin.enable_ac('TPURGENT', 'LEVEL1', 600);
```

21.2.10 ENABLE_CONNECTION_TEST Procedure

This procedure enables usage of a connection test for draining database sessions before planned maintenance. Enabling a test applies immediately to all RAC instances where the PDB is open.

Syntax

```
DBMS_APP_CONT_ADMIN.ENABLE_CONNECTION_TEST (
    connection_test_type    IN VARCHAR2,
    connection_test         IN VARCHAR2,
    service_name             IN VARCHAR2    DEFAULT NULL);
```

Parameters

Table 21-12 ENABLE_CONNECTION_TEST Procedure Parameters

Parameter	Description
CONNECTION_TEST_TYPE	<p>The connection type used when managing connection tests for draining before planned maintenance. See ADD, DELETE, ENABLE, DISABLE procedures for connection tests.</p> <p>The permitted values are:</p> <ul style="list-style-type: none"> • DBMS_APP_CONT_ADMIN.SQL_TEST • DBMS_APP_CONT_ADMIN.PING_TEST • DBMS_APP_CONT_ADMIN.ENDREQUEST_TEST • DBMS_APP_CONT_ADMIN.BEGINREQUEST_TEST

Table 21-12 (Cont.) ENABLE_CONNECTION_TEST Procedure Parameters

Parameter	Description
CONNECTION_TEST	The SQL text used to test and drain connections at the RDBMS before planned maintenance starts. This parameter is allowed only if the value of CONNECTION_TEST_TYPE is SQL_TEST.
SERVICE_NAME	Optional service name qualifier. If the optional service name qualifier is provided, only the test for that service name is enabled. An enable at service name level overrides any higher-level disables. That is, the PDB can be disabled, and the service enabled.

Usage Notes

- This procedure is owned by SYS and is granted to users for execution at CDB\$ROOT or PDB levels, or when not multitenant, at dictionary level
- ENABLE_CONNECTION_TEST enables a connection test for draining sessions during planned maintenance. The enable operation applies to all RAC instances where the PDB is open. It persists across database restarts.
- This procedure is owned by SYS and is granted to users for execution at CDB\$ROOT or PDB levels, or when not multitenant, at dictionary level.

21.2.11 ENABLE_RESET_STATE Procedure

This procedure enables clearing the session state usage between requests, so that each new request starts clean (usage web and stateless applications).

Syntax

```
DBMS_APP_CONT_ADMIN.ENABLE_RESET_STATE (
    service_name IN VARCHAR2,
    level        IN VARCHAR2 DEFAULT AUTO);
```

Parameters

Table 21-13 ENABLE_RESET_STATE Procedure Parameters

Parameter	Description
SERVICE_NAME	Optional service name qualifier. If the optional service name qualifier is provided, RESET_STATE is enabled only for the specified service.
LEVEL	Level of the Oracle Database reset session state configuration. Available options are LEVEL1, LEVEL2, or AUTO.

Usage Notes

- You must have the PDBADMIN user permissions to use this procedure.

- Use the full service name for which you want to clear the session state.

Examples

The following example illustrates how to enable reset state for your service:

```
SQL> execute dbms_app_cont_admin.enable_reset_state('TPURGENT',
'AUTO');
```

21.2.12 ENABLE_TAC Procedure

This procedure enables Transparent Application Continuity (TAC) on a given service.

Syntax

```
DBMS_APP_CONT_ADMIN.ENABLE_TAC (
  service_name          IN VARCHAR2,
  failover_restore      IN VARCHAR2          DEFAULT 'AUTO'
  replay_initiation_timeout IN BINARY_INTEGER DEFAULT 300
  session_state_consistency IN VARCHAR2      DEFAULT 'AUTO');
```

Parameters

Table 21-14 ENABLE_TAC Procedure Parameters

Parameter	Description
SERVICE_NAME	Optional service name qualifier. If the optional service name qualifier is provided, TAC is enabled only for the specified service. An enable at service name level overrides any higher-level disables. That is, the PDB can be disabled, and the service enabled.
FAILOVER_RESTORE	Failover restore. Possible values are AUTO or LEVEL1.
REPLAY_INITIATION_TIMEOUT	Replay timeout that specifies how many seconds after a request is submitted to allow that request to replay.
SESSION_STATE_CONSISTENCY	Session State Consistency. Possible values are AUTO or HYBRID.

Exceptions

- When `FAILOVER_RESTORE` is set to `NULL` or `FAILOVER_RESTORE` is not set to `AUTO` or `LEVEL1`: **ORA-20000 - Invalid failover_restore parameter.**
- When `SESSION_STATE_CONSISTENCY` is set to `NULL` or `SESSION_STATE_CONSISTENCY` is not set as `AUTO`: **ORA-20000 - Invalid session_state_consistency parameter.**

Usage Notes

- You must have the `PDBADMIN` user permissions to use this procedure.
- Use the full service name on which you want to enable TAC.

Examples

The following example illustrates how to enable Transparent Application Continuity for your service:

```
SQL> execute dbms_app_cont_admin.enable_tac('TPURGENT', 'AUTO', 600, 'AUTO');
```

21.2.13 MODIFY_SERVICE Procedure

This procedure modifies a database service using the given parameters.

Syntax

```
DBMS_APP_CONT_ADMIN.MODIFY_SERVICE(  
    service_name IN VARCHAR2,  
    service_params IN svc_parameter_array);
```

Parameters

Table 21-15 MODIFY_SERVICE Procedure Parameters

Parameter	Description
service_name	Name of the service, limited to 64 characters in the Data Dictionary
parameter_array	Associative array with name/value pairs of the service attributes. Supported names: <ul style="list-style-type: none"> • aq_ha_notifications • auto_connection_rebalance • clb_goal • commit_fast_path • commit_outcome • drain_timeout • edition • failover_delay • failover_method • failover_restore • failover_retries • failover_type • goal • replay_initiation_timeout • reset_state • retention_timeout • session_state_consistency • sql_translation_profile • stop_option • template_timeout • true_cache_service

Table 21-15 (Cont.) MODIFY_SERVICE Procedure Parameters

Parameter	Description
aq_ha_notifications	Determines whether Fast Application Notification (FAN) is enabled for OCI/OCCI/ODP. In Oracle Database 12c, FAN uses Oracle Notification Services (ONS). This parameter is still used to enable FAN. FAN is recommended for all High Availability systems, and is on by default for Application Continuity.
auto_connection_rebalance	Automatically balances the workload management.
clb_goal	Connection Load Balancing goal, either LONG or SHORT.
commit_fast_path	Enable or disable Oracle Database transaction guard.
commit_outcome	Determines whether transaction COMMIT outcome is accessible after the COMMIT has executed. While the database guarantees that COMMIT is durable, this ensures that the outcome of the COMMIT is durable. Applications use the feature to probe the status of the commit last executed after an outage, and is available to applications to determine an outcome. Note: <ul style="list-style-type: none"> • Invoking the GET_LTXID_OUTCOME Procedure of the DBMS_APP_CONT package requires that the <code>commit_outcome</code> attribute be set. • <code>commit_outcome</code> has no effect on active Data Guard and read-only databases. • <code>commit_outcome</code> is allowed only on user-defined database services
drain_timeout	When this parameter is set, all sessions connected to that service are drained by the client drivers and pools using Fast Connection Failover (FCF). The <code>drain_timeout</code> can be set on the service, to stop and relocate drains for this time by default.
edition	If this argument has a non-NULL value, this provides the initial session edition for subsequent database connections using this service that do not specify an edition. If no value is specified, this argument has no effect. During service creation or modification, no validation is performed on this parameter. At connection time, if the connecting user does not have <code>USE</code> privilege on the edition, or the edition does not exist, this raises the error <code>ORA-38802 (edition does not exist)</code> .
failover_delay	Delay in seconds between connection retries for Application Continuity and TAF. The default is 10 seconds for Application Continuity. Do not use a 0-second delay if the service needs time to failover and register. Long delays are good for planned outages and to failover to Data Guard. Short delays work well with Oracle RAC when the service is already available.
failover_method	Failover TYPE for the service for Application Continuity and TAF. If the <code>failover_type</code> is set to <code>TRANSACTION</code> on the service, this automatically sets <code>COMMIT_OUTCOME</code> to <code>TRUE</code> . JDBC Replay Driver uses the <code>FAILOVER_TYPE</code> service attribute setting of <code>TRANSACTION</code> for <code>TRANSACTION</code> failover. OCI uses the older settings of <code>SELECT</code> and <code>SESSION</code> . The server only accepts <code>FAILOVER_METHOD = BASIC</code> with the <code>TRANSACTION</code> setting.

Table 21-15 (Cont.) MODIFY_SERVICE Procedure Parameters

Parameter	Description
<code>failover_restore</code>	For Application Continuity, when the <code>failover_restore</code> parameter is set, the session states are restored before replaying for ODP.NET and Java. Use <code>LEVEL1</code> for ODP.NET and Java with Application Continuity to restore the initial state. For AC OCI, use <code>NONE</code> for applications that are not <code>STATIC</code> .
<code>failover_retries</code>	Number of connection retries for Application Continuity and TAF. Using the <code>failover_retries</code> and <code>failover_delay</code> parameters, the failover can be delayed until the service is next available. This parameter is for connecting. It does not control the number of failovers, which is 3 for each incident for Application Continuity.
<code>failover_type</code>	Failover <code>TYPE</code> for the service for Application Continuity and TAF.
<code>goal</code>	Workload management goal directive for the service. Valid values: <ul style="list-style-type: none"> <code>DBMS_SERVICE.GOAL_SERVICE_TIME</code> <code>DBMS_SERVICE.GOAL_THROUGHPUT</code> <code>DBMS_SERVICE.GOAL_NONE</code>
<code>replay_initiation_timeout</code>	For Application Continuity, <code>replay_initiation_timeout</code> is the difference between the time of original execution of first operation of a request, and the time that the replay is ready to start after a successful reconnect. Replay initiation time is measured from the time that the request was originally submitted until the time that replay has connected and is ready to replay. When replay is expected, keep this value high. Default is 900 seconds.
<code>reset_state</code>	Use to clean session state automatically by Oracle Database between requests.
<code>retention_timeout</code>	Used in conjunction with <code>commit_outcome</code> , it determines the amount of time (in seconds) that the <code>COMMIT_OUTCOME</code> is retained. Default is 24 hours (86400). Maximum value is 30 days (2592000).
<code>session_state_consistency</code>	Describes how nontransactional is changed during a request. This parameter is considered only if <code>failover_type</code> is set to <code>TRANSACTION</code> for Application Continuity. Examples of session state are NLS settings, optimizer preferences, event settings, PL/SQL global variables, temporary tables, advanced queues, LOBs, and result cache. If these values change after the request starts, set to <code>DYNAMIC</code> (default). Almost all applications should use <code>DYNAMIC</code> mode. If you are unsure, use <code>DYNAMIC</code> mode.
<code>sql_translation_profile</code>	Name of SQL translation profile.
<code>stop_option</code>	Stop options for the service.
<code>template_timeout</code>	Template timeout time in seconds.
<code>true_cache_service</code>	Name of the True Cache service being registered with the primary service.

Examples

```

DECLARE
params dbms_app_cont_admin.svc_parameter_array;
BEGIN
    params('FAILOVER_TYPE')           := 'TRANSACTION';
    params('FAILOVER_RESTORE')       := 'LEVEL2';

```

```

params('RESET_STATE')           := 'NONE';
params('SESSION_STATE_CONSISTENCY') := 'DYNAMIC';
DBMS_APP_CONT_ADMIN.MODIFY_SERVICE('ernie.example.com', params);
END;
```

21.2.14 SET_DRAINING Procedure

This procedure configures draining options for your service, such as timeout value and stop option.

Syntax

```

DBMS_APP_CONT_ADMIN.SET_DRAINING (
  service_name IN VARCHAR2,
  drain_timeout IN BINARY_INTEGER DEFAULT 300
  stop_option IN VARCHAR2          DEFAULT 'NONE');
```

Parameters

Table 21-16 SET_DRAINING Procedure Parameters

Parameter	Description
SERVICE_NAME	Optional service name qualifier. If the optional service name qualifier is provided, draining is set only for that service.
DRAIN_TIMEOUT	Specify the time, in seconds, allowed for resource draining to be completed. Accepted values are an empty string (""), 0, or any positive integer.
STOP_OPTION	Specify the method of stopping the service. Available options are NONE, IMMEDIATE, or TRANSACTIONAL.

Examples

The following example illustrates how to set draining options for your service:

```

SQL> execute dbms_app_cont_admin.set_draining('TPURGENT', 300,
'IMMEDIATE');
```

21.2.15 SET_LOAD_BALANCING Procedure

This procedure configures load balancing options for your service.

Syntax

```

DBMS_APP_CONT_ADMIN.SET_LOAD_BALANCING (
  service_name IN VARCHAR2,
  goal          IN VARCHAR2);
```

Parameters

Table 21-17 SET_LOAD_BALANCING Procedure Parameters

Parameter	Description
SERVICE_NAME	Optional service name qualifier. If the optional service name qualifier is provided, load balancing is set only for the specified service.
GOAL	Load balancing goal. Possible values are: <ul style="list-style-type: none">• CLBGOAL- Connection Load Balancing Goal.• RLBGOAL- Runtime Load Balancing Goal.

Examples

The following example illustrates how to set load balancing goal for your service:

```
SQL> execute dbms_app_cont_admin.set_load_balancing('TPURGENT', 'CLBGOAL');
```

22

DBMS_APP_CONT_REPORT

This procedure generates a report of ACCHK trace collected while `ACCHK_SET(TRUE)`.

This chapter contains the following topics:

- [DBMS_APP_CONT_REPORT Security Model](#)
- [Summary of DBMS_APP_CONT_REPORT Subprograms](#)

22.1 DBMS_APP_CONT_REPORT Security Model

Applications must have the `EXECUTE` privilege on the `DBMS_APP_CONT_REPORT` package.

22.2 Summary of DBMS_APP_CONT_REPORT Subprograms

This topic lists the `DBMS_APP_CONT_REPORT` subprograms in alphabetical order and briefly describes them.

Table 22-1 *DBMS_APP_CONT_REPORT Package Subprograms*

Subprogram	Description
ACCHK_REPORT Procedure	This procedure provides a report of your run. The data is derived from the <code>acchk</code> views.

22.2.1 ACCHK_REPORT Procedure


This procedure generates a report of your run. The data is derived from the `acchk` views.

Syntax

```
DBMS_APP_CONT_REPORT.ACCHK_REPORT (  
  level          IN NUMBER      DEFAULT SUMMARY,  
  service_name  IN VARCHAR2    DEFAULT NULL,  
  start_time    IN DATE        DEFAULT NULL,  
  duration      IN NUMBER      DEFAULT NULL,  
  source        IN NUMBER      DEFAULT FROM_TABLES);
```


Parameters

Table 22-2 ACCHK_REPORT Procedure Parameters

Parameter	Description
level	<p>These are constants.</p> <ul style="list-style-type: none"> SUMMARY-summary report only (default) WARNING-summary and warnings FULL-summary and all workload capture, including where there are no warnings
service_name	<p>The service name qualifier (Optional). The value NULL applies to all service_names.</p>
start_time	<p>Optional parameter for the start time to filter events and statistics. By default, starts at first available row in tables/trace with ACCHK.</p>
duration	<p>Optional parameter for the amount of time in seconds to filter events and statistics. By default, uses available rows in tables/traces starting from the start_time value.</p>
	<div style="border: 1px solid #0070C0; padding: 10px; background-color: #E6F2FF;"> <p> Note:</p> <p>If both start_time and duration are not specified, then all available rows in tables/traces are used for reporting.</p> </div>
source	<p>Optional parameter for obtaining the statistics and events from trace files when capture was in read-only mode by providing the constant value</p> <p>DBMS_APP_CONT_REPORT.FROM_TRACES. DBMS_APP_CONT_REPORT.FROM_TABLES is the default value and uses the views CDB_ACCHK_STATISTICS and CDB_ACCHK_EVENTS for the report.</p> <p>There are two constants from DBMS_APP_CONT_REPORT:</p> <ul style="list-style-type: none"> FROM_TABLES- The procedure uses CDB_ACCHK_STATISTICS and CDB_ACCHK_EVENTS to show the report. FROM_TRACES- The procedure uses traces to show the report.

Procedure Exceptions

The exceptions of `DBMS_APP_CONT_REPORT.ACCHK_REPORT` procedure are as follows:

- 20000- Invalid report level, use `DBMS_APP_CONT_REPORT` with `SUMMARY` or `WARNING` or `FULL`.
- 20000- Invalid duration, set a valid value.
- 20000- Invalid source, use `DBMS_APP_CONT_REPORT` with either `FROM_TABLES` or `FROM_TRACES`.

Example

To get the recorded statistics and events starting from 10 minutes ago:

```
execute dbms_app_cont_report.acchk_report(dbms_app_cont_report.FULL,  
start_time => current_date -INTERVAL '10' MINUTE);
```

To get the recorded statistics and events starting from 10 minutes ago up to 420 seconds (7 minutes):

```
execute dbms_app_cont_report.acchk_report(dbms_app_cont_report.FULL,  
start_time => current_date -INTERVAL '10' MINUTE, duration => 420);
```

To get the recorded statistics and events of the first 60 seconds starting from the first recorded statistic or event:

```
execute dbms_app_cont_report.acchk_report(dbms_app_cont_report.FULL,  
duration => 60);
```

To get the report by using tables:

```
execute dbms_app_cont_report.acchk_report(source =>  
dbms_app_cont_report.FROM_TABLES);
```

To get the report by using traces. Use this option when in read-only mode:

```
execute dbms_app_cont_report.acchk_report(source =>  
dbms_app_cont_report.FROM_TRACES);
```

To get only the summary report:

```
execute dbms_app_cont_report.acchk_report(dbms_app_cont_report.SUMMARY);
```

23

DBMS_APPLICATION_INFO

Application developers can use the `DBMS_APPLICATION_INFO` package with Oracle Trace and the SQL trace facility to record names of executing modules or transactions in the database for later use when tracking the performance of various modules and debugging.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Operational Notes](#)
- [Summary of DBMS_APPLICATION_INFO Subprograms](#)

23.1 DBMS_APPLICATION_INFO Overview

Registering the application allows system administrators and performance tuning specialists to track performance by module. System administrators can also use this information to track resource use by module. When an application registers with the database, its name and actions are recorded in the `V$SESSION` and `V$SQLAREA` views.

23.2 DBMS_APPLICATION_INFO Security Model

No further privileges are required. The `DBMSAPIN.SQL` script is already run as a part of standard database creation.



Note:

The public synonym for `DBMS_APPLICATION_INFO` is not dropped before creation so that you can redirect the public synonym to point to your own package.

23.3 DBMS_APPLICATION_INFO Operational Notes

Your applications should set the name of the module and name of the action automatically each time a user enters that module. The module name could be the name of a form in an Oracle Forms application, or the name of the code segment in an Oracle Precompilers application. The action name should usually be the name or description of the current transaction within a module.

If you want to gather your own statistics based on module, you can implement a wrapper around this package by writing a version of this package in another schema that first gathers statistics and then calls the `SYS` version of the package. The public synonym for `DBMS_APPLICATION_INFO` can then be changed to point to the DBA's version of the package.

23.4 Summary of DBMS_APPLICATION_INFO Subprograms

This table lists and describes the DBMS_APPLICATION_INFO package subprograms.

Table 23-1 DBMS_APPLICATION_INFO Package Subprograms

Subprogram	Description
READ_CLIENT_INFO Procedure	Reads the value of the <code>client_info</code> field of the current session
READ_MODULE Procedure	Reads the values of the module and action fields of the current session
SET_ACTION Procedure	Sets the name of the current action within the current module
SET_CLIENT_INFO Procedure	Sets the <code>client_info</code> field of the session
SET_MODULE Procedure	Sets the name of the module that is currently running to a new module
SET_SESSION_LONGOPS Procedure	Sets a row in the <code>V\$SESSION_LONGOPS</code> table

23.4.1 READ_CLIENT_INFO Procedure

This procedure reads the value of the `client_info` field of the current session.

Syntax

```
DBMS_APPLICATION_INFO.READ_CLIENT_INFO (
    client_info OUT VARCHAR2);
```

Parameters

Table 23-2 READ_CLIENT_INFO Procedure Parameters

Parameter	Description
<code>client_info</code>	Last client information value supplied to the <code>SET_CLIENT_INFO</code> procedure.

23.4.2 READ_MODULE Procedure

This procedure reads the values of the module and action fields of the current session.

Syntax

```
DBMS_APPLICATION_INFO.READ_MODULE (
    module_name OUT VARCHAR2,
    action_name OUT VARCHAR2);
```

Parameters

Table 23-3 READ_MODULE Procedure Parameters

Parameter	Description
module_name	Last value that the module name was set to by calling SET_MODULE.
action_name	Last value that the action name was set to by calling SET_ACTION or SET_MODULE.

Usage Notes

Module and action names for a registered application can be retrieved by querying V\$SQLAREA or by calling the READ_MODULE procedure. Client information can be retrieved by querying the V\$SESSION view, or by calling the [READ_CLIENT_INFO Procedure](#).

Examples

The following sample query illustrates the use of the MODULE and ACTION column of the V\$SQLAREA.

```
SELECT sql_text, disk_reads, module, action
FROM v$sqlarea
WHERE module = 'add_employee';

SQL_TEXT DISK_READS MODULE ACTION
-----
INSERT INTO emp 1 add_employee insert into emp
(ename, empno, sal, mgr, job, hiredate, comm, deptno)
VALUES
(name, next.emp_seq, manager, title, SYSDATE, commission, department)

1 row selected.
```

23.4.3 SET_ACTION Procedure

This procedure sets the name of the current action within the current module.

Syntax

```
DBMS_APPLICATION_INFO.SET_ACTION (
    action_name IN VARCHAR2);
```

Parameters

Table 23-4 SET_ACTION Procedure Parameters

Parameter	Description
action_name	The name of the current action within the current module. When the current action terminates, call this procedure with the name of the next action if there is one, or NULL if there is not. Names longer than 32 bytes are truncated.

Usage Notes

The action name should be descriptive text about the current action being performed. You should probably set the action name before the start of every transaction.

Set the transaction name to `NULL` after the transaction completes, so that subsequent transactions are logged correctly. If you do not set the transaction name to `NULL`, subsequent transactions may be logged with the previous transaction's name.

Example

The following is an example of a transaction that uses the registration procedure:

```

CREATE OR REPLACE PROCEDURE bal_tran (amt IN NUMBER(7,2)) AS
BEGIN

-- balance transfer transaction

    DBMS_APPLICATION_INFO.SET_ACTION(
        action_name => 'transfer from chk to sav');
    UPDATE chk SET bal = bal + :amt
        WHERE acct# = :acct;
    UPDATE sav SET bal = bal - :amt
        WHERE acct# = :acct;
    COMMIT;
    DBMS_APPLICATION_INFO.SET_ACTION(null);

END;
```

23.4.4 SET_CLIENT_INFO Procedure

This procedure supplies additional information about the client application.

Syntax

```

DBMS_APPLICATION_INFO.SET_CLIENT_INFO (
    client_info IN VARCHAR2);
```

Parameters

Table 23-5 SET_CLIENT_INFO Procedure Parameters

Parameter	Description
client_info	Supplies any additional information about the client application. This information is stored in the <code>V\$SESSION</code> view. Information exceeding 64 bytes is truncated.

Note:

`CLIENT_INFO` is readable and writable by any user. For storing secured application attributes, you can use the application context feature.

23.4.5 SET_MODULE Procedure

This procedure sets the name of the current application or module.

Syntax

```
DBMS_APPLICATION_INFO.SET_MODULE (
    module_name IN VARCHAR2,
    action_name IN VARCHAR2);
```

Parameters

Table 23-6 SET_MODULE Procedure Parameters

Parameter	Description
module_name	Name of module that is currently running. When the current module terminates, call this procedure with the name of the new module if there is one, or NULL if there is not. Names longer than 48 bytes are truncated.
action_name	Name of current action within the current module. If you do not want to specify an action, this value should be NULL. Names longer than 32 bytes are truncated.

Usage Notes

Example

```
CREATE or replace PROCEDURE add_employee(
    name VARCHAR2,
    salary NUMBER,
    manager NUMBER,
    title VARCHAR2,
    commission NUMBER,
    department NUMBER) AS
BEGIN
    DBMS_APPLICATION_INFO.SET_MODULE(
        module_name => 'add_employee',
        action_name => 'insert into emp');
    INSERT INTO emp
        (ename, empno, sal, mgr, job, hiredate, comm, deptno)
        VALUES (name, emp_seq.nextval, salary, manager, title, SYSDATE,
            commission, department);
    DBMS_APPLICATION_INFO.SET_MODULE(null,null);
END;
```

23.4.6 SET_SESSION_LONGOPS Procedure

This procedure sets a row in the V\$SESSION_LONGOPS view. This is a view that is used to indicate the on-going progress of a long running operation. Some Oracle functions, such as

parallel execution and Server Managed Recovery, use rows in this view to indicate the status of, for example, a database backup.

Applications may use the `SET_SESSION_LONGOPS` procedure to advertise information on the progress of application specific long running tasks so that the progress can be monitored by way of the `V$SESSION_LONGOPS` view.

Syntax

```
DBMS_APPLICATION_INFO.SET_SESSION_LONGOPS (
  rindex      IN OUT BINARY_INTEGER,
  slno        IN OUT BINARY_INTEGER,
  op_name     IN      VARCHAR2         DEFAULT NULL,
  target      IN      BINARY_INTEGER  DEFAULT 0,
  context     IN      BINARY_INTEGER  DEFAULT 0,
  sofar       IN      NUMBER           DEFAULT 0,
  totalwork   IN      NUMBER           DEFAULT 0,
  target_desc IN      VARCHAR2        DEFAULT 'unknown target',
  units       IN      VARCHAR2        DEFAULT NULL)
```

```
set_session_longops_nohint constant BINARY_INTEGER := -1;
```

Parameters

Table 23-7 SET_SESSION_LONGOPS Procedure Parameters

Parameter	Description
<code>rindex</code>	A token which represents the <code>v\$session_longops</code> row to update. Set this to <code>set_session_longops_nohint</code> to start a new row. Use the returned value from the prior call to reuse a row.
<code>slno</code>	Saves information across calls to <code>set_session_longops</code> : It is for internal use and should not be modified by the caller.
<code>op_name</code>	Specifies the name of the long running task. It appears as the <code>OPNAME</code> column of <code>v\$session_longops</code> . The maximum length is 64 bytes.
<code>target</code>	Specifies the object that is being worked on during the long running operation. For example, it could be a table ID that is being sorted. It appears as the <code>TARGET</code> column of <code>v\$session_longops</code> .
<code>context</code>	Any number the client wants to store. It appears in the <code>CONTEXT</code> column of <code>v\$session_longops</code> .
<code>sofar</code>	Any number the client wants to store. It appears in the <code>SOFAR</code> column of <code>v\$session_longops</code> . This is typically the amount of work which has been done so far.
<code>totalwork</code>	Any number the client wants to store. It appears in the <code>TOTALWORK</code> column of <code>v\$session_longops</code> . This is typically an estimate of the total amount of work needed to be done in this long running operation.
<code>target_desc</code>	Specifies the description of the object being manipulated in this long operation. This provides a caption for the <code>target</code> parameter. This value appears in the <code>TARGET_DESC</code> field of <code>v\$session_longops</code> . The maximum length is 32 bytes.

Table 23-7 (Cont.) SET_SESSION_LONGOPS Procedure Parameters

Parameter	Description
units	Specifies the units in which <code>sofar</code> and <code>totalwork</code> are being represented. It appears as the <code>UNITS</code> field of <code>v\$session_longops</code> . The maximum length is 32 bytes.

Example

This example performs a task on 10 objects in a loop. As the example completes each object, Oracle updates `V$SESSION_LONGOPS` on the procedure's progress.

```
DECLARE
    rindex    BINARY_INTEGER;
    slno      BINARY_INTEGER;
    totalwork number;
    sofar     number;
    obj       BINARY_INTEGER;

BEGIN
    rindex := dbms_application_info.set_session_longops_nohint;
    sofar := 0;
    totalwork := 10;

    WHILE sofar < 10 LOOP
        -- update obj based on sofar
        -- perform task on object target

        sofar := sofar + 1;
        dbms_application_info.set_session_longops(rindex, slno,
            "Operation X", obj, 0, sofar, totalwork, "table", "tables");
    END LOOP;
END;
```

24

DBMS_APPLY_ADM

The `DBMS_APPLY_ADM` package provides subprograms to configure and manage Oracle Apply processes, XStream outbound servers, and XStream inbound servers.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Operational Notes](#)
- [Summary of DBMS_APPLY_ADM Subprograms](#)

See Also:

Oracle Database XStream Guide for more information about XStream outbound servers and inbound servers

24.1 DBMS_APPLY_ADM Overview

The `DBMS_APPLY_ADM` package provides interfaces to start, stop, and configure Oracle Apply processes, XStream outbound servers, and XStream inbound servers.

This package includes subprograms for configuring apply handlers, setting enqueue destinations for messages, and specifying execution directives for messages. This package also provides administrative subprograms that set the instantiation SCN for objects at a destination database. This package also includes subprograms for managing apply errors.

XStream inbound servers and outbound servers can be used in an XStream configuration in a multitenant container database (CDB). A CDB is an Oracle database that includes zero, one, or many user-created pluggable databases (PDBs).

 **Note:**

- For simplicity, this chapter refers to apply processes, XStream outbound servers, and XStream inbound servers as **apply components**. This chapter identifies a specific type of apply component when necessary.
- Using XStream requires purchasing a license for the Oracle GoldenGate product.

 **See Also:**

- *Oracle Database XStream Guide*
- *Oracle Database Concepts* for more information about CDBs and PDBs

24.2 DBMS_APPLY_ADM Security Model

Security on this package can be controlled by either granting `EXECUTE` on this package to selected users or roles, or by granting `EXECUTE_CATALOG_ROLE` to selected users or roles..

If subprograms in the package are run from within a stored procedure, then the user who runs the subprograms must be granted `EXECUTE` privilege on the package directly. It cannot be granted through a role.

When the `DBMS_APPLY_ADM` package is used to manage an Oracle Replication configuration, it requires that the user is granted the privileges of an Oracle Replication administrator.

When the `DBMS_APPLY_ADM` package is used to manage an XStream configuration, it requires that the user is granted the privileges of an XStream administrator.

 **Note:**

The user must be granted additional privileges to perform some administrative tasks using the subprograms in this package, such as setting an apply user. If additional privileges are required for a subprogram, then the privileges are documented in the section that describes the subprogram.

 **See Also:**

Oracle Database XStream Guide for information about configuring an XStream administrator

24.3 DBMS_APPLY_ADM Deprecated Subprograms

The `NONE` value for the `commit_serialization` apply component parameter is deprecated. It is replaced by the `DEPENDENT_TRANSACTIONS` value.

Note:

Oracle recommends that you do not use deprecated apply component parameter values. Support for deprecated features is for backward compatibility only.

See Also:

[SET_PARAMETER Procedure](#)

24.4 Summary of DBMS_APPLY_ADM Subprograms

This table topic lists and describes the `DBMS_APPLY_ADM` subprograms.

Table 24-1 DBMS_APPLY_ADM Package Subprograms

Subprogram	Description
ALTER_APPLY Procedure	Alters an apply component
CLEAR_KEY_COLUMNS Procedure	Removes the key columns that were used as the substitute primary key by the <code>SET_KEY_COLUMNS</code> procedure
COMPARE_OLD_VALUES Procedure	Specifies whether to compare the old value of one or more columns in a row logical change record (row LCR) with the current value of the corresponding columns at the destination site during apply
CREATE_APPLY Procedure	Creates an apply component
CREATE_OBJECT_DEPENDENCY Procedure	Creates an object dependency
DELETE_ALL_ERRORS Procedure	Deletes all the error transactions for the specified apply component
DELETE_ERROR Procedure	Deletes the specified error transaction
DROP_APPLY Procedure	Drops an apply component
DROP_OBJECT_DEPENDENCY Procedure	Drops an object dependency
EXECUTE_ALL_ERRORS Procedure	Reexecutes the error transactions for the specified apply component
EXECUTE_ERROR Procedure	Reexecutes the specified error transaction
GET_ERROR_MESSAGE Function	Returns the message payload from the error queue for the specified message number and transaction identifier

Table 24-1 (Cont.) DBMS_APPLY_ADM Package Subprograms

Subprogram	Description
HANDLE_COLLISIONS	Enables or disables basic conflict resolution for an apply process and a table
SET_DML_CONFLICT_HANDLER Procedure	Adds, modifies, or removes a prebuilt DML conflict handler for INSERT, UPDATE, or DELETE conflicts on the specified object
SET_DML_HANDLER Procedure	Sets a user procedure as a procedure DML handler for a specified operation on a specified database object for a single apply component or for all apply components in the database
SET_ENQUEUE_DESTINATION Procedure	Sets the queue where the apply component automatically enqueues a message that satisfies the specified rule
SET_EXECUTE Procedure	Specifies whether a message that satisfies the specified rule is executed by an apply component
SET_GLOBAL_INSTANTIATION_SCN Procedure	Records the specified instantiation SCN for the specified source database and, optionally, for the schemas at the source database and the tables owned by these schemas
SET_KEY_COLUMNS Procedures	Records the set of columns to be used as the substitute primary key for local apply purposes and removes existing substitute primary key columns for the specified object if they exist
SET_PARAMETER Procedure	Sets an apply parameter to the specified value
SET_REPERROR_HANDLER Procedure	Specifies how a particular error is handled based on its error number
SET_SCHEMA_INSTANTIATION_SCN Procedure	Records the specified instantiation SCN for the specified schema in the specified source database and, optionally, for the tables owned by the schema at the source database
SET_TABLE_INSTANTIATION_SCN Procedure	Records the specified instantiation SCN for the specified table in the specified source database
SET_UPDATE_CONFLICT_HANDLER Procedure	Adds, updates, or drops an update conflict handler for the specified object
SET_VALUE_DEPENDENCY Procedure	Sets or removes a value dependency
START_APPLY Procedure	Directs the apply component to start applying messages
STOP_APPLY Procedure	Stops the apply component from applying any messages and rolls back any unfinished transactions being applied



Note:

All procedures commit unless specified otherwise. However, the `GET_ERROR_MESSAGE` function does not commit.

24.4.1 ALTER_APPLY Procedure

This procedure alters an apply component.

Syntax

```
DBMS_APPLY_ADM.ALTER_APPLY(
  apply_name           IN VARCHAR2,
  rule_set_name       IN VARCHAR2 DEFAULT NULL,
  remove_rule_set     IN BOOLEAN  DEFAULT FALSE,
  message_handler     IN VARCHAR2 DEFAULT NULL,
  remove_message_handler IN BOOLEAN DEFAULT FALSE,
  ddl_handler         IN VARCHAR2 DEFAULT NULL,
  remove_ddl_handler  IN BOOLEAN  DEFAULT FALSE,
  apply_user          IN VARCHAR2 DEFAULT NULL,
  apply_tag           IN RAW      DEFAULT NULL,
  remove_apply_tag    IN BOOLEAN  DEFAULT FALSE,
  precommit_handler  IN VARCHAR2 DEFAULT NULL,
  remove_precommit_handler IN BOOLEAN DEFAULT FALSE,
  negative_rule_set_name IN VARCHAR2 DEFAULT NULL,
  remove_negative_rule_set IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 24-2 ALTER_APPLY Procedure Parameters

Parameter	Description
apply_name	The name of the apply component being altered. You must specify the name of an existing apply component. Do not specify an owner.
rule_set_name	<p>The name of the positive rule set for the apply component. The positive rule set contains the rules that instruct the apply component to apply messages.</p> <p>If you want to use a positive rule set for the apply component, then you must specify an existing rule set in the form <code>[schema_name.]rule_set_name</code>. For example, to specify a positive rule set in the <code>hr</code> schema named <code>job_apply_rules</code>, enter <code>hr.job_apply_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>An error is returned if the specified rule set does not exist.</p> <p>If you specify <code>NULL</code> and the <code>remove_rule_set</code> parameter is set to <code>FALSE</code>, then this procedure retains any existing positive rule set for the specified apply component. If you specify <code>NULL</code> and the <code>remove_rule_set</code> parameter is set to <code>TRUE</code>, then this procedure removes any existing positive rule set from the specified apply component.</p>

Table 24-2 (Cont.) ALTER_APPLY Procedure Parameters

Parameter	Description
remove_rule_set	<p>If TRUE, then the procedure removes the positive rule set for the specified apply component. If you remove the positive rule set for an apply component, and the apply component does not have a negative rule set, then the apply component dequeues all messages in its queue.</p> <p>If you remove the positive rule set for an apply component, and a negative rule set exists for the apply component, then the apply component dequeues all messages in its queue that are not discarded by the negative rule set.</p> <p>If FALSE, then the procedure retains the positive rule set for the specified apply component.</p> <p>If the rule_set_name parameter is non-NULL, then this parameter should be set to FALSE.</p>
message_handler	<p>A user-defined procedure that processes non-LCR messages in the queue for the apply component.</p> <p>See "Usage Notes" in the CREATE_APPLY Procedure for more information about a message handler procedure.</p>
remove_message_handler	<p>If TRUE, then the procedure removes the message handler for the specified apply component.</p> <p>If FALSE, then the procedure retains any message handler for the specified apply component.</p> <p>If the message_handler parameter is non-NULL, then this parameter should be set to FALSE.</p>
ddl_handler	<p>A user-defined procedure that processes DDL logical change records (DDL LCRs) in the queue for the apply component.</p> <p>All applied DDL LCRs commit automatically. Therefore, if a DDL handler calls the EXECUTE member procedure of a DDL LCR, then a commit is performed automatically.</p> <p>See "Usage Notes" in the CREATE_APPLY Procedure for more information about a DDL handler procedure.</p>
remove_ddl_handler	<p>If TRUE, then the procedure removes the DDL handler for the specified apply component.</p> <p>If FALSE, then the procedure retains any DDL handler for the specified apply component.</p> <p>If the ddl_handler parameter is non-NULL, then this parameter should be set to FALSE.</p>

Table 24-2 (Cont.) ALTER_APPLY Procedure Parameters

Parameter	Description
<code>apply_user</code>	<p>The user in whose security domain an apply component dequeues messages that satisfy its rule sets, applies messages directly to database objects, runs custom rule-based transformations, and runs apply handlers. If <code>NULL</code>, then the apply user is not changed.</p> <p>If a non-<code>NULL</code> value is specified to change the apply user, then the user who invokes the <code>ALTER_APPLY</code> procedure must be granted the <code>DBA</code> role. Only the <code>SYS</code> user can set the <code>apply_user</code> to <code>SYS</code>.</p> <p>If you change the apply user, then this procedure grants the new apply user dequeue privilege on the queue used by the apply component. It also configures the user as a secure queue user of the queue.</p> <p>In addition to the privileges granted by this procedure, you also should grant the following privileges to the apply user:</p> <ul style="list-style-type: none"> • The necessary privileges to perform DML and DDL changes on the apply objects • <code>EXECUTE</code> privilege on the rule sets used by the apply component • <code>EXECUTE</code> privilege on all rule-based transformation functions used in the rule set • <code>EXECUTE</code> privilege on all apply handler procedures <p>These privileges can be granted directly to the apply user, or they can be granted through roles.</p> <p>In addition, the apply user must be granted the <code>EXECUTE</code> privilege on all packages, including Oracle-supplied packages, that are invoked in subprograms run by the apply component. These privileges must be granted directly to the apply user. They cannot be granted through roles.</p> <p>By default, this parameter is set to the user who created the apply component by running either the <code>CREATE_APPLY</code> procedure in this package.</p> <p>Note: If the apply user for an apply component is dropped using <code>DROP USER . . . CASCADE</code>, then the apply component is also dropped automatically.</p>
<code>apply_tag</code>	<p>A binary tag that is added to redo entries generated by the specified apply component. The tag is a binary value that can be used to track LCRs.</p> <p>The tag is relevant only if a capture process at the database where the apply component is running captures changes made by the apply component. If so, then the captured changes include the tag specified by this parameter.</p> <p>If <code>NULL</code>, the default, then the apply tag for the apply component is not changed.</p> <p>The following is an example of a tag with a hexadecimal value of 17:</p> <pre>HEXTORAW('17')</pre>

Table 24-2 (Cont.) ALTER_APPLY Procedure Parameters

Parameter	Description
<code>remove_apply_tag</code>	<p>If <code>TRUE</code>, then the procedure sets the apply tag for the specified apply component to <code>NULL</code>, and the apply component generates redo entries with <code>NULL</code> tags.</p> <p>If <code>FALSE</code>, then the procedure retains any apply tag for the specified apply component.</p> <p>If the <code>apply_tag</code> parameter is non-<code>NULL</code>, then this parameter should be set to <code>FALSE</code>.</p>
<code>precommit_handler</code>	<p>A user-defined procedure that can receive internal commit directives in the queue for the apply component before they are processed by the apply component. Typically, precommit handlers are used for auditing commit information for transactions processed by an apply component.</p> <p>An internal commit directive is enqueued in the following ways:</p> <ul style="list-style-type: none"> • When a capture process captures row LCRs, the capture process enqueues the commit directive for the transaction that contains the row LCRs. • When a user or application enqueues messages and then issues a <code>COMMIT</code> statement, the commit directive is enqueued automatically. <p>For a captured row LCR, a commit directive contains the commit SCN of the transaction from the source database. For a user message, the commit SCN is generated by the apply component.</p> <p>The precommit handler procedure must conform to the following restrictions:</p> <ul style="list-style-type: none"> • Any work that commits must be an autonomous transaction. • Any rollback must be to a named savepoint created in the procedure. <p>If a precommit handler raises an exception, then the entire apply transaction is rolled back, and all of the messages in the transaction are moved to the error queue.</p> <p>See "Usage Notes" in the CREATE_APPLY Procedure for more information about a precommit handler procedure.</p>
<code>remove_precommit_handler</code>	<p>If <code>TRUE</code>, then the procedure removes the precommit handler for the specified apply component.</p> <p>If <code>FALSE</code>, then the procedure retains any precommit handler for the specified apply component.</p> <p>If the <code>precommit_handler</code> parameter is non-<code>NULL</code>, then this parameter should be set to <code>FALSE</code>.</p>

Table 24-2 (Cont.) ALTER_APPLY Procedure Parameters

Parameter	Description
<code>negative_rule_set_name</code>	<p>The name of the negative rule set for the apply component. The negative rule set contains the rules that instruct the apply component to discard messages.</p> <p>If you want to use a negative rule set for the apply component, then you must specify an existing rule set in the form <code>[schema_name.]rule_set_name</code>. For example, to specify a negative rule set in the <code>hr</code> schema named <code>neg_apply_rules</code>, enter <code>hr.neg_apply_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>An error is returned if the specified rule set does not exist.</p> <p>If you specify <code>NULL</code> and the <code>remove_negative_rule_set</code> parameter is set to <code>FALSE</code>, then the procedure retains any existing negative rule set. If you specify <code>NULL</code> and the <code>remove_negative_rule_set</code> parameter is set to <code>TRUE</code>, then the procedure removes any existing negative rule set.</p> <p>If you specify both a positive and a negative rule set for an apply component, then the negative rule set is always evaluated first.</p>
<code>remove_negative_rule_set</code>	<p>If <code>TRUE</code>, then the procedure removes the negative rule set for the specified apply component. If you remove the negative rule set for an apply component, and the apply component does not have a positive rule set, then the apply component dequeues all messages in its queue.</p> <p>If you remove the negative rule set for an apply component, and a positive rule set exists for the apply component, then the apply component dequeues all messages in its queue that are not discarded by the positive rule set.</p> <p>If <code>FALSE</code>, then the procedure retains the negative rule set for the specified apply component.</p> <p>If the <code>negative_rule_set_name</code> parameter is non-<code>NULL</code>, then this parameter should be set to <code>FALSE</code>.</p>

Usage Notes

The following usage notes apply to this procedure:

- [Automatic Restart of Apply Components](#)
- [The ALTER_APPLY Procedure and XStream Outbound Servers](#)
- [The ALTER_APPLY Procedure and XStream Inbound Servers](#)

Automatic Restart of Apply Components

An apply component is stopped and restarted automatically when you change the value of one or more of the following `ALTER_APPLY` procedure parameters:

- `message_handler`
- `ddl_handler`
- `apply_user`
- `apply_tag`

- `precommit_handler`

The ALTER_APPLY Procedure and XStream Outbound Servers

The following usage notes apply to this procedure and XStream outbound servers:

- The `apply_user` parameter can change the connect user for an outbound server.
- You cannot specify an apply handler for an outbound server. An outbound server ignores the settings for the following parameters: `message_handler`, `ddl_handler`, and `precommit_handler`.

The client application can perform custom processing of the LCRs instead if necessary.

- An outbound server cannot set an apply tag for the changes it processes. An outbound server ignores the setting for the `apply_tag` parameter.

The ALTER_APPLY Procedure and XStream Inbound Servers

Inbound servers can use apply handlers and process only DML and DDL LCRs. Therefore, inbound servers ignore message handlers specified in the `message_handler` parameter.

24.4.2 CLEAR_KEY_COLUMNS Procedure

This procedure removes the key columns that were used as the substitute primary key by the `SET_KEY_COLUMNS` procedure.

Syntax

```
DBMS_APPLY_ADM.CLEAR_KEY_COLUMNS (
    apply_name IN VARCHAR2 DEFAULT NULL);
```

Parameter

Table 24-3 CLEAR_KEY_COLUMNS Procedure Parameter

Parameter	Description
<code>apply_name</code>	The apply component name.

Usage Notes

The following usage notes apply to this procedure:

The CLEAR_KEY_COLUMNS Procedure and XStream Outbound Servers

This procedure has no effect on XStream outbound servers.

The CLEAR_KEY_COLUMNS Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

The CLEAR_KEY_COLUMNS Procedure and CDBs

This procedure removes the columns that are used as a substitute primary key. You must perform the `CLEAR_KEY_COLUMNS` procedure in the appropriate PDB.

24.4.3 COMPARE_OLD_VALUES Procedure

This procedure specifies whether to compare the old values of one or more columns in a row logical change record (row LCR) with the current values of the corresponding columns at the destination site during apply.

This procedure is relevant only for UPDATE and DELETE operations because only these operations result in old column values in row LCRs. The default is to compare old values for all columns.

This procedure is overloaded. The `column_list` and `column_table` parameters are mutually exclusive.

Syntax

```
DBMS_APPLY_ADM.COMPARE_OLD_VALUES (
  object_name          IN VARCHAR2,
  column_list          IN VARCHAR2,
  operation             IN VARCHAR2 DEFAULT 'UPDATE',
  compare              IN BOOLEAN  DEFAULT TRUE,
  apply_database_link IN VARCHAR2  DEFAULT NULL);

DBMS_APPLY_ADM.COMPARE_OLD_VALUES (
  object_name          IN VARCHAR2,
  column_table         IN DBMS_UTILITY.LNAME_ARRAY,
  operation            IN VARCHAR2 DEFAULT 'UPDATE',
  compare              IN BOOLEAN  DEFAULT TRUE,
  apply_database_link IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 24-4 COMPARE_OLD_VALUES Procedure Parameters

Parameter	Description
<code>object_name</code>	The name of the source table specified as <code>[schema_name.]object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default.
<code>column_list</code>	A comma-delimited list of column names in the table. There must be no spaces between entries. Specify <code>*</code> to include all nonkey columns.
<code>column_table</code>	A PL/SQL associative array of type <code>DBMS_UTILITY.LNAME_ARRAY</code> that contains names of columns in the table. The first column name should be at position 1, the second at position 2, and so on. The table does not need to be NULL terminated.
<code>operation</code>	The name of the operation, which can be specified as: <ul style="list-style-type: none"> • UPDATE for UPDATE operations • DELETE for DELETE operations • * for both UPDATE and DELETE operations
<code>compare</code>	If <code>compare</code> is TRUE, the old values of the specified columns are compared during apply. If <code>compare</code> is FALSE, the old values of the specified columns are not compared during apply.

Table 24-4 (Cont.) COMPARE_OLD_VALUES Procedure Parameters

Parameter	Description
<code>apply_database_link</code>	The name of the database link to a non-Oracle database. This parameter should be set only when the destination database is a non-Oracle database.

Usage Notes

The following usage notes apply to this procedure:

- [Conflict Detection](#)
- [The COMPARE_OLD_VALUES Procedure and XStream Outbound Servers](#)
- [The COMPARE_OLD_VALUES Procedure and XStream Inbound Servers](#)

Conflict Detection

By default, an apply component uses the old column values in a row LCR to detect conflicts. You can choose not to compare old column values to avoid conflict detection for specific tables. For example, if you do not want to compare the old values for a set of columns during apply, then, using the `COMPARE_OLD_VALUES` procedure, specify the set of columns in the `column_list` or `column_table` parameter, and set the `compare` parameter to `FALSE`.

In addition, when the `compare_key_only` apply component parameter is set to `Y`, automatic conflict detection is disabled, and the apply component only uses primary key and unique key columns to identify the table row for a row LCR. When the `compare_key_only` apply component parameter is set to `N`, automatic conflict detection is enabled, and the apply component uses all of the old values in a row LCR to identify the table row for a row LCR.

Note:

- An apply component compares old values for non-key columns when they are present in a row LCR and when the apply component parameter `compare_key_only` is set to `N`.
- This procedure raises an error if a key column is specified in `column_list` or `column_table` and the `compare` parameter is set to `FALSE`.

See Also:

[SET_PARAMETER Procedure](#) for more information about the `compare_key_only` apply component parameter

The `COMPARE_OLD_VALUES` Procedure and XStream Outbound Servers

This procedure has no effect on XStream outbound servers.

The COMPARE_OLD_VALUES Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.4 CREATE_APPLY Procedure

This procedure creates an apply component.

Syntax

```
DBMS_APPLY_ADM.CREATE_APPLY(
  queue_name          IN VARCHAR2,
  apply_name          IN VARCHAR2,
  rule_set_name       IN VARCHAR2 DEFAULT NULL,
  message_handler     IN VARCHAR2 DEFAULT NULL,
  ddl_handler         IN VARCHAR2 DEFAULT NULL,
  apply_user          IN VARCHAR2 DEFAULT NULL,
  apply_database_link IN VARCHAR2 DEFAULT NULL,
  apply_tag           IN RAW        DEFAULT '00',
  apply_captured      IN BOOLEAN   DEFAULT FALSE,
  precommit_handler   IN VARCHAR2 DEFAULT NULL,
  negative_rule_set_name IN VARCHAR2 DEFAULT NULL,
  source_database     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 24-5 CREATE_APPLY Procedure Parameters

Parameter	Description
queue_name	The name of the queue from which the apply component dequeues messages. You must specify an existing queue in the form <code>[schema_name.]queue_name</code> . For example, to specify a queue in the <code>hr</code> schema named <code>streams_queue</code> , enter <code>hr.streams_queue</code> . If the schema is not specified, then the current user is the default. Note: The <code>queue_name</code> setting cannot be altered after the apply component is created.
apply_name	The name of the apply component being created. A <code>NULL</code> specification is not allowed. Do not specify an owner. The specified name must not match the name of an existing apply component or messaging client. Note: The <code>apply_name</code> setting cannot be altered after the apply component is created.

Table 24-5 (Cont.) CREATE_APPLY Procedure Parameters

Parameter	Description
rule_set_name	<p>The name of the positive rule set for the apply component. The positive rule set contains the rules that instruct the apply component to apply messages.</p> <p>If you want to use a positive rule set for the apply component, then you must specify an existing rule set in the form <code>[schema_name.]rule_set_name</code>. For example, to specify a positive rule set in the <code>hr</code> schema named <code>job_apply_rules</code>, enter <code>hr.job_apply_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>If you specify <code>NULL</code>, and no negative rule set is specified, then the apply component applies either all captured messages or all messages in the persistent queue, depending on the setting of the <code>apply_captured</code> parameter.</p> <p>An error is returned if the specified rule set does not exist.</p>
message_handler	<p>A user-defined procedure that processes non-LCR messages in the queue for the apply component.</p> <p>See "Usage Notes" for more information about a message handler procedure.</p>
ddl_handler	<p>A user-defined procedure that processes DDL logical change record (DDL LCRs) in the queue for the apply component.</p> <p>All applied DDL LCRs commit automatically. Therefore, if a DDL handler calls the <code>EXECUTE</code> member procedure of a DDL LCR, then a commit is performed automatically.</p> <p>See "Usage Notes" for more information about a DDL handler procedure.</p>

Table 24-5 (Cont.) CREATE_APPLY Procedure Parameters

Parameter	Description
apply_user	<p>The user who applies all DML and DDL changes that satisfy the apply component rule sets and who runs user-defined apply handlers. If NULL, then the user who runs the CREATE_APPLY procedure is used.</p> <p>The apply user is the user in whose security domain an apply component dequeues messages that satisfy its rule sets, applies messages directly to database objects, runs custom rule-based transformations configured for apply component rules, and runs apply handlers configured for the apply component. This user must have the necessary privileges to apply changes. This procedure grants the apply user dequeue privilege on the queue used by the apply component and configures the user as a secure queue user of the queue.</p> <p>In addition to the privileges granted by this procedure, you also should grant the following privileges to the apply user:</p> <ul style="list-style-type: none"> • The necessary privileges to perform DML and DDL changes on the apply objects • EXECUTE privilege on the rule sets used by the apply component • EXECUTE privilege on all rule-based transformation functions used in the rule set • EXECUTE privilege on all apply handler procedures <p>These privileges can be granted directly to the apply user, or they can be granted through roles.</p> <p>In addition, the apply user must be granted EXECUTE privilege on all packages, including Oracle-supplied packages, that are invoked in subprograms run by the apply component. These privileges must be granted directly to the apply user. They cannot be granted through roles.</p> <p>You can use the DBMS_XSTREAM_AUTH package to grant and revoke administrative privileges in XStream configuration. These packages do not configure the necessary privileges to perform DML or DDL changes on the apply objects.</p> <p>Note: If the apply user for an apply component is dropped using DROP USER . . . CASCADE, then the apply component is also dropped automatically.</p> <p>See "Usage Notes" for more information about this parameter.</p>
apply_database_link	<p>The database at which the apply component applies messages. This parameter is used by an apply component when applying changes from Oracle to non-Oracle systems, such as Sybase. Set this parameter to NULL to specify that the apply component applies messages at the local database.</p> <p>Note: The apply_database_link setting cannot be altered after the apply component is created.</p>

Table 24-5 (Cont.) CREATE_APPLY Procedure Parameters

Parameter	Description
apply_tag	<p>A binary tag that is added to redo entries generated by the specified apply component. The tag is a binary value that can be used to track LCRs.</p> <p>The tag is relevant only if a capture process at the database where the apply component is running captures changes made by the apply component. If so, then the captured changes include the tag specified by this parameter.</p> <p>By default, the tag for an apply component is the hexadecimal equivalent of '00' (double zero).</p> <p>The following is an example of a tag with a hexadecimal value of 17:</p> <pre>HEXTORAW('17')</pre> <p>If NULL, then the apply component generates redo entries with NULL tags.</p>
apply_captured	<p>Either TRUE or FALSE.</p> <p>If TRUE, then the apply component applies only the captured LCRs in the queue. Captured LCRs are LCRs that were captured by an Oracle Replication capture process.</p> <p>If FALSE, then the apply component applies only the messages in a persistent queue. These are messages that were not captured by an Oracle Replication capture process, such as persistent LCRs or user messages.</p> <p>To apply both captured LCRs and messages in a persistent queue, you must create at least two apply components.</p> <p>Note: The apply_captured setting cannot be altered after the apply component is created.</p>

Table 24-5 (Cont.) CREATE_APPLY Procedure Parameters

Parameter	Description
<code>precommit_handler</code>	<p>A user-defined procedure that can receive internal commit directives in the queue for the apply component before they are processed by the apply component. Typically, precommit handlers are used for auditing commit information for transactions processed by an apply component.</p> <p>An internal commit directive is enqueued in the following ways:</p> <ul style="list-style-type: none"> • When a capture process captures row LCRs, the capture process enqueues the commit directive for the transaction that contains the row LCRs. • When a synchronous capture captures row LCRs, the persistent LCRs that were enqueued by the synchronous capture are organized into a message group. The synchronous capture records the transaction identifier in each persistent LCR in a transaction. • When a user or application enqueues messages and then issues a <code>COMMIT</code> statement, the commit directive is enqueued automatically. <p>For a row LCR captured by a capture process or synchronous capture, a commit directive contains the commit SCN of the transaction from the source database. For a message enqueued by a user or application, the commit SCN is generated by the apply component.</p> <p>The precommit handler procedure must conform to the following restrictions:</p> <ul style="list-style-type: none"> • Any work that commits must be an autonomous transaction. • Any rollback must be to a named savepoint created in the procedure. <p>If a precommit handler raises an exception, then the entire apply transaction is rolled back, and all of the messages in the transaction are moved to the error queue.</p> <p>See "Usage Notes" for more information about a precommit handler procedure.</p>
<code>negative_rule_set_name</code>	<p>The name of the negative rule set for the apply component. The negative rule set contains the rules that instruct the apply component to discard messages.</p> <p>If you want to use a negative rule set for the apply component, then you must specify an existing rule set in the form <code>[schema_name.]rule_set_name</code>. For example, to specify a negative rule set in the <code>hr</code> schema named <code>neg_apply_rules</code>, enter <code>hr.neg_apply_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>If you specify <code>NULL</code>, and no positive rule set is specified, then the apply component applies either all captured LCRs or all of the messages in the persistent queue, depending on the setting of the <code>apply_captured</code> parameter.</p> <p>An error is returned if the specified rule set does not exist.</p> <p>If you specify both a positive and a negative rule set for an apply component, then the negative rule set is always evaluated first.</p>

Table 24-5 (Cont.) CREATE_APPLY Procedure Parameters

Parameter	Description
<code>source_database</code>	<p>The global name of the source database for the changes that will be applied by the apply component. The source database is the database where the changes originated. If an apply component applies captured messages, then the apply component can apply messages from only one capture process at one source database.</p> <p>If NULL, then the source database name of the first LCR received by the apply component is used for the source database.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>NET</code>, then the procedure specifies <code>DBS1.NET</code> automatically.</p> <p>The rules in the apply component rule sets determine which messages are dequeued by the apply component. If the apply component dequeues an LCR with a source database that is different than the source database for the apply component, then an error is raised. You can determine the source database for an apply component by querying the <code>DBA_APPLY_PROGRESS</code> data dictionary view.</p>

Usage Notes

The following sections describe usage notes for this procedure:

- [DBA Role Requirement](#)
- [Handler Procedure Names](#)
- [Message Handler and DDL Handler Procedure](#)
- [Precommit Handler Procedure](#)
- [The CREATE_APPLY Procedure and XStream Outbound Servers](#)
- [The CREATE_APPLY Procedure and XStream Inbound Servers](#)

DBA Role Requirement

If the user who invokes this procedure is different from the user specified in the `apply_user` parameter, then the invoking user must be granted the `DBA` role. If the user who invokes this procedure is the same as the user specified in the `apply_user` parameter, then the `DBA` role is not required for the invoking user. Only the `SYS` user can set the `apply_user` to `SYS`.

Handler Procedure Names

For the `message_handler`, `ddl_handler`, and `precommit_handler` parameters, specify an existing procedure in one of the following forms:

- `[schema_name.]procedure_name`
- `[schema_name.]package_name.procedure_name`

If the procedure is in a package, then the `package_name` must be specified. For example, to specify a procedure in the `apply_pkg` package in the `hr` schema named `process_ddls`, enter `hr.apply_pkg.process_ddls`. An error is returned if the specified procedure does not exist.

The user who invokes the `CREATE_APPLY` procedure must have `EXECUTE` privilege on a specified handler procedure. Also, if the `schema_name` is not specified, then the user who invokes the `CREATE_APPLY` procedure is the default.

Message Handler and DDL Handler Procedure

The procedure specified in both the `message_handler` parameter and the `ddl_handler` parameter must have the following signature:

```
PROCEDURE handler_procedure (  
    parameter_name IN ANYDATA);
```

Here, `handler_procedure` stands for the name of the procedure and `parameter_name` stands for the name of the parameter passed to the procedure. For the message handler, the parameter passed to the procedure is a `ANYDATA` encapsulation of a user message. For the DDL handler procedure, the parameter passed to the procedure is a `ANYDATA` encapsulation of a DDL LCR.



See Also:

[Logical Change Record TYPEs](#) for information about DDL LCRs

Precommit Handler Procedure

The procedure specified in the `precommit_handler` parameter must have the following signature:

```
PROCEDURE handler_procedure (  
    parameter_name IN NUMBER);
```

Here, `handler_procedure` stands for the name of the procedure and `parameter_name` stands for the name of the parameter passed to the procedure. The parameter passed to the procedure is the commit SCN of a commit directive.

The CREATE_APPLY Procedure and XStream Outbound Servers

This procedure cannot create an XStream outbound server. To create an XStream outbound server, use the `DBMS_XSTREAM_ADM` package.

The CREATE_APPLY Procedure and XStream Inbound Servers

The following usage notes apply to this procedure and XStream inbound servers:

- The `CREATE_APPLY` procedure always creates an apply process. The apply process remains an apply process if it receives messages from a source other than an XStream client application, such as a capture process. The apply process can become an inbound server if an XStream client application attaches to it before it receives messages from any other source. After the initial contact, an apply process cannot be changed into an inbound server, and an inbound server cannot be changed into an apply process.
- When creating an inbound server using the `CREATE_APPLY` procedure, set the `apply_captured` parameter to `TRUE`. Inbound servers only process LCRs captured by a capture process.

- Inbound servers can use apply handlers. Inbound servers process only DML and DDL LCRs. Therefore, inbound servers ignore message handlers specified in the `message_handler` parameter.

24.4.5 CREATE_OBJECT_DEPENDENCY Procedure

This procedure creates an object dependency. An object dependency is a virtual dependency definition that defines a parent-child relationship between two objects at a destination database.

An apply component schedules execution of transactions that involve the child object after all transactions with a lower commit system change number (commit SCN) that involve the parent object have been committed. An apply component uses the object identifier of the objects in the logical change records (LCRs) to detect dependencies. The apply component does not use column values in the LCRs to detect dependencies.

Note:

An error is raised if `NULL` is specified for either of the procedure parameters.

See Also:

[DROP_OBJECT_DEPENDENCY Procedure](#)

Syntax

```
DBMS_APPLY_ADM.CREATE_OBJECT_DEPENDENCY (
    object_name          IN VARCHAR2,
    parent_object_name  IN VARCHAR2);
```

Parameters

Table 24-6 CREATE_OBJECT_DEPENDENCY Procedure Parameters

Parameter	Description
<code>object_name</code>	The name of the child database object, specified as <code>[schema_name.]object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default.
<code>parent_object_name</code>	The name of the parent database object, specified as <code>[schema_name.]object_name</code> . For example, <code>hr.departments</code> . If the schema is not specified, then the current user is the default.

Usage Notes

The following usage notes apply to this procedure:

- [The CREATE_OBJECT_DEPENDENCY Procedure and XStream Outbound Servers](#)
- [The CREATE_OBJECT_DEPENDENCY Procedure and XStream Inbound Servers](#)

The CREATE_OBJECT_DEPENDENCY Procedure and XStream Outbound Servers

This procedure has no effect on XStream outbound servers.

The CREATE_OBJECT_DEPENDENCY Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.6 DELETE_ALL_ERRORS Procedure

This procedure deletes all the error transactions for the specified apply component.

Syntax

```
DBMS_APPLY_ADM.DELETE_ALL_ERRORS (
    apply_name IN VARCHAR2 DEFAULT NULL);
```

Parameter

Table 24-7 DELETE_ALL_ERRORS Procedure Parameter

Parameter	Description
apply_name	The name of the apply component that raised the errors while processing the transactions. Do not specify an owner. If NULL, then all error transactions for all apply components are deleted.

Usage Notes

The following usage notes apply to this procedure:

- [The DELETE_ALL_ERRORS Procedure and XStream Outbound Servers](#)
- [The DELETE_ALL_ERRORS Procedure and XStream Inbound Servers](#)

The DELETE_ALL_ERRORS Procedure and XStream Outbound Servers

Outbound servers do not enqueue error transactions into an error queue. This procedure has no effect on XStream outbound servers.

The DELETE_ALL_ERRORS Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.7 DELETE_ERROR Procedure

This procedure deletes the specified error transaction.

Syntax

```
DBMS_APPLY_ADM.DELETE_ERROR (
    local_transaction_id IN VARCHAR2);
```

Parameter

Table 24-8 DELETE_ERROR Procedure Parameter

Parameter	Description
<code>local_transaction_id</code>	The identification number of the error transaction to delete. If the specified transaction does not exist in the error queue, then an error is raised.

Usage Notes

The following usage notes apply to this procedure:

The DELETE_ERROR Procedure and XStream Outbound Servers

Outbound servers do not enqueue error transactions into an error queue. This procedure has no effect on XStream outbound servers.

The DELETE_ERROR Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.8 DROP_APPLY Procedure

This procedure drops an apply component.

Syntax

```
DBMS_APPLY_ADM.DROP_APPLY(
    apply_name          IN VARCHAR2,
    drop_unused_rule_sets IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 24-9 DROP_APPLY Procedure Parameters

Parameter	Description
<code>apply_name</code>	The name of the apply component being dropped. You must specify an existing apply component name. Do not specify an owner.
<code>drop_unused_rule_sets</code>	<p>If <code>TRUE</code>, then the procedure drops any rule sets, positive and negative, used by the specified apply component if these rule sets are not used by any other Oracle Replication or XStream component. These components include capture processes, propagations, apply processes, inbound servers, and messaging clients. If this procedure drops a rule set, then this procedure also drops any rules in the rule set that are not in another rule set.</p> <p>If <code>FALSE</code>, then the procedure does not drop the rule sets used by the specified apply component, and the rule sets retain their rules.</p>

Usage Notes

The following usage notes apply to this procedure:

- [The DROP_APPLY Procedure and Rules](#)
- [The DROP_APPLY Procedure and XStream Outbound Servers](#)
- [The DROP_APPLY Procedure and XStream Inbound Servers](#)

The DROP_APPLY Procedure and Rules

When you use this procedure to drop an apply component, information about rules created for the apply component is removed from the data dictionary views for rules. Information about such a rule is removed even if the rule is not in either the positive or negative rule set for the apply component. The following are the data dictionary views for rules:

- ALL_STREAMS_GLOBAL_RULES
- DBA_STREAMS_GLOBAL_RULES
- ALL_STREAMS_SCHEMA_RULES
- DBA_STREAMS_SCHEMA_RULES
- ALL_STREAMS_TABLE_RULES
- DBA_STREAMS_TABLE_RULES

The DROP_APPLY Procedure and XStream Outbound Servers

When the `DROP_APPLY` procedure is executed on an outbound server, it runs the `DROP_OUTBOUND` procedure in the `DBMS_XSTREAM_ADM` package. Therefore, it might also drop the outbound server's capture process and queue.

The DROP_APPLY Procedure and XStream Inbound Servers

When the `DROP_APPLY` procedure is executed on an inbound server, it runs the `DROP_INBOUND` procedure in the `DBMS_XSTREAM_ADM` package. Therefore, it might also drop the inbound server's queue.

24.4.9 DROP_OBJECT_DEPENDENCY Procedure

This procedure drops an object dependency. An object dependency is a virtual dependency definition that defines a parent-child relationship between two objects at a destination database.

Note:

- An error is raised if an object dependency does not exist for the specified database objects.
- An error is raised if `NULL` is specified for either of the procedure parameters.



See Also:

[CREATE_OBJECT_DEPENDENCY Procedure](#)

Syntax

```
DBMS_APPLY_ADM.DROP_OBJECT_DEPENDENCY (
    object_name      IN  VARCHAR2,
    parent_object_name IN  VARCHAR2);
```

Parameters

Table 24-10 DROP_OBJECT_DEPENDENCY Procedure Parameters

Parameter	Description
object_name	The name of the child database object, specified as <i>[schema_name.]object_name</i> . For example, <i>hr.employees</i> . If the schema is not specified, then the current user is the default.
parent_object_name	The name of the parent database object, specified as <i>[schema_name.]object_name</i> . For example, <i>hr.departments</i> . If the schema is not specified, then the current user is the default.

Usage Notes

The following usage notes apply to this procedure:

The DROP_OBJECT_DEPENDENCY Procedure and XStream Outbound Servers

This procedure has no effect on XStream outbound servers.

The DROP_OBJECT_DEPENDENCY Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.10 EXECUTE_ALL_ERRORS Procedure

This procedure re-executes the error transactions in the error queue for the specified apply component.

The transactions are re-executed in commit SCN order. Error re-execution stops if an error is raised.

Syntax

```
DBMS_APPLY_ADM.EXECUTE_ALL_ERRORS (
    apply_name      IN  VARCHAR2  DEFAULT NULL,
    execute_as_user IN  BOOLEAN   DEFAULT FALSE);
```

Parameters

Table 24-11 EXECUTE_ALL_ERRORS Procedure Parameters

Parameter	Description
<code>apply_name</code>	The name of the apply component that raised the errors while processing the transactions. Do not specify an owner. If <code>NULL</code> , then all error transactions for all apply components are re-executed.
<code>execute_as_user</code>	If <code>TRUE</code> , then the procedure re-executes the transactions in the security context of the current user. If <code>FALSE</code> , then the procedure re-executes each transaction in the security context of the original receiver of the transaction. The original receiver is the user who was processing the transaction when the error was raised. The <code>DBA_APPLY_ERROR</code> data dictionary view lists the original receiver for each error transaction. The user who executes the transactions must have privileges to perform DML and DDL changes on the apply objects and to run any apply handlers. This user must also have dequeue privileges on the queue used by the apply component.

Usage Notes

The following usage notes apply to this procedure:

- [The EXECUTE_ALL_ERRORS Procedure and XStream Outbound Servers](#)
- [The EXECUTE_ALL_ERRORS Procedure and XStream Inbound Servers](#)

The EXECUTE_ALL_ERRORS Procedure and XStream Outbound Servers

Outbound servers do not enqueue error transactions into an error queue. This procedure cannot be used with XStream outbound servers.

The EXECUTE_ALL_ERRORS Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.11 EXECUTE_ERROR Procedure

This procedure re-executes the specified error transaction in the error queue.

Syntax

```
DBMS_APPLY_ADM.EXECUTE_ERROR(
    local_transaction_id IN VARCHAR2,
    execute_as_user      IN BOOLEAN  DEFAULT FALSE,
    user_procedure       IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 24-12 EXECUTE_ERROR Procedure Parameters

Parameter	Description
<code>local_transaction_id</code>	The identification number of the error transaction to execute. If the specified transaction does not exist in the error queue, then an error is raised.
<code>execute_as_user</code>	If <code>TRUE</code> , then the procedure re-executes the transaction in the security context of the current user. If <code>FALSE</code> , then the procedure re-executes the transaction in the security context of the original receiver of the transaction. The original receiver is the user who was processing the transaction when the error was raised. The <code>DBA_APPLY_ERROR</code> data dictionary view lists the original receiver for each error transaction. The user who executes the transaction must have privileges to perform DML and DDL changes on the apply objects and to run any apply handlers. This user must also have dequeue privileges on the queue used by the apply component.
<code>user_procedure</code>	A user-defined procedure that modifies the error transaction so that it can be successfully executed. Specify <code>NULL</code> to execute the error transaction without running a user procedure. See Also: "Usage Notes" for more information about the user procedure

Usage Notes

The following usage notes apply to this procedure:

- [The User Procedure](#)
- [The EXECUTE_ERROR Procedure and XStream Outbound Servers](#)
- [The EXECUTE_ERROR Procedure and XStream Inbound Servers](#)

The User Procedure

You must specify the full procedure name for the `user_procedure` parameter in one of the following forms:

- `[schema_name.]package_name.procedure_name`
- `[schema_name.]procedure_name`

If the procedure is in a package, then the `package_name` must be specified. The user who invokes the `EXECUTE_ERROR` procedure must have `EXECUTE` privilege on the specified procedure. Also, if the `schema_name` is not specified, then the user who invokes the `EXECUTE_ERROR` procedure is the default.

For example, suppose the `procedure_name` has the following properties:

- `strmadmin` is the `schema_name`.
- `fix_errors` is the `package_name`.

- `fix_hr_errors` is the *procedure_name*.

In this case, specify the following:

```
strmadmin.fix_errors.fix_hr_errors
```

The procedure you create for error handling must have the following signature:

```
PROCEDURE user_procedure (
    in_anydata          IN      ANYDATA,
    error_record        IN      DBA_APPLY_ERROR%ROWTYPE,
    error_message_number IN      NUMBER,
    messaging_default_processing IN OUT BOOLEAN,
    out_anydata         OUT     ANYDATA);
```

The user procedure has the following parameters:

- `in_anydata`: The `ANYDATA` encapsulation of a message that the apply component passes to the procedure. A single transaction can include multiple messages. A message can be a row logical change record (row LCR), a DDL logical change record (DDL LCR), or a user message.
- `error_record`: The row in the `DBA_APPLY_ERROR` data dictionary view that identifies the transaction
- `error_message_number`: The message number of the `ANYDATA` object in the `in_anydata` parameter, starting at 1
- `messaging_default_processing`: If `TRUE`, then the apply component continues processing the message in the `in_anydata` parameter, which can include executing DML or DDL statements and invoking apply handlers.
If `FALSE`, then the apply component skips processing the message in the `in_anydata` parameter and moves on to the next message in the `in_anydata` parameter.
- `out_anydata`: The `ANYDATA` object processed by the user procedure and used by the apply component if `messaging_default_processing` is `TRUE`.

If an LCR is executed using the `EXECUTE LCR` member procedure in the user procedure, then the LCR is executed directly, and the `messaging_default_processing` parameter should be set to `FALSE`. In this case, the LCR is not passed to any apply handlers.

Processing an error transaction with a user procedure results in one of the following outcomes:

- The user procedure modifies the transaction so that it can be executed successfully.
- The user procedure fails to make the necessary modifications, and an error is raised when transaction execution is attempted. In this case, the transaction is rolled back and remains in the error queue.

The following restrictions apply to the user procedure:

- Do not execute `COMMIT` or `ROLLBACK` statements. Doing so can endanger the consistency of the transaction.
- Do not modify `LONG`, `LONG RAW` or `LOB` column data in an LCR.
- If the `ANYDATA` object in the `in_anydata` parameter is a row LCR, then the `out_anydata` parameter must be row LCR if the `messaging_default_processing` parameter is set to `TRUE`.

- If the ANYDATA object in the `in_anydata` parameter is a DDL LCR, then the `out_anydata` parameter must be DDL LCR if the `messaging_default_processing` parameter is set to `TRUE`.
- The user who runs the user procedure must have the `SELECT` or `READ` privilege on the `DBA_APPLY_ERROR` data dictionary view.

 **Note:**

LCRs containing transactional directives, such as `COMMIT` and `ROLLBACK`, are not passed to the user procedure.

The EXECUTE_ERROR Procedure and XStream Outbound Servers

Outbound servers do not enqueue error transactions into an error queue. This procedure cannot be used with XStream outbound servers.

The EXECUTE_ERROR Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.12 GET_ERROR_MESSAGE Function

This function returns the message payload from the error queue for the specified message number and transaction identifier. The message can be a logical change record (LCR) or a non-LCR message.

This function is overloaded. One version of this function contains two `OUT` parameters. These `OUT` parameters contain the destination queue into which the message should be enqueued, if one exists, and whether the message should be executed. The destination queue is specified using the `SET_ENQUEUE_DESTINATION` procedure, and the execution directive is specified using the `SET_EXECUTE` procedure.

 **See Also:**

- [SET_ENQUEUE_DESTINATION Procedure](#)
- [SET_EXECUTE Procedure](#)

Syntax

```
DBMS_APPLY_ADM.GET_ERROR_MESSAGE (
  message_number      IN   NUMBER,
  local_transaction_id IN  VARCHAR2,
  destination_queue_name OUT VARCHAR2,
  execute             OUT  BOOLEAN)
RETURN ANYDATA;
```

```
DBMS_APPLY_ADM.GET_ERROR_MESSAGE (
  message_number      IN   NUMBER,
  local_transaction_id IN  VARCHAR2)
RETURN ANYDATA;
```

Parameters

Table 24-13 GET_ERROR_MESSAGE Function Parameters

Parameter	Description
message_number	The identification number of the message. This number identifies the position of the message in the transaction. Query the DBA_APPLY_ERROR data dictionary view to view the message number of each apply error.
local_transaction_id	Identifier of the error transaction for which to return a message
destination_queue_name	Contains the name of the queue into which the message should be enqueued. If the message should not be enqueued into a queue, then this parameter contains NULL.
execute	Contains TRUE if the message should be executed Contains FALSE if the message should not be executed

Usage Notes

The following usage notes apply to this procedure:

- [The GET_ERROR_MESSAGE Procedure and XStream Outbound Servers](#)
- [The GET_ERROR_MESSAGE Procedure and XStream Inbound Servers](#)

The GET_ERROR_MESSAGE Procedure and XStream Outbound Servers

Outbound servers do not enqueue error transactions into an error queue. This procedure cannot be used with XStream outbound servers.

The GET_ERROR_MESSAGE Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.13 HANDLE_COLLISIONS

This procedure enables or disables basic conflict resolution for an apply process and a table.

Syntax

```
DBMS_APPLY_ADM.HANDLE_COLLISIONS(
  apply_name      IN  VARCHAR2,
  enable          IN  BOOLEAN,
  object          IN  VARCHAR2,
  source_object   IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 24-14 HANDLE_COLLISIONS Procedure Parameters

Parameter	Description
apply_name	The name of the apply process.

Table 24-14 (Cont.) HANDLE_COLLISIONS Procedure Parameters

Parameter	Description
enable	<p>If TRUE, then the following conflict resolution methods are used:</p> <ul style="list-style-type: none"> When a conflict is detected for a row that exists in the table, the data in the row LCR overwrites the data in the table. When a conflict is detected for a row that does not exist in the table, the data in the row LCR is ignored. <p>If FALSE then it disables conflict resolution set by this procedure for the specified apply process and object.</p> <p>If NULL, then removes any explicit table-level setting for collision handling for the specified apply process and object.</p>
object	<p>The schema and name of the target table, specified as <code>[schema_name.]table_name</code> for the change of the setting.</p> <p>For example, if you are changing the setting for table <code>employees</code> owned by user <code>hr</code>, then specify <code>hr.employees</code>. If the schema is not specified, then the current user is the default.</p>
source_object	<p>The schema and object name of the source table, specified as <code>[schema_name.]table_name</code> for the table where the change originated.</p> <p>For example, if the change originated at the <code>employees</code> table owned by user <code>hr</code>, then specify <code>hr.employees</code>. If the schema is not specified, then the current user is the default.</p>

24.4.14 SET_DML_CONFLICT_HANDLER Procedure

This procedure adds, modifies, or removes a prebuilt DML conflict handler for INSERT, UPDATE, or DELETE conflicts on the specified object.

This procedure is overloaded. The `column_list` and `column_table` parameters are mutually exclusive.

Syntax

```
DBMS_APPLY_ADM.SET_DML_CONFLICT_HANDLER(
    apply_name          IN VARCHAR2,
    conflict_handler_name IN VARCHAR2,
    object              IN VARCHAR2 DEFAULT NULL,
    operation_name      IN VARCHAR2 DEFAULT NULL,
    conflict_type       IN VARCHAR2 DEFAULT NULL,
    method_name        IN VARCHAR2 DEFAULT NULL,
    column_list         IN VARCHAR2 DEFAULT NULL,
    resolution_column   IN VARCHAR2 DEFAULT NULL,
    source_object       IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_APPLY_ADM.SET_DML_CONFLICT_HANDLER(
    apply_name          IN VARCHAR2,
    conflict_handler_name IN VARCHAR2,
    object              IN VARCHAR2 DEFAULT NULL,
    operation_name      IN VARCHAR2 DEFAULT NULL,
    conflict_type       IN VARCHAR2 DEFAULT NULL,
    method_name        IN VARCHAR2 DEFAULT NULL,
    column_table       IN DBMS_UTILITY.LNAME_ARRAY,
```

```

resolution_column    IN VARCHAR2 DEFAULT NULL,
source_object        IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 24-15 SET_DML_CONFLICT_HANDLER Procedure Parameters

Parameter	Description
apply_name	The name of the apply process.
conflict_handler_name	The name of the conflict handler.
object	<p>The schema and name of the target table, specified as [<i>schema name.</i>] <i>table name</i> for which a conflict handler is being added, modified, or removed.</p> <p>For example, if an update conflict handler is being added for table <code>employees</code> owned by user <code>hr</code>, then specify <code>hr.employees</code>. If the schema is not specified, then the current user is the default.</p>
operation_name	<p>The name of the operation, which can be specified as:</p> <ul style="list-style-type: none"> • INSERT • UPDATE • DELETE <p>In order to set up conflict handlers for different operations on the same table, you must make one call per operation.</p>
conflict_type	<p>Type of update conflict handler to create.</p> <p>You can specify one of the prebuilt handlers, which determine whether the column list from the source database is applied for the row or whether the values in the row at the destination database are retained:</p> <ul style="list-style-type: none"> • <code>ROW_EXISTS</code>: A row with the same primary key already exists in the database for an insert or update. • <code>ROW_MISSING</code>: A row with the same primary key cannot be found for an update or delete.

Table 24-15 (Cont.) SET_DML_CONFLICT_HANDLER Procedure Parameters

Parameter	Description
method_name	<p>Type of update conflict handler to create.</p> <p>You can specify one of the prebuilt handlers, which determine whether the column list from the source database is applied for the row or whether the values in the row at the destination database are retained:</p> <ul style="list-style-type: none"> • DELTA: If the conflict type is <code>ROW_EXISTS</code> and the LCR is an update, then take the difference between the old and new values of the column in the LCR and add it to the current value of the column in the target database. The columns in the column group must be of type <code>NUMBER</code>. • IGNORE: Silently ignores the LCR and can be used for all conflict types. • MAXIMUM: Applies the column list from the source database if it has the greater value for the resolution column. Otherwise, retains the values at the destination database. This resolution method is only supported for <code>ROW_EXISTS</code> and only applies to inserts and updates. • MINIMUM: Applies the column list from the source database if it has the lesser value for the resolution column. Otherwise, retains the values at the destination database. This resolution method is only supported for <code>ROW_EXISTS</code> and only applies to inserts and updates. • OVERWRITE: Applies the column list from the source database, overwriting the column values at the destination database. An <code>INSERT</code> with <code>ROW_EXISTS</code> is converted to an <code>UPDATE</code>. An <code>UPDATE</code> with <code>ROW_MISSING</code> is converted to an <code>INSERT</code>. A <code>DELETE</code> with <code>ROW_MISSING</code> is ignored. • RECORD: Enqueue the LCR into the error queue. Can be used for all conflict types and can only be specified for a column group that contains all the columns in the table. • MAX_AND_EQUALS: Applies the column list from the source database if the value of resolution column is greater than or equal to the value of the column in the database. • MIN_AND_EQUALS: Applies the column list from the source database if the value of resolution column is less than or equal to the value of the column in the database. <p>If <code>NULL</code>, then the procedure removes any existing conflict handler with the same <code>object_name</code>, <code>resolution_group</code>, and <code>conflict_type</code>.</p> <p>If a conflict handler already exists with the same <code>object_name</code> and <code>resolution_column</code> and <code>conflict_type</code>, then the existing handler is replaced.</p>

Table 24-15 (Cont.) SET_DML_CONFLICT_HANDLER Procedure Parameters

Parameter	Description
<code>column_list</code>	<p>A comma-separated list of the column names for which the conflict handler is called.</p> <p>The same column cannot be in more than one column list (for a given <code>apply_name</code>, <code>object_name</code>, <code>operation_name</code> and <code>conflict_type</code>).</p> <p>Specify <code>*</code> for the default column group, which includes all the columns in the table that are not already specified in another column list (for a given <code>apply_name</code>, <code>object_name</code>, <code>operation_name</code> and <code>conflict_type</code>).</p> <p>If a conflict occurs for one or more of the columns in the list when an apply component tries to apply a row logical change record (row LCR), then the conflict handler is called to resolve the conflict. The conflict handler is not called if a conflict occurs only for columns that are not in the list.</p> <p>You cannot use a <code>column_list</code> if you use a <code>*</code> in the <code>object_name</code>.</p> <p>The only time you can use multiple column groups is when you are specifying a conflict handler for insert or update for <code>ROW_EXISTS</code>.</p> <p>Note: Prebuilt conflict handlers do not support LOB, LONG, LONG RAW, user-defined type, and Oracle-supplied type columns. Therefore, you should not include these types of columns in the <code>column_list</code> parameter.</p> <p>This parameter must be set to <code>'*'</code> in the following cases:</p> <ul style="list-style-type: none"> • The <code>operation_name</code> is DELETE. • The <code>method_name</code> is RECORD. • The <code>operation_name</code> is UPDATE and the <code>conflict_type</code> is ROW_MISSING.
<code>column_table</code>	<p>An array of column names for which the conflict handler is called.</p> <p>This parameter is the same as the <code>column_list</code> parameter, but it uses an array instead of a list for the column names.</p> <p>Note: The <code>column_list</code> and <code>column_table</code> parameters are mutually exclusive.</p>
<code>resolution_column</code>	<p>For the MAXIMUM and MINIMUM prebuilt methods, the resolution column is the one tested to determine whether the current row or the LCR has the smaller value. The resolution column must be one of the columns listed in the <code>column_list</code> or <code>column_table</code> parameter.</p> <p>You can specify NULL for other resolution methods.</p>
<code>source_object</code>	<p>The schema and object name of the source table, specified as <code>[schema_name.]table_name</code> for the table where the change originated.</p> <p>For example, if the change originated at the <code>employees</code> table owned by user <code>hr</code>, then specify <code>hr.employees</code>. If the schema is not specified, then the current user is the default.</p>

Usage Notes

The following usage notes apply to this procedure:

- [Modifying an Existing Conflict Handler](#)

- [Removing an Existing Conflict Handler](#)
- [Series of Actions for Conflicts](#)
- [Procedure DML Handlers for Conflicts](#)
- [A Column Can Be in Only One Column List](#)
- [The SET_DML_CONFLICT_HANDLER Procedure and XStream Outbound Servers](#)
- [The SET_DML_CONFLICT_HANDLER Procedure and XStream Inbound Servers](#)
- [Table 24-16](#)
- [Example](#)

Modifying an Existing Conflict Handler

If you want to modify an existing conflict handler, then you specify the `object`, `conflict_type`, and `resolution_column` of an the existing conflict handler. You can modify the `method_name` or the `column_list`.

Removing an Existing Conflict Handler

If you want to remove an existing conflict handler, then specify `NULL` for the `method_name` and specify the `object`, `conflict_type`, and `resolution_column` of the existing conflict handler.

Series of Actions for Conflicts

If an conflict occurs, then Oracle completes the following series of actions:

1. Calls the appropriate conflict handler to resolve the conflict
2. If no conflict handler is specified or if the conflict handler cannot resolve the conflict, then calls the appropriate error handler for the apply component, object name, and operation name to handle the error
3. If no error handler is specified or if the error handler cannot resolve the error, then raises an error and moves the transaction containing the row LCR that caused the error to the error queue



See Also:

["Signature of a DML Handler Procedure or Error Handler Procedure"](#) for information about setting an error handler

Procedure DML Handlers for Conflicts

If you cannot use a prebuilt conflict handler to meet your requirements, then you can create a PL/SQL procedure to use as a custom conflict handler. You use the `SET_DML_HANDLER` procedure to designate one or more custom conflict handlers for a particular table. In addition, a custom conflict handler can process LOB columns and use LOB assembly.



See Also:

[SET_DML_HANDLER Procedure](#)

A Column Can Be in Only One Column List

When a column is in a column list, and you try to add the same column to another column list, this procedure returns the following error:

```
ORA-00001: UNIQUE CONSTRAINT (SYS.APPLY$_CONF_HDLR_COLUMNS_UNQ1) VIOLATED
```

The SET_DML_CONFLICT_HANDLER Procedure and XStream Outbound Servers

This procedure has no effect on XStream outbound servers.

The SET_DML_CONFLICT_HANDLER Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

Table 24-16 Valid Combinations of Parameters

Operation	Conflict Type	Method
INSERT	ROW_EXISTS	OVERWRITE
		RECORD
		IGNORE
		MAXIMUM
		MINIMUM
UPDATE	ROW_EXISTS	OVERWRITE
		RECORD
		IGNORE
		MAXIMUM
		MINIMUM
UPDATE	ROW_MISSING	OVERWRITE
		RECORD
		IGNORE
		MAXIMUM
		MINIMUM
DELETE	ROW_EXISTS	OVERWRITE
		RECORD
		IGNORE
		MAXIMUM
		MINIMUM
DELETE	ROW_MISSING	RECORD
		IGNORE

Example

The following is an example for setting a conflict handler for the `employees` table in the `hr` schema:

```
DECLARE
  cols DBMS_UTILITY.NAME_ARRAY;
```

```

BEGIN
  cols(1) := 'salary';
  cols(2) := 'commission_pct';
  DBMS_APPLY_ADM.SET_DML_CONFLICT_HANDLER(
    apply_name          => 'appl1',
    conflict_handler_name => 'emp_handler_update',
    object              => 'hr.employees',
    operation_name      => 'UPDATE',
    conflict_type       => 'ROW_EXISTS',
    method_name        => 'MAXIMUM',
    resolution_column   => 'salary',
    column_table       => cols);
END;
/

```

This example sets a conflict handler named `emp_handler_update` that is called if a conflict occurs for the `salary` or `commission_pct` column in the `hr.employees` table. If such a conflict occurs, then the `salary` column is evaluated to resolve the conflict. If a conflict occurs only for a column that is not in the column list, such as the `job_id` column, then this conflict handler is not called.

24.4.15 SET_DML_HANDLER Procedure

This procedure sets or unsets a user procedure as a procedure DML handler for a specified operation on a specified database object for a single apply component or for all apply components in the database. The user procedure alters the apply behavior for the specified operation on the specified object.

Syntax

```

DBMS_APPLY_ADM.SET_DML_HANDLER(
  object_name          IN  VARCHAR2,
  object_type          IN  VARCHAR2,
  operation_name       IN  VARCHAR2,
  error_handler        IN  BOOLEAN   DEFAULT FALSE,
  user_procedure       IN  VARCHAR2,
  apply_database_link  IN  VARCHAR2  DEFAULT NULL,
  apply_name           IN  VARCHAR2  DEFAULT NULL,
  assemble_lobs       IN  BOOLEAN   DEFAULT TRUE);

```

Parameters

Table 24-17 SET_DML_HANDLER Procedure Parameters

Parameter	Description
<code>object_name</code>	The name of the source object specified as <code>[schema_name.]object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default. The specified object does not need to exist when you run this procedure.
<code>object_type</code>	The type of the source object. Currently, <code>TABLE</code> is the only possible source object type.

Table 24-17 (Cont.) SET_DML_HANDLER Procedure Parameters

Parameter	Description
operation_name	<p>The name of the operation, which can be specified as:</p> <ul style="list-style-type: none"> • INSERT • UPDATE • DELETE • LOB_UPDATE • DEFAULT <p>The procedure must be run for each operation individually.</p> <p>Specify <code>DEFAULT</code> to set the procedure as the default procedure DML handler for the database object. In this case, the procedure DML handler is used for any <code>INSERT</code>, <code>UPDATE</code>, <code>DELETE</code>, and <code>LOB_WRITE</code> on the database object, if another procedure DML handler is not specifically set for the operation on the database object.</p>
error_handler	<p>If <code>TRUE</code>, then the specified user procedure is run when a row logical change record (row LCR) involving the specified operation on the specified object raises an apply error. You can code the user procedure to resolve possible error conditions, notify administrators of the error, log the error, or any combination of these actions.</p> <p>If <code>FALSE</code>, then the handler being set is run for all row LCRs involving the specified operation on the specified object.</p>
user_procedure	<p>A user-defined procedure that is invoked during apply for the specified operation on the specified object. If the procedure is a procedure DML handler, then it is invoked instead of the default apply performed by Oracle. If the procedure is an error handler, then it is invoked when an apply error is encountered.</p> <p>Specify <code>NULL</code> to unset a procedure DML handler that is set for the specified operation on the specified object.</p>
apply_database_link	<p>The name of the database link to a non-Oracle database. This parameter should be set only when the destination database is a non-Oracle database.</p>
apply_name	<p>The name of the apply component that uses the procedure DML handler or error handler.</p> <p>If <code>NULL</code>, then the procedure sets the procedure DML handler or error handler as a general handler for all apply components in the database.</p> <p>If the <code>user_procedure</code> parameter is set to <code>NULL</code> to unset a handler, and the handler being unset is set for a specific apply component, then use the <code>apply_name</code> parameter to specify the apply component to unset the handler.</p>
assemble_lob	<p>If <code>TRUE</code>, then LOB assembly is used for LOB columns in LCRs processed by the handler. LOB assembly combines multiple LCRs for a LOB column resulting from a single row change into one row LCR before passing the LCR to the handler. Database compatibility must be <code>10.2.0</code> or higher to use LOB assembly.</p> <p>If <code>FALSE</code>, then LOB assembly is not used for LOB columns in LCRs processed by the handler.</p>

Usage Notes

The following usage notes apply to this procedure:

- [Run the SET_DML_HANDLER Procedure at the Destination Database](#)
- [Procedure DML Handlers and Error Handlers](#)
- [The apply_name Parameter](#)
- [Signature of a DML Handler Procedure or Error Handler Procedure](#)
- [LOB Assembly](#)
- [The SET_DML_HANDLER Procedure and XStream Outbound Servers](#)
- [The SET_DML_HANDLER Procedure and XStream Inbound Servers](#)

Run the SET_DML_HANDLER Procedure at the Destination Database

Run this procedure at the destination database. The SET_DML_HANDLER procedure provides a way for users to apply logical change records containing DML changes (row LCRs) using a customized apply.

Procedure DML Handlers and Error Handlers

If the `error_handler` parameter is set to `TRUE`, then it specifies that the user procedure is an error handler. An error handler is invoked only when a row LCR raises an apply error. Such an error can result from a data conflict if no conflict handler is specified or if the update conflict handler cannot resolve the conflict. If the `error_handler` parameter is set to `FALSE`, then the user procedure is a procedure DML handler, not an error handler, and a procedure DML handler is always run instead of performing the specified operation on the specified object.

This procedure either sets a procedure DML handler or an error handler for a particular operation on an object. It cannot set both a procedure DML handler and an error handler for the same object and operation.

 **Note:**

Currently, setting an error handler for an apply component that is applying changes to a non-Oracle database is not supported.

The apply_name Parameter

If the `apply_name` parameter is non-NULL, then the procedure DML handler or error handler is set for the specified apply component. In this case, this handler is not invoked for other apply components at the local destination database. If the `apply_name` parameter is NULL, the default, then the handler is set as a general handler for all apply components at the destination database. When a handler is set for a specific apply component, then this handler takes precedence over any general handlers. For example, consider the following scenario:

- A procedure DML handler named `handler_hr` is specified for an apply component named `apply_hr` for `UPDATE` operations on the `hr.employees` table.

- A general procedure DML handler named `handler_gen` also exists for `UPDATE` operations on the `hr.employees` table.

In this case, the `apply_hr` apply component uses the `handler_hr` procedure DML handler for `UPDATE` operations on the `hr.employees` table.

At the source database, you must specify an unconditional supplemental log group for the columns needed by a DML or error handler.

Signature of a DML Handler Procedure or Error Handler Procedure

You can use the `SET_DML_HANDLER` procedure to set either a procedure DML handler or an error handler for row LCRs that perform a specified operation on a specified object. The signatures of a DML handler procedure and of an error handler procedure are described following this section.

In either case, you must specify the full procedure name for the `user_procedure` parameter in one of the following forms:

- `[schema_name.]package_name.procedure_name`
- `[schema_name.]procedure_name`

If the procedure is in a package, then the `package_name` must be specified. The user who invokes the `SET_DML_HANDLER` procedure must have `EXECUTE` privilege on the specified procedure. Also, if the `schema_name` is not specified, then the user who invokes the `SET_DML_HANDLER` procedure is the default.

For example, suppose the `procedure_name` has the following properties:

- `hr` is the `schema_name`.
- `apply_pkg` is the `package_name`.
- `employees_default` is the `procedure_name`.

In this case, specify the following:

```
hr.apply_pkg.employees_default
```

The following restrictions apply to the user procedure:

- Do not execute `COMMIT` or `ROLLBACK` statements. Doing so can endanger the consistency of the transaction that contains the LCR.
- If you are manipulating a row using the `EXECUTE` member procedure for the row LCR, then do not attempt to manipulate more than one row in a row operation. You must construct and execute manually any DML statements that manipulate more than one row.
- If the command type is `UPDATE` or `DELETE`, then row operations resubmitted using the `EXECUTE` member procedure for the LCR must include the entire key in the list of old values. The key is the primary key or the smallest unique index that has at least one `NOT NULL` column, unless a substitute key has been specified by the `SET_KEY_COLUMNS` procedure. If there is no specified key, then the key consists of all non `LOB`, non `LONG`, and non `LONG RAW` columns.
- If the command type is `INSERT`, then row operations resubmitted using the `EXECUTE` member procedure for the LCR should include the entire key in the list of new values. Otherwise, duplicate rows are possible. The key is the primary key or the smallest unique index that has at least one `NOT NULL` column, unless a substitute key has been specified by the `SET_KEY_COLUMNS` procedure. If there is no specified key, then the key consists of

all of the table columns, except for columns of the following data types: LOB, LONG, LONG RAW, user-defined types (including object types, REFS, varrays, nested tables), and Oracle-supplied types (including Any types, XML types, spatial types, and media types).

The procedure specified in the `user_procedure` parameter must have the following signature:

```
PROCEDURE user_procedure (
    parameter_name IN ANYDATA);
```

Here, `user_procedure` stands for the name of the procedure and `parameter_name` stands for the name of the parameter passed to the procedure. The parameter passed to the procedure is a `ANYDATA` encapsulation of a row LCR.



See Also:

[Logical Change Record TYPEs](#) for more information about LCRs

The procedure you create for error handling must have the following signature:

```
PROCEDURE user_procedure (
    message          IN ANYDATA,
    error_stack_depth IN NUMBER,
    error_numbers    IN DBMS_UTILITY.NUMBER_ARRAY,
    error_messages   IN msg_array);
```

If you want to retry the DML operation within the error handler, then have the error handler procedure run the `EXECUTE` member procedure for the LCR. The last error raised is on top of the error stack. To specify the error message at the top of the error stack, use `error_numbers(1)` and `error_messages(1)`.



Note:

- Each parameter is required and must have the specified datatype. However, you can change the names of the parameters.
- The `msg_array` value must be a user-defined array that is a table of type `VARCHAR2` with at least 76 characters.

Running an error handler results in one of the following outcomes:

- The error handler successfully resolves the error and returns control to the apply component.
- The error handler fails to resolve the error, and the error is raised. The raised error causes the transaction to be rolled back and placed in the error queue.

LOB Assembly

Do not modify `LONG`, `LONG RAW`, or nonassembled LOB column data in an LCR with procedure DML handlers, error handlers, or custom rule-based transformation

functions. Procedure DML handlers and error handlers can modify LOB columns in row LCRs that have been constructed by LOB assembly.

The SET_DML_HANDLER Procedure and XStream Outbound Servers

Outbound servers ignore all apply handlers. This procedure has no effect on XStream outbound servers.

The SET_DML_HANDLER Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.16 SET_ENQUEUE_DESTINATION Procedure

This procedure sets the queue where the apply component automatically enqueues a message that satisfies the specified rule.

This procedure modifies the specified rule's action context to specify the queue. A rule action context is optional information associated with a rule that is interpreted by the client of the rules engine after the rule evaluates to `TRUE` for a message. In this case, the client of the rules engine is an apply component. The information in an action context is an object of type `SYS.RE$NV_LIST`, which consists of a list of name-value pairs.

A queue destination specified by this procedure always consists of the following name-value pair in an action context:

- The name is `APPLY$_ENQUEUE`.
- The value is an `ANYDATA` instance containing the queue name specified as a `VARCHAR2`.

Syntax

```
DBMS_APPLY_ADM.SET_ENQUEUE_DESTINATION(
    rule_name           IN VARCHAR2,
    destination_queue_name IN VARCHAR2);
```

Parameters

Table 24-18 SET_ENQUEUE_DESTINATION Procedure Parameters

Parameter	Description
<code>rule_name</code>	The name of the rule, specified as <code>[schema_name.]rule_name</code> . For example, to specify a rule named <code>hr5</code> in the <code>hr</code> schema, enter <code>hr.hr5</code> for this parameter. If the schema is not specified, then the current user is the default.

Table 24-18 (Cont.) SET_ENQUEUE_DESTINATION Procedure Parameters

Parameter	Description
<code>destination_queue_name</code>	<p>The name of the queue into which the apply component enqueues the message. Specify the queue in the form <code>[schema_name.]queue_name</code>. Only local queues can be specified.</p> <p>For example, to specify a queue in the <code>hr</code> schema named <code>streams_queue</code>, enter <code>hr.streams_queue</code>. If the schema is not specified, then the current user is the default.</p> <p>If NULL, then an existing name-value pair with the name <code>APPLY\$ENQUEUE</code> is removed. If no name-value pair exists with the name <code>APPLY\$ENQUEUE</code> for the rule, then no action is taken.</p> <p>If non-NULL and a name-value pair exists for the rule with the name <code>APPLY\$ENQUEUE</code>, then it is removed, and a new name-value pair with the value specified by this parameter is added.</p>

Usage Notes

The following usage notes apply to this procedure:

- [The SET_ENQUEUE_DESTINATION Procedure and Apply Handlers](#)
- [Considerations for the SET_ENQUEUE_DESTINATION Procedure](#)
- [The SET_ENQUEUE_DESTINATION Procedure and XStream Outbound Servers](#)
- [The SET_ENQUEUE_DESTINATION Procedure and XStream Inbound Servers](#)

The SET_ENQUEUE_DESTINATION Procedure and Apply Handlers

If an apply handler, such as a procedure DML handler, DDL handler, or message handler, processes a message that also is enqueued into a destination queue, then the apply handler processes the message before it is enqueued.

Considerations for the SET_ENQUEUE_DESTINATION Procedure

The following are considerations for using this procedure:

- This procedure does not verify that the specified queue exists. If the queue does not exist, then an error is raised when an apply component tries to enqueue a message into it.
- Oracle Replication capture processes, propagations, and messaging clients ignore the action context created by this procedure.
- The apply user of the apply component using the specified rule must have the necessary privileges to enqueue messages into the specified queue. If the queue is a secure queue, then the apply user must be a secure queue user of the queue.
- The specified rule must be in the positive rule set for an apply component. If the rule is in the negative rule set for an apply component, then the apply component does not enqueue the message into the destination queue.
- If the commit SCN for a message is less than or equal to the relevant instantiation SCN for the message, then the message is not enqueued into the destination queue, even if the message satisfies the apply component rule sets.

The SET_ENQUEUE_DESTINATION Procedure and XStream Outbound Servers

This procedure has no effect on XStream outbound servers.

The SET_ENQUEUE_DESTINATION Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.17 SET_EXECUTE Procedure

This procedure specifies whether a message that satisfies the specified rule is executed by an apply component.

This procedure modifies the specified rule's action context to specify message execution. A rule action context is optional information associated with a rule that is interpreted by the client of the rules engine after the rule evaluates to `TRUE` for a message. In this case, the client of the rules engine is an apply component. The information in an action context is an object of type `SYS.RE$NV_LIST`, which consists of a list of name-value pairs.

A message execution directive specified by this procedure always consists of the following name-value pair in an action context:

- The name is `APPLY$_EXECUTE`.
- The value is an `ANYDATA` instance that contains `NO` as a `VARCHAR2`. When the value is `NO`, an apply component does not execute the message and does not send the message to any apply handler.

Syntax

```
DBMS_APPLY_ADM.SET_EXECUTE (
    rule_name IN VARCHAR2,
    execute   IN BOOLEAN);
```

Parameters

Table 24-19 SET_EXECUTE Procedure Parameters

Parameter	Description
<code>rule_name</code>	The name of the rule, specified as <code>[schema_name.]rule_name</code> . For example, to specify a rule named <code>hr5</code> in the <code>hr</code> schema, enter <code>hr.hr5</code> for this parameter. If the schema is not specified, then the current user is the default.
<code>execute</code>	If <code>TRUE</code> , then the procedure removes the name-value pair with the name <code>APPLY\$_EXECUTE</code> for the specified rule. Removing the name-value pair means that the apply component executes messages that satisfy the rule. If no name-value pair with name <code>APPLY\$_EXECUTE</code> exists for the rule, then no action is taken. If <code>FALSE</code> , then the procedure adds a name-value pair to the rule's action context. The name is <code>APPLY\$_EXECUTE</code> and the value is <code>NO</code> . An apply component does not execute a message that satisfies the rule and does not send the message to any apply handler. If a name-value pair exists for the rule with the name <code>APPLY\$_EXECUTE</code> , then it is removed, and a new one with the value <code>NO</code> is added. If <code>NULL</code> , then the procedure raises an error.

Usage Notes

The following usage notes apply to this procedure:

- [Considerations for the SET_EXECUTE Procedure](#)

- [The SET_EXECUTE Procedure and XStream Outbound Servers](#)
- [The SET_EXECUTE Procedure and XStream Inbound Servers](#)

Considerations for the SET_EXECUTE Procedure

The following are considerations for using this procedure:

- If the message is a logical change record (LCR) and the message is not executed, then the change encapsulated in the LCR is not made to the relevant local database object. Also, if the message is not executed, then it is not sent to any apply handler.
- Oracle Replication capture processes, propagations, and messaging clients ignore the action context created by this procedure.
- The specified rule must be in the positive rule set for an apply component for the apply component to follow the execution directive. If the rule is in the negative rule set for an apply component, then the apply component ignores the execution directive for the rule.

The SET_EXECUTE Procedure and XStream Outbound Servers

This procedure has no effect on XStream outbound servers.

The SET_EXECUTE Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.18 SET_GLOBAL_INSTANTIATION_SCN Procedure

This procedure records the specified instantiation SCN for the specified source database and, optionally, for the schemas at the source database and the tables owned by these schemas. This procedure overwrites any existing instantiation SCN for the database, and, if it sets the instantiation SCN for a schema or a table, then it overwrites any existing instantiation SCN for the schema or table.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

This procedure gives you precise control over which DDL logical change records (DDL LCRs) from a source database are ignored and which DDL LCRs are applied by an apply component.

Syntax

```
DBMS_APPLY_ADM.SET_GLOBAL_INSTANTIATION_SCN(
  source_database_name  IN  VARCHAR2,
  instantiation_scn     IN  NUMBER,
  apply_database_link   IN  VARCHAR2  DEFAULT NULL,
  recursive             IN  BOOLEAN    DEFAULT FALSE,
  source_root_name      IN  VARCHAR2  DEFAULT NULL);
```

Parameters

Table 24-20 SET_GLOBAL_INSTANTIATION_SCN Procedure Parameters

Parameter	Description
source_database_name	The global name of the source database. For example, DBS1.NET. If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify DBS1 and the domain is NET, then the procedure specifies DBS1.NET automatically.
instantiation_scn	The instantiation SCN. Specify NULL to remove the instantiation SCN metadata for the source database from the data dictionary.
apply_database_link	The name of the database link to a non-Oracle database. This parameter should be set only when the destination database of a local apply component is a non-Oracle database.
recursive	If TRUE, then the procedure sets the instantiation SCN for the source database, all schemas in the source database, and all tables owned by the schemas in the source database. This procedure selects the schemas and tables from the ALL_USERS and ALL_TABLES data dictionary views, respectively, at the source database under the security context of the current user. If FALSE, then the procedure sets the global instantiation SCN for the source database, but does not set the instantiation SCN for any schemas or tables Note: If recursive is set to TRUE, then a database link from the destination database to the source database is required. This database link must have the same name as the global name of the source database and must be accessible to the current user. Also, a table must be accessible to the current user in either the ALL_TABLES or DBA_TABLES data dictionary view at the source database for this procedure to set the instantiation SCN for the table at the destination database.
source_root_name	The global name of the source root database. In a non-CDB, this parameter must be NULL. In a CDB, if you want to do the instantiation for a specific container then you must specify both source_database and source_root_name. If you want to do the instantiation for all the containers in the CDB, specify the source_root_name for the database and leave the source_database name as NULL.

Usage Notes

The following usage notes apply to this procedure:

- [Instantiation SCNs and DDL LCRs](#)
- [The recursive Parameter](#)
- [Considerations for the SET_GLOBAL_INSTANTIATION_SCN Procedure](#)
- [The SET_GLOBAL_INSTANTIATION_SCN Procedure and XStream Outbound Servers](#)
- [The SET_GLOBAL_INSTANTIATION_SCN Procedure and XStream Inbound Servers](#)
- [The SET_GLOBAL_INSTANTIATION_SCN Procedure and CDBs](#)

 **See Also:**

- [SET_SCHEMA_INSTANTIATION_SCN Procedure](#)
- [SET_TABLE_INSTANTIATION_SCN Procedure](#)
- [LCR\\$_DDL_RECORD Type](#) for more information about DDL LCRs

Instantiation SCNs and DDL LCRs

If the commit SCN of a DDL LCR for a database object from a source database is less than or equal to the instantiation SCN for that source database at a destination database, then the apply component at the destination database disregards the DDL LCR. Otherwise, the apply component applies the DDL LCR.

The global instantiation SCN specified by this procedure is used for a DDL LCR only if the DDL LCR does not have `object_owner`, `base_table_owner`, and `base_table_name` specified. For example, the global instantiation SCN set by this procedure is used for DDL LCRs with a `command_type` of `CREATE USER`.

The recursive Parameter

If the `recursive` parameter is set to `TRUE`, then this procedure sets the instantiation SCN for each schema at a source database and for the tables owned by these schemas. This procedure uses the `SET_SCHEMA_INSTANTIATION_SCN` procedure to set the instantiation SCN for each schema, and it uses the `SET_TABLE_INSTANTIATION_SCN` procedure to set the instantiation SCN for each table. Each schema instantiation SCN is used for DDL LCRs on the schema, and each table instantiation SCN is used for DDL LCRs and row LCRs on the table.

If the `recursive` parameter is set to `FALSE`, then this procedure does not set the instantiation SCN for any schemas or tables.

Considerations for the SET_GLOBAL_INSTANTIATION_SCN Procedure

The following are considerations for using this procedure:

- Any instantiation SCN specified by this procedure is used only for LCRs captured by a capture process. It is not used for user-created LCRs.
- The instantiation SCN is not set for the `SYS` or `SYSTEM` schemas.

The SET_GLOBAL_INSTANTIATION_SCN Procedure and XStream Outbound Servers

Instantiation SCNs are not required for database objects processed by an outbound server. If an instantiation SCN is set for a database object, then the outbound server only sends the LCRs for the database object with SCN values that are greater than the instantiation SCN value. If a database object does not have an instantiation SCN set, then the outbound server skips the instantiation SCN check and sends all LCRs for that database object. In both cases, the outbound server only sends LCRs that satisfy its rule sets.

The `apply_database_link` parameter must be set to `NULL` or to the local database for this procedure to set an instantiation SCN for an outbound server.

 **See Also:**

Oracle Database XStream Guide for more information about outbound servers and instantiation SCNs

The SET_GLOBAL_INSTANTIATION_SCN Procedure and XStream Inbound Servers

Inbound servers ignore instantiation SCNs. This procedure has no effect on XStream inbound servers.

The SET_GLOBAL_INSTANTIATION_SCN Procedure and CDBs

In a CDB, this procedure must be invoked from the same container as the apply process that uses the instantiation SCN information.

24.4.19 SET_KEY_COLUMNS Procedures

This procedure records the set of columns to be used as the substitute primary key for apply purposes and removes existing substitute primary key columns for the specified object if they exist.

This procedure is overloaded. The `column_list` and `column_table` parameters are mutually exclusive.

Syntax

```
DBMS_APPLY_ADM.SET_KEY_COLUMNS (
  object_name          IN  VARCHAR2,
  column_list          IN  VARCHAR2,
  apply_database_link IN  VARCHAR2 DEFAULT NULL,
  apply_name           IN  VARCHAR2 DEFAULT NULL);
```

```
DBMS_APPLY_ADM.SET_KEY_COLUMNS (
  object_name          IN  VARCHAR2,
  column_table         IN  DBMS_UTILITY.NAME_ARRAY,
  apply_database_link IN  VARCHAR2 DEFAULT NULL,
  apply_name           IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 24-21 SET_KEY_COLUMNS Procedure Parameters

Parameter	Description
<code>object_name</code>	The name of the table specified as <code>[schema_name.]object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default. If the apply component is applying changes to a non-Oracle database in a heterogeneous environment, then the object name is not verified.
<code>column_list</code>	A comma-delimited list of the columns in the table to use as the substitute primary key, with no spaces between the column names. If the <code>column_list</code> parameter is empty or <code>NULL</code> , then the current set of key columns is removed.

Table 24-21 (Cont.) SET_KEY_COLUMNS Procedure Parameters

Parameter	Description
<code>column_table</code>	A PL/SQL associative array of type <code>DBMS_UTILITY.NAME_ARRAY</code> of the columns in the table to use as the substitute primary key. The index for <code>column_table</code> must be 1-based, increasing, dense, and terminated by a <code>NULL</code> . If the <code>column_table</code> parameter is empty or <code>NULL</code> , then the current set of key columns is removed.
<code>apply_database_link</code>	The name of the database link to a non-Oracle database. This parameter should be set only when the destination database is a non-Oracle database.
<code>apply_name</code>	The name of the apply component.

Usage Notes

The following usage notes apply to this procedure:

- [Considerations for the SET_KEY_COLUMNS Procedure](#)
- [Duplicate Rows and Substitute Primary Key Columns](#)
- [The SET_KEY_COLUMNS Procedure and XStream Outbound Servers](#)
- [The SET_KEY_COLUMNS Procedure and XStream Inbound Servers](#)
- [The SET_KEY_COLUMNS Procedure and CDBs](#)

Considerations for the SET_KEY_COLUMNS Procedure

The following are considerations for using this procedure:

- When not empty, the specified set of columns takes precedence over any primary key for the specified object. Do not specify substitute key columns if the object has primary key columns and you want to use those primary key columns as the key.
- Run this procedure at the destination database. At the source database, you must specify an unconditional supplemental log group for the substitute key columns.
- Unlike true primary keys, columns specified as substitute key column columns can contain `NULLS`. However, Oracle recommends that each column you specify as a substitute key column be a `NOT NULL` column. You also should create a single index that includes all of the columns in a substitute key. Following these guidelines improves performance for updates, deletes, and piecewise updates to LOBs because Oracle can locate the relevant row more efficiently.
- Do not permit applications to update the primary key or substitute key columns of a table. This ensures that Oracle can identify rows and preserve the integrity of the data.
- If there is neither a primary key, nor a unique index that has at least one `NOT NULL` column, nor a substitute key for a table, then the key consists of all of the table columns, except for columns of the following data types: `LOB`, `LONG`, `LONG RAW`, user-defined types (including object types, `REFs`, `varrays`, nested tables), and Oracle-supplied types (including `Any` types, `XML` types, spatial types, and media types).

Duplicate Rows and Substitute Primary Key Columns

A table has duplicate rows when all of the column values are identical for two or more rows in the table, excluding LOB, LONG, and LONG RAW columns. You can specify substitute primary key columns for a table at a destination database using by the SET_KEY_COLUMNS procedure. When substitute primary key columns are specified for a table with duplicate rows at a destination database, and the allow_duplicate_rows apply component parameter is set to Y, meet the following requirements to keep the table data synchronized at the source and destination databases:

- Ensure that supplemental logging is specified at source database for the columns specified as substitute key columns at the destination database. The substitute key columns must be in an unconditional log group at the source database.
- Ensure that the substitute key columns uniquely identify each row in the table at the destination database.

The rest of this section provides more details about these requirements.

When there is no key for a table and the allow_duplicate_rows apply component parameter is set to Y, a single row LCR with an UPDATE or DELETE command type only is applied to one of the duplicate rows. In this case, if the table at the source database and the table at the destination database have corresponding duplicate rows, then a change that changes all of the duplicate rows at the source database also changes all the duplicate rows at the destination database when the row LCRs resulting from the change are applied.

For example, suppose a table at a source database has two duplicate rows. An update is performed on the duplicate rows, resulting in two row LCRs. At the destination database, one row LCR is applied to one of the duplicate rows. At this point, the rows are no longer duplicate at the destination database because one of the rows has changed. When the second row LCR is applied at the destination database, the rows are duplicate again. Similarly, if a delete is performed on these duplicate rows at the source database, then both rows are deleted at the destination database when the row LCRs resulting from the source change are applied.

When substitute primary key columns are specified for a table, row LCRs are identified with rows in the table during apply using the substitute primary key columns. If substitute primary key columns are specified for a table with duplicate rows at a destination database, and the allow_duplicate_rows apply component parameter is set to Y, then an update performed on duplicate rows at the source database can result in different changes when the row LCRs are applied at the destination database. Specifically, if the update does not change one of the columns specified as a substitute primary key column, then the same duplicate row can be updated multiple times at the destination database, while other duplicate rows might not be updated.

Also, if the substitute key columns do not identify each row in the table at the destination database uniquely, then a row LCR identified with multiple rows can update any one of the rows. In this case, the update in the row LCR might not be applied to the correct row in the table at the destination database.

An apply component ignores substitute primary key columns when it determines whether rows in a table are duplicates. An apply component determines that rows are duplicates only if all of the column values in the rows are identical (excluding LOB, LONG, and LONG RAW columns). Therefore, an apply component always raises an error if a single update or delete changes two or more nonduplicate rows in a table.

For example, consider a table with columns c1, c2, and c3 on which the SET_KEY_COLUMNS procedure is used to designate column c1 as the substitute primary key. If two rows have the same key value for the c1 column, but different value for the c2 or c3 columns, then an apply component does not treat the rows as duplicates. If an update or delete modifies more than

one row because the `c1` values in the rows are the same, then the apply component raises an error regardless of the setting for the `allow_duplicate_rows` apply component parameter.



See Also:

[SET_PARAMETER Procedure](#) for more information about the `allow_duplicate_rows` apply component parameter

The `SET_KEY_COLUMNS` Procedure and XStream Outbound Servers

This procedure has no effect on XStream outbound servers.

The `SET_KEY_COLUMNS` Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

The `SET_KEY_COLUMNS` Procedure and CDBs

This procedure defines the columns that are used as a substitute primary key. You must perform the `SET_KEY_COLUMNS` procedure in the appropriate PDB.

24.4.20 SET_PARAMETER Procedure

This procedure sets an apply parameter to the specified value.

Syntax

```
DBMS_APPLY_ADM.SET_PARAMETER (
  apply_name IN VARCHAR2,
  parameter  IN VARCHAR2,
  value      IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 24-22 SET_PARAMETER Procedure Parameters

Parameter	Description
<code>apply_name</code>	The apply component name. Do not specify an owner.
<code>parameter</code>	The name of the parameter you are setting.
<code>value</code>	The value to which the parameter is set. If <code>NULL</code> , then the parameter is set to its default value.

Apply Component Parameters

The following table lists the parameters for an apply component.



Note:

Starting from Oracle Database 21c release, OPTIMIZE_PROGRESS_TABLE is desupported.

Table 24-23 Apply Component Parameters

Parameter Name	Possible Values	Default	Description
allow_duplicate_rows	Y or N	N	<p>If Y and more than one row is changed by a single row logical change record (row LCR) with an UPDATE or DELETE command type, then the apply component only updates or deletes one of the rows.</p> <p>If N, then the apply component raises an error when it encounters a single row LCR with an UPDATE or DELETE command type that changes more than one row in a table.</p> <p>Note: Regardless of the setting for this parameter, apply components do not allow changes to duplicate rows for tables with LOB, LONG, or LONG RAW columns.</p> <p>See Also: "Usage Notes" and "Duplicate Rows and Substitute Primary Key Columns"</p>
apply_sequence_nextval	Y or N	N for apply processes Y for XStream outbound servers and XStream inbound servers	<p>Controls whether the apply component checks and adjusts sequence values.</p> <p>If Y, then the apply component checks and adjusts sequence values.</p> <p>For ascending sequences, setting this parameter to Y ensures that the destination sequence values are equal to or greater than the source sequence values.</p> <p>For descending sequences, setting this parameter to Y ensures that the destination sequence values are equal to or less than the source sequence values.</p> <p>If N, then the apply component does not check or adjust sequence values.</p> <p>Note: This parameter is intended for XStream. Do not set this parameter to Y for an apply process in an Oracle Replication environment unless XStream optimizations are enabled by the DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: SET_PARAMETER Procedure for information about the capture_sequence_nextval capture process parameter</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
batchsql_mode	DEPENDENT, DEPENDENT_EAGER, or SEQUENTIAL	DEPENDENT	<p>Determines the batching method used to generate batch transactions for reordering. This parameter can be set to one of the following:</p> <ul style="list-style-type: none"> DEPENDENT - Batch transactions in a dependency-aware manner to minimize cross-batch dependencies and improve parallel processing performance in Oracle GoldenGate BATCHSQL mode. An executing batch has no unresolved dependencies. DEPENDENT_EAGER - Batch transactions in a dependency-aware manner to minimize cross-batch dependencies and improve parallel processing performance in Oracle GoldenGate BATCHSQL mode. A batch can be executed when there are unresolved dependencies. The apply server waits for dependencies to be resolved before executing an LCR. SEQUENTIAL - Batch transactions in a sequential manner. COMMIT_SERIALIZATION = FULL runs in this mode regardless of the Oracle GoldenGate BATCHSQL mode. <p>Note: This parameter is intended for Oracle GoldenGate. Do not use this parameter in an Oracle Replication environment or in an XStream environment.</p>
cdgranularity	ROW or COLGROUP	COLGROUP for XStream In ROW for Oracle GoldenGate	<p>Specifies the conflict detection granularity. This parameter can be set to one of the following:</p> <ul style="list-style-type: none"> ROW - Conflict resolution is applied for all column groups if there is a conflict for any column group. COLGROUP - Conflict resolution is applied for column groups that have a conflict. Conflict resolution is not applied for column groups that do not have a conflict. <p>Note: This parameter is intended for XStream and Oracle GoldenGate. Do not set this parameter for an apply process in an Oracle Replication environment unless XStream optimizations are enabled by the DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
commit_serialization	DEPENDENT_TRANSACTIONALS or FULL	DEPENDENT_TRANSACTIONALS	<p>The order in which applied transactions are committed.</p> <p>Apply servers can apply nondependent transactions at the destination database in an order that is different from the commit order at the source database. Dependent transactions are always applied at the destination database in the same order as they were committed at the source database.</p> <p>You control whether the apply servers can apply nondependent transactions in a different order at the destination database using the <code>commit_serialization</code> apply parameter. This parameter has the following settings:</p> <ul style="list-style-type: none"> • <code>DEPENDENT_TRANSACTIONALS</code> - The apply component can commit nondependent transactions in any order. Performance is best if you specify <code>DEPENDENT_TRANSACTIONALS</code>. • <code>FULL</code> - The apply component commits applied transactions in the order in which they were committed at the source database. <p>Regardless of the specification, applied transactions can execute in parallel subject to data dependencies and constraint dependencies.</p> <p>If you specify <code>DEPENDENT_TRANSACTIONALS</code>, then a destination database might commit changes in a different order than the source database. For example, suppose two nondependent transactions are committed at the source database in the following order:</p> <ol style="list-style-type: none"> 1. Transaction A 2. Transaction B <p>At the destination database, these transactions might be committed in the opposite order:</p> <ol style="list-style-type: none"> 1. Transaction B 2. Transaction A <p>If you specify <code>DEPENDENT_TRANSACTIONALS</code> and there are application constraints that are not enforced by the database, then use virtual dependency definitions or add <code>RELY</code> constraints to account for the application constraints. See <i>Oracle Database Data Warehousing Guide</i> for information about <code>RELY</code> constraints.</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
compare_key_only	Y or N	N for apply processes Y for XStream inbound servers	<p>Note: The NONE value is deprecated for this parameter. It is replaced by the DEPENDENT_TRANSACTIONS value.</p> <p>See Also: "Usage Notes"</p> <p>If Y, then disables automatic conflict detection and only uses primary and unique key columns to identify the table row for a row LCR.</p> <p>If N, then enables automatic conflict detection and uses all of the old values in a row LCR to identify the table row for a row LCR.</p> <p>Note: The COMPARE_OLD_VALUES procedure in this package can disable comparison of old values for specified columns during apply. See COMPARE_OLD_VALUES Procedure.</p> <p>See Also: "Usage Notes"</p>
compute_lcr_dep_on_arrival	Y or N	N	<p>If Y, the dependencies are computed as the LCRs for the transaction are received.</p> <p>If N, the dependencies are computed only after all the LCRs for a transaction are received.</p> <p>If the target table has all of the same constraints as the source table, you can improve the performance by setting this parameter to Y.</p> <p>If the number of LCRs in transaction exceeds the value of the number of the eager_size parameter, then the dependencies for that transaction are calculated on arrival regardless of the setting of compute_lcr_dep_on_arrival.</p> <p>Note: This parameter is intended for XStream. Do not set this parameter to Y for an apply process in an Oracle Replication environment unless XStream optimizations are enabled by the DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p>
disable_on_error	Y or N	Y	<p>If Y, then the apply component is disabled on the first unresolved error, even if the error is not irrecoverable.</p> <p>If N, then the apply component continues regardless of unresolved errors.</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
disable_on_limit	Y or N	N	<p>If Y, then the apply component is disabled if the apply component terminates because it reached a value specified by the <code>time_limit</code> parameter or <code>transaction_limit</code> parameter.</p> <p>If N, then the apply component is restarted immediately after stopping because it reached a limit.</p> <p>When an apply component is restarted, it gets a new session identifier, and the processes associated with the apply component also get new session identifiers. However, the coordinator process number (<code>APnn</code>) remains the same.</p>
eager_size	A positive integer	9500	<p>The apply component usually waits until it receives a commit record before starting to apply changes of a transaction. If XStream is enabled and more than <code>eager_size</code> LCRs arrive for a given transaction, then apply starts processing the changes. If XStream is not enabled and more than <code>eager_size</code> LCRs arrive for a given transaction, then apply waits until the complete transaction is received before processing the changes.</p> <p>Since it is possible that all existing apply servers are handling complete transactions from the source, additional apply servers are automatically created to handle outstanding eager transactions. The apply parameter <code>max_parallelism</code> limits the maximum number of apply servers that can be used for an apply process.</p> <p>This apply parameter is relevant only if its value is less than the value of the <code>txn_lcr_spill_threshold</code> apply parameter. When the value of <code>txn_lcr_spill_threshold</code> is lower than the value of <code>eager_size</code>, transactions spill to disk before eager apply begins.</p> <p>Note: This parameter is intended for XStream. Do not set this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
enable_xstream_table_stats	Y or N	Y	<p>When this parameter is set to Y, statistics about the operations of applied transactions are collected and made available in the V\$XSTREAM_TABLE_STATS view.</p> <p>When this parameter is set to N, no statistics are collected.</p> <p>Note: This parameter is intended for XStream. Do not set this parameter to Y for an apply process in an Oracle Replication environment.</p>
excludetag	Comma-delimited list of Oracle Replication tags	NULL	<p>Controls whether the capture process for an outbound server captures DML changes that are tagged with one of the specified Oracle Replication tags.</p> <p>Whether the capture process captures these changes depends on the settings for the <code>getapplops</code> and <code>getreplicates</code> parameters.</p> <p>If NULL, then the capture process ignores this parameter.</p> <p>Note: This parameter is intended for an XStream Out environment in which multiple outbound servers use the same capture process. XStream inbound servers ignore this parameter. Do not set this parameter in an Oracle Replication environment.</p> <p>See Also: "Usage Notes" for the <code>DBMS_CAPTURE_ADM.SET_PARAMETER</code> procedure for more information about this parameter</p>
excludetrans	Comma-delimited list of transaction names	NULL	<p>Controls whether the capture process for an outbound server captures DML changes in the specified transaction names.</p> <p>Whether the capture process captures these changes depends on the settings for the <code>getapplops</code> and <code>getreplicates</code> parameters.</p> <p>If NULL, then the capture process ignores this parameter.</p> <p>Note: This parameter is intended for an XStream Out environment in which multiple outbound servers use the same capture process. XStream inbound servers ignore this parameter. Do not set this parameter in an Oracle Replication environment.</p> <p>See Also: "Usage Notes" for the <code>DBMS_CAPTURE_ADM.SET_PARAMETER</code> procedure for more information about this parameter</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
excludeuser	Comma-delimited list of user names	NULL	<p>Controls whether the capture process for an outbound server captures DML changes made by the specified users.</p> <p>Whether the capture process captures these changes depends on the settings for the <code>getapplops</code> and <code>getreplicates</code> parameters.</p> <p>Specify an exact pattern match for each user name. The pattern match is case sensitive. For example, specify <code>HR</code> for the <code>hr</code> user.</p> <p>If <code>NULL</code>, then the capture process ignores this parameter.</p> <p>Note: This parameter is intended for an XStream Out environment in which multiple outbound servers use the same capture process. XStream inbound servers ignore this parameter. Do not set this parameter in an Oracle Replication environment.</p> <p>See Also: "Usage Notes" for the <code>DBMS_CAPTURE_ADM.SET_PARAMETER</code> procedure for more information about this parameter</p>
excludeuserid	Comma-delimited list of user ID values	NULL	<p>Controls whether the capture process for an outbound server captures data manipulation language (DML) changes made by the specified users.</p> <p>Whether the capture process captures these changes depends on the settings for the <code>getapplops</code> and <code>getreplicates</code> parameters.</p> <p>To view the user ID for a user, query the <code>USER_ID</code> column in the <code>ALL_USERS</code> data dictionary view.</p> <p>If <code>NULL</code>, then the capture process ignores this parameter.</p> <p>Note: This parameter is intended for an XStream Out environment in which multiple outbound servers use the same capture process. XStream inbound servers ignore this parameter. Do not set this parameter in an Oracle Replication environment.</p> <p>See Also: "Usage Notes" for the <code>DBMS_CAPTURE_ADM.SET_PARAMETER</code> procedure for more information about this parameter</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
getapplops	Y or N	Y	<p>If Y, then the capture process captures DML changes if the original user is not specified in the <code>excludeuserid</code> or <code>excludeuser</code> parameters and the transaction name is not specified in the <code>excludetrans</code> parameter.</p> <p>If N, then the capture process ignores DML changes if the original user is not specified in the <code>excludeuserid</code> or <code>excludeuser</code> parameters and the transaction name is not specified in the <code>excludetrans</code> parameter.</p> <p>In either case, the capture process captures a DML change only if it satisfies the capture process's rule sets.</p> <p>When N is set for both <code>getapplops</code> and <code>getreplicates</code>, no data is captured.</p> <p>Note: This parameter is intended for an XStream Out environment in which multiple outbound servers use the same capture process. XStream inbound servers ignore this parameter. Do not set this parameter in an Oracle Replication environment.</p> <p>See Also: "Usage Notes" for the <code>DBMS_CAPTURE_ADM.SET_PARAMETER</code> procedure for more information about this parameter</p>
getreplicates	Y or N	N	<p>If Y, then the capture process captures DML changes if the original user is specified in the <code>excludeuserid</code> or <code>excludeuser</code> parameters and the transaction name is specified in the <code>excludetrans</code> parameter.</p> <p>If N, then the capture process ignores DML changes if the original user is specified in the <code>excludeuserid</code> or <code>excludeuser</code> parameters and the transaction name is specified in the <code>excludetrans</code> parameter.</p> <p>In either case, the capture process captures a DML change only if it satisfies the capture process's rule sets.</p> <p>When N is set for both <code>getapplops</code> and <code>getreplicates</code>, no data is captured.</p> <p>Note: This parameter is intended for an XStream Out environment in which multiple outbound servers use the same capture process. XStream inbound servers ignore this parameter. Do not set this parameter in an Oracle Replication environment.</p> <p>See Also: "Usage Notes" for the <code>DBMS_CAPTURE_ADM.SET_PARAMETER</code> procedure for more information about this parameter</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
grouptransops	A positive integer from 1 to 10000	250 for apply processes and XStream inbound servers 10000 for XStream outbound servers	<p>The minimum number of LCRs that can be grouped into a single transaction. The commit LCR for a transaction is not included in the LCR count for the transaction.</p> <p>This parameter enables an apply component to group LCRs from multiple transactions into a single transaction. The apply component groups only LCRs that are part of committed transactions.</p> <p>If a transaction has more LCRs than the setting for this parameter, then the transaction is applied as a single transaction. The apply component does not split a transaction into separate transactions.</p> <p>This parameter only takes effect if the <code>parallelism</code> parameter setting is 1. The <code>grouptransops</code> parameter is ignored if the <code>parallelism</code> parameter setting is greater than 1.</p> <p>Note: This parameter is intended for XStream outbound servers and inbound servers. An Oracle Apply process ignores this parameter unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes"</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
handlecollisions	Y or N	N	<p>This parameter controls whether the apply component tries to resolve duplicate-record and missing-record errors when applying changes during data loading.</p> <p>This parameter should be set to N for normal replication activity. It should be set to Y only when data is being loaded (instantiated) and replication is enabled.</p> <p>If Y, then does the equivalent of <code>OVERWRITE</code> for <code>INSERT</code>, <code>UPDATE</code> and <code>DELETE</code> operations that get <code>ROW_EXISTS</code> errors, and ignores <code>UPDATE</code> and <code>DELETE</code> operations that get <code>ROW_MISSING</code> errors.</p> <p>Specifically, the apply component performs the following actions when this parameter is set to Y:</p> <ul style="list-style-type: none"> • If the operation is an insert and the primary key or unique key exists, then the insert is converted to an update. • If the operation is an update that does not modify the primary key or unique key columns, and the row does not exist, then the change is ignored. • If the operation is an update that modifies the primary key or unique key columns, and the row does not exist, then the change is ignored. • If the operation is an update that modifies the primary key or unique key columns, and the a row with the new key values already exists, then delete the row with the old key values and replace the row with the new key values. • If the operation is a delete and the row does not exist, then the change is ignored. <p>If N then it disables the above settings.</p> <p>Note: This parameter is intended for an XStream In environment with one or more inbound servers. Do not set this parameter in an Oracle Replication environment.</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
ignore_transaction	A valid source transaction ID or NULL	NULL	<p>Instructs the apply component to ignore the specified transaction from the source database, effective immediately.</p> <p>Use caution when setting this parameter because ignoring a transaction might lead to data divergence between the source database and destination database.</p> <p>To ignore multiple transactions, specify each transaction in a separate call to the <code>SET_PARAMETER</code> procedure. The <code>DBA_APPLY_PARAMETERS</code> view displays a comma-delimited list of all transactions to be ignored. To clear the list of ignored transactions, run the <code>SET_PARAMETER</code> procedure and specify <code>NULL</code> for the <code>ignore_transaction</code> parameter.</p> <p>If <code>NULL</code>, then the apply component ignores this parameter.</p> <p>Note: An apply component ignores this parameter for transactions that were not captured by a capture process.</p> <p>See Also: "Usage Notes"</p>
maximum_scn	A valid SCN or INFINITE	INFINITE	<p>The apply component is disabled before applying a transaction with a commit SCN greater than or equal to the value specified.</p> <p>If <code>INFINITE</code>, then the apply component runs regardless of the SCN value.</p> <p>Note: An apply component ignores this parameter for transactions that were not captured by a capture process.</p> <p>See Also: "Usage Notes"</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
max_parallelism	A positive integer	50	<p>Limits the maximum number of apply servers that can be used for an apply component.</p> <p>When the apply parallelism parameter is set greater than one, the apply component adds apply servers when necessary to process transactions until it reaches the limit set by this parameter (<code>max_parallelism</code>). Transactions include both unassigned (<code>eager</code>) and assigned transactions.</p> <p>Apply servers that idle for more than 5 minutes are shut down until the configured <code>parallelism</code> is attained.</p> <p>Runtime statistics for servers that have been shut down are aggregated into apply server 0 so that accurate apply statistics for the entire apply process can be maintained.</p> <p>Note: This parameter is intended for XStream. Do not set this parameter to Y for an apply process in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
max_sga_size	A positive integer	INFINITE	<p>Controls the amount of system global area (SGA) memory allocated specifically to the apply component, in megabytes.</p> <p>The memory is allocated for the duration of the apply component's session and is released when the apply component becomes disabled.</p> <p>Note: The sum of system global area (SGA) memory allocated for all components on a database must be less than the value set for the <code>STREAMS_POOL_SIZE</code> initialization parameter.</p> <p>If <code>NULL</code>, then the apply component uses the original default value. A <code>NULL</code> value has the same effect as resetting the parameter to its default value.</p> <p>Note: This parameter is intended for XStream. Do not use or attempt to set this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes"</p>
message_tracking_frequency	0 or a positive integer	2000000	<p>The frequency at which messages applied by the inbound server are tracked automatically.</p> <p>For example, if this parameter is set to the default value of 2000000, then every two-millionth message is tracked automatically.</p> <p>The tracking label used for automatic message tracking is <code>inbound_server_name:AUTOTRACK</code>, where <code>inbound_server_name</code> is the name of the inbound server. Only the first 20 bytes of the inbound server name are used; the rest is truncated if it exceeds 20 bytes.</p> <p>If 0 (zero), then no messages are tracked automatically.</p>
optimize_self_updates	Y or N	Y	<p>This parameter affects conflict resolution when an update in the source database sets a column to its existing value.</p> <p>When this parameter is set to <code>Y</code>, a conflict between the value in the LCR and the corresponding column in the target database is considered resolved.</p> <p>When this parameter is set to <code>N</code>, the conflict is processed.</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
parallelism	A positive integer	4	<p>The number of apply servers that can concurrently apply transactions.</p> <p>The reader server and the apply server process names are <i>ASnn</i>, where <i>nn</i> can include letters and numbers. The total number of <i>ASnn</i> processes is the value of the <code>parallelism</code> parameter plus one.</p> <p>For example, if <code>parallelism</code> is set to 4, then an apply component uses a total of five <i>ASnn</i> processes. In this case, there is one reader server and four apply servers.</p> <p>Setting the <code>parallelism</code> parameter to a number higher than the number of available operating system user processes can disable the apply component. Make sure the <code>PROCESSES</code> initialization parameter is set appropriately when you set the <code>parallelism</code> parameter.</p> <p>Note: When the value of this parameter is changed from 1 to a higher value for a running apply component, the apply component is stopped and restarted automatically. This can take some time depending on the size of the transactions currently being applied. When the value of this parameter is greater than 1, and the parameter value is decreased or increased, the apply component does not restart.</p> <p>See Also: "Usage Notes"</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
<code>parallelism_interval</code>	0 or a positive integer	0	<p>The parallelism interval is the interval in seconds at which the current workload activity is computed.</p> <p>The apply component calculates the mean throughput every 5 X <code>parallelism_interval</code> seconds. After each calculation, the apply component can increase or decrease the number of apply servers to try to improve throughput. If throughput is improved, then the apply component keeps the new number of apply servers.</p> <p>The parallelism interval is used only if the <code>parallelism</code> parameter is set to a value greater than one and the <code>max_parallelism</code> parameter value is greater than the <code>parallelism</code> parameter value.</p> <p>Note: This parameter is intended for an XStream In environment with one or more inbound servers. XStream outbound servers ignore this parameter. Do not set this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes"</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
preserve_encryption	Y or N	Y	<p>Whether to preserve encryption for columns encrypted using Transparent Data Encryption.</p> <p>If Y, then columns in tables at the destination database must be encrypted when corresponding columns in row LCRs are encrypted. If columns are encrypted in row LCRs but the corresponding columns are not encrypted in the tables at the destination database, then an error is raised when the apply component tries to apply the row LCRs.</p> <p>If N, then columns in tables at the destination database do not need to be encrypted when corresponding columns in row LCRs are encrypted. If columns are encrypted in row LCRs but the corresponding columns are not encrypted in the tables at the destination database, then the apply component applies the changes in the row LCRs.</p> <p>Note: When the value of this parameter is changed for a running apply component, the apply component is stopped and restarted automatically. This can take some time depending on the size of the transactions currently being applied.</p> <p>See Also: "Usage Notes"</p>
rtrim_on_implicit_conversion	Y or N	Y	<p>Whether to remove blank padding from the right end of a column when automatic data type conversion is performed during apply.</p> <p>If Y, then blank padding is removed when a CHAR or NCHAR source column in a row LCR is converted to a VARCHAR2, NVARCHAR2, or CLOB column in a table.</p> <p>If N, then blank padding is preserved in the column.</p> <p>See Also: "Usage Notes"</p>
startup_seconds	0, a positive integer, or INFINITE	0	<p>The maximum number of seconds to wait for another instantiation of the same apply component to finish. If the other instantiation of the same apply component does not finish within this time, then the apply component does not start.</p> <p>If INFINITE, then an apply component does not start until another instantiation of the same apply component finishes.</p> <p>See Also: "Usage Notes"</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
suppresstriggers	Y or N	Y	<p>This parameter controls whether triggers fire when a change is made by the apply component.</p> <p>If Y, triggers do not fire for changes made by the apply component.</p> <p>If N, triggers fire for changes made by the apply component.</p> <p>If a trigger's firing property is set to always fire, then the trigger always fires for changes made by the apply component, regardless of the value of the <code>suppresstriggers</code> parameter. A trigger's firing property is set to always fire by running the <code>DBMS_DDL.SET_TRIGGER_FIRING_PROPERTY</code> procedure with the <code>fire_once</code> parameter set to <code>FALSE</code>.</p> <p>Note: This parameter is intended for an XStream In environment with one or more inbound servers. Do not set this parameter in an Oracle Replication environment.</p> <p>See Also: "Usage Notes"</p>
time_limit	A positive integer or INFINITE	INFINITE	<p>The apply component stops as soon as possible after the specified number of seconds since it started.</p> <p>If <code>INFINITE</code>, then the apply component continues to run until it is stopped explicitly.</p> <p>See Also: "Usage Notes"</p>
trace_level	0 or a positive integer	0	<p>Set this parameter only under the guidance of Oracle Support Services.</p> <p>See Also: "Usage Notes"</p>
transaction_limit	A positive integer or INFINITE	INFINITE	<p>The apply component stops after applying the specified number of transactions.</p> <p>If <code>INFINITE</code>, then the apply component continues to run regardless of the number of transactions applied.</p> <p>See Also: "Usage Notes"</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
txn_age_spill_threshold	A positive integer or INFINITE	900	<p>The apply component begins to spill messages from memory to hard disk for a particular transaction when the amount of time that any message in the transaction has been in memory exceeds the specified number. The parameter specifies the age in seconds.</p> <p>When the reader server spills messages from memory, the messages are stored in a database table on the hard disk. These messages are not spilled from memory to a queue table.</p> <p>Message spilling occurs at the transaction level. For example, if this parameter is set to 900, and the reader server of an apply component detects that one message in a transaction has been in memory longer than 900 seconds, then all of the messages in the transaction spill from memory to hard disk.</p> <p>If INFINITE, then the apply component does not spill messages to the hard disk based on the age of the messages.</p> <p>Query the DBA_APPLY_SPILL_TXN data dictionary view for information about transactions spilled by an apply component.</p> <p>See Also: "Usage Notes"</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
txn_lcr_spill_threshold	A positive integer or INFINITE	10000	<p>The apply component begins to spill messages from memory to hard disk for a particular transaction when the number of messages in memory for the transaction exceeds the specified number. The number of messages in first chunk of messages spilled from memory equals the number specified for this parameter, and the number of messages spilled in future chunks is either 100 or the number specified for this parameter, whichever is less.</p> <p>If the reader server of an apply component has the specified number of messages in memory for a particular transaction, then when it detects the next message for this transaction, it spills the messages that are in memory to the hard disk. For example, if this parameter is set to 10000, and a transaction has 10,200 messages, then the reader server handles the transaction in the following way:</p> <ol style="list-style-type: none"> 1. Reads the first 10,000 messages in the transaction into memory 2. Spills messages 1 - 10,000 to hard disk when it detects message 10,000 3. Reads the next 100 messages in the transaction into memory 4. Spills messages 10,001 - 10,100 to hard disk when it detects message 10,100 5. Reads the next 100 messages in the transaction into memory <p>The apply component applies the first 10,100 messages from the hard disk and the last 100 messages from memory.</p> <p>When the reader server spills messages from memory, the messages are stored in a database table on the hard disk. These messages are not spilled from memory to a queue table.</p> <p>Message spilling occurs at the transaction level. For example, if this parameter is set to 10000, and the reader server of an apply component is assembling two transactions, one with 7,500 messages and another with 8,000 messages, then it does not spill any messages.</p> <p>If INFINITE, then the apply component does not spill messages to the hard disk based on the number of messages in a transaction.</p>

Table 24-23 (Cont.) Apply Component Parameters

Parameter Name	Possible Values	Default	Description
write_alert_log	Y or N	Y	<p>Query the <code>DBA_APPLY_SPILL_TXN</code> data dictionary view for information about transactions spilled by an apply component.</p> <p>See Also: "Usage Notes"</p> <p>If <code>Y</code>, then the apply component writes a message to the alert log on exit.</p> <p>If <code>N</code>, then the apply component does not write a message to the alert log on exit.</p> <p>The message specifies the reason why the apply component stopped.</p>

Usage Notes

The following usage notes apply to this procedure:

- [Delays Are Possible Before New Parameter Settings Take Effect](#)
- [Parameters Interpreted as Positive Integers](#)
- [Parameters with a System Change Number \(SCN\) Setting](#)
- [The SET_PARAMETER Procedure and Replication](#)
- [The SET_PARAMETER Procedure and XStream Outbound Servers](#)
- [The SET_PARAMETER Procedure and XStream Inbound Servers](#)

Delays Are Possible Before New Parameter Settings Take Effect

When you alter a parameter value, a short amount of time might pass before the new value for the parameter takes effect.

Parameters Interpreted as Positive Integers

For all parameters that are interpreted as positive integers, the maximum possible value is 4,294,967,295. Where applicable, specify `INFINITE` for larger values.

Parameters with a System Change Number (SCN) Setting

For parameters that require an SCN setting, any valid SCN value can be specified.

The SET_PARAMETER Procedure and Replication

You can use the following parameters in Replication if you enable XStream performance optimizations for Oracle Replication using the procedure

`DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS`:

- `apply_sequence_nextval`
- `compute_lcr_dep_on_arrival`
- `eager_size`
- `grouptransops`
- `max_parallelism`

- `max_sga_size`
- `parallelism_interval`

The SET_PARAMETER Procedure and XStream Outbound Servers

Outbound servers ignore the settings for the following apply parameters:

- `allow_duplicate_rows`
- `commit_serialization`
- `compare_key_only`
- `compute_lcr_dep_on_arrival`
- `disable_on_error`
- `eager_size`
- `enable_xstream_table_stats`
- `grouptransops`
- `handlecollisions`
- `optimize_self_updates`
- `parallelism`
- `parallelism_interval`
- `preserve_encryption`
- `rtrim_on_implicit_conversion`
- `suppresstriggers`

The `commit_serialization` parameter is always set to `FULL` for an outbound server, and the `parallelism` parameter is always set to `1` for an outbound server.

You can use the other apply parameters with outbound servers.



Note:

Using XStream requires purchasing a license for the Oracle GoldenGate product. See *Oracle Database XStream Guide*.

The SET_PARAMETER Procedure and XStream Inbound Servers

Inbound servers ignore the settings for the following apply parameters:

- `excludetag`
- `excludetrans`
- `excludeuser`
- `excludeuserid`
- `getapplops`
- `getreplicates`

- `ignore_transaction`
- `maximum_scn`

You can use all of the other apply component parameters with inbound servers.

The default setting for the `compare_key_only` parameter for an inbound server is `Y`.

The default setting for the `parallelism` parameter for an inbound server is `4`.



Note:

Using XStream requires purchasing a license for the Oracle GoldenGate product. See *Oracle Database XStream Guide*.

24.4.21 SET_REPERROR_HANDLER Procedure

This procedure specifies how a particular error is handled based on its error number.

You can choose between several predefined actions for a given error.

Syntax

```
DBMS_APPLY_ADM.SET_REPERROR_HANDLER (
  apply_name      IN  VARCHAR2,
  object          IN  VARCHAR2,
  error_number    IN  NUMBER,
  method         IN  VARCHAR2,
  source_object   IN  VARCHAR2  DEFAULT NULL,
  max_retries     IN  NUMBER    DEFAULT NULL,
  delay_csecs    IN  NUMBER    DEFAULT 6000);
```

Parameters

Table 24-24 SET_REPERROR_HANDLER Procedure Parameters

Parameter	Description
<code>apply_name</code>	The name of the apply process.
<code>object</code>	The schema and name of the target table, specified as <code>[schema name.]table name</code> for which an error handler is being added, modified, or removed. The table must exist. For example, if an update conflict handler is being added for table <code>employees</code> owned by user <code>hr</code> , then specify <code>hr.employees</code> . If the schema is not specified, then the current user is the default.
<code>error_number</code>	The error handling number. If <code>0</code> , then use the default for all error handling for <code>object</code> .

Table 24-24 (Cont.) SET_REPERERROR_HANDLER Procedure Parameters

Parameter	Description
method	<p>Specifies the action to take when the given <code>error_number</code> occurs.</p> <p>If NULL, remove the error handler for <code>error_number</code></p> <p>The possible actions are:</p> <ul style="list-style-type: none"> • ABEND: Stop the apply process when the error occurs. • RECORD: Move the LCR to the error queue when the error is encountered. • IGNORE: Silently ignore the error and do not apply the LCR. • RETRY: Retry the LCR <code>max_retries</code> times. • RETRY_TRANSACTION: Retry the transaction <code>max_retries</code> times. Wait <code>delay_csecs</code> centiseconds before each retry. <p>RECORD_TRANSACTION : Move the entire transaction to the error queue if this error occurs.</p>
source_object	<p>The schema and object name of the source table, specified as <code>[schema_name.] table_name</code> for the table where the change originated.</p> <p>For example, if the change originated at the <code>employees</code> table owned by user <code>hr</code>, then specify <code>hr.employees</code>. If the schema is not specified, then the current user is the default.</p>
max_retries	<p>Maximum number of times to retry for RETRY and RETRY_TRANSACTION actions in <code>method</code>. Must be specified with either the RETRY or RETRY_TRANSACTION</p>
delay_csecs	<p>The number of centiseconds between retries for RETRY and RETRY_TRANSACTION action in <code>method</code>.</p>

Usage Notes

The following usage notes apply to this procedure:

- [Priority of Error Handlers](#)

Priority of Error Handlers

Any conflict handling specified by `SET_UPDATE_CONFLICT_HANDLER` or `SET_DML_CONFLICT_HANDLER` is tried before the actions specified by `SET_REPERERROR_HANDLER`. The PL/SQL procedure specified by `SET_DML_HANDLER` is called to handle the error if none of the previously mentioned methods resolve it.

24.4.22 SET_SCHEMA_INSTANTIATION_SCN Procedure

This procedure records the specified instantiation SCN for the specified schema in the specified source database and, optionally, for the tables owned by the schema at the source database. This procedure overwrites any existing instantiation SCN for the schema, and, if it sets the instantiation SCN for a table, it overwrites any existing instantiation SCN for the table.

This procedure gives you precise control over which DDL logical change records (LCRs) for a schema are ignored and which DDL LCRs are applied by an apply component.

Syntax

```
DBMS_APPLY_ADM.SET_SCHEMA_INSTANTIATION_SCN(
  source_schema_name  IN  VARCHAR2,
  source_database_name IN  VARCHAR2,
  instantiation_scn   IN  NUMBER,
  apply_database_link IN  VARCHAR2  DEFAULT NULL,
  recursive           IN  BOOLEAN   DEFAULT FALSE,
  source_root_name   IN  VARCHAR2  DEFAULT NULL);
```

Parameters

Table 24-25 SET_SCHEMA_INSTANTIATION_SCN Procedure Parameters

Parameter	Description
source_schema_name	The name of the source schema. For example, hr. When setting an instantiation SCN for schema, always specify the name of the schema at the source database, even if a rule-based transformation or apply handler is configured to change the schema name.
source_database_name	The global name of the source database. For example, DBS1.NET. If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify DBS1 and the domain is NET, then the procedure specifies DBS1.NET automatically.
instantiation_scn	The instantiation SCN. Specify NULL to remove the instantiation SCN metadata for the source schema from the data dictionary.
apply_database_link	The name of the database link to a non-Oracle database. This parameter should be set only when the destination database of a local apply component is a non-Oracle database.
recursive	If TRUE, then the procedure sets the instantiation SCN for the specified schema and all tables owned by the schema in the source database. This procedure selects the tables owned by the specified schema from the ALL_TABLES data dictionary view at the source database under the security context of the current user. If FALSE, then the procedure sets the instantiation SCN for specified schema, but does not set the instantiation SCN for any tables Note: If recursive is set to TRUE, then a database link from the destination database to the source database is required. This database link must have the same name as the global name of the source database and must be accessible to the current user. Also, a table must be accessible to the current user in either the ALL_TABLES or DBA_TABLES data dictionary view at the source database for this procedure to set the instantiation SCN for the table at the destination database.
source_root_name	The global name of the source root database. In a non-CDB, this parameter must be NULL. In a CDB, both source_database and source_root_name must be specified to identify a specific container.

Usage Notes

The following usage notes apply to this procedure:

- [The SET_SCHEMA_INSTANTIATION_SCN Procedure and LCRs](#)
- [Instantiation SCNs and DDL LCRs](#)
- [The recursive Parameter](#)
- [The SET_SCHEMA_INSTANTIATION_SCN Procedure and XStream Outbound Servers](#)
- [The SET_SCHEMA_INSTANTIATION_SCN Procedure and XStream Inbound Servers](#)
- [The SET_SCHEMA_INSTANTIATION_SCN Procedure and CDBs](#)

See Also:

- [SET_GLOBAL_INSTANTIATION_SCN Procedure](#)
- [SET_TABLE_INSTANTIATION_SCN Procedure](#)
- [LCR\\$_DDL_RECORD Type](#) for more information about DDL LCRs

The SET_SCHEMA_INSTANTIATION_SCN Procedure and LCRs

Any instantiation SCN specified by this procedure is used only for LCRs captured by a capture process. It is not used for user-created LCRs.

Instantiation SCNs and DDL LCRs

If the commit SCN of a DDL LCR for a database object in a schema from a source database is less than or equal to the instantiation SCN for that database object at a destination database, then the apply component at the destination database disregards the DDL LCR. Otherwise, the apply component applies the DDL LCR.

The schema instantiation SCN specified by this procedure is used on the following types of DDL LCRs:

- DDL LCRs with a `command_type` of `CREATE TABLE`
- DDL LCRs with a non-NULL `object_owner` specified and neither `base_table_owner` nor `base_table_name` specified.

For example, the schema instantiation SCN set by this procedure is used for a DDL LCR with a `command_type` of `CREATE TABLE` and `ALTER USER`.

The schema instantiation SCN specified by this procedure is not used for DDL LCRs with a `command_type` of `CREATE USER`. A global instantiation SCN is needed for such DDL LCRs.

The recursive Parameter

If the `recursive` parameter is set to `TRUE`, then this procedure sets the table instantiation SCN for each table at the source database owned by the schema. This procedure uses the `SET_TABLE_INSTANTIATION_SCN` procedure to set the instantiation SCN for each table. Each table instantiation SCN is used for DDL LCRs and row LCRs on the table.

If the `recursive` parameter is set to `FALSE`, then this procedure does not set the instantiation SCN for any tables.

The SET_SCHEMA_INSTANTIATION_SCN Procedure and XStream Outbound Servers

Instantiation SCNs are not required for database objects processed by an outbound server. If an instantiation SCN is set for a database object, then the outbound server only sends the LCRs for the database object with SCN values that are greater than the instantiation SCN value. If a database object does not have an instantiation SCN set, then the outbound server skips the instantiation SCN check and sends all LCRs for that database object. In both cases, the outbound server only sends LCRs that satisfy its rule sets.

The `apply_database_link` parameter must be set to `NULL` or to the local database for this procedure to set an instantiation SCN for an outbound server.

See Also:

Oracle Database XStream Guide for more information about outbound servers and instantiation SCNs

The SET_SCHEMA_INSTANTIATION_SCN Procedure and XStream Inbound Servers

Inbound servers ignore instantiation SCNs. This procedure has no effect on XStream inbound servers.

The SET_SCHEMA_INSTANTIATION_SCN Procedure and CDBs

In a CDB, this procedure must be invoked from the same container as the apply process that uses the instantiation SCN information.

24.4.23 SET_TABLE_INSTANTIATION_SCN Procedure

This procedure records the specified instantiation SCN for the specified table in the specified source database. This procedure overwrites any existing instantiation SCN for the particular table.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

This procedure gives you precise control over which logical change records (LCRs) for a table are ignored and which LCRs are applied by an apply component.

Syntax

```
DBMS_APPLY_ADM.SET_TABLE_INSTANTIATION_SCN(  
    source_object_name    IN  VARCHAR2,  
    source_database_name IN  VARCHAR2,  
    instantiation_scn     IN  NUMBER,
```

```

apply_database_link  IN  VARCHAR2  DEFAULT NULL,
source_root_name    IN  VARCHAR2  DEFAULT NULL);

```

Parameters

Table 24-26 SET_TABLE_INSTANTIATION_SCN Procedure Parameters

Parameter	Description
source_object_name	The name of the source object specified as <i>[schema_name.]object_name</i> . For example, <i>hr.employees</i> . If the schema is not specified, then the current user is the default. When setting an instantiation SCN for a database object, always specify the name of the schema and database object at the source database, even if a rule-based transformation or apply handler is configured to change the schema name or database object name.
source_database_name	The global name of the source database. For example, <i>DBS1.NET</i> . If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <i>DBS1</i> and the domain is <i>NET</i> , then the procedure specifies <i>DBS1.NET</i> automatically.
instantiation_scn	The instantiation SCN. Specify <i>NULL</i> to remove the instantiation SCN metadata for the source table from the data dictionary.
apply_database_link	The name of the database link to a non-Oracle database. This parameter should be set only when the destination database of a local apply component is a non-Oracle database. Note: This parameter must be <i>NULL</i> when the procedure is invoked from the root of a CDB.
source_root_name	The global name of the source root database. In a non-CDB, this parameter must be <i>NULL</i> . In a CDB, both <i>source_database</i> and <i>source_root_name</i> must be specified to identify a specific container.

Usage Notes

The following usage notes apply to this procedure:

- [Instantiation SCNs and LCRs](#)
- [The SET_TABLE_INSTANTIATION_SCN Procedure and XStream Outbound Servers](#)
- [The SET_TABLE_INSTANTIATION_SCN Procedure and XStream Inbound Servers](#)
- [The SET_TABLE_INSTANTIATION_SCN Procedure and CDBs](#)

Instantiation SCNs and LCRs

If the commit SCN of an LCR for a table from a source database is less than or equal to the instantiation SCN for that table at some destination database, then the apply component at the destination database disregards the LCR. Otherwise, the apply component applies the LCR.

The table instantiation SCN specified by this procedure is used on the following types of LCRs:

- Row LCRs for the table

- DDL LCRs that have a non-NULL `base_table_owner` and `base_table_name` specified, except for DDL LCRs with a `command_type` of `CREATE TABLE`

For example, the table instantiation SCN set by this procedure is used for DDL LCRs with a `command_type` of `ALTER TABLE` or `CREATE TRIGGER`.

 **Note:**

The instantiation SCN specified by this procedure is used only for LCRs captured by a capture process. It is not used for user-created LCRs.

 **See Also:**

- [SET_GLOBAL_INSTANTIATION_SCN Procedure](#)
- [SET_SCHEMA_INSTANTIATION_SCN Procedure](#)
- [LCR\\$_ROW_RECORD Type](#) for more information about row LCRs
- [LCR\\$_DDL_RECORD Type](#) for more information about DDL LCRs

The `SET_TABLE_INSTANTIATION_SCN` Procedure and XStream Outbound Servers
Instantiation SCNs are not required for database objects processed by an outbound server. If an instantiation SCN is set for a database object, then the outbound server only sends the LCRs for the database object with SCN values that are greater than the instantiation SCN value. If a database object does not have an instantiation SCN set, then the outbound server skips the instantiation SCN check and sends all LCRs for that database object. In both cases, the outbound server only sends LCRs that satisfy its rule sets.

The `apply_database_link` parameter must be set to `NULL` or to the local database for this procedure to set an instantiation SCN for an outbound server.

 **See Also:**

Oracle Database XStream Guide for more information about outbound servers and instantiation SCNs

The `SET_TABLE_INSTANTIATION_SCN` Procedure and XStream Inbound Servers
Inbound servers ignore instantiation SCNs. This procedure has no effect on XStream inbound servers.

The `SET_TABLE_INSTANTIATION_SCN` Procedure and CDBs

In a CDB, this procedure must be invoked from the same container as the apply process that uses the instantiation SCN information.

24.4.24 SET_UPDATE_CONFLICT_HANDLER Procedure

This procedure adds, modifies, or removes a prebuilt update conflict handler for the specified object.

Syntax

```
DBMS_APPLY_ADM.SET_UPDATE_CONFLICT_HANDLER(
  object_name      IN  VARCHAR2,
  method_name      IN  VARCHAR2,
  resolution_column IN  VARCHAR2,
  column_list      IN  DBMS_UTILITY.NAME_ARRAY,
  apply_database_link IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 24-27 SET_UPDATE_CONFLICT_HANDLER Procedure Parameters

Parameter	Description
object_name	<p>The schema and name of the table, specified as <code>[schema_name.]object_name</code>, for which an update conflict handler is being added, modified, or removed.</p> <p>For example, if an update conflict handler is being added for table <code>employees</code> owned by user <code>hr</code>, then specify <code>hr.employees</code>. If the schema is not specified, then the current user is the default.</p>
method_name	<p>Type of update conflict handler to create.</p> <p>You can specify one of the prebuilt handlers, which determine whether the column list from the source database is applied for the row or whether the values in the row at the destination database are retained:</p> <ul style="list-style-type: none"> • MAXIMUM: Applies the column list from the source database if it has the greater value for the resolution column. Otherwise, retains the values at the destination database. • MINIMUM: Applies the column list from the source database if it has the lesser value for the resolution column. Otherwise, retains the values at the destination database. • OVERWRITE: Applies the column list from the source database, overwriting the column values at the destination database. • DISCARD: Retains the column list from the destination database, discarding the column list from the source database. <p>If <code>NULL</code>, then the procedure removes any existing update conflict handler with the same <code>object_name</code>, <code>resolution_column</code>, and <code>column_list</code>. If non-<code>NULL</code>, then the procedure replaces any existing update conflict handler with the same <code>object_name</code> and <code>resolution_column</code>.</p>
resolution_column	<p>Name of the column used to uniquely identify an update conflict handler. For the MAXIMUM and MINIMUM prebuilt methods, the resolution column is also used to resolve the conflict. The resolution column must be one of the columns listed in the <code>column_list</code> parameter.</p> <p><code>NULL</code> is not allowed for this parameter. For the OVERWRITE and DISCARD prebuilt methods, you can specify any column in the column list.</p>

Table 24-27 (Cont.) SET_UPDATE_CONFLICT_HANDLER Procedure Parameters

Parameter	Description
<code>column_list</code>	<p>List of columns for which the conflict handler is called.</p> <p>The same column cannot be in more than one column list.</p> <p>If a conflict occurs for one or more of the columns in the list when an apply component tries to apply a row logical change record (row LCR), then the conflict handler is called to resolve the conflict. The conflict handler is not called if a conflict occurs only for columns that are not in the list.</p> <p>Note: Prebuilt update conflict handlers do not support LOB, LONG, LONG RAW, user-defined type, and Oracle-supplied type columns. Therefore, you should not include these types of columns in the <code>column_list</code> parameter.</p>
<code>apply_database_link</code>	<p>The name of the database link to a non-Oracle database. This parameter should be set only when the destination database is a non-Oracle database.</p> <p>Note: Currently, conflict handlers are not supported when applying changes to a non-Oracle database.</p>

Usage Notes

The following usage notes apply to this procedure:

- [Modifying an Existing Update Conflict Handler](#)
- [Removing an Existing Update Conflict Handler](#)
- [Series of Actions for Conflicts](#)
- [Procedure DML Handlers for Conflicts](#)
- [A Column Can Be in Only One Column List](#)
- [Update Conflict Handlers and Non-Oracle Databases](#)
- [The SET_UPDATE_CONFLICT_HANDLER Procedure and XStream Outbound Servers](#)
- [The SET_UPDATE_CONFLICT_HANDLER Procedure and XStream Inbound Servers](#)

Modifying an Existing Update Conflict Handler

If you want to modify an existing update conflict handler, then you specify the table and resolution column of an the existing update conflict handler. You can modify the prebuilt method or the column list.

Removing an Existing Update Conflict Handler

If you want to remove an existing update conflict handler, then specify `NULL` for the prebuilt method and specify the table, column list, and resolution column of the existing update conflict handler.

Series of Actions for Conflicts

If an update conflict occurs, then Oracle completes the following series of actions:

1. Calls the appropriate update conflict handler to resolve the conflict

2. If no update conflict handler is specified or if the update conflict handler cannot resolve the conflict, then calls the appropriate error handler for the apply component, table, and operation to handle the error
3. If no error handler is specified or if the error handler cannot resolve the error, then raises an error and moves the transaction containing the row LCR that caused the error to the error queue

 **See Also:**

"[Signature of a DML Handler Procedure or Error Handler Procedure](#)" for information about setting an error handler

Procedure DML Handlers for Conflicts

If you cannot use a prebuilt update conflict handler to meet your requirements, then you can create a PL/SQL procedure to use as a custom conflict handler. You use the `SET_DML_HANDLER` procedure to designate one or more custom conflict handlers for a particular table. In addition, a custom conflict handler can process LOB columns and use LOB assembly.

 **See Also:**

[SET_DML_HANDLER Procedure](#)

A Column Can Be in Only One Column List

When a column is in a column list, and you try to add the same column to another column list, this procedure returns the following error:

```
ORA-00001: UNIQUE CONSTRAINT (SYS.APPLY$_CONF_HDLR_COLUMNS_UNQ1) VIOLATED
```

Update Conflict Handlers and Non-Oracle Databases

Setting an update conflict handler for an apply component that is applying to a non-Oracle database is not supported.

The SET_UPDATE_CONFLICT_HANDLER Procedure and XStream Outbound Servers

This procedure has no effect on XStream outbound servers.

The SET_UPDATE_CONFLICT_HANDLER Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

Examples

The following is an example for setting an update conflict handler for the `employees` table in the `hr` schema:

```
DECLARE
  cols DBMS_UTILITY.NAME_ARRAY;
BEGIN
  cols(1) := 'salary';
  cols(2) := 'commission_pct';
```

```

DBMS_APPLY_ADM.SET_UPDATE_CONFLICT_HANDLER(
  object_name      => 'hr.employees',
  method_name     => 'MAXIMUM',
  resolution_column => 'salary',
  column_list     => cols);
END;
/

```

This example sets a conflict handler that is called if a conflict occurs for the `salary` or `commission_pct` column in the `hr.employees` table. If such a conflict occurs, then the `salary` column is evaluated to resolve the conflict. If a conflict occurs only for a column that is not in the column list, such as the `job_id` column, then this conflict handler is not called.

24.4.25 SET_VALUE_DEPENDENCY Procedure

This procedure sets or removes a value dependency. A value dependency is a virtual dependency definition that defines a relationship between the columns of two or more tables.

An apply component uses the name of a value dependencies to detect dependencies between row logical change records (row LCRs) that contain the columns defined in the value dependency. Value dependencies can define virtual foreign key relationships between tables, but, unlike foreign key relationships, value dependencies can involve more than two database objects.

This procedure is overloaded. The `attribute_list` and `attribute_table` parameters are mutually exclusive.

Syntax

```

DBMS_APPLY_ADM.SET_VALUE_DEPENDENCY(
  dependency_name IN VARCHAR2,
  object_name     IN VARCHAR2,
  attribute_list  IN VARCHAR2);

DBMS_APPLY_ADM.SET_VALUE_DEPENDENCY(
  dependency_name IN VARCHAR2,
  object_name     IN VARCHAR2,
  attribute_table IN DBMS_UTILITY.NAME_ARRAY);

```

Parameters

Table 24-28 SET_VALUE_DEPENDENCY Procedure Parameters

Parameter	Description
<code>dependency_name</code>	<p>The name of the value dependency.</p> <p>If a dependency with the specified name does not exist, then it is created.</p> <p>If a dependency with the specified name exists, then the specified object and attributes are added to the dependency.</p> <p>If <code>NULL</code>, an error is raised.</p>

Table 24-28 (Cont.) SET_VALUE_DEPENDENCY Procedure Parameters

Parameter	Description
object_name	The name of the table, specified as <code>[schema_name.] table_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default. If <code>NULL</code> and the specified dependency exists, then the dependency is removed. If <code>NULL</code> and the specified dependency does not exist, then an error is raised. If <code>NULL</code> , then <code>attribute_list</code> and <code>attribute_table</code> also must be <code>NULL</code> .
attribute_list	A comma-delimited list of column names in the table. There must be no spaces between entries.
attribute_table	A PL/SQL associative array of type <code>DBMS_UTILITY.NAME_ARRAY</code> that contains names of columns in the table. The first column name should be at position 1, the second at position 2, and so on. The table does not need to be <code>NULL</code> terminated.

Usage Notes

The following usage notes apply to this procedure:

- [The SET_VALUE_DEPENDENCY Procedure and XStream Outbound Servers](#)
- [The SET_VALUE_DEPENDENCY Procedure and XStream Inbound Servers](#)

The SET_VALUE_DEPENDENCY Procedure and XStream Outbound Servers

This procedure has no effect on XStream outbound servers.

The SET_VALUE_DEPENDENCY Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.26 START_APPLY Procedure

This procedure directs the apply component to start applying messages.

Syntax

```
DBMS_APPLY_ADM.START_APPLY(
    apply_name IN VARCHAR2);
```

Parameter**Table 24-29 START_APPLY Procedure Parameter**

Parameter	Description
apply_name	The apply component name. A <code>NULL</code> setting is not allowed. Do not specify an owner.

Usage Notes

The following usage notes apply to this procedure:

- [Apply Component Status](#)
- [The START_APPLY Procedure and XStream Outbound Servers](#)
- [The START_APPLY Procedure and XStream Inbound Servers](#)

Apply Component Status

The apply component status is persistently recorded. Hence, if the status is `ENABLED`, then the apply component is started upon database instance startup. An apply component (*an*) is an Oracle background process. The enqueue and dequeue state of `DBMS_AQADM.START_QUEUE` and `DBMS_AQADM.STOP_QUEUE` have no effect on the start status of an apply component.

The START_APPLY Procedure and XStream Outbound Servers

This procedure functions the same way for apply processes and outbound servers.

The START_APPLY Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

24.4.27 STOP_APPLY Procedure

This procedure stops the apply component from applying messages and rolls back any unfinished transactions being applied.

Syntax

```
DBMS_APPLY_ADM.STOP_APPLY (
    apply_name IN VARCHAR2,
    force      IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 24-30 STOP_APPLY Procedure Parameters

Parameter	Description
<code>apply_name</code>	The apply component name. A <code>NULL</code> setting is not allowed. Do not specify an owner.
<code>force</code>	If <code>TRUE</code> , then the procedure stops the apply component as soon as possible. If <code>FALSE</code> , then the procedure stops the apply component after ensuring that there are no gaps in the set of applied transactions. The behavior of the apply component depends on the setting specified for the <code>force</code> parameter and the setting specified for the <code>commit_serialization</code> apply component parameter. See " Usage Notes " for more information.

Usage Notes

The following usage notes apply to this procedure:

- [Apply Component Status](#)
- [Queue Subprograms Have No Effect on Apply Component Status](#)
- [The STOP_APPLY force Parameter and the commit_serialization Apply Parameter](#)
- [The STOP_APPLY Procedure and XStream Outbound Servers](#)
- [The STOP_APPLY Procedure and XStream Inbound Servers](#)

Apply Component Status

The apply component status is persistently recorded. Hence, if the status is `DISABLED` or `ABORTED`, then the apply component is not started upon database instance startup.

Queue Subprograms Have No Effect on Apply Component Status

The enqueue and dequeue state of `DBMS_AQADM.START_QUEUE` and `DBMS_AQADM.STOP_QUEUE` have no effect on the `STOP` status of an apply component.

The STOP_APPLY force Parameter and the commit_serialization Apply Parameter

The following table describes apply component behavior for each setting of the `force` parameter in the `STOP_APPLY` procedure and the `commit_serialization` apply component parameter. In all cases, the apply component rolls back any unfinished transactions when it stops.

force	commit_serialization	Apply Component Behavior
TRUE	FULL	The apply component stops immediately and does not apply any unfinished transactions.
TRUE	DEPENDENT_TRANSACTION	When the apply component stops, some transactions that have been applied locally might have committed at the source database at a later point in time than some transactions that have not been applied locally.
FALSE	FULL	The apply component stops after applying the next uncommitted transaction in the commit order, if any such transaction is in progress.
FALSE	DEPENDENT_TRANSACTION	Before stopping, the apply component applies all of the transactions that have a commit time that is earlier than the applied transaction with the most recent commit time.

For example, assume that the `commit_serialization` apply component parameter is set to `DEPENDENT_TRANSACTION` and there are three transactions: transaction 1 has the earliest commit time, transaction 2 is committed after transaction 1, and transaction 3 has the latest commit time. Also assume that an apply component has applied transaction 1 and transaction 3 and is in the process of applying transaction 2 when the `STOP_APPLY` procedure is run. Given this scenario, if the `force` parameter is set to `TRUE`, then transaction 2 is not applied, and the apply component stops (transaction 2 is rolled back). If, however, the `force` parameter is set to `FALSE`, then transaction 2 is applied before the apply component stops.

A different scenario would result if the `commit_serialization` apply component parameter is set to `FULL`. For example, assume that the `commit_serialization` apply component parameter is set to `FULL` and there are three transactions: transaction A has the earliest commit time, transaction B is committed after transaction A, and transaction C has the latest commit time. In this case, the apply component has applied transaction A and is in the process of applying transactions B and C when the `STOP_APPLY` procedure is run. Given this scenario, if the `force` parameter is set to `TRUE`, then transactions B and C are not applied,

and the apply component stops (transactions B and C are rolled back). If, however, the `force` parameter is set to `FALSE`, then transaction B is applied before the apply component stops, and transaction C is rolled back.



See Also:

[SET_PARAMETER Procedure](#) for more information about the `commit_serialization` apply component parameter

The `STOP_APPLY` Procedure and XStream Outbound Servers

This procedure functions the same way for apply processes and outbound servers.

The `STOP_APPLY` Procedure and XStream Inbound Servers

This procedure functions the same way for apply processes and inbound servers.

The `DBMS_AQ` package provides an interface to Oracle Advanced Queuing (AQ).

This chapter contains the following topics:

- [Security Model](#)
- [Constants](#)
- [Data Structures](#)
- [Operational Notes](#)
- [Summary of DBMS_AQ Subprograms](#)



See Also:

- [Oracle Database Advanced Queuing User's Guide](#)
- [Oracle Database Advanced Queuing \(AQ\) Types](#) for information about `TYPES` to use with `DBMS_AQ`.

25.1 DBMS_AQ Security Model

Initially, only `SYS` and `SYSTEM` have execution privilege for the procedures in `DBMS_AQ` and `DBMS_AQADM`.

Queue Security

To enqueue or dequeue, users need `EXECUTE` rights on `DBMS_AQ` and either `ENQUEUE` or `DEQUEUE` privileges on target queues, or `ENQUEUE_ANY/DEQUEUE_ANY` system privileges. Users who have been granted `EXECUTE` rights to `DBMS_AQ` and `DBMS_AQADM` are able to create, manage, and use queues in their own schemas. The `MANAGE_ANY AQ` system privilege is used to create and manage queues in other schemas.

As a database user, you do not need any explicit object-level or system-level privileges to enqueue or dequeue to queues in your own schema other than the `EXECUTE` right on `DBMS_AQ`.



See Also:

[Oracle Database Advanced Queuing User's Guide](#) for more information on queue privileges and access control.

OCI Applications and Queue Access

For an Oracle Call Interface (OCI) application to access a queue, the session user must be granted either the object privilege of the queue he intends to access or the `ENQUEUE ANY QUEUE` or `DEQUEUE ANY QUEUE` system privileges. The `EXECUTE` right of `DBMS_AQ` is not checked against the session user's rights.

Security Required for Propagation

Propagation jobs are owned by `SYS`, but the propagation occurs in the security context of the queue table owner. Previously propagation jobs were owned by the user scheduling propagation, and propagation occurred in the security context of the user setting up the propagation schedule. The queue table owner must be granted `EXECUTE` privileges on the `DBMS_AQADM` package. Otherwise, the Oracle Database snapshot processes do not propagate and generate trace files with the error identifier `SYS.DBMS_AQADM` not defined. Private database links owned by the queue table owner can be used for propagation. The username specified in the connection string must have `EXECUTE` access on the `DBMS_AQ` and `DBMS_AQADM` packages on the remote database.

See Also:

- [DBMS_AQADM](#)
- *Oracle Database Advanced Queuing User's Guide* for more information on security required for propagation

25.2 DBMS_AQ Constants

This topic describes the constants used by `DBMS_AQ`.

The `DBMS_AQ` package uses the constants shown in the following table.

When using enumerated constants such as `BROWSE`, `LOCKED`, or `REMOVE`, the PL/SQL constants must be specified with the scope of the packages defining it. All types associated with the operational interfaces have to be prepended with `DBMS_AQ`. For example: `DBMS_AQ.BROWSE`.

Note:

The `sequence_deviation` attribute has no effect in releases prior to Oracle Streams AQ 10g Release 1 (10.1) if `message_grouping` parameter of `DBMS_AQADM` subprograms is set to `TRANSACTIONAL`. The sequence deviation feature is deprecated in Oracle Streams AQ 10g Release 2 (10.2).

Table 25-1 Enumerated Constants

Parameter	Options	Type	Description
VISIBILITY	IMMEDIATE	-	-
-	ON_COMMIT	-	-
DEQUEUE_MODE	BROWSE	-	-
-	LOCKED	-	-
-	REMOVE	-	-
-	REMOVE_NODATA	-	-
NAVIGATION	FIRST_MESSAGE	-	-
-	NEXT_MESSAGE	-	-
STATE	WAITING	-	-
-	READY	-	-
-	PROCESSED	-	-
-	EXPIRED	-	-
SEQUENCE_DEVIATION	BEFORE	-	-
-	TOP	-	-
WAIT	FOREVER	BINARY_INTEGER	-
-	NO_WAIT	BINARY_INTEGER	-
DELAY	NO_DELAY	-	-
EXPIRATION	NEVER	-	-
NAMESPACE	NAMESPACE_AQ	-	-
-	NAMESPACE_ANONYMOUS	-	-
NTFN_GROUPING_CLASS	NTFN_GROUPING_CLASS	NUMBER	-
	_TIME		
NTFN_GROUPING_TYPE	NTFN_GROUPING_TYPE	NUMBER	-
	SUMMARY		
-	NTFN_GROUPING_TYPE	NUMBER	-
	LAST		
NTFN_GROUPING_REPEAT_COUNT	NTFN_GROUPING_FOREVER	NUMBER	-

25.3 DBMS_AQ Data Types

This topic lists and describes DBMS_AQ data types.

Table 25-2 DBMS_AQ Data Structures

Data Structures	Description
OBJECT_NAME	Names database objects
TYPE_NAME	Defines queue types

Table 25-2 (Cont.) DBMS_AQ Data Structures

Data Structures	Description
JSON	Starting from Oracle Database Release 21c, AQ also supports JSON payload type. A dedicated JSON data type permits us to store the JSON data in a post-parse binary format which allows much faster access to nested JSON values.
Oracle Database Advanced Queuing PL/SQL Callback	Specifies the user-defined PL/SQL procedure, defined in the database to be invoked on message notification

OBJECT_NAME

The `object_name` data structure names database objects. It applies to queues, queue tables, agent names, and object types.

Syntax

```
object_name := VARCHAR2;
object_name := [schema_name.]name;
```

Usage Notes

Names for objects are specified by an optional schema name and a name. If the schema name is not specified, the current schema is assumed. The name must follow object name guidelines in *Oracle Database SQL Language Reference* with regard to reserved characters. Schema names, agent names, and object type names can be up to 128 bytes long. Queue names and queue table names can be up to 122 bytes long. Maximum length of agent names and subscriber names can be 128 characters with datablock size greater than 2k. For 2k datablock size, maximum length for subscriber is 128 bytes.

TYPE_NAME

The `type_name` data structure defines queue types.

Syntax

```
type_name := VARCHAR2;
type_name := object_type | "RAW";
```

Attributes

Table 25-3 Type Name Attributes

Attribute	Description
<code>object_type</code>	Maximum number of attributes in the object type is limited to 900.

Table 25-3 (Cont.) Type Name Attributes

Attribute	Description
"RAW"	<p>To store payload of type RAW, Oracle Database Advanced Queuing creates a queue table with a LOB column as the payload repository. The theoretical maximum size of the message payload is the maximum amount of data that can be stored in a LOB column. However, the maximum size of the payload is determined by which programmatic environment you use to access Oracle Database Advanced Queuing. For PL/SQL, Java and precompilers the limit is 32K; for the OCI the limit is 4G. Because the PL/SQL enqueue and dequeue interfaces accept RAW buffers as the payload parameters you will be limited to 32K bytes. In OCI, the maximum size of your RAW data will be limited to the maximum amount of contiguous memory (as an OCIRaw is simply an array of bytes) that the OCI Object Cache can allocate. Typically, this will be at least 32K bytes and much larger in many cases.</p> <p>Because LOB columns are used for storing RAW payload, the Oracle Database Advanced Queuing administrator can choose the LOB tablespace and configure the LOB storage by constructing a LOB storage string in the <code>storage_clause</code> parameter during queue table creation time.</p>

Oracle Database Advanced Queuing PL/SQL Callback

The `plsqcallback` data structure specifies the user-defined PL/SQL procedure, defined in the database to be invoked on message notification.

Syntax

If a notification message is expected for a RAW payload enqueue, then the PL/SQL callback must have the following signature:

```
procedure plsqcallback(
  context IN RAW,
  reginfo IN SYS.AQ$_REG_INFO,
  descr   IN SYS.AQ$_DESCRIPTOR,
  payload IN RAW,
  payload1 IN NUMBER);
```

Attributes

Table 25-4 Oracle Database Advanced Queuing PL/SQL Callback Attributes

Attribute	Description
<code>context</code>	Specifies the context for the callback function that was passed by <code>dbms_aq.register</code> . See AQ\$_REG_INFO Type.
<code>reginfo</code>	See AQ\$_REG_INFO Type.
<code>descr</code>	See AQ\$_DESCRIPTOR Type
<code>payload</code>	If a notification message is expected for a raw payload enqueue then this contains the raw payload that was enqueued into a non persistent queue. In case of a persistent queue with raw payload this parameter will be null.
<code>payload1</code>	Specifies the length of <code>payload</code> . If <code>payload</code> is null, <code>payload1 = 0</code> .

If the notification message is expected for an ADT payload enqueue, the PL/SQL callback must have the following signature:

```
procedure plsqlcallback(
  context IN RAW,
  reginfo IN SYS.AQ$_REG_INFO,
  descr   IN SYS.AQ$_DESCRIPTOR,
  payload IN VARCHAR2,
  payload1 IN NUMBER);
```

25.4 DBMS_AQ Operational Notes

This topic lists various DBMS_AQ operational notes.

DBMS_AQ and DBMS_AQADM Java Classes

Java interfaces are available for DBMS_AQ and DBMS_AQADM. The Java interfaces are provided in the `$ORACLE_HOME/rdbms/jlib/aqapi.jar`. Users are required to have EXECUTE privileges on the DBMS_AQIN package to use these interfaces.

25.5 Summary of DBMS_AQ Subprograms

The DBMS_AQ package uses subprograms described in this table.

Table 25-5 DBMS_AQ Package Subprograms

Subprograms	Description
BIND_AGENT Procedure	Creates an entry for an Oracle Database Advanced Queuing agent in the LDAP directory
DEQUEUE Procedure	Dequeues a message from the specified queue
DEQUEUE_ARRAY Function	Dequeues an array of messages from the specified queue
ENQUEUE Procedure	Adds a message to the specified queue
ENQUEUE_ARRAY Function	Adds an array of messages to the specified queue
LISTEN Procedures	Listen to one or more queues on behalf of a list of agents
POST Procedure	Posts to a anonymous subscription which allows all clients who are registered for the subscription to get notifications
REGISTER Procedure	Registers for message notifications
SEEK Procedure	Enables a subscriber to seek any particular message of choice
UNBIND_AGENT Procedure	Removes an entry for an Oracle Database Advanced Queuing agent from the LDAP directory
UNREGISTER Procedure	Unregisters a subscription which turns off notification

Note:

DBMS_AQ does not have a purity level defined; therefore, you cannot call any procedure in this package from other procedures that have RNDS, WNDS, RNPS or WNPS constraints defined.

25.5.1 BIND_AGENT Procedure

This procedure creates an entry for an Oracle Database Advanced Queuing agent in the LDAP server.

Syntax

```
DBMS_AQ.BIND_AGENT (
    agent          IN SYS.AQ$_AGENT,
    certificate    IN VARCHAR2 default NULL);
```

Parameters

Table 25-6 BIND_AGENT Procedure Parameters

Parameter	Description
agent	Agent that is to be registered in LDAP server.
certificate	Location (LDAP distinguished name) of the "organizationalperson" entry in LDAP whose digital certificate (attribute <code>usercertificate</code>) is to be used for this agent. Example: "cn=OE, cn=ACME, cn=com" is a distinguished name for a OrganizationalPerson OE whose certificate will be used with the specified agent.

Usage Notes

In the LDAP server, digital certificates are stored as an attribute (`usercertificate`) of the `OrganizationalPerson` entity. The distinguished name for this `OrganizationalPerson` must be specified when binding the agent.

25.5.2 DEQUEUE Procedure

This procedure dequeues a message from the specified queue.

Syntax

```
DBMS_AQ.DEQUEUE (
    queue_name      IN      VARCHAR2,
    dequeue_options IN      dequeue_options_t,
    message_properties OUT   message_properties_t,
    payload         OUT     "<ADT_1>"
    msgid          OUT     RAW);
```

Parameters

Table 25-7 DEQUEUE Procedure Parameters

Parameter	Description
queue_name	Specifies the name of the queue.
dequeue_options	See DEQUEUE_OPTIONS_T Type.
message_properties	See MESSAGE_PROPERTIES_T Type.

Table 25-7 (Cont.) DEQUEUE Procedure Parameters

Parameter	Description
<code>payload</code>	Not interpreted by Oracle Database Advanced Queuing. The payload must be specified according to the specification in the associated queue table. For the definition of <i>type_name</i> refer to <code>TYPE_NAME</code> in DBMS_AQ Data Types .
<code>msgid</code>	System generated identification of the message.

Usage Notes

The search criteria for messages to be dequeued is determined by the following parameters in `dequeue_options`:

- `consumer_name`
- `msgid`

`Msgid` uniquely identifies the message to be dequeued. Only messages in the `READY` state are dequeued unless `msgid` is specified.

- `correlation`

Correlation identifiers are application-defined identifiers that are not interpreted by Oracle Database Advanced Queuing.

- `deq_condition`

Dequeue condition is an expression based on the message properties, the message data properties and PL/SQL functions. A `deq_condition` is specified as a Boolean expression using syntax similar to the `WHERE` clause of a SQL query. This Boolean expression can include conditions on message properties, user data properties (object payloads only), and PL/SQL or SQL functions (as specified in the `where` clause of a SQL query). Message properties include `priority`, `corrid` and other columns in the queue table.

To specify dequeue conditions on a message payload (object payload), use attributes of the object type in clauses. You must prefix each attribute with `tab.user_data` as a qualifier to indicate the specific column of the queue table that stores the payload.

Example: `tab.user_data.orderstatus='EXPRESS'`

The dequeue order is determined by the values specified at the time the queue table is created unless overridden by the `msgid` and correlation ID in `dequeue_options`.

The database-consistent read mechanism is applicable for queue operations. For example, a `BROWSE` call may not see a message that is enqueued after the beginning of the browsing transaction.

The default `NAVIGATION` parameter during dequeue is `NEXT_MESSAGE`. This means that subsequent dequeues will retrieve the messages from the queue based on the snapshot obtained in the first dequeue. In particular, a message that is enqueued after the first dequeue command will be processed only after processing all the remaining messages in the queue. This is usually sufficient when all the messages have already been enqueued into the queue, or when the queue does not have a priority-based ordering. However, applications must use the `FIRST_MESSAGE` navigation option when

the first message in the queue needs to be processed by every dequeue command. This usually becomes necessary when a higher priority message arrives in the queue while messages already-enqueued are being processed.

 **Note:**

It may be more efficient to use the `FIRST_MESSAGE` navigation option when messages are concurrently enqueued. If the `FIRST_MESSAGE` option is not specified, Oracle Database Advanced Queuing continually generates the snapshot as of the first dequeue command, leading to poor performance. If the `FIRST_MESSAGE` option is specified, then Oracle Database Advanced Queuing uses a new snapshot for every dequeue command.

Messages enqueued in the same transaction into a queue that has been enabled for message grouping will form a group. If only one message is enqueued in the transaction, then this will effectively form a group of one message. There is no upper limit to the number of messages that can be grouped in a single transaction.

In queues that have not been enabled for message grouping, a dequeue in `LOCKED` or `REMOVE` mode locks only a single message. By contrast, a dequeue operation that seeks to dequeue a message that is part of a group will lock the entire group. This is useful when all the messages in a group need to be processed as an atomic unit.

When all the messages in a group have been dequeued, the dequeue returns an error indicating that all messages in the group have been processed. The application can then use the `NEXT_TRANSACTION` to start dequeuing messages from the next available group. In the event that no groups are available, the dequeue will time out after the specified `WAIT` period.

Using Secure Queues

For secure queues, you must specify `consumer_name` in the `dequeue_options` parameter. See [DEQUEUE_OPTIONS_T Type](#) for more information about `consumer_name`.

When you use secure queues, the following are required:

- You must have created a valid Oracle Database Advanced Queuing agent using `DBMS_AQADM.CREATE_AQ_AGENT`. See [CREATE_AQ_AGENT Procedure](#).
- You must map the Oracle Database Advanced Queuing agent to a database user with dequeue privileges on the secure queue. Use `DBMS_AQADM.ENABLE_DB_ACCESS` to do this. See [ENABLE_DB_ACCESS Procedure](#).

25.5.3 DEQUEUE_ARRAY Function

This function dequeues an array of messages and returns them in the form of an array of payloads, an array of message properties and an array of message IDs. This function returns the number of messages successfully dequeued.

Syntax

```
DBMS_AQ.DEQUEUE_ARRAY (
    queue_name           IN    VARCHAR2,
    dequeue_options     IN    dequeue_options_t,
    array_size          IN    pls_integer,
    message_properties_array OUT message_properties_array_t,
```



```

payload_array          OUT  "<COLLECTION_1>",
msgid_array           OUT  msgid_array_t,
error_array           OUT  error_array_t)
RETURN pls_integer;

```

Parameters

Table 25-8 DEQUEUE_ARRAY Function Parameters

Parameter	Description
queue_name	The queue name from which messages are dequeued (same as single-row dequeue).
dequeue_options	The set of options which will be applied to all messages in the array (same as single-row dequeue).
array_size	The number of elements to dequeue. For buffered messages, array_size should be 1.
message_properties_array	A record containing an array corresponding to each message property. Each payload element has a corresponding set of message properties. See MESSAGE_PROPERTIES_ARRAY_T Type .
payload_array	An array of dequeued payload data. "<COLLECTION_1>" can be an associative array, varray or nested table in its PL/SQL representation. Users can dequeue JSON, RAW and ADT payloads.
msgid_array	An array of message IDs of the dequeued messages. See MSGID_ARRAY_T Type .
error_array	Currently not implemented

Usage Notes

A nonzero wait time, as specified in `dequeue_options`, is recognized only when there are no messages in the queue. If the queue contains messages that are eligible for dequeue, then the `DEQUEUE_ARRAY` function will dequeue up to `array_size` messages and return immediately.

Dequeue by `message_id` is not supported. See [DEQUEUE Procedure](#) for more information on the `navigation` parameter. Existing `NAVIGATION` modes are supported. In addition, two new `NAVIGATION` modes are supported for queues enabled for message grouping:

- `FIRST_MESSAGE_MULTI_GROUP`
- `NEXT_MESSAGE_MULTI_GROUP`



See Also:

[ENQUEUE_OPTIONS_T Type](#)

For transaction grouped queues and `ONE_GROUP` navigation, messages are dequeued from a single transaction group only, subject to the `array_size` limit. In `MULTI_GROUP` navigation, messages are dequeued across multiple transaction groups, still subject to the `array_size` limit. ORA-25235 is returned to indicate the end of a transaction group.

DEQUEUE_ARRAY is not supported for buffered messages, but you can still use this procedure on individual buffered messages by setting `array_size` to one message.

25.5.4 ENQUEUE Procedure

This procedure adds a message to the specified queue.

Syntax

```
DBMS_AQ.ENQUEUE (
  queue_name          IN          VARCHAR2,
  enqueue_options    IN          enqueue_options_t,
  message_properties IN          message_properties_t,
  payload            IN          "<ADT_1>",
  msgid              OUT         RAW);
```

Parameters

Table 25-9 ENQUEUE Procedure Parameters

Parameter	Description
<code>queue_name</code>	Specifies the name of the queue to which this message should be enqueued. The queue cannot be an exception queue.
<code>enqueue_options</code>	See ENQUEUE_OPTIONS_T Type .
<code>message_properties</code>	See MESSAGE_PROPERTIES_T Type .
<code>payload</code>	Not interpreted by Oracle Database Advanced Queuing. The payload must be specified according to the specification in the associated queue table. NULL is an acceptable parameter. For the definition of <i>type_name</i> refer to <code>TYPE_NAME</code> in DBMS_AQ Data Types .
<code>msgid</code>	System generated identification of the message. This is a globally unique identifier that can be used to identify the message at dequeue time.

Usage Notes

The `sequence_deviation` parameter in `enqueue_options` can be used to change the order of processing between two messages. The identity of the other message, if any, is specified by the `enqueue_options` parameter `relative_msgid`. The relationship is identified by the `sequence_deviation` parameter.

Specifying `sequence_deviation` for a message introduces some restrictions for the delay and priority values that can be specified for this message. The delay of this message must be less than or equal to the delay of the message before which this message is to be enqueued. The priority of this message must be greater than or equal to the priority of the message before which this message is to be enqueued.

 **Note:**

The `sequence_deviation` attribute has no effect in releases prior to Oracle Streams AQ 10g Release 1 (10.1) if `message_grouping` parameter of `DBMS_AQADM` subprograms is set to `TRANSACTIONAL`. The sequence deviation feature is deprecated in Oracle Streams AQ 10g Release 2 (10.2).

If a message is enqueued to a multiconsumer queue with no recipient, and if the queue has no subscribers (or rule-based subscribers that match this message), then Oracle error `ORA_24033` is raised. This is a warning that the message will be discarded because there are no recipients or subscribers to whom it can be delivered.

Using Secure Queues

For secure queues, you must specify the `sender_id` in the `messages_properties` parameter. See [MESSAGE_PROPERTIES_T Type](#) for more information about `sender_id`.

When you use secure queues, the following are required:

- You must have created a valid Oracle Database Advanced Queuing agent using `DBMS_AQADM.CREATE_AQ_AGENT`. See [CREATE_AQ_AGENT Procedure](#).
- You must map `sender_id` to a database user with enqueue privileges on the secure queue. Use `DBMS_AQADM.ENABLE_DB_ACCESS` to do this. See [ENABLE_DB_ACCESS Procedure](#).

25.5.5 ENQUEUE_ARRAY Function

This function enqueues an array of payloads using a corresponding array of message properties. The output will be an array of message IDs of the enqueued messages.

Syntax

```
DBMS_AQ.ENQUEUE_ARRAY (
    queue_name           IN   VARCHAR2,
    enqueue_options     IN   enqueue_options_t,
    array_size          IN   pls_integer,
    message_properties_array IN message_properties_array_t,
    payload_array       IN   "<COLLECTION_1>",
    msgid_array         OUT  msgid_array_t,
    error_array         OUT  error_array_t)
RETURN pls_integer;
```

Parameters

Table 25-10 ENQUEUE_ARRAY Function Parameters

Parameter	Description
<code>queue_name</code>	The queue name in which messages are enqueued (same as single-row enqueue).
<code>enqueue_options</code>	See ENQUEUE_OPTIONS_T Type .

Table 25-10 (Cont.) ENQUEUE_ARRAY Function Parameters

Parameter	Description
array_size	The number of elements to enqueue. For buffered messages, array_size should be 1.
message_properties_array	A record containing an array corresponding to each message property. For each property, the user must allocate array_size elements. See MESSAGE_PROPERTIES_ARRAY_T Type .
payload_array	An array of payload data. "<COLLECTION_1>" can be an associative array, VARRAY, or nested table in its PL/SQL representation. Users can enqueue JSON, RAW, and ADT payloads.
msgid_array	An array of message IDs for the enqueued messages. If an error occurs for a particular message, then its corresponding message ID is null. See MSGID_ARRAY_T Type .
error_array	Currently not implemented

Usage Notes

ENQUEUE_ARRAY is not supported for buffered messages, but you can still use this procedure on individual buffered messages by setting array_size to one message.

25.5.6 LISTEN Procedures

This procedure listens on one or more queues on behalf of a list of agents. The address field of the agent indicates the queue the agent wants to monitor. Only local queues are supported as addresses. Protocol is reserved for future use.

Syntax

```
DBMS_AQ.LISTEN (
    agent_list          IN    AQ$_AGENT_LIST_T,
    wait                IN    BINARY_INTEGER DEFAULT DBMS_AQ.FOREVER,
    agent               OUT   SYS.AQ$_AGENT);
```

```
DBMS_AQ.LISTEN (
    agent_list          IN    AQ$_AGENT_LIST_T,
    wait                IN    BINARY_INTEGER DEFAULT FOREVER,
    listen_delivery_mode IN  PLS_INTEGER DEFAULT DBMS_AQ.PERSISTENT,
    agent               OUT   SYS.AQ$_AGENT,
    message_delivery_mode OUT PLS_INTEGER);
```

```
TYPE aq$_agent_list_t IS TABLE OF aq$_agent INDEXED BY BINARY_INTEGER;
TYPE aq$_agent_list_t IS TABLE OF aq$_agent INDEXED BY BINARY_INTEGER;
```

Parameters

Table 25-11 LISTEN Procedure Parameters

Parameter	Description
agent_list	List of agents to listen for
wait	Time out for the listen call in seconds. By default, the call will block forever.

Table 25-11 (Cont.) LISTEN Procedure Parameters

Parameter	Description
<code>listen_delivery_mode</code>	The caller specifies whether it is interested in persistent, buffered messages or both types of messages, specifying a delivery mode of <code>DBMS_AQ.PERSISTENT</code> or <code>DBMS_AQ.BUFFERED</code> or <code>DBMS_AQ.PERSISTENT_OR_BUFFERED</code>
<code>agent</code>	Agent with a message available for consumption
<code>message_delivery_mode</code>	Returns the message type along with the queue and consumer for which there is a message

Usage Notes

If `agent-address` is a multiconsumer queue, then `agent-name` is mandatory. For single-consumer queues, `agent-name` must not be specified.

This procedure takes a list of agents as an argument. You specify the queue to be monitored in the address field of each agent listed. You also must specify the name of the agent when monitoring multiconsumer queues. For single-consumer queues, an agent name must not be specified. Only local queues are supported as addresses. Protocol is reserved for future use.

This is a blocking call that returns when there is a message ready for consumption for an agent in the list. If there are messages for more than one agent, only the first agent listed is returned. If there are no messages found when the wait time expires, an error is raised.

A successful return from the `LISTEN` call is only an indication that there is a message for one of the listed agents in one the specified queues. The interested agent must still dequeue the relevant message.

**Note:**

You cannot call `LISTEN` on nonpersistent queues.

25.5.7 POST Procedure

This procedure posts to a list of anonymous subscriptions that allows all clients who are registered for the subscriptions to get notifications.

Syntax

```
DBMS_AQ.POST (
  post_list      IN  SYS.AQ$_POST_INFO_LIST,
  post_count     IN  NUMBER);
```

Parameters

Table 25-12 POST Procedure Parameters

Parameter	Description
post_list	Specifies the list of anonymous subscriptions to which you want to post. It is a list of AQ\$_POST_INFO_LIST Type.
post_count	Specifies the number of entries in the post_list.

Usage Notes

This procedure is used to post to anonymous subscriptions which allows all clients who are registered for the subscriptions to get notifications. Several subscriptions can be posted to at one time.

25.5.8 REGISTER Procedure

This procedure registers an e-mail address, user-defined PL/SQL procedure, or HTTP URL for message notification.

Syntax

```
DBMS_AQ.REGISTER (
  reg_list      IN  SYS.AQ$_REG_INFO_LIST,
  count         IN  NUMBER);
```

Parameters

Table 25-13 REGISTER Procedure Parameters

Parameter	Description
reg_list	Specifies the list of subscriptions to which you want to register for message notifications. It is a list of AQ\$_REG_INFO Type.
count	Specifies the number of entries in the reg_list.

Usage Notes

- This procedure is used to register for notifications. You can specify an e-mail address to which message notifications are sent, register a procedure to be invoked on a notification, or register an HTTP URL to which the notification is posted. Interest in several subscriptions can be registered at one time.
- The procedure can also be used to register for grouping notifications using five grouping attributes:
 - Class – grouping criterion (currently only `TIME` criterion is supported)
 - Value – the value of the grouping criterion (currently only time in seconds for criterion `TIME`)
 - Type – summary or last, also contains count of notifications received in group (for AQ namespace only, not for `DBCHANGE` namespace)
 - Repeat count – how many times to perform grouping (Default is `FOREVER`)

- Start time – when to start grouping (Default is current time)
- If you register for e-mail notifications, you should set the host name and port name for the SMTP server that will be used by the database to send e-mail notifications. If required, you should set the send-from e-mail address, which is set by the database as the `sent from` field. You need a Java-enabled database to use this feature.
- If you register for HTTP notifications, you may want to set the host name and port number for the proxy server and a list of no-proxy domains that will be used by the database to post HTTP notifications.



See Also:

[DBMS_AQELM](#) for more information on e-mail and HTTP notifications

25.5.9 SEEK Procedure

This procedure enables a subscriber to seek any particular message of choice. Once a seek operation is successful, the dequeues move from the new seek position onwards. A new call is added to facilitate the seek operation.

Syntax

```
DBMS_AQ.SEEK (
    queue_name          IN      VARCHAR2 not null,
    consumer_name      IN      VARCHAR2 default null,
    seek_input_array   IN      SEEK_INPUT_ARRAY_T,
    skip_option        IN      pls_integer DEFAULT
DBMS_AQ.ERROR_IF_SKIPPED,
    seek_output_array  OUT     SEEK_OUTPUT_ARRAY_T);
```

Parameters

Table 25-14 SEEK Procedure Parameters

Parameter	Description
<code>queue_name</code>	Specifies the name of the queue.
<code>consumer_name</code>	Specifies the name of the subscriber performing seek. <code>consumer_name</code> can be NULL for single-consumer queues.
<code>seek_input_array</code>	Array of type <code>seek_input_t</code> , where individual element in the array has per shard seek input. See SEEK_INPUT_T Type .

Table 25-14 (Cont.) SEEK Procedure Parameters

Parameter	Description
skip_option	<p>Specifies the skip options. The following are the possible values:</p> <ul style="list-style-type: none"> DBMS_AQ.ERROR_IF_SKIPPED (default): Raises an error if seek operation can result in skipping some undequed messages when a seek forward is performed. DBMS_AQ.NO_DISCARD_SKIPPED: Does not discard any skipped messages. Allows the seek operation to go through irrespective of the direction of the seek. Such undequed messages before seek point will be shown as READY_SKIPPED in AQ\$<QUEUE_TABLE_NAME>. DBMS_AQ.DISCARD_SKIPPED: Discards any skipped messages. As soon as all the messages in a subshard are either dequeued or discarded by all its subscribers, the subshard is "retained" which will be truncated after retention time is over. Before retention time is over, the subscribers who have discarded the messages can seek back and dequeue the discarded messages if they wish to do so. The discarded messages will be shown as READY_DISCARDED in AQ\$<QUEUE_TABLE_NAME>.
seek_output_t_array	Array of type seek_output_t, where individual element in the array has seeked from and seeked to fields per shard-priority. See SEEK_OUTPUT_T Type .

25.5.10 UNBIND_AGENT Procedure

This procedure removes the entry for an Oracle Database Advanced Queuing agent from the LDAP server.

Syntax

```
DBMS_AQ.UNBIND_AGENT (
    agent      IN SYS.AQ$_AGENT);
```

Parameters

Table 25-15 BIND_AGENT Procedure Parameters

Parameter	Description
agent	Agent that is to be removed from the LDAP server

25.5.11 UNREGISTER Procedure

This procedure unregisters a subscription which turns off notifications.

Syntax

```
DBMS_AQ.UNREGISTER (
    reg_list    IN SYS.AQ$_REG_INFO_LIST,
    reg_count   IN NUMBER);
```


Parameters

Table 25-16 UNREGISTER Procedure Parameters

Parameter	Description
<code>reg_list</code>	Specifies the list of subscriptions to which you want to register for message notifications. It is a list of AQ\$_REG_INFO Type.
<code>reg_count</code>	Specifies the number of entries in the <code>reg_list</code> .

Usage Notes

This procedure is used to unregister a subscription which turns off notifications. Several subscriptions can be unregistered from at one time.

DBMS_AQADM

The `DBMS_AQADM` package provides procedures to manage Oracle Database Advanced Queuing (AQ) configuration and administration information.

See Also:

- *Oracle Database Advanced Queuing User's Guide*
- [Oracle Database Advanced Queuing \(AQ\) Types](#) for information about the `TYPES` to use with `DBMS_AQADM`

This chapter contains the following topics:

- [Security Model](#)
- [Constants](#)
- [Subprogram Groups](#)
- [Summary of DBMS_AQADM Subprograms](#)

26.1 DBMS_AQADM Security Model

Initially, only `SYS` and `SYSTEM` have execution privilege for the procedures in `DBMS_AQADM` and `DBMS_AQ`. Users who have been granted `EXECUTE` rights to `DBMS_AQ` and `DBMS_AQADM` are able to create, manage, and use queues in their own schemas. The `MANAGE_ANY` AQ system privilege is used to create and manage queues in other schemas and can be granted and revoked through `DBMS_AQADM.GRANT_SYSTEM_PRIVILEGE` and `DBMS_AQADM.REVOKE_SYSTEM_PRIVILEGE` respectively. Starting from Oracle Database 12c Release 2, `MANAGE_ANY` privilege will not allow access to `SYS` owned queues by users other than `SYS`.

User Roles

The database administrator has the option of granting the system privileges `ENQUEUE_ANY` and `DEQUEUE_ANY`, exercising `DBMS_AQADM.GRANT_SYSTEM_PRIVILEGE` and `DBMS_AQADM.REVOKE_SYSTEM_PRIVILEGE` directly to a database user, if you want the user to have this level of control.

The application developer gives rights to a queue by granting and revoking privileges at the object level by exercising `DBMS_AQADM.GRANT_QUEUE_PRIVILEGE` and `DBMS_AQADM.REVOKE_QUEUE_PRIVILEGE`. Starting from Oracle Database 12c Release 2, `ENQUEUE_ANY` and `DEQUEUE_ANY` privileges will not allow access to `SYS` owned queues by users other than `SYS`.

 **See Also:**

- [DBMS_AQ](#).
- *Oracle Database Advanced Queuing User's Guide* for more information on queue privileges and access control.

Security Required for Propagation

Propagation jobs are owned by `SYS`, but the propagation occurs in the security context of the queue table owner. Previously propagation jobs were owned by the user scheduling propagation, and propagation occurred in the security context of the user setting up the propagation schedule. The queue table owner must be granted `EXECUTE` privileges on the `DBMS_AQADM` package. Otherwise, the Oracle Database snapshot processes do not propagate and generate trace files with the error identifier `SYS.DBMS_AQADM` not defined. Private database links owned by the queue table owner can be used for propagation. The username specified in the connection string must have `EXECUTE` access on the `DBMS_AQ` and `DBMS_AQADM` packages on the remote database.

 **See Also:**

Oracle Database Advanced Queuing User's Guide for more information on security required for propagation.

Queue Table Migration

The `MIGRATE_QUEUE_TABLE` procedure requires that the `EXECUTE` privilege on `DBMS_AQADM` be granted to the queue table owner, who is probably an ordinary queue user. If you do not want ordinary queue users to be able to create and drop queues and queue tables, add and delete subscribers, and so forth, then you must revoke the `EXECUTE` privilege as soon as the migration is done.

 **See Also:**

- "[MIGRATE_QUEUE_TABLE Procedure](#)."
- *Oracle Database Advanced Queuing User's Guide* for more information on granting Oracle Database Advanced Queuing system privileges.

26.2 DBMS_AQADM Constants

When using enumerated constants, such as `INFINITE`, `TRANSACTIONAL`, or `NORMAL_QUEUE`, the symbol must be specified with the scope of the packages defining it. All types associated with the administrative interfaces must be prepended with `DBMS_AQADM`. For example: `DBMS_AQADM.NORMAL_QUEUE`.

Table 26-1 Enumerated Types in the Administrative Interface

Parameter	Options
retention	0, 1, 2...INFINITE
message_grouping	TRANSACTIONAL, NONE
queue_type	NORMAL_QUEUE, EXCEPTION_QUEUE, NON_PERSISTENT_QUEUE

**See Also:**

For more information on the Java classes and data structures used in both `DBMS_AQ` and `DBMS_AQADM`, see the [DBMS_AQ](#) package.

26.3 DBMS_AQADM Subprogram Groups

This section lists and describes the `DBMS_AQADM` subprogram groups.

This `DBMS_AQADM` package is made up of the following subprogram groups:

- [Queue Table Subprograms](#)
- [Privilege Subprograms](#)
- [Queue Subprograms](#)
- [Subscriber Subprograms](#)
- [Propagation Subprograms](#)
- [Miscellaneous Subprograms](#)
- [Oracle Database Advanced Queuing Agent Subprograms](#)
- [Alias Subprograms](#)

26.3.1 DBMS_AQADM Queue Table Subprograms

This section lists and describes the `DBMS_AQADM` Queue Table subprograms.

Table 26-2 Queue Table Subprograms

Subprograms	Description
ALTER_QUEUE_TABLE Procedure	Alters the existing properties of a queue table
CREATE_QUEUE_TABLE Procedure	Creates a queue table for messages of a predefined type
DROP_QUEUE_TABLE Procedure	Drops an existing queue table
ENABLE_JMS_TYPES Procedure	A precondition for the enqueue of JMS types and XML types

Table 26-2 (Cont.) Queue Table Subprograms

Subprograms	Description
MIGRATE_QUEUE_TABLE Procedure	Upgrades an 8.0-compatible queue table to an 8.1-compatible or higher queue table, or downgrades an 8.1-compatible or higher queue table to an 8.0-compatible queue table
PURGE_QUEUE_TABLE Procedure	Purges messages from queue tables

26.3.2 DBMS_AQADM Privilege Subprograms

This sections lists and describes the DBMS_AQADM Privilege subprograms.

Table 26-3 Privilege Subprograms

Subprograms	Description
GRANT_QUEUE_PRIVILEGE Procedure	Grants privileges on a queue to users and roles
GRANT_SYSTEM_PRIVILEGE Procedure	Grants Oracle Database Advanced Queuing system privileges to users and roles
REVOKE_QUEUE_PRIVILEGE Procedure	Revokes privileges on a queue from users and roles
REVOKE_SYSTEM_PRIVILEGE Procedure	Revokes Oracle Database Advanced Queuing system privileges from users and roles

26.3.3 DBMS_AQADM Queue Subprograms

This sections lists and describes the DBMS_AQADM Queue subprograms.

Table 26-4 Queue Subprograms

Subprograms	Description
ALTER_QUEUE Procedure	Alters existing properties of a queue
CREATE_NP_QUEUE Procedure	Creates a nonpersistent RAW queue
CREATE_QUEUE Procedure	Creates a queue in the specified queue table
CREATE_SHARDED_QUEUE Procedure	Creates a queue and its queue table for a sharded queue all together.
DROP_SHARDED_QUEUE Procedure	Drops an existing sharded queue from the database queuing system
ALTER_SHARDED_QUEUE Procedure	Alters an sharded queue in the database queuing system
CREATE_EXCEPTION_QUEUE Procedure	Creates an exception queue for a sharded queue
DROP_QUEUE Procedure	Drops an existing queue

Table 26-4 (Cont.) Queue Subprograms

Subprograms	Description
QUEUE_SUBSCRIBERS Function	Returns the subscribers to an 8.0-compatible multiconsumer queue in the PL/SQL index by table collection type <code>DBMS_AQADM.AQ\$_subscriber_list_t</code>
START_QUEUE Procedure	Enables the specified queue for enqueueing or dequeueing
STOP_QUEUE Procedure	Disables enqueueing or dequeueing on the specified queue

26.3.4 DBMS_AQADM Subscriber Subprograms

This section lists and describes the DBMS_AQADM Subscriber subprograms.

Table 26-5 Subscriber Subprograms

Subprograms	Description
ADD_SUBSCRIBER Procedure	Adds a default subscriber to a queue
ALTER_SUBSCRIBER Procedure	Alters existing properties of a subscriber to a specified queue
REMOVE_SUBSCRIBER Procedure	Removes a default subscriber from a queue

26.3.5 DBMS_AQADM Propagation Subprograms

This section lists and describes the DBMS_AQADM propagation subprograms.

Table 26-6 Propagation Subprograms

Subprograms	Description
ALTER_PROPAGATION_SCHEDULE Procedure	Alters parameters for a propagation schedule
DISABLE_PROPAGATION_SCHEDULE Procedure	Disables a propagation schedule
ENABLE_PROPAGATION_SCHEDULE Procedure	Enables a previously disabled propagation schedule
SCHEDULE_PROPAGATION Procedure	Schedules propagation of messages from a queue to a destination identified by a specific database link
UNSCHEDULE_PROPAGATION Procedure	Unscheduled previously scheduled propagation of messages from a queue to a destination identified by a specific database link
VERIFY_QUEUE_TYPES Procedure	Verifies that the source and destination queues have identical types

26.3.6 DBMS_AQADM Miscellaneous Subprograms

This section lists and describes the DBMS_AQADM miscellaneous subprograms.

Table 26-7 Miscellaneous Subprograms

Subprograms	Description
GET_QUEUE_PARAMETER Procedure	Used to get different parameters for sharded queues at queue or database level.
GET_MAX_STREAMS_POOL Procedure	Retrieves the value of Oracle Database Advanced Queuing maximum streams pool memory limit
GET_MIN_STREAMS_POOL Procedure	Retrieves the value of Oracle Database Advanced Queuing minimum streams pool memory limit
GET_WATERMARK Procedure	Retrieves the value of watermark set by the SET_WATERMARK Procedure
SET_QUEUE_PARAMETER Procedure	Used to set different parameters for sharded queues at queue or database level.
SET_MAX_STREAMS_POOL Procedure	Used for Oracle Database Advanced Queuing to specify and limit maximum streams pool memory use
SET_MIN_STREAMS_POOL Procedure	Used for Oracle Database Advanced Queuing to specify and limit minimum streams pool memory use
SET_WATERMARK Procedure	Used for Oracle Database Advanced Queuing notification to specify and limit memory use
UNSET_QUEUE_PARAMETER Procedure	Used to unset different parameters for sharded queues at queue or database level.

26.3.7 DBMS_AQADM Agent Subprograms

This section lists and describes the DBMS_AQADM agent subprograms.

Table 26-8 Oracle Streams AQ Agent Subprograms

Subprograms	Description
ALTER_AQ_AGENT Procedure	Alters an agent registered for Oracle Database Advanced Queuing Internet access, and an Oracle Database Advanced Queuing agent that accesses secure queues
CREATE_AQ_AGENT Procedure	Registers an agent for Oracle Database Advanced Queuing Internet access using HTTP/SMTP protocols, and creates an Oracle Database Advanced Queuing agent to access secure queues
DISABLE_DB_ACCESS Procedure	Revokes the privileges of a specific database user from an Oracle Database Advanced Queuing Internet agent
DROP_AQ_AGENT Procedure	Drops an agent that was previously registered for Oracle Database Advanced Queuing Internet access
ENABLE_DB_ACCESS Procedure	Grants an Oracle Database Advanced Queuing Internet agent the privileges of a specific database user

26.3.8 DBMS_AQADM Alias Subprograms

This section lists and describes the DBMS_AQADM alias subprograms.

Table 26-9 Alias Subprograms

Subprograms	Description
ADD_ALIAS_TO_LDAP Procedure	Creates an alias for a queue, agent, or a JMS ConnectionFactory in LDAP
DEL_ALIAS_FROM_LDAP Procedure	Drops an alias for a queue, agent, or JMS ConnectionFactory in LDAP

26.4 Summary of DBMS_AQADM Subprograms

This section lists and describes the DBMS_AQADM package subprograms.

Table 26-10 DBMS_AQADM Package Subprograms

Subprograms	Description
ADD_ALIAS_TO_LDAP Procedure	Creates an alias for a queue, agent, or a JMS ConnectionFactory in LDAP
ADD_SUBSCRIBER Procedure	Adds a default subscriber to a queue
ALTER_AQ_AGENT Procedure	Alters an agent registered for Oracle Database Advanced Queuing Internet access, and an Oracle Database Advanced Queuing agent that accesses secure queues
ALTER_PROPAGATION_SCHEDULE Procedure	Alters parameters for a propagation schedule
ALTER_QUEUE Procedure	Alters existing properties of a queue
ALTER_QUEUE_TABLE Procedure	Alters the existing properties of a queue table
ALTER_SHARDED_QUEUE Procedure	Provides user the ability to alter the <code>cache_hint</code> and comment for the sharded queue <i>Starting with Oracle Database 20c, sharded queues are deprecated and will be desupported in a futur release. Use Transactional Event Queues(TEQ) instead.</i>
ALTER_SUBSCRIBER Procedure	Alters existing properties of a subscriber to a specified queue
ALTER_TRANSACTIONAL_EVENT_QUEUE Procedure	Provides user the ability to alter the <code>cache_hint</code> and comment for the TEQ queue
CREATE_AQ_AGENT Procedure	Registers an agent for Oracle Database Advanced Queuing Internet access using HTTP/SMTP protocols, and creates an Oracle Database Advanced Queuing agent to access secure queues
CREATE_NP_QUEUE Procedure	Creates a nonpersistent RAW queue
CREATE_QUEUE Procedure	Creates a queue in the specified queue table
CREATE_SHARDED_QUEUE Procedure	Creates a queue and its queue table for a sharded queue all together. <i>Starting with Oracle Database 20c, sharded queues are deprecated and will be desupported in a futur release. Use Transactional Event Queues(TEQ) instead.</i>

Table 26-10 (Cont.) DBMS_AQADM Package Subprograms

Subprograms	Description
CREATE_EXCEPTION_QUEUE Procedure	Creates an exception queue. <i>Starting with Oracle Database 20c, sharded queues are deprecated and will be desupported in a futur release. Use Transactional Event Queues(TEQ) instead.</i>
CREATE_EQ EXCEPTION_QUEUE Procedure	Creates an exception queue.
CREATE_TRANSACTIONAL_EVENT_QUEUE Procedure	Creates a queue and its queue table for a Transactional Event Queue (TEQ).
CREATE_QUEUE_TABLE Procedure	Creates a queue table for messages of a predefined type
DEL_ALIAS_FROM_LDAP Procedure	Drops an alias for a queue, agent, or JMS ConnectionFactory in LDAP
DISABLE_DB_ACCESS Procedure	Revokes the privileges of a specific database user from an Oracle Database Advanced Queuing Internet agent
DISABLE_PROPAGATION_SCHEDULE Procedure	Disables a propagation schedule
DROP_AQ_AGENT Procedure	Drops an agent that was previously registered for Oracle Database Advanced Queuing Internet access
DROP_QUEUE Procedure	Drops an existing queue
DROP_SHARDED_QUEUE Procedure	Drops an existing sharded queue from the database queuing system <i>Starting with Oracle Database 20c, sharded queues are deprecated and will be desupported in a futur release. Use Transactional Event Queues(TEQ) instead.</i>
DROP_TRANSACTIONAL_EVENT_QUEUE Procedure	Drops an existing TEQ queue from the database queuing system
DROP_QUEUE_TABLE Procedure	Drops an existing queue table
ENABLE_DB_ACCESS Procedure	Grants an Oracle Database Advanced Queuing Internet agent the privileges of a specific database user
ENABLE_JMS_TYPES Procedure	A precondition for the enqueue of JMS types and XML types
ENABLE_PROPAGATION_SCHEDULE Procedure	Enables a previously disabled propagation schedule
GET_MAX_STREAMS_POOL Procedure	Retrieves the value of Oracle Database Advanced Queuing maximum streams pool memory limit
GET_MIN_STREAMS_POOL Procedure	Retrieves the value of Oracle Database Advanced Queuing minimum streams pool memory limit
GET_QUEUE_PARAMETER Procedure	Used to get different parameters for sharded queues at queue or database level.
GET_WATERMARK Procedure	Retrieves the value of watermark set by the <code>SET_WATERMARK Procedure</code>
GRANT_QUEUE_PRIVILEGE Procedure	Grants privileges on a queue to users and roles

Table 26-10 (Cont.) DBMS_AQADM Package Subprograms

Subprograms	Description
GRANT_SYSTEM_PRIVILEGE Procedure	Grants Oracle Database Advanced Queuing system privileges to users and roles
MIGRATE_QUEUE_TABLE Procedure	Upgrades an 8.0-compatible queue table to an 8.1-compatible or higher queue table, or downgrades an 8.1-compatible or higher queue table to an 8.0-compatible queue table
PURGE_QUEUE_TABLE Procedure	Purges messages from queue tables
QUEUE_SUBSCRIBERS Function	Returns the subscribers to an 8.0-compatible multiconsumer queue in the PL/SQL index by table collection type DBMS_AQADM.AQ\$_subscriber_list_t
REMOVE_SUBSCRIBER Procedure	Removes a default subscriber from a queue
REVOKE_QUEUE_PRIVILEGE Procedure	Revokes privileges on a queue from users and roles
REVOKE_SYSTEM_PRIVILEGE Procedure	Revokes Oracle Database Advanced Queuing system privileges from users and roles
SCHEDULE_PROPAGATION Procedure	Schedules propagation of messages from a queue to a destination identified by a specific database link
SET_QUEUE_PARAMETER Procedure	Used to set different parameters for sharded queues at queue or database level.
SET_MAX_STREAMS_POOL Procedure	Used for Oracle Database Advanced Queuing to specify and limit maximum streams pool memory use
SET_MIN_STREAMS_POOL Procedure	Used for Oracle Database Advanced Queuing to specify and limit minimum streams pool memory use
SET_WATERMARK Procedure	Used for Oracle Database Advanced Queuing notification to specify and limit memory use
START_QUEUE Procedure	Enables the specified queue for enqueueing or dequeuing
STOP_QUEUE Procedure	Disables enqueueing or dequeuing on the specified queue
UNSCHEDULE_PROPAGATION Procedure	Unschedules previously scheduled propagation of messages from a queue to a destination identified by a specific database link
UNSET_QUEUE_PARAMETER Procedure	Used to unset different parameters for sharded queues at queue or database level.
VERIFY_QUEUE_TYPES Procedure	Verifies that the source and destination queues have identical types

26.4.1 ADD_ALIAS_TO_LDAP Procedure

This procedure creates an alias for a queue, agent, or a JMS ConnectionFactory in LDAP. The alias will be placed directly under the database server's distinguished name in LDAP hierarchy.

Syntax

```
DBMS_AQADM.ADD_ALIAS_TO_LDAP (
    alias          IN VARCHAR2,
    obj_location  IN VARCHAR2);
```

Parameters

Table 26-11 ADD_ALIAS_TO_LDAP Procedure Parameters

Parameter	Description
alias	Name of the alias. Example: west_shipping.
obj_location	The distinguished name of the object (queue, agent or connection factory) to which alias refers.

Usage Notes

This method can be used to create aliases for queues, agents, and JMS ConnectionFactory objects. These object must exist before the alias is created. These aliases can be used for JNDI lookup in JMS and Oracle Database Advanced Queuing Internet access.

26.4.2 ADD_SUBSCRIBER Procedure

This procedure adds a default subscriber to a queue.

Syntax

```
DBMS_AQADM.ADD_SUBSCRIBER (
    queue_name      IN      VARCHAR2,
    subscriber      IN      sys.aq$_agent,
    rule            IN      VARCHAR2 DEFAULT NULL,
    transformation  IN      VARCHAR2 DEFAULT NULL,
    queue_to_queue  IN      BOOLEAN DEFAULT FALSE,
    delivery_mode   IN      PLS_INTEGER DEFAULT DBMS_AQADM.PERSISTENT);
```

Parameters

Table 26-12 ADD_SUBSCRIBER Procedure Parameters

Parameter	Description
queue_name	Name of the queue.
subscriber	Agent on whose behalf the subscription is being defined.

Table 26-12 (Cont.) ADD_SUBSCRIBER Procedure Parameters

Parameter	Description
rule	A conditional expression based on the message properties, the message data properties and PL/SQL functions. A rule is specified as a Boolean expression using syntax similar to the WHERE clause of a SQL query. This Boolean expression can include conditions on message properties, user data properties (object payloads only), and PL/SQL or SQL functions (as specified in the where clause of a SQL query). Currently supported message properties are <code>priority</code> and <code>corrid</code> . To specify rules on a message payload (object payload), use attributes of the object type in clauses. You must prefix each attribute with <code>tab.user_data</code> as a qualifier to indicate the specific column of the queue table that stores the payload. The rule parameter cannot exceed 4000 characters.
transformation	Specifies a transformation that will be applied when this subscriber dequeues the message. The source type of the transformation must match the type of the queue. If the subscriber is remote, then the transformation is applied before propagation to the remote queue.
queue_to_queue	If TRUE, propagation is from queue-to-queue.
delivery_mode	The administrator may specify one of <code>DBMS_AQADM.PERSISTENT</code> , <code>DBMS_AQADM.BUFFERED</code> , or <code>DBMS_AQADM.PERSISTENT_OR_BUFFERED</code> for the delivery mode of the messages the subscriber is interested in. This parameter will not be modifiable by <code>ALTER_SUBSCRIBER</code> .

Usage Notes

A program can enqueue messages to a specific list of recipients or to the default list of subscribers. This operation only succeeds on queues that allow multiple consumers. This operation takes effect immediately, and the containing transaction is committed. Enqueue requests that are executed after the completion of this call will reflect the new behavior.

Any string within the rule must be quoted:

```
rule => 'PRIORITY <= 3 AND CORRID = ''FROM JAPAN'''
```

Note that these are all single quotation marks.

26.4.3 ALTER_AQ_AGENT Procedure

This procedure alters an agent registered for Oracle Database Advanced Queuing Internet access. It is also used to alter an Oracle Database Advanced Queuing agent that accesses secure queues.

Syntax

```
DBMS_AQADM.ALTER_AQ_AGENT (
  agent_name          IN VARCHAR2,
  certificate_location IN VARCHAR2 DEFAULT NULL,
  enable_http         IN BOOLEAN DEFAULT FALSE,
  enable_smtp         IN BOOLEAN DEFAULT FALSE,
  enable_anyp         IN BOOLEAN DEFAULT FALSE )
```

Parameters

Table 26-13 ALTER_AQ_AGENT Procedure Parameters

Parameter	Description
agent_name	Specifies the username of the Oracle Database Advanced Queuing Internet agent.
certification_location	Agent's certificate location in LDAP (default is NULL). If the agent is allowed to access Oracle Database Advanced Queuing through SMTP, then its certificate must be registered in LDAP. For access through HTTP, the certificate location is not required.
enable_http	TRUE means the agent can access Oracle Database Advanced Queuing through HTTP. FALSE means the agent cannot access Oracle Database Advanced Queuing through HTTP.
enable_smtp	TRUE means the agent can access Oracle Database Advanced Queuing through SMTP (e-mail). FALSE means the agent cannot access Oracle Database Advanced Queuing through SMTP.
enable_anyp	TRUE means the agent can access Oracle Database Advanced Queuing through any protocol (HTTP or SMTP).

26.4.4 ALTER_PROPAGATION_SCHEDULE Procedure

This procedure alters parameters for a propagation schedule.

Syntax

```
DBMS_AQADM.ALTER_PROPAGATION_SCHEDULE (
    queue_name          IN    VARCHAR2,
    destination         IN    VARCHAR2 DEFAULT NULL,
    duration            IN    NUMBER   DEFAULT NULL,
    next_time           IN    VARCHAR2 DEFAULT NULL,
    latency             IN    NUMBER   DEFAULT 60,
    destination_queue   IN    VARCHAR2 DEFAULT NULL);
```

Parameters

Table 26-14 ALTER_PROPAGATION_SCHEDULE Procedure Parameters

Parameter	Description
queue_name	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the user.
destination	Destination database link. Messages in the source queue for recipients at this destination are propagated. If it is NULL, then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 128 bytes, and if the name is not fully qualified, then the default domain name is used.
duration	Duration of the propagation window in seconds. A NULL value means the propagation window is forever or until the propagation is unscheduled.

Table 26-14 (Cont.) ALTER_PROPAGATION_SCHEDULE Procedure Parameters

Parameter	Description
next_time	Date function to compute the start of the next propagation window from the end of the current window. If this value is NULL, then propagation is stopped at the end of the current window. For example, to start the window at the same time every day, next_time should be specified as SYSDATE + 1 - duration/86400.
latency	<p>Maximum wait, in seconds, in the propagation window for a message to be propagated after it is enqueued. The default value is 60. Caution: if latency is not specified for this call, then latency will over-write any existing value with the default value.</p> <p>For example, if the latency is 60 seconds and there are no messages to be propagated during the propagation window, then messages from that queue for the destination are not propagated for at least 60 more seconds. It will be at least 60 seconds before the queue will be checked again for messages to be propagated for the specified destination. If the latency is 600, then the queue will not be checked for 10 minutes and if the latency is 0, then a job queue process will be waiting for messages to be enqueued for the destination and as soon as a message is enqueued it will be propagated.</p>
destination_queue	Name of the target queue to which messages are to be propagated in the form of a dblink

26.4.5 ALTER_QUEUE Procedure

This procedure alters existing properties of a queue. The parameters max_retries, retention_time, and retry_delay are not supported for nonpersistent queues.

Syntax

```
DBMS_AQADM.ALTER_QUEUE (
    queue_name      IN    VARCHAR2,
    max_retries     IN    NUMBER  DEFAULT NULL,
    retry_delay     IN    NUMBER  DEFAULT NULL,
    retention_time  IN    NUMBER  DEFAULT NULL,
    auto_commit     IN    BOOLEAN  DEFAULT TRUE,
    comment         IN    VARCHAR2  DEFAULT NULL);
```

Parameters

Table 26-15 ALTER_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the queue that is to be altered

Table 26-15 (Cont.) ALTER_QUEUE Procedure Parameters

Parameter	Description
max_retries	Limits the number of times a dequeue with REMOVE mode can be attempted on a message. The maximum value of max_retries is 2**31 -1. A message is moved to an exception queue if RETRY_COUNT is greater than MAX_RETRIES. RETRY_COUNT is incremented when the application issues a rollback after executing the dequeue. If a dequeue transaction fails because the server process dies (including ALTER SYSTEM KILL SESSION) or SHUTDOWN ABORT on the instance, then RETRY_COUNT is not incremented. Note that max_retries is supported for all single consumer queues and 8.1-compatible or higher multiconsumer queues but not for 8.0-compatible multiconsumer queues.
retry_delay	Delay time in seconds before this message is scheduled for processing again after an application rollback. The default is NULL, which means that the value will not be altered. Note that retry_delay is supported for single consumer queues and 8.1-compatible or higher multiconsumer queues but not for 8.0-compatible multiconsumer queues.
retention_time	Retention time in seconds for which a message is retained in the queue table after being dequeued. The default is NULL, which means that the value will not be altered.
auto_commit	TRUE causes the current transaction, if any, to commit before the ALTER_QUEUE operation is carried out. The ALTER_QUEUE operation become persistent when the call returns. This is the default. FALSE means the operation is part of the current transaction and becomes persistent only when the caller enters a commit. Caution: This parameter has been deprecated.
comment	User-specified description of the queue. This user comment is added to the queue catalog. The default value is NULL, which means that the value will not be changed.

26.4.6 ALTER_QUEUE_TABLE Procedure

This procedure alters the existing properties of a queue table.

Syntax

```
DBMS_AQADM.ALTER_QUEUE_TABLE (
  queue_table      IN  VARCHAR2,
  comment          IN  VARCHAR2          DEFAULT NULL,
  primary_instance IN  BINARY_INTEGER DEFAULT NULL,
  secondary_instance IN BINARY_INTEGER DEFAULT NULL,
  replication_mode IN  BINARY_INTEGER DEFAULT NULL);
```

Parameters

Table 26-16 ALTER_QUEUE_TABLE Procedure Parameters

Parameter	Description
queue_table	Name of a queue table to be created.

Table 26-16 (Cont.) ALTER_QUEUE_TABLE Procedure Parameters

Parameter	Description
comment	Modifies the user-specified description of the queue table. This user comment is added to the queue catalog. The default value is NULL which means that the value will not be changed.
primary_instance	This is the primary owner of the queue table. Queue monitor scheduling and propagation for the queues in the queue table will be done in this instance. The default value is NULL, which means that the current value will not be changed.
secondary_instance	The queue table fails over to the secondary instance if the primary instance is not available. The default value is NULL, which means that the current value will not be changed.
replication_mode	DBMS_AQADM.REPLICATION_MODE if queue is being altered to be in the Replication Mode. DBMS_AQADM.NONE if queue is being altered to not be replicated. The default value is NULL.

26.4.7 ALTER_SHARDED_QUEUE Procedure

This procedure provides user the ability to alter a sharded queue.



See Also:

Oracle® Database Advanced Queuing User's Guide for information about sharded queues

Syntax

```
PROCEDURE ALTER_SHARDED_QUEUE (
  queue_name          IN VARCHAR2,
  max_retries         IN NUMBER          DEFAULT NULL,
  comment             IN VARCHAR2       DEFAULT NULL,
  queue_properties    IN QUEUE_PROPS_T  DEFAULT NULL,
  replication_mode    IN BINARY_INTEGER DEFAULT NULL);
```

Parameters

Table 26-17 ALTER_SHARDED_QUEUE Procedure Parameters

Parameter	Description
queue_name	This parameter specifies the name of the sharded queue. A maximum of 128 characters are allowed.
max_retries	The maximum number of retries allowed.
comment	The comment of the queue.
queue_properties	Properties such as Normal or Exception Queue, Retry delay, retention time, sort list and cache hint. Refer to QUEUE_PROPS_T Type for more information about queue_properties.

Table 26-17 (Cont.) ALTER_SHARDED_QUEUE Procedure Parameters

Parameter	Description
replication_mode	Reserved for future use. DBMS_AQADM.REPLICATION_MODE if queue is being altered to be in the Replication Mode or else DBMS_AQADM.NONE. Default is NULL.

26.4.8 ALTER_SUBSCRIBER Procedure

This procedure alters existing properties of a subscriber to a specified queue. Only the rule can be altered.

Syntax

```
DBMS_AQADM.ALTER_SUBSCRIBER (
  queue_name      IN   VARCHAR2,
  subscriber      IN   sys.aq$_agent,
  rule            IN   VARCHAR2
  transformation  IN   VARCHAR2);
```

Parameters

Table 26-18 ALTER_SUBSCRIBER Procedure Parameters

Parameter	Description
queue_name	Name of the queue.
subscriber	Agent on whose behalf the subscription is being altered. See "AQ__AGENT Type" .
rule	A conditional expression based on the message properties, the message data properties and PL/SQL functions. The rule parameter cannot exceed 4000 characters. To eliminate the rule, set the rule parameter to NULL.
transformation	Specifies a transformation that will be applied when this subscriber dequeues the message. The source type of the transformation must match the type of the queue. If the subscriber is remote, then the transformation is applied before propagation to the remote queue.

Usage Notes

This procedure alters both the rule and the transformation for the subscriber. If you want to retain the existing value for either of them, you must specify its old value. The current values for rule and transformation for a subscriber can be obtained from the *schema.AQ\$queue_table_R* and *schema.AQ\$queue_table_S* views.

26.4.9 ALTER_TRANSACTIONAL_EVENT_QUEUE Procedure

This procedure provides user the ability to alter a TEQ queue.



See Also:

Oracle® Database Advanced Queuing User's Guide for information about TEQ queues

Syntax

```
PROCEDURE ALTER_TRANSACTIONAL_EVENT_QUEUE (
  queue_name          IN VARCHAR2,
  max_retries         IN NUMBER          DEFAULT NULL,
  comment             IN VARCHAR2       DEFAULT NULL,
  queue_properties    IN QUEUE_PROPS_T  DEFAULT NULL,
  replication_mode    IN BINARY_INTEGER DEFAULT NULL);
```

Parameters

Table 26-19 ALTER_TRANSACTIONAL_EVENT_QUEUE Procedure Parameters

Parameter	Description
queue_name	This parameter specifies the name of the TEQ queue. A maximum of 128 characters are allowed.
max_retries	The maximum number of retries allowed.
comment	The comment of the queue.
queue_properties	Properties such as Normal or Exception Queue, Retry delay, retention time, sort list and cache hint. Refer to QUEUE_PROPS_T Type for more information about queue_properties.
replication_mode	Reserved for future use. DBMS_AQADM.REPLICATION_MODE if queue is being altered to be in the Replication Mode or else DBMS_AQADM.NONE. Default is NULL.

26.4.10 CREATE_AQ_AGENT Procedure

This procedure registers an agent for Oracle Database Advanced Queuing Internet access using HTTP/SMTP protocols. It is also used to create an Oracle Database Advanced Queuing agent to access secure queues.

Syntax

```
DBMS_AQADM.CREATE_AQ_AGENT (
  agent_name          IN VARCHAR2,
  certificate_location IN VARCHAR2 DEFAULT NULL,
  enable_http         IN BOOLEAN DEFAULT FALSE,
  enable_smtp         IN BOOLEAN DEFAULT FALSE,
  enable_anyp         IN BOOLEAN DEFAULT FALSE )
```

Parameters

Table 26-20 CREATE_AQ_AGENT Procedure Parameters

Parameter	Description
agent_name	Specifies the username of the Oracle Database Advanced Queuing Internet agent.
certification_location	Agent's certificate location in LDAP (default is NULL). If the agent is allowed to access Oracle Database Advanced Queuing through SMTP, then its certificate must be registered in LDAP. For access through HTTP, the certificate location is not required.
enable_http	TRUE means the agent can access Oracle Database Advanced Queuing through HTTP. FALSE means the agent cannot access Oracle Database Advanced Queuing through HTTP.
enable_smtp	TRUE means the agent can access Oracle Database Advanced Queuing through SMTP (e-mail). FALSE means the agent cannot access Oracle Database Advanced Queuing through SMTP.
enable_anyp	TRUE means the agent can access Oracle Database Advanced Queuing through any protocol (HTTP or SMTP).

Usage Notes

The `SYS.AQ$INTERNET_USERS` view has a list of all Oracle Database Advanced Queuing Internet agents.

26.4.11 CREATE_NP_QUEUE Procedure

This procedure creates a nonpersistent RAW queue.



Note:

Nonpersistent queues are deprecated as of Release 10gR2. Oracle recommends using buffered messaging.

Syntax

```
DBMS_AQADM.CREATE_NP_QUEUE (
  queue_name          IN          VARCHAR2,
  multiple_consumers IN          BOOLEAN DEFAULT FALSE,
  comment             IN          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 26-21 CREATE_NP_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the nonpersistent queue that is to be created. The name must be unique within a schema and must follow object name guidelines in <i>Oracle Database SQL Language Reference</i> .
multiple_consumers	FALSE means queues created in the table can only have one consumer for each message. This is the default. TRUE means queues created in the table can have multiple consumers for each message. Note that this parameter is distinguished at the queue level, because a nonpersistent queue does not inherit this characteristic from any user-created queue table.
comment	User-specified description of the queue. This user comment is added to the queue catalog.

Usage Notes

The queue may be either single-consumer or multiconsumer queue. All queue names must be unique within a schema. The queues are created in a 8.1-compatible or higher system-created queue table (AQ\$_MEM_SC or AQ\$_MEM_MC) in the same schema as that specified by the queue name.

If the queue name does not specify a schema name, the queue is created in the login user's schema. After a queue is created with CREATE_NP_QUEUE, it can be enabled by calling START_QUEUE. By default, the queue is created with both enqueue and dequeue disabled.

You cannot dequeue from a nonpersistent queue. The only way to retrieve a message from a nonpersistent queue is by using the OCI notification mechanism. You cannot invoke the LISTEN call on a nonpersistent queue.

26.4.12 CREATE_QUEUE Procedure

This procedure creates a queue in the specified queue table.

Syntax

```
DBMS_AQADM.CREATE_QUEUE (
  queue_name      IN      VARCHAR2,
  queue_table     IN      VARCHAR2,
  queue_type      IN      BINARY_INTEGER DEFAULT NORMAL_QUEUE,
  max_retries     IN      NUMBER          DEFAULT NULL,
  retry_delay     IN      NUMBER          DEFAULT 0,
  retention_time  IN      NUMBER          DEFAULT 0,
  dependency_tracking IN  BOOLEAN          DEFAULT FALSE,
  comment         IN      VARCHAR2        DEFAULT NULL,
  auto_commit     IN      BOOLEAN          DEFAULT TRUE);
```

Parameters

Table 26-22 CREATE_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the queue that is to be created. The name must be unique within a schema and must follow object name guidelines in <i>Oracle Database SQL Language Reference</i> with regard to reserved characters.
queue_table	Name of the queue table that will contain the queue.
queue_type	Specifies whether the queue being created is an exception queue or a normal queue. <code>NORMAL_QUEUE</code> means the queue is a normal queue. This is the default. <code>EXCEPTION_QUEUE</code> means it is an exception queue. Only the dequeue operation is allowed on the exception queue.
max_retries	Limits the number of times a dequeue with the <code>REMOVE</code> mode can be attempted on a message. The maximum value of <code>max_retries</code> is $2^{31} - 1$. A message is moved to an exception queue if <code>RETRY_COUNT</code> is greater than <code>MAX_RETRIES</code> . <code>RETRY_COUNT</code> is incremented when the application issues a rollback after executing the dequeue. If a dequeue transaction fails because the server process dies (including <code>ALTER SYSTEM KILL SESSION</code>) or <code>SHUTDOWN ABORT</code> on the instance, then <code>RETRY_COUNT</code> is not incremented. Note that <code>max_retries</code> is supported for all single consumer queues and 8.1-compatible or higher multiconsumer queues but not for 8.0-compatible multiconsumer queues.
retry_delay	Delay time, in seconds, before this message is scheduled for processing again after an application rollback. The default is 0, which means the message can be retried as soon as possible. This parameter has no effect if <code>max_retries</code> is set to 0. Note that <code>retry_delay</code> is supported for single consumer queues and 8.1-compatible or higher multiconsumer queues but not for 8.0-compatible multiconsumer queues.
retention_time	Number of seconds for which a message is retained in the queue table after being dequeued from the queue. <code>INFINITE</code> means the message is retained forever. <code>NUMBER</code> is the number of seconds for which to retain the messages. The default is 0, no retention.
dependency_tracking	Reserved for future use. <code>FALSE</code> is the default. <code>TRUE</code> is not permitted in this release.
comment	User-specified description of the queue. This user comment is added to the queue catalog.
auto_commit	<code>TRUE</code> causes the current transaction, if any, to commit before the <code>CREATE_QUEUE</code> operation is carried out. The <code>CREATE_QUEUE</code> operation becomes persistent when the call returns. This is the default. <code>FALSE</code> means the operation is part of the current transaction and becomes persistent only when the caller enters a commit. Caution: This parameter has been deprecated.

Usage Notes

All queue names must be unique within a schema. After a queue is created with `CREATE_QUEUE`, it can be enabled by calling `START_QUEUE`. By default, the queue is created with both enqueue and dequeue disabled.

26.4.13 CREATE_QUEUE_TABLE Procedure

This procedure creates a queue table for messages of a predefined type.

Syntax

```
DBMS_AQADM.CREATE_QUEUE_TABLE (
  queue_table          IN      VARCHAR2,
  queue_payload_type  IN      VARCHAR2,
  storage_clause       IN      VARCHAR2          DEFAULT NULL,
  sort_list           IN      VARCHAR2          DEFAULT NULL,
  multiple_consumers  IN      BOOLEAN           DEFAULT FALSE,
  message_grouping    IN      BINARY_INTEGER   DEFAULT NONE,
  comment             IN      VARCHAR2          DEFAULT NULL,
  auto_commit         IN      BOOLEAN           DEFAULT TRUE,
  primary_instance    IN      BINARY_INTEGER   DEFAULT 0,
  secondary_instance  IN      BINARY_INTEGER   DEFAULT 0,
  compatible          IN      VARCHAR2          DEFAULT NULL,
  secure              IN      BOOLEAN           DEFAULT FALSE,
  replication_mode    IN      BINARY_INTEGER   DEFAULT NONE);
```

Parameters

Table 26-23 CREATE_QUEUE_TABLE Procedure Parameters

Parameter	Description
<code>queue_table</code>	Name of a queue table to be created
<code>queue_payload_type</code>	Type of the user data stored. See Type Name in DBMS_AQ Data Types for valid values for this parameter.
<code>storage_clause</code>	Storage parameter. The storage parameter is included in the <code>CREATE TABLE</code> statement when the queue table is created. The <code>storage_clause</code> argument can take any text that can be used in a standard <code>CREATE TABLE storage_clause</code> argument. The storage parameter can be made up of any combinations of the following parameters: <code>PCTFREE</code> , <code>PCTUSED</code> , <code>INITRANS</code> , <code>MAXTRANS</code> , <code>TABLESPACE</code> , <code>LOB</code> , and a table storage clause. If a tablespace is not specified here, then the queue table and all its related objects are created in the default user tablespace. If a tablespace is specified here, then the queue table and all its related objects are created in the tablespace specified in the storage clause. See <i>Oracle Database SQL Language Reference</i> for the usage of these parameters.

Table 26-23 (Cont.) CREATE_QUEUE_TABLE Procedure Parameters

Parameter	Description
sort_list	<p>The columns to be used as the sort key in ascending order. This parameter has the following format: <code>'sort_column_1,sort_column_2'</code></p> <p>The allowed column names are <code>priority</code>, <code>enq_time</code>, and <code>commit_time</code>. If both columns are specified, then <code>sort_column_1</code> defines the most significant order.</p> <p>After a queue table is created with a specific ordering mechanism, all queues in the queue table inherit the same defaults. The order of a queue table cannot be altered after the queue table has been created.</p> <p>If no sort list is specified, then all the queues in this queue table are sorted by the enqueue time in ascending order. This order is equivalent to FIFO order.</p> <p>Even with the default ordering defined, a dequeuer is allowed to choose a message to dequeue by specifying its <code>msgid</code> or <code>correlation</code>. <code>msgid</code>, <code>correlation</code>, and <code>sequence_deviation</code> take precedence over the default dequeuing order, if they are specified.</p> <p>When <code>commit_time</code> is specified for the <code>sort_list</code> parameter the resulting queue table uses commit-time ordering.</p> <p>See also "Priority and Ordering of Messages" in <i>Oracle Database Advanced Queuing User's Guide</i> for information about message ordering in Oracle Database Advanced Queuing.</p>
multiple_consumers	<p><code>FALSE</code> means queues created in the table can only have one consumer for each message. This is the default. <code>TRUE</code> means queues created in the table can have multiple consumers for each message.</p>
message_grouping	<p>Message grouping behavior for queues created in the table. <code>NONE</code> means each message is treated individually. <code>TRANSACTIONAL</code> means messages enqueued as part of one transaction are considered part of the same group and can be dequeued as a group of related messages.</p>
comment	<p>User-specified description of the queue table. This user comment is added to the queue catalog.</p>
auto_commit	<p><code>TRUE</code> causes the current transaction, if any, to commit before the <code>CREATE_QUEUE_TABLE</code> operation is carried out. The <code>CREATE_QUEUE_TABLE</code> operation becomes persistent when the call returns. This is the default. <code>FALSE</code> means the operation is part of the current transaction and becomes persistent only when the caller enters a commit.</p> <p>Note: This parameter has been deprecated.</p>
primary_instance	<p>The primary owner of the queue table. Queue monitor scheduling and propagation for the queues in the queue table are done in this instance. The default value for primary instance is 0, which means queue monitor scheduling and propagation will be done in any available instance.</p>
secondary_instance	<p>The queue table fails over to the secondary instance if the primary instance is not available. The default value is 0, which means that the queue table will fail over to any available instance.</p>

Table 26-23 (Cont.) CREATE_QUEUE_TABLE Procedure Parameters

Parameter	Description
<code>compatible</code>	The lowest database version with which the queue is compatible. Currently the possible values are either 8.0, 8.1, or 10.0. If the database is in 10.1-compatible mode, the default value is 10.0. If the database is in 8.1-compatible or 9.2-compatible mode, the default value is 8.1. If the database is in 8.0 compatible mode, the default value is 8.0.
<code>secure</code>	This parameter must be set to <code>TRUE</code> if you want to use the queue table for secure queues. Secure queues are queues for which AQ agents must be associated explicitly with one or more database users who can perform queue operations, such as enqueue and dequeue. The owner of a secure queue can perform all queue operations on the queue, but other users cannot perform queue operations on a secure queue, unless they are configured as secure queue users.
<code>replication_mode</code>	<code>DBMS_AQADM.REPLICATION_MODE</code> if queue is being created in the Replication Mode or else <code>DBMS_AQADM.NONE</code> . Default is <code>DBMS_AQADM.NONE</code> .

Usage Notes

The sort keys for dequeue ordering, if any, must be defined at table creation time. The following objects are created at this time:

- `aq$_queue_table_name_e`, a default exception queue associated with the queue table
- `aq$queue_table_name`, a read-only view, which is used by Oracle Database Advanced Queuing applications for querying queue data
- `aq$_queue_table_name_t`, an index (or an index organized table (IOT) in the case of multiple consumer queues) for the queue monitor operations
- `aq$_queue_table_name_i`, an index (or an index organized table in the case of multiple consumer queues) for dequeue operations

For 8.1-compatible or higher queue tables, the following index-organized tables are created:

- `aq$_queue_table_name_s`, a table for storing information about the subscribers
- `aq$_queue_table_name_r`, a table for storing information about rules on subscriptions

`aq$_queue_table_name_h`, an index-organized table for storing the dequeue history data

`CLOB`, `BLOB`, and `BFILE` are valid attributes for Oracle Database Advanced Queuing object type payloads. However, only `CLOB` and `BLOB` can be propagated using Oracle Database Advanced Queuing propagation in Oracle8i release 8.1.5 or later. See the *Oracle Database Advanced Queuing User's Guide* for more information.

The default value of the `compatible` parameter depends on the database compatibility mode in the `init.ora`. If the database is in 10.1-compatible mode, the default value is 10.0. If the database is in 8.1-compatible or 9.2-compatible mode, the default value is 8.1. If the database is in 8.0 compatible mode, the default value is 8.0

You can specify and modify the `primary_instance` and `secondary_instance` only in 8.1-compatible or higher mode. You cannot specify a secondary instance unless there is a primary instance.

26.4.14 CREATE_SHARDED_QUEUE Procedure

The `CREATE_SHARDED_QUEUE` API creates a queue and its queue table as appropriate for a sharded queue. This API cannot be used to create unsharded queues. Sharded queues must be created using this single integrated API that will automatically set AQ properties as needed.

Starting with Oracle Database 20c, the `CREATE_SHARDED_QUEUE` procedure is deprecated and will be desupported in a future release. Use the [CREATE_TRANSACTIONAL_EVENT_QUEUE Procedure](#) procedure instead.

Sharded queues may be either a single consumer or a multi-consumer queue.

Syntax

```
PROCEDURE CREATE_SHARDED_QUEUE (
    queue_name          IN VARCHAR2,
    storage_clause      IN VARCHAR2          DEFAULT NULL,
    multiple_consumers  IN BOOLEAN          DEFAULT FALSE,
    max_retries         IN NUMBER           DEFAULT NULL,
    comment             IN VARCHAR2        DEFAULT NULL,
    queue_payload_type  IN VARCHAR2        DEFAULT JMS_TYPE,
    queue_properties    IN QUEUE_PROPS_T   DEFAULT NULL,
    replication_mode    IN BINARY_INTEGER  DEFAULT NONE,
    queue_type          IN BINARY_INTEGER  DEFAULT SHARDED_QUEUE,
    squeue_ver          IN BINARY_INTEGER  DEFAULT SQ);
```

Parameters

Table 26-24 CREATE_SHARDED_QUEUE Procedure Parameters

Parameter	Description
<code>queue_name</code>	This required parameter specifies the name of the new queue. Maximum of 128 characters allowed.
<code>storage_clause</code>	The storage parameter is included in the <code>CREATE TABLE</code> statement when the queue table is created. The <code>storage_clause</code> argument can take any text that can be used in a standard <code>CREATE TABLE storage_clause</code> argument. The storage parameter can be made up of any combinations of the following parameters: <code>PCTFREE</code> , <code>PCTUSED</code> , <code>INITRANS</code> , <code>MAXTRANS</code> , <code>TABLESPACE</code> , <code>LOB</code> , and a table storage clause. If a tablespace is not specified here, then the queue table and all its related objects are created in the default user tablespace. If a tablespace is specified here, then the queue table and all its related objects are created in the tablespace specified in the storage clause. See <i>Oracle Database SQL Language Reference</i> for the usage of these parameters.
<code>multiple_consumers</code>	<code>FALSE</code> means queues can only have one consumer for each message. This is the default. <code>TRUE</code> means queues created in the table can have multiple consumers for each message.

Table 26-24 (Cont.) CREATE_SHARDED_QUEUE Procedure Parameters

Parameter	Description
max_retries	This optional parameter limits the number of times that a dequeue can be reattempted on a message after a failure. The maximum value of max_retries is $2^{31} - 1$. After the retry limit has been exceeded, the message will be purged from the queue. RETRY_COUNT is incremented when the application issues a rollback after executing the dequeue. If a dequeue transaction fails because the server process dies (including ALTER SYSTEM KILL SESSION) or SHUTDOWN ABORT on the instance, then RETRY_COUNT is not incremented.
comment	This optional parameter is a user-specified description of the queue table. This user comment is added to the queue catalog.
queue_payload_type	Payload can be RAW, JSON, DBMS_AQADM.JMS_TYPE, or an object type. Default is DBMS_AQADM.JMS_TYPE. See DBMS_AQ Data Types .
queue_properties	Properties such as Normal or Exception Queue, Retry delay, retention time, sort list and cache hint. Refer to QUEUE_PROPS_T Type for more information about queue_properties.
replication_mode	Reserved for future use. DBMS_AQADM.REPLICATION_MODE if Queue is being created in the Replication Mode or else DBMS_AQADM.NONE. Default is DBMS_AQADM.NONE.
queue_kind	This parameter specifies the queue type. The following types are: CLASSIC_QUEUE CONSTANT BINARY_INTEGER := 0; SHARDED_QUEUE CONSTANT BINARY_INTEGER := 1; TRANSACTIONAL_EVENT_QUEUE CONSTANT BINARY_INTEGER := 2; The default value is SHARDED_QUEUE.
squeue_ver	The sharded queue phase/version. SQ CONSTANT BINARY_INTEGER := 0; TEQ CONSTANT BINARY_INTEGER := 1;

26.4.15 CREATE_EXCEPTION_QUEUE Procedure

The CREATE_EXCEPTION_QUEUE API creates an exception queue for a sharded queue.

Syntax

```
PROCEDURE CREATE_EXCEPTION_QUEUE (
    sharded_queue_name    IN VARCHAR2,
    exception_queue_name  IN VARCHAR2 DEFAULT NULL
);
```

Parameters

Table 26-25 CREATE_EXCEPTION_QUEUE Procedure Parameters

Parameter	Description
sharded_queue_name	The name of the sharded queue.
exception_queue_name	The name of the exception queue.

26.4.16 CREATE_EQ_EXCEPTION_QUEUE Procedure

The `CREATE_EQ_EXCEPTION_QUEUE` API creates an exception queue for a TEQ queue.

Syntax

```
PROCEDURE CREATE_EQ_EXCEPTION_QUEUE (
    teq_queue_name      IN VARCHAR2,
    exception_queue_name IN VARCHAR2 DEFAULT NULL
);
```

Parameters

Table 26-26 CREATE_EQ_EXCEPTION_QUEUE Procedure Parameters

Parameter	Description
teq_queue_name	The name of the TEQ queue.
exception_queue_name	The name of the exception queue.

26.4.17 CREATE_TRANSACTIONAL_EVENT_QUEUE Procedure

The `CREATE_TRANSACTIONAL_EVENT_QUEUE` API creates a queue and its queue table as appropriate for a Transactional Event Queue (TEQ). This API cannot be used to create AQ queues. TEQs must be created using this single integrated API that will automatically set AQ properties as needed.

TEQs may be either a single consumer or a multi-consumer queue.

Syntax

```
PROCEDURE CREATE_TRANSACTIONAL_EVENT_QUEUE (
    queue_name           IN VARCHAR2,
    storage_clause       IN VARCHAR2           DEFAULT NULL,
    multiple_consumers   IN BOOLEAN           DEFAULT FALSE,
    max_retries          IN NUMBER            DEFAULT NULL,
    comment              IN VARCHAR2         DEFAULT NULL,
    queue_payload_type   IN VARCHAR2         DEFAULT JMS_TYPE,
    queue_properties     IN QUEUE_PROPS_T    DEFAULT NULL,
    replication_mode     IN BINARY_INTEGER   DEFAULT NONE);
```

Parameters

Table 26-27 CREATE_TRANSACTIONAL_EVENT_QUEUE Procedure Parameters

Parameter	Description
queue_name	This required parameter specifies the name of the new queue. Maximum of 128 characters allowed.
storage_clause	The storage parameter is included in the CREATE TABLE statement when the queue table is created. The storage_clause argument can take any text that can be used in a standard CREATE TABLE storage_clause argument. The storage parameter can be made up of any combinations of the following parameters: PCTFREE, PCTUSED, INITRANS, MAXTRANS, TABLESPACE, LOB, and a table storage clause. If a tablespace is not specified here, then the queue table and all its related objects are created in the default user tablespace. If a tablespace is specified here, then the queue table and all its related objects are created in the tablespace specified in the storage clause. See <i>Oracle Database SQL Language Reference</i> for the usage of these parameters.
multiple_consumers	FALSE means queues can only have one consumer for each message. This is the default. TRUE means queues created in the table can have multiple consumers for each message.
max_retries	This optional parameter limits the number of times that a dequeue can be attempted on a message after a failure. The maximum value of max_retries is $2^{31} - 1$. After the retry limit has been exceeded, the message will be purged from the queue. RETRY_COUNT is incremented when the application issues a rollback after executing the dequeue. If a dequeue transaction fails because the server process dies (including ALTER SYSTEM KILL SESSION) or SHUTDOWN ABORT on the instance, then RETRY_COUNT is not incremented.
comment	This optional parameter is a user-specified description of the queue table. This user comment is added to the queue catalog.
queue_payload_type	Payload can be RAW, JSON, DBMS_AQADM.JMS_TYPE, or an object type. Default is DBMS_AQADM.JMS_TYPE. See DBMS_AQ Data Types .
queue_properties	Properties such as Normal or Exception Queue, Retry delay, retention time, sort list and cache hint. Refer to QUEUE_PROPS_T Type for more information about queue_properties.
replication_mode	Reserved for future use. DBMS_AQADM.REPLICATION_MODE if Queue is being created in the Replication Mode or else DBMS_AQADM.NONE. Default is DBMS_AQADM.NONE.

26.4.18 DEL_ALIAS_FROM_LDAP Procedure

This procedure drops an alias for a queue, agent, or JMS ConnectionFactory in LDAP.

Syntax

```
DBMS_AQADM.DEL_ALIAS_FROM_LDAP (
    alias IN VARCHAR2);
```

Parameters

Table 26-28 DEL_ALIAS_FROM_LDAP Procedure Parameters

Parameter	Description
alias	The alias to be removed.

26.4.19 DISABLE_DB_ACCESS Procedure

This procedure revokes the privileges of a specific database user from an Oracle Database Advanced Queuing Internet agent.

Syntax

```
DBMS_AQADM.DISABLE_DB_ACCESS (
  agent_name          IN VARCHAR2,
  db_username         IN VARCHAR2)
```

Parameters

Table 26-29 DISABLE_DB_ACCESS Procedure Parameters

Parameter	Description
agent_name	Specifies the username of the Oracle Database Advanced Queuing Internet agent.
db_username	Specifies the database user whose privileges are to be revoked from the Oracle Database Advanced Queuing Internet agent.

Usage Notes

The Oracle Database Advanced Queuing Internet agent should have been previously granted those privileges using the [ENABLE_DB_ACCESS Procedure](#).

26.4.20 DISABLE_PROPAGATION_SCHEDULE Procedure

This procedure disables a propagation schedule.

Syntax

```
DBMS_AQADM.DISABLE_PROPAGATION_SCHEDULE (
  queue_name          IN VARCHAR2,
  destination         IN VARCHAR2 DEFAULT NULL,
  destination_queue   IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 26-30 DISABLE_PROPAGATION_SCHEDULE Procedure Parameters

Parameter	Description
queue_name	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the user.
destination	Destination database link. Messages in the source queue for recipients at this destination are propagated. If it is <code>NULL</code> , then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 128 bytes, and if the name is not fully qualified, then the default domain name is used.
destination_queue	Name of the target queue to which messages are to be propagated in the form of a database link

26.4.21 DROP_AQ_AGENT Procedure

This procedure drops an agent that was previously registered for Oracle Database Advanced Queuing Internet access.

Syntax

```
DBMS_AQADM.DROP_AQ_AGENT (
    agent_name          IN VARCHAR2)
```

Parameters

Table 26-31 DROP_AQ_AGENT Procedure Parameters

Parameter	Description
agent_name	Specifies the username of the Oracle Database Advanced Queuing Internet agent

26.4.22 DROP_QUEUE Procedure

This procedure drops an existing queue.

Syntax

```
DBMS_AQADM.DROP_QUEUE (
    queue_name          IN   VARCHAR2,
    auto_commit         IN   BOOLEAN DEFAULT TRUE);
```

Parameters

Table 26-32 DROP_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the queue that is to be dropped.

Table 26-32 (Cont.) DROP_QUEUE Procedure Parameters

Parameter	Description
auto_commit	TRUE causes the current transaction, if any, to commit before the DROP_QUEUE operation is carried out. The DROP_QUEUE operation becomes persistent when the call returns. This is the default. FALSE means the operation is part of the current transaction and becomes persistent only when the caller enters a commit. Caution: This parameter has been deprecated.

Usage Notes

DROP_QUEUE is not allowed unless STOP_QUEUE has been called to disable the queue for both enqueueing and dequeuing. All the queue data is deleted as part of the drop operation.

26.4.23 DROP_QUEUE_TABLE Procedure

This procedure drops an existing queue table.

Syntax

```
DBMS_AQADM.DROP_QUEUE_TABLE (
    queue_table      IN    VARCHAR2,
    force            IN    BOOLEAN DEFAULT FALSE,
    auto_commit      IN    BOOLEAN DEFAULT TRUE);
```

Parameters

Table 26-33 DROP_QUEUE_TABLE Procedure Parameters

Parameter	Description
queue_table	Name of a queue table to be dropped.
force	FALSE means the operation does not succeed if there are any queues in the table. This is the default. TRUE means all queues in the table are stopped and dropped automatically.
auto_commit	TRUE causes the current transaction, if any, to commit before the DROP_QUEUE_TABLE operation is carried out. The DROP_QUEUE_TABLE operation becomes persistent when the call returns. This is the default. FALSE means the operation is part of the current transaction and becomes persistent only when the caller enters a commit. Caution: This parameter has been deprecated.

Usage Notes

All the queues in a queue table must be stopped and dropped before the queue table can be dropped. You must do this explicitly unless the force option is used, in which case this is done automatically.

26.4.24 DROP_SHARDED_QUEUE Procedure

This procedure drops an existing sharded queue from the database queuing system.

You must stop the queue before calling `DROP_SHARDED_QUEUE`. User must stop the queue explicitly if `force` is set to `FALSE` before calling `DROP_SHARDED_QUEUE`. If `force` is set to `TRUE` then queue will be stopped internally and then dropped.

Syntax

```
DBMS_AQADM.DROP_SHARDED_QUEUE (
    queue_name IN VARCHAR2,
    force      IN BOOLEAN DEFAULT FALSE )
```

Parameters

Table 26-34 DROP_SHARDED_QUEUE Procedure Parameters

Parameter	Description
<code>queue_name</code>	This required parameter specifies the name of the sharded queue.
<code>force</code>	The sharded queue is dropped even if the queue is not stopped.

26.4.25 DROP_TRANSACTIONAL_EVENT_QUEUE Procedure

This procedure drops an existing TEQ queue from the database queuing system.

You must stop the queue before calling `DROP_TRANSACTIONAL_EVENT_QUEUE`. User must stop the queue explicitly if `force` is set to `FALSE` before calling `DROP_TRANSACTIONAL_EVENT_QUEUE`. If `force` is set to `TRUE` then queue will be stopped internally and then dropped.

Syntax

```
DBMS_AQADM.DROP_TRANSACTIONAL_EVENT_QUEUE (
    queue_name IN VARCHAR2,
    force      IN BOOLEAN DEFAULT FALSE )
```

Parameters

Table 26-35 DROP_TRANSACTIONAL_EVENT_QUEUE Procedure Parameters

Parameter	Description
<code>queue_name</code>	This required parameter specifies the name of the TEQ queue.
<code>force</code>	The TEQ queue is dropped even if the queue is not stopped.

26.4.26 ENABLE_DB_ACCESS Procedure

This procedure grants an Oracle Database Advanced Queuing Internet agent the privileges of a specific database user.

Syntax

```
DBMS_AQADM.ENABLE_DB_ACCESS (
  agent_name      IN VARCHAR2,
  db_username     IN VARCHAR2)
```

Parameters

Table 26-36 ENABLE_DB_ACCESS Procedure Parameters

Parameter	Description
agent_name	Specifies the username of the Oracle Database Advanced Queuing Internet agent.
db_username	Specified the database user whose privileges are to be granted to the Oracle Database Advanced Queuing Internet agent.

Usage Notes

The Oracle Database Advanced Queuing Internet agent should have been previously created using the [CREATE_AQ_AGENT Procedure](#).

For secure queues, the sender and receiver agent of the message must be mapped to the database user performing the enqueue or dequeue operation.

The `SYS.AQ$INTERNET_USERS` view has a list of all Oracle Database Advanced Queuing Internet agents and the names of the database users whose privileges are granted to them.

26.4.27 ENABLE_JMS_TYPES Procedure

Enqueue JMS types and XML types.

Syntax

```
DBMS_AQADM.ENABLE_JMS_TYPES (
  queue_table IN VARCHAR2);
```

Parameters

Table 26-37 ENABLE_JMS_TYPES Procedure Parameters

Parameter	Description
queue_table	Specifies name of the queue table to be enabled for JMS and XML types.

26.4.28 ENABLE_PROPAGATION_SCHEDULE Procedure

This procedure enables a previously disabled propagation schedule.

Syntax

```
DBMS_AQADM.ENABLE_PROPAGATION_SCHEDULE (
    queue_name          IN   VARCHAR2,
    destination         IN   VARCHAR2 DEFAULT NULL,
    destination_queue   IN   VARCHAR2 DEFAULT NULL);
```

Parameters

Table 26-38 ENABLE_PROPAGATION_SCHEDULE Procedure Parameters

Parameter	Description
queue_name	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the user.
destination	Destination database link. Messages in the source queue for recipients at this destination are propagated. If it is NULL, then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 128 bytes, and if the name is not fully qualified, then the default domain name is used.
destination_queue	Name of the target queue to which messages are to be propagated in the form of a dblink

26.4.29 GET_MAX_STREAMS_POOL Procedure

This procedure retrieves the value of Oracle Database Advanced Queuing maximum streams pool memory limit.

Syntax

```
DBMS_AQADM.GET_MAX_STREAMS_POOL (
    value OUT NUMBER);
```

Parameters

Table 26-39 GET_MAX_STREAMS_POOL Procedure Parameter

Parameter	Description
value	Value in megabytes.

26.4.30 GET_MIN_STREAMS_POOL Procedure

This procedure retrieves the value of Oracle Database Advanced Queuing minimum streams pool memory limit.

Syntax

```
DBMS_AQADM.GET_MIN_STREAMS_POOL (
    value      OUT      NUMBER);
```

Parameters

Table 26-40 GET_MIN_STREAMS_POOL Procedure Parameter

Parameter	Description
value	Value in megabytes.

26.4.31 GET_QUEUE_PARAMETER Procedure

This procedure allows user to get different parameters for sharded queues at queue or database level.

For database level the `queue_name` should be `NULL`. Note that queue overrides database level parameter values.



See Also:

Oracle® Database Advanced Queuing User's Guide for information about sharded queues

Syntax

```
PROCEDURE GET_QUEUE_PARAMETER (
    queue_name      IN VARCHAR2,
    param_name      IN VARCHAR2,
    param_value     OUT NUMBER);
```

Parameters

Table 26-41 GET_QUEUE_PARAMETER Procedure Parameters

Parameter	Description
queue_name	The name of the sharded queue.
param_name	The name of the parameter. Table 26-42 and Table 26-43 describe the valid parameter names.
param_value	The value of the parameter.

Table 26-42 Sharded queue parameters

Parameter Name	Scope	Allowed Values	Description
SHARD_NUM	Queue level	[1, UB4MAXVAL]	Number of shards created per instance for a queue, when KEY_BASED_ENQUEUE is not set. When KEY_BASED_ENQUEUE is set, the value is maximum number of shards created for the queue across all instances. The default value is 5.
KEY_BASED_ENQUEUE	Queue level	[0, 1]	When set, the shard to which a message gets enqueued is determined by the key value specified in the message. Refer to key-based sharding (link) for more details. This parameter cannot be unset once set. When this parameter is not set (default), a session is bound to a shard at the time of first enqueue to the queue. All messages enqueued by the session will go to the same shard to which the session is bound.
STICKY_DEQUEUE	Queue level	[0, 1]	When set, dequeue session sticks to a shard in the queue. A session is bound to a shard on first dequeue from the queue. All messages dequeued by the session come from the same shard to which it is bound. This parameter cannot be unset once set. When this parameter is not set, messages dequeued by a session can spread across multiple shards of the queue.

Table 26-43 Key-based Parameters

Parameter Name	Scope	Description
AQ\$KEY_TO_SHARD_MAP	Queue level	Shard number to which a given key is mapped. When key-based sharding is enabled, this parameter is used to establish mapping between a key and a shard number or retrieve the shard number to which given key is mapped.
AQ\$GET_KEY_SHARD_INST	Queue level	Instance number that owns the shard to which a given key is mapped. Applicable only when key-based sharding is enabled. It is a read-only parameter.

Example 26-1 Key to shard mapping

Users can explicitly map a new key to an existing shard or to a new shard.

To map a key value 'RED' to a shard with id 0 for queue named MY_SHQ1, submit the following:

```
execute
    dbms_aqadm.set_queue_paramter('MY_SHQ1',
    'AQ$KEY_TO_SHARD_MAP=RED', 0);
```

If a key is being enqueued which has not been explicitly mapped to a shard, then one of the shards is chosen at random and mapped to that key permanently. Once a key is mapped to shard, the mapping cannot be changed.

To get the shard identifier for a key which is mapped already, submit the following:

```
declare
    pval number;
begin
    dbms_aqadm.get_queue_parameter('MY_SHQ1', 'AQ$GET_KEY_SHARD=RED', pval);
    dbms_output.put_line('The key RED is mapped to shard id ' || pval);
END;
/
```

Example 26-2 Key to instance mapping

User sharding performs best when cross instance enqueues are not involved. To know the instance where a key can be enqueued without any cross instance enqueue, submit the following:

```
declare
    pval number;
begin
    dbms_aqadm.get_queue_parameter('MY_SHQ1', 'AQ$GET_KEY_SHARD_INST=RED', pval);
    dbms_output.put_line('The key RED is owned by instance id ' || pval);
END;
/
```

26.4.32 GET_WATERMARK Procedure

This procedure retrieves the value of watermark set by `SET_WATERMARK`.

Syntax

```
DBMS_AQADM.GET_WATERMARK (
    wmvalue      IN      NUMBER);
```

Parameters

Table 26-44 GET_WATERMARK Procedure Parameter

Parameter	Description
wmvalue	Watermark value in megabytes.

26.4.33 GRANT_QUEUE_PRIVILEGE Procedure

This procedure grants privileges on a queue to users and roles. The privileges are `ENQUEUE` or `DEQUEUE`. Initially, only the queue table owner can use this procedure to grant privileges on the queues.

Syntax

```
DBMS_AQADM.GRANT_QUEUE_PRIVILEGE (
    privilege      IN      VARCHAR2,
    queue_name     IN      VARCHAR2,
    grantee        IN      VARCHAR2,
    grant_option    IN      BOOLEAN := FALSE);
```

Parameters

Table 26-45 GRANT_QUEUE_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The Oracle Database Advanced Queuing queue privilege to grant. The options are <code>ENQUEUE</code> , <code>DEQUEUE</code> , and <code>ALL</code> . <code>ALL</code> means both <code>ENQUEUE</code> and <code>DEQUEUE</code> .
queue_name	Name of the queue.
grantee	Grantee(s). The grantee(s) can be a user, a role, or the <code>PUBLIC</code> role.
grant_option	Specifies if the access privilege is granted with the <code>GRANT</code> option or not. If the privilege is granted with the <code>GRANT</code> option, then the grantee is allowed to use this procedure to grant the access privilege to other users or roles, regardless of the ownership of the queue table. The default is <code>FALSE</code> .

26.4.34 GRANT_SYSTEM_PRIVILEGE Procedure

This procedure grants Oracle Database Advanced Queuing system privileges to users and roles.

The privileges are `ENQUEUE_ANY`, `DEQUEUE_ANY`, and `MANAGE_ANY`. Initially, only `SYS` and `SYSTEM` can use this procedure successfully.

 **Note:**

Starting from Oracle Database 12c Release 2, `MANAGE_ANY`, `ENQUEUE_ANY`, and `DEQUEUE_ANY` privileges will not allow access to `SYS` owned queues by users other than `SYS`.

Syntax

```
DBMS_AQADM.GRANT_SYSTEM_PRIVILEGE (
  privilege      IN   VARCHAR2,
  grantee       IN   VARCHAR2,
  admin_option   IN   BOOLEAN := FALSE);
```

Parameters**Table 26-46 GRANT_SYSTEM_PRIVILEGE Procedure Parameters**

Parameter	Description
<code>privilege</code>	The Oracle Database Advanced Queuing system privilege to grant. The options are <code>ENQUEUE_ANY</code> , <code>DEQUEUE_ANY</code> , and <code>MANAGE_ANY</code> . <code>ENQUEUE_ANY</code> means users granted this privilege are allowed to enqueue messages to any queues in the database. <code>DEQUEUE_ANY</code> means users granted this privilege are allowed to dequeue messages from any queues in the database. <code>MANAGE_ANY</code> means users granted this privilege are allowed to run <code>DBMS_AQADM</code> calls on any schemas in the database.
<code>grantee</code>	Grantee(s). The grantee(s) can be a user, a role, or the <code>PUBLIC</code> role.
<code>admin_option</code>	Specifies if the system privilege is granted with the <code>ADMIN</code> option or not. If the privilege is granted with the <code>ADMIN</code> option, then the grantee is allowed to use this procedure to grant the system privilege to other users or roles. The default is <code>FALSE</code> .

 **Note:**

Starting from Oracle Database 12c Release 2, `MANAGE_ANY`, `ENQUEUE_ANY`, and `DEQUEUE_ANY` privileges will not allow access to `SYS` owned queues by users other than `SYS`.

26.4.35 MIGRATE_QUEUE_TABLE Procedure

This procedure upgrades an 8.0-compatible queue table to an 8.1-compatible or higher queue table, or downgrades an 8.1-compatible or higher queue table to an 8.0-compatible queue table.

Syntax

```
DBMS_AQADM.MIGRATE_QUEUE_TABLE (
  queue_table  IN   VARCHAR2,
  compatible   IN   VARCHAR2);
```

Parameters

Table 26-47 MIGRATE_QUEUE_TABLE Procedure Parameters

Parameter	Description
queue_table	Specifies name of the queue table to be migrated.
compatible	Set this to 8.1 to upgrade an 8.0-compatible queue table, or set this to 8.0 to downgrade an 8.1-compatible queue table.

26.4.36 PURGE_QUEUE_TABLE Procedure

This procedure purges messages from queue tables. You can perform various purge operations on both single-consumer and multiconsumer queue tables for persistent and buffered messages.

Syntax

```
DBMS_AQADM.PURGE_QUEUE_TABLE (
  queue_table      IN  VARCHAR2,
  purge_condition  IN  VARCHAR2,
  purge_options    IN  aq$_purge_options_t);
```

where type `aq$_purge_options_t` is described in [Oracle Database Advanced Queuing \(AQ\) Types](#).

Parameters

Table 26-48 PURGE_QUEUE_TABLE Procedure Parameters

Parameter	Description
queue_table	Specifies the name of the queue table to be purged.
purge_condition	Specifies the purge condition to use when purging the queue table. The purge condition must be in the format of a SQL <code>WHERE</code> clause, and it is case-sensitive. The condition is based on the columns of <code>aq\$queue_table_name</code> view. When specifying the <code>purge_condition</code> , qualify the column names in <code>aq\$queue_table_name</code> view with <code>qtview</code> . To purge all queues in a queue table, set <code>purge_condition</code> to either <code>NULL</code> (a bare null word, no quotes) or <code>' '</code> (two single quotes).

Table 26-48 (Cont.) PURGE_QUEUE_TABLE Procedure Parameters

Parameter	Description
<code>purge_options</code>	<p>Type <code>aq\$_purge_options_t</code> contains a <code>block</code> parameter and a <code>delivery_mode</code> parameter.</p> <ul style="list-style-type: none"> If <code>block</code> is <code>TRUE</code>, then an exclusive lock on all the queues in the queue table is held while purging the queue table. This will cause concurrent enqueueers and dequeuers to block while the queue table is purged. The purge call always succeeds if <code>block</code> is <code>TRUE</code>. The default for <code>block</code> is <code>FALSE</code>. This will not block enqueueers and dequeuers, but it can cause the purge to fail with an error during high concurrency times. <code>delivery_mode</code> is used to specify whether <code>DBMS_AQADM.PERSISTENT</code>, <code>DBMS_AQADM.BUFFERED</code> or <code>DBMS_AQADM.PERSISTENT_OR_BUFFERED</code> types of messages are to be purged. You cannot implement arbitrary purge conditions if buffered messages have to be purged.

Usage Notes

- You can purge selected messages from the queue table by specifying a `purge_condition`. [Table 26-48](#) describes these parameters. Messages can be enqueued to and dequeued from the queue table while the queue table is being purged.
- A trace file is generated in the `udump` destination when you run this procedure. It details what the procedure is doing.
- This procedure commits batches of messages in autonomous transactions. Several such autonomous transactions may get executed as a part of one `purge_queue_table` call depending on the number of messages in the queue table.

26.4.37 QUEUE_SUBSCRIBERS Function

This function returns the subscribers to an 8.0-compatible multiconsumer queue in the PL/SQL index by table collection type `DBMS_AQADM.AQ$_subscriber_list_t`.

Each element of the collection is of type `sys.aq$_agent`. This functionality is provided for 8.1-compatible queues by the `AQ$queue_table_name_S` view.

Syntax

```
DBMS_AQADM.QUEUE_SUBSCRIBERS (
    queue_name          IN          VARCHAR2);
RETURN aq$_subscriber_list_t IS
```

Parameters**Table 26-49** QUEUE_SUBSCRIBERS Function Parameters

Parameter	Description
queue_name	Specifies the queue whose subscribers are to be printed.

26.4.38 REMOVE_SUBSCRIBER Procedure

This procedure removes a default subscriber from a queue. This operation takes effect immediately, and the containing transaction is committed. All references to the subscriber in existing messages are removed as part of the operation.

Syntax

```
DBMS_AQADM.REMOVE_SUBSCRIBER (
    queue_name      IN      VARCHAR2,
    subscriber      IN      sys.aq$_agent);
```

Parameters**Table 26-50** REMOVE_SUBSCRIBER Procedure Parameters

Parameter	Description
queue_name	Name of the queue.
subscriber	Agent who is being removed. See AQ\$_AGENT Type .

26.4.39 REVOKE_QUEUE_PRIVILEGE Procedure

This procedure revokes privileges on a queue from users and roles. The privileges are ENQUEUE or DEQUEUE.

Syntax

```
DBMS_AQADM.REVOKE_QUEUE_PRIVILEGE (
    privilege      IN      VARCHAR2,
    queue_name     IN      VARCHAR2,
    grantee        IN      VARCHAR2);
```

Parameters**Table 26-51** REVOKE_QUEUE_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The Oracle Database Advanced Queuing queue privilege to revoke. The options are ENQUEUE, DEQUEUE, and ALL. ALL means both ENQUEUE and DEQUEUE.
queue_name	Name of the queue.
grantee	Grantee(s). The grantee(s) can be a user, a role, or the PUBLIC role. If the privilege has been propagated by the grantee through the GRANT option, then the propagated privilege is also revoked.

Usage Notes

To revoke a privilege, the revoker must be the original grantor of the privilege. The privileges propagated through the `GRANT` option are revoked if the grantor's privileges are revoked.

26.4.40 REVOKE_SYSTEM_PRIVILEGE Procedure

This procedure revokes Oracle Database Advanced Queuing system privileges from users and roles. The privileges are `ENQUEUE_ANY`, `DEQUEUE_ANY` and `MANAGE_ANY`. The `ADMIN` option for a system privilege cannot be selectively revoked. Starting from Oracle Database 12c Release 2, `MANAGE_ANY`, `ENQUEUE_ANY`, and `DEQUEUE_ANY` privileges will not allow access to `SYS` owned queues by users other than `SYS`.

Syntax

```
DBMS_AQADM.REVOKE_SYSTEM_PRIVILEGE (
    privilege      IN   VARCHAR2,
    grantee        IN   VARCHAR2);
```

Parameters

Table 26-52 REVOKE_SYSTEM_PRIVILEGE Procedure Parameters

Parameter	Description
<code>privilege</code>	The Oracle Database Advanced Queuing system privilege to revoke. The options are <code>ENQUEUE_ANY</code> , <code>DEQUEUE_ANY</code> , and <code>MANAGE_ANY</code> . The <code>ADMIN</code> option for a system privilege cannot be selectively revoked.

Note:

Starting from Oracle Database 12c Release 2, `MANAGE_ANY`, `ENQUEUE_ANY`, and `DEQUEUE_ANY` privileges will not allow access to `SYS` owned queues by users other than `SYS`.

`grantee` Grantee(s). The grantee(s) can be a user, a role, or the `PUBLIC` role.

26.4.41 SCHEDULE_PROPAGATION Procedure

This procedure schedules propagation of messages from a queue to a destination identified by a specific database link.

Syntax

```
DBMS_AQADM.SCHEDULE_PROPAGATION (
    queue_name      IN   VARCHAR2,
    destination     IN   VARCHAR2 DEFAULT NULL,
    start_time      IN   DATE      DEFAULT SYSDATE,
    duration        IN   NUMBER    DEFAULT NULL,
    next_time       IN   VARCHAR2  DEFAULT NULL,
```

```

latency          IN      NUMBER  DEFAULT 60,
destination_queue IN      VARCHAR2 DEFAULT NULL);

```

Parameters

Table 26-53 SCHEDULE_PROPAGATION Procedure Parameters

Parameter	Description
queue_name	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the administrative user.
destination	Destination database link. Messages in the source queue for recipients at this destination are propagated. If it is NULL, then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 390 bytes, and if the name is not fully qualified, then the default domain name is used. The pattern <i>schema.queue@dblink</i> is used.
start_time	Initial start time for the propagation window for messages from the source queue to the destination.
duration	Duration of the propagation window in seconds. A NULL value means the propagation window is forever or until the propagation is unscheduled.
next_time	Date function to compute the start of the next propagation window from the end of the current window. If this value is NULL, then propagation is stopped at the end of the current window. For example, to start the window at the same time every day, <i>next_time</i> should be specified as <i>SYSDATE + 1 - duration/86400</i> .
latency	<p>Maximum wait, in seconds, in the propagation window for a message to be propagated after it is enqueued.</p> <p>For example, if the latency is 60 seconds and there are no messages to be propagated during the propagation window, then messages from that queue for the destination are not propagated for at least 60 more seconds.</p> <p>It is at least 60 seconds before the queue is checked again for messages to be propagated for the specified destination. If the latency is 600, then the queue is not checked for 10 minutes, and if the latency is 0, then a job queue process will be waiting for messages to be enqueued for the destination. As soon as a message is enqueued, it is propagated.</p>
destination_queue	Name of the target queue to which messages are to be propagated in the form of a <i>dblink</i>

Usage Notes

Messages may also be propagated to other queues in the same database by specifying a `NULL` destination. If a message has multiple recipients at the same destination in either the same or different queues, the message is propagated to all of them at the same time.

Oracle extensions for JMS such as JMS propagation and remote subscribers are not currently supported for sharded queues. Propagation between sharded and non-sharded queues is not supported.

Related Topics

- [Oracle Database Advanced Queuing User's Guide](#)

26.4.42 SET_QUEUE_PARAMETER Procedure

This procedure allows user to set different parameters for sharded queues at queue or database level. For database level the `queue_name` should be `NULL`. Note that queue overrides database level parameter values.



See Also:

[Oracle® Database Advanced Queuing User's Guide](#) for information about sharded queues

Syntax

```
PROCEDURE SET_QUEUE_PARAMETER (
  queue_name      IN VARCHAR2,
  param_name     IN VARCHAR2,
  param_value    IN NUMBER);
```

Parameters

Table 26-54 SET_QUEUE_PARAMETER Procedure Parameters

Parameter	Description
<code>queue_name</code>	The name of the sharded queue.
<code>param_name</code>	The name of the parameter. Table 26-55 and Table 26-56 describe the valid parameter names.
<code>param_value</code>	The value of the parameter.

Table 26-55 Sharded queue parameters

Parameter Name	Scope	Allowed Values	Description
<code>SHARD_NUM</code>	Queue level	[1, UB4MAXVAL]	Maximum number of shards allowed for the queue.

Table 26-55 (Cont.) Sharded queue parameters

Parameter Name	Scope	Allowed Values	Description
SUBSHARD_SIZE	Queue level	[1, UB2MAXVAL]	<p>Default value is 20,000.</p> <p>This is the size of each partition for allocation of memory in a shard. Each shard consists of multiple subshards, which are allocated, used, and purged automatically based on message enqueue and dequeue rate for the shard.</p>
KEY_BASED_ENQUEUE	Queue level	[0, 1]	<p>When set, the shard to which a message gets enqueued is determined by the key value specified in the message. Refer to key-based sharding (link) for more details. This parameter cannot be unset once set.</p> <p>When this parameter is not set (default), a session is bound to a shard at the time of first enqueue to the queue. All messages enqueued by the session will go to the same shard to which the session is bound.</p>
STICKY_DEQUEUE	Queue level	[0, 1]	<p>When set, dequeue session sticks to a shard in the queue. A session is bound to a shard on first dequeue from the queue. All messages dequeued by the session come from the same shard to which it is bound. This parameter cannot be unset once set.</p> <p>When this parameter is not set, messages dequeued by a session can spread across multiple shards of the queue.</p>

Table 26-56 Key-based Parameters

Parameter Name	Scope	Description
AQ\$KEY_TO_SHARD_MAP	Queue level	Shard number to which a given key is mapped. When key-based sharding is enabled, this parameter is used to establish mapping between a key and a shard number or retrieve the shard number to which given key is mapped.
AQ\$GET_KEY_SHARD_INST	Queue level	Instance number that owns the shard to which a given key is mapped. Applicable only when key-based sharding is enabled. It is a read-only parameter.

Example 26-3 Create a sharded queue with key based enqueues

To create a sharded queue with key based enqueues (user sharding), the PL/SQL procedure `DBMS_AQADM.SET_QUEUE_PARAMETER` is called after `CREATE_SHARDED_QUEUE`.

```
execute
    sys.dbms_aqadm.create_sharded_queue(queue_name => 'MY_SHQ1');
```

```
execute
    dbms_aqadm.set_queue_parameter('MY_SHQ1', 'KEY_BASED_ENQUEUE',
1);
```

Example 26-4 Create a sharded queue with sticky dequeues

To create a sharded queue with key based enqueues (user sharding), the PL/SQL procedure `DBMS_AQADM.SET_QUEUE_PARAMETER` is called after `CREATE_SHARDED_QUEUE`.

```
execute
    sys.dbms_aqadm.create_sharded_queue(queue_name => 'MY_SHQ1');
```

```
execute
    dbms_aqadm.set_queue_parameter('MY_SHQ1', 'STICKY_DEQUEUE', 1);
```

Example 26-5 Setting or changing the number of shards

Once a queue is created, it can have a maximum of 5 shards by default in non-Oracle RAC databases. In Oracle RAC databases, each queue can have a maximum of 5 shards per database instance by default.

```
execute
    dbms_aqadm.set_queue_parameter('MY_SHQ1', 'SHARD_NUM', 200);
```

**Note:**

Odd numbered shard identifiers are reserved for internal use. In the above example, the 200 shard identifiers used will be 0, 2, 4, ..., 398.

26.4.43 SET_MAX_STREAMS_POOL Procedure

This procedure is used for Oracle Database Advanced Queuing to specify and limit maximum streams pool memory use.

Syntax

```
DBMS_AQADM.SET_MAX_STREAMS_POOL (
    value      IN      NUMBER);
```

Parameters**Table 26-57 SET_MAX_STREAMS_POOL Procedure Parameter**

Parameter	Description
value	Value in megabytes.

26.4.44 SET_MIN_STREAMS_POOL Procedure

This procedure is used for Oracle Database AQ to specify and limit minimum streams pool memory use.

Syntax

```
DBMS_AQADM.SET_MIN_STREAMS_POOL (
    value      IN      NUMBER);
```

Parameters**Table 26-58 SET_MIN_STREAMS_POOL Procedure Parameter**

Parameter	Description
value	Value in megabytes.

26.4.45 SET_WATERMARK Procedure

This procedure is used for Oracle Database Advanced Queuing notification to specify and limit memory use.

Syntax

```
DBMS_AQADM.SET_WATERMARK (
    wmvalue    IN      NUMBER);
```


Parameters

Table 26-59 SET_WATERMARK Procedure Parameter

Parameter	Description
wmvalue	Watermark value in megabytes.

26.4.46 START_QUEUE Procedure

This procedure enables the specified queue for enqueueing or dequeuing.

Syntax

```
DBMS_AQADM.START_QUEUE (
  queue_name      IN      VARCHAR2,
  enqueue         IN      BOOLEAN DEFAULT TRUE,
  dequeue         IN      BOOLEAN DEFAULT TRUE);
```

Parameters

Table 26-60 START_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the queue to be enabled
enqueue	Specifies whether ENQUEUE should be enabled on this queue. TRUE means enable ENQUEUE. This is the default. FALSE means do not alter the current setting.
dequeue	Specifies whether DEQUEUE should be enabled on this queue. TRUE means enable DEQUEUE. This is the default. FALSE means do not alter the current setting.

Usage Notes

After creating a queue, the administrator must use `START_QUEUE` to enable the queue. The default is to enable it for both `ENQUEUE` and `DEQUEUE`. Only `dequeue` operations are allowed on an exception queue. This operation takes effect when the call completes and does not have any transactional characteristics.

26.4.47 STOP_QUEUE Procedure

This procedure disables enqueueing or dequeuing on the specified queue.

Syntax

```
DBMS_AQADM.STOP_QUEUE (
  queue_name      IN      VARCHAR2,
  enqueue         IN      BOOLEAN DEFAULT TRUE,
  dequeue         IN      BOOLEAN DEFAULT TRUE,
  wait            IN      BOOLEAN DEFAULT TRUE,
  free_memory     IN      BOOLEAN DEFAULT FALSE);
```

Parameters

Table 26-61 STOP_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the queue to be disabled
enqueue	Specifies whether ENQUEUE should be disabled on this queue. TRUE means disable ENQUEUE. This is the default. FALSE means do not alter the current setting.
dequeue	Specifies whether DEQUEUE should be disabled on this queue. TRUE means disable DEQUEUE. This is the default. FALSE means do not alter the current setting.
wait	Specifies whether to wait for the completion of outstanding transactions. TRUE means wait if there are any outstanding transactions. In this state no new transactions are allowed to enqueue to or dequeue from this queue. FALSE means return immediately either with a success or an error.
free_memory	Specifies whether the queue should be stopped.

Usage Notes

By default, this call disables both ENQUEUE and DEQUEUE. A queue cannot be stopped if there are outstanding transactions against the queue. This operation takes effect when the call completes and does not have any transactional characteristics.

26.4.48 UNSCHEDULE_PROPAGATION Procedure

This procedure unschedules previously scheduled propagation of messages from a queue to a destination identified by a specific database link.

Syntax

```
DBMS_AQADM.UNSCHEDULE_PROPAGATION (
    queue_name          IN  VARCHAR2,
    destination         IN  VARCHAR2 DEFAULT NULL,
    destination_queue  IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 26-62 UNSCHEDULE_PROPAGATION Procedure Parameters

Parameter	Description
queue_name	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the administrative user.
destination	Destination database link. Messages in the source queue for recipients at this destination are propagated. If it is NULL, then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 128 bytes, and if the name is not fully qualified, then the default domain name is used.

Table 26-62 (Cont.) UNSCHEDULE_PROPAGATION Procedure Parameters

Parameter	Description
destination_queue	Name of the target queue to which messages are to be propagated in the form of a dblink

26.4.49 UNSET_QUEUE_PARAMETER Procedure

This procedure allows user to unset different parameters for sharded queues at queue or database level.

For database level the `queue_name` should be `NULL`. Note that queue overrides database level parameter values.

See Also:

Oracle® Database Advanced Queuing User's Guide for information about sharded queues

Syntax

```
PROCEDURE UNSET_QUEUE_PARAMETER(
    queue_name      IN VARCHAR2,
    param_name     IN VARCHAR2);
```

Parameters

Table 26-63 UNSET_QUEUE_PARAMETER Procedure Parameters

Parameter	Description
queue_name	The name of the sharded queue.
param_name	The name of the parameter. Table 26-64 and Table 26-65 describe the valid parameter names.

Table 26-64 Sharded queue parameters

Parameter Name	Scope	Allowed Values	Description
SHARD_NUM	Queue level	[1, UB4MAXVAL]	Maximum number of shards allowed for the queue.

Table 26-64 (Cont.) Sharded queue parameters

Parameter Name	Scope	Allowed Values	Description
SUBSHARD_SIZE	Queue level	[1, UB2MAXVAL]	<p>Default value is 20,000.</p> <p>This is the size of each partition for allocation of memory in a shard. Each shard consists of multiple subshards, which are allocated, used, and purged automatically based on message enqueue and dequeue rate for the shard.</p>
KEY_BASED_ENQUEUE	Queue level	[0, 1]	<p>When set, the shard to which a message gets enqueued is determined by the key value specified in the message. Refer to key-based sharding (link) for more details. This parameter cannot be unset once set.</p> <p>When this parameter is not set (default), a session is bound to a shard at the time of first enqueue to the queue. All messages enqueued by the session will go to the same shard to which the session is bound.</p>
STICKY_DEQUEUE	Queue level	[0, 1]	<p>When set, dequeue session sticks to a shard in the queue. A session is bound to a shard on first dequeue from the queue. All messages dequeued by the session come from the same shard to which it is bound. This parameter cannot be unset once set.</p> <p>When this parameter is not set, messages dequeued by a session can spread across multiple shards of the queue.</p>

Table 26-65 Key-based Parameters

Parameter Name	Scope	Description
AQ\$KEY_TO_SHARD_MAP	Queue level	Shard number to which a given key is mapped. When key-based sharding is enabled, this parameter is used to establish mapping between a key and a shard number or retrieve the shard number to which given key is mapped.
AQ\$GET_KEY_SHARD_INST	Queue level	Instance number that owns the shard to which a given key is mapped. Applicable only when key-based sharding is enabled. It is a read-only parameter.

26.4.50 VERIFY_QUEUE_TYPES Procedure

This procedure verifies that the source and destination queues have identical types.

The result of the verification is stored in the table `sys.aq$_message_types`, overwriting all previous output of this command.

Syntax

```
DBMS_AQADM.VERIFY_QUEUE_TYPES (
    src_queue_name    IN    VARCHAR2,
    dest_queue_name   IN    VARCHAR2,
    destination       IN    VARCHAR2 DEFAULT NULL,
    rc                OUT   BINARY_INTEGER);
```

Parameters

Table 26-66 VERIFY_QUEUE_TYPES Procedure Parameters

Parameter	Description
<code>src_queue_name</code>	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the user.
<code>dest_queue_name</code>	Name of the destination queue where messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the user.
<code>destination</code>	Destination database link. Messages in the source queue for recipients at this destination are propagated. If it is <code>NULL</code> , then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 128 bytes, and if the name is not fully qualified, then the default domain name is used.

Table 26-66 (Cont.) VERIFY_QUEUE_TYPES Procedure Parameters

Parameter	Description
<code>rc</code>	Return code for the result of the procedure. If there is no error, and if the source and destination queue types match, then the result is 1. If they do not match, then the result is 0. If an Oracle error is encountered, then it is returned in <code>rc</code> .

 **Note:**

- `SYS.AQ$_MESSAGE_TYPES` can have multiple entries for the same source queue, destination queue, and database link, but with different transformations.
- `VERIFY_QUEUE_TYPES` check happens once per AQ propagation schedule and not for every propagated message send.
- In case the payload of the queue is modified then the existing propagation schedule between source and destination queue needs to be dropped and recreated.

27

DBMS_AQELM

The package provides subprograms to manage the configuration of Oracle Advanced Queuing (AQ) asynchronous notification by e-mail and HTTP.



See Also:

Oracle Database Advanced Queuing User's Guide for detailed information about DBMS_AQELM

This chapter contains the following topics: DBMS_AQELM

- [Security Model](#)
- [Summary of DBMS_AQELM Subprograms](#)

27.1 DBMS_AQELM Security Model

You need the administrator role `AQ_ADMINISTRATOR_ROLE` to run all procedures in `DBMS_AQELM`.

27.2 Summary of DBMS_AQELM Subprograms

This section lists and briefly describes the `DBMS_AQELM` subprograms.

Table 27-1 DBMS_AQELM Package Subprograms

Subprogram	Description
SET_MAILHOST Procedure	Sets the host name for the SMTP server that the database will use to send out e-mail notifications
SET_MAILPORT Procedure	Sets the port number for the SMTP server
SET_SENDFROM Procedure	Sets the sent-from e-mail address

27.2.1 SET_MAILHOST Procedure

This procedure sets the host name for the SMTP server. The database uses this SMTP server host name to send out e-mail notifications.

Syntax

```
DBMS_AQELM.SET_MAILHOST (  
    mailhost IN VARCHAR2);
```

Parameters

Table 27-2 SET_MAILHOST Procedure Parameters

Parameter	Description
mailhost	SMTP server host name.

Usage Notes

As part of the configuration for e-mail notifications, a user with `AQ_ADMINISTRATOR_ROLE` or with `EXECUTE` permissions on the `DBMS_AQELM` package needs to set the host name before registering for e-mail notifications.

27.2.2 SET_MAILPORT Procedure

This procedure sets the port number for the SMTP server.

Syntax

```
DBMS_AQELM.SET_MAILPORT (
    mailport IN NUMBER);
```

Parameters

Table 27-3 SET_MAILPORT Procedure Parameters

Parameter	Description
mailport	SMTP server port number.

Usage Notes

As part of the configuration for e-mail notifications, a user with `AQ_ADMINISTRATOR_ROLE` or with `EXECUTE` permissions on `DBMS_AQELM` package needs to set the port number before registering for e-mail notifications. The database uses this SMTP server port number to send out e-mail notifications. If not set, the SMTP mailport defaults to 25.

27.2.3 SET_SENDFROM Procedure

This procedure sets the sent-from e-mail address. This e-mail address is used in the sent-from field in all the e-mail notifications sent out by the database to the registered e-mail addresses.

Syntax

```
DBMS_AQELM.SET_SENDFROM (
    sendfrom IN VARCHAR2);
```


Parameters

Table 27-4 SET_SENDFROM Procedure Parameters

Parameter	Description
sendfrom	The sent-from e-mail address.

Usage Notes

As part of the configuration for e-mail notifications, a user with `AQ_ADMINISTRATOR_ROLE` or with `EXECUTE` permissions on the `DBMS_AQELM` package should set the sent-from address before registering for e-mail notifications

28

DBMS_AQIN

The `DBMS_AQIN` package plays a part in providing secure access to the Oracle JMS interfaces.



See Also:

Oracle Database Advanced Queuing User's Guide for detailed information about `DBMS_AQIN`

This chapter contains the following topic:

- [Security Model](#)

28.1 DBMS_AQIN Security Model

While you should not call any subprograms in the `DBMS_AQIN` package directly, you must have the `EXECUTE` privilege on the `DBMS_AQIN` and `DBMS_AQJMS` packages to use the Oracle JMS interfaces.

Use the following syntax to accomplish this with regard to the `DBMS_AQIN` package:

```
GRANT EXECUTE ON DBMS_AQIN to user;
```

You must have `EXECUTE` privilege on the `DBMS_AQIN` and `DBMS_AQJMS` packages to use the Oracle JMS interfaces. You can also acquire these rights through the `AQ_USER_ROLE` or the `AQ_ADMINISTRATOR_ROLE`.



See Also:

Oracle Database Advanced Queuing User's Guide for more information on accessing standard and Oracle JMS applications.

DBMS_AQMIGTOOL

The `DBMS_AQMIGTOOL` package simplifies migration from Oracle Database Advanced Queuing (AQ) to Transactional Event Queue (TxEventQ) with orchestration automation, source and target compatibility diagnostics and remediation, and a unified user experience. Migration scenarios can be short or long-lived and be performed with or without AQ downtime, eliminating operational disruption.



See Also:

Migrating from AQ to TxEventQ in *Oracle Database Advanced Queuing User's Guide* for detailed information about `DBMS_AQMIGTOOL`

This chapter contains the following topics:

- [Security Model](#)
- [DBMS_AQMIGTOOL Constants](#)
- [Summary of DBMS_AQMIGTOOL Subprograms](#)

29.1 DBMS_AQMIGTOOL Security Model

All `DBMS_AQMIGTOOL` subprograms require the user to have `EXECUTE` privilege over the `DBMS_AQMIGTOOL` package. If the invoker of the package is the owner of the queue, then only `EXECUTE` privilege on the `DBMS_AQMIGTOOL` package is sufficient. But if the invoker is non-owner, then it also needs to have `MANAGE_ANY` queue system privilege, which can be granted through `DBMS_AQADM.GRANT_SYSTEM_PRIVILEGE`.

29.2 DBMS_AQMIGTOOL Constants

The `DBMS_AQMIGTOOL` package defines several constants that can be used for specifying parameter values.

When using enumerated constants, such as `AUTOMATIC`, `INTERACTIVE`, or `ENABLE_EVALUATION`, the symbol must be specified with the scope of the packages defining it. All types associated with the administrative interfaces must be prepended with `DBMS_AQMIGTOOL`. For example, `DBMS_AQMIGTOOL.AUTOMATIC`.

Table 29-1 DBMS_AQMIGTOOL Constants

Parameter	Options	Value
mig_mode	AUTOMATIC	1
	INTERACTIVE	2
	OFFLINE	3
	ONLY_DEFINITION	4
ordering	GLOBAL	1
	SESSION	2
checkmode	CURRENT	1
	ENABLE_EVALUATION	2
cancelmode	RESTORE	1
	NORESTORE	2
	Q_EMPTY	3
purge_option	ONLY_CQ	1
	ONLY_TXEVENTQ	2
	BOTH_Q	3

29.3 Summary of DBMS_AQMIGTOOL Subprograms

This section lists and briefly describes the DBMS_AQMIGTOOL subprograms.

Table 29-2 DBMS_AQMIGTOOL Package Subprograms

Subprogram	Description
CANCEL_MIGRATION Procedure	Cancels an ongoing migration by dropping the interim TxEventQ
CHECK_MIGRATED_MESSAGES Procedure	Provides a count of messages in the <code>READY</code> state within the AQ and the interim TxEventQ
CHECK_MIGRATION_TO_TXEVENTQ Procedure	Analyzes the AQ's definition and data and report any features unsupported in TxEventQ
CHECK_STATUS Procedure	Returns the current status of the ongoing migration process
CLEAR_UNSUPPORTED_FEATURE_TABLE Procedure	Clears entries from the <code>USER_TXEVENTQ_MIGRATION_STATUS</code> view
COMMIT_MIGRATION Procedure	Completes the migration process by dropping AQ, renaming the interim TxEventQ to match AQ's name, and enabling TxEventQ for all operations
DISABLE_MIGRATION_CHECK Procedure	Disables the internal AQ monitoring for detecting unsupported features and stops event insertion in the <code>USER_TXEVENTQ_MIGRATION_STATUS</code> view
INIT_MIGRATION Procedure	Analyzes the AQ's definition and data for unsupported features and then starts the migration process by creating an interim TxEventQ copying the AQ's configuration

Table 29-2 (Cont.) DBMS_AQMIGTOOL Package Subprograms

Subprogram	Description
PURGE_QUEUE_MESSAG ES Procedure	Purges messages from the queue
RECOVER_MIGRATION Procedure	Helps recovery from any failures during execution of migration procedures such as DBMS_AQMIGTOOL.INIT_MIGRATION, DBMS_AQMIGTOOL.COMMIT_MIGRATION, or DBMS_AQMIGTOOL.CANCEL_MIGRATION
RENAME_QUEUE Procedure	Renames the TxEventQ along with its default exception queue if present

29.3.1 CANCEL_MIGRATION Procedure

This procedure serves the purpose of canceling an ongoing migration. It involves dropping the interim TxEventQ, which was created during the execution of DBMS_AQMIGTOOL.INIT_MIGRATION.

Syntax

```
PROCEDURE DBMS_AQMIGTOOL.CANCEL_MIGRATION (
    cqschema    IN VARCHAR2,
    cqname      IN VARCHAR2,
    cancelmode  IN NUMBER DEFAULT DBMS_AQMIGTOOL.RESTORE );
```


Parameters

Table 29-3 CANCEL_MIGRATION Procedure Parameters

Parameter	Description
cqschema	Specifies the schema name where the queue exists
cqname	Specifies the queue name for which the migration needs to be canceled

Table 29-3 (Cont.) CANCEL_MIGRATION Procedure Parameters

Parameter	Description
cancelmode	<p>Specifies the mode in which the user wants to cancel the migration. The following are the possible values:</p> <p>DBMS_AQMIGTOOL.RESTORE (default): This option restores the messages from the interim TxEventQ into the AQ, including their message state. New MSGID will get populated for restored messages.</p>

 **Note:**

The priority behavior of restored messages may change as AQ and TxEventQ default values are different.

DBMS_AQMIGTOOL.NOESTORE: Messages within interim TxEventQ will be discarded.

DBMS_AQMIGTOOL.EMPTY: If the interim TxEventQ is not empty, selecting this option will trigger an exception, prompting the user to dequeue all messages from the interim TxEventQ. This mode is useful if the user wishes to prevent message migration while transitioning to the AQ.

Usage Notes

A prerequisite for this procedure is that the migration must already be started on the queue, that is, DBMS_AQMIGTOOL.INIT_MIGRATION should be invoked before executing this procedure. For DBMS_AQMIGTOOL.RESTORE mode, the TxEventQ's exception queue messages are not restored to AQ or its exception queue.

29.3.2 CHECK_MIGRATED_MESSAGES Procedure

This procedure calculates the count of messages in the READY state within both the AQ and the interim TxEventQ. This count provides valuable insight before using DBMS_AQMIGTOOL.COMMIT_MIGRATION or DBMS_AQMIGTOOL.CANCEL_MIGRATION. The calculated count is independent of the number of subscribers.

Syntax

```
PROCEDURE SYS.DBMS_AQMIGTOOL.CHECK_MIGRATED_MESSAGES (
    cqschema          IN VARCHAR2,
    cqname            IN VARCHAR2,
    txeventq_migrated_message IN OUT NUMBER,
    cq_pending_messages IN OUT NUMBER);
```

Parameters

Table 29-4 CHECK_MIGRATED_MESSAGES Procedure Parameters

Parameter	Description
cqschema	Specifies the schema name where the queue exists

Table 29-4 (Cont.) CHECK_MIGRATED_MESSAGES Procedure Parameters

Parameter	Description
cqname	Specifies the name of the queue on which the migration process has started
txeventq_migrated_message	Represents the count of messages in the READY state within the interim TxEventQ. The count helps estimate the potential fallback time if the user opts to execute DBMS_AQMIGTOOL.CANCEL_MIGRATION.
cq_pending_messages	Represents the count of messages in the READY state within the AQ. The count helps determine the remaining number of READY state messages until the AQ is empty, which is a prerequisite for using the DBMS_AQMIGTOOL.COMMIT_MIGRATION procedure.

Usage Notes

A prerequisite for this procedure is that the migration must already be started on the queue, meaning DBMS_AQMIGTOOL.INIT_MIGRATION should be invoked before executing this procedure.

29.3.3 CHECK_MIGRATION_TO_TXEVENTQ Procedure

This procedure examines the AQ's definition and data and reports any features that are unsupported in TxEventQ. If no unsupported features are detected, then `migration_report` will be empty.

Syntax

```
PROCEDURE DBMS_AQMIGTOOL.CHECK_MIGRATION_TO_TXEVENTQ (
    cqschema          IN VARCHAR2,
    cqname            IN VARCHAR2,
    migration_report  IN OUT TXEVENTQ_MIGREPORT_ARRAY,
    checkmode         IN NUMBER DEFAULT DBMS_AQMIGTOOL.ENABLE_EVALUATION);
```

Parameters**Table 29-5 CHECK_MIGRATION_TO_TXEVENTQ Procedure Parameters**

Parameter	Description
cqschema	Specifies the schema name where the queue exists
cqname	Specifies the queue name for which unsupported features need to be checked
migration_report	A Varray containing details of unsupported events and their corresponding descriptions. It holds the most recent 20 unsupported features.

Table 29-5 (Cont.) CHECK_MIGRATION_TO_TXEVENTQ Procedure Parameters

Parameter	Description
checkmode	<p>Specifies the mode in which the user wants to check. The following are the possible values:</p> <p>DBMS_AQMIGTOOL.CURRENT: This mode generates a report using the current definition of the AQ and its data.</p> <p>DBMS_AQMIGTOOL.ENABLE_EVALUATION (Default): This mode, along with the CURRENT option report, will enable the monitoring of the AQ. It helps the capturing runtime-specific unsupported features. As more workload is applied to the AQ, the unsupported features, if found any, are recorded in an internal table accessible through the USER_TXEVENTQ_MIGRATION_STATUS view. Users can disable monitoring using DBMS_AQMIGTOOL.DISABLE_MIGRATION_CHECK.</p>

Usage Notes

Several features like relative message identifier, sequence deviation, and transformation are not supported in TxEventQ. If the queue uses any of them, they will be recorded in the `migration_report`.

It is recommended to use the `DBMS_AQMIGTOOL.CHECK_MIGRATION_TO_TXEVENTQ` procedure to detect unsupported features before beginning the migration process.



See Also:

Limitations and Workarounds in *Oracle Database Transactional Event Queues and Advanced Queuing User's Guide*

29.3.4 CHECK_STATUS Procedure

This procedure returns the status of the migration process. In case any unsupported features are detected, the procedure will return details about the most recent unsupported feature, including its description. On the other hand, if no unsupported features are detected, it will return a status of 'No Compatibility Error'.

Syntax

```
PROCEDURE DBMS_AQMIGTOOL.CHECK_STATUS (
    cqschema          IN VARCHAR2,
    cqname            IN VARCHAR2,
    status            IN OUT VARCHAR2,
    migration_comment IN OUT VARCHAR2);
```

Parameters

Table 29-6 CHECK_STATUS Procedure Parameters

Parameter	Description
cqschema	Specifies the schema name where the queue exists

Table 29-6 (Cont.) CHECK_STATUS Procedure Parameters

Parameter	Description
cqname	Specifies the name of the queue for which the migration process status needs to be checked
status	Return the compatibility status. In case of incompatibility, that is, detection of unsupported features; the most recent unsupported event will be returned, and the status return format will be: "Compatibility Error: <feature_name> Unsupported Feature".
migration_comment	If the status is incompatible, the description of the unsupported event will be provided

Usage Notes

A prerequisite for this procedure is that the migration must already be started on the queue, meaning `DBMS_AQMIGTOOL.INIT_MIGRATION` should be invoked before executing this procedure.

The following table will store the information regarding events during pre-init or post-init migration. Users can access this information through security views:

`DBA_TXEVENTQ_MIGRATION_STATUS`, `USER_TXEVENTQ_MIGRATION_STATUS`, and `ALL_TXEVENTQ_MIGRATION_STATUS`.

```
sys.aq$_migration_status(
    migration_id          RAW(16);
    source_schema        VARCHAR2(128) NOT NULL,
    source_queue         VARCHAR2(128) NOT NULL,
    source_queue_table   VARCHAR2(128),
    target_schema        VARCHAR2(128) NOT NULL,
    target_queue         VARCHAR2(128) NOT NULL,
    status               NUMBER,
    event               VARCHAR(128),
    event_timestamp      TIMESTAMP WITH TIME ZONE,
    event_id            NUMBER,
    event_error          VARCHAR2(1024),
    ordering             VARCHAR(30),
    suffix              VARCHAR2(2),
    mig_mode            NUMBER,
    spare1              NUMBER,
    spare2              VARCHAR2(30),
    spare3              TIMESTAMP WITH TIME ZONE
)
```

A unique `migration_id` will be assigned to each initiated migration.



See Also:

`DBA_TXEVENTQ_MIGRATION_STATUS` in Oracle Database Reference

`USER_TXEVENTQ_MIGRATION_STATUS` in Oracle Database Reference

`ALL_TXEVENTQ_MIGRATION_STATUS` in Oracle Database Reference

29.3.5 CLEAR_UNSUPPORTED_FEATURE_TABLE Procedure

This procedure removes entries from the underlying table of the `USER_TXEVENTQ_MIGRATION_STATUS` view. This view stores records related to unsupported features detected by the `DBMS_AQMIGTOOL.CHECK_MIGRATION_TO_TXEVENTQ` procedure and details of other migration procedure calls (`INIT_MIGRATION/COMMIT_MIGRATION/CANCEL_MIGRATION`) used for internal purposes.

Syntax

```
PROCEDURE DBMS_AQMIGTOOL.CLEAR_UNSUPPORTED_FEATURE_TABLE (
    cqschema          IN   VARCHAR2,
    cqname            IN   VARCHAR2 DEFAULT NULL,
    eraseall          IN   BOOLEAN DEFAULT FALSE);
```

Parameters

Table 29-7 CLEAR_UNSUPPORTED_FEATURE_TABLE Procedure Parameters

Parameter	Description
<code>cqschema</code>	Specifies the schema name where the queue exists
<code>cqname</code>	Specifies the name of the queue for which records need to be cleared
<code>eraseall</code>	<code>TRUE</code> erases all the records for the specified queue.

Note:

The `TRUE` value is intended solely for internal purposes and should not be used without consulting Oracle support.

`FALSE` erases records related to unsupported features only.

Usage Notes

Users can use this procedure to erase the records generated by the `DBMS_AQMIGTOOL.CHECK_MIGRATION_TO_TXEVENTQ` procedure. Dropping the queue or the user will also erase records for that queue. However, executing `DBMS_AQMIGTOOL.COMMIT_MIGRATION` or `DBMS_AQMIGTOOL.CANCEL_MIGRATION` will not clear the records for the queue. Therefore, this procedure offers the flexibility to erase records for a queue at any point.

29.3.6 COMMIT_MIGRATION Procedure

This procedure completes the migration process. It drops AQ and renames the interim TxEventQ to the AQ's name, and enables the TxEventQ for all operations. It is

important to note that an empty AQ (that is, with no messages in the `READY` state) is required to execute the procedure successfully; otherwise, an exception will be raised.

Syntax

```
PROCEDURE DBMS_AQMIGTOOL.COMMIT_MIGRATION (
    cqschema      IN VARCHAR,
    cqname        IN VARCHAR,
    ignore_warning IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 29-8 COMMIT_MIGRATION Procedure Parameters

Parameter	Description
<code>cqschema</code>	Specifies the schema name where the queue exists
<code>cqname</code>	Specifies the queue name for which the migration needs to be completed
<code>ignore_warning</code>	After <code>DBMS_AQMIGTOOL.INIT_MIGRATION</code> , all unsupported events are recorded as warnings. <code>TRUE</code> means the procedure will ignore the warnings and complete the migration. <code>FALSE</code> means the procedure will throw an error if there are any warnings.

Usage Notes

A prerequisite for this procedure is that the migration must already be started on the queue. In other words, the `DBMS_AQMIGTOOL.INIT_MIGRATION` procedure should be invoked before executing this procedure. The messages from the AQ's exception queue will not be copied to the `TxEVENTQ`'s exception queue.

29.3.7 DISABLE_MIGRATION_CHECK Procedure

This procedure disables the internal monitoring of the AQ aimed at detecting unsupported features. It also stops the recording of events for the `USER_TXEVENTQ_MIGRATION_STATUS` view.

Syntax

```
PROCEDURE DBMS_AQMIGTOOL.DISABLE_MIGRATION_CHECK (
    cqschema IN VARCHAR2)
    cqname   IN VARCHAR2);
```

Parameters

Table 29-9 DISABLE_MIGRATION_CHECK Procedure Parameter

Parameter	Description
<code>cqschema</code>	Specifies the schema name where the queue exists
<code>cqname</code>	Specifies the name of the queue on which migration monitoring needs to be disabled

Usage Notes

As a pre-migration step, the user can start recording unsupported features by invoking `DBMS_AQMIGTOOL.CHECK_MIGRATION_TO_TXEVENTQ` with `DBMS_AQMIGTOOL.ENABLE_EVALUATION`

option. This can be followed by running a comprehensive workload on the AQ to detect potential issues and then stop recording unsupported features by calling `DBMS_AQMIGTOOL.DISABLE_MIGRATION_CHECK`. The user can modify the workload if any migration issues are found before repeating the process. If no migration issues were found, migration of the AQ can be attempted.

29.3.8 INIT_MIGRATION Procedure

This procedure examines the definition and data of the AQ to detect any features that are not supported in TxEventQ. If any unsupported features are detected, an exception is raised. Otherwise, the procedure starts the migration process by creating an interim TxEventQ that copies the configuration of the AQ, which includes payload type, rules, subscribers, privileges, PL/SQL notifications, and more.

Syntax


```
PROCEDURE DBMS_AQMIGTOOL.INIT_MIGRATION (
    cqschema          IN VARCHAR2,
    cqname            IN VARCHAR2 DEFAULT NULL,
    txeventqschema    IN VARCHAR2 DEFAULT NULL,
    txeventqname      IN VARCHAR2 DEFAULT NULL,
    mig_mode          IN NUMBER DEFAULT DBMS_AQMIGTOOL.INTERACTIVE,
    ordering          IN NUMBER DEFAULT DBMS_AQMIGTOOL.GLOBAL,
    suffix            IN VARCHAR2 DEFAULT 'M');
```

Parameters

Table 29-10 INIT_MIGRATION Procedure Parameters

Parameter	Description
cqschema	Specifies the schema name where the queue (AQ) exists
cqname	Specifies the name of the queue (AQ) for which the migration process is to be started. If cqname is NULL, then migration initiates for all AQs in cqschema, ignoring queues with unsupported features. Execution displays the count of queues where <code>DBMS_AQMIGTOOL.INIT_MIGRATION</code> succeeded.
txeventqschema	Specifies the schema name where the target TxEventQ is intended to be created. Only provide this value for <code>DBMS_AQMIGTOOL.ONLY_DEFINITION</code> mode. If the invoker is on a different schema than txeventqschema, it needs <code>MANAGE_ANY</code> queue system privilege to execute this procedure successfully.
txeventqname	Specifies the name of the queue for the target TxEventQ to be created. Only provide this value for <code>DBMS_AQMIGTOOL.ONLY_DEFINITION</code> mode.

Table 29-10 (Cont.) INIT_MIGRATION Procedure Parameters

Parameter	Description
<code>mig_mode</code>	<p>Specifies the migration mode. The following are the possible values:</p> <p><code>DBMS_AQMIGTOOL.AUTOMATIC</code>: Enqueue and dequeue operations are allowed in this mode, but a background job will attempt to execute <code>DBMS_AQMIGTOOL.COMMIT_MIGRATION</code> once no messages are left in the <code>READY</code> state in AQ and no unsupported features are detected.</p> <p><code>DBMS_AQMIGTOOL.INTERACTIVE</code> (Default): In this mode, both enqueue and dequeue operations are allowed.</p> <p><code>DBMS_AQMIGTOOL.OFFLINE</code>: Only dequeue operations are allowed in this mode, which helps in reducing the workload by restricting the new enqueue operations.</p> <p><code>DBMS_AQMIGTOOL.ONLY_DEFINITION</code>: This mode creates a separate TxEventQ with the same configuration as the AQ instead of an interim TxEventQ setup. This completes the migration process, with AQ and TxEventQ remaining in the system. The messages present in AQ will not be copied to the newly created TxEventQ.</p>
	<p> Note:</p> <p>For the <code>DBMS_AQMIGTOOL.ONLY_DEFINITION</code> mode, there is no need to call <code>DBMS_AQMIGTOOL.COMMIT_MIGRATION</code> or <code>DBMS_AQMIGTOOL.CANCEL_MIGRATION</code> to complete or cancel the migration; this <code>DBMS_AQMIGTOOL.INIT_MIGRATION</code> call is sufficient. However, for other modes, the user must explicitly call other procedures in the <code>DBMS_AQMIGTOOL</code> package to proceed further.</p>
<code>ordering</code>	<p>Specifies the message level ordering the user wants to follow. The following are the possible values:</p> <p><code>DBMS_AQMIGTOOL.GLOBAL</code> (Default): This option implements global-level message ordering by setting the number of event streams in the TxEventQ to one.</p> <p><code>DBMS_AQMIGTOOL.SESSION</code>: This option imposes a message order only for a session. The number of event streams in the TxEventQ will be set based on the initialization parameter <code>_aq_init_shards</code>. Oracle recommends using this option to achieve the full performance benefits of TxEventQ.</p>
<code>suffix</code>	<p>Specifies a single character suffix for naming the interim TxEventQ. The interim TxEventQ name will be in the format <code><cqname>_<suffix></code>. The default value for the suffix is <code>M</code>.</p>

Usage Notes

- This procedure will also create the default exception queue on the TxEventQ, following the naming format `AQ$_<TxEventQ_name>_E`.

- The following points are not relevant for `DBMS_AQMIGTOOL.ONLY_DEFINITION` mode but apply to other modes:
 - It restricts AQ from administrative operations to maintain interim TxEventQ configuration integrity until the migration is completed or canceled.
 - The Enqueue - Dequeue operations are allowed on AQ:
 - * Enqueue requests for new messages are directed to the interim TxEventQ.
 - * Messages are first dequeued from AQ. If no messages are in the `READY` state, then messages are dequeued from the interim TxEventQ.
 - Users are restricted from performing all direct operations on the interim TxEventQ. Enqueue and dequeue operations on interim TxEventQ will always be performed through AQ.
- If the procedure triggers an exception due to the detection of unsupported features, it is recommended to use the `DBMS_AQMIGTOOL.CHECK_MIGRATION_TO_TXEVENTQ` procedure to obtain a detailed list of the detected unsupported features.
- If there is a name conflict, such as when a queue (AQ) being migrated shares the same name as the queue table in which it resides, then only the `DBMS_AQMIGTOOL.ONLY_DEFINITION` mode is supported. For any other modes, attempting to proceed will result in an exception being raised.

29.3.9 PURGE_QUEUE_MESSAGES Procedure

This procedure purges messages from the queue. It can perform message purging from the AQ, the interim TxEventQ, or both, depending on user input. Specifically, one of the prerequisites for executing `DBMS_AQMIGTOOL.COMMIT_MIGRATION` is to ensure an empty AQ, meaning no messages in the `READY` state. This procedure allows users to efficiently purge all messages from the AQ to fulfill this requirement.

Syntax

```
PROCEDURE DBMS_AQMIGTOOL.PURGE_QUEUE_MESSAGES (
    cqschema      IN VARCHAR2,
    cqname        IN VARCHAR2,
    purge_option  IN NUMBER DEFAULT DBMS_AQMIGTOOL.ONLY_CQ);
```

Parameters

Table 29-11 PURGE_QUEUE_MESSAGES Procedure Parameters

Parameter	Description
<code>cqschema</code>	Specifies the schema name where the queue exists
<code>cqname</code>	Specifies the name of the queue where the migration process started

Table 29-11 (Cont.) PURGE_QUEUE_MESSAGES Procedure Parameters

Parameter	Description
purge_option	Specifies the option from which queue messages need to be purged. The following options are available: DBMS_AQMIGTOOL.ONLY_CQ (Default): Purge messages only from the AQ. DBMS_AQMIGTOOL.ONLY_TXEVENTQ: Purge messages only from the interim TxEventQ. DBMS_AQMIGTOOL.BOTH: Purge messages from both the AQ and the interim TxEventQ.

Usage Notes

Suppose the count of messages in the `READY` state within the AQ is obtained from the `DBMS_AQMIGTOOL.CHECK_MIGRATED_MESSAGE` procedure is large, and the user wishes to speed up the `DBMS_AQMIGTOOL.COMMIT_MIGRATION` process without waiting for dequeues to consume the messages, the `DBMS_AQMIGTOOL.PURGE_QUEUE_MESSAGES` procedure can be used.

A prerequisite for this procedure is that the migration must already be started on the queue, meaning `DBMS_AQMIGTOOL.INIT_MIGRATION` should be invoked before executing this procedure.

29.3.10 RECOVER_MIGRATION Procedure

This procedure restores the migration state to the nearest feasible and consistent point, either before or after the execution of `DBMS_AQMIGTOOL.CANCEL_MIGRATION`, `DBMS_AQMIGTOOL.COMMIT_MIGRATION`, or `DBMS_AQMIGTOOL.INIT_MIGRATION`. The recovered state is then displayed to the user through the output parameter `recovery_message`, providing guidance for further action. If migration procedures experience unexpected failures, such as instance crashes, then this procedure can be used to recover the migration to the nearest consistent state like before `INIT_MIGRATION`, after `INIT_MIGRATION`, after `COMMIT_MIGRATION`, and after `CANCEL_MIGRATION`.

Syntax

```
PROCEDURE DBMS_AQMIGTOOL.RECOVER_MIGRATION (
    cqschema          IN VARCHAR2,
    cqname            IN VARCHAR2,
    recovery_message  OUT VARCHAR2);
```

Parameters

Table 29-12 RECOVER_MIGRATION Procedure Parameters

Parameter	Description
cqschema	Specifies the schema name where the queue exists
cqname	Specifies the name of the queue where the migration procedure was attempted
recovery_message	Returns a descriptive message indicating the restored migration state's nearest feasible and consistent point

Usage Notes

The following table shows all the possible recovery_message:

Table 29-13 Recommended action table according to recovery_message

Error while executing migration procedure:	recovery_message	Recommended Action
DBMS_AQMIGTOOL.INIT_MIGRATION	State is restored to before INIT_MIGRATION call execution.	To start the migration, the user must explicitly call DBMS_AQMIGTOOL.INIT_MIGRATION again.
DBMS_AQMIGTOOL.INIT_MIGRATION	State is restored to after INIT_MIGRATION call execution.	No further action is needed to start the migration, as this procedure has successfully started.
DBMS_AQMIGTOOL.COMMIT_MIGRATION	State is restored to after COMMIT_MIGRATION call execution.	No further action is needed to complete the migration, as this procedure has successfully completed it.
DBMS_AQMIGTOOL.CANCEL_MIGRATION	State is restored to before CANCEL_MIGRATION call execution.	To proceed with canceling the migration, the user must explicitly call DBMS_AQMIGTOOL.CANCEL_MIGRATION again.
DBMS_AQMIGTOOL.CANCEL_MIGRATION	State is restored to after CANCEL_MIGRATION call execution.	No further action is needed to cancel the migration, as this procedure has successfully cancelled it.
No migration procedure	No need for recovery call.	Since no migration procedure execution is detected, restoring it to the nearest feasible and consistent point is not required.

29.3.11 RENAME_QUEUE Procedure

This procedure renames the TxEventQ along with its default exception queue if present.

Syntax

```
PROCEDURE DBMS_AQMIGTOOL.RENAME_QUEUE (
    schema          IN VARCHAR2,
    qname           IN VARCHAR2,
    new_qname       IN VARCHAR2);
```


Parameters

Table 29-14 RENAME_QUEUE Procedure Parameters

Parameter	Description
schema	Specifies the schema name where the queue exists
qname	Specifies the current name of the queue to be renamed
new_qname	Specify the new name to be given to the existing queue. The new name must be unique within a schema and must follow object name guidelines in Oracle Database SQL Language Reference with regard to reserved characters.

Usage Notes

This procedure requires a prerequisite step: the user must perform `DBMS_AQADM.STOP_QUEUE` to ensure there are no concurrent enqueue and dequeue transactions.

If the default exception queue is present, it will be renamed from `<schema>.AQ$_<qname>_E` to `<schema>.AQ$_<new_qname>_E`.

30

DBMS_ASSERT

The DBMS_ASSERT package provides an interface to validate properties of the input value.



See Also:

Oracle Database PL/SQL Language Reference for more information about "Avoiding SQL Injection in PL/SQL"

This chapter contains the following topics:

- [Operational Notes](#)
- [Summary of DBMS_ASSERT Subprograms](#)

30.1 DBMS_ASSERT Operational Notes

If the condition which determines the property asserted in a function is not met then a value error is raised. Otherwise the input value is returned through the return value. Most functions return the value unchanged, however, several functions modify the value.

30.2 Summary of DBMS_ASSERT Subprograms

This section describes the subprograms of the DBMS_ASSERT package.

Table 30-1 DBMS_ASSERT Package Subprograms

Subprogram	Description
ENQUOTE_LITERAL Function	Enquotes a string literal
ENQUOTE_NAME Function	Ensures that a string is enclosed by quotation marks, then checks that the result is a valid SQL identifier.
NOOP Functions	Returns the value without any checking
QUALIFIED_SQL_NAME Function	Verifies that the input string is a qualified SQL name
SCHEMA_NAME Function	Verifies that the input string is an existing schema name
SIMPLE_SQL_NAME Function	Verifies that the input string is a simple SQL name
SQL_OBJECT_NAME Function	Verifies that the input parameter string is a qualified SQL identifier of an existing SQL object

30.2.1 ENQUOTE_LITERAL Function

This function adds leading and trailing single quotes to a string literal.

Syntax

```
DBMS_ASSERT.ENQUOTE_LITERAL (  
    str          VARCHAR2)  
RETURN VARCHAR2;
```

Parameters

Table 30-2 ENQUOTE_LITERAL Function Parameters

Parameter	Description
str	String to enquote

Usage Notes

- Verify that all single quotes except leading and trailing characters are paired with adjacent single quotes.
- No additional quotes are added if the name was already in quotes.

30.2.2 ENQUOTE_NAME Function

This function encloses the provided string in double quotes (quotation marks). No additional quotes are added if the string was already in quotes (quotation marks). The quoted string is then checked to see if it is a valid (quoted) simple SQL name.

For more information on Database object names and qualifiers, see Oracle Database SQL Language Reference.

Syntax

```
DBMS_ASSERT.ENQUOTE_NAME (  
    str          VARCHAR2,  
    capitalize   BOOLEAN DEFAULT TRUE)  
RETURN VARCHAR2;
```

Parameters

Table 30-3 ENQUOTE_NAME Function Parameters

Parameter	Description
str	String to enquote
capitalize	If TRUE or defaulted, alphabetic characters of str which was not in quotes are translated to upper case

Usage Notes

- No additional quotes are added if the name was already in quotes.
- Verify that all other double quotes in the string are adjacent pairs of double quotes.

Examples

```
-- This procedure creates a single column table in the createOneColumnTable's schema.
create or replace procedure createOneColumnTable(proposedTableName varchar2) is
BEGIN
  IF
    (proposedTableName is NULL)
  THEN
    raise value_error;
  END IF;
  -- The use of ENQUOTE_NAME ensures that the table will be created in the
  -- definer's schema and not in some other schema even if the definer has
  -- privileges to create tables in other schemas.
  EXECUTE IMMEDIATE 'create table ' ||
  DBMS_ASSERT.ENQUOTE_NAME(proposedTableName) || ' (c1 number)';
  EXCEPTION
    WHEN
      others
    THEN
      dbms_output.put_line('Table creation failed due to: ' || SQLERRM);
END;
/

-- Examples of ENQUOTE_NAME showing input/output relationships
BEGIN
  -- 'eMp' becomes "EMP" since it is unquoted
  dbms_output.put_line(DBMS_ASSERT.ENQUOTE_NAME('eMp'));
END;
/

BEGIN
  -- For quoted strings, the case is preserved
  dbms_output.put_line(DBMS_ASSERT.ENQUOTE_NAME('"EmP"'));
END;
/

-- Invalid identifier example
BEGIN
  dbms_output.put_line(DBMS_ASSERT.ENQUOTE_NAME('SCOTT."EMP"'));
END;
/

-- CHR(0) examples
-- The following examples illustrates that CHR(0), the NULL character, cannot appear
-- in the string; such a string poses a SQL injection risk.
BEGIN
  dbms_output.put_line(DBMS_ASSERT.ENQUOTE_NAME('BAD' || CHR(0) || 'IDENTIFIER'));
END;
/

BEGIN
  dbms_output.put_line(DBMS_ASSERT.ENQUOTE_NAME('"SCOTT' || CHR(0) || '.EMP"'));
END;
/

-- Oracle allows a period (.) to be a part of a quoted string
BEGIN
  dbms_output.put_line(DBMS_ASSERT.ENQUOTE_NAME('"SCOTT.EMP"'));
END;
/
```

```
-- The single quotation mark ('), as opposed to a double quotation mark, can
appear in the string
-- Note: In Oracle, a single quotation mark is specified in a literal using two
single
-- quotes. The first quotation mark escapes the second quotation mark in the
same way that
-- backslash (\) in POSIX is an escape character.
BEGIN
    dbms_output.put_line(DBMS_ASSERT.ENQUOTE_NAME('"O"LEARY'));
END;
/
```

30.2.3 NOOP Functions

This function returns the value without any checking.

Syntax

```
DBMS_ASSERT.NOOP (
    str      VARCHAR2 CHARACTER SET ANY_CS)
RETURN      VARCHAR2 CHARACTER SET str%CHARSET;

DBMS_ASSERT.NOOP (
    str      CLOB CHARACTER SET ANY_CS)
RETURN      CLOB CHARACTER SET str%CHARSET;
```

Parameters

Table 30-4 *NOOP Function Parameters*

Parameter	Description
str	Input value

30.2.4 QUALIFIED_SQL_NAME Function

This function verifies that the input string is a qualified SQL name.

Syntax

```
DBMS_ASSERT.QUALIFIED_SQL_NAME (
    str      VARCHAR2 CHARACTER SET ANY_CS)
RETURN      VARCHAR2 CHARACTER SET str%CHARSET;
```

Parameters

Table 30-5 *QUALIFIED_SQL_NAME Function Parameters*

Parameter	Description
str	Input value

Exceptions

ORA44004: string is not a qualified SQL name

Usage Notes

A qualified SQL name <qualified name> can be expressed by the following grammar:

```
<local qualified name> ::= <simple name> {'.' <simple name>}
<database link name> ::= <local qualified name> ['@' <connection string>]
<connection string> ::= <simple name>
<qualified name> ::= <local qualified name> ['@' <database link name>]
```

30.2.5 SCHEMA_NAME Function

This function verifies that the input string is an existing schema name.

Syntax

```
DBMS_ASSERT.SCHEMA_NAME (
    str          VARCHAR2 CHARACTER SET ANY_CS)
RETURN         VARCHAR2 CHARACTER SET str%CHARSET;
```

Parameters

Table 30-6 SCHEMA_NAME Function Parameters

Parameter	Description
str	Input value

Exceptions

ORA44001: Invalid schema name

Usage Notes

By definition, a schema name need not be just a simple SQL name. For example, "FIRST LAST" is a valid schema name. As a consequence, care must be taken to quote the output of schema name before concatenating it with SQL text.

30.2.6 SIMPLE_SQL_NAME Function

This function verifies that the input string is a simple SQL name.

Syntax

```
DBMS_ASSERT.SIMPLE_SQL_NAME (
    str          VARCHAR2 CHARACTER SET ANY_CS)
RETURN         VARCHAR2 CHARACTER SET str%CHARSET;
```

Parameters

Table 30-7 SIMPLE_SQL_NAME Function Parameters

Parameter	Description
str	Input value

Exceptions

ORA44003: string is not a simple SQL name

Usage Notes

- The input value must be meet the following conditions:
 - The name must begin with an alphabetic character. It may contain alphanumeric characters as well as the characters `_`, `$`, and `#` in the second and subsequent character positions.
 - Quoted SQL names are also allowed.
 - Quoted names must be enclosed in double quotes.
 - Quoted names allow any characters between the quotes.
 - Quotes inside the name are represented by two quote characters in a row, for example, "a name with "" inside" is a valid quoted name.
 - The input parameter may have any number of leading and/or trailing white space characters.
- The length of the name is not checked.

30.2.7 SQL_OBJECT_NAME Function

This function verifies that the input parameter string is a qualified SQL identifier of an existing SQL object.

Syntax

```
DBMS_ASSERT.SQL_OBJECT_NAME (
    str          VARCHAR2 CHARACTER SET ANY_CS)
RETURN         VARCHAR2 CHARACTER SET str%CHARSET;
```

Parameters

Table 30-8 *SQL_OBJECT_NAME Function Parameters*

Parameter	Description
<code>str</code>	Input value

Exceptions

ORA44002: Invalid object name

Usage Notes

The use of synonyms requires that the base object exists.

31

DBMS_AUDIT_MGMT

The `DBMS_AUDIT_MGMT` package provides subprograms to manage audit trail records. These subprograms enable audit administrators to manage the audit trail. In a mixed-mode environment, these audit trails comprise the database, operating system (OS), and XML audit trails. In a unified auditing environment, this comprises the unified audit trail.

This chapter contains the following topics:

- [DBMS_AUDIT_MGMT Overview](#)
- [DBMS_AUDIT_MGMT Deprecated and Desupported Subprograms](#)
- [DBMS_AUDIT_MGMT Security Model](#)
- [DBMS_AUDIT_MGMT Constants](#)
- [DBMS_AUDIT_MGMT Views](#)
- [Subprogram Groups](#)
- [Summary of DBMS_AUDIT_MGMT Subprograms](#)

See Also:

- *Oracle Database Security Guide* regarding verifying security access with auditing
- *Oracle Database Upgrade Guide* regarding migrating to unified auditing

31.1 DBMS_AUDIT_MGMT Overview

Database auditing helps meet your database security and compliance requirements. In a mixed mode environment, audit records are written to database tables, operating system (OS) files, or XML files depending on the `AUDIT_TRAIL` initialization parameter setting. If you have upgraded to unified auditing, then the audit records are written to the unified audit trail.

Note:

Traditional auditing is desupported in Oracle Database 23ai. Oracle recommends that you use unified auditing instead. Any current traditional audit settings that you have will still be honored, but you cannot create new traditional audit settings. You can delete existing traditional audit settings. See *Oracle Database Security Guide* for more information.

In a mixed mode environment, when `AUDIT_TRAIL` is set to `DB`, database records are written to the `AUD$` table. In a unified auditing environment, audit records are written to a read-only table in the `AUDSYS` schema. The contents of this table are available from the

UNIFIED_AUDIT_TRAIL data dictionary view. When AUDIT_TRAIL is set to OS, audit records are written to operating system files. When AUDIT_TRAIL is set to XML, audit records are written to operating system files in XML format.

With Unified Auditing facility, all audit records are written to the unified audit trail in a uniform format and are made available through the UNIFIED_AUDIT_TRAIL views.

It is important to manage your audit records properly in order to ensure efficient performance and disk space management. The DBMS_AUDIT_MGMT subprograms enable you to efficiently manage your audit trail records.

If you have not yet migrated to unified auditing, the DBMS_AUDIT_MGMT package provides a subprogram that allows you to move the database audit trail tables out of the SYSTEM tablespace. This improves overall database performance by reducing the load on the SYSTEM tablespace. It also enables you to dedicate an optimized tablespace for audit records.

For a mixed mode environment, the DBMS_AUDIT_MGMT subprograms also enable you to manage your operating system and XML audit files. You can define properties like the maximum size and age of an audit file. This enables you to keep the file sizes of OS and XML audit files in check.

The DBMS_AUDIT_MGMT subprograms enable you to perform cleanup operations on all audit trail types. Audit trails can be cleaned based on the last archive timestamp value. The last archive timestamp represents the timestamp of the most recent audit record that was securely archived.

The DBMS_AUDIT_MGMT package provides a subprogram that enables audit administrators to set the last archive timestamp for archived audit records. This subprogram can also be used by external archival systems to set the last archive timestamp.

The DBMS_AUDIT_MGMT subprograms also enable you to configure jobs that periodically delete audit trail records. The frequency with which these jobs should run can be controlled by the audit administrator.



See Also:

Oracle Database Security Guide for a detailed description of unified auditing

31.2 DBMS_AUDIT_MGMT Deprecated and Desupported Subprograms

Oracle recommends that you do not use deprecated subprograms in new applications. Support for deprecated features is for backward compatibility only.

The following have been deprecated from the DBMS_AUDIT_MGMT package starting in Oracle Database 12c release 12.2:

- DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL procedure (desupported starting in Oracle Database 23.4)

- `AUDIT_TRAIL_WRITE` mode of the `AUDIT_TRAIL_PROPERTY` parameter of the `DBMS_AUDIT_MGMT.SET_AUDIT_TRAIL_PROPERTY` procedure

These are no longer necessary because audit records now bypass the common logging infrastructure queues and are directly written to a new internal relational table.

31.3 DBMS_AUDIT_MGMT Security Model

All `DBMS_AUDIT_MGMT` subprograms require the user to have `EXECUTE` privilege over the `DBMS_AUDIT_MGMT` package. The `SYSDBA` and `AUDIT_ADMIN` roles have `EXECUTE` privileges on the package by default.

Oracle strongly recommends that only audit administrators should have the `EXECUTE` privilege on the `DBMS_AUDIT_MGMT` package and be granted the `AUDIT_ADMIN` role.

Executions of the `DBMS_AUDIT_MGMT` subprograms are always audited.

31.4 DBMS_AUDIT_MGMT Constants

The `DBMS_AUDIT_MGMT` package defines several constants that can be used for specifying parameter values.

These constants shown in the following tables:

- [Table 31-1](#)
- [Table 31-2](#)
- [Table 31-3](#)

Audit trails can be classified based on whether audit records are written to database tables, operating system files, or XML files. The following table lists the audit trail type constants.

Table 31-1 DBMS_AUDIT_MGMT Constants - Audit Trail Types

Constant	Type	Description
<code>AUDIT_TRAIL_ALL</code>	<code>PLS_INTEGER</code>	All audit trail types. This includes the standard database audit trail (<code>SYS.AUD\$</code> , <code>SYS.FGA_LOG\$</code> and unified audit trail tables), operating system (OS) audit trail, and XML audit trail.
<code>AUDIT_TRAIL_AUD_STD</code>	<code>PLS_INTEGER</code>	Standard database audit records in the <code>SYS.AUD\$</code> table
<code>AUDIT_TRAIL_DB_STD</code>	<code>PLS_INTEGER</code>	Both standard audit (<code>SYS.AUD\$</code>) and FGA audit(<code>SYS.FGA_LOG\$</code>) records
<code>AUDIT_TRAIL_FGA_STD</code>	<code>PLS_INTEGER</code>	Standard database fine-grained auditing (FGA) records in the <code>SYS.FGA_LOG\$</code> table
<code>AUDIT_TRAIL_FILES</code>	<code>PLS_INTEGER</code>	Both operating system (OS) and XML audit trails
<code>AUDIT_TRAIL_OS</code>	<code>PLS_INTEGER</code>	Operating system audit trail. This refers to the audit records stored in operating system files.
<code>AUDIT_TRAIL_UNIFIED</code>	<code>PLS_INTEGER</code>	Unified audit trail. In unified auditing, all audit records are written to the unified audit trail and are made available through the unified audit trail views, such as <code>UNIFIED_AUDIT_TRAIL</code> .

Table 31-1 (Cont.) DBMS_AUDIT_MGMT Constants - Audit Trail Types

Constant	Type	Description
AUDIT_TRAIL_UNIFIED_FILES	PLS_INTEGER	Operating system spillover files in each database (primary or standby); used in archive or purge operations
AUDIT_TRAIL_UNIFIED_TABLE	PLS_INTEGER	Records from the AUDSYS.AUD\$UNIFIED table; used in archive or purge operations
AUDIT_TRAIL_XML	PLS_INTEGER	XML audit trail. This refers to the audit records stored in XML files.

Audit trail properties determine the audit configuration settings. The following table lists the constants related to audit trail properties.

Table 31-2 DBMS_AUDIT_MGMT Constants - Audit Trail Properties

Constant	Type	Description
AUDIT_TRAIL_WRITE_MODE	PLS_INTEGER	<p>Note: AUDIT_TRAIL_WRITE_MODE has been deprecated starting in Oracle Database 12c release 12.2. It is retained only for backwards compatibility, and has no effect on Oracle Database versions 12.2 and higher.</p> <p>A value of AUDIT_TRAIL_IMMEDIATE_WRITE indicates that the audit record must be immediately persisted and not to be queued. By contrast, AUDIT_TRAIL_QUEUED_WRITE indicates that the audit record can be queued and persisting can be done according to the database's flushing strategy.</p> <p>See Also <i>Oracle Database Security Guide</i></p>
CLEAN_UP_INTERVAL	PLS_INTEGER	Interval, in hours, after which the cleanup procedure is called to clear audit records in the specified audit trail
DB_DELETE_BATCH_SIZE	PLS_INTEGER	Specifies the batch size to be used for deleting audit records in database audit tables. The audit records are deleted in batches of size equal to DB_DELETE_BATCH_SIZE.
FILE_DELETE_BATCH_SIZE	PLS_INTEGER	Specifies the batch size to be used for deleting audit files in the audit directory. The audit files are deleted in batches of size equal to FILE_DELETE_BATCH_SIZE.
OS_FILE_MAX_AGE	PLS_INTEGER	Specifies the maximum number of days for which an operating system (OS) or XML audit file can be kept open before a new audit file gets created
OS_FILE_MAX_SIZE	PLS_INTEGER	Specifies the maximum size, in kilobytes (KB), to which an operating system (OS) or XML audit file can grow before a new file is opened

The audit trail purge job cleans the audit trail. The following table lists the constants related to purge job status values.

Table 31-3 DBMS_AUDIT_MGMT Constants - Purge Job Status

Constant	Type	Description
PURGE_JOB_DISABLE	PLS_INTEGER	Disables a purge job
PURGE_JOB_ENABLE	PLS_INTEGER	Enables a purge job

31.5 DBMS_AUDIT_MGMT Views

DBMS_AUDIT_MGMT views are used to display DBMS_AUDIT_MGMT configuration and cleanup events.

These views listed in the following table.

Table 31-4 Views used by DBMS_AUDIT_MGMT

View	Description
DBA_AUDIT_MGMT_CLEAN_EVENTS	Displays the cleanup event history
DBA_AUDIT_MGMT_CLEANUP_JOBS	Displays the currently configured audit trail purge jobs
DBA_AUDIT_MGMT_CONFIG_PARAMS	Displays the currently configured audit trail properties
DBA_AUDIT_MGMT_LAST_ARCH_TS	Displays the last archive timestamps set for the audit trails



See Also:

Oracle Database Reference for more information on these views

31.6 DBMS_AUDIT_MGMT Subprogram Groups

The DBMS_AUDIT_MGMT package subprograms can be grouped into two categories: Audit Trail Management Subprograms and Audit Trail Cleanup Subprograms.

- [Audit Trail Management Subprograms](#)
- [Audit Trail Cleanup Subprograms](#)

31.6.1 DBMS_AUDIT_MGMT Audit Trail Management Subprograms

Audit trail management subprograms enable you to manage audit trail properties.

Table 31-5 Audit Trail Management Subprograms

Subprogram	Description
ALTER_PARTITION_INTERVAL Procedure	Changes the unified audit internal relational table's partition interval

Table 31-5 (Cont.) Audit Trail Management Subprograms

Subprogram	Description
CLEAR_AUDIT_TRAIL_PROPERTY Procedure	Clears the value for the audit trail property that you specify
GET_AUDIT_TRAIL_PROPERTY_VALUE Function	Returns the property value set by the SET_AUDIT_TRAIL_PROPERTY Procedure
GET_LAST_ARCHIVE_TIMESTAMP Function	Returns the timestamp set by the SET_LAST_ARCHIVE_TIMESTAMP Procedure in that database instance
LOAD_UNIFIED_AUDIT_FILES Procedure	Loads the data from the spillover OS audit files in a unified audit trail into the designated unified audit trail tablespace
SET_AUDIT_TRAIL_LOCATION Procedure	Moves the audit trail tables from their current tablespace to a user-specified tablespace
SET_AUDIT_TRAIL_PROPERTY Procedure	Sets an audit trail property for the audit trail type that you specify
SET_LAST_ARCHIVE_TIMESTAMP Procedure	Sets a timestamp indicating when the audit records or files were last archived
TRANSFER_UNIFIED_AUDIT_RECORDS Procedure	Transfers audit records from the common logging infrastructure (CLI) swap table to the <code>AUDSYS.AUD\$UNIFIED</code> relational table

The [Summary of DBMS_AUDIT_MGMT Subprograms](#) contains a complete listing of all subprograms in the package.

31.6.2 DBMS_AUDIT_MGMT Audit Trail Cleanup Subprograms

Audit trail cleanup subprograms help you perform cleanup related operations on the audit trail records.

Table 31-6 Audit Trail Cleanup Subprograms

Subprogram	Description
CLEAN_AUDIT_TRAIL Procedure	Deletes audit trail records or files that have been archived
CLEAR_LAST_ARCHIVE_TIMESTAMP Procedure	Clears the timestamp set by the SET_LAST_ARCHIVE_TIMESTAMP Procedure
CREATE_PURGE_JOB Procedure	Creates a purge job for periodically deleting the audit trail records or files
DEINIT_CLEANUP Procedure	Undoes the setup and initialization performed by the INIT_CLEANUP Procedure
DROP_OLD_UNIFIED_AUDIT_TABLES Procedure	Drops old unified audit tables following the cloning of a pluggable database (PDB)
DROP_PURGE_JOB Procedure	Drops the purge job created using the CREATE_PURGE_JOB Procedure
INIT_CLEANUP Procedure	Sets up the audit management infrastructure and sets a default cleanup interval for audit trail records or files

Table 31-6 (Cont.) Audit Trail Cleanup Subprograms

Subprogram	Description
IS_CLEANUP_INITIALIZED Function	Checks to see if the INIT_CLEANUP Procedure has been run for an audit trail type
SET_PURGE_JOB_INTERVAL Procedure	Sets the interval at which the CLEAN_AUDIT_TRAIL Procedure is called for the purge job that you specify
SET_PURGE_JOB_STATUS Procedure	Enables or disables the purge job that you specify

The [Summary of DBMS_AUDIT_MGMT Subprograms](#) contains a complete listing of all subprograms in the package.

31.7 Summary of DBMS_AUDIT_MGMT Subprograms

This table lists and describes the subprograms of the `DBMS_AUDIT_MGMT` package

Table 31-7 DBMS_AUDIT_MGMT Package Subprograms

Subprogram	Description
ALTER_PARTITION_INTERVAL Procedure	Changes the unified audit internal relational table's partition interval
CLEAN_AUDIT_TRAIL Procedure	Deletes audit trail records that have been archived
CLEAR_AUDIT_TRAIL_PROPERTY Procedure	Clears the value for the audit trail property that you specify
CLEAR_LAST_ARCHIVE_TIMESTAMP Procedure	Clears the timestamp set by the SET_LAST_ARCHIVE_TIMESTAMP Procedure
CREATE_PURGE_JOB Procedure	Creates a purge job for periodically deleting the audit trail records
DEINIT_CLEANUP Procedure	Undoes the setup and initialization performed by the INIT_CLEANUP Procedure
DROP_OLD_UNIFIED_AUDIT_TABLES Procedure	Drops old unified audit tables following the cloning of a pluggable database (PDB)
DROP_PURGE_JOB Procedure	Drops the purge job created using the CREATE_PURGE_JOB Procedure
GET_AUDIT_COMMIT_DELAY Function	Returns the audit commit delay time as the number of seconds. This is the maximum time that it takes to <code>COMMIT</code> an audit record to the database audit trail.
GET_AUDIT_TRAIL_PROPERTY_VALUE Function	Returns the property value set by the SET_AUDIT_TRAIL_PROPERTY Procedure
GET_LAST_ARCHIVE_TIMESTAMP Function	Returns the timestamp set by the SET_LAST_ARCHIVE_TIMESTAMP Procedure in that database instance
INIT_CLEANUP Procedure	Sets up the audit management infrastructure and sets a default cleanup interval for audit trail records
IS_CLEANUP_INITIALIZED Function	Checks to see if the INIT_CLEANUP Procedure has been run for an audit trail type

Table 31-7 (Cont.) DBMS_AUDIT_MGMT Package Subprograms

Subprogram	Description
LOAD_UNIFIED_AUDIT_FILES Procedure	Loads the data from the spillover OS audit files in a unified audit trail into the designated unified audit trail tablespace
SET_AUDIT_TRAIL_LOCATION Procedure	Moves the audit trail tables from their current tablespace to a user-specified tablespace
SET_AUDIT_TRAIL_PROPERTY Procedure	Sets the audit trail properties for the audit trail type that you specify
SET_LAST_ARCHIVE_TIMESTAMP Procedure	Sets a timestamp indicating when the audit records were last archived
SET_PURGE_JOB_INTERVAL Procedure	Sets the interval at which the CLEAN_AUDIT_TRAIL Procedure is called for the purge job that you specify
SET_PURGE_JOB_STATUS Procedure	Enables or disables the purge job that you specify
TRANSFER_UNIFIED_AUDIT_RECORDS Procedure	Transfers audit records from the common logging infrastructure (CLI) swap table to the AUDSYS.AUD\$UNIFIED relational table

31.7.1 ALTER_PARTITION_INTERVAL Procedure

This procedure changes the unified audit internal relational table's partition interval.

Syntax

```
DBMS_AUDIT_MGMT.ALTER_PARTITION_INTERVAL(
    interval_number          IN BINARY_INTEGER,
    interval_frequency      IN VARCHAR2);
```

Parameters

Table 31-8 ALTER_PARTITION_INTERVAL Procedure Parameters

Parameter	Description
<code>interval_number</code>	Sets how often the database creates partitions for the unified audit internal relational table. For example, to specify that the partition is created every two days, you must enter 2.
<code>interval_frequency</code>	Sets the frequency for the value that was set in the <code>interval_number</code> setting. For example, for a partition to be created every two days, with <code>interval_number</code> set to 2, you must set <code>interval_frequency</code> to <code>DAY</code> . Supported values are <code>YEAR</code> , <code>MONTH</code> , and <code>DAY</code> . The default is <code>DAY</code> .

Usage Notes

- The interval frequency that you choose depends on the rate of audit records that are generated in your database. The default setting is for one month. If you have a high audit record rate and are using the default, then too many audit records may be generated in the same partition. In this case, you should change the interval frequency to a more frequent interval, such as one month or one day. If the audit

record rate generation is not so high, then you may want to keep it at the default of one month.

Example

The following example sets the partition interval to occur every two months.

```
BEGIN
  DBMS_AUDIT_MGMT.ALTER_PARTITION_INTERVAL(
    interval_number      => 2,
    interval_frequency   => 'MONTH');
END;
```

31.7.2 CLEAN_AUDIT_TRAIL Procedure

This procedure deletes audit trail records.

The `CLEAN_AUDIT_TRAIL` procedure is usually called after the [SET_LAST_ARCHIVE_TIMESTAMP Procedure](#) has been used to set the last archived timestamp for the audit records.

Syntax

```
DBMS_AUDIT_MGMT.CLEAN_AUDIT_TRAIL(
  audit_trail_type      IN PLS_INTEGER,
  use_last_arch_timestamp IN BOOLEAN DEFAULT TRUE,
  container             IN PLS_INTEGER DEFAULT CONTAINER_CURRENT,
  database_id          IN NUMBER DEFAULT NULL,
  container_guid       IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 31-9 CLEAN_AUDIT_TRAIL Procedure Parameters

Parameter	Description
<code>audit_trail_type</code>	The audit trail type for which the cleanup operation needs to be performed. Audit trail types are listed in Table 31-1 .
<code>use_last_arch_timestamp</code>	Specifies whether the last archived timestamp should be used for deciding on the records that should be deleted. A value of <code>TRUE</code> indicates that only audit records created before the last archive timestamp should be deleted. A value of <code>FALSE</code> indicates that all audit records should be deleted. The default value is <code>TRUE</code> . Oracle recommends using this value, as this helps guard against inadvertent deletion of records.
<code>container</code>	Values: <code>CONTAINER_CURRENT</code> for the connected pluggable database (PDB) or <code>CONTAINER_ALL</code> for all pluggable databases (PDBs). When <code>CONTAINER</code> is set to <code>CONTAINER_ALL</code> , this purges the audit trail in all the PDBs, otherwise it only purges from the connected PDB.
<code>database_id</code>	Database ID (DBID) of the audit records to cleanup
<code>container_guid</code>	Container GUID of the audit records to cleanup Note: This parameter has been deprecated but is currently retained for backward compatibility.

Usage Notes

The following usage notes apply:

- When cleaning up operating system (OS) or XML audit files, only files in the current audit directory, specified by the `AUDIT_FILE_DEST` parameter, are cleaned up.
- For Windows platforms, no cleanup is performed when the `audit_trail_type` parameter is set to `DBMS_AUDIT_MGMT.AUDIT_TRAIL_OS`. This is because operating system (OS) audit records on Windows are written to the Windows Event Viewer.
- For Unix platforms, no cleanup is performed for cases where the operating system (OS) audit records are written to the syslog. When the `audit_trail_type` parameter is set to `DBMS_AUDIT_MGMT.AUDIT_TRAIL_OS`, it removes only the `*.aud` files under the directory specified by the `AUDIT_FILE_DEST` initialization parameter.

See Also:

"AUDIT_SYSLOG_LEVEL" in the *Oracle Database Reference*

- When the `audit_trail_type` parameter is set to `DBMS_AUDIT_MGMT.AUDIT_TRAIL_XML`, this procedure only removes XML audit files (`*.xml`) from the current audit directory.

Oracle database maintains a book-keeping file (`adx_${ORACLE_SID}.txt`) for the XML audit files. This file is not removed by the cleanup procedure.

- If the cleanup of the unified audit trail is performed when the `use_last_arch_timestamp` parameter is set to `TRUE`:
 - If you set the `database_id` value for the cleanup operation, then this value is used with the last archive timestamp while `CLEAN_AUDIT_TRAIL` runs. While cleaning up the unified audit records that are present in the database tables, if the `HIGH_VALUE` of an audit table partition is less than last archive timestamp, then those partitions will be dropped directly and for remaining audit table partitions, records will be deleted based on the `database_id` value along with last archive timestamp. However, for the unified audit records that are present during the cleanup of spillover operating system audit files, the `database_id` value is ignored. Cleanup for operating system audit files is based on the last archive timestamp only. If you want to have the `database_id` value used for the cleanup operation of unified audit trail records that are present in the spillover operating system audit files, then load the contents of these files into database tables by using the `DBMS_AUDIT_MGMT.LOAD_UNIFIED_AUDIT_FILES` procedure before you run `DBMS_AUDIT_MGMT.CLEAN_AUDIT_TRAIL`.
 - If you do not set the `database_id` value when you invoke the `CLEAN_AUDIT_TRAIL` procedure, then Oracle Database purges unified audit records based on the last archive timestamp value irrespective of `database_id` values and irrespective of the location (that is, database tables or spillover operating system audit files) where the unified audit records reside. During cleanup, last archive timestamp value of current database ID of the container will be used.

- If the cleanup of the unified audit trail is performed when the `use_last_arch_timestamp` parameter is set to `FALSE`:
 - If you set the `database_id` value for the cleanup operation, then this value is used while `CLEAN_AUDIT_TRAIL` cleans up the unified audit trail records that are present in database tables. However, the `database_id` value is not used for the cleanup of unified audit trail records that are present in spillover operating system files. If want the `database_id` value to be used in the `CLEAN_AUDIT_TRAIL` operation of unified audit records that are present in spillover operating system audit files, then load the contents of these files to the database tables by using the `DBMS_AUDIT_MGMT.LOAD_UNIFIED_AUDIT_FILES` procedure before you run `DBMS_AUDIT_MGMT.CLEAN_AUDIT_TRAIL`.
 - If you do not set the `database_id` value when you invoke the `CLEAN_AUDIT_TRAIL` procedure, then Oracle Database purges all unified audit records irrespective of `database_id` values and irrespective of the location (that is, database tables or spillover operating system audit files) where the unified audit records reside.
- `CLEAN_AUDIT_TRAIL` procedure expects that the last archive timestamp set via `SET_LAST_ARCHIVE_TIMESTAMP` has been set using `SYS_EXTRACT_UTC` if it want to refer to `SYSTIMESTAMP`. Reference to data in Unified Audit trail is done in UTC timeformat.
- If the PDB database is read only then clean up of that database audit record does not take place and returns without performing a clean up job on `AUDSYS.AUD$UNIFIED` table.
- If timestamp of database is ahead of current system timestamp then it will return an error.
- In a multitenant setup, if one of the PDB has timestamp ahead of the current system timestamp (in UTC format) then records for that PDB are not cleaned where as the other database do clean up their audit trail records leaving the last activity of "clean up" in the audit trail.
- The `SET_LAST_ARCHIVE_TIMESTAMP` procedure and `CLEAN_AUDIT_TRAIL` procedure should be not be executed in the same transaction block. Otherwise, the results are usually unpredictable.
- Make sure that the transaction for `SET_LAST_ARCHIVE_TIMESTAMP` is completed before you call the `CLEAN_AUDIT_TRAIL` procedure. To have predictable results in terms of cleaning records until the time provided in `SET_LAST_ARCHIVE_TIMESTAMP(UTC format)`, make sure that `SET_LAST_ARCHIVE_TIMESTAMP` and `CLEAN_AUDIT_TRAIL` procedures are not called in the same transaction. It is recommended to `commit` before you call the `CLEAN_AUDIT_TRAIL` procedure.
- Run the `CLEAN_AUDIT_TRAIL` procedure when `USE_LAST_ARCH_TIMESTAMP = TRUE` uses the last archived timestamp that was set for the current `DB_UNIQUE_NAME` column value.

Examples

The following example calls the `CLEAN_AUDIT_TRAIL` procedure to clean up the operating system (OS) audit trail records that were updated before the last archive timestamp.

```
BEGIN
DBMS_AUDIT_MGMT.CLEAN_AUDIT_TRAIL(
  audit_trail_type => DBMS_AUDIT_MGMT.AUDIT_TRAIL_OS,
  use_last_arch_timestamp => TRUE);
END;
```

31.7.3 CLEAR_AUDIT_TRAIL_PROPERTY Procedure

This procedure clears the value for the specified audit trail property.

Audit trail properties are set using the [SET_AUDIT_TRAIL_PROPERTY Procedure](#).

The `CLEAR_AUDIT_TRAIL_PROPERTY` procedure can optionally reset the property value to its default value through the `use_default_values` parameter.

Syntax

```
DBMS_AUDIT_MGMT.CLEAR_AUDIT_TRAIL_PROPERTY(
  audit_trail_type      IN PLS_INTEGER,
  audit_trail_property  IN PLS_INTEGER,
  use_default_values    IN BOOLEAN DEFAULT FALSE) ;
```

Parameters

Table 31-10 CLEAR_AUDIT_TRAIL_PROPERTY Procedure Parameters

Parameter	Description
<code>audit_trail_type</code>	The audit trail type for which the property needs to be cleared. Audit trail types are listed in Table 31-1
<code>audit_trail_property</code>	The audit trail property whose value needs to be cleared. You cannot clear the value for the <code>CLEANUP_INTERVAL</code> property. Audit trail properties are listed in Table 31-2
<code>use_default_values</code>	Specifies whether the default value of the <code>audit_trail_property</code> should be used in place of the cleared value. A value of <code>TRUE</code> causes the default value of the parameter to be used. A value of <code>FALSE</code> causes the <code>audit_trail_property</code> to have no value. The default value for this parameter is <code>FALSE</code> .

Usage Notes

The following usage notes apply:

- You can use this procedure to clear the value for an audit trail property that you do not wish to use. For example, if you do not want a restriction on the operating system audit file size, then you can use this procedure to reset the `OS_FILE_MAX_SIZE` property.
You can also use this procedure to reset an audit trail property to its default value. You need to set `use_default_values` to `TRUE` when invoking the procedure.
- The `DB_DELETE_BATCH_SIZE` property needs to be individually cleared for the `AUDIT_TRAIL_AUD_STD` and `AUDIT_TRAIL_FGA_STD` audit trail types. You cannot clear this property collectively using the `AUDIT_TRAIL_DB_STD` and `AUDIT_TRAIL_ALL` audit trail types.
- If you clear the value of the `DB_DELETE_BATCH_SIZE` property with `use_default_value` set to `FALSE`, the default value of `DB_DELETE_BATCH_SIZE` is still assumed. This is because audit records are always deleted in batches.

- The `FILE_DELETE_BATCH_SIZE` property needs to be individually cleared for the `AUDIT_TRAIL_OS` and `AUDIT_TRAIL_XML` audit trail types. You cannot clear this property collectively using the `AUDIT_TRAIL_FILES` and `AUDIT_TRAIL_ALL` audit trail types.
- If you clear the value of the `FILE_DELETE_BATCH_SIZE` property with `use_default_value` set to `FALSE`, the default value of `FILE_DELETE_BATCH_SIZE` is still assumed. This is because audit files are always deleted in batches.
- You cannot clear the value for the `CLEANUP_INTERVAL` property.
- You cannot clear the value for the `AUDIT_TRAIL_WRITE_MODE` property.

Examples

The following example calls the `CLEAR_AUDIT_TRAIL_PROPERTY` procedure to clear the value for the audit trail property, `OS_FILE_MAX_SIZE`. The procedure uses a value of `FALSE` for the `USE_DEFAULT_VALUES` parameter. This means that there will be no maximum size threshold for operating system (OS) audit files.

```
BEGIN
DBMS_AUDIT_MGMT.CLEAR_AUDIT_TRAIL_PROPERTY (
  AUDIT_TRAIL_TYPE      => DBMS_AUDIT_MGMT.AUDIT_TRAIL_OS,
  AUDIT_TRAIL_PROPERTY  => DBMS_AUDIT_MGMT.OS_FILE_MAX_SIZE,
  USE_DEFAULT_VALUES    => FALSE );
END;
```

31.7.4 CLEAR_LAST_ARCHIVE_TIMESTAMP Procedure

This procedure clears the timestamp set by the `SET_LAST_ARCHIVE_TIMESTAMP` Procedure.

Syntax

```
DBMS_AUDIT_MGMT.CLEAR_LAST_ARCHIVE_TIMESTAMP (
  audit_trail_type      IN PLS_INTEGER,
  rac_instance_number  IN PLS_INTEGER DEFAULT NULL,
  container             IN PLS_INTEGER DEFAULT CONTAINER_CURRENT,
  database_id          IN NUMBER DEFAULT NULL,
  container_guid       IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 31-11 CLEAR_LAST_ARCHIVE_TIMESTAMP Procedure Parameters

Parameter	Description
<code>audit_trail_type</code>	The audit trail type for which the timestamp needs to be cleared. Audit trail types are listed in Table 31-1 .
<code>rac_instance_number</code>	The instance number for the Oracle Real Application Clusters (Oracle RAC) instance. The default value is <code>NULL</code> . The <code>rac_instance_number</code> is not relevant for single instance databases. You can find the instance number by issuing the <code>SHOW PARAMETER INSTANCE_NUMBER</code> command in SQL*Plus.

Table 31-11 (Cont.) CLEAR_LAST_ARCHIVE_TIMESTAMP Procedure Parameters

Parameter	Description
container	Values: CONTAINER_CURRENT for the connected pluggable database (PDB) or CONTAINER_ALL for all pluggable databases (PDBs). When CONTAINER is set to CONTAINER_ALL, this clears the last archive timestamp from all the PDBs, otherwise it clears from only the connected PDB.
database_id	Database ID (DBID) of the audit records to cleanup
container_guid	Container GUID of the audit records to cleanup Note: This parameter has been deprecated but is currently retained for backward compatibility.

Usage Notes

The following usage notes apply:

- The timestamp for only one audit_trail_type can be cleared at a time.
- The following are invalid audit_trail_type values for this procedure and cannot be used:
 - AUDIT_TRAIL_ALL
 - AUDIT_TRAIL_DB_STD
 - AUDIT_TRAIL_FILES

Examples

The following example calls the CLEAR_LAST_ARCHIVE_TIMESTAMP procedure to clear the timestamp value for the operating system (OS) audit trail type.

```
BEGIN
DBMS_AUDIT_MGMT.CLEAR_LAST_ARCHIVE_TIMESTAMP (
  audit_trail_type => DBMS_AUDIT_MGMT.AUDIT_TRAIL_OS,
  rac_instance_number => 1);
END;
```

Related Topics

- [SET_LAST_ARCHIVE_TIMESTAMP Procedure](#)
This procedure sets a timestamp indicating when the audit records were last archived. The audit administrator provides the timestamp to be attached to the audit records.

31.7.5 CREATE_PURGE_JOB Procedure

This procedure creates a purge job for periodically deleting the audit trail records.

This procedure carries out the cleanup operation at intervals specified by the user. It calls the [CLEAN_AUDIT_TRAIL Procedure](#) to perform the cleanup operation.

The [SET_PURGE_JOB_INTERVAL Procedure](#) is used to modify the frequency of the purge job.

The [SET_PURGE_JOB_STATUS Procedure](#) is used to enable or disable the purge job.

The [DROP_PURGE_JOB Procedure](#) is used to drop a purge job created with the `CREATE_PURGE_JOB` procedure.

Syntax

```
DBMS_AUDIT_MGMT.CREATE_PURGE_JOB (
    audit_trail_type           IN PLS_INTEGER,
    audit_trail_purge_interval IN PLS_INTEGER,
    audit_trail_purge_name    IN VARCHAR2,
    use_last_arch_timestamp   IN BOOLEAN DEFAULT TRUE,
    container                  IN PLS_INTEGER DEFAULT CONTAINER_CURRENT) ;
```

Parameters

Table 31-12 CREATE_PURGE_JOB Procedure Parameters

Parameter	Description
<code>audit_trail_type</code>	The audit trail type for which the purge job needs to be created. Audit trail types are listed in Table 31-1 .
<code>audit_trail_purge_interval</code>	The interval, in hours, at which the clean up procedure is called. A lower value means that the cleanup is performed more often.
<code>audit_trail_purge_name</code>	A name to identify the purge job.
<code>use_last_arch_timestamp</code>	Specifies whether the last archived timestamp should be used for deciding on the records that should be deleted. A value of <code>TRUE</code> indicates that only audit records created before the last archive timestamp should be deleted. A value of <code>FALSE</code> indicates that all audit records should be deleted. The default value is <code>TRUE</code> .
<code>container</code>	Values: <code>CONTAINER_CURRENT</code> for the connected pluggable database (PDB) or <code>CONTAINER_ALL</code> for all pluggable databases (PDBs). When <code>CONTAINER</code> is set to <code>CONTAINER_ALL</code> , it creates one job in the Root PDB and the invocation of this job will invoke cleanup in all the PDBs.

Usage Notes

Use this procedure to schedule the [CLEAN_AUDIT_TRAIL Procedure](#) for your audit trail records.

Examples

The following example calls the `CREATE_PURGE_JOB` procedure to create a cleanup job called `CLEANUP`, for all audit trail types. It sets the `audit_trail_purge_interval` parameter to 100. This means that the cleanup job is invoked every 100 hours. It also sets the `use_last_arch_timestamp` parameter value to `TRUE`. This means that all audit records older than the last archive timestamp are deleted.

```
BEGIN
DBMS_AUDIT_MGMT.CREATE_PURGE_JOB (
    audit_trail_type           => DBMS_AUDIT_MGMT.AUDIT_TRAIL_ALL,
    audit_trail_purge_interval => 100 /* hours */,
```

```

audit_trail_purge_name    => 'CLEANUP',
use_last_arch_timestamp   => TRUE);
END;
```

31.7.6 DEINIT_CLEANUP Procedure

This procedure undoes the setup and initialization performed by the `INIT_CLEANUP` procedure. This procedure is deprecated starting in Oracle Database 23ai. Traditional auditing packages and functions are deprecated in Oracle Database 23ai. The `DEINIT_CLEANUP` procedure clears the value of the `default_cleanup_interval` parameter. However, when used for audit tables, it does not move the audit trail tables back to their original tablespace.

Syntax

```

DBMS_AUDIT_MGMT.DEINIT_CLEANUP (
  audit_trail_type  IN PLS_INTEGER,
  container         IN PLS_INTEGER DEFAULT CONTAINER_CURRENT);
```

Parameters

Table 31-13 DEINIT_CLEANUP Procedure Parameters

Parameter	Description
<code>audit_trail_type</code>	The audit trail type for which the procedure needs to be called. Audit trail types are listed in Table 31-1
<code>container</code>	Values: <code>CONTAINER_CURRENT</code> for the connected pluggable database (PDB) or <code>CONTAINER_ALL</code> for all pluggable databases (PDBs). When <code>CONTAINER</code> is set to <code>CONTAINER_ALL</code> , this de-initializes the audit trail from cleanup in all the pluggable databases, otherwise it de-initializes the audit trail from cleanup in the connected PDB only.

Usage Notes

With the desupport of traditional auditing, the PL/SQL packages and functions associated with traditional auditing are deprecated, This deprecation includes the packages and functions `INIT_CLEANUP`, `DEINIT_CLEANUP`, and `IS_CLEANUP_INITIALIZED`. While these packages or functions continue to operate in Oracle Database 23ai, you can neither add to or modify traditional auditing configurations.

You cannot run this procedure for `AUDIT_TRAIL_UNIFIED`. Doing so it will raise `ORA-46250: Invalid value for argument 'AUDIT_TRAIL_TYPE'`

Examples

The following example clears the `default_cleanup_interval` parameter setting for the standard database audit trail:

```

BEGIN
DBMS_AUDIT_MGMT.DEINIT_CLEANUP (
  AUDIT_TRAIL_TYPE => DBMS_AUDIT_MGMT.AUDIT_TRAIL_AUD_STD);
END;
```

Related Topics

- [INIT_CLEANUP Procedure](#)

31.7.7 DROP_OLD_UNIFIED_AUDIT_TABLES Procedure

This procedure drops old unified audit tables following the cloning of a pluggable database (PDB).

Syntax

```
DBMS_AUDIT_MGMT.DROP_OLD_UNIFIED_AUDIT_TABLES(
    container_guid    IN VARCHAR2) ;
```

Parameters**Table 31-14 DROP_OLD_UNIFIED_AUDIT_TABLES Procedure Parameters**

Parameter	Description
container_guid	Container GUID of the old unified audit tables

Usage Notes

When a pluggable database gets cloned, the unified audit tables get newly created in the new pluggable database. To drop the old unified audit tables, use the `DROP_OLD_UNIFIED_AUDIT_TABLES` by specifying the old GUID of the PDB from which the clone was created. You can query the historical GUIDs from the `DBA_PDB_HISTORY` view for the given PDB.

Only use the `DBMS_AUDIT_MGMT.DROP_OLD_UNIFIED_AUDIT_TABLES` procedure if the database was upgraded from Oracle Database release 12.1 or earlier. If the database was upgraded from a later release (including release 12.2), then an `ORA-55906: Secure file log [id: 0 name: ORA$AUDIT_NEXTGEN_LOG] does not exist error will appear`. This is because starting with release 12.2, the common logging infrastructure tables that this procedure searches are no longer being created. Instead, the `AUD$UNIFIED` relational table stores the unified audit records.

Examples

```
BEGIN
    DBMS_AUDIT_MGMT.DROP_OLD_UNIFIED_AUDIT_TABLES (
        container_guid => 'E4721865A9321CB5E043EFA9E80A2D77');
END;
```

31.7.8 DROP_PURGE_JOB Procedure

This procedure drops the purge job created using the `CREATE_PURGE_JOB` Procedure. The name of the purge job is passed as an argument.

Syntax

```
DBMS_AUDIT_MGMT.DROP_PURGE_JOB(
    audit_trail_purge_name    IN VARCHAR2) ;
```


Parameters

Table 31-15 DROP_PURGE_JOB Procedure Parameters

Parameter	Description
audit_trail_purge_name	The name of the purge job which is being deleted. This is the purge job name that you specified with the CREATE_PURGE_JOB Procedure .

Examples

The following example calls the `DROP_PURGE_JOB` procedure to drop the purge job called `CLEANUP`.

```
BEGIN
DBMS_AUDIT_MGMT.DROP_PURGE_JOB (
  AUDIT_TRAIL_PURGE_NAME => 'CLEANUP');
END;
```

Related Topics

- [CREATE_PURGE_JOB Procedure](#)
This procedure creates a purge job for periodically deleting the audit trail records.

31.7.9 GET_AUDIT_COMMIT_DELAY Function

This function returns the audit commit delay time as the number of seconds. audit commit delay time is the maximum time that it takes to `COMMIT` an audit record to the database audit trail. If it takes more time to `COMMIT` an audit record than defined by the audit commit delay time, then a copy of the audit record is written to the operating system (OS) audit trail.

The audit commit delay time value is useful when determining the last archive timestamp for database audit records.

Syntax

```
DBMS_AUDIT_MGMT.GET_AUDIT_COMMIT_DELAY
  RETURN NUMBER;
```

31.7.10 GET_AUDIT_TRAIL_PROPERTY_VALUE Function

This procedure returns the property value set by the `SET_AUDIT_TRAIL_PROPERTY` Procedure.

Syntax

```
DBMS_AUDIT_MGMT.GET_AUDIT_TRAIL_PROPERTY_VALUE (
  audit_trail_type      IN PLS_INTEGER,
  audit_trail_property  IN PLS_INTEGER)
  RETURN NUMBER;
```

Parameters

Table 31-16 GET_AUDIT_TRAIL_PROPERTY_VALUE Function Parameters

Parameter	Description
audit_trail_type	The audit trail type for the timestamp to be retrieved. Audit trail types are listed in Table 31-1 .
audit_trail_property	The audit trail property that is being queried. Audit trail properties are listed in Table 31-2 .

Return Values

If the property value is cached in SGA memory, this function will return the value set by the [SET_AUDIT_TRAIL_PROPERTY Procedure](#). Else it will return NULL.

The GET_AUDIT_TRAIL_PROPERTY_VALUE function may return an ORA-46250 error if the audit trail property value has been set to DBMS_AUDIT_MGMT.CLEAN_UP_INTERVAL. To find the cleanup interval of the purge job, query SYS.DAM_CLEANUP_JOBS\$.

Examples

The following example prints the property value of OS_FILE_MAX_AGE set by the [SET_AUDIT_TRAIL_PROPERTY Procedure](#).

```
SET_AUDIT_TRAIL_PROPERTY.
SET SERVEROUTPUT ON
DECLARE
  OS_MAX_AGE_VAL NUMBER;
BEGIN
  OS_MAX_AGE_VAL := DBMS_AUDIT_MGMT.GET_AUDIT_TRAIL_PROPERTY_VALUE(
    audit_trail_type      => DBMS_AUDIT_MGMT.AUDIT_TRAIL_OS,
    audit_trail_property  => DBMS_AUDIT_MGMT.OS_FILE_MAX_AGE);
  IF OS_MAX_AGE_VAL is not NULL THEN
    DBMS_OUTPUT.PUT_LINE('The Maximum Age configured for OS Audit files is: ' ||
      OS_MAX_AGE_VAL);
  END IF;
END;
```

Related Topics

- [SET_AUDIT_TRAIL_PROPERTY Procedure](#)
This procedure sets an audit trail property for the audit trail type that is specified.

31.7.11 GET_LAST_ARCHIVE_TIMESTAMP Function

This procedure returns the timestamp set by the SET_LAST_ARCHIVE_TIMESTAMP procedure in that database instance.

Syntax

```
DBMS_AUDIT_MGMT.GET_LAST_ARCHIVE_TIMESTAMP(
  audit_trail_type IN PLS_INTEGER)
RETURN TIMESTAMP;
```

Parameters

Table 31-17 GET_LAST_ARCHIVE_TIMESTAMP Function Parameters

Parameter	Description
<code>audit_trail_type</code>	The audit trail type for the timestamp to be retrieved. Supported Audit trail types for this procedure are <code>AUDIT_TRAIL_OS</code> , <code>AUDIT_TRAIL_XML</code> and <code>AUDIT_TRAIL_UNIFIED</code> . All Audit trail types are listed in Table 31-1 .

Return Values

The `GET_LAST_ARCHIVE_TIMESTAMP` function returns last archive timestamp.

Usage Notes

- Alternatively, you can query the `DBA_AUDIT_MGMT_LAST_ARCH_TS` data dictionary view to check the last archived timestamp for a database that is in read-write mode.
- The `DBA_AUDIT_MGMT_LAST_ARCH_TS` data dictionary view can contain multiple last archive timestamps with different `DB_UNIQUE_NAME` column values. `GET_LAST_ARCHIVE_TIMESTAMP` will return the last archive timestamp where the `DB_UNIQUE_NAME` column value is equal to the current `DB_UNIQUE_NAME` value.

Examples

The following example prints the timestamp set by the `SET_LAST_ARCHIVE_TIMESTAMP` procedure on a `READ ONLY` database.

```
SET SERVEROUTPUT ON
DECLARE
  LAT_TS TIMESTAMP;
BEGIN
  LAT_TS := DBMS_AUDIT_MGMT.GET_LAST_ARCHIVE_TIMESTAMP(
    audit_trail_type => DBMS_AUDIT_MGMT.AUDIT_TRAIL_OS);
  IF LAT_TS is not NULL THEN
    DBMS_OUTPUT.PUT_LINE('The Last Archive Timestamp is: ' || to_char(LAT_TS));
  END IF;
END;
```

Related Topics

- [SET_LAST_ARCHIVE_TIMESTAMP Procedure](#)
This procedure sets a timestamp indicating when the audit records were last archived. The audit administrator provides the timestamp to be attached to the audit records.

31.7.12 INIT_CLEANUP Procedure

This procedure sets up the audit management infrastructure and a default cleanup interval for the audit trail records. This procedure is deprecated starting in Oracle

Database 23ai. Traditional auditing packages and functions are deprecated in Oracle Database 23ai.

If the audit trail tables are in the `SYSTEM` tablespace, then the procedure moves them to the `SYSAUX` tablespace. If you are using unified auditing, you do not need to run this procedure because the unified audit trail tables are in the `SYSAUX` tablespace by default. If you are not using unified auditing, refer to *Oracle Database Upgrade Guide* for documentation which references an environment without unified auditing.

Moving the audit trail tables out of the `SYSTEM` tablespace enhances overall database performance. The `INIT_CLEANUP` procedure moves the audit trail tables to the `SYSAUX` tablespace. If the [SET_AUDIT_TRAIL_LOCATION Procedure](#) has already moved the audit tables elsewhere, then no tables are moved.

The [SET_AUDIT_TRAIL_LOCATION Procedure](#) enables you to specify an alternate target tablespace for the database audit tables.

The `INIT_CLEANUP` procedure is currently not relevant for the `AUDIT_TRAIL_OS`, `AUDIT_TRAIL_XML`, and `AUDIT_TRAIL_FILES` audit trail types. No preliminary set up is required for these audit trail types.



See Also:

[Table 31-1](#) for a list of all audit trail types

This procedure also sets a default cleanup interval for the audit trail records.

Syntax

```
DBMS_AUDIT_MGMT.INIT_CLEANUP(
    audit_trail_type      IN PLS_INTEGER,
    default_cleanup_interval IN PLS_INTEGER
    container            IN PLS_INTEGER DEFAULT CONTAINER_CURRENT);
```

Parameters

Table 31-18 INIT_CLEANUP Procedure Parameters

Parameter	Description
<code>audit_trail_type</code>	The audit trail type for which the clean up operation needs to be initialized. Audit trail types are listed in Table 31-1 except <code>AUDIT_TRAIL_UNIFIED</code>
<code>default_cleanup_interval</code>	The default time interval, in hours, after which the cleanup procedure should be called. The minimum value is 1 and the maximum is 999.

Table 31-18 (Cont.) INIT_CLEANUP Procedure Parameters

Parameter	Description
container	Values: CONTAINER_CURRENT for the connected pluggable database (PDB) or CONTAINER_ALL for all Open and Available pluggable databases (PDBs). When CONTAINER is set to CONTAINER_ALL, this initializes the audit trails for clean up in all the Open and Available pluggable databases, otherwise this initializes the audit trail in the connected PDB only. When you add a new PDB you need to initialize the audit trails for clean up in the new PDB using the CONTAINER_CURRENT option.

Usage Notes

With the desupport of traditional auditing, the PL/SQL packages and functions associated with traditional auditing are deprecated. This deprecation includes the packages and functions `INIT_CLEANUP`, `DEINIT_CLEANUP`, and `IS_CLEANUP_INITIALIZED`. While these packages or functions continue to operate in Oracle Database 23ai, you can neither add to or modify traditional auditing configurations.

The following usage notes apply:

- This procedure may involve data movement across tablespaces. This can be a resource intensive operation especially if your database audit trail tables are already populated. Oracle recommends that you invoke the procedure during non-peak hours.
- You should ensure that the `SYSAUX` tablespace, into which the audit trail tables are being moved, has sufficient space to accommodate the audit trail tables. You should also optimize the `SYSAUX` tablespace for frequent write operations.
- You can change the `default_cleanup_interval` later using the [SET_AUDIT_TRAIL_PROPERTY Procedure](#).
- If you do not wish to move the audit trail tables to the `SYSAUX` tablespace, then you should use the `DBMS_AUDIT_MGMT.SET_AUDIT_TRAIL_LOCATION` procedure to move the audit trail tables to another tablespace before calling the `INIT_CLEANUP` procedure.
- Invoking this procedure with `AUDIT_TRAIL_UNIFIED` results in `ORA-46250`. It requires no initializations for cleanup since it is cleanup-ready by default.



See Also:

["SET_AUDIT_TRAIL_LOCATION Procedure"](#)

Examples

The following example calls the `INIT_CLEANUP` procedure to set a `default_cleanup_interval` of 12 hours for all audit trail types:

```
BEGIN
DBMS_AUDIT_MGMT.INIT_CLEANUP (
```

```

        audit_trail_type    => DBMS_AUDIT_MGMT.AUDIT_TRAIL_ALL,
    default_cleanup_interval => 12 /* hours */);
END;
```



See Also:

[Table 31-1](#) for a list of all audit trail types

31.7.13 IS_CLEANUP_INITIALIZED Function

This function checks to see if the `INIT_CLEANUP` procedure has been run for an audit trail type. This procedure is deprecated starting in Oracle Database 23ai. Traditional auditing packages and functions are deprecated in Oracle Database 23ai.

With the desupport of traditional auditing, the PL/SQL packages and functions associated with traditional auditing are deprecated. This deprecation includes the packages and functions `INIT_CLEANUP`, `DEINIT_CLEANUP`, and `IS_CLEANUP_INITIALIZED`. While these packages or functions continue to operate in Oracle Database 23ai, you can neither add to or modify traditional auditing configurations.

The `IS_CLEANUP_INITIALIZED` function returns `TRUE` if the procedure has already been run for the audit trail type. It returns `FALSE` if the procedure has not been run for the audit trail type.

This function is currently not relevant for the `AUDIT_TRAIL_OS`, `AUDIT_TRAIL_XML`, and `AUDIT_TRAIL_FILES` audit trail types. The function always returns `TRUE` for these audit trail types. No preliminary set up is required for these audit trail types.



See Also:

[Table 31-1](#) for a list of all audit trail types

Syntax

```

DBMS_AUDIT_MGMT.IS_CLEANUP_INITIALIZED(
    audit_trail_type IN PLS_INTEGER
    container        IN PLS_INTEGER DEFAULT CONTAINER_CURRENT)
RETURN BOOLEAN;
```

Parameters

Table 31-19 IS_CLEANUP_INITIALIZED Function Parameters

Parameter	Description
<code>audit_trail_type</code>	The audit trail type for which the function needs to be called. Note that this does not apply to <code>AUDIT_TRAIL_UNIFIED</code> . Audit trail types are listed in Table 31-1

Table 31-19 (Cont.) IS_CLEANUP_INITIALIZED Function Parameters

Parameter	Description
container	<p>Values: CONTAINER_CURRENT for the connected pluggable database (PDB) or CONTAINER_ALL for all pluggable databases (PDBs).</p> <ul style="list-style-type: none"> When CONTAINER is set to CONTAINER_ALL, this function returns the initialization status of all the pluggable databases. The function returns FALSE even if one of the PDBs is not initialized. When CONTAINER is set to CONTAINER_CURRENT, this returns the initialization status of the connected PDB.

Examples

The following example checks to see if the standard database audit trail type has been initialized for cleanup operation. If the audit trail type has not been initialized, then it calls the [INIT_CLEANUP Procedure](#) to initialize the audit trail type.

```
BEGIN
  IF
    NOT
    DBMS_AUDIT_MGMT.IS_CLEANUP_INITIALIZED(DBMS_AUDIT_MGMT.AUDIT_TRAIL_AUD_STD)
  THEN
    DBMS_AUDIT_MGMT.INIT_CLEANUP(
      audit_trail_type      => DBMS_AUDIT_MGMT.AUDIT_TRAIL_AUD_STD,
      default_cleanup_interval => 12 /* hours */);
  END IF;
END;
```

Related Topics

- [INIT_CLEANUP Procedure](#)

31.7.14 LOAD_UNIFIED_AUDIT_FILES Procedure

This procedure loads the data from the spillover OS audit files in a unified audit trail into the designated unified audit trail tablespace.



See Also:

Oracle Database Security Guide for information about moving the OS audit trail records into the unified audit trail

Syntax

```
DBMS_AUDIT_MGMT.LOAD_UNIFIED_AUDIT_FILES (
  container      IN BINARY_INTEGER,
  load_batch_size IN PLS_INTEGER);
```

Parameters

Table 31-20 LOAD_UNIFIED_AUDIT_FILES Procedure Parameters

Parameter	Description
container	<p>Values: CONTAINER_CURRENT for the connected pluggable database (PDB) or CONTAINER_ALL for all pluggable databases (PDBs).</p> <ul style="list-style-type: none"> CONTAINER_CURRENT - loads the unified audit files from \$ORACLE_BASE/audit/\$ORACLE_SID OS directory to the tables in only current PDB CONTAINER_ALL - loads the unified audit files from \$ORACLE_BASE/audit/\$ORACLE_SID OS directory to the tables in the respective PDBs, but for all the active PDBs
load_batch_size	<p>Specifies the number of spillover OS audit files to be loaded into the designated unified audit trail tablespace. The load_batch_size parameter can have a minimum value of 1 and maximum value of 32767. The default value is equivalent to DEFAULT_FILE_LOAD_BATCH_SIZE.</p>

Usage Notes

- Ensure that you set the audit data designated tablespace to be online before you run the LOAD_UNIFIED_AUDIT_FILES procedure.

31.7.15 SET_AUDIT_TRAIL_LOCATION Procedure

This procedure moves the audit trail tables from their current tablespace to a user-specified tablespace.

The SET_AUDIT_TRAIL_LOCATION procedure is not relevant for the AUDIT_TRAIL_OS, AUDIT_TRAIL_XML, and AUDIT_TRAIL_FILES audit trail types. The AUDIT_FILE_DEST initialization parameter is the only way you can specify the destination directory for these audit trail types.



See Also:

- [Table 31-1](#) for a list of all audit trail types
- AUDIT_FILE_DEST in the *Oracle Database Reference*

Syntax

```
DBMS_AUDIT_MGMT.SET_AUDIT_TRAIL_LOCATION (
  audit_trail_type          IN PLS_INTEGER,
  audit_trail_location_value IN VARCHAR2) ;
```


Parameters

Table 31-21 SET_AUDIT_TRAIL_LOCATION Procedure Parameters

Parameter	Description
<code>audit_trail_type</code>	The audit trail type for which the audit trail location needs to be set. Audit trail types are listed in Table 31-1
<code>audit_trail_location_value</code>	Target location or tablespace for the audit trail records

Usage Notes

The following usage notes apply:

- Before changing the audit trail location, check the block size of the new location that you plan to use. The block size must be the same size as that of the current audit trail location. Otherwise, an `ORA-14520: Tablespace string block size [string] does not match existing object block size [string] error` appears. To check the block size of a tablespace, query the `USER_TABLESPACES` or `DBA_TABLESPACES` data dictionary view. See *Oracle Database VLDB and Partitioning Guide* for more information about partition restrictions for multiple block sizes.
- By default, audit trail records are written to the `SYSAUX` tablespace. You can change the tablespace location to a user tablespace using this procedure. However the designated tablespace must be an automatic storage space management (ASSM) tablespace.
- This procedure is valid for the following `audit_trail_type` values:
 - `AUDIT_TRAIL_AUD_STD`
 - `AUDIT_TRAIL_FGA_STD`
 - `AUDIT_TRAIL_DB_STD`
 - `AUDIT_TRAIL_UNIFIED`
- For the `audit_trail_type` values `AUDIT_TRAIL_AUD_STD`, `AUDIT_TRAIL_FGA_STD`, and `AUDIT_TRAIL_DB_STD`, you should ensure that the target tablespace, into which the audit trail tables are being moved, has sufficient space to accommodate the audit trail tables. You should also optimize the target tablespace for frequent write operations.
- This procedure involves data movement across tablespaces. For the `audit_trail_type` values `AUDIT_TRAIL_AUD_STD`, `AUDIT_TRAIL_FGA_STD`, and `AUDIT_TRAIL_DB_STD`, this can be a resource intensive operation especially if your database audit trail tables are already populated. Oracle recommends that you invoke the procedure during non-peak hours.
- You optionally can specify an encrypted tablespace for the audit trail location.
- When `AUDIT_TRAIL_TYPE` is `AUDIT_TRAIL_UNIFIED`, this procedure sets the tablespace for newer audit records in the unified audit trail but does not move the older audit records. Thus, it is not resource intensive for the unified audit trail.

- The UNIFIED_AUDIT_TRAIL data dictionary view is built on top of an internal relational table. This table is an interval partitioned table (irrespective of database editions) with a default interval of 1 day. This setting means that when you execute the DBMS_AUDIT_MGMT.SET_AUDIT_TRAIL_LOCATION procedure, only newly created partitions of the internal table are created in the new tablespace that is set as part of this procedure. Existing partitions of this table remain in the earlier tablespace (SYSaux is the default tablespace for this internal table). If you want to change this table's partition interval, then use the DBMS_AUDIT_MGMT.ALTER_PARTITION_INTERVAL procedure.
- As a best practice to improve performance and the availability of audit records, enable the AUTOEXTEND option on the audit tablespace.
- If the tablespace that is specified for the audit_trail_location_value parameter has a block size that is different from the current tablespace, then this procedure for AUDIT_TRAIL_UNIFIED audit_trail_type fails with an ORA-14520: Tablespace string block size [string] does not match existing object block size [string] error. This is due to the restrictions of multiple block sizes for partition tables.

Examples

The following example moves the database audit trail tables, AUD\$ and FGA_LOG\$, from the current tablespace to a user-created tablespace called RECORDS:

```
BEGIN
DBMS_AUDIT_MGMT.SET_AUDIT_TRAIL_LOCATION (
    audit_trail_type          => DBMS_AUDIT_MGMT.AUDIT_TRAIL_DB_STD,
    audit_trail_location_value => 'RECORDS');
END;
```

31.7.16 SET_AUDIT_TRAIL_PROPERTY Procedure

This procedure sets an audit trail property for the audit trail type that is specified.

The procedure sets the properties OS_FILE_MAX_SIZE, OS_FILE_MAX_AGE, and FILE_DELETE_BATCH_SIZE for operating system (OS), XML, and unified audit trail types. The OS_FILE_MAX_SIZE and OS_FILE_MAX_AGE properties determine the maximum size and age of an audit trail file before a new audit trail file is created. The OS_FILE_MAX_SIZE and OS_FILE_MAX_AGE properties determine the maximum size and age of an audit trail file before a new audit trail file gets created. The FILE_DELETE_BATCH_SIZE property specifies the number of audit trail files that are deleted in one batch.

The procedure sets the properties DB_DELETE_BATCH_SIZE and CLEANUP_INTERVAL for the database audit trail type. DB_DELETE_BATCH_SIZE specifies the batch size in which records get deleted from audit trail tables. This ensures that if a cleanup operation gets interrupted midway, the process does not need to start afresh the next time it is invoked. This is because all batches before the last processed batch are already committed.

The CLEANUP_INTERVAL specifies the frequency, in hours, with which the cleanup procedure is called.

Syntax

```
DBMS_AUDIT_MGMT.SET_AUDIT_TRAIL_PROPERTY (
    audit_trail_type          IN PLS_INTEGER,
    audit_trail_property      IN PLS_INTEGER,
    audit_trail_property_value IN PLS_INTEGER) ;
```

Parameters

Table 31-22 SET_AUDIT_TRAIL_PROPERTY Procedure Parameters

Parameter	Description
<code>audit_trail_type</code>	The audit trail type for which the property needs to be set. Audit trail types are listed in Table 31-1
<code>audit_trail_property</code>	The audit trail property that is being set. Audit trail properties are listed in Table 31-2
<code>audit_trail_property_value</code>	The value of the property specified using <code>audit_trail_property</code> . The following are valid values for audit trail properties: <ul style="list-style-type: none"> • <code>OS_FILE_MAX_SIZE</code> can have a minimum value of 1 and maximum value of 2000000. The default value is 10000. <code>OS_FILE_MAX_SIZE</code> is measured in kilobytes (KB). • <code>OS_FILE_MAX_AGE</code> can have a minimum value of 1 and a maximum value of 497. The default value is 5. <code>OS_FILE_MAX_AGE</code> is measured in days. • <code>DB_DELETE_BATCH_SIZE</code> can have a minimum value of 100 and a maximum value of 1000000. The default value is 10000. <code>DB_DELETE_BATCH_SIZE</code> is measured as the number of audit records that are deleted in one batch. • <code>FILE_DELETE_BATCH_SIZE</code> can have a minimum value of 100 and a maximum value of 1000000. The default value is 1000. <code>FILE_DELETE_BATCH_SIZE</code> is measured as the number of audit files that are deleted in one batch. • <code>CLEANUP_INTERVAL</code> can have a minimum value of 1 and a maximum value of 999. The default value is set using the INIT_CLEANUP Procedure. <code>CLEANUP_INTERVAL</code> is measured in hours.

Usage Notes

The following usage notes apply:

- The audit trail properties for which you do not explicitly set values use their default values.
- If you have set both the `OS_FILE_MAX_SIZE` and `OS_FILE_MAX_AGE` properties for an operating system (OS), XML or unified audit trail type, then a new audit trail file is created depending on which of these two limits is reached first

For example, let us take a scenario where `OS_FILE_MAX_SIZE` is 10000 and `OS_FILE_MAX_AGE` is 5. If the operating system audit file is already more than 5 days old and has a size of 9000 KB, then a new audit file is opened. This is because one of the limits has been reached.
- You can set the `OS_FILE_MAX_SIZE` and `OS_FILE_MAX_AGE` properties for the unified audit trail type by using `AUDIT_TRAIL_UNIFIED` or `AUDIT_TRAIL_UNIFIED_FILES`. Note that `AUDIT_TRAIL_UNIFIED` is deprecated

- The `DB_DELETE_BATCH_SIZE` property needs to be individually set for the `AUDIT_TRAIL_AUD_STD` and `AUDIT_TRAIL_FGA_STD` audit trail types. You cannot set this property collectively using the `AUDIT_TRAIL_DB_STD` and `AUDIT_TRAIL_ALL` audit trail types.
- The `DB_DELETE_BATCH_SIZE` property enables you to control the number of audit records that are deleted in one batch. Setting a large value for this parameter requires increased allocation for the undo log space.
- The `FILE_DELETE_BATCH_SIZE` property needs to be individually set for the `AUDIT_TRAIL_OS` and `AUDIT_TRAIL_XML` audit trail types. You cannot set this property collectively using the `AUDIT_TRAIL_FILES` and `AUDIT_TRAIL_ALL` audit trail types.
- The `FILE_DELETE_BATCH_SIZE` property enables you to control the number of audit files that are deleted in one batch. Setting a very large value may engage the `GEN0` background process for a long time.
- In Oracle Database Standard Edition, you can only associate the tablespace for unified auditing once. You should perform this association before you generate any audit records for the unified audit trail. The default tablespace is `SYSAUX`. After you have associated the tablespace, you cannot modify it on the Standard Edition because the partitioning feature is not supported in the Standard Edition.

Examples

The following example calls the `SET_AUDIT_TRAIL_PROPERTY` procedure to set the `OS_FILE_MAX_SIZE` property for the operating system (OS) audit trail. It sets this property value to 102400. This means that a new audit file gets created every time the current audit file size reaches 100 MB.

```
BEGIN
DBMS_AUDIT_MGMT.SET_AUDIT_TRAIL_PROPERTY (
    audit_trail_type      => DBMS_AUDIT_MGMT.AUDIT_TRAIL_OS,
    audit_trail_property  => DBMS_AUDIT_MGMT.OS_FILE_MAX_SIZE,
    audit_trail_property_value => 102400 /* 100MB*/ );
END;
```

The following example calls the `SET_AUDIT_TRAIL_PROPERTY` procedure to set the `OS_FILE_MAX_AGE` property for the operating system (OS) audit trail. It sets this property value to 5. This means that a new audit file gets created every sixth day.

```
BEGIN
DBMS_AUDIT_MGMT.SET_AUDIT_TRAIL_PROPERTY (
    audit_trail_type      => DBMS_AUDIT_MGMT.AUDIT_TRAIL_OS,
    audit_trail_property  => DBMS_AUDIT_MGMT.OS_FILE_MAX_AGE,
    audit_trail_property_value => 5 /* days */);
END;
```

The following example calls the `SET_AUDIT_TRAIL_PROPERTY` procedure to set the `DB_DELETE_BATCH_SIZE` property for the `AUDIT_TRAIL_AUD_STD` audit trail. It sets this property value to 100000. This means that during a cleanup operation, audit records are deleted from the `SYS.AUD$` table in batches of size 100000.

```
BEGIN
DBMS_AUDIT_MGMT.SET_AUDIT_TRAIL_PROPERTY (
    audit_trail_type      => DBMS_AUDIT_MGMT.AUDIT_TRAIL_AUD_STD,
    audit_trail_property  => DBMS_AUDIT_MGMT.DB_DELETE_BATCH_SIZE,
    audit_trail_property_value => 100000 /* delete batch size */);
END;
```

31.7.17 SET_LAST_ARCHIVE_TIMESTAMP Procedure

This procedure sets a timestamp indicating when the audit records were last archived. The audit administrator provides the timestamp to be attached to the audit records.

The [CLEAN_AUDIT_TRAIL Procedure](#) uses this timestamp to decide on the audit records to be deleted.

Syntax

```
DBMS_AUDIT_MGMT.SET_LAST_ARCHIVE_TIMESTAMP (
  audit_trail_type      IN PLS_INTEGER,
  last_archive_time     IN TIMESTAMP,
  rac_instance_number  IN PLS_INTEGER DEFAULT NULL,
  container             IN PLS_INTEGER DEFAULT CONTAINER_CURRENT,
  database_id          IN NUMBER DEFAULT NULL,
  container_guid       IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 31-23 SET_LAST_ARCHIVE_TIMESTAMP Procedure Parameters

Parameter	Description
audit_trail_type	The audit trail type for which the timestamp needs to be set. Audit trail types are listed in Table 31-1 .
last_archive_time	The <code>TIMESTAMP</code> value based on which the audit records or files should be deleted. This indicates the last time when the audit records or files were archived.
rac_instance_number	<p>The instance number for the Oracle Real Application Clusters (Oracle RAC) instance. The default value is <code>NULL</code>.</p> <p>The <code>rac_instance_number</code> parameter is not accepted when <code>AUDIT_TRAIL_TYPE</code> has values:</p> <ul style="list-style-type: none"> • <code>audit_trail_aud_std</code> • <code>audit_trail_db_std</code> • <code>audit_trail_fga_std</code> • <code>audit_trail_unified</code> <p>Set <code>rac_instance_number</code> to 1 for a single-instance database.</p>
container	<p>Values: <code>CONTAINER_CURRENT</code> for the connected pluggable database (PDB) or <code>CONTAINER_ALL</code> for all pluggable databases (PDBs). When <code>CONTAINER</code> is set to <code>CONTAINER_ALL</code>, this sets the value for last archive timestamp in all the pluggable databases, otherwise it sets the value in the connected PDB only.</p>

 **Note:**

ORA-46250 error is thrown if any future date or `TIMESTAMP` value is given.

Table 31-23 (Cont.) SET_LAST_ARCHIVE_TIMESTAMP Procedure Parameters

Parameter	Description
database_id	Database ID (DBID) of the audit records to cleanup
container_guid	Container GUID of the audit records to cleanup Note: This parameter has been deprecated but is currently retained for backward compatibility.

Usage Notes

The following usage notes apply:

- The `last_archive_time` must be specified in Coordinated Universal Time (UTC) when the audit trail types are `AUDIT_TRAIL_AUD_STD`, `AUDIT_TRAIL_FGA_STD`, or `AUDIT_TRAIL_UNIFIED`. This is because the database audit trails store the timestamps in UTC. UTC is also known as Greenwich Mean Time (GMT).
- The `last_archive_time` must be specified as the local time zone time when the audit trail types are `AUDIT_TRAIL_OS` or `AUDIT_TRAIL_XML`. The time zone must be the time zone of the machine where the OS or XML audit files were created. This is because the operating system audit files are cleaned based on the audit file's Last Modification Timestamp property. The Last Modification Timestamp property value is stored in the local time zone of the machine.
- When you use an Oracle Real Application Clusters (Oracle RAC) database, Oracle recommends that you use the Network Time Protocol (NTP) to synchronize individual Oracle RAC nodes.
- The `SET_LAST_ARCHIVE_TIMESTAMP` procedure and `CLEAN_AUDIT_TRAIL` procedure should be not be executed in the same transaction block. Otherwise, the results are usually unpredictable.
- If this timestamp set to a future date, an error is returned.
- Make sure that the transaction for `SET_LAST_ARCHIVE_TIMESTAMP` is completed before you call the `CLEAN_AUDIT_TRAIL` procedure. To have predictable results in terms of cleaning records until the time provided in `SET_LAST_ARCHIVE_TIMESTAMP(UTC format)`, make sure that `SET_LAST_ARCHIVE_TIMESTAMP` and `CLEAN_AUDIT_TRAIL` procedures are not called in the same transaction. It is recommended to `commit` before you call the `CLEAN_AUDIT_TRAIL` procedure.
- When you invoke `SET_LAST_ARCHIVE_TIMESTAMP` using database links, be cognizant that there could be time difference between the source and the target databases.
- When you set the last archive timestamp on a read-write database, the `DB_UNIQUE_NAME` column of the `DBA_AUDIT_MGMT_LAST_ARCH_TS` data dictionary view is also populated. You cannot configure the `DB_UNIQUE_NAME` value, so you cannot set it by using the `SET_LAST_ARCHIVE_TIMESTAMP` procedure.
- For every configuration of the last archive timestamp, Oracle Database cleans entries from the `DBA_AUDIT_MGMT_LAST_ARCH_TS` data dictionary view where the `DB_UNIQUE_NAME` column value is not equal to the current `DB_UNIQUE_NAME` value. This avoids having to reuse the old last archive timestamp when multiple switch-over operations take place and keeps in check the growing rows of the `DBA_AUDIT_MGMT_LAST_ARCH_TS` view.

Examples

The following example calls the `SET_LAST_ARCHIVE_TIMESTAMP` procedure to set the last archive timestamp for the operating system (OS) audit trail type on Oracle RAC instance 1. It uses the `TO_TIMESTAMP` function to convert a character string into a timestamp value.

A subsequent call to the [CLEAN_AUDIT_TRAIL Procedure](#), with `use_last_arch_timestamp` set to `TRUE`, will delete all those OS audit files from the current `AUDIT_FILE_DEST` directory that were modified before 10-Sep-2012 14:10:10.0.

```
BEGIN
DBMS_AUDIT_MGMT.SET_LAST_ARCHIVE_TIMESTAMP(
  audit_trail_type      => DBMS_AUDIT_MGMT.AUDIT_TRAIL_OS,
  last_archive_time     => TO_TIMESTAMP('12-SEP-0714:10:10.0','DD-MON-
RRHH24:MI:SS.FF'),
  rac_instance_number   => 1);
END;
```

31.7.18 SET_PURGE_JOB_INTERVAL Procedure

This procedure sets the interval at which the `CLEAN_AUDIT_TRAIL` Procedure is called for the purge job specified.

The purge job must have already been created using the [CREATE_PURGE_JOB Procedure](#).

Syntax

```
DBMS_AUDIT_MGMT.SET_PURGE_JOB_INTERVAL(
  audit_trail_purge_name      IN VARCHAR2,
  audit_trail_interval_value  IN PLS_INTEGER) ;
```

Parameters

Table 31-24 SET_PURGE_JOB_INTERVAL Procedure Parameters

Parameter	Description
<code>audit_trail_purge_name</code>	The name of the purge job for which the interval is being set. This is the purge job name that you specified with the CREATE_PURGE_JOB Procedure .
<code>audit_trail_interval_value</code>	The interval, in hours, at which the clean up procedure should be called. This value modifies the <code>audit_trail_purge_interval</code> parameter set using the CREATE_PURGE_JOB Procedure

Usage Notes

Use this procedure to modify the `audit_trail_purge_interval` parameter set using the [CREATE_PURGE_JOB Procedure](#).

Examples

The following example calls the `SET_PURGE_JOB_INTERVAL` procedure to change the frequency at which the purge job called `CLEANUP` is invoked. The new interval is set to 24 hours.

```
BEGIN
DBMS_AUDIT_MGMT.SET_PURGE_JOB_INTERVAL(
  AUDIT_TRAIL_PURGE_NAME      => 'CLEANUP',
  AUDIT_TRAIL_INTERVAL_VALUE  => 24 );
END;
```

Related Topics

- [CLEAN_AUDIT_TRAIL Procedure](#)
This procedure deletes audit trail records.

31.7.19 SET_PURGE_JOB_STATUS Procedure

This procedure enables or disables the specified purge job.

The purge job must have already been created using the [CREATE_PURGE_JOB Procedure](#).

Syntax

```
DBMS_AUDIT_MGMT.SET_PURGE_JOB_STATUS(
  audit_trail_purge_name      IN VARCHAR2,
  audit_trail_status_value    IN PLS_INTEGER) ;
```

Parameters

Table 31-25 SET_PURGE_JOB_STATUS Procedure Parameters

Parameter	Description
<code>audit_trail_purge_name</code>	The name of the purge job for which the status is being set. This is the purge job name that you specified with the CREATE_PURGE_JOB Procedure .
<code>audit_trail_status_value</code>	One of the values specified in Table 31-3 . The value <code>PURGE_JOB_ENABLE</code> enables the specified purge job. The value <code>PURGE_JOB_DISABLE</code> disables the specified purge job.

Examples

The following example calls the `SET_PURGE_JOB_STATUS` procedure to enable the `CLEANUP` purge job.

```
BEGIN
DBMS_AUDIT_MGMT.SET_PURGE_JOB_STATUS(
  audit_trail_purge_name      => 'CLEANUP',
  audit_trail_status_value    => DBMS_AUDIT_MGMT.PURGE_JOB_ENABLE);
END;
```


31.7.20 TRANSFER_UNIFIED_AUDIT_RECORDS Procedure

This procedure transfers unified audit records that were in a pre-upgraded Oracle database to an internal relational table that is designed to improve read performance.

In the pre-upgraded Oracle database, these records resided in the common logging infrastructure (CLI) SGA back-end tables.

Syntax

```
DBMS_AUDIT_MGMT.TRANSFER_UNIFIED_AUDIT_RECORDS (
    container_guid          IN VARCHAR2    DEFAULT NULL);
```

Parameters

Table 31-26 TRANSFER_UNIFIED_AUDIT_RECORDS Procedure Parameters

Parameter	Description
container_guid	The GUID of the container of the associated CLI back-end table. This back-end table contains the audit records from the pre-upgraded Oracle database. If you omit this setting, then the GUID of the current container is used.

Usage Notes

- It is not mandatory to run `DBMS_AUDIT_MGMT.TRANSFER_UNIFIED_AUDIT_RECORDS` after an upgrade, but for better read performance of the unified audit trail, Oracle highly recommends that you run this procedure.
- The `DBMS_AUDIT_MGMT.TRANSFER_UNIFIED_AUDIT_RECORDS` is designed to be a one-time operation, to be performed after you upgrade from Oracle Database 12c release 12.1.
- There is one CLI back-end table per GUID of the container. You can find the GUIDs for containers by querying the `PDB_GUID` column of the `DBA_PDB_HISTORY` data dictionary view. Execute the `DBMS_AUDIT_MGMT.TRANSFER_UNIFIED_AUDIT_RECORDS` procedure by passing each of these GUIDs one by one to ensure that you move the unified audit records from these CLI back-end tables to the `AUDSYS.AUD$UNIFIED` table.
- In a multitenant environment, you must run the `DBMS_AUDIT_MGMT.TRANSFER_UNIFIED_AUDIT_RECORDS` procedure only in the container to which the transfer operation applies, whether it is the root or an individual PDB. You cannot run this procedure in the root, for example, to transfer audit records in a PDB.
- If you have a high rate of audit record generation and your database supports partitioning, then you may want to use the `DBMS_AUDIT_MGMT.ALTER_PARTITION_INTERVAL` procedure to alter the partition interval setting for the internal relational table. See [ALTER_PARTITION_INTERVAL Procedure](#) for more information.

32

DBMS_AUDIT_UTIL

The `DBMS_AUDIT_UTIL` package provides functions that enable you to format the output of queries to the `DBA_FGA_AUDIT_TRAIL`, `DBA_AUDIT_TRAIL`, `UNIFIED_AUDIT_TRAIL`, and `V$XML_AUDIT_TRAIL` views.

This chapter contains the following topics:

- [DBMS_AUDIT_UTIL Overview](#)
- [DBMS_AUDIT_UTIL Security Model](#)
- [DBMS_AUDIT_UTIL Views](#)
- [Summary of DBMS_AUDIT_UTIL Subprograms](#)

32.1 DBMS_AUDIT_UTIL Overview

The functions in the `DBMS_AUDIT_UTIL` package enable you to format the output of queries to the `RLS_INFO` column of several audit trail views so that the output appear in separate rows.

These functions use a cursor to find and format each row of the corresponding view. To use the functions in this package, include the function in a query to one of the following views:

- `DBA_FGA_AUDIT_TRAIL` data dictionary view, for the `DECODE_RLS_INFO_ATTRAIL_FGA` function
- `DBA_AUDIT_TRAIL` data dictionary view, for the `DECODE_RLS_INFO_ATTRAIL_STD` function
- `UNIFIED_AUDIT_TRAIL` data dictionary view, for the `DECODE_RLS_INFO_ATTRAIL_UNI` function
- `V$XML_AUDIT_TRAIL` dynamic view, for the `DECODE_RLS_INFO_ATTRAIL_XML` function

32.2 DBMS_AUDIT_UTIL Security Model

All `DBMS_AUDIT_UTIL` subprograms require the user to have `EXECUTE` privilege on the `DBMS_AUDIT_UTIL` package.

The `SYSDBA` administrative privilege and `AUDIT_ADMIN` and `AUDIT_VIEWER` roles have the `EXECUTE` privilege on the `DBMS_AUDIT_UTIL` package by default. An auditor can view audit data after being granted the `AUDIT_VIEWER` role.

Oracle strongly recommends that only audit administrators have the `EXECUTE` privilege on the `DBMS_AUDIT_UTIL` package and be granted the `AUDIT_VIEWER` role.

32.3 DBMS_AUDIT_UTIL Views

The views in this section display the audit information used by the `DBMS_AUDIT_UTIL` package function.

[Table 32-1](#) displays the `DBMS_AUDIT_UTIL` views.

Table 32-1 Views Used by DBMS_AUDIT_UTIL

View	Description
<code>DBA_FGA_AUDIT_TRAIL</code>	Displays fine-grained audit record information; used with the <code>DBMS_AUDIT_UTIL.DECODE_RLS_INFO_ATRAIL_FGA</code> function
<code>DBA_AUDIT_TRAIL</code>	Displays standard audit record information; used with the <code>DBMS_AUDIT_UTIL.DECODE_RLS_INFO_ATRAIL_STD</code> function
<code>UNIFIED_AUDIT_TRAIL</code>	Displays unified audit trail information; used with the <code>DBMS_AUDIT_UTIL.DECODE_RLS_INFO_ATRAIL_XML</code> function
<code>V\$XML_AUDIT_TRAIL</code>	Displays XML audit record information; used with the <code>DBMS_AUDIT_UTIL.DECODE_RLS_INFO_ATRAIL_UNI</code> function

32.4 Summary of DBMS_AUDIT_UTIL Subprograms

This table lists the `DBMS_AUDIT_UTIL` subprograms and their descriptions.

Table 32-2 DBMS_AUDIT_UTIL Package Subprograms

Subprogram	Description
DECODE_RLS_INFO_ATRAIL_FGA Function	Reformats the output for queries to the <code>RLS_INFO</code> column of the <code>DBA_FGA_AUDIT_TRAIL</code> data dictionary view
DECODE_RLS_INFO_ATRAIL_STD Function	Reformats the output for queries to the <code>RLS_INFO</code> column of the <code>DBA_AUDIT_TRAIL</code> data dictionary view
DECODE_RLS_INFO_ATRAIL_UNI Function	Reformats the output for queries to the <code>RLS_INFO</code> column of the <code>UNIFIED_AUDIT_TRAIL</code> data dictionary view
DECODE_RLS_INFO_ATRAIL_XML Function	Reformats the output for queries to the <code>RLS_INFO</code> column of the <code>V\$XML_AUDIT_TRAIL</code> dynamic view

32.4.1 DECODE_RLS_INFO_ATRAIL_FGA Function

This function reformats the output for queries to the `RLS_INFO` column of the `DBA_FGA_AUDIT_TRAIL` data dictionary view so that the output is easily readable. It is used for the concatenated Oracle Virtual Private Database predicates for multiple fine-

grained audit policies in an environment that has not been enabled for unified auditing. It returns the output in separate rows.



See Also:

Oracle Database Security Guide regarding fine-grained auditing

Syntax

```
DECODE_RLS_INFO_ATRAIL_FGA (
    IN_CURSOR          REF CURSOR          IN)
RETURN PIPELINED ROW;
```

Parameters

Except for the `IN_CURSOR` parameter, the parameters for the `DECODE_RLS_INFO_ATRAIL_FGA` function are the same as the columns in the `DBA_FGA_AUDIT_TRAIL` data dictionary view. See *Oracle Database Reference* for more information about this view.

Usage Notes

- To use this function, include it in a query to the `DBA_FGA_AUDIT_TRAIL` data dictionary view, using a cursor similar to the example shown in the following section.
- See *Oracle Database Reference* for more information about the `DBA_FGA_AUDIT_TRAIL` data dictionary view.

Example

```
SELECT DB_USER, OBJECT_NAME, SQL_TEXT
       RLS_PREDICATE, RLS_POLICY_TYPE, RLS_POLICY_OWNER, RLS_POLICY_NAME
FROM TABLE (DBMS_AUDIT_UTIL.DECODE_RLS_INFO_ATRAIL_FGA
             (CURSOR (SELECT * FROM DBA_FGA_AUDIT_TRAIL)));
```

Return Values

A piped row with decoded values of `DBA_FGA_AUDIT_TRAIL.RLS_INFO` column.

32.4.2 DECODE_RLS_INFO_ATRAIL_STD Function

This function reformats the output for queries to the `RLS_INFO` column of the `DBA_AUDIT_TRAIL` data dictionary view so that the output is easily readable. It is used for the concatenated Oracle Virtual Private Database predicates for multiple standard audit records in an environment that has not been enabled for unified auditing. It returns the output in separate rows.



See Also:

Oracle Database Security Guide regarding auditing

Syntax

```
DECODE_RLS_INFO_ATRAIL_STD(
  IN_CURSOR          REF CURSOR          IN)
RETURN PIPELINED ROW;
```

Parameters

Except for the `IN_CURSOR` parameter, the parameters for the `DECODE_RLS_INFO_ATRAIL_STD` function are the same as the columns in the `DBA_AUDIT_TRAIL` data dictionary view. See *Oracle Database Reference* for more information about this view.

Usage Notes

- To use this function, include it in a query to the `DBA_AUDIT_TRAIL` data dictionary view, using a cursor similar to the example shown in the following section.
- See *Oracle Database Reference* for more information about the `DBA_AUDIT_TRAIL` data dictionary view.

Example

```
SELECT USERNAME, USERHOST, ACTION, OBJ_NAME, OBJ_PRIVILEGE
       RLS_PREDICATE, RLS_POLICY_TYPE, RLS_POLICY_OWNER, RLS_POLICY_NAME
FROM TABLE (DBMS_AUDIT_UTIL.DECODE_RLS_INFO_ATRAIL_STD
             (CURSOR (SELECT * FROM DBA_AUDIT_TRAIL)));
```

Return Values

A piped row with decoded values of `DBA_AUDIT_TRAIL.RLS_INFO` column

32.4.3 DECODE_RLS_INFO_ATRAIL_UNI Function

This function reformats the output for queries to the `RLS_INFO` column of the `V$XML_AUDIT_TRAIL` dynamic view so that the output is easily readable. It is used for the concatenated Oracle Virtual Private Database predicates for multiple XML audit records in an environment that has not been enabled for unified auditing. It returns the output in separate rows.

**See Also:**

Oracle Database Security Guide regarding unified auditing

Syntax

```
DECODE_RLS_INFO_ATRAIL_UNI(
  IN_CURSOR          REF CURSOR          IN)
RETURN PIPELINED ROW;
```

Parameters

Except for the `IN_CURSOR` parameter, the parameters for the `DECODE_RLS_INFO_ATRAIL_UNI` function are the same as the columns in the

V\$XML_AUDIT_TRAIL data dictionary view. See *Oracle Database Reference* for more information about this view.

Usage Notes

- To use this function, include it in a query to the V\$XML_AUDIT_TRAIL dynamic view, using a cursor similar to the example shown in the following section.
- See *Oracle Database Reference* for more information about the V\$XML_AUDIT_TRAIL dynamic view.

Example

```
SELECT OBJECT_NAME, SQL_TEXT
       RLS_PREDICATE, RLS_POLICY_TYPE, RLS_POLICY_OWNER, RLS_POLICY_NAME
FROM TABLE (DBMS_AUDIT_UTIL.DECODE_RLS_INFO_ATRAIL_UNI
             (CURSOR (SELECT * FROM V$XML_AUDIT_TRAIL)));
```

Return Values

A piped row with decoded values of V\$XML_AUDIT_TRAIL.RLS_INFO column

32.4.4 DECODE_RLS_INFO_ATRAIL_XML Function

This function reformats the output for queries to the RLS_INFO column of the UNIFIED_AUDIT_TRAIL data dictionary view so that the output is easily readable. It is used for the concatenated Oracle Virtual Private Database predicates for multiple audit records from unified audit policies. It returns the output in separate rows.



See Also:

Oracle Database Security Guide regarding auditing

Syntax

```
DECODE_RLS_INFO_ATRAIL_XML(
  IN_CURSOR          REF CURSOR          IN)
RETURN PIPELINED ROW;
```

Parameters

Except for the IN_CURSOR parameter, the parameters for the DECODE_RLS_INFO_ATRAIL_XML function are the same as the columns in the UNIFIED_AUDIT_TRAIL data dictionary view. See *Oracle Database Reference* for more information about this view.

Usage Notes

- To use this function, include it in a query to the UNIFIED_AUDIT_TRAIL data dictionary view, using a cursor similar to the example shown in the following section.
- See *Oracle Database Reference* for more information about the UNIFIED_AUDIT_TRAIL data dictionary view.

Example

```
SELECT DBUSERNAME, ACTION_NAME, OBJECT_NAME, SQL_TEXT,  
       RLS_PREDICATE, RLS_POLICY_TYPE, RLS_POLICY_OWNER, RLS_POLICY_NAME  
FROM TABLE (DBMS_AUDIT_UTIL.DECODE_RLS_INFO_ATRAIL_XML  
             (CURSOR (SELECT * FROM UNIFIED_AUDIT_TRAIL)));
```

Return Values

A piped row with decoded values of UNIFIED_AUDIT_TRAIL.RLS_INFO column

33

DBMS_AUTO_CLUSTERING

The `DBMS_AUTO_CLUSTERING` package contains a collection of subprograms that recommend clustering and zone map schemes for improved query performance.

This chapter contains the following topics:

- [DBMS_AUTO_CLUSTERING Overview](#)
- [Summary of DBMS_AUTO_CLUSTERING Subprograms](#)

33.1 DBMS_AUTO_CLUSTERING Overview

The `DBMS_AUTO_CLUSTERING` package generates clustering recommendations, such as tables to cluster and clustering schemes. It also verifies the impact of the clustering recommendation and implements the clustering recommendation.

33.2 Summary of DBMS_AUTO_CLUSTERING Subprograms

This table lists the `DBMS_AUTO_CLUSTERING` subprograms and their descriptions.

Table 33-1 DBMS_AUTO_CLUSTERING Package Subprograms

Subprogram	Description
CONFIGURE Procedure	Configures settings related to automatic clustering.
RECOMMEND_CLUSTERING_METHOD Function	Generates a recommendation. No recommendation will be returned if the recommendation criteria are not met. The generated recommendation is stored in the <code>DBA_AUTO_CLUSTERING_RECOMMENDATION</code> view. The function will return the recommendation ID when a recommendation is generated and <code>NULL</code> when no recommendation is generated.
VERIFY_RECOMMENDATION Procedure	Verifies the performance of the clustering recommendation. It retrieves the information used for generating the recommendation based on input arguments. This procedure finds the original table and the SQL tuning set used for the recommendation task. It creates a table and applies the clustering recommendation to the table. It runs a workload against the clustered table and the original table and returns a detailed report on performance benefits. The verification result can be <code>ACCEPTED</code> or <code>REJECTED</code> .
APPLY_RECOMMENDATION Procedure	Clusters an input table using the recommendation (identified by <code>recommendation_id</code>). The value of the incremental column specifies whether to use full clustering or incremental clustering.

Table 33-1 (Cont.) DBMS_AUTO_CLUSTERING Package Subprograms

Subprogram	Description
GET_RECOMMENDATION Function	Returns the latest recommendation ID for a given input.
REPORT_ACTIVITY Function	Returns a report of the auto-clustering operations executed during a specific period in a database.
REPORT_LAST_ACTIVITY Function	Returns a report of the last automatic indexing operation executed in a database.

33.2.1 CONFIGURE Procedure

This procedure configures settings related to automatic clustering and zone map.

Syntax

```
DBMS_AUTO_CLUSTERING.CONFIGURE (
    parameter_name      IN VARCHAR2,
    parameter_value     IN VARCHAR2,
    allow               IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 33-2 CONFIGURE Procedure Parameters

Parameter	Description
<code>parameter_name</code>	<p>Automatic clustering configuration setting. It can have one of the following values:</p> <ul style="list-style-type: none"> AUTO_CLUSTERING_SCHEMA: Schemas to include or exclude from the automatic clustering recommendation. Its behavior is controlled by <code>allow</code> parameter. <p>The automatic clustering process manages two schema lists – the <i>inclusion list</i> and the <i>exclusion list</i>. The inclusion list contains the schemas that can use cluster tables. The exclusion list contains the schemas that cannot use cluster tables. When automatic clustering is enabled for a database, both lists are initially empty, and all schemas in the database can use auto-clustering in all modules in the database.</p> <p>If the inclusion list contains at least one module, then only the modules listed in the inclusion list can use auto-clustering.</p> <p>If the inclusion list is empty and the exclusion list contains at least one module, then all the modules can use auto-clustering, except the module listed in the exclusion list.</p> <p>If both the lists (the inclusion list and the exclusion list) contain at least one module, then all the modules can use auto-clustering, except the modules listed in the exclusion list.</p> AUTO_CLUSTERING_REPORT_RETENTION: Number of days for which automatic clustering logs are retained in the database before they are deleted. As automatic clustering report is generated based on these logs, it cannot be generated for a period beyond the value specified for <code>AUTO_CLUSTERING_REPORT_RETENTION</code>. Default value is 31 days¹. AUTO_CLUSTERING_WORKLOAD_WINDOW: Maximum number of hours for which auto-clustering will investigate queries from the latest snapshots from <code>AutoSTS</code> to make recommendations. For example, if the parameter is 24, then auto-clustering will look at statements in latest 24 hours from the <code>AutoSTS</code>. <p>Valid value is an integer value between 1 and 8760 (24*36). Default value is 24.</p> AUTO_CLUSTERING_WORKLOAD_MIN_TIME: Minimum database time, in seconds, for a query to be considered for auto-clustering recommendation. Queries below this

Table 33-2 (Cont.) CONFIGURE Procedure Parameters

Parameter	Description
	threshold will not be considered for recommendations.
	Valid value is an integer value between 0 and 3600 (1 hour). Default value is 120 (2 minutes).
parameter_value	Value for the configuration setting specified in the parameter_name.
	When it is set to NULL, the configuration setting is assigned the default value.
allow	This parameter is applicable only for the AUTO_CLUSTERING_SCHEMA and it can have one of the following values: <ul style="list-style-type: none"> • TRUE: Add the specified modules to the inclusion list. • FALSE: Add the specified modules to the exclusion list. • NULL: Remove the specified modules from the list to which it is currently added.

¹ Default value for auto partitioning is 90 days and 373 days for auto indexing.

33.2.2 RECOMMEND_CLUSTERING_METHOD Function

This function generates a recommendation. No recommendation will be returned if the recommendation criteria are not met. The generated recommendation can be retrieved from the DBA_AUTO_CLUSTERING_RECOMMENDATION view. The function will return the recommendation ID when a recommendation is generated and NULL when no recommendation is generated.

Syntax

```
DBMS_AUTO_CLUSTERING.RECOMMEND_CLUSTERING_METHOD (
    sqlset_owner      IN  VARCHAR2 DEFAULT 'SYS',
    sqlset_name       IN  VARCHAR2 DEFAULT 'SYS_AUTO_STS',
    table_owner       IN  VARCHAR2 DEFAULT NULL,
    table_name        IN  VARCHAR2 DEFAULT NULL,
    report_type       IN  VARCHAR2 DEFAULT 'TEXT',
    report_section    IN  VARCHAR2 DEFAULT 'SUMMARY',
    report_level      IN  VARCHAR2 DEFAULT 'TYPICAL',
    verification      IN  BOOLEAN  DEFAULT TRUE)
RETURN RAW;
```

Parameters

Table 33-3 RECOMMEND_CLUSTERING_METHOD Procedure Parameters

Parameter	Description
sqlset_owner	Owner of the SQL Tuning set representing the workload to be considered. Default is SYS.
sqlset_name	Name of the SQL Tuning set representing the workload to be considered. Default is SYS_AUTO_STS.
table_owner, table_name	Name of a table for generating recommendation.
report_type	Type parameter for generating report for the recommendation activity. Default is TEXT.
report_section	Section parameter used to generate persistent report for the recommended clustering method. Default is SUMMARY.
report_level	Level parameter used to generate report for the recommended clustering method. Default is TYPICAL.
verification	Verification parameter indicates whether the generated recommendation is verified as part of RECOMMEND_CLUSTERING_METHOD. Default is TRUE, which means, the generated recommendation is verified to see how it performs based on the workload. If it is set to FALSE, only recommendations are generated, and their performance against workload and schema is not verified.

33.2.3 VERIFY_RECOMMENDATION Procedure

This procedure verifies the performance of the clustering recommendation. It retrieves the information used for generating the recommendation based on the input arguments. This procedure finds the original table and the SQL tuning set used for the recommendation task identified by the recommendation ID. It creates a table and applies the clustering recommendation to the table. It runs a workload against the clustered table and the original table and returns a detailed report on performance benefits. The verification result can be ACCEPTED or REJECTED.

Syntax

```
DBMS_AUTO_CLUSTERING.VERIFY_RECOMMENDATION (
    recommendation_id    IN RAW,
    table_owner          IN VARCHAR2 DEFAULT NULL,
    table_name           IN VARCHAR2 DEFAULT NULL)
RETURN CLOB;
```

Parameters

Table 33-4 VERIFY_RECOMMENDATION Procedure Parameters

Parameter	Description
<code>recommendation_id</code>	Recommendation ID returned from <code>RECOMMEND_CLUSTERING_METHOD</code> function that generates recommendation for several tables in a given workload.
<code>table_owner</code>	Name of a owner to validate as a candidate for automatic clustering within the given recommendation id.
<code>table_name</code>	Name of a table to validate as a candidate for automatic clustering within the given recommendation id.

33.2.4 APPLY_RECOMMENDATION Procedure

This procedure clusters an input table using the recommendation (identified by `recommendation_id`). The value of the incremental column specifies whether to use full clustering or incremental clustering. Full clustering clusters an input table after applying the recommended clustering clause and performs an alter table move online to cluster data in the table. Incremental clustering applies the recommended clustering clause, and Automatic Data Compression (ADO) background will cluster data in the background.

Syntax

```
DBMS_AUTO_CLUSTERING.APPLY_RECOMMENDATION(
    recommendation_id IN RAW DEFAULT NULL,
    table_name        IN VARCHAR2 DEFAULT NULL,
    table_owner       IN VARCHAR2 DEFAULT NULL,
    clustering_ddl    IN VARCHAR2 DEFAULT NULL,
    zonemap_ddl       IN VARCHAR2 DEFAULT NULL,
    apply_mode        IN VARCHAR2 DEFAULT 'FULL',
    zonemap_creation  IN BOOLEAN  DEFAULT TRUE);
```

Parameters

Table 33-5 APPLY_RECOMMENDATION Procedure Parameters

Parameter	Description
<code>recommendation_id</code>	The task ID that recommends clustering for the given table. If not specified, the clustering recommendation made in the latest task will be used.
<code>table_name</code>	Name of the input table.
<code>table_owner</code>	Owner of the input table.

Table 33-5 (Cont.) APPLY_RECOMMENDATION Procedure Parameters

Parameter	Description
clustering_ddl	Clustering DDL to add to the target table. <code>table_owner</code> and <code>table_name</code> are NULL if they are extracted from the specified DDL.
zonemap_ddl	Zonemap DDL to use in the target table. <code>table_owner</code> and <code>table_name</code> are NULL if they are extracted from the specified DDL.
apply_mode	Mode to specify the clustering to be performed: <ul style="list-style-type: none"> FULL: full clustering using online redefinition INCREMENTAL: background incremental clustering
zonemap_creation	If this value is set to FALSE, it will not create a zonemap. It will only apply the clustering clause. Default is TRUE.

33.2.5 GET_RECOMMENDATION Function

This function returns the latest recommendation ID for a given input.

Syntax

```
DBMS_AUTO_CLUSTERING.GET_RECOMMENDATION (
    table_owner    IN VARCHAR2,
    table_name     IN VARCHAR2,
RETURN RAW;
```

Parameters

Table 33-6 GET_RECOMMENDATION Function Parameters

Parameter	Description
table_owner	Owner of the table to cluster
table_name	Name of the table to cluster

33.2.6 REPORT ACTIVITY Function

This function returns a report of the auto-clustering operations executed during a specific period in a database.

Syntax

```
DBMS_AUTO_CLUSTERING.REPORT_ACTIVITY (
    activity_start IN TIMESTAMP WITH TIME ZONE DEFAULT
SYSTIMESTAMP-1,
    activity_end   IN TIMESTAMP WITH TIME ZONE DEFAULT SYSTIMESTAMP,
```

```

type          IN  VARCHAR2 DEFAULT 'TEXT',
section       IN  VARCHAR2 DEFAULT 'ALL',
level        IN  VARCHAR2 DEFAULT 'TYPICAL')
RETURN CLOB;

```

Parameters

Table 33-7 REPORT ACTIVITY Function Parameters

Parameter	Description
activity_start	Time from when automatic clustering operations are considered for the report. If no value is specified or NULL is specified, then the report is generated for the last automatic clustering operation that was executed.
activity_end	Time until the automatic clustering operations are considered for the report. If no value is specified or NULL is specified, then the report is generated for the last automatic clustering operation that was executed.
type	Format of the report. It can have one of the following values: <ul style="list-style-type: none"> TEXT HTML XML The default value is TEXT
section	Sections to include in the report. It can have a combination of the following values: <ul style="list-style-type: none"> SUMMARY: Include only the summary details section in the report. ALL: Include all the sections in the report. This is the default value.
level	Level of automatic clustering information to include in the report. It can have one of the following values: <ul style="list-style-type: none"> BASIC: Include basic automatic clustering information in the report. TYPICAL: Include typical automatic clustering information in the report. This is the default value. ALL: Include all the automatic clustering information in the report.

33.2.7 REPORT_LAST_ACTIVITY Function

This function returns a report of the last automatic clustering operation executed in a database.

Syntax

```

DBMS_AUTO_CLUSTERING.REPORT_LAST_ACTIVITY (
type          IN  VARCHAR2 DEFAULT 'TEXT',
section       IN  VARCHAR2 DEFAULT 'ALL',

```

```

        level          IN VARCHAR2 DEFAULT 'TYPICAL')
RETURN CLOB;

```

Parameters

Table 33-8 REPORT_LAST_ACTIVITY Function Parameters

Parameter	Description
type	<p>Format of the report. It can have one of the following values:</p> <ul style="list-style-type: none"> TEXT HTML XML <p>The default value is TEXT.</p>
section	<p>Sections to include in the report. It can have a combination of the following values:</p> <ul style="list-style-type: none"> SUMMARY: Include only the summary details section in the report. ALL: Include all the sections in the report. This is the default value.
level	<p>Level of automatic clustering information to include in the report. It can have one of the following values:</p> <ul style="list-style-type: none"> BASIC: Include basic automatic clustering information in the report. TYPICAL: Include typical automatic clustering information in the report. This is the default value. ALL: Include all the automatic clustering information in the report.

34

DBMS_AUTO_SQLTUNE

The `DBMS_AUTO_SQLTUNE` package is the interface for managing the Automatic SQL Tuning task. Unlike `DBMS_SQLTUNE`, the `DBMS_AUTO_SQLTUNE` package requires the `DBA` role.

The chapter contains the following topics:

- [DBMS_AUTO_SQLTUNE Overview](#)
- [DBMS_AUTO_SQLTUNE Security Model](#)
- [Summary of DBMS_AUTO_SQLTUNE Subprograms](#)

34.1 DBMS_AUTO_SQLTUNE Overview

The `DBMS_AUTO_SQLTUNE` package is the interface to SQL Tuning Advisor (`DBMS_SQLTUNE`) when run within the AutoTask framework.

The database creates the automated system task `SYS_AUTO_SQL_TUNING_TASK` as part of the catalog scripts. This task automatically chooses a set of high-load SQL from AWR and runs SQL Tuning Advisor on this SQL. The automated task performs the same comprehensive analysis as any other SQL Tuning task.

The automated task tests any SQL profiles it finds by executing both the old and new query plans. Automatic SQL Tuning differs from manual SQL tuning in one important way. If automatic implementation of SQL profiles is enabled (the default is disabled), then the database implements any SQL profiles that promise a great performance benefit. The implementation occurs at tuning time so that the database can immediately benefit from the new plan. You can enable or disable automatic implementation by using the `SET_AUTO_TUNING_TASK_PARAMETER` API to set the `ACCEPT_SQL_PROFILES` parameter.

In each maintenance window, the automated tuning task stores its results as a new execution. Each execution result has the same task name but a different execution name. Query the `DBA_ADVISOR_EXECUTIONS` view for information about task executions. To view reports that span multiple executions, use the [REPORT_AUTO_TUNING_TASK](#) Function.

34.2 DBMS_AUTO_SQLTUNE Security Model

This package is available to users with the `DBA` role. For other users, you must grant the `EXECUTE` privilege on the package explicitly. Note that the `EXECUTE_AUTO_TUNING_TASK` procedure is an exception: only `SYS` can invoke it.

Users can call APIs in this package to control how the automatic tuning task behaves when it runs, such as enabling automatic SQL profile creation and configuring the total and per-SQL time limits under which the task runs. Because these settings affect the overall performance of the database, it may not be appropriate for all users with the `ADVISOR` privilege to have access to this package.

34.3 Summary of DBMS_AUTO_SQLTUNE Subprograms

The DBMS_AUTO_SQLTUNE package contains EXECUTE, REPORT, and SET subprograms.

Table 34-1 DBMS_AUTO_SQLTUNE Package Subprograms

Subprogram	Description
EXECUTE_AUTO_TUNING_TASK Function and Procedure	Executes the Automatic SQL Tuning task immediately (SYS only)
REPORT_AUTO_TUNING_TASK Function	Displays a text report of the automatic tuning task's history
SET_AUTO_TUNING_TASK_PARAMETER Procedures	Changes a task parameter value for the daily automatic runs

34.3.1 EXECUTE_AUTO_TUNING_TASK Function and Procedure

This function and procedure executes the Automatic SQL Tuning task (SYS_AUTO_SQL_TUNING_TASK).

Both the function and the procedure run in the context of a new task execution. The difference is that the function returns the name of the new execution.

Syntax

```
DBMS_AUTO_SQLTUNE.EXECUTE_AUTO_TUNING_TASK(
  execution_name    IN VARCHAR2           := NULL,
  execution_params  IN DBMS_ADVISOR.argList := NULL,
  execution_desc    IN VARCHAR2           := NULL)
RETURN VARCHAR2;
```

```
DBMS_AUTO_SQLTUNE.EXECUTE_AUTO_TUNING_TASK(
  execution_name    IN VARCHAR2           := NULL,
  execution_params  IN DBMS_ADVISOR.argList := NULL,
  execution_desc    IN VARCHAR2           := NULL);
```

Parameters

Table 34-2 EXECUTE_AUTO_TUNING_TASK Function and Procedure Parameters

Parameter	Description
execution_name	A name to qualify and identify an execution. If not specified, it is generated by the advisor and returned by function.
execution_params	List of parameters (name, value) for the specified execution. The execution parameters have effect only on the execution for which they are specified. They override the values for the parameters stored in the task (set through the SET_AUTO_TUNING_TASK_PARAMETER Procedures).

Table 34-2 (Cont.) EXECUTE_AUTO_TUNING_TASK Function and Procedure Parameters

Parameter	Description
execution_desc	A 256-length string describing the execution

Usage Notes

Only SYS can invoke this subprogram. A tuning task can be executed multiple times without having to reset it.

Examples

```
EXEC DBMS_AUTO_SQLTUNE.EXECUTE_AUTO_TUNING_TASK('SYS_AUTO_SQL_TUNING_TASK');
```

34.3.2 REPORT_AUTO_TUNING_TASK Function

This procedure displays the results of an Automatic SQL Tuning task.

Syntax

```
DBMS_AUTO_SQLTUNE.REPORT_AUTO_TUNING_TASK(
  begin_exec      IN  VARCHAR2  := NULL,
  end_exec        IN  VARCHAR2  := NULL,
  type            IN  VARCHAR2  := 'TEXT',
  level           IN  VARCHAR2  := 'TYPICAL',
  section         IN  VARCHAR2  := ALL,
  object_id       IN  NUMBER     := NULL,
  result_limit    IN  NUMBER     := NULL)
RETURN CLOB;
```

Parameters

Table 34-3 REPORT_AUTO_TUNING_TASK Function Parameters

Parameter	Description
begin_exec	Name of the beginning task execution to use. If NULL, the report is generated for the most recent task execution.
end_exec	Name of the ending task execution to use. If NULL, the report is generated for the most recent task execution.
type	Type of the report to produce. Possible values are TEXT which produces a text report.
level	Level of detail in the report: <ul style="list-style-type: none"> BASIC: simple version of the report. Just show info about the actions taken by the advisor. TYPICAL: show information about every statement analyzed, including requests not implemented. ALL: highly detailed report level, also provides annotations about statements skipped over.

Table 34-3 (Cont.) REPORT_AUTO_TUNING_TASK Function Parameters

Parameter	Description
section	Section of the report to include: <ul style="list-style-type: none"> • SUMMARY: summary information • FINDINGS: tuning findings • PLAN: explain plans • INFORMATION: general information • ERROR: statements with errors • ALL: all sections
object_id	Advisor framework object id that represents a single statement to restrict reporting to. NULL for all statements. Only valid for reports that target a single execution.
result_limit	Maximum number of SQL statements to show in the report

Return Values

A CLOB containing the desired report.

Examples

```
-- Get the whole report for the most recent execution
SELECT DBMS_AUTO_SQLTUNE.REPORT_AUTO_TUNING_TASK
FROM DUAL;

-- Show the summary for a range of executions
SELECT
DBMS_AUTO_SQLTUNE.REPORT_AUTO_TUNING_TASK(:begin_exec, :end_exec,
'TEXT',
'TYPICAL', 'SUMMARY')
FROM DUAL;

-- Show the findings for the statement of interest
SELECT DBMS_AUTO_SQLTUNE.REPORT_AUTO_TUNING_TASK(:exec, :exec, 'TEXT',
'TYPICAL', 'FINDINGS', 5)
FROM DUAL;
```

34.3.3 SET_AUTO_TUNING_TASK_PARAMETER Procedures

This procedure updates the value of a SQL tuning parameter of type VARCHAR2 or NUMBER for SYS_AUTO_SQL_TUNING_TASK.

Syntax

```
DBMS_AUTO_SQLTUNE.SET_AUTO_TUNING_TASK_PARAMETER(
parameter IN VARCHAR2,
value IN VARCHAR2);

DBMS_AUTO_SQLTUNE.SET_AUTO_TUNING_TASK_PARAMETER(
```

```
parameter IN VARCHAR2,
value     IN NUMBER);
```

Parameters

Table 34-4 SET_AUTO_TUNING_TASK_PARAMETER Procedure Parameters

Parameter	Description
parameter	<p>Name of the parameter to set. The possible tuning parameters that can be set by this procedure using the parameter in the form VARCHAR2:</p> <ul style="list-style-type: none"> • MODE: tuning scope (comprehensive, limited) • USERNAME: user name under which the statement is parsed • DAYS_TO_EXPIRE: number of days until the task is deleted • EXECUTION_DAYS_TO_EXPIRE: number of days until the task execution is deleted • DEFAULT_EXECUTION_TYPE: default execution when none is specified by the EXECUTE_AUTO_TUNING_TASK Function and Procedure • TIME_LIMIT: global timeout in seconds • LOCAL_TIME_LIMIT: per-statement timeout in seconds • TEST_EXECUTE: <ul style="list-style-type: none"> – FULL - test-execute for as much time as necessary, up to the local time limit for the SQL (or the global task time limit if no SQL time limit is set) – AUTO - test-execute for an automatically chosen time proportional to the tuning time – OFF - do not test-execute • BASIC_FILTER: basic filter for SQL tuning set • OBJECT_FILTER: object filter for SQL tuning set • PLAN_FILTER: plan filter for SQL tuning set (see SELECT_SQLSET for possible values) • RANK_MEASURE1: first ranking measure for SQL tuning set • RANK_MEASURE2: second ranking measure for SQL tuning set • RANK_MEASURE3: third ranking measure for SQL tuning set • RESUME_FILTER: extra filter for SQL tuning sets besides BASIC_FILTER • SQL_LIMIT: maximum number of SQL statements to tune • SQL_PERCENTAGE: percentage filter of SQL tuning set statements <p>The following parameters are supported for the automatic tuning task only:</p> <ul style="list-style-type: none"> • ACCEPT_SQL_PROFILES: whether the task should accept SQL profiles automatically (TRUE or FALSE) • MAX_AUTO_SQL_PROFILES: maximum number of automatic SQL profiles allowed on the system, in sum • MAX_SQL_PROFILES_PER_EXEC: maximum number of SQL profiles that can be automatically implemented per execution of the task.
value	New value of the specified parameter

35

DBMS_AUTO_INDEX

The `DBMS_AUTO_INDEX` package provides the interface for managing auto indexes in an Oracle database.

This chapter contains the following topics:

- [DBMS_AUTO_INDEX Overview](#)
- [Summary of DBMS_AUTO_INDEX Subprograms](#)

35.1 DBMS_AUTO_INDEX Overview

The `DBMS_AUTO_INDEX` package is the interface for configuring auto indexes and generating reports of auto indexing operations in an Oracle database.

35.2 Summary of DBMS_AUTO_INDEX Subprograms

This table lists the `DBMS_AUTO_INDEX` package subprograms and briefly describes them.

Table 35-1 DBMS_AUTO_INDEX Package Subprograms

Procedure	Description
CONFIGURE Procedure	Configures settings related to automatic indexing.
DROP_AUTO_INDEXES Procedure	This procedure can be used to manually drop the automatically created indexes that overrides the retention parameter setting.
DROP_SECONDARY_INDEXES Procedure	Deletes all the indexes, except the ones used for constraints, from a schema or a table.
REPORT_ACTIVITY Function	Returns a report of the automatic indexing operations executed during a specific period in a database.
REPORT_LAST_ACTIVITY Function	Returns a report of the last automatic indexing operation executed in a database.
RECOMMEND Function	Run auto index on demand. This function analyzes all statements within a workload, creates invisible auto indexes and evaluates the performance of the statements in the workload with and without the candidate indexes.

35.2.1 CONFIGURE Procedure

This procedure configures settings related to automatic indexing.

Syntax

```
DBMS_AUTO_INDEX.CONFIGURE (  
    parameter_name          IN VARCHAR2,
```

```
parameter_value    IN VARCHAR2,  
allow              IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 35-2 CONFIGURE Procedure Parameters

Parameter	Description
parameter_name	<p>Automatic indexing configuration setting. It can have one of the following values:</p> <ul style="list-style-type: none"> • AUTO_INDEX_MODE: Modes of operation of auto indexes. It can have one of the following values: <ul style="list-style-type: none"> – IMPLEMENT: In this mode, new auto indexes are created as <i>visible</i> indexes and any existing <i>invisible</i> auto indexes are also set to <i>visible</i> indexes. In this mode, auto indexes are available to be used in SQL statements. – REPORT ONLY: In this mode, new auto indexes are created as <i>invisible</i> indexes and are not available to be used in SQL statements. – OFF: Setting the mode to OFF prevents new auto indexes from being considered and created. However, it does not disable existing auto indexes. • AUTO_INDEX_SCHEMA: Schemas to include or exclude from using auto indexes. Its value is case-sensitive and can include wildcards. Its behavior is controlled by the <code>allow</code> parameter. <p>The automatic indexing process manages two schema lists – the <i>inclusion list</i> and the <i>exclusion list</i>. The inclusion list contains the schemas that can use auto indexes. The exclusion list contains the schemas that cannot use auto indexes. Initially, both these lists are empty and all the schemas in the database can use auto indexes when automatic indexing is enabled for a database.</p> <p>If the inclusion list contains at least one schema, then only the schemas listed in the inclusion list can use auto indexes.</p> <p>If the inclusion list is empty and the exclusion list contains at least one schema, then all the schemas can use auto indexes, except the schemas listed in the exclusion list.</p> <p>If both the lists (the inclusion list and the exclusion list) contain at least one schema, then all the schemas can use auto indexes, except the schemas listed in the exclusion list.</p> • AUTO_INDEX_RETENTION_FOR_AUTO: Number of days for which the unused auto indexes are retained in the database, after which they are deleted. Default value is 373 days. • AUTO_INDEX_RETENTION_FOR_MANUAL: Number of days for which the unused

Table 35-2 (Cont.) CONFIGURE Procedure Parameters

Parameter	Description
	<p>manually created indexes (non-auto indexes) are retained in the database, after which they are deleted. When it is set to NULL, the manually created indexes are not deleted by the automatic indexing process. Default value is NULL.</p> <ul style="list-style-type: none"> • AUTO_INDEX_REPORT_RETENTION: Number of days for which automatic indexing logs are retained in the database before they are deleted. As automatic indexing report is generated based on these logs, automatic indexing report cannot be generated for a period beyond the value specified for AUTO_INDEX_REPORT_RETENTION. Default value is 373 days. • AUTO_INDEX_DEFAULT_TABLESPACE: Tablespace to use to store auto indexes. Default is NULL, which means the default permanent tablespace specified during the database creation is used to store auto indexes. Note that you cannot specify an Oracle-owned tablespace (such as SYSAUX) as the default tablespace. • AUTO_INDEX_SPACE_BUDGET: Percentage of tablespace size to use for auto indexes. This configuration setting can be used only when the default tablespace specified during the database creation is used for storing auto indexes. • AUTO_INDEX_COMPRESSION: Values to enable and disable advanced index compression for auto indexes. The supported values are: <ul style="list-style-type: none"> – ON: to enable advanced index compression for auto indexes – OFF: to disable advanced index compression for auto indexes The default value is OFF. • AUTO_INDEX_TABLE: You can use the AUTO_INDEX_TABLE configuration setting to specify tables that can use auto indexes. When you enable automatic indexing for a schema, all the tables in that schema can use auto indexes. However, if there is a conflict between the schema level and table level setting, the table level setting takes precedence. The parameter value is <schema_name>.<table_name>. You can then specify TRUE or FALSE to enable or disable auto indexes on the table respectively. To remove all tables from inclusion/exclusion list run the statement: EXEC

Table 35-2 (Cont.) CONFIGURE Procedure Parameters

Parameter	Description
parameter_value	<p>DBMS_AUTO_INDEX.CONFIGURE('AUTO_INDEX_TABLE', NULL);</p> <p>Value for the configuration setting specified in parameter_name.</p> <p>When it is set to NULL, the configuration setting is assigned the default value.</p>
allow	<p>This parameter is applicable only for the AUTO_INDEX_SCHEMA configuration setting and it can have one of the following values:</p> <ul style="list-style-type: none"> • TRUE: Add the specified schema to the inclusion list. • FALSE: Add the specified schema to the exclusion list. • NULL: Remove the specified schema from the list to which it is currently added. <p>Refer to the description of the AUTO_INDEX_SCHEMA configuration setting for more information about the inclusion list and the exclusion list.</p>

Examples

These examples are based on the assumption that the inclusion list and the exclusion list are initially empty.

The following example adds the SH and HR schemas to the exclusion list, so that only the SH and HR schemas cannot use auto indexes.

```
begin
  dbms_auto_index.configure(
    parameter_name => 'AUTO_INDEX_SCHEMA',
    parameter_value => 'SH',
    allow          => FALSE);

  dbms_auto_index.configure(
    parameter_name => 'AUTO_INDEX_SCHEMA',
    parameter_value => 'HR',
    allow          => FALSE);
end;
```

The following example removes the HR schema from the exclusion list, so that it can also use auto indexes. Now, only the SH schema cannot use auto indexes, because it is the only schema added to the exclusion list.

```
begin
  dbms_auto_index.configure(
    parameter_name => 'AUTO_INDEX_SCHEMA',
    parameter_value => 'HR',
    allow          => NULL);
end;
```

The following example removes all the schemas from the exclusion list, so that all the schemas can use auto indexes.

```
begin
  dbms_auto_index.configure(
    parameter_name => 'AUTO_INDEX_SCHEMA',
    parameter_value => NULL,
    allow          => TRUE);
end;
```

The following example adds the HR schema to the inclusion list, so that only the HR schema can use auto indexes.

```
begin
  dbms_auto_index.configure(
    parameter_name => 'AUTO_INDEX_SCHEMA',
    parameter_value => 'HR',
    allow          => TRUE);
end;
```

The following example sets the retention period for auto indexes to 90 days.

```
begin
  dbms_auto_index.configure(
    parameter_name => 'AUTO_INDEX_RETENTION_FOR_AUTO',
    parameter_value => '90');
end;
```

The following example sets the retention period for auto indexes to the default value of 373 days.

```
begin
  dbms_auto_index.configure(
    parameter_name => 'AUTO_INDEX_RETENTION_FOR_AUTO',
    parameter_value => NULL);
end;
```

The following example enables a table:

```
EXEC DBMS_AUTO_INDEX.CONFIGURE('AUTO_INDEX_TABLE', 'SH.SALES', TRUE);
```

To remove all tables from inclusion/exclusion list:

```
EXEC DBMS_AUTO_INDEX.CONFIGURE('AUTO_INDEX_TABLE', NULL);
```

35.2.2 DROP_AUTO_INDEXES Procedure

This procedure can be used to manually drop the automatically created indexes that overrides the retention parameter setting.

Syntax

```
DBMS_AUTO_INDEX.DROP_AUTO_INDEXES (
  owner          IN  VARCHAR2 DEFAULT NULL,
  index_name     IN  VARCHAR2 DEFAULT NULL,
  allow_recreate IN  BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 35-3 DROP_AUTO_INDEXES Procedure Parameters

Parameter	Description
owner	The name of the index owner.
index_name	The name of the index.
allow_recreate	Set this parameter to allow or disallow automatic creation of the dropped index again.

Examples

Drop a single index and allow recreate:

```
exec dbms_auto_index.drop_auto_indexes('SH','"SYS_AI_612ud3j5ngf0c"',TRUE);
```

Drop all indexes owned by SH and allow recreate:

```
exec dbms_auto_index.drop_auto_indexes('SH',NULL,TRUE);
```

Drop all indexes owned by HR, disallowing recreate and then change the recreation status back to allow:

```
exec dbms_auto_index.drop_auto_indexes('HR',NULL);
exec dbms_auto_index.drop_auto_indexes('HR', NULL, TRUE);
```

Usage Notes

- If the values of the parameters `owner` and `index_name` are explicitly set to `NULL`, all auto indexes which the user has privileges on will be dropped.
- If `owner` is explicitly specified and `index_name` is set to `NULL`, all auto indexes within the given schema will be dropped. The dropped indexes are not recreated automatically by the system by default. Set `allow_recreate` parameter to `TRUE` to change this behavior.
- This procedure updates the `allow_recreate` status associated with the dropped indexes from `FALSE` to `TRUE` and vice-versa.

35.2.3 DROP_SECONDARY_INDEXES Procedure

This procedure deletes all the indexes, except the ones used for constraints, from a schema or a table.

Syntax

```
DBMS_AUTO_INDEX.DROP_SECONDARY_INDEXES (
  ownname      IN  VARCHAR2 DEFAULT NULL,
  tablename    IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 35-4 DROP_SECONDARY_INDEXES Procedure Parameters

Parameter	Description
ownname	(Optional) Name of the schema from which all the indexes need to be deleted. Note: The indexes used for constraints are not deleted.
tablename	(Optional) Name of the table from which all the indexes need to be deleted. Note: The indexes used for constraints are not deleted.

Examples

The following example deletes all the indexes, except the ones used for constraints, from the SH schema.

```
begin
  dbms_auto_index.drop_secondary_indexes('SH');
end;
```

The following example deletes all the indexes, except the ones used for constraints, from the EMP table in the HR schema.

```
begin
  dbms_auto_index.drop_secondary_indexes('HR', 'EMP');
end;
```

The following example deletes all the indexes, except the ones used for constraints, for which the user has the delete privileges from all the schemas in a database.

```
begin
  dbms_auto_index.drop_secondary_indexes;
end;
```

35.2.4 REPORT_ACTIVITY Function

This function returns a report of the automatic indexing operations executed during a specific period in a database.

Syntax

```
DBMS_AUTO_INDEX.REPORT_ACTIVITY (
  activity_start IN TIMESTAMP WITH TIME ZONE DEFAULT SYSTIMESTAMP -
1,
  activity_end   IN TIMESTAMP WITH TIME ZONE DEFAULT SYSTIMESTAMP,
  type          IN VARCHAR2 DEFAULT 'TEXT',
  section       IN VARCHAR2 DEFAULT 'ALL',
  level         IN VARCHAR2 DEFAULT 'TYPICAL')
RETURN CLOB;
```

Parameters

Table 35-5 REPORT_ACTIVITY Function Parameters

Parameter	Description
activity_start	Time starting from which the executed automatic indexing operations are considered for the report. If NULL is specified, the last executed automatic indexing operation is considered for the report. If no value is specified for this parameter, then the current time minus one day (24 hours) is considered at the start time.
activity_end	Time till which the executed automatic indexing operations are considered for the report. If no value is specified, then the current time is considered as the end time.
type	Format of the report. It can have one of the following values: <ul style="list-style-type: none"> TEXT HTML XML The default value is TEXT.
section	Sections to include in the report. It can have a combination of the following values: <ul style="list-style-type: none"> SUMMARY: Include only the summary details section in the report. INDEX_DETAILS: Include only the auto index details section in the report. VERIFICATION_DETAILS: Include only the auto index verification details section in the report. ERRORS: Include only the error details section in the report. ALL: Include all the sections (summary details, auto index details, auto index verification details, and error details) in the report. This is the default value. A combination of these values can be specified using the + or - operators as shown in the following examples: <ul style="list-style-type: none"> SUMMARY +INDEX_DETAILS +ERRORS: Include summary details, auto index details, and error details sections in the report. ALL -ERRORS: Include all the sections in the report, except the error details section.

Table 35-5 (Cont.) REPORT_ACTIVITY Function Parameters

Parameter	Description
level	Level of automatic indexing information to include in the report. It can have one of the following values: <ul style="list-style-type: none">• BASIC: Include basic automatic indexing information in the report.• TYPICAL: Include typical automatic indexing information in the report. This is the default value.• ALL: Include all the automatic indexing information in the report.

Return Value

A report of the automatic indexing operations executed during the specified period in a database.

Examples

The following example generates a typical report of the automatic indexing operations executed in the last 24 hours. The report is generated in the text format and contains all the sections (summary details, auto index details, auto index verification details, and error details).

```
declare
  report clob := null;
begin
  report := dbms_auto_index.report_activity();
end;
```

35.2.5 REPORT_LAST_ACTIVITY Function

This function returns a report of the last automatic indexing operation executed in a database.

Syntax

```
DBMS_AUTO_INDEX.REPORT_LAST_ACTIVITY (
  type          IN VARCHAR2 DEFAULT 'TEXT',
  section       IN VARCHAR2 DEFAULT 'ALL',
  level         IN VARCHAR2 DEFAULT 'TYPICAL')
RETURN CLOB;
```

Parameters

Table 35-6 REPORT_LAST_ACTIVITY Function Parameters

Parameter	Description
type	<p>Format of the report. It can have one of the following values:</p> <ul style="list-style-type: none"> TEXT HTML XML <p>The default value is TEXT.</p>
section	<p>Sections to include in the report. It can have a combination of the following values:</p> <ul style="list-style-type: none"> SUMMARY: Include only the summary details section in the report. INDEX_DETAILS: Include only the auto index details section in the report. VERIFICATION_DETAILS: Include only the auto index verification details section in the report. ERRORS: Include only the error details section in the report. ALL: Include all the sections (summary details, auto index details, auto index verification details, and error details) in the report. This is the default value. <p>A combination of these values can be specified using the + or - operators as shown in the following examples:</p> <ul style="list-style-type: none"> SUMMARY +INDEX_DETAILS +ERRORS: Include summary details, auto index details, and error details sections in the report. ALL -ERRORS: Include all the sections in the report, except the error details section.
level	<p>Level of automatic indexing information to include in the report. It can have one of the following values:</p> <ul style="list-style-type: none"> BASIC: Include basic automatic indexing information in the report. TYPICAL: Include typical automatic indexing information in the report. This is the default value. ALL: Include all the automatic indexing information in the report.

Return Value

A report of the last automatic indexing operation executed in a database.

Examples

The following example generates a typical report of the last automatic indexing operation executed in a database. The report is generated in the text format and contains all the

sections (summary details, auto index details, auto index verification details, and error details).

```
declare
  report clob := null;
begin
  report := dbms_auto_index.report_last_activity();
end;
```

35.2.6 RECOMMEND Function

Run auto indexing on demand.

This function analyzes all statements within a workload, creates invisible auto indexes and evaluates the performance of the statements in the workload both with and without the candidate indexes. If called in `IMPLEMENT` mode, this function marks as visible any indexes that improve performance. If called in `REPORT ONLY` mode, all indexes created in this task are dropped at the end of the task. In that case you can run `DBMS_AUTO_INDEX.REPORT_ACTIVITY()` to view the results.

Syntax

```
DBMS_AUTO_INDEX.RECOMMEND (
  WORKLOAD_START_TIME IN TIMESTAMP DEFAULT NULL,
  WORKLOAD_END_TIME   IN TIMESTAMP DEFAULT NULL,
  AUTO_INDEX_MODE      IN VARCHAR2 )
RETURN VARCHAR2;
```

Parameters

Table 35-7 RECOMMEND Function Parameters

Parameter	Description
WORKLOAD_START_TIME	The starting point for analysis within the ASTS (Automatic SQL tuning set) workload. The default NULL means all statements from the start of the workload to WORKLOAD_END_TIME are analyzed.
WORKLOAD_END_TIME	The end point for analysis within the ASTS workload. The default NULL means that all statements from WORKLOAD_START_TIME to the end of the workload are analyzed.
AUTO_INDEX_MODE	<ul style="list-style-type: none"> REPORT ONLY Analysis is performed, but there is no change. Created indexes are dropped. See <code>DBMS_AUTO_INDEX.REPORT_ACTIVITY()</code> to view verification details. IMPLEMENT Marks performance-improving indexes as visible. The default is <code>REPORT ONLY</code> .

Return Value

The execution name of the task is returned.

Example 35-1 Using the RECOMMEND Function

Execute the function and then call `DBMS_AUTO_INDEX.REPORT_LAST_ACTIVITY` to return the report.

```
var tname varchar2(100)
EXEC :tname := dbms_auto_index.recommend()
SELECT :tname task_name FROM dual;
```

Get the report:

```
set linesize 250
set trims on
set pagesize 1000
set long 10000000
column report format a120
spool report.txt
SELECT dbms_auto_index.report_last_activity('text','all','all') report FROM
dual;
spool off
```

36

DBMS_AUTO_MV

DBMS_AUTO_MV contains subprograms for configuring automatic materialized views.

This chapter contains the following topics:

- [Using DBMS_AUTO_MV](#)
- [Summary of DBMS_AUTO_MV Subprograms](#)

36.1 Using DBMS_AUTO_MV

The DBMS_AUTO_MV package contains functions and procedures to manage automatic materialized views.

This package is owned by SYS, so EXECUTE package privilege is required by non-SYS users. Grant EXECUTE privilege on the package to the users.

36.2 Summary of DBMS_AUTO_MV Subprograms

This table lists the DBMS_AUTO_MV package subprograms and briefly describes them.

Table 36-1 DBMS_AUTO_MV Package Subprograms

Subprogram	Description
CONFIGURE Procedure	Enables, disables, and configures the various parameters of the automatic materialized view feature.
DROP_AUTO_MVS Procedure	Drops automatic materialized views that were created. This routine can only be executed by DBA.
RECOMMEND Function	This function allows a user to manually generate automatic materialized view recommendations for SQL statements in a given SQL tuning set
REFRESH Procedure	This procedure allows a user to manually refresh all stale automatic materialized views in the system unconditionally.
REPORT_ACTIVITY Function	This function generates a report on the automatic materialized view activities and usage for a specified time duration. The report can be generated in text, HTML, or XML formats as specified by the argument type.
REPORT_LAST_ACTIVITY Function	This function generates a report on the most recent automatic materialized view activities and usage. The report can be generated in text, HTML, or XML formats as specified by the argument type.

36.2.1 CONFIGURE Procedure

This procedure enables, disables, and configures the various parameters of the automatic materialized view feature.

Syntax

```
DBMS_AUTO_MV.CONFIGURE (
    parameter  IN VARCHAR2,
    value      IN VARCHAR2,
    allow      IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 36-2 CONFIGURE Procedure Parameters

Parameter	Description
parameter	The name of the parameter to be modified. Parameter names are not case sensitive.
value	The value of the specified parameter.
allow	This parameter allows or disallows various schemas or app modules. It is applicable only for the <code>AUTO_MV_SCHEMA</code> and <code>AUTO_MV_APP_MODULE</code> parameters.

Parameters

Table 36-3 CONFIGURE Parameters Names

Parameter	Description
<code>AUTO_MV_MODE</code>	<p>Enables, disables, or engages report-only mode.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> <code>OFF</code>: No recommendations are made. This is the default value. <code>REPORT ONLY</code>: This mode generates recommendations and stores them in the internal repository so they are available to the DBA through <code>DBA_AUTO_MV_ANALYSIS_RECOMMENDATIONS</code>. <code>IMPLEMENT</code>: This mode generates, verifies, and publishes recommendations, or drops them.
<code>AUTO_MV_MAINT_TASK</code>	<p>Activates and deactivated automatic maintenance of materialized views.</p> <ul style="list-style-type: none"> <code>ENABLE</code>: Activates automatic maintenance of materialized views. <code>DISABLE</code>: Deactivates the automatic maintenance of materialized views. If automatic maintenance of materialized views is in progress, it finishes the maintenance. This is the default value. <code>CLEANUP_AND_DISABLE</code>: Drops all automatic materialized views, and deactivates automatic maintenance of materialized views. If automatic materialized views maintenance is in progress, it finishes the maintenance before the task is deactivated.

Table 36-3 (Cont.) CONFIGURE Parameters Names

Parameter	Description
AUTO_MV_SPACE_BUDGET	<p>Specifies the amount of space budget available for implementing automatic materialized views. The total space value is the sum of currently space used by all user tables (i.e. not system tables). The calculation does not include user access structures (like indexes or materialized views). Possible values are:</p> <ul style="list-style-type: none"> Budget in percent: A positive number ending with % symbol designating the percentage of currently utilized space for all user tables. Budget in GB: A positive integer ending with GB that indicates the absolute space limit for automatic materialized views. For example, 10GB indicates 10 Gigabytes. The minimum value is 1GB but no maximum value. <p>The default budget is 10% of the total size of user tables.</p>
AUTO_MV_DEFAULT_TABLESPACE	<p>Specifies the tablespace to place automatic materialized views. Possible values are:</p> <ul style="list-style-type: none"> Tablespace name: A valid Oracle tablespace name to be used when creating new automatic materialized views. Quoted identifiers are supported. NULL: A new automatic materialized view is created in the default tablespace of the owner of parent object. If automatic materialized view has more than one parent object, such as materialized views defined on multiple base tables, the default tablespace of the owner of largest base table is selected. This is the default value. <p>If the value is changed dynamically, it takes effect the next time automatic materialized views recommendations are implemented.</p>
AUTO_MV_TEMP_TABLESPACE	<p>Specifies the temporary tablespace while creating or refreshing automatic materialized views. Possible values are:</p> <ul style="list-style-type: none"> Tablespace name: A valid Oracle temp tablespace name to be used when creating new automatic materialized views and the data needs to be spilled to temp. NULL: The temp table space assigned to the owner of the largest parent object of the automatic materialized views. This is the default value. <p>If the value is changed dynamically, it takes effect the next time recommendations are implemented.</p>
AUTO_MV_RETENTION	<p>Specifies the number of days automatic materialized views exists without being utilized by a query. When the expiry period is reached, the materialized view is dropped.</p> <p>Positive integer: An integer between 1 and 373. The default value is 33 days.</p>
AUTO_MV_ANALYZE_REPORT_RETENTION	<p>Specifies the maximum number of days to retain analysis and recommendation history.</p> <p>Positive integer: An integer value between 0 and 90. Value 0 implies that history is not maintained. The default value is 31.</p> <p>The history of analysis and verification is retained in the DBA_AUTO_MV_* dictionary tables.</p>
AUTO_MV_ANALYZE_WORKLOAD_WINDOW	<p>Specifies the maximum number of hours to make recommendations.</p> <p>Positive integer: An integer value between 1 and 8760. The default value is 24.</p>

Table 36-3 (Cont.) CONFIGURE Parameters Names

Parameter	Description
AUTO_MV_ANALYZE_WORKLOAD_MIN_TIME	<p>Specifies the minimum time in seconds for a query to be considered for automatic materialized views recommendation. Queries below this threshold are not considered for recommendations.</p> <p>Positive value: An integer value between 0 and 3600 (1 hour). The default value is 120 (2 minutes).</p>
AUTO_MV_SCHEMA	<p>Specifies the schemas to include or exclude from creation of automatic materialized views.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> TRUE: Adds the specified schema to the inclusion list. FALSE: Adds the specified schema to the exclusion list. NULL: Removes the specified schema from the list to which it is currently added. <p>If both the lists (the inclusion list and the exclusion list) contain at least one schema, then all the schemas can use automatic materialized views, except the schemas listed in the exclusion list.</p>
AUTO_MV_APPLICATION_MODULE	<p>Specifies application modules to include or exclude from creation of automatic materialized views. Possible values are:</p> <ul style="list-style-type: none"> TRUE: Adds the specified application module to the inclusion list. FALSE: Adds the specified application module to the exclusion list. NULL: Removes the specified application module from the list to which it is currently added. <p>Initially, the inclusion list and the exclusion list are empty and we can create automatic materialized views under all application modules when automatic automatic materialized views are enabled for a database.</p>
AUTO_MV_VERIFICATION_REPORT_RETENTION	<p>Specifies the maximum number of days to retain the verification history.</p> <p>Positive value: An integer value between 0 and 90 for the number of days the history of analysis and verification is retained in the DBA_AUTO_MV_* dictionary tables. Value 0 implies that history is not maintained. The default value is 31.</p>
AUTO_MV_MAIN_T_REPORT_RETENTION	<p>Specifies the maximum number of days to retain history of automatic materialized view maintenance.</p> <p>Positive integer: An integer value between 0 and 90 for the number of days the history of automatic materialized view refreshes is retained in the DBA_AUTO_MV_REFRESH_* dictionary tables. Value 0 means no history is maintained. The default value is 31.</p>

Example

```

begin
  dbms_auto_mv.configure ('AUTO_MV_SPACE_BUDGET', '50%');
end;
begin
  dbms_auto_mv.configure ('AUTO_MV_SCHEMA', 'SH', FALSE);
  dbms_auto_mv.configure ('AUTO_MV_SCHEMA', 'SCOTT');
end;
/

```

36.2.2 DROP_AUTO_MVS Procedure

This procedure drops automatic materialized views that were created. This routine can only be executed by DBA.

Syntax

```
DBMS_AUTO_MV.DROP_AUTO_MVS (
  owner          IN VARCHAR2,
  mv_name        IN VARCHAR2,
  allow_recreate IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 36-4 DROP_AUTO_MVS Procedure Parameters

Parameter	Description
OWNER	Specifies the name of the owner of the automatic materialized views. If OWNER is explicitly specified and MV_NAME is set to null, all automatic materialized views which the user has privileges are dropped. If OWNER is explicitly specified and MV_NAME is set to null, all automatic materialized views with the given OWNER are dropped. Dropped automatic materialized views are not recreated automatically by the system as default.
MV_NAME	The name of the automatic materialized views.
ALLOW_RECREATE	Enables or disables the automatic creation of dropped automatic materialized views. FALSE disables the automatic creation of dropped automatic materialized views. This is default. TRUE enables the automatic creation of dropped automatic materialized views.

Examples

```
begin
  dbms_auto_mv.DROP_AUTO_MVS ('SH');
end;
/

begin
  dbms_auto_mv.DROP_AUTO_MVS ('SH', 'AUTO_MV$$_G2MKPB9SA1FB7');
end;
/
```

36.2.3 RECOMMEND Function

This function allows a user to manually generate automatic materialized view recommendations for SQL statements in a given SQL tuning set

Syntax

```
DBMS_AUTO_MV.RECOMMEND (
  sts_owner          IN VARCHAR2 DEFAULT 'SYS',
```

```

sts_name          IN VARCHAR2 DEFAULT 'SYS_AUTO_STS',
workload_start_time IN TIMESTAMP DEFAULT NULL,
workload_end_time  IN TIMESTAMP DEFAULT NULL,
automv_mode        IN VARCHAR2 DEFAULT 'REPORT ONLY')
RETURN VARCHAR2;
```

Parameters

Table 36-5 RECOMMEND Function Parameters

Parameter	Description
sts_owner	The name of the owner of the SQL tuning set. The default value is SYS.
sts_name	The name of the SQL tuning set. The default value is SYS_AUTO_STS.
workload_start_time	The start time of the workload window. The value NULL means that the default is chosen. The default is SYSDATE minus the number of hours defined by AUTO_MV_ANALYZE_WORKLOAD_WINDOW.
workload_end_time	The end time of the workload window.
automv_mode	When AUTOMV_MODE is set to REPORT ONLY, which is the default mode, the function will only output the recommendations. If this parameter is set to IMPLEMENT, then the recommended automatic materialized views will be verified and implemented.

Return Value

The execution name (`execution_name`) to be used in `DBA_AUTO_MV%` catalog views.

Examples

In the following examples, the default SQL tuning set, `SYS_AUTO_STS` is used. Make sure that `SYS_AUTO_STS` contains the required workload to generate the automatic materialized views.

Example 1: Generate and report recommendations using `SYS_AUTO_STS` for the past 24 hours. Note that the default behavior of this function is `REPORT ONLY`, so no automatic materialized view will be implemented.

```

var exec_name varchar2(200);
begin
    :exec_name := dbms_auto_mv.recommend();
end;
/

SELECT * FROM DBA_AUTO_MV_ANALYSIS_RECOMMENDATIONS
        WHERE exec_name = :exec_name;
```


Example 2: Generate and publish recommendations using `SYS_AUTO_STS` for the past 24 hours.

```
var exec_name varchar2(200);
begin
    :exec_name := dbms_auto_mv.recommend(automv_mode=>'IMPLEMENT');
end;
/
```

36.2.4 REFRESH Procedure

This procedure allows a user to manually refresh all stale automatic materialized views in the system unconditionally.

Syntax

```
DBMS_AUTO_MV.REFRESH ();
```

Example

```
begin
    dbms_auto_mv.refresh();
end;
/
```

36.2.5 REPORT_ACTIVITY Function

This function generates a report on the automatic materialized view activities and usage for a specified time duration. The report can be generated in text, HTML, or XML formats as specified by the argument type.

Syntax

```
DBMS_AUTO_MV.REPORT_ACTIVITY (
    activity_start      IN  TIMESTAMP WITH TIME ZONE DEFAULT SYSTIMESTAMP
-1,
    activity_end        IN  TIMESTAMP WITH TIME ZONE DEFAULT SYSTIMESTAMP,
    type                IN  VARCHAR2  DEFAULT 'TEXT',
    section             IN  VARCHAR2  DEFAULT 'ALL',
    level               IN  VARCHAR2  DEFAULT 'TYPICAL')
RETURN CLOB;
```

Parameters

Table 36-6 REPORT_ACTIVITY Function Parameters

Parameter	Description
<code>activity_start</code>	The start time for report generation.
<code>activity_end</code>	The end time for report generation.

Table 36-6 (Cont.) REPORT_ACTIVITY Function Parameters

Parameter	Description
type	<p>The format type in which the report needs to be generated. The possible values are:</p> <ul style="list-style-type: none"> • TEXT • HTML • XML <p>The default value is TEXT.</p>
section	<p>The section can be a combination of the following:</p> <ul style="list-style-type: none"> • SUMMARY • MV_DETAILS • QUERY_DETAILS • VERIFICATION_DETAILS • ALL <p>The default value is ALL.</p> <p>You can generate a specific combination of report by using + or - operators. For example, when section is specified as SUMMARY+MV_DETAILS, the generated report will contain only the summary and the details about the automatic materialized view.</p>
level	<p>The level can be either BASIC, TYPICAL, or ALL. When the level is set to BASIC, a minimum set of information regarding the most recent automatic materialized view activity is reported. On the other hand, when the level is set to ALL, a detailed report is generated.</p> <p>The default value is TYPICAL.</p>

Return Value

This function returns the report as a CLOB.

Examples

Example 1: The following call to REPORT_ACTIVITY() generates an HTML output for all the automatic materialized view activities:

```
select dbms_auto_mv.report_activity(type => 'HTML') from dual;
```

36.2.6 REPORT_LAST_ACTIVITY Function

This function generates a report on the most recent automatic materialized view activities and usage. The report can be generated in text, HTML, or XML formats as specified by the argument type.

Syntax

```
DBMS_AUTO_MV.REPORT_LAST_ACTIVITY (
    type          IN VARCHAR2 DEFAULT 'TEXT',
```

```

    section          IN  VARCHAR2  DEFAULT 'ALL',
    level           IN  VARCHAR2  DEFAULT 'TYPICAL')
RETURN CLOB;

```

Parameters

Table 36-7 REPORT_LAST_ACTIVITY Function Parameters

Parameter	Description
type	<p>The format type in which the report needs to be generated. The possible values are:</p> <ul style="list-style-type: none"> • TEXT • HTML • XML <p>The default value is TEXT.</p>
section	<p>The section can be a combination of the following:</p> <ul style="list-style-type: none"> • SUMMARY • MV_DETAILS • QUERY_DETAILS • VERIFICATION_DETAILS • ALL <p>The default value is ALL.</p> <p>You can generate a specific combination of report by using + or - operators. For example, when section is specified as SUMMARY+MV_DETAILS, the generated report will contain only the summary and the details about the automatic materialized view.</p>
level	<p>The level can be either BASIC, TYPICAL, or ALL. When the level is set to BASIC, a minimum set of information regarding the most recent automatic materialized view activity is reported. On the other hand, when the level is set to ALL, a detailed report is generated.</p> <p>The default value is TYPICAL.</p>

Return Value

This functions returns the report as a CLOB.

Examples

Example 1: The following call to REPORT_LAST_ACTIVITY() generates a TEXT output:

```
select dbms_auto_mv.report_last_activity('TEXT', 'ALL', 'TYPICAL') from dual;
```

Example 2: The following call to REPORT_LAST_ACTIVITY() generates an XML output:

```
select dbms_auto_mv.report_last_activity('XML', 'ALL', 'TYPICAL') from dual;
```

Example 3: The following call to REPORT_LAST_ACTIVITY() generates an HTML output:

```
select dbms_auto_mv.report_last_activity('HTML', 'ALL', 'TYPICAL')  
from dual;
```

37

DBMS_AUTO_REPORT

The `DBMS_AUTO_REPORT` package provides an interface to view SQL Monitoring and Real-time Automatic Database Diagnostic Monitor (ADDM) data that has been captured into Automatic Workload Repository (AWR). It also provides subprograms to control the behavior of how these data are captured to AWR.



See Also:

Oracle Database SQL Tuning Guide for more information about reporting database operations

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_AUTO_REPORT Subprograms](#)

37.1 DBMS_AUTO_REPORT Overview

This package provides an interface to view SQL Monitoring and Real-time ADDM data that has been captured into AWR. It also provides subprograms to control the behavior of how these data are captured to AWR. Captured data are stored in AWR and exposed via 2 views: `DBA_HIST_REPORTS` and `DBA_HIST_REPORTS_DETAILS`.

37.2 DBMS_AUTO_REPORT Security Model

This package is available to `PUBLIC` and performs its own security checking.

37.3 Summary of DBMS_AUTO_REPORT Subprograms

This table describes the parameters of the `DBMS_AUTO_REPORT` package subprograms.

Table 37-1 DBMS_AUTO_REPORT Package Subprograms

Subprogram	Description
<code>FINISH_REPORT_CAPTURE Procedure</code>	Ends the complete capture of SQL monitor data that was started with the <code>START_REPORT_CAPTURE Procedure</code> .
<code>REPORT_REPOSITORY_ID ETAIL Function</code>	Obtains the stored report for a given report ID
<code>REPORT_REPOSITORY_ID ETAIL_XML Function</code>	Obtains the stored XML report for a given report ID

Table 37-1 (Cont.) DBMS_AUTO_REPORT Package Subprograms

Subprogram	Description
REPORT_REPOSITORY_LIST_XML Function	Obtains an XML report of the list of SQL Monitor and Real-time ADDM data captured in AWR
START_REPORT_CAPTURE Procedure	Captures SQL monitor data of any newly monitored SQLs every minute since the last run of the capture cycle, and stores it in AWR.
PURGE_ALL_REPORTS Function	Purges all SQL Monitor content from WRP\$_ tables associated with a single DBID (if specified), or from all non-local DBIDs if no DBID is specified.
PURGE_REPORTS_BY_RETENTION Function	Purges SQL Monitor reports older than the retention period from WRP\$_ tables associated with a specified container DBID, or if no DBID is specified, then it purges old reports from all non-local containers.

37.3.1 FINISH_REPORT_CAPTURE Procedure

This procedure ends the complete capture of SQL monitor data that was started with the `START_REPORT_CAPTURE` procedure.

After calling this subprogram, capture of data continues every minute except that it is not captured for all active SQLs but only for those deemed important, namely the top 5 SQLs (by elapsed time, or elapsed time*DOP in case of PQ) whose monitoring has completed.

Syntax

```
DBMS_AUTO_REPORT.FINISH_REPORT_CAPTURE;
```

Related Topics

- [START_REPORT_CAPTURE Procedure](#)
This procedure captures SQL monitor data of any newly monitored SQLs every minute since the last run of the capture cycle, and stores it in AWR.

37.3.2 REPORT_REPOSITORY_DETAIL Function

This procedure obtains the stored report for a given report ID in the specified format such as XML or HTML.

Syntax

```
DBMS_AUTO_REPORT.REPORT_REPOSITORY_DETAIL (
  rid          IN NUMBER      DEFAULT NULL,
  type        IN VARCHAR2    DEFAULT 'XML',
  base_path   IN VARCHAR2    DEFAULT NULL)
RETURNS CLOB
```

Parameters

Table 37-2 REPORT_REPOSITORY_DETAIL Function Parameters

Parameter	Description
rid	ID of the stored report which returned by the function
type	Desired format of the report. Values can be 'XML', 'TEXT', 'HTML', 'EM' or 'ACTIVE'. The last two options generate a report in the same format called active HTML. Default value is 'XML'.
base_path	Unused/Non-operative

Return Values

The persisted report for the given record ID

37.3.3 REPORT_REPOSITORY_DETAIL_XML Function

This procedure obtains the stored XML report for a given report ID.

Syntax

```
DBMS_AUTO_REPORT.REPORT_REPOSITORY_DETAIL_XML (
    rid          IN NUMBER      DEFAULT NULL,
    base_path    IN VARCHAR2   DEFAULT NULL)
RETURNS XMLTYPE
```

Parameters

Table 37-3 REPORT_REPOSITORY_DETAIL_XML Function Parameters

Parameter	Description
rid	ID of the stored report which returned by the function
base_path	Unused/Non-operative

Return Values

The persisted XML report for the given record ID

37.3.4 REPORT_REPOSITORY_LIST_XML Function

This procedure obtains an XML report of the list of SQL Monitor and Real-time ADDM data captured in AWR.

The input parameters can be used to select and restrict which captured data will be included in the list report. All parameters are optional.

Syntax

```
DBMS_AUTO_REPORT.REPORT_REPOSITORY_LIST_XML (
    active_since IN DATE      DEFAULT NULL,
    active_upto  IN DATE      DEFAULT NULL,
    snapshot_id  IN NUMBER    DEFAULT NULL,
```

```

        dbid                IN NUMBER    DEFAULT NULL,
        inst_id             IN NUMBER    DEFAULT NULL,
        con_dbid            IN NUMBER    DEFAULT NULL,
        session_id          IN NUMBER    DEFAULT NULL,
        session_serial      IN NUMBER    DEFAULT NULL,
        component_name      IN VARCHAR2  DEFAULT NULL,
        key1                 IN VARCHAR2  DEFAULT NULL,
        key2                 IN VARCHAR2  DEFAULT NULL,
        key3                 IN VARCHAR2  DEFAULT NULL,
        report_level        IN VARCHAR2  DEFAULT 'TYPICAL',
        base_path            IN VARCHAR2  DEFAULT NULL)
    RETURNS XMLTYPE

```

Parameters

Table 37-4 *REPORT_REPOSITORY_LIST_XML Function Parameters*

Parameter	Description
active_since	Start of a time range used to select data. When a time range is specified, only those data are included in the list that were active during the time range. When no value is specified the time range is chosen as the last 24 hours ending at the current system time.
active_upto	Same as active_since except that it is the end of the time range
snapshot_id	If a value is specified, only those data captured during the specified snapshot ID are included in the list report. If no value is specified, no filtering is performed on snapshot ID.
dbid	If a value is specified, only those data captured for the specified database ID are included in the list report. If no value is specified, no filtering is performed on database ID
inst_id	If a value is specified, only those data captured on the specified instance number are included in the list report. If no value is specified, no filtering is performed on the instance ID.
con_dbid	If a value is specified, only those data captured on the specified container DBID are included in the list report. If no value is specified, no filtering is performed on the container DBID.
session_id	If a value is specified, only those data captured for the specified session ID are included in the list report. If no value is specified, no filtering is performed on session ID.
session_serial	If a value is specified, only those data captured for the specified session are included in the list report. If no value is specified, no filtering is performed on session serial number. This parameter should be used in conjunction with the session_id parameter.
component_name	Can be 'sqlmonitor' for SQL Monitor data or 'rtaddm' for Real-time ADDM data. If a value is specified then data pertaining only to the specified component will be included in the list report. If no value is specified, no filtering is performed.
key1	Key value relevant to a component. For SQL Monitor, key1 is the SQL ID of the captured SQL statement. If a value is specified, only those data having specified value for key1 are included, else no filtering is performed on key1.
key2	Key value relevant to a component. For SQL Monitor, key2 is the SQL execution ID of the captured SQL statement. If a value is specified, only those data having specified value for key2 are included, else no filtering is performed on key2.

Table 37-4 (Cont.) REPORT_REPOSITORY_LIST_XML Function Parameters

Parameter	Description
key3	Key value relevant to a component. For SQL Monitor, key3 is the SQL execution start time of the captured SQL statement. If a value is specified, then only those data having specified value for key3 are included, else no filtering is performed on key3.
report_level	Currently only 'TYPICAL' is used
base_path	Unused/Non-operative

37.3.5 START_REPORT_CAPTURE Procedure

This procedure captures SQL monitor data of any newly monitored SQLs every minute since the last run of the capture cycle, and stores it in AWR.

Every capture cycle attempts to capture data for SQLs that are not currently executing or queued. This is a complete capture since data of all newly monitored SQLs is captured. It continues to run every minute until it is explicitly ended with the [FINISH_REPORT_CAPTURE Procedure](#). In the case of a RAC system, the capture will start on each node of the cluster.

Syntax

```
DBMS_AUTO_REPORT.START_REPORT_CAPTURE;
```

37.3.6 PURGE_ALL_REPORTS Function

This function purges all SQL Monitor content from WRP\$_ tables associated with a single DBID (if specified), or from all non-local DBIDs if no DBID is specified.

Syntax

```
DBMS_AUTO_REPORT.PURGE_ALL_REPORTS (
    dbid IN NUMBER DEFAULT NULL,
);
```

This function does not return a value.

37.3.7 PURGE_REPORTS_BY_RETENTION Function

This function purges SQL Monitor reports older than the retention period from WRP\$_ tables associated with a specified container DBID, or if no DBID is specified, then it purges old reports from all non-local containers.

Only the reports that are older than the retention period are purged.

Syntax

```
DBMS_AUTO_REPORT.PURGE_REPORTS_BY_RETENTION (
    dbid IN NUMBER DEFAULT NULL,
);
```

This function does not return a value.

DBMS_AUTO_TASK_ADMIN

The `DBMS_AUTO_TASK_ADMIN` package provides an interface to `AUTOTASK` functionality. It is used by the DBA as well as Enterprise Manager to access the `AUTOTASK` controls. Enterprise Manager also uses the `AUTOTASK` Advisor.

See Also:

Oracle Database Administrator's Guide for more information about "Configuring Automated Maintenance Task"

This chapter contains the following sections:

- [Deprecated Subprograms](#)
- [Security Model](#)
- [Constants](#)
- [Summary of DBMS_AUTO_TASK_ADMIN Subprograms](#)

38.1 DBMS_AUTO_TASK_ADMIN Deprecated Subprograms

The `DBMS_AUTO_TASK_ADMIN` `OVERVERRIDE_PRIORITY` subprogram has been deprecated.

Note:

Oracle recommends that you do not use deprecated procedures in new applications. Support for deprecated features is for backward compatibility only.

- [OVERVERRIDE_PRIORITY Procedures](#)

38.2 DBMS_AUTO_TASK_ADMIN Security Model

`DBMS_AUTO_TASK_ADMIN` is a definer's rights package, and `EXECUTE` is automatically granted to `DBA`, `IMP_FULL_DATABASE` and `DATAPUMP_IMP_FULL_DATABASE`.

38.3 DBMS_AUTO_TASK_ADMIN Constants

The `DBMS_AUTO_TASK_ADMIN` package defines several constants that can be used for specifying parameter values.

These constants shown in the following table:

Table 38-1 DBMS_AUTO_TASK_ADMIN Constants

Name	Type	Value	Description
PRIORITY_MEDIUM	VARCHAR2	'MEDIUM'	Task with this priority should be executed as time permits
PRIORITY_HIGH	VARCHAR2	'HIGH'	Task with this priority should be executed within the current Maintenance Window
PRIORITY_URGENT	VARCHAR2	'URGENT'	Task with this priority is to be executed at the earliest opportunity

38.4 Summary of DBMS_AUTO_TASK_ADMIN Subprograms

This table lists the DBMS_AUTO_TASK_ADMIN subprograms and briefly describes them.

Table 38-2 DBMS_AUTO_TASK_ADMIN Package Subprograms

Method	Description
DISABLE Procedures	Prevents AUTOTASK from executing any requests from a specified client or operation.
ENABLE Procedures	Allows a previously disabled client, operation, target type, or individual target to be enabled under AUTOTASK control
GET_CLIENT_ATTRIBUTES Procedure	Returns values of select client attributes
GET_P1_RESOURCES Procedure	Returns percent of resources allocated to each AUTOTASK High Priority Consumer Groups
OVERRIDE_PRIORITY Procedures	Manually overrides task priority.
SET_CLIENT_SERVICE Procedure	Associates an AUTOTASK Client with a specified Service
SET_P1_RESOURCES Procedure	Sets percentage-based resource allocation for each High Priority Consumer Group used by AUTOTASK Clients

38.4.1 DISABLE Procedures

This procedure prevents AUTOTASK from executing any requests from a specified client or operation.

Syntax

Disables all AUTOTASK functionality.

```
DBMS_AUTO_TASK_ADMIN.DISABLE;
```

Disables all tasks for the client or operation.

```
DBMS_AUTO_TASK_ADMIN.DISABLE (
    client_name      IN      VARCHAR2,
```

```
operation      IN   VARCHAR2,
window_name   IN   VARCHAR2);
```

Parameters

Table 38-3 DISABLE Procedure Parameters

Parameter	Description
client_name	Name of the client, as found in DBA_AUTOTASK_CLIENT View
operation	Name of the operation as specified in DBA_AUTOTASK_OPERATION View
window_name	Optional name of the window in which client is to be disabled

Usage Notes

- If operation and window_name are both NULL, the client is disabled.
- If operation is not NULL, window_name is ignored and the operation is disabled
- If operation is NULL and window_name is not NULL, the client is disabled in the specified window.
- Auto STS Capture Task is accepted.

38.4.2 ENABLE Procedures

This procedure allows a previously disabled client, operation, target type, or individual target to be enabled under AUTOTASK control.

Specifying the DEFERRED option postpones the effect of the call until the start of the next maintenance window. If IMMEDIATE option is specified the effect of this call is immediate – as long as there is a currently open maintenance window.

Syntax

Re-enabling AUTOTASK. This version enables the specified client. Note that any explicitly disabled tasks or operations must be re-enabled individually.

```
DBMS_AUTO_TASK_ADMIN.ENABLE;
```

Re-enabling a client or operation. Note that any explicitly disabled tasks or operations must be re-enabled individually.

```
DBMS_AUTO_TASK_ADMIN.ENABLE (
  client_name      IN   VARCHAR2,
  operation        IN   VARCHAR2,
  window_name     IN   VARCHAR2);
```

Parameters

Table 38-4 ENABLE Procedure Parameters

Parameter	Description
client_name	Name of the client, as found in DBA_AUTOTASK_CLIENT View

Table 38-4 (Cont.) ENABLE Procedure Parameters

Parameter	Description
operation	Name of the operation as specified in DBA_AUTOTASK_OPERATION View
window_name	Optional name of the window in which client is to be enabled

Usage Notes

- If operation and window_name are both NULL, the client is enabled.
- If operation is not NULL, window_name is ignored and the specified operation is enabled
- If operation is NULL and window_name is not NULL, the client is enabled in the specified window.
- Auto STS Capture Task is accepted.

38.4.3 GET_CLIENT_ATTRIBUTES Procedure

This procedure returns values of select client attributes.

Syntax

```
DBMS_AUTO_TASK_ADMIN.GET_CLIENT_ATTRIBUTES (
    client_name      IN   VARCHAR2,  service_name      OUT   VARCHAR2,
    window_group    OUT   VARCHAR2);
```

Parameters

Table 38-5 GET_CLIENT_ATTRIBUTES Procedure Parameters

Parameter	Description
client_name	Name of the client, as found in DBA_AUTOTASK_CLIENT View
service_name	Service name for client, may be NULL
window_group	Name of the window group in which the client is active

38.4.4 GET_P1_RESOURCES Procedure

This procedure returns percent of resources allocated to each AUTOTASK High Priority Consumer Group.

Syntax

```
DBMS_AUTO_TASK_ADMIN.GET_P1_RESOURCES (
    stats_group_pct  OUT   NUMBER,
    seg_group_pct   OUT   NUMBER,
    tune_group_pct   OUT   NUMBER,
    health_group_pct OUT   NUMBER);
```

Parameters

Table 38-6 GET_P1_RESOURCES Procedure Parameters

Parameter	Description
stats_group_pct	%resources for Statistics Gathering
seq_group_pct	%resources for Space Management
tune_group_pct	%resources for SQL Tuning
health_group_pct	%resources for Health Checks

Usage Notes

Values will add up to 100%.

38.4.5 OVERRIDE_PRIORITY Procedures

This deprecated procedure is used to manually override task priority.

**Note:**

This subprogram is deprecated and becomes nonoperative with Oracle Database 12c.

This can be done at the client, operation or individual task level. This priority assignment is honored during the next maintenance window in which the named client is active. Specifically, setting the priority to `URGENT` causes a high priority job to be generated at the start of the maintenance window. Setting `priority` to `CLEAR` removes the override.

Syntax

Override Priority for a Client.

```
DBMS_AUTO_TASK_ADMIN.OVERRIDE_PRIORITY (
  client_name      IN   VARCHAR2,
  priority         IN   VARCHAR2);
```

Override Priority for an Operation.

```
DBMS_AUTO_TASK_ADMIN.OVERRIDE_PRIORITY (
  client_name      IN   VARCHAR2,
  operation        IN   VARCHAR2,
  priority         IN   VARCHAR2);
```

Override Priority for a Task.

```
DBMS_AUTO_TASK_ADMIN.OVERRIDE_PRIORITY (
  client_name      IN   VARCHAR2,
  operation        IN   VARCHAR2,
  task_target_type IN   VARCHAR2,
  task_target_name IN   VARCHAR2,
  priority         IN   VARCHAR2);
```

Parameters

Table 38-7 OVERRIDE_PRIORITY Procedure Parameters

Parameter	Description
client_name	Name of the client, as found in DBA_AUTOTASK_CLIENT View
priority	URGENT, HIGH, MEDIUM or LOW
operation	Name of the operation as specified in DBA_AUTOTASK_OPERATION View
task_target_type	Type of target to be affected, as found in V\$AUTOTASK_TARGET_TYPE View
task_target_name	Name of the specific target to be affected

38.4.6 SET_CLIENT_SERVICE Procedure

This procedure associates an AUTOTASK Client with a specified Service.

Syntax

```
DBMS_AUTO_TASK_ADMIN.SET_CLIENT_SERVICE (
  client_name      IN   VARCHAR2,
  service_name     IN   VARCHAR2);
```

Parameters

Table 38-8 SET_CLIENT_SERVICE Procedure Parameters

Parameter	Description
client_name	Name of the client, as found in DBA_AUTOTASK_CLIENT View
service_name	Service name for client, may be NULL

Usage Notes

All work performed on behalf of the Client takes place only on instances where the service is enabled.

38.4.7 SET_P1_RESOURCES Procedure

This procedure sets percentage-based resource allocation for each High Priority Consumer Group used by AUTOTASK Clients.

Syntax

```
DBMS_AUTO_TASK_ADMIN.SET_P1_RESOURCES (
  stats_group_pct  IN   NUMBER,
  seg_group_pct    IN   NUMBER,
  tune_group_pct   IN   NUMBER,
  health_group_pct IN   NUMBER);
```


Parameters

Table 38-9 SET_P1_RESOURCES Procedure Parameters

Parameter	Description
stats_group_pct	%resources for Statistics Gathering
seq_group_pct	%resources for Space Management
tune_group_pct	%resources for SQL Tuning
health_group_pct	%resources for Health Checks

Usage Notes

Values must be integers in the range 0 to 100, and must add up to 100 (percent), otherwise, an exception is raised.

39

DBMS_AUTO_ZONEMAP

The `DBMS_AUTO_ZONEMAP` package provides autonomous maintenance and creation of zone map.

This chapter contains the following topics:

- [DBMS_AUTO_TASK_ADMIN Security Model](#)
- [Summary of DBMS_AUTO_ZONEMAP Subprograms](#)

39.1 DBMS_AUTO_TASK_ADMIN Security Model

The subprograms in `DBMS_AUTO_TASK_ADMIN` package can be executed by users with DBA privileges.

39.2 Summary of DBMS_AUTO_ZONEMAP Subprograms

This table lists the `DBMS_AUTO_ZONEMAP` package subprograms and briefly describes them.

Table 39-1 DBMS_AUTO_ZONEMAP Package Subprograms

Procedure	Description
ACTIVITY_REPORT Function	This function reports auto zone map activity for a given time window.
CONFIGURE Procedure	This procedure sets configuration options for auto zone map.

39.2.1 ACTIVITY_REPORT Function

This function reports auto zone map activity for a given time window.

Syntax

```
DBMS_AUTO_ZONEMAP.ACTIVITY_REPORT (  
    start_time      IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,  
    end_time        IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,  
    type            IN VARCHAR2 DEFAULT NULL,  
    section         IN VARCHAR2 DEFAULT NULL,  
    level           IN VARCHAR2 DEFAULT NULL);  
RETURNS CLOB
```

Parameters

Table 39-2 ACTIVITY_REPORT Function Parameters


Parameter	Description
start_time	Timestamp from which auto zone map executions are observed for the report. If the value is <code>NULL</code> , the function reports everything from the beginning of auto zone map maintenance subject to purging. The default value is <code>NULL</code> .
end_time	Timestamp until which auto zone map executions are observed for the report. If the value is <code>NULL</code> , the function reports everything to the end of auto zone map maintenance subject to purging. The default value is <code>NULL</code> .
<div style="border-left: 2px solid #0070C0; padding-left: 10px; margin-bottom: 10px;">  Note: If you specify <code>NULL</code> for both <code>start_time</code> and <code>end_time</code>, the function will display the report from the last run. </div>	
type	Output type of the report. The possible values are <code>TEXT</code> , <code>XML</code> , and <code>HTML</code> . The default value is <code>TEXT</code> .
section	Particular section in the report. The possible values are: <ul style="list-style-type: none"> • <code>SUMMARY</code>: Very high level numbers summary on new zone map created and maintained for the given time window. • <code>DETAILS</code>: Detailed summary report on names and other details of new zone map created and maintained for the given time window. It also includes findings details. • <code>ALL</code>: In addition to summary and details, it includes time series based execution / action logs. The default value is <code>ALL</code> .

Table 39-2 (Cont.) ACTIVITY_REPORT Function Parameters

Parameter	Description
level	<p>Format of the report. It represents the level of details with in each section. Possible values are:</p> <ul style="list-style-type: none"> BASIC: Represents very high level details in executive summary. You will only see numbers on zone map that were created, complete rebuilt and fast rebuilt. In new zone map details section, only new zone map name, date created and base table name re displayed. Under maintenance details section, only zone map name, previous state and current state are displayed. Under findings section, only object name and blacklist reason are displayed. Under action logs section, only important time series based log messages pertaining to zone map creation and maintenance are displayed. TYPICAL: Full overview on executive summary section. Under new zone map details section, schema name, column list, and date created are displyed. Under zone map maintenance details section, refresh type and date are displayed. In findings section, timestamp and exception message are displayed. In action logs section more comprehensive logs than basic, which will have information about candidate column list, findings information, and creation DDLs are displayed. This is the default value. ALL: On top of typical level, DOP used for each operation for creating or maintaining zone map, time took to process each DDL and other details in action logs are displayed. All log messages with details on clustering ratios of columns, exception messages and other details are also displayed.

Return Values

Report in CLOB format. The default report format is TEXT. Possible formats are TEXT, XML, and HTML.

Usage Notes

- DBMS_AUTO_ZONEMAP.ACTIVITY_REPORT(): returns report for all the execution history of last execution in TEXT format and all the sections will be displayed with typical level.
- DBMS_AUTO_ZONEMAP.ACTIVITY_REPORT(systimestamp-2, NULL): returns report for all the execution history for last two days in TEXT format and all the sections will be displayed with typical level.
- DBMS_AUTO_ZONEMAP.ACTIVITY_REPORT(NULL, systimestamp-1): returns report for all the execution history from beginning to yesterday in TEXT format and all the sections will be displayed with typical level.
- DBMS_AUTO_ZONEMAP.ACTIVITY_REPORT(NULL, NULL, 'HTML', 'DETAILS', 'BASIC'): returns last execution's report in HTML format and only details section will be displayed with only basic details in each section
- DBMS_AUTO_ZONEMAP.ACTIVITY_REPORT(systimestamp – 2, systimestmap, 'TEXT', 'ALL', 'TYPICAL'): returns report for last 48 hours in text format and all the sections will be displayed with typical details.

39.2.2 CONFIGURE Procedure

This procedure sets configuration options for auto zone map; specifically to enable or disable feature and to control foreground or background mode of the feature.

Syntax

```
DBMS_AUTO_ZONEMAP.CONFIGURE (  
    parameter_name      IN   VARCHAR2,  
    parameter_value     IN   VARCHAR2);
```

Parameters

Table 39-3 CONFIGURE Procedure Parameters

Parameter	Description
parameter_name	AUTO_ZONEMAP_MODE is the only configure parameter name that is currently allowed. If you specify any other name, an invalid argument error message is displayed.
parameter_value	The four values are allowed for this parameter: <ul style="list-style-type: none">• ON: Turns on auto zone map feature completely. Both for foreground and background zone map creation and maintenance.• OFF: Turns off auto zone map feature completely. Both for foreground and background zone map creation and maintenance.• FOREGROUND: Turns on only for foreground zone map creation and maintenance.• BACKGROUND: Turns on only for background zone map creation and maintenance.

DBMS_AVTUNE

The `DBMS_AVTUNE` package analyzes query access levels and aggregation workloads for each auto-cache enabled analytic view (AV) and creates or drops AV auto-caches to improve the overall performance of the SQL queries on that AV.

This chapter contains the following topics:

- [DBMS_AVTUNE Overview](#)
- [DBMS_AVTUNE Security Model](#)
- [Summary of DBMS_AVTUNE Subprograms](#)

40.1 DBMS_AVTUNE Overview

This package allows you to create a cache on an existing AV. It also enables the AV for auto caching. You can also create, refresh, and remove a star cache.

Usage Notes

- It is intended that the owner of the AV is also the user calling this package. Calling this package on an AV in another schema is not supported.
- Before you use any other procedure in this package, you need to call the `AUTO_CACHE_ENABLE` procedure. After the AV is enabled, auto-tuning will continue till the AV is disabled. You can call any other procedures on an enabled AV to manually tune the AV for more fine-grained control of the performance.

40.2 DBMS_AVTUNE Security Model

The `DBMS_AVTUNE` package runs under `AUTHID CURRENT_USER`. The SQL generated through use of the package is executed as the current user, and `EXECUTE` privilege on the package is granted to `PUBLIC`.

40.3 Summary of DBMS_AVTUNE Subprograms

This table lists the `DBMS_AVTUNE` package subprograms and briefly describes them.

Table 40-1 DBMS_AVTUNE Package Subprograms

Procedure	Description
AUTO_CACHE_CREATE Procedure	This procedure creates a cache on an existing analytic view.
AUTO_CACHE_DISABLE Procedure	This procedure disables an analytic view for auto caching and removes all auto-caches.
AUTO_CACHE_ENABLE Procedure	This procedure enables analytic views for auto caching and sets auto-cache settings for analytic views. This procedure throws an error if the AV is already enabled.

Table 40-1 (Cont.) DBMS_AVTUNE Package Subprograms

Procedure	Description
AUTO_CACHE_MODIFY Procedure	This procedure modifies tuning parameters originally supplied in the enable call.
AUTO_CACHE_REFRESH Procedure	This procedure forces a refresh immediately of all auto-caches for the analytic view.
AUTO_CACHE_REMOVE Procedure	This procedure manually removes the auto-cache defined for the specified levels.
AUTO_CACHE_TUNE Procedure	This procedure forces the tuning process to run immediately for the analytic view and implement changes.
AUTO_CACHE_STAR_DISABLE Procedure	This procedure removes the star cache on the attribute dimension <code>dim_name</code> .
AUTO_CACHE_STAR_ENABLE Procedure	This procedure creates a star cache on the attribute dimension <code>dim_name</code> .
AUTO_CACHE_STAR_MODIFY Procedure	This procedure modifies the parameters specified in the enable call.
AUTO_CACHE_STAR_REFRESH Procedure	This procedure refreshes the star cache for the attribute dimension <code>dim_name</code> .

40.3.1 AUTO_CACHE_CREATE Procedure

This procedure creates a cache on an existing analytic view.

Syntax

```
DBMS_AVTUNE.AUTO_CACHE_CREATE (
    av_name      IN  VARCHAR2,
    level_group  IN  LEVEL_LIST,
    av_owner     IN  VARCHAR2);
```

Parameters

Table 40-2 AUTO_CACHE_CREATE Procedure Parameters

Parameter	Description
<code>av_name</code>	The name of the analytic view.
<code>level_group</code>	Represents the levels to cache.
<code>av_owner</code>	The owner of the AV, defaulting to the current schema.

Example

```
execute dbms_avtune.auto_cache_create('UNITS_HCUBE_AVTUNE',
    dbms_avtune.level_list(dbms_avtune.level('PRODUCT', 'ROLLUP',
'CLASS'),
    dbms_avtune.level('TIME', 'CALENDAR', 'YEAR')));
```

40.3.2 AUTO_CACHE_DISABLE Procedure

This procedure disables an analytic view for auto caching and removes all auto-caches.

Syntax

```
DBMS_AVTUNE.AUTO_CACHE_DISABLE (
    av_name      IN  VARCHAR2,
    av_owner     IN  VARCHAR2);
```

Parameters

Table 40-3 AUTO_CACHE_DISABLE Procedure Parameters

Parameter	Description
av_name	The name of the analytic view to disable caching on.
av_owner	The owner of the AV, defaulting to the current schema.

40.3.3 AUTO_CACHE_ENABLE Procedure

This procedure enables analytic views for auto caching and sets auto-cache settings for analytic views. This procedure throws an error if the AV is already enabled. It is not possible to update an already enabled AV using this procedure.

Syntax

```
DBMS_AVTUNE.AUTO_CACHE_ENABLE (
    av_name      IN  VARCHAR2,
    refresh_intvl IN  NUMBER,
    num_queries  IN  NUMBER,
    avg_query_time IN  NUMBER,
    total_cache_pct IN  NUMBER,
    init_max_pct  IN  NUMBER,
    init_numhier IN  NUMBER,
    init_fixed_lvls IN  LEVEL_LIST,
    run_mode     IN  VARCHAR2,
    av_owner     IN  VARCHAR2);
```

Parameters

Table 40-4 AUTO_CACHE_ENABLE Procedure Parameters

Parameter	Description
av_name	The name of the analytic view to enable caching on.
refresh_intvl	The number of minutes to wait between each cache refresh. The default value is 10 minutes.
num_queries	The minimum number of queries to consider for caches. The default value is 1.
avg_query_time	The average number of seconds each query should take before being considered for caches. The default value is 3.
total_cache_pct	The maximum percentage of the fact table you wish to cache. The default value is 50.

Table 40-4 (Cont.) AUTO_CACHE_ENABLE Procedure Parameters

Parameter	Description
init_max_pct	The maximum percentage of the fact table for the initial cache. The default value is 1%.
init_numhier	The maximum number of hierarchies to use for each dimension in the initial cache.
init_fixed_lvl	The levels you definitely want in the initial cache.
run_mode	This parameter is not used. Always use the default value.
av_owner	The owner of the AV, defaulting to the current schema.

40.3.4 AUTO_CACHE_MODIFY Procedure

This procedure modifies the tuning parameters originally supplied in the enable call. The parameters remain unchanged if NULL is specified.

Syntax

```
DBMS_AVTUNE.AUTO_CACHE_MODIFY (
    av_name          IN   VARCHAR2,
    refresh_intvl    IN   NUMBER,
    num_queries      IN   NUMBER,
    avg_query_time   IN   NUMBER,
    total_cache_pct  IN   NUMBER,
    av_owner         IN   VARCHAR2);
```

Parameters

Table 40-5 AUTO_CACHE_MODIFY Procedure Parameters

Parameter	Description
av_name	The name of the analytic view to enable caching on.
refresh_intvl	The number of minutes to wait between each cache refresh. The default value is 10 minutes.
num_queries	The minimum number of queries to consider for caches. The default value is 1.
avg_query_time	The average number of seconds each query should take before being considered for caches. The default value is 3.
total_cache_pct	The maximum percentage of the fact table you wish to cache. The default value is 50.
av_owner	The owner of the AV, defaulting to the current schema.

40.3.5 AUTO_CACHE_REFRESH Procedure

This procedure forces a refresh immediately of all auto-caches for the analytic view.

Syntax

```
DBMS_AVTUNE.AUTO_CACHE_REFRESH (
    av_name          IN   VARCHAR2,
    av_owner         IN   VARCHAR2);
```

Parameters

Table 40-6 AUTO_CACHE_REFRESH Procedure Parameters

Parameter	Description
av_name	The name of the analytic view.
av_owner	The owner of the AV, defaulting to the current schema.

40.3.6 AUTO_CACHE_REMOVE Procedure

This procedure manually removes the auto-cache defined for the specified levels.

Syntax

```
DBMS_AVTUNE.AUTO_CACHE_REMOVE (
  av_name      IN  VARCHAR2,
  level_group  IN  LEVEL_LIST,
  av_owner     IN  VARCHAR2);
```

Parameters

Table 40-7 AUTO_CACHE_REMOVE Procedure Parameters

Parameter	Description
av_name	The name of the analytic view.
level_group	Represents the levels to cache.
av_owner	The owner of the AV, defaulting to the current schema.

40.3.7 AUTO_CACHE_TUNE Procedure

This procedure forces the tuning process to run immediately for the analytic view and implement changes.

Syntax

```
DBMS_AVTUNE.AUTO_CACHE_TUNE (
  av_name      IN  VARCHAR2,
  num_queries  IN  NUMBER,
  avg_query_time IN NUMBER,
  run_mode     IN  VARCHAR2,
  av_owner     IN  VARCHAR2);
```

Parameters

Table 40-8 AUTO_CACHE_TUNE Procedure Parameters

Parameter	Description
av_name	The name of the analytic view.
num_queries	The minimum number of queries to consider for caches. The default value is 1.

Table 40-8 (Cont.) AUTO_CACHE_TUNE Procedure Parameters

Parameter	Description
avg_query_time	The average number of seconds each query should take before being considered for caches. The default value is 3.
run_mode	The run_mode parameter is not used. Always use the default value.
av_owner	The owner of the AV, defaulting to the current schema.

40.3.8 AUTO_CACHE_STAR_DISABLE Procedure

This procedure removes the star cache on the attribute dimension `dim_name`.

Syntax

```
DBMS_AVTUNE.AUTO_CACHE_STAR_DISABLE (
    dim_name      IN  VARCHAR2,
    dim_owner     IN  VARCHAR2);
```

Parameters

Table 40-9 AUTO_CACHE_STAR_DISABLE Procedure Parameters

Parameter	Description
dim_name	The name of the attribute dimension.
dim_owner	The owner of the attribute dimension.

40.3.9 AUTO_CACHE_STAR_ENABLE Procedure

This procedure creates a star cache on the attribute dimension `dim_name`. The `av_name` can optionally be passed to qualify the attribute dimension.

Syntax

```
DBMS_AVTUNE.AUTO_CACHE_STAR_ENABLE (
    dim_name      IN  VARCHAR2,
    av_name       IN  VARCHAR2,
    refresh_intvl IN  NUMBER,
    run_mode      IN  VARCHAR2,
    dim_owner     IN  VARCHAR2,
    av_owner      IN  VARCHAR2);
```

Parameters

Table 40-10 AUTO_CACHE_STAR_ENABLE Procedure Parameters

Parameter	Description
dim_name	The name of the attribute dimension.

Table 40-10 (Cont.) AUTO_CACHE_STAR_ENABLE Procedure Parameters

Parameter	Description
av_name	The name of the AV to associate the star cache with, if any. The av_name can optionally be specified to associate the star cache with the given AV. When this is done then the star cache will be refreshed and maintained with the AV instead of independently.
refresh_intvl	The number of minutes to wait between each cache refresh. The default value is 10 minutes.
run_mode	This parameter is not used. Always use the default value.
dim_owner	The owner of the attribute dimension.
av_owner	The owner of the AV, defaulting to the current schema.

40.3.10 AUTO_CACHE_STAR_MODIFY Procedure

This procedure modifies the parameters specified in the enable call. The parameters remain unchanged if NULL is specified.

Syntax

```
DBMS_AVTUNE.AUTO_CACHE_STAR_MODIFY (
  dim_name      IN  VARCHAR2,
  av_name       IN  VARCHAR2,
  refresh_intvl IN  NUMBER,
  dim_owner     IN  VARCHAR2,
  av_owner     IN  VARCHAR2);
```

Parameters

Table 40-11 AUTO_CACHE_STAR_MODIFY Procedure Parameters

Parameter	Description
dim_name	The name of the attribute dimension.
av_name	The name of the associated analytic view.
refresh_intvl	The number of minutes to wait for each cache refresh. The default value is 10 minutes.
dim_owner	The owner of the attribute dimension.
av_owner	The owner of the AV, defaulting to the current schema.

40.3.11 AUTO_CACHE_STAR_REFRESH Procedure

This procedure refreshes the star cache for the attribute dimension dim_name.

Syntax

```
DBMS_AVTUNE.AUTO_CACHE_STAR_REFRESH (
  dim_name      IN  VARCHAR2,
  dim_owner     IN  VARCHAR2);
```

Parameters

Table 40-12 AUTO_CACHE_STAR_REFRESH Procedure Parameters

Parameter	Description
dim_name	The name of the attribute dimension.
dim_owner	The owner of the attribute dimension.

DBMS_BLOCKCHAIN_TABLE

A blockchain table is an append-only table designed for centralized blockchain applications. The `DBMS_BLOCKCHAIN_TABLE` package allows you do operations like the following: delete rows in a blockchain table that are beyond the row retention defined for the blockchain table; get the bytes that are input to the cryptographic hash for a row so you can verify the hash in the row; sign a row you inserted into a blockchain table after the row is added to a chain in the blockchain table; and have the database verify the hashes and digital signatures on some or all rows in a blockchain table. V2 blockchain tables support schema evolution, delegate signatures, and countersignatures in addition to the functionality found in V1 blockchain tables. Blockchain tables support only `DER` encoding for `X.509` certificates, not `PEM` encoding.

This chapter contains the following topics:

- [DBMS_BLOCKCHAIN_TABLE Overview](#)
- [DBMS_BLOCKCHAIN_TABLE Security Model](#)
- [Summary of DBMS_BLOCKCHAIN_TABLE Subprograms](#)



See Also:

- *Oracle Database Administrator's Guide*
- *Oracle Database Concepts*
- *Oracle Database SQL Language Reference*
- *Oracle Database Reference*
- For information on hidden columns in blockchain tables, see [Hidden Columns in Blockchain Tables](#)

41.1 DBMS_BLOCKCHAIN_TABLE Overview

In Oracle Blockchain Table, peers are database users who trust the database to maintain a tamper-resistant ledger.

The ledger is implemented as a blockchain table, which is defined and managed by the application. Existing applications can protect against fraud without requiring a new infrastructure or programming model. Although transaction throughput is lower than for a standard table, performance for a blockchain table is better than for a decentralized blockchain.

The `DBMS_BLOCKCHAIN_TABLE` package lets you do the following:

- delete rows in a blockchain table that are beyond the row retention defined for the blockchain table
- get the bytes that are input to the signature algorithm so you can sign a row you inserted into the blockchain table

- get the bytes that are input to the cryptographic hash for a row so you can verify the hash in the row
- sign a row you inserted into a blockchain table after the row is added to a chain in the blockchain table
- have the database verify the hashes and signatures on some or all rows in a blockchain table
- enable a delegate with sufficient privileges to sign a row inserted by another user
- procure a countersignature for the row that is being signed by the end-user or delegate

41.2 DBMS_BLOCKCHAIN_TABLE Security Model

The `DBMS_BLOCKCHAIN_TABLE` package is owned by `SYS` and is installed as part of database installation. The routines in the package are run with invoker's rights (run with the privileges of the current user). Thus any user with select privileges on the blockchain table should be able to validate the row contents of that table.

Any user with delete privileges on the blockchain table can delete rows beyond the retention period defined for the blockchain table.

A user that inserted a row into the blockchain table can add a digital signature to the row after the row is added to a chain in the blockchain table. This user can secure a countersignature on this row either when signing the row or at a later time after the row has been signed either by the user or by a delegate.

A delegate signer for a row in a blockchain table needs the `SIGN` privilege on the table. In addition, the ID number of the delegate user may be specified in the hidden column `ORABCTAB_DELEGATE_USER_NUMBER$` when the row is inserted.

A user with the `SIGN` privilege on a blockchain table can secure a countersignature on any row in the blockchain table that has a user signature or a delegate signature. Similarly, the owner of a blockchain table can secure a countersignature on any row in the blockchain table that has a user signature or a delegate signature.

41.3 Summary of DBMS_BLOCKCHAIN_TABLE Subprograms

The `DBMS_BLOCKCHAIN_TABLE` package uses `ADD_INTERVAL_PARTITIONING`, `COUNTERSIGN_ROW`, `COUNTERSIGN_ROW_SPECIFIED_BY_KEY_COLUMNS`, `DELETE_EXPIRED_ROWS`, `GET_BLOCKCHAIN_DIGEST`, `GET_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS`, `GET_BYTES_FOR_ROW_HASH`, `GET_BYTES_FOR_ROW_HASH_SPECIFIED_BY_KEY_COLUMNS`, `GET_BYTES_FOR_ROW_SIGNATURE`, `GET_BYTES_FOR_ROW_SIGNATURE_SPECIFIED_BY_KEY_COLUMNS`, `GET_SIGNED_BLOCKCHAIN_DIGEST`, `GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS`, `SIGN_ROW`, `SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS`, `SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS_WITH_COUNTERSIGNATURE`, `SIGN_ROW_WITH_COUNTERSIGNATURE`, `VERIFY_ROWS`, `VERIFY_TABLE_BLOCKCHAIN`, and `VERIFY_USER_BLOCKCHAIN_ROWS` subprograms to perform various functions.

Table 41-1 DBMS_BLOCKCHAIN_TABLE Package Subprograms

Subprogram	Description
ADD_INTERVAL_PARTITIONING Procedure	This procedure adds interval partitioning to an existing, non-partitioned, V1 or V2 blockchain table.
COUNTERSIGN_ROW Procedure	This procedure procures a countersignature on a specified row in a blockchain table. The countersignature will be produced by signing the row data content using the table owner's private key stored in the database wallet.
COUNTERSIGN_ROW_SPECIFIED_BY_KEY_COLUMNS Procedure	It is an extension of <code>COUNTERSIGN_ROW</code> that uses at most three user columns to identify exactly one row in a blockchain table and procure a countersignature on that row.
DELETE_EXPIRED_ROWS Procedure	This procedure deletes rows outside the retention window created before <code>before_timestamp</code> if the timestamp is specified; otherwise, this procedure deletes all rows outside the retention window. This procedure commits before deleting any expired rows and commits after deleting any expired rows.
GET_BLOCKCHAIN_DIGEST Function	This function generates and returns a cryptographic hash of the digest for a specified blockchain table.
GET_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS Function	This function generates and returns a cryptographic hash of the digest for user-specified rows in a blockchain table.
GET_BYTES_FOR_ROW_HASH Procedure	This procedure returns in <code>row_data</code> the bytes for the particular row identified (a series of meta-data-value, column-data-value pairs in column position order) followed by the hash for the previous row in the chain in the data format specified.
GET_BYTES_FOR_ROW_HASH_SPECIFIED_BY_KEY_COLUMNS Procedure	It is an extension of <code>GET_BYTES_FOR_ROW_HASH</code> that uses at most three user columns instead of the <code>instance identifier</code> , <code>chain identifier</code> , and <code>sequence number</code> to uniquely identify the row.
GET_BYTES_FOR_ROW_SIGNATURE Procedure	This procedure returns the bytes used to compute a user signature, a delegate signature, or a countersignature. For a user signature or a delegate signature, the procedure returns in <code>row_data</code> the bytes in the hash in the row without any metadata.
GET_BYTES_FOR_ROW_SIGNATURE_SPECIFIED_BY_KEY_COLUMNS Procedure	It is an extension of <code>GET_BYTES_FOR_ROW_SIGNATURE</code> that uses at most three user column values instead of the <code>instance identifier</code> , <code>chain identifier</code> , and <code>sequence number</code> to uniquely identify the row.
GET_SIGNED_BLOCKCHAIN_DIGEST Function	This function generates and returns the signed digest for a specified blockchain table using the table owner's private key stored in the database wallet. The <code>signed_bytes</code> , <code>signed_row_indexes</code> , and <code>schema_certificate_guid</code> are also returned.
GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS Function	This function generates and returns the signed digest for user-specified rows in a blockchain table using the table owner's private key stored in the database wallet. The particular rows in the digest are specified by the <code>row_selector</code> parameter. The <code>signed_bytes</code> , <code>signed_row_indexes</code> , and <code>schema_certificate_guid</code> are also returned.
SIGN_ROW Procedure	This procedure can be used by the current user to provide a signature on the row content of a previously inserted row.
SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS Procedure	This procedure allows an end user or a delegate to sign a row using a set of at most three user columns that uniquely identify a single row.

Table 41-1 (Cont.) DBMS_BLOCKCHAIN_TABLE Package Subprograms

Subprogram	Description
SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS_WITH_COUNTERSIGNATURE Procedure	This procedure uses at most three user column names and values to uniquely identify a single row to sign and countersign.
SIGN_ROW_WITH_COUNTERSIGNATURE Procedure	It is an extension of <code>SIGN_ROW</code> that enables the user to request a countersignature from the database. The countersignature will be produced by signing the row data content using the table owner's private key stored in the database wallet.
VERIFY_ROWS Procedure	This procedure verifies all rows on all applicable system chains for the integrity of <code>HASH</code> column value for rows created in the range of <code>low_timestamp</code> to <code>high_timestamp</code> . Row signatures can be verified as an option.
VERIFY_TABLE_BLOCKCHAIN Procedure	This procedure verifies all rows whose creation-times fall between the minimum value for the row-creation time from <code>bytes_previous</code> and the maximum value for row-creation time from <code>bytes_latest</code> and returns the number of successfully verified rows.
VERIFY_USER_BLOCKCHAIN_ROWS Procedure	This procedure verifies rows of one or more user chains when the user chains feature is enabled on the blockchain table.

41.3.1 ADD_INTERVAL_PARTITIONING Procedure

This procedure adds interval partitioning to an existing, non-partitioned, V1 or V2 blockchain table.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.ADD_INTERVAL_PARTITIONING (
    schema_name          IN    VARCHAR2,
    table_name           IN    VARCHAR2,
    interval_number      IN    NUMBER,
    interval_frequency   IN    VARCHAR2,
    first_high_timestamp IN    TIMESTAMP);
```

Parameters

Table 41-2 ADD_INTERVAL_PARTITIONING Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema.
<code>table_name</code>	The name of the blockchain table.
<code>interval_number</code>	Sets how often the database creates partitions for the blockchain table.
<code>interval_frequency</code>	Sets the frequency for the value that was set in the <code>interval_number</code> setting. Supported values are <code>YEAR</code> , <code>MONTH</code> , <code>DAY</code> , <code>HOURL</code> , and <code>MINUTE</code> .
<code>first_high_timestamp</code>	A timestamp that determines the upper boundary of the first partition in the blockchain table.

Usage Notes

- For an existing, non-partitioned, V1 or V2 immutable table, a procedure with the same name and the same parameters is provided in the `DBMS_IMMUTABLE_TABLE` package.
- Composite partitioning (that is, sub-partitioning) is not supported with the above interval partitioning.

41.3.2 COUNTERSIGN_ROW Procedure

This procedure procures a countersignature on a specified row in a blockchain table. The countersignature will be produced by signing the row data content using the table owner's private key stored in the database wallet. A row in a blockchain table can be countersigned only if the row belongs to the current epoch for the blockchain table.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.COUNTERSIGN_ROW (
  schema_name          IN VARCHAR2,
  table_name           IN VARCHAR2,
  instance_id          IN NUMBER,
  chain_id             IN NUMBER,
  sequence_id          IN NUMBER,
  countersignature_algo IN NUMBER DEFAULT
DBMS_BLOCKCHAIN_TABLE.SIGN_ALGO_DEFAULT,
  countersignature_signed_bytes IN OUT BLOB,
  countersignature      OUT RAW,
  countersignature_certificate_guid OUT RAW,
  countersignature_content_version IN VARCHAR2 DEFAULT 'V2_DIGEST',
  pdb_guid             IN RAW DEFAULT NULL);
```

Parameters

Table 41-3 COUNTERSIGN_ROW Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema.
<code>table_name</code>	The name of the blockchain table.
<code>instance_id</code>	The instance that inserted the row. Valid values are 1, 2, and so on.
<code>chain_id</code>	The chain containing the row. By default, there are 32 chains in each instance, and they are numbered from 0 to 31.
<code>sequence_id</code>	The position of the row on the specified chain.
<code>countersignature_algo</code>	The digital signature algorithm for the countersignature. The parameter must be one of the following package constants: <ul style="list-style-type: none"> • <code>SIGN_ALGO_RSA_SHA2_256</code> • <code>SIGN_ALGO_RSA_SHA2_384</code> • <code>SIGN_ALGO_RSA_SHA2_512</code>
<code>countersignature_signed_bytes</code>	The bytes that are input to the algorithm that generates the countersignature. The caller must pass an empty BLOB for this parameter.
<code>countersignature</code>	The digital signature on the bytes returned in <code>countersignature_signed_bytes</code> .

Table 41-3 (Cont.) COUNTERSIGN_ROW Parameters

Parameter	Description
countersignature_certificate_guid	A unique identifier for the certificate of the blockchain table owner stored in the database that may be used to verify the countersignature.
countersignature_content_version	The version of the data contents and layout that are used as input to the countersignature algorithm. Only 'V2_DIGEST' is supported in this release.
pdb_guid	The identifier of the local pluggable database. This parameter is used by Oracle GoldenGate replication and must be NULL.

41.3.3 COUNTERSIGN_ROW_SPECIFIED_BY_KEY_COLUMNS Procedure

It is an extension of COUNTERSIGN_ROW that uses at most three user columns to identify exactly one row in a blockchain table and procure a countersignature on that row. A row in a blockchain table can be countersigned only if the row belongs to the current epoch for the blockchain table.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.COUNTERSIGN_ROW_SPECIFIED_BY_KEY_COLUMNS (
    schema_name          IN          VARCHAR2,
    table_name           IN          VARCHAR2,
    keycol1_name         IN          VARCHAR2,
    keycol1_value        IN          VARCHAR2,
    keycol2_name         IN          VARCHAR2 DEFAULT NULL,
    keycol2_value        IN          VARCHAR2 DEFAULT NULL,
    keycol3_name         IN          VARCHAR2 DEFAULT NULL,
    keycol3_value        IN          VARCHAR2 DEFAULT NULL,
    countersignature_algo IN          NUMBER DEFAULT
DBMS_BLOCKCHAIN_TABLE.SIGN_ALGO_DEFAULT,
    countersignature_signed_bytes IN OUT BLOB,
    countersignature     OUT          RAW,
    countersignature_certificate_guid OUT  RAW,
    countersignature_content_version IN   VARCHAR2 DEFAULT
'V2_DIGEST',
    pdb_guid             IN          RAW DEFAULT NULL);
```

Parameters

Table 41-4 COUNTERSIGN_ROW_SPECIFIED_BY_KEY_COLUMNS Procedure Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the blockchain table.
keycol1_name	The name of the key column.
keycol1_value	The value of the key column.

Table 41-4 (Cont.) COUNTERSIGN_ROW_SPECIFIED_BY_KEY_COLUMNS Procedure Parameters

Parameter	Description
keycol2_name	The name of the second column in a composite key.
keycol2_value	The value of the second column in a composite key.
keycol3_name	The name of the third column in a composite key.
keycol3_value	The value of the third column in a composite key.
countersignature_algo	The digital signature algorithm for the countersignature. The parameter must be one of the following package constants: <ul style="list-style-type: none"> SIGN_ALGO_RSA_SHA2_256 SIGN_ALGO_RSA_SHA2_384 SIGN_ALGO_RSA_SHA2_512
countersignature_signed_bytes	The bytes that are input to the algorithm that generates the countersignature. The caller must pass an empty BLOB for this parameter.
countersignature	The digital signature on the bytes returned in countersignature_signed_bytes.
countersignature_certificate_guid	A unique identifier for the certificate of the blockchain table owner stored in the database that may be used to verify the countersignature.
countersignature_content_version	The version of the data contents and layout that are used as input to the countersignature algorithm. Only 'V2_DIGEST' is supported in this release.
pdb_guid	The identifier of the local pluggable database. This parameter is used by Oracle GoldenGate replication and must be NULL.

41.3.4 DELETE_EXPIRED_ROWS Procedure

This procedure deletes rows outside the retention window created before_timestamp if the timestamp is specified; otherwise, this procedure deletes all rows outside the retention window. The number of rows deleted is returned in number_of_rows_deleted parameter. This procedure commits before deleting any expired rows and commits after deleting any expired rows.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.DELETE_EXPIRED_ROWS (
    schema_name          IN VARCHAR2,
    table_name           IN VARCHAR2,
    before_timestamp     IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
    number_of_rows_deleted OUT NUMBER);
```

Parameters

Table 41-5 DELETE_EXPIRED_ROWS Procedure Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the blockchain table.

Table 41-5 (Cont.) DELETE_EXPIRED_ROWS Procedure Parameters

Parameter	Description
before_timestamp	The end time for the range of rows deleted by the procedure, subject to the row retention time currently associated with the blockchain table. This is an optional parameter. The default value is NULL.
number_of_rows_deleted	The count of the number of rows deleted.

41.3.5 GET_BLOCKCHAIN_DIGEST Function

This function generates and returns a cryptographic hash of the digest for a specified blockchain table.

Note:

Rows inserted into a blockchain table that have not been committed are not guaranteed to be durable. Therefore, a blockchain digest does not include inserted rows that have not been committed.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.GET_BLOCKCHAIN_DIGEST(
  schema_name      IN      VARCHAR2,
  table_name       IN      VARCHAR2,
  digest_bytes     IN OUT  BLOB,
  digest_rows_indexes OUT  SYS.ORABCTAB_ROW_ARRAY_T,
  hash_algo       IN      NUMBER   DEFAULT
  DBMS_BLOCKCHAIN_TABLE.HASH_ALGO_DEFAULT)
  RETURN RAW;
```

Parameters

Table 41-6 GET_BLOCKCHAIN_DIGEST Function Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the blockchain table.
digest_bytes	The BLOB value that contains a header followed by an array of row-info. This sequence of bytes is input to the cryptographic hash function. The caller must pass an empty BLOB for this parameter.
digest_rows_indexes	This parameter specifies the rows in the blockchain table that were chosen for the digest.
hash_algo	The cryptographic hash algorithm to use. The parameter must be one of the following package constants: <ul style="list-style-type: none"> • HASH_ALGO_SHA2_256 • HASH_ALGO_SHA2_384 • HASH_ALGO_SHA2_512

Usage Notes

- A blockchain table digest created by the `GET_BLOCKCHAIN_DIGEST` function has table information specific to a pluggable database. Such a digest can be used only in the pluggable database in which the digest was created and only for the table that was used to create the digest. For `DBMS_BLOCKCHAIN_TABLE.VERIFY_TABLE_BLOCKCHAIN`, these requirements mean that both blockchain table digests must have been generated in the current pluggable database for the same blockchain table.

For example, suppose you create a digest for a blockchain table in pluggable database A, use Data Pump to export the blockchain table, and use Data Pump to import the blockchain table into pluggable database B. The blockchain table digest created in pluggable database A cannot be used in pluggable database B. You need to create a new blockchain table digest in pluggable database B.

See Also:

Oracle Database Administrator's Guide

41.3.6 GET_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS Function

This function generates and returns a cryptographic hash of the digest for user-specified rows in a blockchain table.

Note:

Rows inserted into a blockchain table that have not been committed are not guaranteed to be durable. Therefore, a blockchain digest does not include inserted rows that have not been committed.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.GET_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS (
  schema_name      IN      VARCHAR2,
  table_name       IN      VARCHAR2,
  row_selector     IN      VARCHAR2,
  digest_bytes     IN OUT  BLOB,
  row_data_bytes   IN OUT  BLOB,
  digest_rows_indexes OUT  SYS.ORABCTAB_ROW_ARRAY_T,
  hash_algo       IN      NUMBER  DEFAULT
DBMS_BLOCKCHAIN_TABLE.HASH_ALGO_DEFAULT)
RETURN RAW;
```

Parameters

Table 41-7 GET_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS Function Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the blockchain table.
row_selector	The condition, a where clause without the WHERE keyword.
digest_bytes	The BLOB value that contains a header followed by an array of row-info. This sequence of bytes is input to the cryptographic hash function. The caller must pass an empty BLOB for this parameter.
row_data_bytes	This parameter specifies the content of the rows in the blockchain table that were selected for the digest. The caller must pass an empty BLOB for this parameter.
digest_rows_indexes	This parameter specifies the rows in the blockchain table that were selected for the digest.
hash_algo	The cryptographic hash algorithm to use. The parameter must be one of the following package constants: <ul style="list-style-type: none"> HASH_ALGO_SHA2_256 HASH_ALGO_SHA2_384 HASH_ALGO_SHA2_512

Usage Notes

- A blockchain table digest created by the GET_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS function has table information specific to a pluggable database. Such a digest can be used only in the pluggable database in which the digest was created and only for the table that was used to create the digest. For DBMS_BLOCKCHAIN_TABLE.VERIFY_TABLE_BLOCKCHAIN, these requirements mean that both blockchain table digests must have been generated in the current pluggable database for the same blockchain table.

For example, suppose you create a digest for a blockchain table in pluggable database A, use Data Pump to export the blockchain table, and use Data Pump to import the blockchain table into pluggable database B. The blockchain table digest created in pluggable database A cannot be used in pluggable database B. You need to create a new blockchain table digest in pluggable database B.

See Also:

Oracle Database Administrator's Guide

41.3.7 GET_BYTES_FOR_ROW_HASH Procedure

This procedure returns in `row_data` the bytes for the particular row identified (a series of meta-data-value, column-data-value pairs in column position order) followed by the hash for the previous row in the chain in the data format specified.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.GET_BYTES_FOR_ROW_HASH (
  schema_name      IN VARCHAR2,
  table_name       IN VARCHAR2,
  instance_id      IN NUMBER,
  chain_id         IN NUMBER,
  sequence_id      IN NUMBER,
  data_format      IN NUMBER,
  row_data         IN OUT BLOB,
  chain_name       IN VARCHAR2 DEFAULT NULL,
  pdb_guid         IN RAW DEFAULT NULL);
```

Parameters

Table 41-8 GET_BYTES_FOR_ROW_HASH Procedure Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema.
<code>table_name</code>	The name of the blockchain table.
<code>instance_id</code>	The instance that inserted the row. Valid values are 1, 2, and so on.
<code>chain_id</code>	The chain containing the row. By default, there are 32 chains in each instance, and they are numbered from 0 to 31.
<code>sequence_id</code>	The position of the row on the specified chain.
<code>data_format</code>	The version of the data layout for the hash in the specified row. Must be 1 in this release.
<code>row_data</code>	The bytes for the specified row in the specified data format that can be input to the cryptographic hash function to verify the value of the hash in the row. Any bytes in the <code>BLOB</code> are overwritten.
<code>chain_name</code>	The name of the user chain when the bytes for the cryptographic hash on the user chain are desired. Specify <code>NULL</code> when the bytes for the cryptographic hash on the system chain are desired.
<code>pdb_guid</code>	For a V2 blockchain table, the identifier of the pluggable database that inserted the row. Must be <code>NULL</code> for a V1 blockchain table.

Usage Notes

The metadata bytes for a column are 20 bytes that encode the blockchain algorithm version used to hash the row, the column position, the column data type, whether the column value is `NULL`, and the actual length of the column value in bytes.

For non-character columns, the column data bytes are the actual bytes representing the column value on the disk. For character and character LOB columns, the values are normalized to specific character sets. For `CHAR` and `NCHAR` columns, the number of blanks is normalized.

A few metadata bytes are reserved for future use.

 **See Also:**

For more information on normalizations, see *Oracle Database Administrator's Guide*

41.3.8 GET_BYTES_FOR_ROW_HASH_SPECIFIED_BY_KEY_COLUMNS Procedure

It is an extension of `GET_BYTES_FOR_ROW_HASH` that uses at most three user columns instead of an instance identifier, chain identifier, and sequence number to uniquely identify the row.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.GET_BYTES_FOR_ROW_HASH_SPECIFIED_BY_KEY_COLUMNS (
  schema_name  IN    VARCHAR2,
  table_name   IN    VARCHAR2,
  data_format  IN    NUMBER,
  row_data     IN OUT BLOB,
  chain_name   IN    VARCHAR2 DEFAULT NULL,
  keycol1_name IN    VARCHAR2,
  keycol1_value IN   VARCHAR2,
  keycol2_name IN    VARCHAR2 DEFAULT NULL,
  keycol2_value IN   VARCHAR2 DEFAULT NULL,
  keycol3_name IN    VARCHAR2 DEFAULT NULL,
  keycol3_value IN   VARCHAR2 DEFAULT NULL,
  pdb_guid     IN    RAW DEFAULT NULL);
```

Parameters

Table 41-9 GET_BYTES_FOR_ROW_HASH_SPECIFIED_BY_KEY_COLUMNS
Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema.
<code>table_name</code>	The name of the blockchain table.
<code>data_format</code>	The version of the data layout for the hash in the specified row. Must be 1 in this release.
<code>row_data</code>	The bytes for the specified row in the specified data format that can be input to the cryptographic hash function to verify the value of the hash in the row. Any bytes in the BLOB are overwritten.
<code>chain_name</code>	The name of the user chain when the bytes for the cryptographic hash on the user chain are desired. Specify <code>NULL</code> when the bytes for the cryptographic hash on the system chain are desired.
<code>keycol1_name</code>	The name of the key column.
<code>keycol1_value</code>	The value of the key column.

Table 41-9 (Cont.)
GET_BYTES_FOR_ROW_HASH_SPECIFIED_BY_KEY_COLUMNS Parameters

Parameter	Description
keycol2_name	The name of the second column in a composite key.
keycol2_value	The value of the second column in a composite key.
keycol3_name	The name of the third column in a composite key.
keycol3_value	The value of the third column in a composite key.
pdb_guid	For a V2 blockchain table, the identifier of the pluggable database that inserted the row. Must be <code>NULL</code> for a V1 blockchain table.

41.3.9 GET_BYTES_FOR_ROW_SIGNATURE Procedure

This procedure returns the bytes used to compute a user signature, a delegate signature, or a countersignature. For a user signature or a delegate signature, the procedure returns in `row_data` the bytes in the hash in the row without any metadata. No other columns are involved, either in the row or in the previous row. For a countersignature, the routine returns in `row_data` the bytes that are input to the digital signature algorithm that computes a countersignature on the row.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.GET_BYTES_FOR_ROW_SIGNATURE (
  schema_name      IN VARCHAR2,
  table_name       IN VARCHAR2,
  instance_id      IN NUMBER,
  chain_id         IN NUMBER,
  sequence_id      IN NUMBER,
  data_format      IN NUMBER,
  row_data         IN OUT BLOB,
  pdb_guid         IN RAW DEFAULT NULL,
  signature_type   IN VARCHAR2 DEFAULT 'USER');
```

Parameters

Table 41-10 GET_BYTES_FOR_ROW_SIGNATURE Procedure Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the blockchain table.
instance_id	The instance on which the row was inserted. Valid values are 1, 2, and so on.
chain_id	The chain on which the row was inserted. By default, there are 32 chains in each instance, and they are numbered from 0 to 31.
sequence_id	The position of the row on the chain.
data_format	The format of the data in <code>row_data</code> . Must be 1 in this release.
row_data	A sequence of bytes that must be signed. The caller must pass an empty BLOB for this parameter.
pdb_guid	For a V2 blockchain table, the identifier of the pluggable database that inserted the row. Must be <code>NULL</code> for a V1 blockchain table.

Table 41-10 (Cont.) GET_BYTES_FOR_ROW_SIGNATURE Procedure Parameters

Parameter	Description
signature_type	The valid values for signature_type are USER, DELEGATE, and COUNTERSIGNATURE. DELEGATE and USER may be used interchangeably.

41.3.10

GET_BYTES_FOR_ROW_SIGNATURE_SPECIFIED_BY_KEY_COLUMNS Procedure

It is an extension of GET_BYTES_FOR_ROW_SIGNATURE that uses at most three user column values instead of an instance identifier, chain identifier, and sequence number to uniquely identify the row.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.GET_BYTES_FOR_ROW_SIGNATURE_SPECIFIED_BY_KEY_COLUMNS (
  schema_name IN VARCHAR2,
  table_name IN VARCHAR2,
  data_format IN NUMBER,
  row_data IN OUT BLOB,
  keycol1_name IN VARCHAR2,
  keycol1_value IN VARCHAR2,
  keycol2_name IN VARCHAR2 DEFAULT NULL,
  keycol2_value IN VARCHAR2 DEFAULT NULL,
  keycol3_name IN VARCHAR2 DEFAULT NULL,
  keycol3_value IN VARCHAR2 DEFAULT NULL,
  pdb_guid IN RAW DEFAULT NULL,
  signature_type IN VARCHAR2 DEFAULT 'USER');
```

Parameters

Table 41-11 GET_BYTES_FOR_ROW_SIGNATURE_SPECIFIED_BY_KEY_COLUMNS Procedure Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the blockchain table.
data_format	The format of the data in row_data. Must be 1 in this release.
row_data	A sequence of bytes that must be signed. The caller must pass an empty BLOB for this parameter.
keycol1_name	The name of the key column.
keycol1_value	The value of the key column.
keycol2_name	The name of the second column in a composite key.
keycol2_value	The value of the second column in a composite key.
keycol3_name	The name of the third column in a composite key.
keycol3_value	The value of the third column in a composite key.
pdb_guid	For a V2 blockchain table, the identifier of the pluggable database that inserted the row. Must be NULL for a V1 blockchain table.

Table 41-11 (Cont.)
GET_BYTES_FOR_ROW_SIGNATURE_SPECIFIED_BY_KEY_COLUMNS
Procedure Parameters

Parameter	Description
signature_type	The valid values for signature_type are USER, DELEGATE, and COUNTERSIGNATURE. DELEGATE and USER may be used interchangeably.

41.3.11 GET_SIGNED_BLOCKCHAIN_DIGEST Function

This function generates and returns the signed digest for a specified blockchain table using the table owner's private key stored in the database wallet. The signed_bytes, signed_row_indexes, and schema_certificate_guid are also returned.



Note:

Rows inserted into a blockchain table that have not been committed are not guaranteed to be durable. Therefore, a signed blockchain digest does not include inserted rows that have not been committed.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.GET_SIGNED_BLOCKCHAIN_DIGEST (
    schema_name          IN      VARCHAR2,
    table_name           IN      VARCHAR2,
    signed_bytes         IN OUT  BLOB,
    signed_rows_indexes  OUT    SYS.ORABCTAB_ROW_ARRAY_T,
    schema_certificate_guid OUT    RAW,
    signature_algo       IN      NUMBER DEFAULT
DBMS_BLOCKCHAIN_TABLE.SIGN_ALGO_DEFAULT)
RETURN RAW;
```

Parameters

Table 41-12 GET_SIGNED_BLOCKCHAIN_DIGEST Function Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the blockchain table.
signed_bytes	The BLOB value that contains a header followed by an array of row-info. This sequence of bytes is the digest that is digitally signed. The caller must pass an empty BLOB for this parameter.
signed_rows_indexes	This parameter specifies the rows in the blockchain table that were digitally signed.
schema_certificate_guid	A unique identifier for the certificate of the blockchain table owner stored in the database that may be used to verify the digital signature.

Table 41-12 (Cont.) GET_SIGNED_BLOCKCHAIN_DIGEST Function Parameters

Parameter	Description
<code>signature_algo</code>	The digital signature algorithm to use. The parameter must be one of the following package constants: <ul style="list-style-type: none"> <code>SIGN_ALGO_RSA_SHA2_256</code> <code>SIGN_ALGO_RSA_SHA2_384</code> <code>SIGN_ALGO_RSA_SHA2_512</code>

Usage Notes

- The database computes the signature on `signed_bytes` using the PKI private key of blockchain table owner.
- The certificate of blockchain table owner must be added to the database using `DBMS_USER_CERTS.ADD_CERTIFICATE`.
- The PKI private key and certificate of blockchain table owner must exist in a wallet located under the `<WALLET_ROOT>/bctable/` directory for a non-container database.
- The PKI private key and certificate of blockchain table owner must exist in a wallet located under the `<WALLET_ROOT>/pdb_guid/bctable/` directory for a container database.
- A blockchain table digest created by the `GET_SIGNED_BLOCKCHAIN_DIGEST` function has table information specific to a pluggable database. Such a digest can be used only in the pluggable database in which the digest was created and only for the table that was used to create the digest. For `DBMS_BLOCKCHAIN_TABLE.VERIFY_TABLE_BLOCKCHAIN`, these requirements mean that both blockchain table digests must have been generated in the current pluggable database for the same blockchain table.

For example, suppose you create a digest for a blockchain table in pluggable database A, use Data Pump to export the blockchain table, and use Data Pump to import the blockchain table into pluggable database B. The blockchain table digest created in pluggable database A cannot be used in pluggable database B. You need to create a new blockchain table digest in pluggable database B.

 **Note:**

The `bctable` subdirectory is the name of a database component that uses wallets. It is not the name of a blockchain table.

 **See Also:**

Oracle Database Administrator's Guide

41.3.12

GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS

Function

This function generates and returns the signed digest for user-specified rows in a blockchain table using the table owner's private key stored in the database wallet. The particular rows in the digest are specified by the `row_selector` parameter. The `signed_bytes`, `signed_row_indexes`, and `schema_certificate_guid` are also returned.

 **Note:**

Rows inserted into a blockchain table that have not been committed are not guaranteed to be durable. Therefore, a signed blockchain digest does not include inserted rows that have not been committed.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS (
  schema_name          IN      VARCHAR2,
  table_name           IN      VARCHAR2,
  row_selector         IN      VARCHAR2,
  signed_bytes         IN OUT  BLOB,
  row_data_bytes       IN OUT  BLOB,
  signed_rows_indexes  OUT    SYS.ORABCTAB_ROW_ARRAY_T,
  schema_certificate_guid OUT    RAW,
  signature_algo       IN      NUMBER DEFAULT
DBMS_BLOCKCHAIN_TABLE.SIGN_ALGO_DEFAULT)
RETURN RAW;
```

Parameters

Table 41-13 GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS Function Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema.
<code>table_name</code>	The name of the blockchain table.
<code>row_selector</code>	The condition, a where clause without the <code>WHERE</code> keyword.
<code>signed_bytes</code>	The BLOB value that contains a header followed by an array of row-info. This sequence of bytes is the digest that is digitally signed. The caller must pass an empty BLOB for this parameter.
<code>row_data_bytes</code>	This parameter specifies the content of the rows in the blockchain table that were selected for the digest. The caller must pass an empty BLOB for this parameter.
<code>signed_rows_indexes</code>	This parameter specifies the rows in the blockchain table that were digitally signed.
<code>schema_certificate_guid</code>	A unique identifier for the certificate of the blockchain table owner stored in the database that may be used to verify the digital signature.

Table 41-13 (Cont.) GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS Function Parameters

Parameter	Description
signature_algo	The algorithm used to create the digital signature. The algorithm must be one of the following constants defined in the DBMS_BLOCKCHAIN_TABLE package: <ul style="list-style-type: none"> SIGN_ALGO_RSA_SHA2_256 SIGN_ALGO_RSA_SHA2_384 SIGN_ALGO_RSA_SHA2_512

Usage Notes

- The database computes the signature on `signed_bytes` using the PKI private key of blockchain table owner.
- The certificate of blockchain table owner must be added to the database using `DBMS_USER_CERTS.ADD_CERTIFICATE`.
- The PKI private key and certificate of blockchain table owner must exist in a wallet located under the `<WALLET_ROOT>/bctable/` directory for a non-container database.
- The PKI private key and certificate of blockchain table owner must exist in a wallet located under the `<WALLET_ROOT>/pdb_guid/bctable/` directory for a container database.
- A blockchain table digest created by the `GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS` function has table information specific to a pluggable database. Such a digest can be used only in the pluggable database in which the digest was created and only for the table that was used to create the digest. For `DBMS_BLOCKCHAIN_TABLE.VERIFY_TABLE_BLOCKCHAIN`, these requirements mean that both blockchain table digests must have been generated in the current pluggable database for the same blockchain table.

For example, suppose you create a digest for a blockchain table in pluggable database A, use Data Pump to export the blockchain table, and use Data Pump to import the blockchain table into pluggable database B. The blockchain table digest created in pluggable database A cannot be used in pluggable database B. You need to create a new blockchain table digest in pluggable database B.

Note:

The `bctable` subdirectory is the name of a database component that uses wallets. It is not the name of a blockchain table.

See Also:

Oracle Database Administrator's Guide

41.3.13 SIGN_ROW Procedure

This procedure can be used by the current user to provide a signature on row content of a previously inserted row. The transaction that inserted the row into the blockchain table must have committed before the `SIGN_ROW` procedure is called.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.SIGN_ROW(
  schema_name          IN VARCHAR2,
  table_name           IN VARCHAR2,
  instance_id          IN NUMBER,
  chain_id             IN NUMBER,
  sequence_id          IN NUMBER,
  hash                 IN RAW DEFAULT NULL,
  signature            IN RAW,
  certificate_guid     IN RAW,
  signature_algo       IN NUMBER,
  delegate            IN BOOLEAN DEFAULT FALSE,
  pdb_guid            IN RAW DEFAULT NULL);
```

Parameters

Table 41-14 SIGN_ROW Procedure Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema.
<code>table_name</code>	The name of the blockchain table.
<code>instance_id</code>	The instance on which the row was inserted.
<code>chain_id</code>	The chain containing the row to be signed. There are 32 chains in each instance, and they are numbered from 0 to 31.
<code>sequence_id</code>	The position of the row on the chain. Valid values are 1, 2, and so on.
<code>hash</code>	If non-NULL, the expected value of the hash in the row to be signed. If NULL, the hash in the row to be signed is not checked.
<code>signature</code>	The user's digital signature on the hash value stored in the row.
<code>certificate_guid</code>	A unique identifier for the certificate stored in the database that may be used to verify the digital signature.
<code>signature_algo</code>	The algorithm used to create the digital signature. The algorithm must be one of the following constants defined in the <code>DBMS_BLOCKCHAIN_TABLE</code> package: <ul style="list-style-type: none"> <code>SIGN_ALGO_RSA_SHA2_256</code> <code>SIGN_ALGO_RSA_SHA2_384</code> <code>SIGN_ALGO_RSA_SHA2_512</code>
<code>delegate</code>	If TRUE, then the row is being signed by a delegate. If FALSE, then the row is being signed by the user that inserted the row.
<code>pdb_guid</code>	The identifier of the local pluggable database. This parameter is used by Oracle GoldenGate replication and must be NULL.

**Note:**

For information on hidden columns in blockchain tables, see Hidden Columns in Blockchain Tables

Usage Notes

- The database will verify that:
 - if `delegate` is `FALSE`, the current user's `obj#` matches the value in the hidden column `ORABCTAB_USER_NUMBER$` (ensures that the user owns the row)
 - if `delegate` is `TRUE` and the hidden column `ORABCTAB_DELEGATE_USER_NUMBER$` is not `NULL`, the current user's `obj#` matches the value in this column
 - if `delegate` is `TRUE`, the current user has `SIGN` privilege on the blockchain table
 - the hash (if provided) matches the hash column content for the row
 - the signature column value for the specific row identified by `'instance_id'`, `'chain_id'`, and `'sequence_id'` is `NULL`
 - if the verification succeeds, the signature value is stored for the row.
 - The `SIGN_ROW` procedure depends on information specific to a pluggable database and is applicable only to rows that were inserted in the current pluggable database by users, applications, or utilities other than Data Pump.

For example, suppose you insert a row into a blockchain table in pluggable database A, commit the `INSERT` transaction, use Data Pump to export the blockchain table, and use Data Pump to import the blockchain table into pluggable database B. If you try to sign this row in pluggable database B, `DBMS_BLOCKCHAIN_TABLE.SIGN_ROW` will raise an exception. Hence you should sign all rows in a blockchain table that need to be signed before using Data Pump to create a copy of the blockchain table.

41.3.14 SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS Procedure

This procedure allows an end user or a delegate to sign a row using a set of at most three user columns that uniquely identify a single row.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS (
  schema_name      IN      VARCHAR2,
  table_name       IN      VARCHAR2,
  hash             IN      RAW DEFAULT NULL,
  signature        IN      RAW,
  certificate_guid IN      RAW,
  signature_algo   IN      NUMBER,
  delegate         IN      BOOLEAN DEFAULT FALSE,
  keycol1_name     IN      VARCHAR2,
  keycol1_value    IN      VARCHAR2,
  keycol2_name     IN      VARCHAR2 DEFAULT NULL,
  keycol2_value    IN      VARCHAR2 DEFAULT NULL,
  keycol3_name     IN      VARCHAR2 DEFAULT NULL,
  keycol3_value    IN      VARCHAR2 DEFAULT NULL,
  pdb_guid        IN      RAW DEFAULT NULL);
```

Parameters

Table 41-15 SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS Procedure Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the blockchain table.
hash	If non-NULL, the expected value of the hash in the row to be signed. If NULL, the hash in the row to be signed is not checked.
signature	The user's digital signature on the hash value stored in the row.
certificate_guid	A unique identifier for the certificate stored in the database that may be used to verify the digital signature.
signature_algo	The algorithm used to create the digital signature. The algorithm must be one of the following constants defined in the DBMS_BLOCKCHAIN_TABLE package: <ul style="list-style-type: none"> SIGN_ALGO_RSA_SHA2_256 SIGN_ALGO_RSA_SHA2_384 SIGN_ALGO_RSA_SHA2_512
delegate	If TRUE, then the row is being signed by a delegate. If FALSE, then the row is being signed by the user that inserted the row.
keycol1_name	The name of the key column.
keycol1_value	The value of the key column.
keycol2_name	The name of the second column in a composite key.
keycol2_value	The value of the second column in a composite key.
keycol3_name	The name of the third column in a composite key.
keycol3_value	The value of the third column in a composite key.
pdb_guid	The identifier of the local pluggable database. This parameter is used by Oracle GoldenGate replication and must be NULL.

Usage Notes

Only non-NULL values can be used for `keycol1_value`, `keycol2_value`, and `keycol3_value`. If a NULL value is specified for `keycol2_value` or `keycol3_value`, then the corresponding parameter `keycol2_name` or `keycol3_name` must be NULL. Any other combination raises an exception.

41.3.15

SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS_WITH_COUNTERSIGNATURE Procedure

This procedure uses at most three user column names and values to uniquely identify a single row to sign and countersign. A row in a blockchain table can be countersigned only if the row belongs to the current epoch for the blockchain table.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS_WITH_COUNTERSIGNATURE (
  schema_name          IN      VARCHAR2,
  table_name           IN      VARCHAR2,
  hash                 IN      RAW DEFAULT NULL,
```

```

signature                IN      RAW,
certificate_guid         IN      RAW,
signature_algo          IN      NUMBER,
delegate                IN      BOOLEAN DEFAULT FALSE,
keycol1_name            IN      VARCHAR2,
keycol1_value           IN      VARCHAR2,
keycol2_name            IN      VARCHAR2 DEFAULT NULL,
keycol2_value           IN      VARCHAR2 DEFAULT NULL,
keycol3_name            IN      VARCHAR2 DEFAULT NULL,
keycol3_value           IN      VARCHAR2 DEFAULT NULL,
countersignature_algo   IN      NUMBER DEFAULT
DBMS_BLOCKCHAIN_TABLE.SIGN_ALGO_DEFAULT,
countersignature_signed_bytes IN  OUT BLOB,
countersignature        OUT     RAW,
countersignature_certificate_guid OUT RAW,
countersignature_content_version IN  VARCHAR2 DEFAULT 'V2_DIGEST',
pdb_guid                IN      RAW DEFAULT NULL);

```

Parameters

Table 41-16 SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS_WITH_COUNTERSIGNATURE Procedure Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the blockchain table.
hash	If non-NULL, the expected value of the hash in the row to be signed. If NULL, the hash in the row to be signed is not checked
signature	The user's digital signature on the hash value stored in the row.
certificate_guid	A unique identifier for the certificate stored in the database that may be used to verify the digital signature.
signature_algo	The algorithm used to create the digital signature. The algorithm must be one of the following constants defined in the DBMS_BLOCKCHAIN_TABLE package: <ul style="list-style-type: none"> SIGN_ALGO_RSA_SHA2_256 SIGN_ALGO_RSA_SHA2_384 SIGN_ALGO_RSA_SHA2_512
delegate	If TRUE, then the row is being signed by a delegate. If FALSE, then the row is being signed by the user that inserted the row.
keycol1_name	The name of the key column.
keycol1_value	The value of the key column.
keycol2_name	The name of the second column in a composite key.
keycol2_value	The value of the second column in a composite key.
keycol3_name	The name of the third column in a composite key.
keycol3_value	The value of the third column in a composite key.
countersignature_algo	The digital signature algorithm for the countersignature. The parameter must be one of the following package constants: <ul style="list-style-type: none"> SIGN_ALGO_RSA_SHA2_256 SIGN_ALGO_RSA_SHA2_384 SIGN_ALGO_RSA_SHA2_512
countersignature_signed_bytes	The bytes that are input to the algorithm that generates the countersignature. The caller must pass an empty BLOB for this parameter.

Table 41-16 (Cont.)
SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS_WITH_COUNTERSIGNATURE
Procedure Parameters

Parameter	Description
countersignature	The digital signature on the bytes returned in countersignature_signed_bytes.
countersignature_certificate_guid	A unique identifier for the certificate of the blockchain table owner stored in the database that may be used to verify the countersignature.
countersignature_content_version	The version of the data contents and layout that are used as input to the countersignature algorithm. Only 'V2_DIGEST' is supported in this release.
pdb_guid	The identifier of the local pluggable database. This parameter is used by Oracle GoldenGate replication and must be NULL.

41.3.16 SIGN_ROW_WITH_COUNTERSIGNATURE Procedure

It is an extension of `SIGN_ROW` that enables the user to request a countersignature from the database. The countersignature will be produced by signing the row data content using the table owner's private key stored in the database wallet. A row in a blockchain table can be countersigned only if the row belongs to the current epoch for the blockchain table.

If `delegate` is `TRUE`, then it is the delegate user that is requesting the countersignature.

The countersignature is stored in the row along with all the meta-information needed to recompute the signed bytes used in its computation.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.SIGN_ROW_WITH_COUNTERSIGNATURE (
    schema_name           IN VARCHAR2,
    table_name            IN VARCHAR2,
    instance_id           IN NUMBER,
    chain_id              IN NUMBER,
    sequence_id           IN NUMBER,
    hash                  IN RAW DEFAULT NULL,
    signature              IN RAW,
    certificate_guid       IN RAW,
    signature_algo         IN NUMBER,
    delegate              IN BOOLEAN DEFAULT FALSE,
    countersignature_algo IN NUMBER DEFAULT
DBMS_BLOCKCHAIN_TABLE.SIGN_ALGO_DEFAULT,
    countersignature_signed_bytes IN OUT BLOB,
    countersignature       OUT RAW,
    countersignature_certificate_guid OUT RAW,
    countersignature_content_version IN VARCHAR2 DEFAULT 'V2_DIGEST',
    pdb_guid              IN RAW DEFAULT NULL);
```

Parameters

Table 41-17 SIGN_ROW_WITH_COUNTERSIGNATURE Procedure Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the blockchain table.
instance_id	The instance on which the row was inserted.
chain_id	The chain containing the row to be signed. By default, there are 32 chains in each instance, and they are numbered from 0 to 31.
sequence_id	The position of the row on the chain. Valid values are 1, 2, and so on.
hash	If non-NULL, the expected value of the hash in the row to be signed. If NULL, the hash in the row to be signed is not checked.
signature	The user's digital signature on the hash value stored in the row.
certificate_guid	A unique identifier for the certificate stored in the database that may be used to verify the digital signature.
signature_algo	The algorithm used to create the digital signature. The algorithm must be one of the following constants defined in the DBMS_BLOCKCHAIN_TABLE package: <ul style="list-style-type: none"> SIGN_ALGO_RSA_SHA2_256 SIGN_ALGO_RSA_SHA2_384 SIGN_ALGO_RSA_SHA2_512
delegate	If TRUE, then the row is being signed by a delegate. If FALSE, then the row is being signed by the user that inserted the row.
countersignature_algo	The digital signature algorithm for the countersignature. The parameter must be one of the following package constants: <ul style="list-style-type: none"> SIGN_ALGO_RSA_SHA2_256 SIGN_ALGO_RSA_SHA2_384 SIGN_ALGO_RSA_SHA2_512
countersignature_signed_bytes	The bytes that are input to the algorithm that generates the countersignature. The caller must pass an empty BLOB for this parameter.
countersignature	The digital signature on the bytes returned in countersignature_signed_bytes.
countersignature_certificate_guid	A unique identifier for the certificate of the blockchain table owner stored in the database that may be used to verify the countersignature.
countersignature_content_version	The version of the data contents and layout that are used as input to the countersignature algorithm. Only 'V2_DIGEST' is supported in this release.
pdb_guid	The identifier of the local pluggable database. This parameter is used by Oracle GoldenGate replication and must be NULL.

Usage Notes

- SYS can always countersign any row of a blockchain table.
- An end-user or a delegate that signs and procures a countersignature using SIGN_ROW_SPECIFIED_BY_KEY_COLUMNS_WITH_COUNTERSIGNATURE or SIGN_ROW_WITH_COUNTERSIGNATURE does not need any additional privileges to procure a countersignature.

41.3.17 VERIFY_ROWS Procedure

Verifies all rows on all applicable system chains for integrity of `HASH` column value and optionally the `SIGNATURE` column value for rows created in the range of `low_timestamp` to `high_timestamp`. An appropriate exception is thrown if the integrity of chains is compromised.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.VERIFY_ROWS(
  schema_name          IN VARCHAR2,
  table_name           IN VARCHAR2,
  low_timestamp        IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
  high_timestamp       IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
  instance_id          IN NUMBER DEFAULT NULL,
  chain_id             IN NUMBER DEFAULT NULL,
  number_of_rows_verified OUT NUMBER,
  verify_signature     IN BOOLEAN DEFAULT TRUE,
  verify_delegate_signature IN BOOLEAN DEFAULT TRUE,
  verify_countersignature IN BOOLEAN DEFAULT TRUE,
  pdb_guid             IN RAW DEFAULT NULL);
```

Parameters

Table 41-18 VERIFY_ROWS Procedure Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema.
<code>table_name</code>	The name of the blockchain table.
<code>low_timestamp</code>	If specified, the low end of the time range for verifying rows. The default value is <code>NULL</code> .
<code>high_timestamp</code>	If specified, the high end of the time range for verifying rows. The default value is <code>NULL</code> .
<code>instance_id</code>	If specified, restricts row verification to rows inserted on the specified instance.
<code>chain_id</code>	If specified, restricts row verification to rows on the specified chain. By default, there are 32 chains in each instance, and they are numbered from 0 to 31.
<code>number_of_rows_verified</code>	The number of rows verified.
<code>verify_signature</code>	If <code>verify_signature</code> is <code>TRUE</code> , both the hash on each row and any user signature on the row are verified. If <code>verify_signature</code> is <code>FALSE</code> , user signatures are not verified.
<code>verify_delegate_signature</code>	If <code>verify_delegate_signature</code> is <code>TRUE</code> , both the hash on each row and any delegate signature on the row are verified. If <code>verify_delegate_signature</code> is <code>FALSE</code> , delegate signatures are not verified.
<code>verify_countersignature</code>	If <code>verify_countersignature</code> is <code>TRUE</code> , both the hash on each row and any countersignature on the row are verified. If <code>verify_countersignature</code> is <code>FALSE</code> , countersignatures are not verified.
<code>pdb_guid</code>	For a V2 blockchain table, if not <code>NULL</code> , restricts attention to system chains inserted by the specified pluggable database. Must be <code>NULL</code> for a V1 blockchain table.

Usage Notes

- `schema_name` and `table_name` are the required input parameters.
- All other input parameters are optional, with the following exception:
 - If `chain_id` is specified, `instance_id` must be specified.
- Valid values for `instance_id` are 1, 2, ... etc.
- If neither `instance_id`, nor `chain_id` is specified, then it implies all chains. If only `instance_id` is specified, then it implies all chains on that instance. If both are specified, then it implies the specific chain provided by the combination.
- If both `low_timestamp` and `high_timestamp` are specified, then `high_timestamp` must be later than `low_timestamp`.

If `low_timestamp` is not specified, then the range is the oldest row in the blockchain table to `high_timestamp`.

If `high_timestamp` is not specified, then the range is `low_timestamp` to the timestamp of the last row inserted in the table.

41.3.18 VERIFY_TABLE_BLOCKCHAIN Procedure

This procedure verifies signatures and system chains for all rows whose creation-times fall between the minimum value for the row-creation time from `bytes_previous` and the maximum value for row-creation time from `bytes_latest`. The OUT parameter `number_of_rows_verified` returns the number of successfully verified rows.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.VERIFY_TABLE_BLOCKCHAIN(
  bytes_latest          IN      BLOB          DEFAULT NULL,
  bytes_previous       IN      BLOB          DEFAULT NULL,
  number_of_rows_verified OUT    NUMBER,
  verify_signature     IN      BOOLEAN      DEFAULT TRUE,
  verify_delegate_signature IN  BOOLEAN      DEFAULT TRUE,
  verify_countersignature IN  BOOLEAN      DEFAULT TRUE,
  signed_bytes_latest  IN      BLOB          DEFAULT NULL,
  signed_bytes_previous IN  BLOB          DEFAULT NULL);
```

Parameters

Table 41-19 VERIFY_TABLE_BLOCKCHAIN Procedure Parameters

Parameter	Description
<code>bytes_latest</code>	A digest populated by a call to <code>GET_SIGNED_BLOCKCHAIN_DIGEST</code> , <code>GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS</code> , <code>GET_BLOCKCHAIN_DIGEST</code> , or <code>GET_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS</code> .
<code>bytes_previous</code>	A digest populated by a call to <code>GET_SIGNED_BLOCKCHAIN_DIGEST</code> , <code>GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS</code> , <code>GET_BLOCKCHAIN_DIGEST</code> , or <code>GET_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS</code> before the <code>bytes_latest</code> BLOB was populated.

Table 41-19 (Cont.) VERIFY_TABLE_BLOCKCHAIN Procedure Parameters

Parameter	Description
number_of_rows_verified	The count of the rows in the blockchain table that were verified.
verify_signature	If <code>verify_signature</code> is TRUE, both the hash on each row and any user signature on the row are verified. If <code>verify_signature</code> is FALSE, user signatures are not verified.
verify_delegate_signature	If <code>verify_delegate_signature</code> is TRUE, both the hash on each row and any delegate signature on the row are verified. If <code>verify_delegate_signature</code> is FALSE, delegate signatures are not verified.
verify_countersignature	If <code>verify_countersignature</code> is TRUE, both the hash on each row and any countersignature on the row are verified. If <code>verify_countersignature</code> is FALSE, countersignatures are not verified.
signed_bytes_latest	<code>signed_bytes_latest</code> has been deprecated.
signed_bytes_previous	<code>signed_bytes_previous</code> has been deprecated.

Usage Notes

The BLOBs in `bytes_latest` and `bytes_previous` must be associated with the same blockchain table. For `GET_SIGNED_BLOCKCHAIN_DIGEST` and `GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS`, the relevant BLOB parameter is called `signed_bytes`. For `GET_BLOCKCHAIN_DIGEST` and `GET_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS`, the relevant BLOB parameter is called `digest_bytes`.

41.3.19 VERIFY_USER_BLOCKCHAIN_ROWS Procedure

This procedure verifies rows of one or more user chains when the user chains feature is enabled for a blockchain table.

Syntax

```
DBMS_BLOCKCHAIN_TABLE.verify_user_blockchain_rows (
  schema_name          IN    VARCHAR2,
  table_name           IN    VARCHAR2,
  row_version_name     IN    VARCHAR2,
  number_of_rows_verified OUT NUMBER,
  keycol1_value        IN    VARCHAR2 DEFAULT NULL,
  keycol2_value        IN    VARCHAR2 DEFAULT NULL,
  keycol3_value        IN    VARCHAR2 DEFAULT NULL,
  low_timestamp        IN    TIMESTAMP WITH TIME ZONE DEFAULT NULL,
  high_timestamp       IN    TIMESTAMP WITH TIME ZONE DEFAULT NULL,
  verify_signature     IN    BOOLEAN DEFAULT TRUE,
  verify_delegate_signature IN BOOLEAN DEFAULT TRUE,
  verify_countersignature IN BOOLEAN DEFAULT TRUE,
  pdb_guid             IN    RAW DEFAULT NULL);
```


Parameters

Table 41-20 VERIFY_USER_BLOCKCHAIN_ROWS Procedure Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the blockchain table.
row_version_name	The name of the row version given when the blockchain table was created.
number_of_rows_verified	The number of rows verified.
keycol1_value	The value of the key column.
keycol2_value	The value of the second column in a composite key.
keycol3_value	The value of the third column in a composite key.
low_timestamp	If specified, the low end of the time range for verifying rows. The default value is NULL.
high_timestamp	If specified, the high end of the time range for verifying rows. The default value is NULL.
verify_signature	If verify_signature is TRUE, both the hash on each row and any user signature on the row are verified. If verify_signature is FALSE, user signatures are not verified.
verify_delegate_signature	If verify_delegate_signature is TRUE, both the hash on each row and any delegate signature on the row are verified. If verify_delegate_signature is FALSE, delegate signatures are not verified.
verify_countersignature	If verify_countersignature is TRUE, both the hash on each row and any countersignature on the row are verified. If verify_countersignature is FALSE, countersignatures are not verified.
pdb_guid	For a V2 blockchain table, if not NULL, restricts attention to user chains inserted by the specified pluggable database. Must be NULL for a V1 blockchain table.

Usage Notes

The parameters `keycol1_value`, `keycol2_value`, and `keycol3_value` may be used to limit the user chains that are verified. If all three of these parameters are NULL, all user chains are verified. If one or more of these parameters are not NULL, then only user chains matching the non-NULL parameters are verified.

DBMS_BLOCKER_RESOLVER

The `DBMS_BLOCKER_RESOLVER` package provides a method of changing some Blocker Resolver configuration parameters.

This chapter contains the following topics:

- [DBMS_BLOCKER_RESOLVER Overview](#)
- [DBMS_BLOCKER_RESOLVER Security Model](#)
- [DBMS_BLOCKER_RESOLVER Constants](#)
- [DBMS_BLOCKER_RESOLVER Exceptions](#)
- [Summary of DBMS_BLOCKER_RESOLVER Subprograms](#)

42.1 DBMS_BLOCKER_RESOLVER Overview

The `DBMS_BLOCKER_RESOLVER` package provides a method of changing some Blocker Resolver configuration parameters.

 **Note:**

The `DBMS_HANG_MANAGER` package is deprecated in Oracle Database 23ai. Use `DBMS_BLOCKER_RESOLVER` instead.

The `DBMS_HANG_MANAGER` package provides a method of changing some configuration parameters and constraints to address session issues. This package is being replaced with `DBMS_BLOCKER_RESOLVER`. `DBMS_HANG_MANAGER` can be removed in a future release.

Blocker Resolver is always enabled on all databases, Automatic Storage Management (ASM) disk groups, and single instance systems (when not using Oracle RAC). Delay resolution is enabled on all instances by default except for single instance systems (when not using Oracle RAC) where it is disabled and cannot be enabled at this time.

 **Note:**

The `DBMS_BLOCKER_RESOLVER` package is intended for use by database administrators (DBA) only. It is not intended for use by application developers.

42.2 DBMS_BLOCKER_RESOLVER Security Model

`DBMS_BLOCKER_RESOLVER` can only be run as the `SYS` user.

42.3 DBMS_BLOCKER_RESOLVER Constants

The table in this topic lists DBMS_BLOCKER_RESOLVER package constants.

Table 42-1 DBMS_BLOCKER_RESOLVER Constants

Name	Type	Value	Description
RESOLUTION_SCOPE	VARCHAR2	resolution scope	Resolution scope parameter name
SENSITIVITY	VARCHAR2	sensitivity	Sensitivity parameter name
BASE_FILE_SIZE_LIMIT	VARCHAR2	base file size limit	Base file size limit parameter name. The default value of this parameter is 100 MB.
BASE_FILE_SET_COUNT	VARCHAR2	base file set count	Base file set count parameter name. The default value is 5 trace files in the circular trace file set.
LWS_FILE_SIZE_LIMIT	VARCHAR2	long waiting session file size limit	Long waiting session file size limit parameter name. The default value of this parameter is 100 MB.
LWS_FILE_SET_COUNT	VARCHAR2	long waiting session set count	Long waiting session set count parameter name. The default value is 5 trace files in the circular trace file set.
RESOLUTION_SCOPE_PROCESS	VARCHAR2	PROCESS	Enables only session and/or process termination
RESOLUTION_SCOPE_INSTANCE	VARCHAR2	INSTANCE	Enables session, process, and instance termination. The latter is used in specific scenarios. The default value is INSTANCE.
SENSITIVITY_NORMAL	VARCHAR2	NORMAL	Sets various Blocker Resolver intervals to their default values. The default value is NORMAL.
SENSITIVITY_HIGH	VARCHAR2	HIGH	Sets the various Blocker Resolver intervals to half of their default values

42.4 DBMS_BLOCKER_RESOLVER Exceptions

The table in this topic lists the exceptions raised by the `DBMS_BLOCKER_RESOLVER` package.

Table 42-2 DBMS_BLOCKER_RESOLVER Package Exceptions

Exception	Error Code	Description
<code>ERRNUM_INPUT_ERROR</code>	-32706	Invalid user input
<code>ERRNUM_INTERNAL_ERROR</code>	-32707	Database experienced an error setting a parameter
<code>ERRNUM_UNSUPPORTED_ERROR</code>	-32708	Operation is not supported on this instance type

42.5 Summary of DBMS_BLOCKER_RESOLVER Subprograms

The `DBMS_BLOCKER_RESOLVER` package includes the `SET` procedure subprogram.

Table 42-3 DBMS_BLOCKER_RESOLVER Package Subprograms

Subprogram	Description
SET Procedure	Sets the specified parameter to the specified value

42.5.1 SET Procedure

This procedure sets the specified parameters to specified values.

Syntax

```
DBMS_BLOCKER_RESOLVER.SET (
  pname IN VARCHAR2,
  pvalue IN VARCHAR2);
```

Parameters

Table 42-4 SET Procedure Parameters

Parameter	Description
<code>pname</code>	Contains the parameter name that needs to be modified.
<code>pvalue</code>	Contains the new value for the parameter name specified in <code>pname</code> .

DBMS_CAPTURE_ADM

The `DBMS_CAPTURE_ADM` package, one of a set of Oracle Replication packages, provides subprograms for starting, stopping, and configuring a capture process. The source of the captured changes is the redo logs, and the repository for the captured changes is a queue.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_CAPTURE_ADM Subprograms](#)

43.1 DBMS_CAPTURE_ADM Overview

This package provides interfaces to start, stop, and configure a capture process or a synchronous capture. This package includes subprograms for preparing database objects for instantiation.

Capture processes can be used in an XStream configuration in a multitenant container database (CDB). A CDB is an Oracle database that includes zero, one, or many user-created pluggable databases (PDBs).

See Also:

Oracle Database Concepts for more information about CDBs and PDBs

43.2 DBMS_CAPTURE_ADM Security Model

The `DBMS_CAPTURE_ADM` security can be controlled in one of two ways.

- Granting `EXECUTE` on this package to selected users or roles.
- Granting `EXECUTE_CATALOG_ROLE` to selected users or roles.

If subprograms in the package are run from within a stored procedure, then the user who runs the subprograms must be granted `EXECUTE` privilege on the package directly. It cannot be granted through a role.

When the `DBMS_CAPTURE_ADM` package is used to manage an Oracle Replication configuration, it requires that the user is granted the privileges of an Oracle Replication administrator.

When the `DBMS_CAPTURE_ADM` package is used to manage an XStream configuration, it requires that the user is granted the privileges of an XStream administrator.

 **Note:**

- The user must be granted additional privileges to perform some administrative tasks using the subprograms in this package, such as setting a capture user. If additional privileges are required for a subprogram, then the privileges are documented in the section that describes the subprogram.
- Using XStream requires purchasing a license for the Oracle GoldenGate product. See *Oracle Database XStream Guide*.

 **See Also:**

Oracle Database XStream Guide for information about configuring an XStream administrator

43.3 Summary of DBMS_CAPTURE_ADM Subprograms

This table lists the `DBMS_CAPTURE_ADM` subprograms and briefly describes them.

Table 43-1 DBMS_CAPTURE_ADM Package Subprograms

Subprogram	Description
ABORT_GLOBAL_INSTANTIATION Procedure	Reverses the effects of running the <code>PREPARE_GLOBAL_INSTANTIATION</code> , <code>PREPARE_SCHEMA_INSTANTIATION</code> , and <code>PREPARE_TABLE_INSTANTIATION</code> procedures
ABORT_SCHEMA_INSTANTIATION Procedure	Reverses the effects of running the <code>PREPARE_SCHEMA_INSTANTIATION</code> and <code>PREPARE_TABLE_INSTANTIATION</code> procedures
ABORT_SYNC_INSTANTIATION Procedure	Reverses the effects of running the <code>PREPARE_SYNC_INSTANTIATION</code> procedure
ABORT_TABLE_INSTANTIATION Procedure	Reverses the effects of running the <code>PREPARE_TABLE_INSTANTIATION</code> procedure
ALTER_CAPTURE Procedure	Alters a capture process
ALTER_SYNC_CAPTURE Procedure	Alters a synchronous capture

Table 43-1 (Cont.) DBMS_CAPTURE_ADM Package Subprograms

Subprogram	Description
BUILD Procedure	Extracts the data dictionary of the current database to the redo logs and automatically specifies database supplemental logging for all primary key and unique key columns
CREATE_CAPTURE Procedure	Creates a capture process
CREATE_SYNC_CAPTURE Procedure	Creates a synchronous capture
DROP_CAPTURE Procedure	Drops a capture process
INCLUDE_EXTRA_ATTRIBUTE Procedure	Includes or excludes an extra attribute in logical change records (LCRs) captured by the specified capture process or synchronous capture
PREPARE_GLOBAL_INSTANTIATION Procedure	Performs the synchronization necessary for instantiating all the tables in the database at another database and can enable supplemental logging for key columns or all columns in these tables
PREPARE_SCHEMA_INSTANTIATION Procedure	Performs the synchronization necessary for instantiating all tables in the schema at another database and can enable supplemental logging for key columns or all columns in these tables
PREPARE_SYNC_INSTANTIATION Function	Performs the synchronization necessary for instantiating one or more tables at another database and returns the prepare SCN
PREPARE_TABLE_INSTANTIATION Procedure	Performs the synchronization necessary for instantiating the table at another database and can enable supplemental logging for key columns or all columns in the table
SET_PARAMETER Procedure	Sets a capture process parameter to the specified value
START_CAPTURE Procedure	Starts the capture process, which mines redo logs and enqueues the mined redo information into the associated queue
STOP_CAPTURE Procedure	Stops the capture process from mining redo logs

**Note:**

All subprograms commit unless specified otherwise.

43.3.1 ABORT_GLOBAL_INSTANTIATION Procedure

This procedure reverses the effects of running the `PREPARE_GLOBAL_INSTANTIATION`, `PREPARE_SCHEMA_INSTANTIATION`, and `PREPARE_TABLE_INSTANTIATION` procedures.

Specifically, this procedure performs the following actions:

- Removes data dictionary information related to the database, schema, and table instantiations

- Removes any supplemental logging enabled by the `PREPARE_GLOBAL_INSTANTIATION`, `PREPARE_SCHEMA_INSTANTIATION`, and `PREPARE_TABLE_INSTANTIATION` procedures

Syntax

```
DBMS_CAPTURE_ADM.ABORT_GLOBAL_INSTANTIATION(
  container IN VARCHAR2 DEFAULT 'CURRENT');
```

Parameter

Table 43-2 ABORT_GLOBAL_INSTANTIATION Procedure Parameter

Parameter	Description
<code>container</code>	<p>Either <code>CURRENT</code>, <code>ALL</code>, or <code>pdb_name</code>.</p> <p>If <code>CURRENT</code> is specified, then this procedure removes supplemental logging for the current container.</p> <p>If <code>ALL</code> is specified, then this procedure removes supplemental logging for all of the containers in the current CDB.</p> <p>If <code>pdb_name</code> is specified, then this procedure removes supplemental logging for the specified PDB.</p> <p><code>ALL</code> and <code>pdb_name</code> are valid only when you invoke the procedure from the root.</p>

43.3.2 ABORT_SCHEMA_INSTANTIATION Procedure

This procedure reverses the effects of running the `PREPARE_SCHEMA_INSTANTIATION` procedure. It also reverses the effects of running the `PREPARE_TABLE_INSTANTIATION` procedure on tables in the specified schema.

Specifically, this procedure performs the following actions:

- Removes data dictionary information related to schema instantiations and table instantiations of tables in the schema
- Removes any supplemental logging enabled by the `PREPARE_SCHEMA_INSTANTIATION` procedure
- Removes any supplemental logging enabled by the `PREPARE_TABLE_INSTANTIATION` procedure for tables in the specified schema

Syntax

```
DBMS_CAPTURE_ADM.ABORT_SCHEMA_INSTANTIATION(
  schema_name IN VARCHAR2,
  container IN VARCHAR2 DEFAULT 'CURRENT');
```

Parameter

Table 43-3 ABORT_SCHEMA_INSTANTIATION Procedure Parameter

Parameter	Description
<code>schema_name</code>	The name of the schema for which to abort the effects of preparing instantiation

Table 43-3 (Cont.) ABORT_SCHEMA_INSTANTIATION Procedure Parameter

Parameter	Description
container	<p>Either CURRENT , ALL, or <i>pdb_name</i>.</p> <p>If CURRENT is specified, then this procedure removes supplemental logging for the current container.</p> <p>If ALL is specified, then this procedure removes supplemental logging for all of the containers in the current CDB.</p> <p>If <i>pdb_name</i> is specified, then this procedure removes supplemental logging for the specified PDB.</p> <p>ALL and <i>pdb_name</i> are valid only when you invoke the procedure from the root.</p>

43.3.3 ABORT_SYNC_INSTANTIATION Procedure

This procedure reverses the effects of running the PREPARE_SYNC_INSTANTIATION procedure. Specifically, this procedure removes data dictionary information related to the table instantiation.

This procedure is overloaded. The *table_names* parameter is VARCHAR2 datatype in one version and DBMS_UTILITY.UNCL_ARRAY datatype in the other version.

Syntax

```
DBMS_CAPTURE_ADM.ABORT_SYNC_INSTANTIATION(
    table_names IN VARCHAR2);

DBMS_CAPTURE_ADM.ABORT_SYNC_INSTANTIATION(
    table_names IN DBMS_UTILITY.UNCL_ARRAY);
```

Parameters

Table 43-4 ABORT_SYNC_INSTANTIATION Procedure Parameter

Parameter	Description
table_names	<p>When the <i>table_names</i> parameter is VARCHAR2 datatype, a comma-delimited list of the tables for which to abort the effects of preparing instantiation. There must be no spaces between entries.</p> <p>When the <i>table_names</i> parameter is DBMS_UTILITY.UNCL_ARRAY datatype, specify a PL/SQL associative array of this type that contains the names of the tables for which to abort the effects of preparing instantiation. The first table name is at position 1, the second at position 2, and so on. The table does not need to be NULL terminated.</p> <p>In either version of the procedure, specify the name of each table in the form [<i>schema_name</i>.]<i>table_name</i>. For example, hr.employees. If the schema is not specified, then the current user is the default.</p>

43.3.4 ABORT_TABLE_INSTANTIATION Procedure

This procedure reverses the effects of running the `PREPARE_TABLE_INSTANTIATION` procedure.

Specifically, this procedure performs the following actions:

- Removes data dictionary information related to the table instantiation
- Removes any supplemental logging enabled by the `PREPARE_TABLE_INSTANTIATION` procedure

Syntax

```
DBMS_CAPTURE_ADM.ABORT_TABLE_INSTANTIATION (
    table_name IN VARCHAR2);
container IN VARCHAR2 DEFAULT 'CURRENT');
```

Parameter

Table 43-5 ABORT_TABLE_INSTANTIATION Procedure Parameter

Parameter	Description
<code>table_name</code>	The name of the table for which to abort the effects of preparing instantiation, specified as <code>[schema_name.]object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default.
<code>container</code>	Either <code>CURRENT</code> , <code>ALL</code> , or <code>pdb_name</code> . If <code>CURRENT</code> is specified, then this procedure removes supplemental logging for the current container. If <code>ALL</code> is specified, then this procedure removes supplemental logging for all of the containers in the current CDB. If <code>pdb_name</code> is specified, then this procedure removes supplemental logging for the specified PDB. <code>ALL</code> and <code>pdb_name</code> are valid only when you invoke the procedure from the root.

43.3.5 ALTER_CAPTURE Procedure

This procedure alters a capture process.

Syntax

```
DBMS_CAPTURE_ADM.ALTER_CAPTURE (
    capture_name           IN VARCHAR2,
    rule_set_name          IN VARCHAR2  DEFAULT NULL,
    remove_rule_set        IN BOOLEAN   DEFAULT FALSE,
    start_scn              IN NUMBER    DEFAULT NULL,
    use_database_link       IN BOOLEAN   DEFAULT NULL,
    first_scn              IN NUMBER    DEFAULT NULL,
    negative_rule_set_name IN VARCHAR2  DEFAULT NULL,
    remove_negative_rule_set IN BOOLEAN  DEFAULT FALSE,
    capture_user            IN VARCHAR2  DEFAULT NULL,
    checkpoint_retention_time IN NUMBER  DEFAULT NULL,
```

```

start_time          IN  TIMESTAMP  DEFAULT NULL,
oldest_scn         IN  NUMBER      DEFAULT NULL);

```

Parameters

Table 43-6 ALTER_CAPTURE Procedure Parameters

Parameter	Description
capture_name	The name of the capture process being altered. You must specify an existing capture process name. Do not specify an owner.
rule_set_name	<p>The name of the positive rule set for the capture process. The positive rule set contains the rules that instruct the capture process to capture changes.</p> <p>To change the positive rule set for the capture process, specify an existing rule set in the form <code>[schema_name.]rule_set_name</code>. For example, to specify a positive rule set in the <code>hr</code> schema named <code>job_capture_rules</code>, enter <code>hr.job_capture_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>An error is returned if the specified rule set does not exist. You can create a rule set and add rules to it using the <code>DBMS_RULE_ADM</code> package.</p> <p>If you specify <code>NULL</code> and the <code>remove_rule_set</code> parameter is set to <code>FALSE</code>, then the procedure retains any existing positive rule set. If you specify <code>NULL</code> and the <code>remove_rule_set</code> parameter is set to <code>TRUE</code>, then the procedure removes any existing positive rule set.</p>
remove_rule_set	<p>If <code>TRUE</code>, then the procedure removes the positive rule set for the specified capture process. If you remove a positive rule set for a capture process, and the capture process does not have a negative rule set, then the capture process captures all supported changes to all objects in the database, excluding database objects in the <code>SYS</code> and <code>SYSTEM</code> schemas.</p> <p>If you remove a positive rule set for a capture process, and the capture process has a negative rule set, then the capture process captures all supported changes that are not discarded by the negative rule set.</p> <p>If <code>FALSE</code>, then the procedure retains the positive rule set for the specified capture process.</p> <p>If the <code>rule_set_name</code> parameter is non-<code>NULL</code>, then ensure that this parameter is set to <code>FALSE</code>.</p>
start_scn	<p>A valid SCN for the database from which the capture process starts capturing changes. The SCN value must be greater than or equal to the first SCN for the capture process. Also, the capture process must be stopped before resetting its start SCN.</p> <p>An error is returned if an invalid SCN is specified or if the capture process is enabled.</p>

Table 43-6 (Cont.) ALTER_CAPTURE Procedure Parameters

Parameter	Description
use_database_link	<p>If TRUE, then the capture process at a downstream database uses a database link to the source database for administrative purposes relating to the capture process. If you want a capture process that is not using a database link currently to begin using a database link, then specify TRUE. In this case, a database link with the same name as the global name of the source database must exist at the downstream database.</p> <p>If FALSE, then either the capture process is running on the source database, or the capture process at a downstream database does not use a database link to the source database. If you want a capture process that is using a database link currently to stop using a database link, then specify FALSE. In this case, you must prepare source database objects for instantiation manually when you add or change capture process rules that pertain to these objects.</p> <p>If NULL, then the current value of this parameter for the capture process is not changed.</p>
first_scn	<p>The lowest SCN in the redo log from which a capture process can capture changes. If you specify a new first SCN for the capture process, then the specified first SCN must meet the following requirements:</p> <ul style="list-style-type: none"> • It must be greater than the current first SCN for the capture process. • It must be less than or equal to the current applied SCN for the capture process. However, this requirement does not apply if the current applied SCN for the capture process is zero. • It must be less than or equal to the required checkpoint SCN for the capture process. <p>An error is returned if the specified SCN does not meet the first three requirements. See "Usage Notes" for information about determining an SCN value that meets all of these conditions.</p> <p>When the first SCN is modified, the capture process purges information from its LogMiner data dictionary that is required to restart it at an earlier SCN. See BUILD Procedure for more information about a LogMiner data dictionary.</p> <p>If the specified first SCN is higher than the current start SCN for the capture process, then the start SCN is set automatically to the new value of the first SCN.</p>

Table 43-6 (Cont.) ALTER_CAPTURE Procedure Parameters

Parameter	Description
<code>negative_rule_set_name</code>	<p>The name of the negative rule set for the capture process. The negative rule set contains the rules that instruct the capture process to discard changes.</p> <p>To change the negative rule set for the capture process, specify an existing rule set in the form <code>[schema_name.]rule_set_name</code>. For example, to specify a negative rule set in the <code>hr</code> schema named <code>neg_capture_rules</code>, enter <code>hr.neg_capture_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>An error is returned if the specified rule set does not exist. You can create a rule set and add rules to it using the <code>DBMS_RULE_ADM</code> package.</p> <p>If you specify <code>NULL</code> and the <code>remove_negative_rule_set</code> parameter is set to <code>FALSE</code>, then the procedure retains any existing negative rule set. If you specify <code>NULL</code> and the <code>remove_negative_rule_set</code> parameter is set to <code>TRUE</code>, then the procedure removes any existing negative rule set.</p> <p>If you specify both a positive and a negative rule set for a capture process, then the negative rule set is always evaluated first.</p>
<code>remove_negative_rule_set</code>	<p>If <code>TRUE</code>, then the procedure removes the negative rule set for the specified capture process. If you remove a negative rule set for a capture process, and the capture process does not have a positive rule set, then the capture process captures all supported changes to all objects in the database, excluding database objects in the <code>SYS</code> and <code>SYSTEM</code> schemas.</p> <p>If you remove a negative rule set for a capture process, and a positive rule set exists for the capture process, then the capture process captures all changes that are not discarded by the positive rule set.</p> <p>If <code>FALSE</code>, then the procedure retains the negative rule set for the specified capture process.</p> <p>If the <code>negative_rule_set_name</code> parameter is non-<code>NULL</code>, then ensure that this parameter is set to <code>FALSE</code>.</p>

Table 43-6 (Cont.) ALTER_CAPTURE Procedure Parameters

Parameter	Description
capture_user	<p>The user in whose security domain a capture process captures changes that satisfy its rule sets and runs custom rule-based transformations configured for capture process rules. If NULL, then the capture user is not changed.</p> <p>To change the capture user, the user who invokes the ALTER_CAPTURE procedure must be granted the DBA role. Only the SYS user can set the capture_user to SYS.</p> <p>If you change the capture user, then this procedure grants the new capture user enqueue privilege on the queue used by the capture process and configures the user as a secure queue user of the queue. In addition, ensure that the capture user has the following privileges:</p> <ul style="list-style-type: none"> EXECUTE privilege on the rule sets used by the capture process EXECUTE privilege on all rule-based transformation functions used in the rule set <p>These privileges can be granted directly to the capture user, or they can be granted through roles.</p> <p>In addition, the capture user must be granted EXECUTE privilege on all packages, including Oracle-supplied packages, that are invoked in rule-based transformations run by the capture process. These privileges must be granted directly to the capture user. They cannot be granted through roles.</p> <p>The capture process is stopped and restarted automatically when you change the value of this parameter.</p> <p>Note: If the capture user for a capture process is dropped using DROP USER . . . CASCADE, then the capture process is also dropped automatically.</p>
checkpoint_retention_time	<p>Either the number of days that a capture process retains checkpoints before purging them automatically, or DBMS_CAPTURE_ADM.INFINITE if checkpoints should not be purged automatically. If NULL, then the checkpoint retention time is not changed.</p> <p>If a number is specified, then a capture process purges a checkpoint the specified number of days after the checkpoint was taken. Partial days can be specified using decimal values. For example, .25 specifies 6 hours.</p> <p>When a checkpoint is purged, LogMiner data dictionary information for the archived redo log file that corresponds to the checkpoint is purged, and the first_scn of the capture process is reset to the SCN value corresponding to the first change in the next archived redo log file.</p>
start_time	<p>A valid time from which the capture process starts capturing changes. The capture process must be stopped before resetting its start time.</p> <p>An error is returned if an invalid time is specified or if the capture process is enabled.</p> <p>The start_scn and start_time parameters are mutually exclusive.</p>
oldest_scn	<p>The oldest SCN of the transactions currently being processed.</p>

Usage Notes

If you want to alter the first SCN for a capture process, then the value specified must meet the conditions in the description for the `first_scn` parameter.

Examples

The following query determines the current first SCN, applied SCN, and required checkpoint SCN for each capture process in a database:

```
SELECT CAPTURE_NAME, FIRST_SCN, APPLIED_SCN, REQUIRED_CHECKPOINT_SCN
       FROM DBA_CAPTURE;
```

43.3.6 ALTER_SYNC_CAPTURE Procedure

This procedure alters a synchronous capture.

Syntax

```
DBMS_CAPTURE_ADM.ALTER_SYNC_CAPTURE (
    capture_name  IN  VARCHAR2,
    rule_set_name IN  VARCHAR2  DEFAULT NULL,
    capture_user  IN  VARCHAR2  DEFAULT NULL);
```

Parameters

Table 43-7 ALTER_SYNC_CAPTURE Procedure Parameters

Parameter	Description
<code>capture_name</code>	The name of the synchronous capture being altered. You must specify an existing synchronous capture name. Do not specify an owner.
<code>rule_set_name</code>	The name of the positive rule set for the synchronous capture. The positive rule set contains the rules that instruct the synchronous capture to capture changes. To change the rule set for the synchronous capture, specify an existing rule set in the form <code>[schema_name.]rule_set_name</code> . For example, to specify a positive rule set in the <code>strmadmin</code> schema named <code>sync_cap_rules</code> , enter <code>strmadmin.sync_cap_rules</code> . If the schema is not specified, then the current user is the default. An error is returned if the specified rule set does not exist. If <code>NULL</code> , then the rule set is not changed.

Table 43-7 (Cont.) ALTER_SYNC_CAPTURE Procedure Parameters


Parameter	Description
capture_user	<p>The user in whose security domain a synchronous capture captures changes that satisfy its rule set and runs custom rule-based transformations configured for synchronous capture rules. If NULL, then the capture user is not changed.</p> <p>To change the capture user, the user who invokes the ALTER_SYNC_CAPTURE procedure must be granted the DBA role. Only the SYS user can set the capture_user to SYS.</p> <p>If you change the capture user, then this procedure grants the new capture user enqueue privilege on the queue used by the synchronous capture and configures the user as a secure queue user of the queue. In addition, ensure that capture user has the following privileges:</p> <ul style="list-style-type: none"> EXECUTE privilege on the rule sets used by the synchronous capture EXECUTE privilege on all rule-based transformation functions used in the rule set <p>These privileges can be granted directly to the capture user, or they can be granted through roles.</p> <p>In addition, the capture user must be granted EXECUTE privilege on all packages, including Oracle-supplied packages, that are invoked in rule-based transformations run by the synchronous capture. These privileges must be granted directly to the capture user. They cannot be granted through roles.</p>

Usage Notes

If the capture user for a synchronous capture is dropped using DROP USER . . . CASCADE, then the synchronous capture is also dropped automatically.

43.3.7 BUILD Procedure

This procedure extracts the data dictionary of the current database to the redo log and automatically specifies database supplemental logging by running the SQL statement ALTER DATABASE ADD SUPPLEMENTAL LOG DATA;

 **Note:**

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

This procedure is overloaded. One version of this procedure contains the OUT parameter first_scn, and the other does not.

Syntax

```
DBMS_CAPTURE_ADM.BUILD(
    first_scn OUT NUMBER);

DBMS_CAPTURE_ADM.BUILD;
```


Parameters

Table 43-8 BUILD Procedure Parameter

Parameter	Description
<code>first_scn</code>	Contains the lowest SCN value corresponding to the data dictionary extracted to the redo log that can be specified as a first SCN for a capture process

Usage Notes

The following usage notes apply to this procedure:

- You can run this procedure multiple times at a source database.
- If you plan to capture changes originating at a source database with a capture process, then this procedure must be executed at the source database at least once. When the capture process is started, either at a local source database or at a downstream database, the capture process uses the extracted information in the redo log to create a LogMiner data dictionary.
- A LogMiner data dictionary is a separate data dictionary used by a capture process to determine the details of a change that it is capturing. The LogMiner data dictionary is necessary because the primary data dictionary of the source database might not be synchronized with the redo data being scanned by a capture process.
- After executing this procedure, you can query the `FIRST_CHANGE#` column of the `V$ARCHIVED_LOG` dynamic performance view where the `DICTIONARY_BEGIN` column is `YES` to determine the lowest SCN value for the database that can be specified as a first SCN for a capture process. The first SCN for a capture process is the lowest SCN in the redo log from which the capture process can capture changes. You can specify the first SCN for a capture process when you run the `CREATE_CAPTURE` or `ALTER_CAPTURE` procedure in the `DBMS_CAPTURE_ADM` package.
- In a CDB, the `BUILD` procedure must be executed from the root.

43.3.8 CREATE_CAPTURE Procedure

This procedure creates a capture process.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.



See Also:

[DBMS_RULE_ADM](#) for more information about rules and rule sets

Syntax

```
DBMS_CAPTURE_ADM.CREATE_CAPTURE(
  queue_name           IN VARCHAR2,
  capture_name         IN VARCHAR2,
  rule_set_name        IN VARCHAR2  DEFAULT NULL,
  start_scn            IN NUMBER     DEFAULT NULL,
  source_database      IN VARCHAR2   DEFAULT NULL,
  use_database_link    IN BOOLEAN    DEFAULT FALSE,
  first_scn            IN NUMBER     DEFAULT NULL,
  logfile_assignment   IN VARCHAR2   DEFAULT 'implicit',
  negative_rule_set_name IN VARCHAR2  DEFAULT NULL,
  capture_user         IN VARCHAR2   DEFAULT NULL,
  checkpoint_retention_time IN NUMBER  DEFAULT 60,
  start_time           IN TIMESTAMP  DEFAULT NULL,
  source_root_name     IN VARCHAR2   DEFAULT NULL,
  capture_class        IN VARCHAR2   DEFAULT 'Streams');
```

Parameters

Table 43-9 CREATE_CAPTURE Procedure Parameters

Parameter	Description
queue_name	The name of the queue into which the capture process enqueues changes. You must specify an existing queue in the form [<i>schema_name</i> .] <i>queue_name</i> . For example, to specify a queue in the <i>hr</i> schema named <i>streams_queue</i> , enter <i>hr.streams_queue</i> . If the schema is not specified, then the current user is the default. Note: The <i>queue_name</i> setting cannot be altered after the capture process is created.
capture_name	The name of the capture process being created. A NULL specification is not allowed. Do not specify an owner. Note: The <i>capture_name</i> setting cannot be altered after the capture process is created.

Table 43-9 (Cont.) CREATE_CAPTURE Procedure Parameters

Parameter	Description
rule_set_name	<p>The name of the positive rule set for the capture process. The positive rule set contains the rules that instruct the capture process to capture changes.</p> <p>If you want to use a positive rule set for the capture process, then you must specify an existing rule set in the form [<i>schema_name</i>.]<i>rule_set_name</i>. For example, to specify a positive rule set in the hr schema named job_capture_rules, enter hr.job_capture_rules. If the schema is not specified, then the current user is the default.</p> <p>An error is returned if the specified rule set does not exist. You can create a rule set and add rules to it using the DBMS_RULE_ADM package.</p> <p>If you specify NULL, and no negative rule set is specified, then the capture process captures all supported changes to all objects in the database, excluding database objects in the SYS and SYSTEM schemas.</p> <p>If you specify NULL, and a negative rule set exists for the capture process, then the capture process captures all changes that are not discarded by the negative rule set.</p>
start_scn	<p>A valid SCN for the database from which the capture process starts capturing changes.</p> <p>An error is returned if an invalid SCN is specified.</p> <p>The start_scn and start_time parameters are mutually exclusive.</p> <p>See Also: "Usage Notes" for more information setting the start_scn parameter</p>
source_database	<p>The global name of the source database. The source database is where the changes to be captured originated.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify DBS1 and the domain is .EXAMPLE.COM, then the procedure specifies DBS1.EXAMPLE.COM automatically.</p> <p>If NULL, or if the specified name is the same as the global name of the current database, then local capture is assumed and only the default values for use_database_link and first_scn can be specified.</p>

Table 43-9 (Cont.) CREATE_CAPTURE Procedure Parameters

Parameter	Description
<code>use_database_link</code>	<p>If <code>TRUE</code>, then the capture process at a downstream database uses a database link to the source database for administrative purposes relating to the capture process. A database link with the same name as the global name of the source database must exist at the downstream database.</p> <p>The capture process uses the database link to prepare database objects for instantiation at the source database and run the <code>DBMS_CAPTURE_ADM.BUILD</code> procedure at the source database, if necessary.</p> <p>During the creation of a downstream capture process, if the <code>first_scn</code> parameter is set to <code>NULL</code>, then the <code>use_database_link</code> parameter must be set to <code>TRUE</code>. Otherwise, an error is returned.</p> <p>If <code>FALSE</code>, then either the capture process is running on the source database, or the capture process at a downstream database does not use a database link to the source database. In this case, you must perform the following administrative tasks manually:</p> <ul style="list-style-type: none"> • Run the <code>DBMS_CAPTURE_ADM.BUILD</code> procedure at the source database to extract the data dictionary at the source database to the redo log when a capture process is created. • Obtain the first SCN for the downstream capture process if the first SCN is not specified during capture process creation. The first SCN is needed to create and maintain a capture process. • Prepare source database objects for instantiation.
<code>first_scn</code>	<p>The lowest SCN in the redo log from which a capture process can capture changes. A non-<code>NULL</code> value for this parameter is valid only if the <code>DBMS_CAPTURE_ADM.BUILD</code> procedure has been run at least once at the source database.</p> <p>You can query the <code>FIRST_CHANGE#</code> column of the <code>V\$ARCHIVED_LOG</code> dynamic performance view where the <code>DICTIONARY_BEGIN</code> column is <code>YES</code> to determine whether the <code>DBMS_CAPTURE_ADM.BUILD</code> procedure has been run on a source database. Any of the values returned by such a query can be used as a <code>first_scn</code> value if the redo log containing that SCN value is still available.</p> <p>See Also: "Usage Notes" for more information setting the <code>first_scn</code> parameter</p>

Table 43-9 (Cont.) CREATE_CAPTURE Procedure Parameters

Parameter	Description
<code>logfile_assignment</code>	<p>If <code>implicit</code>, which is the default, then the capture process at a downstream database scans all redo log files added by redo transport services or manually from the source database to the downstream database.</p> <p>If <code>explicit</code>, then a redo log file is scanned by a capture process at a downstream database only if the capture process name is specified in the <code>FOR <i>logminer_session_name</i></code> clause. If <code>explicit</code>, then the redo log file must be added manually to the downstream database, and redo transport services cannot be used to add redo log files to the capture process being created.</p> <p>If you specify <code>explicit</code> for this parameter for a local capture process, then the local capture process cannot use the online redo log to find changes. In this case, the capture process must use the archived redo log.</p> <p>See Also: "Usage Notes" for information about adding redo log files manually</p>
<code>negative_rule_set_name</code>	<p>The name of the negative rule set for the capture process. The negative rule set contains the rules that instruct the capture process to discard changes.</p> <p>If you want to use a negative rule set for the capture process, then you must specify an existing rule set in the form <code>[<i>schema_name</i>.]<i>rule_set_name</i></code>. For example, to specify a negative rule set in the <code>hr</code> schema named <code>neg_capture_rules</code>, enter <code>hr.neg_capture_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>If you specify <code>NULL</code>, and no positive rule set is specified, then the capture process captures all supported changes to all objects in the database, excluding database objects in the <code>SYS</code> and <code>SYSTEM</code> schemas.</p> <p>If you specify <code>NULL</code>, and a positive rule set exists for the capture process, then the capture process captures all changes that are not discarded by the positive rule set.</p> <p>An error is returned if the specified rule set does not exist. You can create a rule set and add rules to it using the <code>DBMS_RULE_ADM</code> package.</p> <p>If you specify both a positive and a negative rule set for a capture process, then the negative rule set is always evaluated first.</p>

Table 43-9 (Cont.) CREATE_CAPTURE Procedure Parameters

Parameter	Description
capture_user	<p>The user in whose security domain a capture process captures changes that satisfy its rule sets and runs custom rule-based transformations configured for capture process rules. If NULL, then the user who runs the CREATE_CAPTURE procedure is used.</p> <p>Note: If the capture user for a capture process is dropped using DROP USER . . . CASCADE, then the capture process is also dropped automatically.</p> <p>See Also: "Usage Notes" for more information about this parameter.</p>
checkpoint_retention_time	<p>Either specify the number of days that a capture process retains checkpoints before purging them automatically, or specify DBMS_CAPTURE_ADM.INFINITE if checkpoints should not be purged automatically.</p> <p>If a number is specified, then a capture process purges a checkpoint the specified number of days after the checkpoint was taken. Partial days can be specified using decimal values. For example, .25 specifies 6 hours.</p> <p>When a checkpoint is purged, LogMiner data dictionary information for the archived redo log file that corresponds to the checkpoint is purged, and the first_scn of the capture process is reset to the SCN value corresponding to the first change in the next archived redo log file.</p>
start_time	<p>A valid time from which the capture process starts capturing changes.</p> <p>An error is returned if an invalid time is specified.</p> <p>The start_scn and start_time parameters are mutually exclusive.</p> <p>See Also: "Usage Notes" for more information setting the start_time parameter</p>
source_root_name	<p>The global name of the root in the source CDB.</p> <p>If you specify NULL, or if the specified name is the same as the global name of the current root, then local capture is assumed.</p> <p>If not NULL, then remote capture is assumed and a condition is added to the generated rules to filter the LCRs based on the root in the source CDB.</p> <p>Note: In a downstream capture configuration, if the capture database is CDB and the source database is a non-CDB, then specify the same value for source_root_name and source_database. The source_root_name parameter does not need to be specified for local capture for either a CDB or a non-CDB.</p>

Table 43-9 (Cont.) CREATE_CAPTURE Procedure Parameters

Parameter	Description
<code>capture_class</code>	<p>The valid values are 'Streams', 'XStream' or 'GoldenGate'.</p> <p>If NULL is specified, then 'Streams' is assumed.</p> <p>Note: The <code>capture_class</code> parameter cannot be set to 'Streams' or NULL when the capture database is a CDB.</p>

Usage Notes

Consider the following usage notes when you run this procedure:

- [DBA Role Requirement](#)
- [Capture User Requirements](#)
- [First SCN and Start SCN Settings](#)
- [Explicit Log File Assignment](#)

DBA Role Requirement

If the user who invokes this procedure is different from the user specified in the `capture_user` parameter, then the invoking user must be granted the DBA role. If the user who invokes this procedure is the same as the user specified in the `capture_user` parameter, then the DBA role is not required for the invoking user. Only the SYS user can set the `capture_user` to SYS.

Capture User Requirements

The `capture_user` parameter specifies the user who captures changes that satisfy the capture process rule sets. This user must have the necessary privileges to capture changes. This procedure grants the capture user enqueue privilege on the queue used by the capture process and configures the user as a secure queue user of the queue.

In addition, ensure that the capture user has the following privileges:

- EXECUTE privilege on the rule sets used by the capture process
- EXECUTE privilege on all rule-based transformation functions used in the positive rule set

These privileges can be granted directly to the capture user, or they can be granted through roles.

In addition, the capture user must be granted EXECUTE privilege on all packages, including Oracle-supplied packages, that are invoked in rule-based transformations run by the capture process. These privileges must be granted directly to the capture user. They cannot be granted through roles.

 **Note:**

- A capture user does not require privileges on a database object to capture changes to the database object. The capture process can pass these changes to a rule-based transformation function. Therefore, ensure that you consider security implications when you configure a capture process.
- Creation of the first capture process in a database might take some time because the data dictionary is duplicated during this creation.

First SCN and Start SCN Settings

When you create a capture process using this procedure, you can specify the first SCN and start SCN for the capture process. A capture process scans the redo data from the first SCN or an existing capture process checkpoint forward, even if the start SCN is higher than the first SCN or the checkpoint SCN. In this case, the capture process does not capture any changes in the redo data before the start SCN. Oracle recommends that, at capture process creation time, the difference between the first SCN and start SCN be as small as possible to keep the amount of redo scanned by the capture process to a minimum.

 **Note:**

When you specify the `start_time` parameter instead of the `start_scn` parameter, the `start_time` corresponds with a specific SCN. In this case, the information in this section also applies to the SCN that corresponds with the specified `start_time`.

In some cases, the behavior of the capture process is different depending on the settings of these SCN values and on whether the capture process is local or downstream.

The following table describes capture process behavior for SCN value settings:

first_scn Setting	start_scn Setting	Capture Process Type	Description
Non-NULL	NULL	Local or Downstream	<p>The new capture process is created at the local database with a new LogMiner session starting from the value specified for the <code>first_scn</code> parameter. The start SCN is set to the specified first SCN value automatically, and the new capture process does not capture changes that were made before this SCN.</p> <p>The <code>BUILD</code> procedure in the <code>DBMS_CAPTURE_ADM</code> package is not run automatically. This procedure must have been run at least once before on the source database, and the specified first SCN must correspond to the SCN value of a previous build that is still available in the redo log. When the new capture process is started for the first time, it creates a new LogMiner data dictionary using the data dictionary information in the redo log. If the <code>BUILD</code> procedure has not been run at least once on the source database, then an error is raised when the capture process is started.</p> <p>Capture process behavior is the same for a local capture process and a downstream capture process created with these SCN settings, except that a local capture process is created at the source database and a downstream capture process is created at the downstream database.</p>
Non-NULL	Non-NULL	Local or Downstream	<p>If the specified value for the <code>start_scn</code> parameter is greater than or equal to the specified value for the <code>first_scn</code> parameter, then the new capture process is created at the local database with a new LogMiner session starting from the specified first SCN. In this case, the new capture process does not capture changes that were made before the specified start SCN. If the specified value for the <code>start_scn</code> parameter is less than the specified value for the <code>first_scn</code> parameter, then an error is raised.</p> <p>The <code>BUILD</code> procedure in the <code>DBMS_CAPTURE_ADM</code> package is not run automatically. This procedure must have been called at least once before on the source database, and the specified <code>first_scn</code> must correspond to the SCN value of a previous build that is still available in the redo log. When the new capture process is started for the first time, it creates a new LogMiner data dictionary using the data dictionary information in the redo log. If the <code>BUILD</code> procedure has not been run at least once on the source database, then an error is raised.</p> <p>Capture process behavior is the same for a local capture process and a downstream capture process created with these SCN settings, except that a local capture process is created at the source database and a downstream capture process is created at the downstream database.</p>

first_scn Setting	start_scn Setting	Capture Process Type	Description
NULL	Non-NULL	Local	<p>The new capture process creates a new LogMiner data dictionary if either one of the following conditions is true:</p> <ul style="list-style-type: none"> • There is no existing capture process for the local source database, and the specified value for the <code>start_scn</code> parameter is greater than or equal to the current SCN for the database. • There are existing capture processes, but none of the capture processes have taken a checkpoint yet, and the specified value for the <code>start_scn</code> parameter is greater than or equal to the current SCN for the database. <p>In either of these cases, the <code>BUILD</code> procedure in the <code>DBMS_CAPTURE_ADM</code> package is run during capture process creation. The new capture process uses the resulting build of the source data dictionary in the redo log to create a LogMiner data dictionary the first time it is started, and the first SCN corresponds to the SCN of the data dictionary build. If there are any in-flight transactions, then the <code>BUILD</code> procedure waits until these transactions commit before completing. An in-flight transaction is one that is active during capture process creation or a data dictionary build.</p> <p>However, if there is at least one existing local capture process for the local source database that has taken a checkpoint, then the new capture process shares an existing LogMiner data dictionary with one or more of the existing capture processes. In this case, a capture process with a first SCN that is lower than or equal to the specified start SCN must have been started successfully at least once. Also, if there are any in-flight transactions, then the capture process is created after these transactions commit.</p> <p>If there is no existing capture process for the local source database (or if no existing capture processes have taken a checkpoint yet), and the specified start SCN is less than the current SCN for the database, then an error is raised.</p>

first_scn Setting	start_scn Setting	Capture Process Type	Description
NULL	Non-NULL	Downstream	<p>When the <code>CREATE_CAPTURE</code> procedure creates a downstream capture process, the <code>use_database_link</code> parameter must be set to <code>TRUE</code> when the <code>first_scn</code> parameter is set to <code>NULL</code>. Otherwise, an error is raised. The database link is used to obtain the current SCN of the source database.</p> <p>The new capture process creates a new LogMiner data dictionary if either one of the following conditions is true:</p> <ul style="list-style-type: none"> • There is no existing capture process that captures changes to the source database at the downstream database, and the specified value for the <code>start_scn</code> parameter is greater than or equal to the current SCN for the source database. • There are existing capture processes that capture changes to the source database at the downstream database, but none of the capture processes have taken a checkpoint yet, and the specified value for the <code>start_scn</code> parameter is greater than or equal to the current SCN for the source database. <p>In either of these cases, the <code>BUILD</code> procedure in the <code>DBMS_CAPTURE_ADM</code> package is run during capture process creation. The first time you start the new capture process, it uses the resulting build of the source data dictionary in the redo log files copied to the downstream database to create a LogMiner data dictionary. Here, the first SCN for the new capture process corresponds to the SCN of the data dictionary build. If there are any in-flight transactions, then the <code>BUILD</code> procedure waits until these transactions commit before completing.</p> <p>However, if at least one existing capture process has taken a checkpoint and captures changes to the source database at the downstream database, then the new capture process shares an existing LogMiner data dictionary with one or more of these existing capture processes. In this case, one of these existing capture processes with a first SCN that is lower than or equal to the specified start SCN must have been started successfully at least once. Also, if there are any in-flight transactions, then the capture process is created after these transactions commit.</p> <p>If there is no existing capture process that captures changes to the source database at the downstream database (or no existing capture process has taken a checkpoint), and the specified <code>start_scn</code> parameter value is less than the current SCN for the source database, then an error is raised.</p>
NULL	NULL	Local or Downstream	<p>The behavior is the same as setting the <code>first_scn</code> parameter to <code>NULL</code> and setting the <code>start_scn</code> parameter to the current SCN of the source database.</p>



See Also:

[BUILD Procedure](#) for more information about the `BUILD` procedure and the LogMiner data dictionary

Explicit Log File Assignment

If you specify `explicit` for the `logfile_assignment` parameter, then you add a redo log file manually to a downstream database using the following statement:

```
ALTER DATABASE REGISTER LOGICAL LOGFILE
  file_name FOR capture_process;
```

Here, `file_name` is the name of the redo log file being added and `capture_process` is the name of the capture process that will use the redo log file at the downstream database. The `capture_process` is equivalent to the `logminer_session_name` and must be specified. The redo log file must be present at the site running the downstream database. You must transfer this file manually to the site running the downstream database using the `DBMS_FILE_TRANSFER` package, FTP, or some other transfer method.

See Also:

Oracle Database SQL Language Reference for more information about the `ALTER DATABASE` statement and *Oracle Data Guard Concepts and Administration* for more information registering redo log files

43.3.9 CREATE_SYNC_CAPTURE Procedure

This procedure creates a synchronous capture.

Syntax

```
DBMS_CAPTURE_ADM.CREATE_SYNC_CAPTURE(
  queue_name      IN  VARCHAR2,
  capture_name    IN  VARCHAR2,
  rule_set_name   IN  VARCHAR2,
  capture_user    IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 43-10 CREATE_SYNC_CAPTURE Procedure Parameters

Parameter	Description
<code>queue_name</code>	The name of the queue into which the synchronous capture enqueues changes. You must specify an existing queue in the form <code>[schema_name.]queue_name</code> . For example, to specify a queue in the <code>strmadmin</code> schema named <code>streams_queue</code> , enter <code>strmadmin.streams_queue</code> . If the schema is not specified, then the current user is the default. Note: The <code>queue_name</code> setting cannot be altered after the synchronous capture is created.
<code>capture_name</code>	The name of the synchronous capture being created. A <code>NULL</code> specification is not allowed. Do not specify an owner. Note: The <code>capture_name</code> setting cannot be altered after the synchronous capture is created.

Table 43-10 (Cont.) CREATE_SYNC_CAPTURE Procedure Parameters

Parameter	Description
<code>rule_set_name</code>	<p>The name of the positive rule set for the synchronous capture. The positive rule set contains the rules that instruct the synchronous capture to capture changes.</p> <p>Specify an existing rule set in the form <code>[schema_name.]rule_set_name</code>. For example, to specify a positive rule set in the <code>strmadmin</code> schema named <code>sync_cap_rules</code>, enter <code>strmadmin.sync_cap_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>An error is returned if the specified rule set does not exist.</p> <p>If <code>NULL</code>, then an error is returned.</p>
<code>capture_user</code>	<p>The user in whose security domain the synchronous capture captures changes that satisfy its rule set and runs custom rule-based transformations configured for synchronous capture rules. If <code>NULL</code>, then the user who runs the <code>CREATE_SYNC_CAPTURE</code> procedure is used.</p> <p>Only a user who is granted the <code>DBA</code> role can set a capture user. Only the <code>SYS</code> user can set the <code>capture_user</code> to <code>SYS</code>.</p> <p>Note: If the capture user for a synchronous capture is dropped using <code>DROP USER . . . CASCADE</code>, then the synchronous capture is also dropped automatically.</p> <p>See Also: "Usage Notes" for more information about this parameter.</p>

Usage Notes

When the `CREATE_SYNC_CAPTURE` procedure creates a synchronous capture, the procedure must obtain an exclusive lock on each table for which it will capture changes. The rules in the specified rule set for the synchronous capture determine these tables. If there are outstanding transactions on a table for which the synchronous capture will capture changes, then the procedure waits until it can obtain a lock.

The `capture_user` parameter specifies the user who captures changes that satisfy the synchronous capture rule set. This user must have the necessary privileges to capture changes.

In addition, ensure that the capture user has the following privileges:

- `ENQUEUE` privilege on the queue specified in the `queue_name` parameter
- `EXECUTE` privilege on the rule set used by the synchronous capture
- `EXECUTE` privilege on all rule-based transformation functions used in the rule set

These privileges can be granted directly to the capture user, or they can be granted through roles.

In addition, the capture user must be granted `EXECUTE` privilege on all packages, including Oracle-supplied packages, that are invoked in rule-based transformations run by the synchronous capture. These privileges must be granted directly to the capture user. These privileges cannot be granted through roles.

 **Note:**

A capture user does not require privileges on a database object to capture changes to the database object. The synchronous capture can pass these changes to a rule-based transformation function. Therefore, ensure that you consider security implications when you configure a synchronous capture.

43.3.10 DROP_CAPTURE Procedure

This procedure drops a capture process.

Syntax

```
DBMS_CAPTURE_ADM.DROP_CAPTURE (
    capture_name          IN VARCHAR2,
    drop_unused_rule_sets IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 43-11 DROP_CAPTURE Procedure Parameters

Parameter	Description
capture_name	The name of the capture process being dropped. Specify an existing capture process name. Do not specify an owner.
drop_unused_rule_sets	If TRUE , then the procedure drops any rule sets, positive and negative, used by the specified capture process if these rule sets are not used by any other Oracle Replication client. Oracle Replication clients include capture processes, propagations, apply processes, and messaging clients. If this procedure drops a rule set, then this procedure also drops any rules in the rule set that are not in another rule set. If FALSE , then the procedure does not drop the rule sets used by the specified capture process, and the rule sets retain their rules.

Usage Notes

The following usage notes apply to this procedure:

- [The Capture Process Must Be Stopped Before It Is Dropped](#)
- [The DROP_CAPTURE Procedure and Rules-related Information](#)

The Capture Process Must Be Stopped Before It Is Dropped

A capture process must be stopped before it can be dropped.

 **See Also:**

[STOP_CAPTURE Procedure](#)

The DROP_CAPTURE Procedure and Rules-related Information

When you use this procedure to drop a capture process, rules-related information for the capture process is removed from the data dictionary views for Oracle Replication rules. Information about such a rule is removed even if the rule is not in either rule set for the capture process.

The following are the data dictionary views for Oracle Replication rules:

- ALL_STREAMS_GLOBAL_RULES
- DBA_STREAMS_GLOBAL_RULES
- ALL_STREAMS_SCHEMA_RULES
- DBA_STREAMS_SCHEMA_RULES
- ALL_STREAMS_TABLE_RULES
- DBA_STREAMS_TABLE_RULES
- DBA_STREAMS_RULES

43.3.11 INCLUDE_EXTRA_ATTRIBUTE Procedure

This procedure includes or excludes an extra attribute in logical change records (LCRs) captured by the specified capture process or synchronous capture.

Syntax

```
DBMS_CAPTURE_ADM.INCLUDE_EXTRA_ATTRIBUTE (
    capture_name    IN  VARCHAR2,
    attribute_name  IN  VARCHAR2,
    include         IN  BOOLEAN   DEFAULT TRUE);
```

Parameters

Table 43-12 INCLUDE_EXTRA_ATTRIBUTE Procedure Parameters

Parameter	Description
capture_name	The name of the capture process or synchronous capture. Specify an existing capture process name or synchronous capture name. Do not specify an owner.

Table 43-12 (Cont.) INCLUDE_EXTRA_ATTRIBUTE Procedure Parameters

Parameter	Description
<code>attribute_name</code>	<p>The name of the attribute to be included in or excluded from LCRs captured by the capture process or synchronous capture. The following names are valid settings:</p> <ul style="list-style-type: none"> <code>row_id</code> The rowid of the row changed in a row LCR. This attribute is not included in DDL LCRs, or in row LCRs for index-organized tables. The type is <code>VARCHAR2</code>. <code>serial#</code> The serial number of the session that performed the change captured in the LCR. The type is <code>NUMBER</code>. <code>session#</code> The identifier of the session that performed the change captured in the LCR. The type is <code>NUMBER</code>. <code>thread#</code> The thread number of the instance in which the change captured in the LCR was performed. Typically, the thread number is relevant only in an Oracle Real Application Clusters (Oracle RAC) environment. The type is <code>NUMBER</code>. <code>tx_name</code> The name of the transaction that includes the LCR. The type is <code>VARCHAR2</code>. <code>username</code> The name of the user who performed the change captured in the LCR. The type is <code>VARCHAR2</code>.
<code>include</code>	<p>If <code>TRUE</code>, then the specified attribute is included in LCRs captured by the capture process or synchronous capture.</p> <p>If <code>FALSE</code>, then the specified attribute is excluded from LCRs captured by the capture process or synchronous capture.</p>

Usage Notes

Some information is not captured by a capture process or synchronous capture unless you use this procedure to specify that the information should be captured. If you want to exclude an extra attribute that is being captured by a capture process or synchronous capture, then specify the attribute and specify `FALSE` for the `include` parameter.

43.3.12 PREPARE_GLOBAL_INSTANTIATION Procedure

This procedure performs the synchronization necessary for instantiating all the tables in the database at another database and can enable supplemental logging for key columns or all columns in these tables.

This procedure prepares the tables in the database for instantiation when a capture process will be used to capture changes to the tables in the database.

This procedure records the lowest SCN of each object in the database for instantiation. SCNs after the lowest SCN for an object can be used for instantiating the object. Running this procedure prepares all current and future objects in the database for instantiation.

Syntax

```
DBMS_CAPTURE_ADM.PREPARE_GLOBAL_INSTANTIATION
    supplemental_logging IN VARCHAR2 DEFAULT 'KEYS',
    container             IN VARCHAR2 DEFAULT 'CURRENT');
```

Parameter

Table 43-13 PREPARE_GLOBAL_INSTANTIATION Procedure Parameter

Parameter	Description
supplemental_logging	<p>Either NONE, KEYS, or ALL.</p> <p>If NONE is specified, then this procedure does not enable supplemental logging for any columns in the tables in the database. This procedure does not remove existing supplemental logging specifications for these tables.</p> <p>If KEYS is specified, then this procedure enables supplemental logging for primary key, unique key, bitmap index, and foreign key columns in the tables in the database and for any table added to the database in the future. Primary key columns are logged unconditionally. Unique key, bitmap index, and foreign key columns are logged conditionally. Specifying KEYS does not enable supplemental logging of bitmap join index columns.</p> <p>If ALL is specified, then this procedure enables supplemental logging for all columns in the tables in the database and for any table added to the database in the future. The columns are logged unconditionally. Supplemental logging is not enabled for columns of the following types: LOB, LONG, LONG RAW, user-defined types, and Oracle-supplied types.</p>
container	<p>Either CURRENT , ALL, or <i>pdb_name</i>.</p> <p>If CURRENT is specified, then this procedure adds supplemental logging for the current container.</p> <p>If ALL is specified, then this procedure adds supplemental logging for all of the containers in the current CDB.</p> <p>If <i>pdb_name</i> is specified, then this procedure adds supplemental logging for the specified PDB.</p> <p>ALL and <i>pdb_name</i> are valid only when you invoke the procedure from the root.</p>

Usage Notes

Run this procedure at the source database.

If you use a capture process to capture all of the changes to a database, then use this procedure to prepare the tables in the database for instantiation after the capture process has been configured.

43.3.13 PREPARE_SCHEMA_INSTANTIATION Procedure

This procedure performs the synchronization necessary for instantiating all tables in the schema at another database and can enable supplemental logging for key columns or all columns in these tables.

This procedure prepares the tables in the schema for instantiation when a capture process will be used to capture changes to the tables in the schema.

This procedure records the lowest SCN of each object in the schema for instantiation. SCNs after the lowest SCN for an object can be used for instantiating the object. Running this procedure prepares all current and future objects in the schema for instantiation.

Syntax

```
DBMS_CAPTURE_ADM.PREPARE_SCHEMA_INSTANTIATION(
  schema_name          IN  VARCHAR2,
  supplemental_logging IN  VARCHAR2  DEFAULT 'KEYS',
  container            IN  VARCHAR2  DEFAULT 'CURRENT');
```

Parameters

Table 43-14 PREPARE_SCHEMA_INSTANTIATION Procedure Parameters

Parameter	Description
schema_name	The name of the schema. For example, hr.
supplemental_logging	<p>Either NONE, KEYS, or ALL.</p> <p>If NONE is specified, then this procedure does not enable supplemental logging for any columns in the tables in the schema. This procedure does not remove existing supplemental logging specifications for these tables.</p> <p>If KEYS is specified, then this procedure enables supplemental logging for primary key, unique key, bitmap index, and foreign key columns in the tables in the schema and for any table added to this schema in the future. Primary key columns are logged unconditionally. Unique key, bitmap index, and foreign key columns are logged conditionally. Specifying KEYS does not enable supplemental logging of bitmap join index columns.</p> <p>If ALL is specified, then this procedure enables supplemental logging for all columns in the tables in the schema and for any table added to this schema in the future. The columns are logged unconditionally. Supplemental logging is not enabled for columns of the following types: LOB, LONG, LONG RAW, user-defined types, and Oracle-supplied types.</p>
container	<p>Either CURRENT, ALL, or pdb_name.</p> <p>If CURRENT is specified, then this procedure adds supplemental logging for the current container.</p> <p>If ALL is specified, then this procedure adds supplemental logging for all of the containers in the current CDB.</p> <p>If pdb_name is specified, then this procedure adds supplemental logging for the specified PDB</p> <p>ALL and pdb_name are valid only when you invoke the procedure from the root.</p>

Usage Notes

Run this procedure at the source database. If you use a capture process to capture all of the changes to a schema, then use this procedure to prepare the tables in the schema for instantiation after the capture process has been configured.

43.3.14 PREPARE_SYNC_INSTANTIATION Function

This function performs the synchronization necessary for instantiating one or more tables at another database. This function returns the prepare system change number (SCN) for the table or tables being prepared for instantiation.

This function prepares one or more tables for instantiation when a synchronous capture will be used to capture changes to the tables.

This function records the lowest SCN of each table for instantiation (prepare SCN). SCNs after the lowest SCN for an object can be used for instantiating the object.

This function is overloaded. The `table_names` parameter is `VARCHAR2` datatype in one version and `DBMS_UTILITY.UNCL_ARRAY` datatype in the other version.

Syntax

```
DBMS_CAPTURE_ADM.PREPARE_SYNC_INSTANTIATION(
    table_names IN VARCHAR2)
RETURN NUMBER;
```

```
DBMS_CAPTURE_ADM.PREPARE_SYNC_INSTANTIATION(
    table_names IN DBMS_UTILITY.UNCL_ARRAY)
RETURN NUMBER;
```

Parameters

Table 43-15 PREPARE_SYNC_INSTANTIATION Function Parameter

Parameter	Description
<code>table_names</code>	<p>When the <code>table_names</code> parameter is <code>VARCHAR2</code> datatype, a comma-delimited list of the tables to prepare for instantiation. There must be no spaces between entries.</p> <p>When the <code>table_names</code> parameter is <code>DBMS_UTILITY.UNCL_ARRAY</code> datatype, specify a PL/SQL associative array of this type that contains the names of the tables to prepare for instantiation. The first table name is at position 1, the second at position 2, and so on. The table does not need to be <code>NULL</code> terminated.</p> <p>In either version of the function, specify the name of each table in the form <code>[schema_name.]table_name</code>. For example, <code>hr.employees</code>. If the schema is not specified, then the current user is the default.</p>

43.3.15 PREPARE_TABLE_INSTANTIATION Procedure

This procedure performs the synchronization necessary for instantiating the table at another database and can enable supplemental logging for key columns or all columns in the table.

This procedure prepares the table for instantiation when a capture process will be used to capture changes to the table.

This procedure records the lowest SCN of the table for instantiation. SCNs after the lowest SCN for an object can be used for instantiating the object.

Syntax

```
DBMS_CAPTURE_ADM.PREPARE_TABLE_INSTANTIATION(
    table_name          IN VARCHAR2,
```

```

supplemental_logging IN VARCHAR2 DEFAULT 'KEYS',
container            IN VARCHAR2 DEFAULT 'CURRENT');

```

Parameters

Table 43-16 PREPARE_TABLE_INSTANTIATION Procedure Parameters

Parameter	Description
table_name	The name of the table specified as [<i>schema_name.</i>] <i>object_name</i> . For example, hr.employees. If the schema is not specified, then the current user is the default.
supplemental_logging	<p>Either NONE, KEYS, or ALL.</p> <p>If NONE is specified, then this procedure does not enable supplemental logging for any columns in the table. This procedure does not remove existing supplemental logging specifications for the table.</p> <p>If KEYS is specified, then this procedure enables supplemental logging for primary key, unique key, bitmap index, and foreign key columns in the table. The procedure places the key columns for the table in three separate log groups: the primary key columns in an unconditional log group, the unique key columns and bitmap index columns in a conditional log group, and the foreign key columns in a conditional log group. Specifying KEYS does not enable supplemental logging of bitmap join index columns.</p> <p>If ALL is specified, then this procedure enables supplemental logging for all columns in the table. The procedure places all of the columns for the table in an unconditional log group. Supplemental logging is not enabled for columns of the following types: LOB, LONG, LONG RAW, user-defined types, and Oracle-supplied types.</p>
container	<p>Either CURRENT , ALL, or <i>pdb_name</i>.</p> <p>If CURRENT is specified, then this procedure adds supplemental logging for the current container.</p> <p>If ALL is specified, then this procedure adds supplemental logging for all of the containers in the current CDB.</p> <p>If <i>pdb_name</i> is specified, then this procedure adds supplemental logging for the specified PDB.</p> <p>ALL and <i>pdb_name</i> are valid only when you invoke the procedure from the root.</p>

Usage Notes

Run this procedure at the source database. If you use a capture process to capture all of the changes to a table, then use this procedure to prepare the table for instantiation after the capture process has been configured.

43.3.16 SET_PARAMETER Procedure

This procedure sets a capture process parameter to the specified value.

Syntax

```

DBMS_CAPTURE_ADM.SET_PARAMETER(
capture_name IN VARCHAR2,

```

```
parameter    IN VARCHAR2,
value        IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 43-17 SET_PARAMETER Procedure Parameters

Parameter	Description
capture_name	The name of the capture process. Do not specify an owner.
parameter	The name of the parameter you are setting.
value	The value to which the parameter is set. If NULL, then the parameter is set to its default value.

Capture Process Parameters

The following table lists the parameters for the capture process.

Table 43-18 Capture Process Parameters

Parameter Name	Possible Values	Default	Description
annotateddlsize	0 or a positive integer up to 4294967296 (4 GB)	0	<p>The maximum length of the DDL text, in bytes, up to which the DDL can be chosen for annotation, if applicable for the DDL. Any DDL text whose size is greater than the specified size is not annotated.</p> <p>The default, 0, indicates that no DDL text processed by this capture process is annotated.</p> <p>Annotating DDL can simplify filtering and transformation of the DDL within Oracle GoldenGate.</p> <p>Note: This parameter is intended for Oracle GoldenGate. Do not use this parameter in an Oracle Replication environment or in an XStream environment.</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
capture_idkey_objects	Y or N	N	<p>If Y, then the capture process captures ID key logical change records (LCRs). If N, then the capture process does not capture ID key LCRs.</p> <p>Capture processes do not fully support capturing changes to some data types from the redo log. ID key LCRs enable an XStream configuration to capture these changes and process them with an XStream client application.</p> <p>Note: This parameter is intended for XStream. Do not use this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter and <i>Oracle Database XStream Guide</i> for more information about ID key LCRs</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
capture_sequence _nextval	Y or N	N	<p>If Y, then the capture process captures sequence LCRs for all of the sequences in the database, except for sequences in Oracle-supplied, administrative schemas such as SYS and SYSTEM. The capture process's rule sets can filter sequence LCRs in the same way that they filter row LCRs and DDL LCRs.</p> <p>If N, then the capture process does not capture sequence LCRs.</p> <p>An apply process or XStream inbound server can use sequence LCRs to ensure that the sequence values at a destination database use the appropriate values. For increasing sequences, the sequence values at the destination are equal to or greater than the sequence values at the source database. For decreasing sequences, the sequence values at the destination are less than or equal to the sequence values at the source database.</p> <p>Note: This parameter is intended for XStream. Do not use this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter and "SET_PARAMETER Procedure" for information about the <code>apply_sequence_nextval</code> apply process parameter</p>
disable_on_limit	Y or N	N	<p>If Y, then the capture process is disabled because it reached a value specified by the <code>time_limit</code> parameter or <code>message_limit</code> parameter.</p> <p>If N, then the capture process is restarted immediately after stopping because it reached a limit.</p> <p>When a capture process is restarted, it starts to capture changes at the point where it last stopped. A restarted capture process gets a new session identifier, and the processes associated with the capture process also get new session identifiers. However, the capture process number (<code>CPnn</code>) remains the same.</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
downstream_real_time_mine	Y or N	Y for local capture processes N for downstream capture processes	<p>If Y, then the capture process is a real-time downstream capture process. After setting this parameter to Y, switch the redo log file at the source database using the SQL statement <code>ALTER SYSTEM ARCHIVE LOG CURRENT</code> to begin real-time downstream capture. If this parameter is set to Y, then redo data from the source database must be sent to the standby redo log at the downstream database.</p> <p>If N, then the capture process is an archived-log downstream capture process.</p> <p>An error is raised if an attempt is made to set this parameter for a local capture process.</p>
excludetag	Comma-delimited list of Oracle Replication tags	NULL	<p>Controls whether the capture process captures DML changes that are tagged with one of the specified Oracle Replication tags. Whether the capture process captures these changes depends on the settings for the <code>getapplops</code> and <code>getreplicates</code> parameters.</p> <p>If NULL, then the capture process ignores this parameter.</p> <p>Note: This parameter is intended for XStream. Do not use this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
excludetrans	Comma-delimited list of transaction names	NULL	<p>Controls whether the capture process captures DML changes in the specified transaction names.</p> <p>Whether the capture process captures these changes depends on the settings for the <code>getapplops</code> and <code>getreplicates</code> parameters.</p> <p>If NULL, then the capture process ignores this parameter.</p> <p>Note: This parameter is intended for XStream. Do not use this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>
excludeuser	Comma-delimited list of user names	NULL	<p>Controls whether the capture process captures DML changes made by the specified users.</p> <p>Whether the capture process captures these changes depends on the settings for the <code>getapplops</code> and <code>getreplicates</code> parameters.</p> <p>Specify an exact pattern match for each user name. The pattern match is case sensitive. For example, specify <code>HR</code> for the <code>hr</code> user.</p> <p>If NULL, then the capture process ignores this parameter.</p> <p>Note: This parameter is intended for XStream. Do not use this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
excludeuserid	Comma-delimited list of user ID values	NULL	<p>Controls whether the capture process captures data manipulation language (DML) changes made by the specified users.</p> <p>Whether the capture process captures these changes depends on the settings for the <code>getapplops</code> and <code>getreplicates</code> parameters.</p> <p>To view the user ID for a user, query the <code>USER_ID</code> column in the <code>ALL_USERS</code> data dictionary view.</p> <p>If <code>NULL</code>, then the capture process ignores this parameter.</p> <p>Note: This parameter is intended for XStream. Do not use this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>
getapplops	Y or N	Y	<p>If <code>Y</code>, then the capture process captures DML changes if the original user is not specified in the <code>excludeuserid</code> or <code>excludeuser</code> parameters and the transaction name is not specified in the <code>excludetrans</code> parameter.</p> <p>If <code>N</code>, then the capture process ignores DML changes if the original user is not specified in the <code>excludeuserid</code> or <code>excludeuser</code> parameters and the transaction name is not specified in the <code>excludetrans</code> parameter.</p> <p>In either case, the capture process captures a DML change only if it satisfies the capture process's rule sets.</p> <p>Note: This parameter is intended for XStream. Do not use this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
getreplicates	Y or N	N	<p>If Y, then the capture process captures DML changes if the original user is specified in the <code>excludeuserid</code> or <code>excludeuser</code> parameters and the transaction name is specified in the <code>excludetrans</code> parameter.</p> <p>If N, then the capture process ignores DML changes if the original user is specified in the <code>excludeuserid</code> or <code>excludeuser</code> parameters and the transaction name is specified in the <code>excludetrans</code> parameter.</p> <p>In either case, the capture process captures a DML change only if it satisfies the capture process's rule sets.</p> <p>Note: This parameter is intended for XStream. Do not use this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>
ignore_transaction	A valid transaction ID or NULL	NULL	<p>Instructs the capture process to ignore the specified transaction from the source database, effective immediately.</p> <p>The capture process eliminates all subsequent LCRs for the transaction. If the specified transaction is committed successfully at the source database, the destination database will receive a <code>ROLLBACK</code> statement instead, and any LCRs from the transaction that were enqueued before the ignore transaction request are rolled backed at the destination database.</p> <p>If NULL, then the capture process ignores this parameter.</p> <p>Use caution when setting this parameter because ignoring a transaction might lead to data divergence between the source database and destination database.</p> <p>To ignore multiple transactions, specify each transaction in a separate call to the <code>SET_PARAMETER</code> procedure. The <code>DBA_CAPTURE_PARAMETERS</code> view displays a comma-delimited list of all transactions to be ignored. To clear the list of ignored transactions, run the <code>SET_PARAMETER</code> procedure and specify NULL for the <code>ignore_transaction</code> parameter.</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
ignore_unsupported_table	A fully qualified table name, *, or -	*	<p>Controls the behavior of the capture process when it tries to capture changes to a specified table or to an unsupported table.</p> <p>A capture process tries to capture changes to an unsupported table when its rule sets instruct it to do so. If you do not want the capture process to try to capture changes to unsupported tables, then ensure that the capture process's rule sets exclude unsupported tables.</p> <p>When a table name is specified, the capture process does not capture changes to the specified table. The table name must be entered in the form <i>table_owner.table_name</i>. For example, <code>hr.employees</code>. To specify multiple tables, specify each table in a separate call to the <code>SET_PARAMETER</code> procedure.</p> <p>When * is specified and the capture process tries to capture a change to an unsupported table, the capture process ignores the change and continues to run. The change to the unsupported table is not captured, and the capture process records the unsupported table in the alert log.</p> <p>When - is specified and the capture process tries to capture a change to an unsupported table, the capture process aborts.</p>
include_objects	A list of tables or schema names separated by commas	none	<p>Directs capture to include changes from the specified tables or schemas.</p> <p>An LCR that is selected by <code>include_objects</code> is passed to the outbound server regardless of any further filtering that is specified.</p> <p>Note: This parameter is intended for XStream. Do not use or attempt to set this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
inline_lob_optimization	Y or N	N	<p>If Y, then LOBs that can be processed inline (such as small LOBs) are included in the LCR directly, rather than sending LOB chunk LCRs.</p> <p>If N, then each LOB column is sent as NULL followed by LOB chunk LCRs to update the LOB column.</p> <p>Note: This parameter is intended for XStream. Do not use or attempt to set this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>
maximum_scn	A valid SCN or INFINITE	INFINITE	<p>The capture process is disabled before capturing a change record with an SCN greater than or equal to the value specified.</p> <p>If INFINITE, then the capture process runs regardless of the SCN value.</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
max_sga_size	A positive integer	INFINITE	<p>Controls the amount of system global area (SGA) memory allocated specifically to the capture process, in megabytes. The capture process attempts to allocate memory up to this limit. A capture process uses Oracle LogMiner to scan for changes in the redo log.</p> <p>The memory is allocated for the duration of the capture process session and is released when the capture process becomes disabled.</p> <p>Note: The sum of system global area (SGA) memory allocated for all components on a database must be less than the value set for the STREAMS_POOL_SIZE initialization parameter.</p> <p>If NULL, then the capture component uses the original default value. A NULL value has the same effect as resetting the parameter to its default value.</p> <p>Note: This parameter is intended for XStream. Do not use or attempt to set this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
merge_threshold	A negative integer, 0, a positive integer, or INFINITE	60	<p>The amount of time, in seconds, between the message creation time of the original capture process and the message creation time of the cloned capture process.</p> <p>Specifically, if the difference, in seconds, between the <code>CAPTURE_MESSAGE_CREATE_TIME</code> of the cloned capture process and the original capture process is less than or equal to the value specified for this parameter, then automatic merge begins by running the <code>MERGE_STREAMS</code> procedure.</p> <p>This parameter is relevant only when changes captured by the capture process are applied by two or more apply processes and the <code>split_threshold</code> parameter is set to a value other than <code>INFINITE</code>.</p> <p>If a negative value is specified, then automatic merge is disabled.</p> <p>If 0 (zero) is specified, then there must be no lag between the original capture process and the cloned capture process to begin the merge.</p> <p>If <code>INFINITE</code> is specified, then automatic merging starts immediately.</p>
message_limit	A positive integer or INFINITE	INFINITE	<p>The capture process stops after capturing the specified number of messages.</p> <p>If <code>INFINITE</code>, then the capture process continues to run regardless of the number of messages captured.</p>
message_tracking_frequency	0 or a positive integer	2000000	<p>The frequency at which messages captured by the capture process are tracked automatically.</p> <p>For example, if this parameter is set to the default value of 2000000, then every two-millionth message is tracked automatically.</p> <p>The tracking label used for automatic message tracking is <code>capture_process_name:AUTOTRACK</code>, where <code>capture_process_name</code> is the name of the capture process. Only the first 20 bytes of the capture process name are used; the rest is truncated if it exceeds 20 bytes.</p> <p>If 0 (zero), then no messages are tracked automatically.</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
<code>parallelism</code>	A positive integer	1	<p>The number of preparer servers that can concurrently mine the redo log for the capture process.</p> <p>A capture process consists of one reader server, one or more preparer servers, and one builder server. The preparer servers concurrently format changes found in the redo log into logical change records (LCRs). Each reader server, preparer server, and builder server is a process, and the number of preparer servers equals the number specified for the <code>parallelism</code> capture process parameter. So, if <code>parallelism</code> is set to 5, then a capture process uses a total of seven processes: one reader server, five preparer servers, and one builder server.</p> <p>Setting the <code>parallelism</code> parameter to a number higher than the number of available parallel execution servers might disable the capture process. Ensure that the <code>PROCESSES</code> initialization parameter is set appropriately when you set the <code>parallelism</code> capture process parameter.</p> <p>Note: When you change the value of this parameter, the capture process is stopped and restarted automatically.</p>
<code>skip_autofiltere d_table_ddl</code>	Y or N	Y	<p>If Y, then the capture process does not capture data definition language (DDL) changes to tables that are automatically filtered by the capture process.</p> <p>If N, then the capture process can capture DDL changes to tables that are automatically filtered by the capture process if the DDL changes satisfy the capture process rule sets.</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
split_threshold	0, a positive integer, or INFINITE	1800	<p>The amount of time, in seconds, that a stream is broken before the stream is automatically split from other streams that flow from the capture process. When a stream is split, the capture process, queue, and propagation are cloned.</p> <p>In this case, a stream is a flow of logical change records (LCRs) that flows from a capture process to an apply. A stream is broken when LCRs captured by the capture process cannot reach the apply process. For example, a stream is broken when the relevant propagation or apply process is disabled.</p> <p>This parameter is relevant only when changes captured by the capture process are applied by two or more apply processes.</p> <p>If 0 (zero), then automatic splitting starts immediately.</p> <p>If INFINITE, then automatic splitting is disabled. The stream is not split regardless of the amount of time that it is broken.</p> <p>This parameters is designed to be used with the merge_threshold parameter.</p>
startup_seconds	0, a positive integer, or INFINITE	0	<p>The maximum number of seconds to wait for another instantiation of the same capture process to finish. If the other instantiation of the same capture process does not finish within this time, then the capture process does not start. This parameter is useful only if you are starting the capture process manually.</p> <p>If INFINITE, then the capture process does not start until another instantiation of the same capture process finishes.</p>
time_limit	A positive integer or INFINITE	INFINITE	<p>The capture process stops as soon as possible after the specified number of seconds since it started.</p> <p>If INFINITE, then the capture process continues to run until it is stopped explicitly.</p>
trace_level	0 or a positive integer	0	<p>Set this parameter only under the guidance of Oracle Support Services.</p>

Table 43-18 (Cont.) Capture Process Parameters

Parameter Name	Possible Values	Default	Description
use_rac_service	Y or N	Y if Replication N if XStream	<p>If Y, then the capture process is run in the owning instance of its queue.</p> <p>If N, then the client specifies where the capture process is to run.</p> <p>Note: This parameter is intended for XStream. Do not use or attempt to set this parameter in an Oracle Replication environment unless XStream optimizations are enabled by the <code>DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS</code> procedure. See "ENABLE_GG_XSTREAM_FOR_STREAMS Procedure" for information about enabling XStream optimizations.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>
write_alert_log	Y or N	Y	<p>If Y, then the capture process writes a message to the alert log on exit.</p> <p>If N, then the capture process does not write a message to the alert log on exit.</p> <p>The message specifies the reason the capture process stopped.</p>
xout_client_exists	Y or N	Y if the capture process sends LCRs to XStream outbound servers N if the capture process sends LCRs to Oracle Apply processes	<p>Y indicates that the capture process sends LCRs to one or more XStream outbound servers.</p> <p>N indicates that the capture process sends LCRs to one or more Oracle Apply processes.</p> <p>A single capture process cannot send LCRs to both outbound servers and apply processes.</p> <p>In an XStream configuration where an outbound server runs on a different database than its capture process, set this parameter to Y to enable the capture process to send LCRs to the outbound server.</p> <p>Note: Using XStream requires purchasing a license for the Oracle GoldenGate product. See <i>Oracle Database XStream Guide</i>.</p>

Usage Notes

The following usage notes apply to the `SET_PARAMETER` procedure:

- [Delays Are Possible Before New Parameter Settings Take Effect](#)
- [Parameters Interpreted as Positive Integers](#)
- [Parameters with a System Change Number \(SCN\) Setting](#)
- [Parameters that Require XStream Optimizations](#)

- [XStream or Oracle GoldenGate Integrated Capture Configurations](#)

Delays Are Possible Before New Parameter Settings Take Effect

When you alter a parameter value, a short amount of time might pass before the new value for the parameter takes effect.

Parameters Interpreted as Positive Integers

For all parameters that are interpreted as positive integers, the maximum possible value is 4,294,967,295. Where applicable, specify `INFINITE` for larger values.

Parameters with a System Change Number (SCN) Setting

For parameters that require an SCN setting, any valid SCN value can be specified.

Parameters that Require XStream Optimizations

A capture process uses the following parameters only when the capture process is sending logical change records (LCRs) to an XStream outbound server or when XStream optimizations are enabled for Oracle Replication components:

- `capture_idkey_objects`
- `capture_sequence_nextval`
- `excludetag`
- `excludetrans`
- `excludeuser`
- `excludeuserid`
- `getapplops`
- `getreplicates`
- `include_objects`
- `inline_lob_optimization`
- `max_sga_size`
- `use_rac_services`

The `DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS` procedure enables XStream optimizations for Oracle Replication. When XStream optimizations are not enabled by the `DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS` procedure, a capture process raises an error if one of these parameters is set to any value other than its default value.

When XStream optimizations are enabled for Oracle Replication and the `capture_idkey_objects` parameter is set to `Y`, a capture process can capture ID key LCRs. ID key LCRs do not contain all of the columns for a row change. Instead, they contain the `rowid` of the changed row, a group of key columns to identify the row in the table, and the data for the scalar columns of the table that are supported by capture processes. An apply process can apply these changes using the information available the ID key LCRs.

To determine the database objects for which a capture process will capture ID key LCRs, run the following query on the source database:

```
SELECT OWNER, OBJECT_NAME
       FROM DBA_XSTREAM_OUT_SUPPORT_MODE
       WHERE SUPPORT_MODE='ID KEY';
```

 **Note:**

Using XStream requires purchasing a license for the Oracle GoldenGate product. See *Oracle Database XStream Guide*.

 **See Also:**

Oracle Database XStream Guide for more information about ID key LCRs

XStream or Oracle GoldenGate Integrated Capture Configurations

In an XStream or Oracle GoldenGate integrated capture configuration, the following parameters control which changes are captured by a capture process:

- `capture_idkey_objects`
- `capture_sequence_nextval`
- `excludetag`
- `excludetrans`
- `excludeuser`
- `excludeuserid`
- `getapplops`
- `getreplicates`
- `include_objects`
- `inline_lob_optimization`
- `max_sga_size`
- `use_rac_services`

You can set these parameters to avoid change cycling. Change cycling sends a change back to the database where it originated. Typically, change cycling should be avoided in a replication environment so that the same change is not made to a database more than once.

In an XStream or Oracle GoldenGate integrated capture configuration that performs bi-directional replication, a GoldenGate Replicat process runs on the source database for a capture process. Therefore, the changes made by the GoldenGate Replicat are recorded in the redo log.

If an integrated configuration performs bi-directional replication, then, to avoid change cycling, the capture process should not capture the changes made by the Oracle GoldenGate Replicat process. To accomplish this goal, use the default settings for the `getapplops` and `getreplicates` parameters and exclude changes made by the user running the Replicat process. To exclude these changes, specify this user in the `excludeuserid` or `excludeuser` parameter. Typically, the user running the Oracle GoldenGate Replicat process is the XStream administrator.

In some configurations, the goal might be to capture or exclude changes made by applications or by the Replicat process. For example, an intermediate database in a replication environment might capture all of the changes made to the database, including both application changes and Replicat process changes, and send these changes to a different destination database.

Table 43-19 describes the capture process behavior when at least one of the exclude parameters is non-NULL.

Table 43-19 Behavior When at Least One exclude Parameter Is Non-NULL

getapplops Setting	getreplicates Setting	Description
Y	Y	The capture process captures all DML changes.
Y	N	The capture process captures the DML changes made by the users that are not in the <code>excludeuserid</code> or <code>excludeuser</code> parameters. The capture process captures the DML changes that are not in the transactions in the <code>excludetrans</code> parameter. The capture process captures only the DML changes that do not have a tag that is in the <code>excludetags</code> parameter.
N	Y	The capture process captures only the DML changes made by the users that are in the <code>excludeuserid</code> or <code>excludeuser</code> parameters. The capture process captures only the DML changes that are in the transactions in the <code>excludetrans</code> parameter. The capture process captures only the DML changes that have a tag that is in the <code>excludetags</code> parameter.
N	N	The capture process does not capture any DML changes.

Table 43-19 describes the capture process behavior when all of the exclude parameters are set to NULL.

Table 43-20 Behavior When All exclude Parameters Are Set to NULL

getapplops Setting	getreplicates Setting	Description
Y	Y	The capture process captures all DML changes.
Y	N	The capture process captures all DML changes.
N	Y	The capture process does not capture any DML changes.
N	N	The capture process does not capture any DML changes.

See the documentation for the Oracle GoldenGate product for more information:

http://docs.oracle.com/cd/E15881_01/index.htm

 **Note:**

A capture process evaluates a change using these parameters before it evaluates a change using its rule sets. Therefore, a capture process can discard a change before the change is evaluated against the capture process's rule sets. Also, regardless of the settings for these parameters, a capture process captures a change only if the change satisfies the capture process's rule sets.

 **See Also:**

Oracle Database XStream Guide

43.3.17 START_CAPTURE Procedure

This procedure starts the capture process, which mines redo logs and enqueues the mined redo information into the associated queue.

The start status is persistently recorded. Hence, if the status is `ENABLED`, then the capture process is started upon database instance startup.

The capture process is a background Oracle process and is prefixed by `c`.

The enqueue and dequeue state of `DBMS_AQADM.START_QUEUE` and `DBMS_AQADM.STOP_QUEUE` have no effect on the start status of a capture process.

Syntax

```
DBMS_CAPTURE_ADM.START_CAPTURE (
    capture_name IN VARCHAR2);
```

Parameters

Table 43-21 START_CAPTURE Procedure Parameter

Parameter	Description
<code>capture_name</code>	The name of the capture process. Do not specify an owner. The capture process uses LogMiner to capture changes in the redo information. A <code>NULL</code> setting is not allowed.

Usage Notes

The capture process status is persistently recorded. Hence, if the status is `ENABLED`, then the capture process is started upon database instance startup. A capture process (`cnnn`) is an Oracle background process.

43.3.18 STOP_CAPTURE Procedure

This procedure stops the capture process from mining redo logs.

Syntax

```
DBMS_CAPTURE_ADM.STOP_CAPTURE(  
    capture_name IN VARCHAR2,  
    force        IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 43-22 STOP_CAPTURE Procedure Parameters

Parameter	Description
capture_name	The name of the capture process. A NULL setting is not allowed. Do not specify an owner.
force	If TRUE, then the procedure stops the capture process as soon as possible. If the capture process cannot stop normally, then it aborts. If FALSE, then the procedure stops the capture process as soon as possible. If the capture process cannot stop normally, then an ORA-26672 error is returned, and the capture process might continue to run.

Usage Notes

The following usage notes apply to this procedure:

- The capture process status is persistently recorded. Hence, if the status is `DISABLED` or `ABORTED`, then the capture process is not started upon database instance startup.
- A capture process is an Oracle background process with a name in the form `CPnn`, where `nn` can include letters and numbers.
- The enqueue and dequeue state of `DBMS_AQADM.START_QUEUE` and `DBMS_AQADM.STOP_QUEUE` have no effect on the stop status of a capture process.

DBMS_CACHEUTIL

The `DBMS_CACHEUTIL` package provides an interface to control object-level cache fusion locking policies in an Oracle Real Application Clusters (Oracle RAC) environment and to manage assignments to the `KEEP` buffer pool for Oracle True Cache.

44.1 DBMS_CACHEUTIL Overview

`DBMS_CACHEUTIL` provides a collection of procedures related to Oracle Real Application Clusters (Oracle RAC) and Oracle True Cache.

With `DBMS_CACHEUTIL`, you can do the following:

- Control object-level cache fusion locking policies, such as object affinity, read-mostly, and object down-convert in an Oracle RAC environment.

For example, you can fine-tune cache fusion locking policies for a specific configuration or workload at the object level. This might reduce locking overhead in an Oracle RAC environment and improve performance.

- Affinity specifies an implicit, exclusive lock for an object to an instance, so that read accesses and updates to the object on this instance become more optimized. However, updates to the object on other instances become less optimized.
- Read-mostly specifies an implicit, shared lock for an object in the cluster, so that read access to the object becomes more optimized. However, updates to the object on any instances become less optimized.
- A down-convert converts an object's exclusive locks on an instance to shared mode for all instances in an Oracle RAC environment.

Note:

Object affinity and read-mostly locking optimization works only for the primary RAC database, and it doesn't work for Oracle Active Data Guard.

- Manage object assignments to the `KEEP` buffer cache for an Oracle True Cache instance. True Cache is an in-memory, consistent, and automatically managed SQL and key-value (object or JSON) cache for Oracle Database.

You can apply the procedures in this package to tables, indexes, lob, partitions (for partitioned objects), and subpartitions (for composite partitioned objects).

For non-partitioned objects, the input (`schema` and `obj` corresponds to `OWNER` and `OBJECT_NAME` in `DBA_OBJECTS` and should uniquely define a segment. That means it should have, for example, a valid `DATA_OBJECT_ID` in `DBA_OBJECTS`.

For partitioned or composite partitioned objects, the input (`schema`, `obj`, and `partition`) corresponds to `OWNER`, `OBJECT_NAME`, and `SUBOBJECT_NAME` in `DBA_OBJECTS` and should

uniquely define a segment. That means it should have a valid `DATA_OBJECT_ID` in `DBA_OBJECTS`.

Except for depended indexes, this procedure does not apply for the dependent object segments, such as lob and partition or subpartition segments. It should be explicitly called on the segment if necessary.

Related Topics

- Real Application Clusters Administration and Deployment Guide

Related Topics

- Oracle True Cache User's Guide

44.2 DBMS_CACHEUTIL Security Model

The security model describes the privileges needed for using the `DBMS_CACHEUTIL` package.

Use the following for this package:

```
CREATE OR REPLACE PUBLIC SYNONYM dbms_cacheutil FOR sys.dbms_cacheutil

GRANT EXECUTE ON dbms_cacheutil TO dba
```

44.3 Summary of DBMS_CACHEUTIL Subprograms

This table lists the package subprograms in alphabetical order.

Table 44-1 DBMS_CACHEUTIL Package Subprograms

Subprogram	Description
DISSOLVE_AFFINITY Procedure	This procedure dissolves the object affinity from a node in an Oracle RAC environment.
DISSOLVE_READMOSTLY Procedure	This procedure dissolves an object's read-mostly setting in an Oracle RAC environment.
GRAB_AFFINITY Procedure	This procedure sets the object affinity to a node in an Oracle RAC environment.
GRAB_READMOSTLY Procedure	This procedure grabs an object's read-mostly setting in an Oracle RAC environment.
LIST_READMOSTLY Procedure	This procedure lists objects that have the read-mostly property set in an Oracle RAC environment.
OBJECT_DOWNCONVERT Procedure	This procedure down-converts an object's exclusive locks on an instance to shared mode for all instances in an Oracle RAC environment.
TRUE_CACHE_KEEP Procedure	When you call this procedure on a True Cache instance, it assigns the object to the <code>KEEP</code> buffer pool on that instance.
TRUE_CACHE_UNKEEP Procedure	When an object on a True Cache instance no longer needs to be in the <code>KEEP</code> buffer pool, use this procedure to remove the object's <code>KEEP</code> assignment.

44.3.1 DISSOLVE_AFFINITY Procedure

DISSOLVE_AFFINITY dissolves the object affinity from a node in an Oracle RAC environment.

Syntax

```
DBMS_CACHEUTIL.DISSOLVE_AFFINITY(
  schema          IN VARCHAR2,
  obj             IN VARCHAR2,
  partition       IN VARCHAR2 := NULL,
  dissolve_index  IN BOOLEAN := TRUE,
  active_drm      IN BOOLEAN := FALSE);
```

Parameters

Table 44-2 DISSOLVE_AFFINITY Procedure Parameters

Parameter	Description
schema	The name of the schema for the object.
obj	The name of the object.
partition	<ul style="list-style-type: none"> If the object is not partitioned, then this is NULL. If the object is partitioned, use the name of the partition segment. If it's a composited partitioned object, use the name of the subpartition segment.
dissolve_index	To dissolve affinity for dependent indexes, use TRUE.
active_drm	For internal use only. Do not use.

44.3.2 DISSOLVE_READMOSTLY Procedure

DISSOLVE_READMOSTLY dissolves an object's read-mostly setting in an Oracle RAC environment.

Syntax

```
DBMS_CACHEUTIL.DISSOLVE_READMOSTLY(
  schema          IN VARCHAR2,
  obj             IN VARCHAR2,
  partition       IN VARCHAR2 := NULL,
  dissolve_index  IN BOOLEAN := TRUE);
```

Parameters

Table 44-3 DISSOLVE_READMOSTLY Procedure Parameters

Parameter	Description
schema	The name of the schema for the object.
obj	The name of the object.

Table 44-3 (Cont.) DISSOLVE_READMOSTLY Procedure Parameters

Parameter	Description
partition	<ul style="list-style-type: none"> If the object is not partitioned, then this is NULL. If the object is partitioned, use the name of the partition segment. If it's a composited partitioned object, use the name of the subpartition segment.
dissolve_index	To dissolve read-mostly for dependent indexes, use TRUE.

44.3.3 GRAB_AFFINITY Procedure

GRAB_AFFINITY sets the object affinity to a node in an Oracle RAC environment.

This is useful when you know that, for a particular workload, an object will be heavily accessed by one particular Oracle RAC node. Grabbing an object affinity to that node reduces locking overhead and could improve performance.



Note:

The affinity that this procedure grabs can still change by the automatic object affinity policy if the policy decides that it's not optimal to keep the affinity. The CURRENT_MASTER column in the V\$GCSPFMASTER_INFO view indicates the current affinity of the particular object segment.



Note:

Object affinity locking optimization works only for the primary RAC database, and it doesn't work for Oracle Active Data Guard.

Syntax

```
DBMS_CACHEUTIL.GRAB_AFFINITY (
  schema          IN VARCHAR2,
  obj              IN VARCHAR2,
  partition       IN VARCHAR2 := NULL,
  grab_index      IN BOOLEAN := TRUE,
  active_drm      IN BOOLEAN := FALSE);
```

Parameters

Table 44-4 GRAB_AFFINITY Procedure Parameters

Parameter	Description
schema	The name of the schema for the object.
obj	The name of the object.

Table 44-4 (Cont.) GRAB_AFFINITY Procedure Parameters

Parameter	Description
partition	<ul style="list-style-type: none"> If the object is not partitioned, then this is <code>NULL</code>. If the object is partitioned, use the name of the partition segment. If it's a composited partitioned object, use the name of the subpartition segment.
grab_index	To grab affinity for dependent indexes, use <code>TRUE</code> .
active_drm	For internal use only. Do not use.

44.3.4 GRAB_READMOSTLY Procedure

`GRAB_READMOSTLY` sets an object to read-mostly in an Oracle RAC environment.

This is useful when you know that, for a particular workload, accesses to an object will mostly be `READ` instead of `INSERT` or `UPDATE`. Grabbing read-mostly for the object would reduce locking overhead and could improve performance.



Note:

The read-mostly that this procedure grabs can still change by the automatic read-mostly policy if the policy decides that it's not optimal to keep the read-mostly set. The read-mostly property is persistent across instance lifetimes. You can use the `LIST_READMOSTLY` procedure included in this package to list the current set of object segments with read-mostly set.



Note:

Read-mostly locking optimization works only for the primary RAC database, and it doesn't work for Oracle Active Data Guard.

Syntax

```
DBMS_CACHEUTIL.GRAB_READMOSTLY (
  schema          IN VARCHAR2,
  obj             IN VARCHAR2,
  partition       IN VARCHAR2 := NULL,
  grab_index      IN BOOLEAN := TRUE);
```

Parameters

Table 44-5 GRAB_READMOSTLY Procedure Parameters

Parameter	Description
schema	The name of the schema for the object.

Table 44-5 (Cont.) GRAB_READMOSTLY Procedure Parameters

Parameter	Description
obj	The name of the object.
partition	<ul style="list-style-type: none"> • If the object is not partitioned, then this is NULL. • If the object is partitioned, use the name of the partition segment. • If it's a composited partitioned object, use the name of the subpartition segment.
grab_index	To grab read-mostly for dependent indexes, use TRUE.

44.3.5 LIST_READMOSTLY Procedure

This procedure lists objects that have the read-mostly property set in an Oracle RAC environment.

Syntax

```
DBMS_CACHEUTIL.LIST_READMOSTLY;
```

44.3.6 OBJECT_DOWNCONVERT Procedure

OBJECT_DOWNCONVERT down-converts an object's exclusive locks on an instance to shared mode for all instances in an Oracle RAC environment.

This is useful when a particular object is loaded through the buffer cache by an Oracle RAC node and this node holds many exclusive locks for this object, which has caused extra locking overhead. Down-converting locks for this object to shared locks on the RAC node could reduce the locking overhead and improve performance.

Syntax

```
DBMS_CACHEUTIL.OBJECT_DOWNCONVERT (
  schema          IN VARCHAR2,
  obj             IN VARCHAR2,
  partition       IN VARCHAR2 := NULL,
  downconvert_index IN BOOLEAN := TRUE);
```

Parameters

Table 44-6 OBJECT_DOWNCONVERT Procedure Parameters

Parameter	Description
schema	The name of the schema for the object.
obj	The name of the object.
partition	<ul style="list-style-type: none"> • If the object is not partitioned, then this is NULL. • If the object is partitioned, use the name of the partition segment. • If it's a composited partitioned object, use the name of the subpartition segment.

Table 44-6 (Cont.) OBJECT_DOWNCONVERT Procedure Parameters

Parameter	Description
downconvert_index	To down-convert dependent indexes, use TRUE.

44.3.7 TRUE_CACHE_KEEP Procedure

When you call this procedure on True Cache, it assigns the object to the `KEEP` buffer pool on that cache.

To use this procedure, the `DB_KEEP_CACHE_SIZE` initialization parameter must be configured on True Cache.

Syntax

```
DBMS_CACHEUTIL.TRUE_CACHE_KEEP (
  schema          IN VARCHAR2,
  obj              IN VARCHAR2,
  partition       IN VARCHAR2 := NULL);
```

Parameters

Table 44-7 TRUE_CACHE_KEEP Procedure Parameters

Parameter	Description
schema	The name of the schema for the object.
obj	The name of the object.
partition	<ul style="list-style-type: none"> If the object is not partitioned, then this is <code>NULL</code>. If the object is partitioned, use the name of the partition segment. If it's a composited partitioned object, use the name of the subpartition segment.

Related Topics

- Oracle True Cache User's Guide

44.3.8 TRUE_CACHE_UNKEEP Procedure

When an object on True Cache no longer needs to be in the `KEEP` buffer pool, use this procedure to remove the object's `KEEP` assignment.

Syntax

```
DBMS_CACHEUTIL.TRUE_CACHE_UNKEEP (
  schema          IN VARCHAR2,
  obj              IN VARCHAR2,
  partition       IN VARCHAR2 := NULL);
```

Parameters

Table 44-8 TRUE_CACHE_UNKEEP Procedure Parameters

Parameter	Description
schema	The name of the schema for the object.
obj	The name of the object.
partition	<ul style="list-style-type: none">• If the object is not partitioned, then this is <code>NULL</code>.• If the object is partitioned, use the name of the partition segment.• If it's a composited partitioned object, use the name of the subpartition segment.

Related Topics

- Oracle True Cache User's Guide

DBMS_CLOUD

The `DBMS_CLOUD` package provides comprehensive support for working with data in Object Storage.

This chapter contains the following topics:

- [DBMS_CLOUD Overview](#)
- [Installing the DBMS_CLOUD Package](#)
- [DBMS_CLOUD Security Model](#)
- [DBMS_CLOUD Exceptions](#)
- [Summary of DBMS_CLOUD Subprograms](#)
- [DBMS_CLOUD Package File URI Formats](#)
- [DBMS_CLOUD Package Format Options](#)
- [DBMS_CLOUD Avro and Parquet Support](#)

45.1 DBMS_CLOUD Overview

Using `DBMS_CLOUD` to work with data in Object Storage you can do the following:

- Manage your credentials for accessing Object Store.
- Copy data as-is: External data is loaded into the database in a single one-step operation, without the need to create any objects in the database. The load operation is monitored and tracked inside the database.
- Manage the information about your load operations.
- Validate the content of external data prior to consumption. Prior to consumption of external data you verify its content and identify rows that do not conform to the expected external data format.
- Create an external table. Create the necessary object in the database for flexible and continuous consumption.
- Work with objects in object stores and directories.

45.2 Installing the DBMS_CLOUD Package

The `DBMS_CLOUD` package provides a comprehensive support for working with data in Object Storage starting with Oracle Database 19c and later releases. However, this package is not pre-installed with Oracle Database. You need to manually install the `DBMS_CLOUD` package and also configure users or roles to use this package.

For information on installing the `DBMS_CLOUD` package and configuring users/roles, see the MOS-NOTE with Doc ID [2748362.1](#).

45.3 DBMS_CLOUD Security Model

Security on this package can be controlled by granting `EXECUTE` on this package to selected users or roles.

45.4 DBMS_CLOUD Exceptions

The following table describes exceptions for `DBMS_CLOUD`.

Exception	Code	Description
<code>reject_limit</code>	20003	The reject limit of an external table was reached.
<code>credential_not_exist</code>	20004	A credential object does not exist.
<code>table_not_exist</code>	20005	A table does not exist.
<code>unsupported_obj_store</code>	20006	An unsupported object store URI was provided.
<code>iden_too_long</code>	20008	An identifier is too long.
<code>invalid_format</code>	20009	A format argument is not valid.
<code>missing_credential</code>	20010	Mandatory credential object information was not specified.
<code>invalid_object_uri</code>	20011	An invalid object URI was provided.
<code>invalid_partitioning_clause</code>	20012	An partitioning clause is missing or was not provided.
<code>unsupported_feature</code>	20013	An unsupported feature was used that is not existent in the current database version.
<code>part_not_exist</code>	20014	A partition or subpartition does not exist, or a table is not a partitioned external table or hybrid partitioned table.
<code>invalid_table_name</code>	20016	An invalid table name was used.
<code>invalid_schema_name</code>	20017	An invalid schema name was used.
<code>invalid_dir_name</code>	20018	An invalid directory name was used.
<code>invalid_file_name</code>	20019	An invalid file name was used.
<code>invalid_cred_attribute</code>	20020	Invalid credential attributes were specified.
<code>table_exist</code>	20021	A table already exists.
<code>credential_exist</code>	20022	A credential object already exists.
<code>invalid_req_method</code>	20023	A request method is either too long or invalid.
<code>invalid_req_header</code>	20024	An invalid request header was specified.
<code>file_not_exist</code>	20025	A file does not exist.
<code>invalid_response</code>	20026	An HTTP response was not valid.
<code>invalid_operation</code>	20027	An invalid task class or ID was specified.
<code>invalid_user_name</code>	20028	An invalid username was specified.

45.5 Summary of DBMS_CLOUD Subprograms

This section covers the `DBMS_CLOUD` subprograms provided with Oracle Database.

Subprogram	Description
COPY_DATA Procedure	This procedure loads data into existing Oracle Database tables from files in the Cloud.
COPY_DATA Procedure for Avro or Parquet Files	This procedure with the <code>format</code> parameter <code>type</code> set to the value <code>avro</code> or <code>parquet</code> loads data into existing Oracle Database tables from Avro or Parquet files in the Cloud. Similar to text files, the data is copied from the source Avro or Parquet file into the preexisting internal table.
CREATE_CREDENTIAL Procedure	This procedure stores cloud service credentials in Oracle Database.
CREATE_EXTERNAL_TABLE Procedure	This procedure creates an external table on files in the Cloud. This allows you to run queries on external data from Oracle Database.
CREATE_EXTERNAL_TABLE Procedure for Avro or Parquet Files	This procedure with the <code>format</code> parameter <code>type</code> set to the value <code>avro</code> or <code>parquet</code> creates an external table with either Avro or Parquet format files in the Cloud. This allows you to run queries on external data from Oracle Database.
CREATE_EXTERNAL_PART_TABLE Procedure	This procedure creates an external partitioned table on files in the Cloud. This allows you to run queries on external data from Oracle Database.
CREATE_HYBRID_PART_TABLE Procedure	This procedure creates a hybrid partitioned table. This allows you to run queries on hybrid partitioned data from Oracle Database.
DELETE_ALL_OPERATIONS Procedure	This procedure clears either all data load operations logged in the <code>user_load_operations</code> table in your schema or clears all the data load operations of the specified type, as indicated with the <code>type</code> parameter.
DELETE_FILE Procedure	This procedure removes the specified file from the specified directory on Oracle Database
DELETE_OBJECT Procedure	This procedure deletes the specified object on object store.
DROP_CREDENTIAL Procedure	This procedure removes an existing credential from Oracle Database.
GET_OBJECT Procedure and Function	This procedure is overloaded. The procedure form reads an object from Cloud Object Storage and copies it to Oracle Database. The function form reads an object from Cloud Object Storage and returns a <code>BLOB</code> to Oracle Database.
LIST_FILES Function	This function lists the files in the specified directory. The results include the file names and additional metadata about the files such as file size in bytes, creation timestamp, and the last modification timestamp.
LIST_OBJECTS Function	This function lists objects in the specified location on object store. The results include the object names and additional metadata about the objects such as size, checksum, creation timestamp, and the last modification timestamp.
PUT_OBJECT Procedure	This procedure is overloaded. In one form the procedure copies a file from Oracle Database to the Cloud Object Storage. In another form the procedure copies a <code>BLOB</code> from Oracle Database to the Cloud Object Storage.

Subprogram	Description
UPDATE_CREDENTIAL Procedure	This procedure updates cloud service credential attributes in Oracle Database.
VALIDATE_EXTERNAL_TABLE Procedure	This procedure validates the source files for an external table, generates log information, and stores the rows that do not match the format options specified for the external table in a <i>badfile</i> table on Oracle Database.
VALIDATE_EXTERNAL_PART_TABLE Procedure	This procedure validates the source files for an external partitioned table, generates log information, and stores the rows that do not match the format options specified for the external table in a <i>badfile</i> table on Oracle Database.
VALIDATE_HYBRID_PART_TABLE Procedure	This procedure validates the source files for a hybrid partitioned table, generates log information, and stores the rows that do not match the format options specified for the hybrid table in a <i>badfile</i> table on Oracle Database.

45.5.1 COPY_DATA Procedure

This procedure loads data into existing Oracle Database tables from files in the Cloud, or from files in a directory. The overloaded form enables you to use the `operation_id` parameter.

Syntax

```
DBMS_CLOUD.COPY_DATA (
    table_name          IN VARCHAR2,
    credential_name     IN VARCHAR2 DEFAULT NULL,
    file_uri_list       IN CLOB,
    schema_name         IN VARCHAR2,
    field_list          IN CLOB,
    format              IN CLOB);
```

```
DBMS_CLOUD.COPY_DATA (
    table_name          IN VARCHAR2,
    credential_name     IN VARCHAR2 DEFAULT NULL,
    file_uri_list       IN CLOB DEFAULT NULL,
    schema_name         IN VARCHAR2 DEFAULT NULL,
    field_list          IN CLOB DEFAULT NULL,
    format              IN CLOB DEFAULT NULL,
    operation_id        OUT NOCOPY NUMBER);
```

Parameters

Parameter	Description
<code>table_name</code>	The name of the target table on the database. The target table needs to be created before you run <code>COPY_DATA</code> .
<code>credential_name</code>	The name of the credential to access the Cloud Object Storage. This parameter is not used when you specify a directory with <code>file_uri_list</code> .

Parameter	Description
file_uri_list	<p>This parameter specifies either a comma-delimited list of source file URIs or one or more directories and source files.</p> <p>Cloud source file URIs</p> <p>You can use wildcards in the file names in your URIs. The character "*" can be used as the wildcard for multiple characters, the character "?" can be used as the wildcard for a single character. The format of the URIs depends on the Cloud Object Storage service you are using, for details see DBMS_CLOUD Package File URI Formats.</p> <p>Directory</p> <p>You can specify one directory and one or more file names or use a comma separated list of directories and file names. The format to specify a directory is: 'MY_DIR:filename.ext'. By default the directory name MY_DIR is a database object and is case-insensitive. The file name is case sensitive.</p> <p>You can use wildcards to specify file names in a directory. The character "*" can be used as the wildcard for multiple characters, the character "?" can be used as the wildcard for a single character. For example: 'MY_DIR:*' or 'MY_DIR:test?'</p> <p>To specify multiple directories, use a comma separated list of directories: For example: 'MY_DIR1:*, MY_DIR2:test?'</p> <p>Use double quotes to specify a case-sensitive directory name. For example: '"my_dir1":*, "my_dir2":Test?'</p> <p>To include a quote character, use two quotes. For example: 'MY_DIR: "'filename.ext'. This specifies the filename starts with a quote (').</p>
schema_name	<p>The name of the schema where the target table resides. The default value is NULL meaning the target table is in the same schema as the user running the procedure.</p>
field_list	<p>Identifies the fields in the source files and their data types. The default value is NULL meaning the fields and their data types are determined by the target table definition. This argument's syntax is the same as the field_list clause in regular Oracle external tables. For more information about field_list see <i>Oracle® Database Utilities</i>.</p> <p>For an example using field_list, see CREATE_EXTERNAL_TABLE Procedure.</p>
format	<p>The options describing the format of the source, log, and bad files. For the list of the options and how to specify the values see DBMS_CLOUD Package Format Options.</p> <p>For Avro or Parquet file format options, see DBMS_CLOUD Package Format Options for Avro or Parquet.</p>
operation_id	<p>Use this parameter to track the progress and final status of the load operation as the corresponding ID in the USER_LOAD_OPERATIONS view.</p>

Usage Note

The default record delimiter is detected newline. With detected newline, DBMS_CLOUD tries to automatically find the correct newline character to use as the record delimiter. DBMS_CLOUD first searches for the Windows newline character \r\n. If it finds the Windows newline

character, this is used as the record delimiter for all files in the procedure. If a Windows newline character is not found, DBMS_CLOUD searches for the UNIX/Linux newline character `\n`, and if it finds one it uses `\n` as the record delimiter for all files in the procedure. If the source files use a combination of different record delimiters, you may encounter an error such as, "KUP-04020: found record longer than buffer size supported". In this case, you need to either modify the source files to use the same record delimiter or only specify the source files that use the same record delimiter.

See [DBMS_CLOUD Package Format Options](#) for information on the `recorddelimiter` format option.

45.5.2 COPY_DATA Procedure for Avro or Parquet Files

This procedure with the `format` parameter type set to the value `avro` or `parquet` loads data into existing Oracle Database tables from Avro or Parquet files in the Cloud or from files in a directory.

Similar to text files, the data is copied from the source Avro or Parquet file into the preexisting internal table.

Syntax

```
DBMS_CLOUD.COPY_DATA (  
    table_name          IN VARCHAR2,  
    credential_name     IN VARCHAR2 DEFAULT NULL,  
    file_uri_list       IN CLOB,  
    schema_name         IN VARCHAR2 DEFAULT,  
    field_list          IN CLOB DEFAULT,  
    format              IN CLOB DEFAULT);
```

Parameters

Parameter	Description
<code>table_name</code>	The name of the target table on the database. The target table needs to be created before you run <code>COPY_DATA</code> .
<code>credential_name</code>	The name of the credential to access the Cloud Object Storage. This parameter is not used when you specify a directory with <code>file_uri_list</code> .

Parameter	Description
<code>file_uri_list</code>	<p>This parameter specifies either a comma-delimited list of source file URIs or one or more directories and source files.</p> <p>Cloud source file URIs</p> <p>You can use wildcards in the file names in your URIs. The character "*" can be used as the wildcard for multiple characters, the character "?" can be used as the wildcard for a single character. The format of the URIs depends on the Cloud Object Storage service you are using, for details see DBMS_CLOUD Package File URI Formats.</p> <p>Directory</p> <p>You can specify one directory and one or more file names or use a comma separated list of directories and file names. The format to specify a directory is: '<i>MY_DIR:filename.ext</i>'. By default the directory name <i>MY_DIR</i> is a database object and is case-insensitive. The file name is case sensitive.</p> <p>You can use wildcards to specify file names in a directory. The character "*" can be used as the wildcard for multiple characters, the character "?" can be used as the wildcard for a single character. For example: '<i>MY_DIR:*</i>' or '<i>MY_DIR:test?</i>'</p> <p>To specify multiple directories, use a comma separated list of directories: For example: '<i>MY_DIR1:*, MY_DIR2:test?</i>'</p> <p>Use double quotes to specify a case-sensitive directory name. For example: '"<i>my_dir1</i>":*, "<i>my_dir2</i>":Test?'</p> <p>To include a quote character, use two quotes. For example: '<i>MY_DIR</i>:''filename.ext''. This specifies the filename starts with a quote (').</p>
<code>schema_name</code>	<p>The name of the schema where the target table resides. The default value is NULL meaning the target table is in the same schema as the user running the procedure.</p>
<code>field_list</code>	<p>Ignored for Avro or Parquet files.</p> <p>The fields in the source match the external table columns by name. Source data types are converted to the external table column data type.</p> <p>For Parquet files, see DBMS_CLOUD Package Parquet to Oracle Data Type Mapping for details on mapping.</p> <p>For Avro files, see DBMS_CLOUD Package Avro to Oracle Data Type Mapping for details on mapping.</p>
<code>format</code>	<p>The options describing the format of the source files. For Avro or Parquet files, only two options are supported: see DBMS_CLOUD Package Format Options for Avro or Parquet.</p>

Usage Notes

- As with other data files, Avro and Parquet data loads generate logs that are viewable in the tables `dba_load_operations` and `user_load_operations`. Each load operation adds a record to `dba[user]_load_operations` that indicates the table containing the logs.

The log table provides summary information about the load.
- For Avro or Parquet, when the `format` parameter `type` is set to the value `avro` or `parquet`, the `BADFILE_TABLE` table is always empty.

- For Parquet files, PRIMARY KEY constraint errors throw an ORA error.
- If data for a column encounters a conversion error, for example, the target column is not large enough to hold the converted value, the value for the column is set to NULL. This does not produce a rejected record.

45.5.3 CREATE_CREDENTIAL Procedure

This procedure stores cloud service credentials in Oracle Database.

Use stored cloud service credentials to access the cloud service for data loading, for querying external data residing in the cloud, or for other cases when you use DBMS_CLOUD procedures with a credential_name parameter. This procedure is overloaded:

- Use the Oracle Cloud Infrastructure-related parameters, including: user_ocid, tenancy_ocid, private_key, and fingerprint only when you are using Oracle Cloud Infrastructure Signing Keys authentication.
- Use the AWS ARN-related parameter params, only when you are using Amazon Resource Names (ARNs) credentials.

Syntax

```
DBMS_CLOUD.CREATE_CREDENTIAL (
  credential_name  IN VARCHAR2,
  username         IN VARCHAR2,
  password        IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_CLOUD.CREATE_CREDENTIAL (
  credential_name IN VARCHAR2,
  user_ocid      IN VARCHAR2,
  tenancy_ocid  IN VARCHAR2,
  private_key    IN VARCHAR2,
  fingerprint   IN VARCHAR2);
```

```
DBMS_CLOUD.CREATE_CREDENTIAL (
  credential_name IN VARCHAR2,
  params          IN CLOB DEFAULT);
```

Parameters

Parameter	Description
credential_name	The name of the credential to be stored. The credential_name parameter must conform to Oracle object naming conventions, which do not allow spaces or hyphens.
username	The username and password arguments together specify your cloud service credentials. See the usage notes for what to specify for the username and password for different cloud services.
password	The username and password arguments together specify your cloud service credentials.

Parameter	Description
<code>user_ocid</code>	Specifies the user's OCID. See Where to Get the Tenancy's OCID and User's OCID for details on obtaining the User's OCID.
<code>tenancy_ocid</code>	Specifies the tenancy's OCID. See Where to Get the Tenancy's OCID and User's OCID for details on obtaining the Tenancy's OCID.
<code>private_key</code>	Specifies the generated private key. Private keys generated with a passphrase are not supported. You need to generate the private key without a passphrase. See How to Generate an API Signing Key for details on generating a key pair in PEM format.
<code>fingerprint</code>	Specifies a fingerprint. After a generated public key is uploaded to the user's account the fingerprint is displayed in the console. Use the displayed fingerprint for this argument. See How to Get the Key's Fingerprint and How to Generate an API Signing Key for more details.
<code>params</code>	Specifies credential parameters using Amazon Resource Names (ARNs) credentials.

Usage Notes

- This operation stores the credentials in the database in an encrypted format.
- You can see the credentials in your schema by querying the `user_credentials` table.
- The `ADMIN` user can see all the credentials by querying the `dba_credentials` table.
- You only need to create credentials once unless your cloud service credentials change. Once you store the credentials you can then use the same credential name for `DBMS_CLOUD` procedures that require a `credential_name` parameter.
- This procedure is overloaded. If you provide one of the key based authentication attributes, `user_ocid`, `tenancy_ocid`, `private_key`, or `fingerprint`, the call is assumed to be an Oracle Cloud Infrastructure Signing Key based credential.
- You can list credentials from the view `ALL_CREDENTIALS`. For example, run the following command to list credentials:

```
SELECT credential_name, username, comments FROM all_credentials;
```

Oracle Cloud Infrastructure Credentials (Auth Tokens)

For Oracle Cloud Infrastructure the `username` is your Oracle Cloud Infrastructure user name. The `password` is your Oracle Cloud Infrastructure auth token. See [Working with Auth Tokens](#).

For example:

```
BEGIN
  DBMS_CLOUD.CREATE_CREDENTIAL(
    credential_name => 'DEF_CRED_NAME',
    username => 'adwc_user@example.com',
    password => 'password' );
END;
/
```


Oracle Cloud Infrastructure Signing Key Based Credentials

Use the Oracle Cloud Infrastructure signing key related parameters, including: `user_ocid`, `tenancy_ocid`, `private_key`, and `fingerprint` with Oracle Cloud Infrastructure Signing Keys authentication.

For example:

```

BEGIN
  DBMS_CLOUD.CREATE_CREDENTIAL (
    credential_name => 'OCI_KEY_CRED',
    user_ocid      =>
'ocid1.user.oc1..aaaaaaaauq54mi7zdyfhw33ozkquontjceel7fok5nq3bf2vwetkpg
soa',
    tenancy_ocid  =>
'ocid1.tenancy.oc1..aabbbbbbaafcue47pqmrf4vigneebgbcmoy5r7xvoypicjqgqe
32ewnrcyx2a',
    private_key   =>
'MIIEogIBAAKCAQEAtUnxbmrekwgVac6FdWeRzoXvIpA9+0r1.....wtnNpESQQQ0QLGPD8
NM//JEBg=',
    fingerprint  =>
'f2:db:f9:18:a4:aa:fc:94:f4:f6:6c:39:96:16:aa:27');
END;
/

```

Private keys generated with a passphrase are not supported. You need to generate the private key without a passphrase. See [How to Generate an API Signing Key](#) for more information.

Oracle Cloud Infrastructure Object Storage Classic Credentials

If your source files reside in Oracle Cloud Infrastructure Object Storage Classic, the `username` is your Oracle Cloud Infrastructure Classic user name and the `password` is your Oracle Cloud Infrastructure Classic password.

Amazon Web Services (AWS) Credentials

If your source files reside in Amazon S3 or you are calling an AWS API, the `username` is your AWS access key ID and the `password` is your AWS secret access key. See [AWS Identity and Access Management](#).

Microsoft Azure Credentials

If your source files reside in Azure Blob Storage or you are calling an Azure API, the `username` is your Azure storage account name and the `password` is an Azure storage account access key. See [About Azure storage accounts](#).

AWS Amazon Resource Names (ARN) Credentials

If your source files reside in Amazon S3 or you are calling an AWS API, use `params` to specify the parameters for the Amazon Resource Names (ARN).

Parameter	Value
<code>aws_role_arn</code>	Specifies the Amazon Resource Name (ARN) that identifies the AWS role. If this parameter is not supplied when creating the credential, ORA-20041 is raised.
<code>external_id_type</code>	Optionally set the <code>external_id_type</code> to use the Oracle Database compartment OCID, database OCID, or tenancy OCID by supplying one of: <code>compartment_ocid</code> , <code>database_ocid</code> , or <code>tenant_ocid</code> . If this parameter is not given when creating the credential, the default value is <code>database_ocid</code> .

For example:

```
BEGIN DBMS_CLOUD.CREATE_CREDENTIAL(
    credential_name => 'MY_CRED',
    params          => JSON_OBJECT(
        'aws_role_arn'      value 'arn:aws:iam::123456:role/
AWS_ROLE_ARN',
        'external_id_type' value 'database_ocid'));
END;
/
```

GitHub Personal Access Token

If your source files reside in a GitHub repository or you are calling a GitHub API, the `username` is your GitHub email and the `password` is your GitHub personal access token. See [Creating a personal access token](#) for more information.

For example:

```
BEGIN
    DBMS_CLOUD.CREATE_CREDENTIAL(
        credential_name => 'MY_GITHUB_CRED',
        username       => 'user@example.com',
        password       => 'your_personal_access_token' );
END;
/
```

45.5.4 CREATE_EXTERNAL_TABLE Procedure

This procedure creates an external table on files in the Cloud or from files in a directory. This allows you to run queries on external data from Oracle Database.

Syntax

```
DBMS_CLOUD.CREATE_EXTERNAL_TABLE (
    table_name      IN VARCHAR2,
    credential_name IN VARCHAR2 DEFAULT NULL,
    file_uri_list   IN CLOB,
    column_list     IN CLOB,
```

```

field_list      IN CLOB DEFAULT,
format         IN CLOB DEFAULT);

```

Parameters

Parameter	Description
table_name	The name of the external table.
credential_name	The name of the credential to access the Cloud Object Storage. This parameter is not used when you specify a directory with <code>file_uri_list</code> .
file_uri_list	<p>This parameter specifies either a comma-delimited list of source file URIs or one or more directories and source files.</p> <p>Cloud source file URIs</p> <p>You can use wildcards in the file names in your URIs. The character "*" can be used as the wildcard for multiple characters, the character "?" can be used as the wildcard for a single character.</p> <p>The format of the URIs depends on the Cloud Object Storage service you are using, for details see DBMS_CLOUD Package File URI Formats.</p> <p>Directory</p> <p>You can specify one directory and one or more file names or use a comma separated list of directories and file names. The format to specify a directory is: <code>'MY_DIR:filename.ext'</code>. By default the directory name <code>MY_DIR</code> is a database object and is case-insensitive. The file name is case sensitive.</p> <p>You can use wildcards to specify file names in a directory. The character "*" can be used as the wildcard for multiple characters, the character "?" can be used as the wildcard for a single character. For example: <code>'MY_DIR:*</code> or <code>'MY_DIR:test?'</code></p> <p>To specify multiple directories, use a comma separated list of directories: For example: <code>'MY_DIR1:*, MY_DIR2:test?'</code></p> <p>Use double quotes to specify a case-sensitive directory name. For example: <code>"my_dir1":*, "my_dir2":Test?'</code></p> <p>To include a quote character, use two quotes. For example: <code>'MY_DIR: 'filename.ext'</code>. This specifies the filename starts with a quote (').</p>
column_list	Comma-delimited list of column names and data types for the external table.
field_list	Identifies the fields in the source files and their data types. The default value is NULL meaning the fields and their data types are determined by the <code>column_list</code> parameter. This argument's syntax is the same as the <code>field_list</code> clause in regular Oracle external tables. For more information about <code>field_list</code> see Oracle® Database Utilities .
format	<p>The options describing the format of the source files. For the list of the options and how to specify the values see DBMS_CLOUD Package Format Options.</p> <p>For Avro or Parquet format files, see CREATE_EXTERNAL_TABLE Procedure for Avro or Parquet Files.</p>

Usage Notes

- The procedure `DBMS_CLOUD.CREATE_EXTERNAL_TABLE` supports external partitioned files in the supported cloud object storage services, including:
 - Oracle Cloud Infrastructure Object Storage
 - Azure Blob Storage
 - Amazon S3
 - GitHub Repository

The credential is a table level property; therefore, the external files must be on the same object store.

See [DBMS_CLOUD Package File URI Formats](#) for more information.

- The default record delimiter is detected newline. With detected newline, `DBMS_CLOUD` tries to automatically find the correct newline character to use as the record delimiter. `DBMS_CLOUD` first searches for the Windows newline character `\r\n`. If it finds the Windows newline character, this is used as the record delimiter for all files in the procedure. If a Windows newline character is not found, `DBMS_CLOUD` searches for the UNIX/Linux newline character `\n`, and if it finds one it uses `\n` as the record delimiter for all files in the procedure. If the source files use a combination of different record delimiters, you may encounter an error such as, "KUP-04020: found record longer than buffer size supported". In this case, you need to either modify the source files to use the same record delimiter or only specify the source files that use the same record delimiter.

See [DBMS_CLOUD Package Format Options](#) for information on the `recorddelimiter` format option.

Example

```
BEGIN
  DBMS_CLOUD.CREATE_EXTERNAL_TABLE(
    table_name =>'WEATHER_REPORT_DOUBLE_DATE',
    credential_name =>'OBJ_STORE_CRED',
    file_uri_list => '&base_URL/
Charlotte_NC_Weather_History_Double_Dates.csv',
    format => json_object('type' value 'csv', 'skipheaders' value '1'),
    field_list => 'REPORT_DATE DATE''mm/dd/yy'',
                  REPORT_DATE_COPY DATE ''yyyy-mm-dd'',
                  ACTUAL_MEAN_TEMP,
                  ACTUAL_MIN_TEMP,
                  ACTUAL_MAX_TEMP,
                  AVERAGE_MIN_TEMP,
                  AVERAGE_MAX_TEMP,
                  AVERAGE_PRECIPITATION',
    column_list => 'REPORT_DATE DATE,
                  REPORT_DATE_COPY DATE,
                  ACTUAL_MEAN_TEMP NUMBER,
                  ACTUAL_MIN_TEMP NUMBER,
                  ACTUAL_MAX_TEMP NUMBER,
                  AVERAGE_MIN_TEMP NUMBER,
                  AVERAGE_MAX_TEMP NUMBER,
                  AVERAGE_PRECIPITATION NUMBER');
END;
```

```
/
SELECT * FROM WEATHER_REPORT_DOUBLE_DATE where
    actual_mean_temp > 69 and actual_mean_temp < 74
```

45.5.5 CREATE_EXTERNAL_TABLE Procedure for Avro or Parquet Files

This procedure with the `format` parameter type set to the value `avro` or `parquet` creates an external table with either Avro or Parquet format files in the Cloud or from files in a directory.

This allows you to run queries on external data from Oracle Database.

Syntax

```
DBMS_CLOUD.CREATE_EXTERNAL_TABLE (
    table_name          IN VARCHAR2,
    credential_name    IN VARCHAR2 DEFAULT NULL,
    file_uri_list       IN CLOB,
    column_list         IN CLOB,
    field_list          IN CLOB DEFAULT,
    format              IN CLOB DEFAULT);
```

Parameters

Parameter	Description
<code>table_name</code>	The name of the external table.
<code>credential_name</code>	The name of the credential to access the Cloud Object Storage. This parameter is not used when you specify a directory with <code>file_uri_list</code> .

Parameter	Description
<code>file_uri_list</code>	<p>This parameter specifies either a comma-delimited list of source file URIs or one or more directories and source files.</p> <p>Cloud source file URIs</p> <p>You can use wildcards in the file names in your URIs. The character "*" can be used as the wildcard for multiple characters, the character "?" can be used as the wildcard for a single character.</p> <p>The format of the URIs depends on the Cloud Object Storage service you are using, for details see DBMS_CLOUD Package File URI Formats.</p> <p>Directory</p> <p>You can specify one directory and one or more file names or use a comma separated list of directories and file names. The format to specify a directory is: '<i>MY_DIR:filename.ext</i>'. By default the directory name <i>MY_DIR</i> is a database object and is case-insensitive. The file name is case sensitive.</p> <p>You can use wildcards to specify file names in a directory. The character "*" can be used as the wildcard for multiple characters, the character "?" can be used as the wildcard for a single character. For example: '<i>MY_DIR:*</i>' or '<i>MY_DIR:test?</i>'</p> <p>To specify multiple directories, use a comma separated list of directories: For example: '<i>MY_DIR1:*, MY_DIR2:test?</i>'</p> <p>Use double quotes to specify a case-sensitive directory name. For example: '"<i>my_dir1</i>":*, "<i>my_dir2</i>":Test?'</p> <p>To include a quote character, use two quotes. For example: '<i>MY_DIR:''filename.ext</i>'. This specifies the filename starts with a quote (').</p>
<code>column_list</code>	<p>(Optional) This field, when specified, overrides the <code>format->schema</code> parameter which specifies that the schema, columns, and data types, are derived automatically. See the <code>format</code> parameter for details.</p> <p>When the <code>column_list</code> is specified for Avro or Parquet source, the column names must match those columns found in the file. Oracle data types must map appropriately to the Avro or Parquet data types.</p> <p>For Parquet files, see DBMS_CLOUD Package Parquet to Oracle Data Type Mapping for details.</p> <p>For Avro files, see DBMS_CLOUD Package Avro to Oracle Data Type Mapping for details.</p>
<code>field_list</code>	<p>Ignored for Avro or Parquet files.</p> <p>The fields in the source match the external table columns by name. Source data types are converted to the external table column data type.</p> <p>For Parquet files, see DBMS_CLOUD Package Parquet to Oracle Data Type Mapping for details.</p> <p>For Avro files, see DBMS_CLOUD Package Avro to Oracle Data Type Mapping for details.</p>
<code>format</code>	<p>For Avro or Parquet, there are only two supported parameters. See DBMS_CLOUD Package Format Options for Avro or Parquet for details.</p>

Examples Avro

```
format => '{"type":"avro", "schema": "all"}'
```

```
format => json_object('type' value 'avro', 'schema' value 'first')
```

Examples Parquet

```
format => '{"type":"parquet", "schema": "all"}'
```

```
format => json_object('type' value 'parquet', 'schema' value 'first')
```

Avro or Parquet Column Name Mapping to Oracle Column Names

See [DBMS_CLOUD Package Avro and Parquet to Oracle Column Name Mapping](#) for information on column name mapping and column name conversion usage in Oracle SQL.

45.5.6 CREATE_EXTERNAL_PART_TABLE Procedure

This procedure creates an external partitioned table on files in the Cloud. This allows you to run queries on external data from Oracle Database.

Syntax

```
DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE (  
    table_name          IN VARCHAR2,  
    credential_name     IN VARCHAR2,  
    partitioning_clause IN CLOB,  
    column_list         IN CLOB,  
    field_list          IN CLOB DEFAULT,  
    format              IN CLOB DEFAULT);
```

```
DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE (  
    table_name          IN VARCHAR2,  
    credential_name     IN VARCHAR2,  
    file_uri_list       IN VARCHAR2,  
    column_list         IN CLOB,  
    field_list          IN CLOB DEFAULT,  
    format              IN CLOB DEFAULT);
```

Parameters

Parameter	Description
table_name	The name of the external table.
credential_name	The name of the credential to access the Cloud Object Storage.

Parameter	Description
<code>partitioning_clause</code>	<p>Specifies the complete partitioning clause, including the location information for individual partitions.</p> <p>If you use the <code>partitioning_clause</code> parameter, the <code>file_uri_list</code> parameter is not allowed.</p>
<code>file_uri_list</code>	<p>There are two options for the <code>file_uri_list</code> parameter:</p> <ul style="list-style-type: none">• A common-delimited list of individual file URIs without wildcards.• A single file URI with wildcards, and the wildcards can only be after the last slash "/". <p>If you use the parameter <code>file_uri_list</code>, the <code>partitioning_clause</code> parameter is not allowed.</p> <p>The format of the URIs depends on the Cloud Object Storage service. See DBMS_CLOUD Package File URI Formats for more information.</p>
<code>column_list</code>	<p>Comma-delimited list of column names and data types for the external table. This parameter has the following requirements, depending on the type of the data files specified with the <code>file_uri_list</code> parameter:</p> <ul style="list-style-type: none">• The <code>column_list</code> parameter is required with unstructured files. Using unstructured files, for example with CSV text files, the <code>column_list</code> parameter must specify all the column names and data types inside the data file as well as the partition columns derived from the object name.• The <code>column_list</code> parameter is optional with structured files. For example, with Avro, ORC, or Parquet data files, the <code>column_list</code> is not required. When the <code>column_list</code> is not included, the <code>format</code> parameter <code>partition_columns</code> option must include specifications for both column names (<code>name</code>) and data types (<code>type</code>).
<code>field_list</code>	<p>Identifies the fields in the source files and their data types. The default value is NULL meaning the fields and their data types are determined by the <code>column_list</code> parameter. This argument's syntax is the same as the <code>field_list</code> clause in regular Oracle external tables. For more information about <code>field_list</code> see <i>Oracle® Database Utilities</i>.</p>

Parameter	Description
format	<p>The <code>format</code> option <code>partition_columns</code> specifies the DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE column names and data types of partition columns when the partition columns are derived from the file path, depending on the type of data file, structured or unstructured:</p> <ul style="list-style-type: none"> When the DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE includes the <code>column_list</code> parameter and the data files are unstructured, such as with CSV text files, <code>partition_columns</code> does not include the data type. For example, use a format such as the following for this type of <code>partition_columns</code> specification: <pre>"partition_columns":["state","zipcode"]'</pre> When the DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE does not include the <code>column_list</code> parameter and the data files are structured, such as Avro, ORC, or Parquet files, the <code>partition_columns</code> option includes both the column name, <code>name</code> sub-clause, and the data type, <code>type</code> sub-clause. For example, the following shows a <code>partition_columns</code> specification: <pre>"partition_columns":[{"name":"country", " type":"varchar2(10)"}, {"name":"year", " type":"number"}, {"name":"month", " type":"varchar2(10)"}]</pre> <p>If the data files are unstructured and the <code>type</code> sub-clause is specified with <code>partition_columns</code>, the <code>type</code> sub-clause is ignored.</p> <p>For object names that are not based on hive format, the order of the <code>partition_columns</code> specified columns must match the order as they appear in the object name in the file path specified in the <code>file_uri_list</code> parameter.</p> <p>To see all the <code>format</code> parameter options describing the format of the source files, see DBMS_CLOUD Package Format Options.</p>

Usage Notes

- You cannot call this procedure with both `partitioning_clause` and `file_uri_list` parameters.
- Specifying the `column_list` parameter is optional with structured data files, including Avro, Parquet, or ORC data files. If `column_list` is not specified, the `format` parameter `partition_columns` option must include both `name` and `type`.

- The `column_list` parameter is required with unstructured data files, such as CSV text files.
- The procedure `DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE` supports external partitioned files in the supported cloud object storage services, including:
 - Oracle Cloud Infrastructure Object Storage
 - Azure Blob Storage
 - Amazon S3
 - GitHub Repository

See [DBMS_CLOUD Package File URI Formats](#) for more information.

- When you call `DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE` with the `file_uri_list` parameter, the types for columns specified in the Cloud Object Store file name must be one of the following types:

```
VARCHAR2 (n)
NUMBER (n)
NUMBER (p, s)
NUMBER
DATE
TIMESTAMP (9)
```

- The default record delimiter is detected newline. With detected newline, `DBMS_CLOUD` tries to automatically find the correct newline character to use as the record delimiter. `DBMS_CLOUD` first searches for the Windows newline character `\r\n`. If it finds the Windows newline character, this is used as the record delimiter for all files in the procedure. If a Windows newline character is not found, `DBMS_CLOUD` searches for the UNIX/Linux newline character `\n`, and if it finds one it uses `\n` as the record delimiter for all files in the procedure. If the source files use a combination of different record delimiters, you may encounter an error such as, "KUP-04020: found record longer than buffer size supported". In this case, you need to either modify the source files to use the same record delimiter or only specify the source files that use the same record delimiter.

See [DBMS_CLOUD Package Format Options](#) for information on the `recorddelimiter` format option.

- The external partitioned tables you create with `DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE` include two invisible columns `file$path` and `file$name`. These columns help identify which file a record is coming from.
 - `file$path`: Specifies the file path text up to the beginning of the object name.
 - `file$name`: Specifies the object name, including all the text that follows the bucket name.

Examples

Example using the `partitioning_clause` parameter:

```
BEGIN
  DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE (
    table_name => 'PET1',
    credential_name => 'OBJ_STORE_CRED',
    format => json_object('delimiter' value ',', 'recorddelimiter' value
      'newline', 'characterset' value 'us7ascii'),
```

```

        column_list => 'col1 number, col2 number, col3 number',
        partitioning_clause => 'partition by range (col1)
                                (partition p1 values less than (1000)
                                location
                                    ( '&base_URL//file_11.txt' )
                                ,
                                partition p2 values less than (2000)
                                location
                                    ( '&base_URL//file_21.txt' )
                                ,
                                partition p3 values less than (3000)
                                location
                                    ( '&base_URL//file_31.txt' )
                                )'
    );
END;
/

```

Example using the file_uri_list and column_list parameters with unstructured data files:

```

BEGIN
  DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE(
    table_name => 'MYSALES',
    credential_name => 'DEF_CRED_NAME',
    file_uri_list => 'https://objectstorage.us-phoenix-1.oraclecloud.com/n/
namespace-string/b/bucketname/o/*.csv',
    column_list => 'product varchar2(100), units number, country varchar2(100),
year number, month varchar2(2)',
    field_list => 'product, units', --[Because country, year and month are not
in the file, they are not listed in the field list]
    format => '{"type": "csv", "partition_columns":
["country", "year", "month"]}');
END;
/

```

Example using the file_uri_list without the column_list parameter with structured data files:

```

BEGIN
  DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE(
    table_name => 'MYSALES',
    credential_name => 'DEF_CRED_NAME',
    DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE(
      table_name => 'MYSALES',
      credential_name => 'DEF_CRED_NAME',
      file_uri_list => 'https://objectstorage.us-phoenix-1.oraclecloud.com/n/
namespace-string/b/bucketname/o/*.parquet',
      format =>
        json_object('type' value 'parquet', 'schema' value 'first',
                    'partition_columns' value
                      json_array(
                        json_object('name' value 'country', 'type' value

```

```
'varchar2(100)'),
                                json_object('name' value 'year', 'type' value 'number'),
                                json_object('name' value 'month', 'type' value
'varchar2(2)')
                                )
                                )
);
END;
/
```

45.5.7 CREATE_HYBRID_PART_TABLE Procedure

This procedure creates a hybrid partitioned table. This allows you to run queries on hybrid partitioned data from Oracle Database.

Syntax

```
DBMS_CLOUD.CREATE_HYBRID_PART_TABLE (
    table_name          IN VARCHAR2,
    credential_name     IN VARCHAR2,
    partitioning_clause IN CLOB,
    column_list         IN CLOB,
    field_list          IN CLOB DEFAULT,
    format              IN CLOB DEFAULT);
```

Parameters

Parameter	Description
table_name	The name of the external table.
credential_name	The name of the credential to access the Cloud Object Storage.
partitioning_clause	Specifies the complete partitioning clause, including the location information for individual partitions.
column_list	Comma-delimited list of column names and data types for the external table.
field_list	Identifies the fields in the source files and their data types. The default value is NULL meaning the fields and their data types are determined by the <i>column_list</i> parameter. This argument's syntax is the same as the <i>field_list</i> clause in regular Oracle external tables. For more information about <i>field_list</i> see <i>Oracle® Database Utilities</i> .
format	The options describing the format of the source files. For the list of the options and how to specify the values see DBMS_CLOUD Package Format Options .

Usage Note

- The procedure `DBMS_CLOUD.CREATE_HYBRID_PART_TABLE` supports external partitioned files in the supported cloud object storage services, including:
 - Oracle Cloud Infrastructure Object Storage
 - Azure Blob Storage
 - Amazon S3

- GitHub Repository

The credential is a table level property; therefore, the external files must be on the same object store.

See [DBMS_CLOUD Package File URI Formats](#) for more information.

- The external partitioned tables you create with `DBMS_CLOUD.CREATE_HYBRID_PART_TABLE` include two invisible columns `file$path` and `file$name`. These columns help identify which file a record is coming from.
 - `file$path`: Specifies the file path text up to the beginning of the object name.
 - `file$name`: Specifies the object name, including all the text that follows the bucket name.

Example

```
BEGIN
  DBMS_CLOUD.CREATE_HYBRID_PART_TABLE(
    table_name => 'HPT1',
    credential_name => 'OBJ_STORE_CRED',
    format => json_object('delimiter' value ',', 'recorddelimiter'
value 'newline', 'characteraset' value 'us7ascii'),
    column_list => 'col1 number, col2 number, col3 number',
    partitioning_clause => 'partition by range (col1)
                          (partition p1 values less than (1000)
external location
                          ( '&base_URL/file_11.txt' )
                          ,
                          partition p2 values less than (2000)
external location
                          ( '&base_URL/file_21.txt' )
                          ,
                          partition p3 values less than (3000)
                          )'
    );
END;
/
```

45.5.8 DELETE_ALL_OPERATIONS Procedure

This procedure clears either all data load operations logged in the `user_load_operations` table in your schema or clears all the data load operations of the specified type, as indicated with the `type` parameter.

Syntax

```
DBMS_CLOUD.DELETE_ALL_OPERATIONS (
  type          IN VARCHAR DEFAULT NULL);
```

Parameters

Parameter	Description
type	Specifies the type of operation to delete. Type values can be found in the TYPE column in the user_load_operations table. If no type is specified all rows are deleted.

Usage Note

- DBMS_CLOUD.DELETE_ALL_OPERATIONS does not delete currently running operations (operations in a "Running" status).

45.5.9 DELETE_FILE Procedure

This procedure removes the specified file from the specified directory on Oracle Database.

Syntax

```
DBMS_CLOUD.DELETE_FILE (
    directory_name    IN VARCHAR2,
    file_name         IN VARCHAR2);
```

Parameters

Parameter	Description
directory_name	The name of the directory on the Oracle Database instance.
file_name	The name of the file to be removed.

 **Note:**

To run DBMS_CLOUD.DELETE_FILE, you need to grant write privileges on the directory that contains the file to the user. For example, run the following command as ADMIN to grant write privileges to db_user:

```
GRANT WRITE ON DIRECTORY data_pump_dir TO db_user;
```

Example

```
BEGIN
    DBMS_CLOUD.DELETE_FILE (
        directory_name => 'DATA_PUMP_DIR',
        file_name => 'exp1.dmp' );
END;
/
```

45.5.10 DELETE_OBJECT Procedure

This procedure deletes the specified object on object store.

Syntax

```
DBMS_CLOUD.DELETE_OBJECT (
    credential_name    IN VARCHAR2,
    object_uri         IN VARCHAR2,
    force              IN BOOLEAN DEFAULT FALSE);
```

Parameters

Parameter	Description
credential_name	The name of the credential to access the Cloud Object Storage.
object_uri	Object or file URI for the object to delete. The format of the URI depends on the Cloud Object Storage service you are using, for details see DBMS_CLOUD Package File URI Formats .
force	Ignore and do not report errors if object does not exist. Valid values are: TRUE and FALSE. The default value is FALSE.

Example

```
BEGIN
    DBMS_CLOUD.DELETE_OBJECT(
        credential_name => 'DEF_CRED_NAME',
        object_uri => 'https://objectstorage.us-
ashburn-1.oraclecloud.com/n/namespace-string/b/bucketname/o/
expl.dmp' );
    END;
/
```

45.5.11 DROP_CREDENTIAL Procedure

This procedure removes an existing credential from Oracle Database.

Syntax

```
DBMS_CLOUD.DROP_CREDENTIAL (
    credential_name    IN VARCHAR2);
```

Parameters

Parameter	Description
credential_name	The name of the credential to be removed.

45.5.12 GET_OBJECT Procedure and Function

This procedure is overloaded. The procedure form reads an object from Cloud Object Storage and copies it to Oracle Database. The function form reads an object from Cloud Object Storage and returns a BLOB to Oracle Database.

Syntax

```
DBMS_CLOUD.GET_OBJECT (
    credential_name      IN VARCHAR2,
    object_uri           IN VARCHAR2,
    directory_name       IN VARCHAR2,
    file_name            IN VARCHAR2 DEFAULT NULL,
    startoffset          IN NUMBER DEFAULT 0,
    endoffset            IN NUMBER DEFAULT 0,
    compression         IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_CLOUD.GET_OBJECT(
    credential_name      IN VARCHAR2 DEFAULT NULL,
    object_uri           IN VARCHAR2,
    startoffset          IN NUMBER DEFAULT 0,
    endoffset            IN NUMBER DEFAULT 0,
    compression         IN VARCHAR2 DEFAULT NULL)
RETURN BLOB;
```

Parameters

Parameter	Description
credential_name	The name of the credential to access the Cloud Object Storage.
object_uri	Object or file URI. The format of the URI depends on the Cloud Object Storage service you are using, for details see DBMS_CLOUD Package File URI Formats .
directory_name	The name of the directory on the database. 1
file_name	Specifies the name of the file to create. If file name is not specified, the file name is taken from after the last slash in the <code>object_uri</code> parameter. For special cases, for example when the file name contains slashes, use the <code>file_name</code> parameter.
startoffset	The offset, in bytes, from where the procedure starts reading.
endoffset	The offset, in bytes, until where the procedure stops reading.
compression	Specifies the compression used to store the object. When <code>compression</code> is set to 'AUTO' the file is uncompressed (the value 'AUTO' implies the object specified with <code>object_uri</code> is compressed with Gzip).

 **Note:**

To run `DBMS_CLOUD.GET_OBJECT`, you need to grant `WRITE` privileges on the directory to the user. For example, run the following command as `ADMIN` to grant write privileges to `db_user`:

```
GRANT WRITE ON DIRECTORY data_pump_dir TO db_user;
```

Return Values

The function form reads from Object Store and `DBMS_CLOUD.GET_OBJECT` returns a `BLOB`.

Examples

```
BEGIN
  DBMS_CLOUD.GET_OBJECT(
    credential_name => 'OBJ_STORE_CRED',
    object_uri => 'https://objectstorage.us-
phoenix-1.oraclecloud.com/n/namespace-string/b/bucketname/o/file.txt',
    directory_name => 'DATA_PUMP_DIR');
END;
/
```

To read character data from a file in Object Store:

```
SELECT to_clob(
  DBMS_CLOUD.GET_OBJECT(
    credential_name => 'OBJ_STORE_CRED',
    object_uri => 'https://objectstorage.us-
phoenix-1.oraclecloud.com/n/namespace-string/b/bucketname/o/file.txt'))
FROM DUAL;
```

To add an image stored on Object Store in a `BLOB` in the database:

```
DECLARE
  l_blob BLOB := NULL;
BEGIN
  l_blob := DBMS_CLOUD.GET_OBJECT(
    credential_name => 'OBJ_STORE_CRED',
    object_uri => 'https://objectstorage.us-
phoenix-1.oraclecloud.com/n/namespace-string/b/bucketname/o/
MyImage.gif' );
END;
/
```

In this example, *namespace-string* is the Oracle Cloud Infrastructure object storage namespace and *bucketname* is the bucket name. See [Understanding Object Storage Namespaces](#) for more information.

45.5.13 LIST_FILES Function

This function lists the files in the specified directory. The results include the file names and additional metadata about the files such as file size in bytes, creation timestamp, and the last modification timestamp.

Syntax

```
DBMS_CLOUD.LIST_FILES (
    directory_name    IN VARCHAR2)
    RETURN TABLE;
```

Parameters

Parameter	Description
directory_name	The name of the directory on the database.

Usage Notes

- DBMS_CLOUD.LIST_FILES is only supported for directory objects mapping to Oracle File System (OFS) or Database File System (DBFS) file systems.
- To run DBMS_CLOUD.LIST_FILES, you need to grant read privileges on the directory to the user. For example, run the following command as ADMIN to grant read privileges to db_user:

```
GRANT READ ON DIRECTORY data_pump_dir TO db_user;
```

- This is a pipelined table function with return type as DBMS_CLOUD_TYPES.list_object_ret_t.
- DBMS_CLOUD.LIST_FILES does not obtain the checksum value and returns NULL for this field.

Example

This is a pipelined function that returns a row for each file. For example, use the following query to use this function:

```
SELECT * FROM DBMS_CLOUD.LIST_FILES('DATA_PUMP_DIR');
```

OBJECT_NAME	BYTES	CHECKSUM	CREATED	LAST_MODIFIED
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
cwallet.sso	2965		2018-12-12T18:10:47Z	
			2019-11-23T06:36:54Z	

45.5.14 LIST_OBJECTS Function

This function lists objects in the specified location on object store. The results include the object names and additional metadata about the objects such as size, checksum, creation timestamp, and the last modification timestamp.

Syntax

```
DBMS_CLOUD.LIST_OBJECTS (
    credential_name    IN VARCHAR2,
    location_uri       IN VARCHAR2)
RETURN TABLE;
```

Parameters

Parameter	Description
credential_name	The name of the credential to access the Cloud Object Storage.
location_uri	Object or file URI. The format of the URI depends on the Cloud Object Storage service you are using, for details see DBMS_CLOUD Package File URI Formats .

Usage Notes

- Depending on the capabilities of the object store, `DBMS_CLOUD.LIST_OBJECTS` does not return values for certain attributes and the return value for the field is `NULL` in this case.

All supported Object Stores return values for the `OBJECT_NAME`, `BYTES`, and `CHECKSUM` fields.

The following table shows support for the fields `CREATED` and `LAST_MODIFIED` by Object Store:

Object Store	CREATED	LAST_MODIFIED
Oracle Cloud Infrastructure Native	Returns timestamp	Returns timestamp
Oracle Cloud Infrastructure Swift	Returns <code>NULL</code>	Returns timestamp
Oracle Cloud Infrastructure Classic	Returns <code>NULL</code>	Returns timestamp
Amazon S3	Returns <code>NULL</code>	Returns timestamp
Azure	Returns timestamp	Returns timestamp
GitHub Repository		

- The checksum value is the MD5 checksum. This is a 32-character hexadecimal number that is computed on the object contents. It is expected to have a different checksum value if `OCI$RESOURCE_PRINCIPAL` credential is used.
- This is a pipelined table function with return type as `DBMS_CLOUD_TYPES.list_object_ret_t`.

Example

This is a pipelined function that returns a row for each object. For example, use the following query to use this function:

```
SELECT * FROM DBMS_CLOUD.LIST_OBJECTS('OBJ_STORE_CRED',
    'https://objectstorage.us-phoenix-1.oraclecloud.com/n/namespace-string/b/
    bucketname/o/');
```

```
OBJECT_NAME    BYTES    CHECKSUM
CREATED        LAST_MODIFIED
-----
cwallet.sso    2965     2339a2731ba24a837b26d344d643dc07
2019-11-23T06:36:54Z
```

In this example, *namespace-string* is the Oracle Cloud Infrastructure object storage namespace and *bucketname* is the bucket name. See [Understanding Object Storage Namespaces](#) for more information.

45.5.15 PUT_OBJECT Procedure

This procedure is overloaded. In one form the procedure copies a file from Oracle Database to the Cloud Object Storage. In another form the procedure copies a BLOB from Oracle Database to the Cloud Object Storage.

Syntax

```
DBMS_CLOUD.PUT_OBJECT (
    credential_name    IN VARCHAR2,
    object_uri         IN VARCHAR2,
    directory_name     IN VARCHAR2,
    file_name          IN VARCHAR2);
```

```
DBMS_CLOUD.PUT_OBJECT (
    credential_name    IN VARCHAR2,
    object_uri         IN VARCHAR2,
    contents           IN BLOB,
    file_name          IN VARCHAR2);
```

Parameters

Parameter	Description
credential_name	The name of the credential to access the Cloud Object Storage.
object_uri	Object or file URI. The format of the URI depends on the Cloud Object Storage service you are using, for details see DBMS_CLOUD Package File URI Formats .
directory_name	The name of the directory on the Oracle Database. 1

Parameter	Description
file_name	The name of the file in the specified directory.



Note:

To run `DBMS_CLOUD.PUT_OBJECT`, you need to grant read privileges on the directory to the user. For example, run the following command as `ADMIN` to grant read privileges to `db_user`:

```
GRANT READ ON DIRECTORY data_pump_dir TO db_user;
```

Example

To handle `BLOB` data after in-database processing and then store the data directly into a file in the object store:

```
DECLARE
    my_blob_data BLOB;
BEGIN
    /* Some processing producing BLOB data and populating my_blob_data */
    DBMS_CLOUD.PUT_OBJECT(
        credential_name => 'OBJ_STORE_CRED',
        object_uri => 'https://objectstorage.us-
        phoenix-1.oraclecloud.com/n/namespace-string/b/bucketname/o/
        my_new_file',
        contents => my_blob_data));
END;
/
```

Usage Notes

Depending on your Cloud Object Storage, the size of the object you transfer is limited as follows:

Cloud Object Storage Service	Object Transfer Size Limit
Oracle Cloud Infrastructure Object Storage	50 GB
Amazon S3	5 GB
Azure Blob Storage	256 MB

Oracle Cloud Infrastructure object store does not allow writing files into a public bucket without supplying credentials (Oracle Cloud Infrastructure allows users to download objects from public buckets). Thus, you must supply a credential name with valid credentials to store an object in an Oracle Cloud Infrastructure public bucket using `PUT_OBJECT`.

See [DBMS_CLOUD Package File URI Formats](#) for more information.

45.5.16 UPDATE_CREDENTIAL Procedure

This procedure updates cloud service credential attributes in Oracle Database.

Use stored credentials for data loading, for querying external data residing in the Cloud, or wherever you use DBMS_CLOUD procedures with a `credential_name` parameter. This procedure lets you update an attribute with a new value for a specified `credential_name`.

Syntax

```
DBMS_CLOUD.UPDATE_CREDENTIAL (
  credential_name  IN VARCHAR2,
  attribute        IN VARCHAR2,
  value           IN VARCHAR2);
```

Parameters

Parameter	Description
<code>credential_name</code>	The name of the credential to be stored.
<code>attribute</code>	Name of attribute to update: USERNAME or PASSWORD.
<code>value</code>	New value for the selected attribute.

Usage Notes

- The user name is case sensitive. It cannot contain double quotes or spaces.
- You only need to create credentials once unless your cloud service credentials change. Once you store the credentials you can then use the same credential name for DBMS_CLOUD procedures that require a `credential_name` parameter.

Example

```
BEGIN
  DBMS_CLOUD.UPDATE_CREDENTIAL(
    credential_name => 'OBJ_STORE_CRED',
    attribute => 'PASSWORD',
    value => 'password');
END;
/
```

45.5.17 VALIDATE_EXTERNAL_TABLE Procedure

This procedure validates the source files for an external table, generates log information, and stores the rows that do not match the format options specified for the external table in a *badfile* table on Oracle Database. The overloaded form enables you to use the `operation_id` parameter.

Syntax

```
DBMS_CLOUD.VALIDATE_EXTERNAL_TABLE (
  table_name      IN VARCHAR2,
```

```

schema_name      IN VARCHAR2 DEFAULT,
rowcount         IN NUMBER DEFAULT,
stop_on_error    IN BOOLEAN DEFAULT);

```

```

DBMS_CLOUD.VALIDATE_EXTERNAL_TABLE(
  table_name      IN VARCHAR2,
  operation_id    OUT NOCOPY NUMBER,
  schema_name     IN VARCHAR2 DEFAULT NULL,
  rowcount        IN NUMBER DEFAULT 0,
  stop_on_error   IN BOOLEAN DEFAULT TRUE);

```

Parameters

Parameter	Description
table_name	The name of the external table.
operation_id	Use this parameter to track the progress and final status of the load operation as the corresponding ID in the <code>USER_LOAD_OPERATIONS</code> view.
schema_name	The name of the schema where the external table resides. The default value is <code>NULL</code> meaning the external table is in the same schema as the user running the procedure.
rowcount	Number of rows to be scanned. The default value is <code>NULL</code> meaning all the rows in the source files are scanned.
stop_on_error	Determines if the validate should stop when a row is rejected. The default value is <code>TRUE</code> meaning the validate stops at the first rejected row. Setting the value to <code>FALSE</code> specifies that the validate does not stop at the first rejected row and validates all rows up to the value specified for the <code>rowcount</code> parameter. If the external table refers to Avro or Parquet files then the validate stops at the first rejected row. When the external table specifies the <code>format</code> parameter type set to the value <code>avro</code> or <code>parquet</code> , the parameter <code>stop_on_error</code> effectively always has the value <code>TRUE</code> . Thus, the table badfile will always be empty for an external table referring to Avro or Parquet files.

Usage Notes

- `DBMS_CLOUD.VALIDATE_EXTERNAL_TABLE` works with both partitioned external tables and hybrid partitioned tables. This potentially reads data from all external partitions until `rowcount` is reached or `stop_on_error` applies. You do not have control over which partition, or parts of a partition, is read in which order.

45.5.18 VALIDATE_EXTERNAL_PART_TABLE Procedure

This procedure validates the source files for an external partitioned table, generates log information, and stores the rows that do not match the format options specified for the external table in a *badfile* table on Oracle Database. The overloaded form enables you to use the `operation_id` parameter.

Syntax

```
DBMS_CLOUD.VALIDATE_EXTERNAL_PART_TABLE (
    table_name           IN VARCHAR2,
    partition_name      IN CLOB DEFAULT,
    schema_name         IN VARCHAR2 DEFAULT,
    rowcount            IN NUMBER DEFAULT,
    partition_key_validation IN BOOLEAN DEFAULT,
    stop_on_error       IN BOOLEAN DEFAULT);
```

```
DBMS_CLOUD.VALIDATE_EXTERNAL_PART_TABLE (
    table_name           IN VARCHAR2,
    operation_id        OUT NUMBER,
    partition_name      IN CLOB DEFAULT,
    schema_name         IN VARCHAR2 DEFAULT,
    rowcount            IN NUMBER DEFAULT,
    partition_key_validation IN BOOLEAN DEFAULT,
    stop_on_error       IN BOOLEAN DEFAULT);
```

Parameters

Parameter	Description
table_name	The name of the external table.
operation_id	Use this parameter to track the progress and final status of the load operation as the corresponding ID in the <code>USER_LOAD_OPERATIONS</code> view.
partition_name	If defined, then only a specific partition is validated. If not specified then read all partitions sequentially until <code>rowcount</code> is reached.
schema_name	The name of the schema where the external table resides. The default value is <code>NULL</code> meaning the external table is in the same schema as the user running the procedure.
rowcount	Number of rows to be scanned. The default value is <code>NULL</code> meaning all the rows in the source files are scanned.
partition_key_validation	For internal use only. Do not use this parameter.
stop_on_error	Determines if the validate should stop when a row is rejected. The default value is <code>TRUE</code> meaning the validate stops at the first rejected row. Setting the value to <code>FALSE</code> specifies that the validate does not stop at the first rejected row and validates all rows up to the value specified for the <code>rowcount</code> parameter. If the external table refers to Avro or Parquet files then the validate stops at the first rejected row. When the external table specifies the <code>format</code> parameter type set to the value <code>avro</code> or <code>parquet</code> , the parameter <code>stop_on_error</code> effectively always has the value <code>TRUE</code> . Thus, the table badfile will always be empty for an external table referring to Avro or Parquet files.

45.5.19 VALIDATE_HYBRID_PART_TABLE Procedure

This procedure validates the source files for a hybrid partitioned table, generates log information, and stores the rows that do not match the format options specified for the hybrid table in a *badfile* table on Oracle Database. The overloaded form enables you to use the *operation_id* parameter.

Syntax

```
DBMS_CLOUD.VALIDATE_HYBRID_PART_TABLE (
    table_name           IN VARCHAR2,
    partition_name      IN CLOB DEFAULT,
    schema_name         IN VARCHAR2 DEFAULT,
    rowcount            IN NUMBER DEFAULT,
    partition_key_validation IN BOOLEAN DEFAULT,
    stop_on_error       IN BOOLEAN DEFAULT);
```

```
DBMS_CLOUD.VALIDATE_HYBRID_PART_TABLE (
    table_name           IN VARCHAR2,
    operation_id        OUT NUMBER,
    partition_name      IN CLOB DEFAULT,
    schema_name         IN VARCHAR2 DEFAULT,
    rowcount            IN NUMBER DEFAULT,
    partition_key_validation IN BOOLEAN DEFAULT,
    stop_on_error       IN BOOLEAN DEFAULT);
```

Parameters

Parameter	Description
<code>table_name</code>	The name of the external table.
<code>operation_id</code>	Use this parameter to track the progress and final status of the load operation as the corresponding ID in the <code>USER_LOAD_OPERATIONS</code> view.
<code>partition_name</code>	If defined, then only a specific partition is validated. If not specified then read from all external partitions sequentially until <code>rowcount</code> is reached.
<code>schema_name</code>	The name of the schema where the external table resides. The default value is <code>NULL</code> meaning the external table is in the same schema as the user running the procedure.
<code>rowcount</code>	Number of rows to be scanned. The default value is <code>NULL</code> meaning all the rows in the source files are scanned.
<code>partition_key_validation</code>	For internal use only. Do not use this parameter.

Parameter	Description
<code>stop_on_error</code>	<p>Determines if the validate should stop when a row is rejected. The default value is <code>TRUE</code> meaning the validate stops at the first rejected row. Setting the value to <code>FALSE</code> specifies that the validate does not stop at the first rejected row and validates all rows up to the value specified for the <code>rowcount</code> parameter.</p> <p>If the external table refers to Avro or Parquet files then the validate stops at the first rejected row.</p> <p>When the external table specifies the <code>format</code> parameter type set to the value <code>avro</code> or <code>parquet</code>, the parameter <code>stop_on_error</code> effectively always has the value <code>TRUE</code>. Thus, the table badfile will always be empty for an external table referring to Avro or Parquet files.</p>

45.6 DBMS_CLOUD Package File URI Formats

Describes the format of the source file URIs in operations with `DBMS_CLOUD`. The format depends on the object storage service you are using.

`DBMS_CLOUD` guarantees secure communication and any URI that you specify must use `HTTPS`, with `https://` as the prefix for the URI.

Topics

- [Oracle Cloud Infrastructure Object Storage Native URI Format](#)
- [Oracle Cloud Infrastructure Object Storage Swift URI Format](#)
- [Oracle Cloud Infrastructure Object Storage URI Format Using Pre-Authenticated Request URL](#)
- [URI Format Using Public URL](#)
- [Oracle Cloud Infrastructure Object Storage Classic URI Format](#)
- [Amazon S3 URI Format](#)
- [Azure Blob Storage URI Format](#)

45.6.1 Oracle Cloud Infrastructure Object Storage Native URI Format

If your source files reside on the Oracle Cloud Infrastructure Object Storage you can use Oracle Cloud Infrastructure native URIs, with the format:

```
https://objectstorage.region.oraclecloud.com/n/namespace-string/b/bucket/o/filename
```

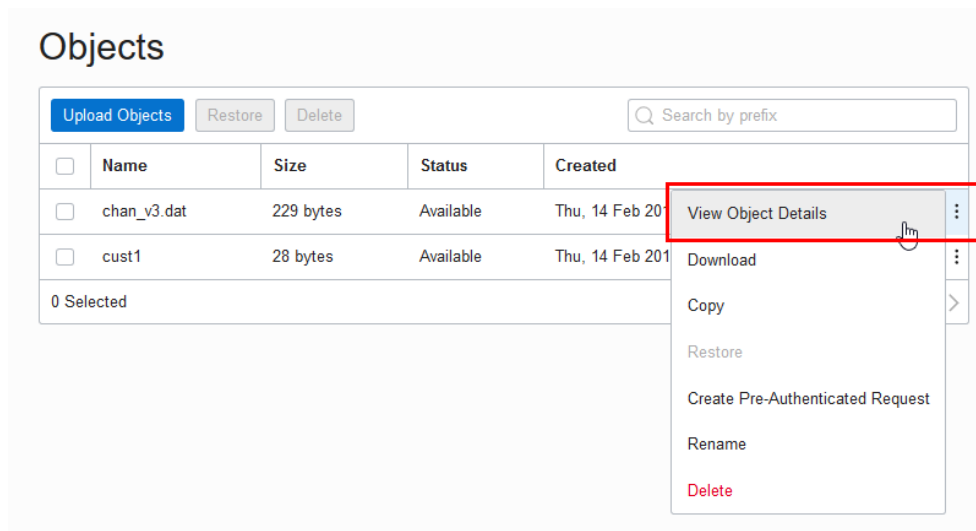
For example, the Native URI for the file `channels.txt` in the `bucketname` bucket in the Phoenix data center is:

```
https://objectstorage.us-phoenix-1.oraclecloud.com/n/namespace-string/b/bucketname/o/channels.txt
```

In this example, *namespace-string* is the Oracle Cloud Infrastructure object storage namespace and *bucketname* is the bucket name. See [Understanding Object Storage Namespaces](#) for more information.

You can find the URI from the Oracle Cloud Infrastructure Object Storage "Object Details" in the right hand side ellipsis menu in the Object Store:

1. Open the Oracle Cloud Infrastructure Console by clicking the ☰ next to Oracle Cloud.
2. From the Oracle Cloud Infrastructure left navigation menu click **Core Infrastructure**. Under **Object Storage**, click **Object Storage**.
3. Under List Scope, select a **Compartment**.
4. From the **Name** column, select a bucket.
5. In the Objects area, click **View Object Details**.



The screenshot shows the 'Objects' page in the Oracle Cloud Infrastructure console. It features a table with columns for Name, Size, Status, and Created. Two objects are listed: 'chan_v3.dat' (229 bytes, Available, Thu, 14 Feb 20) and 'cust1' (28 bytes, Available, Thu, 14 Feb 20). A context menu is open for the first object, with 'View Object Details' highlighted in a red box. Other menu items include Download, Copy, Restore, Create Pre-Authenticated Request, Rename, and Delete.

<input type="checkbox"/>	Name	Size	Status	Created	
<input type="checkbox"/>	chan_v3.dat	229 bytes	Available	Thu, 14 Feb 20	View Object Details
<input type="checkbox"/>	cust1	28 bytes	Available	Thu, 14 Feb 20	Download

6. On the **Object Details** page, the **URL Path (URI)** field shows the URI to access the object.

 **Note:**

The source files need to be stored in an Object Storage tier bucket. Oracle Database does not support buckets in the Archive Storage tier. See [Overview of Object Storage](#) for more information.

45.6.2 Oracle Cloud Infrastructure Object Storage Swift URI Format

If your source files reside on the Oracle Cloud Infrastructure Object Storage you can use Oracle Cloud Infrastructure Swift URIs with the format:

```
https://swiftobjectstorage.region.oraclecloud.com/v1/namespace-string/  
bucket/filename
```

For example, the Swift URI for the file `channels.txt` in the `bucketname` bucket in the Phoenix data center is:

```
https://swiftobjectstorage.us-phoenix-1.oraclecloud.com/v1/namespace-string/  
bucketname/channels.txt
```

In this example, `namespace-string` is the Oracle Cloud Infrastructure object storage namespace and `bucketname` is the bucket name. See [Understanding Object Storage Namespaces](#) for more information.

**Note:**

The source files need to be stored in an Object Storage tier bucket. Oracle Database does not support buckets in the Archive Storage tier. See [Overview of Object Storage](#) for more information.

45.6.3 Oracle Cloud Infrastructure Object Storage URI Format Using Pre-Authenticated Request URL

If your source files reside on the Oracle Cloud Infrastructure Object Storage you can use Oracle Cloud Infrastructure pre-authenticated URIs. When you create a pre-authenticated request, a unique URL is generated. You can then provide the unique URL to users in your organization, partners, or third parties to access the Object Storage resource target identified in the pre-authenticated request.

**Note:**

Carefully assess the business requirement for and the security ramifications of pre-authenticated access. When you create the pre-authenticated request URL, note the **Expiration** and the **Access Type** to make sure they are appropriate for your use.

A pre-authenticated request URL gives anyone who has the URL access to the targets identified in the request for as long as the request is active. In addition to considering the operational needs of pre-authenticated access, it is equally important to manage its distribution.

The format for pre-authenticated request URLs is:

```
https://objectstorage.region.oraclecloud.com/p/encrypted_string/n/namespace-string/b/  
bucket/o/filename
```

For example, a sample pre-authenticated URI for the file `channels.txt` in the `bucketname` bucket in the Phoenix data center is:

```
https://objectstorage.us-phoenix-1.oraclecloud.com/p/2xN-uDtWJNsid910UCYGue/n/  
namespace-string/b/bucketname/o/channels.txt
```

In this example, *namespace-string* is the Oracle Cloud Infrastructure object storage namespace and *bucketname* is the bucket name. See [Understanding Object Storage Namespaces](#) for more information.

You can use a pre-authenticated URL in any `DBMS_CLOUD` procedure that takes a URL to access files in Oracle Cloud Infrastructure object store, without the need to create a credential. You need to either specify the `credential_name` parameter as `NULL` or not supply a `credential_name` parameter.

For example:

```
BEGIN
  DBMS_CLOUD.COPY_DATA(
    table_name =>'CHANNELS',
    file_uri_list =>'https://objectstorage.us-
phoenix-1.oraclecloud.com/p/unique-pre-authenticated-string/n/
namespace-string/b/bucketname/o/channels.txt',
    format => json_object('delimiter' value ',') );
END;
/
```

 **Note:**

A list of mixed URLs is valid. If the URL list contains both pre-authenticated URLs and URLs that require authentication, `DBMS_CLOUD` uses the specified `credential_name` to access the URLs that require authentication and for the pre-authenticated URLs the specified `credential_name` is ignored.

See [Using Pre-Authenticated Requests](#) for more information.

45.6.4 URI Format Using Public URL

If your source files reside on an Object Store that provides public URLs, you can use public URLs with `DBMS_CLOUD` procedures. Public means the Object Storage service supports anonymous, unauthenticated access to the Object Store files. See your Cloud Object Storage service for details on how to make an object public in a supported Object Store.

 **Note:**

Carefully assess the business requirement for and the security ramifications of using public URLs. When you use public URLs, due to the file content not being authenticated, make sure this is appropriate for your use.

You can use a public URL in any `DBMS_CLOUD` procedure that takes a URL to access files in your object store, without the need to create a credential. You need to either specify the `credential_name` parameter as `NULL` or not supply a `credential_name` parameter.

For example the following uses `DBMS_CLOUD.COPY_DATA` without a `credential_name`:

```
BEGIN
  DBMS_CLOUD.COPY_DATA(
    table_name => 'CHANNELS',
    file_uri_list => 'https://objectstorage.us-ashburn-1.oraclecloud.com/n/
namespace-string/b/bucketname/o/chan_v3.dat',
    format => json_object('delimiter' value ',') );
END;
/
```

In this example, *namespace-string* is the Oracle Cloud Infrastructure object storage namespace and *bucketname* is the bucket name. See [Understanding Object Storage Namespaces](#) for more information.

 **Note:**

A list of mixed URLs is valid. If the URL list contains both public URLs and URLs that require authentication, `DBMS_CLOUD` uses the specified `credential_name` to access the URLs that require authentication and for the public URLs the specified `credential_name` is ignored.

See [Public Buckets](#) for information on using Oracle Cloud Infrastructure public buckets.

45.6.5 Oracle Cloud Infrastructure Object Storage Classic URI Format

If your source files reside in Oracle Cloud Infrastructure Object Storage Classic, see the REST page for a description of the URI format for accessing your files: [About REST URLs for Oracle Cloud Infrastructure Object Storage Classic Resources](#).

45.6.6 Amazon S3 URI Format

If your source files reside in Amazon S3, see the following for a description of the URI format for accessing your files: [Accessing a Bucket](#).

For example the following refers to the file `channels.txt` in the `adb` bucket in the `us-west-2` region.

```
https://s3-us-west-2.amazonaws.com/adb/channels.txt
```

 **Note:**

`DBMS_CLOUD` only supports native S3 storage, and no S3-compliant APIs or storage devices.

45.6.7 Azure Blob Storage URI Format

If your source files reside in Azure Blob Storage, see the following for a description of the URI format for accessing your files: [Resource URI Syntax](#).

For example the following refers to the file `channels.txt` in the `adb` container in the storage account `db_user`:

```
https://db_user.blob.core.windows.net/adb/channels.txt
```

 **Note:**

You can use Shared Access Signatures (SAS) URL in any `DBMS_CLOUD` procedure that takes a URL to access files in Azure Blob Storage, without the need to create a credential. To use a Shared Access Signature (SAS) URL, either specify the `credential_name` parameter as `NULL`, or do not supply a `credential_name` parameter. See Grant Limited Access to Azure Storage Resources Using Shared Access Signatures (SAS) for more information.

45.7 DBMS_CLOUD Package Format Options

The format argument in `DBMS_CLOUD` specifies the format of source files.

The two ways to specify the format argument are:

```
format => '{"format_option" : "format_value" }'
```

And:

```
format => json_object('format_option' value 'format_value')
```

Examples:

```
format => json_object('type' VALUE 'CSV')
```

To specify multiple format options, separate the values with a `,`.

For example:

```
format => json_object('ignoremissingcolumns' value 'true', 'removequotes' value 'true',
                    'dateformat' value 'YYYY-MM-DD-HH24-MI-SS',
                    'blankasnull' value 'true', 'logretention' value 7)
```

 **Note:**

For Avro or Parquet format options, see [DBMS_CLOUD Package Format Options for Avro or Parquet](#).

Format Option	Description	Syntax
<code>blankasnull</code>	When set to <code>true</code> , loads fields consisting of spaces as null.	<code>blankasnull : true</code> Default value: <code>False</code>

Format Option	Description	Syntax
charsetset Valid with format JSON and COPY_DATA	Specifies the charset of source files	charsetset: <i>string</i> Default value: Database charset
columnpath Only use with format JSON and COPY_DATA	Array of JSON path expressions that correspond to the fields that need to be extracted from the JSON records. Each of the JSON path expressions in the array should follow the rules described in SQL/JSON Path Expressions . Only use with format JSON and DBMS_CLOUD.COPY_DATA.	JSON Array of json path expressions expressed in string format. For example: 'columnpath' value <code>'["\$\$.WEATHER_STATION_ID", "\$\$.WEATHER_STATION_NAME"]'</code>
compression	Specifies the compression type of the source file. ZIP archiving format is not supported. Specifying the value <code>auto</code> checks for the compression types: <code>gzip</code> , <code>zlib</code> , <code>bzip2</code> .	compression: <code>auto gzip zlib bzip2</code> Default value: Null value meaning no compression.
conversionerrors	If a row is rejected because of data type conversion errors, the related columns are stored as null or the row is rejected.	conversionerrors : <code>reject_record store_null</code> Default value: <code>reject_record</code>
dateformat	Specifies the date format in the source file. The format option <code>AUTO</code> searches for the following formats: J MM-DD-YYYYBC MM-DD-YYYY YYYYMMDD HHMISS YYMMDD HHMISS YYYY.DDD YYYY-MM-DD	dateformat : <i>string</i> Default value: Database date format
delimiter	Specifies the field delimiter. To use a special character as the delimiter, specify the HEX value of the ASCII code of the character. For example, the following specifies the TAB character as the delimiter: <pre>format => json_object('delimiter' value 'X'9''')</pre>	delimiter : <i>character</i> Default value (pipe character)
enablelogs	Specifies a boolean value, when set to <code>TRUE</code> , logs are generated. When set to <code>FALSE</code> , logs are not generated. The value for <code>enablelogs</code> must be enclosed in single quotes. For example: <pre>format => JSON_OBJECT('enablelogs' value 'FALSE')</pre>	enablelogs: <code>false</code> Default value: <code>true</code>

Format Option	Description	Syntax
endquote	Data can be enclosed between two delimiters, specified with <code>quote</code> and <code>endquote</code> . The <code>quote</code> and <code>endquote</code> characters are removed during loading when specified. For example: format => JSON_OBJECT('quote' value '(, 'endquote' value ')')	endquote: character Default value: Null, meaning no endquote.
escape	The character "\" is used as the escape character when specified.	escape : true Default value: false
ignoreblanklines	Blank lines are ignored when set to true.	ignoreblanklines : true Default value: False
ignoremissingcolumns	If there are more columns in the <code>field_list</code> than there are in the source files, the extra columns are stored as null.	ignoremissingcolumns : true Default value False
language	Specifies a language name (for example, FRENCH), from which locale-sensitive information can be derived.	language: <i>string</i> Default value: Null See Locale Data in <i>Oracle Database Globalization Support Guide</i> for a listing of Oracle-supported languages.
logdir	Specifies a string value that determines the directory object name where the <code>logfile_table</code> or <code>badfile_table</code> files are saved. By default, the <code>logdir</code> is not case-sensitive, but the case is reserved when the specified value is enclosed in double-quotes. For example: format => JSON_OBJECT ('logdir' value 'test_log') The <code>logdir</code> format option specified in the above example saves the <code>logfile_table</code> or <code>badfile_table</code> files in the TEST_LOG directory object. format => JSON_OBJECT ('logdir' value "test_log") The <code>logdir</code> format option specified in the above example saves the <code>logfile_table</code> or <code>badfile_table</code> files in the test_log directory object.	logdir: <i>string</i> Default value: DATA_PUMP_DIR

Format Option	Description	Syntax
logprefix	<p>Specifies a string value that determines the prefix for the logfile_table and badfile_table files.</p> <p>The log table name format is: <i>logprefix\$operation_id</i></p> <p>By default, the logprefix is in upper case, but the case is reserved when the specified value is enclosed in double-quotes.</p> <p>For example:</p> <pre>format => JSON_OBJECT ('logprefix' value 'TEST')</pre> <p>Log files then use the TEST prefix, such as: TEST\$2_LOG and TEST\$2_BAD.</p>	<p>logprefix: <i>string</i></p> <p>Default value: COPY</p>
logretention	<p>Specifies a positive integer duration, in days, for which the logfile_table and badfile_table files are retained.</p> <p>Valid values: 0 to 99999</p> <p>For example:</p> <pre>format => JSON_OBJECT ('logretention' value 7)</pre>	<p>logretention: <i>number</i></p> <p>Default value: 2</p>
numericcharacter s	<p>Specifies the characters to use as the group separator and decimal character.</p> <p><i>decimal_character</i>: The decimal separates the integer portion of a number from the decimal portion.</p> <p><i>group_separator</i>: The group separator separates integer groups (that is, thousands, millions, billions, and so on).</p>	<p>numericcharacters: '<i>decimal_character</i> <i>group_separator</i>'</p> <p>Default value: ". ,"</p> <p>See NLS_NUMERIC_CHARACTERS in <i>Oracle Database Globalization Support Guide</i> for more information.</p>
numberformat	<p>Specifies the number format model. Number format models cause the number to be rounded to the specified number of significant digits. A number format model is composed of one or more number format elements.</p> <p>This is used in combination with numericcharacters.</p>	<p>numberformat: <i>number_format_model</i></p> <p>Default value: is derived from the setting of the NLS_TERRITORY parameter</p> <p>See Number Format Models in <i>SQL Language Reference</i> for more information.</p>

Format Option	Description	Syntax
partition_columns	<p>The format option <code>partition_columns</code> is used with <code>DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE</code> to specify the column names and data types of partition columns when the partition columns are derived from the file path, depending on the type of data file, structured or unstructured:</p> <ul style="list-style-type: none"> When the <code>DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE</code> includes the <code>column_list</code> parameter and the data file is unstructured, such as with CSV text files, <code>partition_columns</code> does not include the data type. For example, use a format such as the following for this type of <code>partition_columns</code> specification: <pre>"partition_columns": ["state", "zipcode"]'</pre> <p>The data type is not required because it is specified in the <code>DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE column_list</code> parameter.</p> When the <code>DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE</code> does not include the <code>column_list</code> parameter and the data files are structured, such as Avro, ORC, or Parquet files, the <code>partition_columns</code> option includes the data type. For example, the following shows a <code>partition_columns</code> specification: <pre>"partition_columns": [{"name": "country", "type": "varchar2(10)"}, {"name": "year", "type": "number"}, {"name": "month", "type": "varchar2(10)"}]</pre> <p>If the data files are unstructured and the type sub-clause is specified with <code>partition_columns</code>, the type sub-clause is ignored.</p> <p>For object names that are not based on hive format, the order of the <code>partition_columns</code> specified columns must match the order as they appear in the object name in the <code>file_uri_list</code>.</p>	
quote	<p>Specifies the quote character for the fields, the quote characters are removed during loading when specified.</p>	<p>quote: <i>character</i> Default value: Null meaning no quote</p>

Format Option	Description	Syntax
<code>recorddelimiter</code>	<p>Specifies the record delimiter.</p> <p>By default, DBMS_CLOUD tries to automatically find the correct newline character as the delimiter. It first searches the file for the Windows newline character "\r\n". If it finds the Windows newline character, this is used as the record delimiter for all files in the procedure. If a Windows newline character is not found, it searches for the UNIX/Linux newline character "\n" and if it finds one it uses "\n" as the record delimiter for all files in the procedure.</p> <p>Specify this argument explicitly if you want to override the default behavior, for example:</p> <pre>format => json_object('recorddelimiter' VALUE ''\r\n'')</pre> <p>To indicate that there is no record delimiter you can specify a <code>recorddelimiter</code> that does not occur in the input file. For example, to indicate that there is no delimiter, specify the control character 0x01 (SOH) as a value for the <code>recorddelimiter</code> and set the <code>recorddelimiter</code> value to "0x'01'" (this character does not occur in JSON text). For example:</p> <pre>format => '{"recorddelimiter" : "0x'01'"}</pre> <p>The <code>recorddelimiter</code> is set once per procedure call. If you are using the default value, <code>detected newline</code>, then all files use the same record delimiter, if one is detected.</p>	<p><code>recorddelimiter</code>: <i>character</i></p> <p>Default value: detected newline</p>
<code>rejectlimit</code>	<p>The operation will error out after specified number of rows are rejected.</p>	<p><code>rejectlimit</code>: <i>number</i></p> <p>Default value: 0</p>
<code>removequotes</code>	<p>Removes any quotes that are around any field in the source file.</p>	<p><code>removequotes</code>: <i>true</i></p> <p>Default value: <i>False</i></p>
<code>skipheaders</code>	<p>Specifies how many rows should be skipped from the start of the file.</p>	<p><code>skipheaders</code>: <i>number</i></p> <p>Default value: 0 if not specified, 1 if specified without a value</p>
<code>territory</code>	<p>Specifies a territory name to further determine input data characteristics.</p>	<p><code>territory</code>: <i>string</i></p> <p>Default value: <i>Null</i></p> <p>See <i>Locale Data in Oracle Database Globalization Support Guide</i> for a listing of Oracle-supported territories.</p>

Format Option	Description	Syntax
timestampformat	Specifies the timestamp format in the source file. The format option AUTO searches for the following formats: YYYY-MM-DD HH:MI:SS.FF YYYY-MM-DD HH:MI:SS.FF3 YYYY-MM-DD HH24:MI:SS.FF3 MM/DD/YYYY HH:MI:SS.FF3	timestampformat : <i>string</i> Default value: Database timestamp format The string can contain wildcard characters such as "\$".
timestamplocaltzformat	Specifies the timestamp with local timezone format in the source file. The format option AUTO searches for the following formats: DD Mon YYYY HH:MI:SS.FF TZR MM/DD/YYYY HH:MI:SS.FF TZR YYYY-MM-DD HH:MI:SS+/-TZR YYYY-MM-DD HH:MI:SS.FF3 DD.MM.YYYY HH:MI:SS TZR	timestamplocaltzformat : <i>string</i> Default value: Database timestamp with local timezone format
timestampwithtzformat	Specifies the timestamp with timezone format in the source file. The format option AUTO searches for the following formats: DD Mon YYYY HH:MI:SS.FF TZR MM/DD/YYYY HH:MI:SS.FF TZR YYYY-MM-DD HH:MI:SS+/-TZR YYYY-MM-DD HH:MI:SS.FF3 DD.MM.YYYY HH:MI:SS TZR	timestampwithtzformat : <i>string</i> Default value: Database timestamp with timezone format
trimspaces	Specifies how the leading and trailing spaces of the fields are trimmed. See the description of trim_spec.	trimspaces: rtrim ltrim notrim lrtrim ldrtrim Default value: notrim
truncatecol	If the data in the file is too long for a field, then this option will truncate the value of the field rather than reject the row.	truncatecol:true Default value: False
type	Specifies the source file type. See the description of CSV in field_definitions Clause See DBMS_CLOUD Package Format Options for Avro or Parquet for type values avro or parquet.	type: csv csv with embedded csv without embedded csv is the same as csv without embedded. Default value: Null

45.8 DBMS_CLOUD Avro and Parquet Support

This section covers the DBMS_CLOUD Avro and Parquet support provided with Oracle Database.

Topics

- [DBMS_CLOUD Package Format Options for Avro or Parquet](#)
- [DBMS_CLOUD Package Avro to Oracle Data Type Mapping](#)
- [DBMS_CLOUD Package Parquet to Oracle Data Type Mapping](#)

- [DBMS_CLOUD Package Avro and Parquet Complex Types](#)
- [DBMS_CLOUD Package Avro and Parquet to Oracle Column Name Mapping](#)

45.8.1 DBMS_CLOUD Package Format Options for Avro or Parquet

The format argument in DBMS_CLOUD specifies the format of source files.

The two ways to specify the format argument are:

```
format => '{"format_option" : "format_value" }'
```

And:

```
format => json_object('format_option' value 'format_value')
```

Examples:

```
format => json_object('type' VALUE 'CSV')
```

To specify multiple format options, separate the values with a ",".

For example:

```
format => json_object('ignoremissingcolumns' value 'true', 'removequotes' value 'true', 'dateformat' value 'YYYY-MM-DD-HH24-MI-SS', 'blankasnull' value 'true')
```

Format Option	Description	Syntax
type	Specifies the file type.	type : avro parquet
schema	<p>When schema is set to <code>first</code> or <code>all</code>, the external table columns and data types are automatically derived from the Avro or Parquet file metadata.</p> <p>The column names will match those found in Avro or Parquet. The data types are converted from Avro or Parquet data types to Oracle data types. All columns are added to the table.</p> <p>The value <code>first</code> specifies to use the metadata from the first Avro or Parquet file in the <code>file_uri_list</code> to auto generate the columns and their data types. Use <code>first</code> if all of the files have the same schema.</p> <p>The value <code>all</code> specifies to use the metadata from all Avro or Parquet files in the <code>file_uri_list</code> to auto generate the columns and their data types. Use <code>all</code> (slower) if the files may have different schemas.</p> <p>Default: If <code>column_list</code> is specified, then the <code>schema</code> value, if specified is ignored. If <code>column_list</code> is not specified then the <code>schema</code> default value is <code>first</code>.</p> <p>Note: For Avro or Parquet format files the <code>schema</code> format option is not available and the <code>column_list</code> parameter must be specified for partitioned external tables using the <code>DBMS_CLOUD.CREATE_EXTERNAL_PART_TABLE</code> procedure.</p>	schema: first all

45.8.2 DBMS_CLOUD Package Avro to Oracle Data Type Mapping

Describes the mapping of Avro data types to Oracle data types.

Note:

Complex types, such as maps, arrays, and structs are supported starting with Oracle Database 19c. See [DBMS_CLOUD Package Avro and Parquet Complex Types](#) for information on using Avro complex types.

Avro Type	Oracle Type
INT	NUMBER(10)
LONG	NUMBER(19)
BOOL	NUMBER(1)
UTF8 BYTE_ARRAY	RAW(2000)
FLT	BINARY_FLOAT
DBL	BINARY_DOUBLE
DECIMAL(p)	NUMBER(p)
DECIMAL(p,s)	NUMBER(p,s)
DATE	DATE
STRING	VARCHAR2
TIME_MILLIS	VARCHAR2(20 BYTE)
TIME_MICROS	VARCHAR2(20 BYTE)
TIMESTAMP_MILLIS	TIMESTAMP(3)
TIMESTAMP_MICROS	TIMESTAMP(6)
ENUM	VARCHAR2(<i>n</i>) Where: " <i>n</i> " is the actual maximum length of the AVRO ENUM's possible values
DURATION	RAW(2000)
FIXED	RAW(2000)
NULL	VARCHAR2(1) BYTE

See [DBMS_CLOUD Package Avro and Parquet Complex Types](#) for information on using Avro complex types.

45.8.3 DBMS_CLOUD Package Parquet to Oracle Data Type Mapping

Describes the mapping of Parquet data types to Oracle data types.

Note:

Complex types, such as maps, arrays, and structs are supported starting with Oracle Database 19c. See [DBMS_CLOUD Package Avro and Parquet Complex Types](#) for information on using Parquet complex types.

Parquet Type	Oracle Type
UINT_64	NUMBER(20)
INT_64	NUMBER(19)
UINT_32	NUMBER(10)
INT_32	NUMBER(10)
UINT_16	NUMBER(5)
INT_16	NUMBER(5)
UINT_8	NUMBER(3)
INT_8	NUMBER(3)
BOOL	NUMBER(1)
UTF8 BYTE_ARRAY	VARCHAR2(4000 BYTE)
FLT	BINARY_FLOAT
DBL	BINARY_DOUBLE
DECIMAL(p)	NUMBER(p)
DECIMAL(p,s)	NUMBER(p,s)
DATE	DATE
STRING	VARCHAR2(4000)
TIME_MILLIS	VARCHAR2(20 BYTE)
TIME_MILLIS_UTC	VARCHAR2(20 BYTE)
TIME_MICROS	VARCHAR2(20 BYTE)
TIME_MICROS_UTC	VARCHAR2(20 BYTE)
TIMESTAMP_MILLIS	TIMESTAMP(3)
TIMESTAMP_MILLIS_UTC	TIMESTAMP(3)
TIMESTAMP_MICROS	TIMESTAMP(6)
TIMESTAMP_MICROS_UTC	TIMESTAMP(6)
TIMESTAMP_NANOS	TIMESTAMP(9)

See [DBMS_CLOUD Package Avro and Parquet Complex Types](#) for information on using Parquet complex types.

45.8.4 DBMS_CLOUD Package Avro and Parquet Complex Types

Describes the mapping of Avro and Parquet complex data types to Oracle data types.

Oracle Database supports complex data types, including the following complex types:

- struct
- list
- map
- union
- array

When you specify a source file type of Avro or Parquet and the source file includes complex columns, Oracle Database queries return JSON for the complex columns. This simplifies processing of query results; you can use Oracle's powerful JSON parsing features consistently across the file types and data types. The following table shows the format for the complex types in Oracle Database:



Note:

The complex fields map to VARCHAR2 columns and VARCHAR2 size limits apply.

Type	Parquet	Avro	Oracle
List: sequence of values	List	Array	VARCHAR2 (JSON format)
Map: list of objects with single key	Map	Map	VARCHAR2 (JSON format)
Union: values of different type	Not Available	Union	VARCHAR2 (JSON format)
Object: zero or more key-value pairs	Struct	Record	VARCHAR2 (JSON format)

45.8.5 DBMS_CLOUD Package Avro and Parquet to Oracle Column Name Mapping

Describes rules for how Avro and Parquet column names are converted to Oracle column names.

The following are supported for Avro and Parquet column names, but may require use of double quotes for Oracle SQL references in external tables. Thus, for ease of use and to avoid having to use double quotes when referencing column names, if possible do not use the following in Avro and Parquet column names:

- Embedded blanks
- Leading numbers
- Leading underscores
- Oracle SQL reserved words

The following table shows various types of Avro and Parquet column names, and rules for using the column names in Oracle column names in external tables.

Avro or Parquet Name	CREATE TABLE Name	Oracle CATALOG	Valid SQL	Notes
part, Part, or PART	part, Part, PART	PART	select part select Part select paRt select PART	Oracle implicitly uppercases unquoted column names
Ord No	"Ord No"	Ord No	select "Ord No"	Double quotes are required when there are embedded blanks, which also preserves the character case

Avro or Parquet Name	CREATE TABLE Name	Oracle CATALOG	Valid SQL	Notes
__index_key__	"__index_key__"	__index_key__	select "__index_key__" -	Double quotes are required when there is a leading underscore, which also preserves the character case
6Way	"6Way"	6Way	select "6Way"	Double quotes are required when there is a leading numeric digit, which also preserves the character case
create, Create, or CREATE, and so on. (any case variation) partition, Partition, PARTITION, and so on (for an Oracle Reserved word)	"CREATE" "PARTITION"	CREATE PARTITION	select "CREATE" select "PARTITION"	Double quotes are required around Oracle SQL Reserved words. These are forced to uppercase, but must always be double-quoted when used anywhere in SQL
rowid, Rowid, ROWid, and so on (for ROWID see notes)	rowid		select "rowid" select "Rowid" select "ROWid" select "rowid"	For ROWID, any mixed or lower-case variation of ROWID preserves the case and must always be double-quoted and use the original case variations. Due to the inherent conflict with Oracle ROWID for the table, if you specify upper-case ROWID, it is automatically stored as lower-case "rowid" and must always be double-quoted when referenced.

 **Notes:**

- In general a column name in an external table can be referenced without double quotes.
- Unless there is an embedded blank, a leading underscore ("_") or leading numeric digit ("0" through "9") in the column name, the original case of the column name is preserved, and it must always be referenced with double quotes and using the original case (upper, lower or mixed-case) of the Avro or Parquet column name.
- After using `DBMS_CLOUD.CREATE_EXTERNAL_TABLE` to create an external table with the format specified as `avro` or `parquet`, use the `DESCRIBE` command in SQL*Plus to view the table's column names.
- When Oracle SQL Reserved Words are used in Avro or Parquet column names, they must always be double-quoted when referenced anywhere in SQL. See Oracle SQL Reserved Words for more information.

DBMS_COMPARISON

The `DBMS_COMPARISON` package provides interfaces to compare and converge database objects at different databases.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Views](#)
- [Operational Notes](#)
- [Data Structures](#)
- [Summary of DBMS_COMPARISON Subprograms](#)

46.1 DBMS_COMPARISON Overview

The `DBMS_COMPARISON` package is an Oracle-supplied package that you can use to compare database objects at two databases. This package also enables you converge the database objects so that they are consistent at different databases. Typically, this package is used in environments that share a database object at multiple databases. When copies of the same database object exist at multiple databases, the database object is a **shared database object**. Several data dictionary views contain information about comparisons made with the `DBMS_COMPARISON` package.

Shared database objects might be maintained by data replication. For example, materialized views or Oracle Streams components might replicate the database objects and maintain them at multiple databases. A custom application might also maintain shared database objects. When a database object is shared, it can diverge at the databases that share it. You can use this package to identify differences in the shared database objects. After identifying the differences, you can optionally use this package to synchronize the shared database objects.

To compare a database object that is shared at two different databases, complete the following general steps:

1. Run the [CREATE_COMPARISON Procedure](#) in this package to create a **comparison**. The comparison identifies the database objects to compare and specifies parameters for the comparison.
2. Run the [COMPARE Function](#) in this package to compare the database object at the two databases and identify differences. This function returns `TRUE` when no differences are found and `FALSE` when differences are found. This function also populates data dictionary views with comparison results. Separate comparison results are generated for each execution of the `COMPARE` function.
3. If you want to examine the comparison results, query the following data dictionary views:

- DBA_COMPARISON_SCAN
 - USER_COMPARISON_SCAN
 - DBA_COMPARISON_SCAN_VALUES
 - USER_COMPARISON_SCAN_VALUES
 - DBA_COMPARISON_ROW_DIF
 - USER_COMPARISON_ROW_DIF
4. If there are differences, and you want to synchronize the database objects at the two databases, then run the `CONVERGE` procedure in this package.

After you create a comparison with the `CREATE_COMPARISON` procedure in the `DBMS_COMPARISON` package, you can run the comparison at any time using the `COMPARE` function. Each time you run the `COMPARE` function, it records comparison results in the appropriate data dictionary views. Comparison results might be modified when subprograms in this package are invoked and the scans in the comparison results are specified. For example, comparison results might be modified when you run the `RECHECK` function.

The comparison results for a single execution of the `COMPARE` function can include one or more **scans**. A scan checks for differences in some or all of the rows in a shared database object at a single point in time. You can compare database objects multiple times, and a unique scan ID identifies each scan in the comparison results.

A **bucket** is a range of rows in a database object that is being compared. Buckets improve performance by splitting the database object into ranges and comparing the ranges independently. Every comparison divides the rows being compared into an appropriate number of buckets, and each bucket is compared by a scan.

Each time the `COMPARE` function splits a bucket into smaller buckets, it performs new scans of the smaller buckets. The scan that analyzes a larger bucket is the **parent scan** of each scan that analyzes the smaller buckets into which the larger bucket was split. The **root scan** in the comparison results is the highest level parent scan. The root scan does not have a parent.

You can recheck a scan using the `RECHECK` function, and you can converge a scan using the `CONVERGE` procedure. When you want to recheck or converge all of the rows comparison results, specify the root scan ID for the comparison results in the appropriate subprogram. When you want to recheck or converge a portion of the rows in comparison results, specify the scan ID of the scan that contains the differences.

46.2 DBMS_COMPARISON Security Model

Security on this package can be controlled in one of two ways.

- Granting `EXECUTE` on this package to selected users or roles.
- Granting `EXECUTE_CATALOG_ROLE` to selected users or roles.

If subprograms in the package are run from within a stored procedure, then the user who runs the subprograms must be granted `EXECUTE` privilege on the package directly. It cannot be granted through a role.

Each subprogram in the `DBMS_COMPARISON` package has a `comparison_name` parameter. The current user must be the owner of the specified comparison to run a subprogram in the `DBMS_COMPARISON` package.

To run the `COMPARE` function, `RECHECK` function, or `CONVERGE` procedure, the following users must have the `SELECT` or `READ` privilege on each copy of the shared database object:

- The comparison owner at the local database
- When a database link is used, the user at the remote database to which the comparison owner connects through a database link

The `CONVERGE` procedure also requires additional privileges for one of these users at the database where it makes changes to the shared database object. The user must have `INSERT`, `UPDATE`, and `DELETE` privileges on the shared database object at this database.

In addition, when the `CONVERGE` procedure is run with either the `local_converge_tag` or `remote_converge_tag` parameter set to a non-NULL value, then the following additional requirements must be met:

- If the local table "wins," then the user at the remote database to which the invoker of the `CONVERGE` procedure connects through a database link must be granted either `EXECUTE_CATALOG_ROLE` or `EXECUTE` privilege on the `DBMS_STREAMS_ADM` package.
- If the remote table "wins," then the invoker of the `CONVERGE` procedure at the local database must be granted either `EXECUTE_CATALOG_ROLE` or `EXECUTE` privilege on the `DBMS_STREAMS_ADM` package.



Note:

The database administrator (DBA) can assume control over some of the `DBMS_COMPARISON` functions and procedures owned by other users. This control applies to `DROP_COMPARISON` and `PURGE_COMPARISON`. This DBA override can be particularly useful in cleanup operations when comparisons created by another user need to be dropped.

46.3 DBMS_COMPARISON Constants

The `DBMS_COMPARISON` package defines several enumerated constants to use specifying parameter values. Enumerated constants must be prefixed with the package name. For example, `DBMS_COMPARISON.CMP_SCAN_MODE_FULL`.

Table 46-1 lists the parameters and enumerated constants.

Table 46-1 DBMS_COMPARISON Parameters with Enumerated Constants

Parameter	Option	Type	Description
<code>comparison_mode</code>	<ul style="list-style-type: none"> • <code>CMP_COMPARE_MODE_OBJECT</code> 	<code>VARCHAR2(30)</code>	<code>CMP_COMPARE_MODE_OBJECT</code> is a database object. This constant can be specified as <code>'OBJECT'</code> .

Table 46-1 (Cont.) DBMS_COMPARISON Parameters with Enumerated Constants

Parameter	Option	Type	Description
scan_mode	<ul style="list-style-type: none"> CMP_SCAN_MODE_FULL CMP_SCAN_MODE_RANDOM CMP_SCAN_MODE_CYCLIC CMP_SCAN_MODE_CUSTOM 	VARCHAR2 (30)	<p>CMP_SCAN_MODE_FULL indicates that the entire database object is compared. This constant can be specified as 'FULL'.</p> <p>CMP_SCAN_MODE_RANDOM indicates that a random portion of the database object is compared. This constant can be specified as 'RANDOM'.</p> <p>CMP_SCAN_MODE_CYCLIC indicates that a portion of the database object is compared when you perform a single comparison. When you compare the database object again, another portion of the database object is compared, starting where the last comparison ended. This constant can be specified as 'CYCLIC'.</p> <p>CMP_SCAN_MODE_CUSTOM indicates that the user who runs the subprogram specifies the range to compare in the database object. This constant can be specified as 'CUSTOM'.</p>
converge_options	<ul style="list-style-type: none"> CMP_CONVERGE_LOCAL_WINS CMP_CONVERGE_REMOTE_WINS 	VARCHAR2 (30)	<p>CMP_CONVERGE_LOCAL_WINS indicates that the column values at the local database replace the column values at the remote database when these column values are different. This constant can be specified as 'LOCAL'.</p> <p>CMP_CONVERGE_REMOTE_WINS indicates that the column values at the remote database replace the column values at the local database when these column values are different. This constant can be specified as 'REMOTE'.</p>
null_value	<ul style="list-style-type: none"> CMP_NULL_VALUE_DEF 	VARCHAR2 (100)	<p>CMP_NULL_VALUE_DEF indicates that ORA\$STREAMS\$NV is substituted for NULL values in database objects during comparison. This constant can be specified as 'ORA\$STREAMS\$NV'.</p>
max_num_buckets	<ul style="list-style-type: none"> CMP_MAX_NUM_BUCKETS 	INTEGER	<p>CMP_MAX_NUM_BUCKETS indicates that the maximum number of buckets is 1,000. This constant can be specified as 1000.</p>

Table 46-1 (Cont.) DBMS_COMPARISON Parameters with Enumerated Constants

Parameter	Option	Type	Description
min_rows_in_bucket	<ul style="list-style-type: none"> CMP_MIN_ROWS_IN_BUCKET 	INTEGER	CMP_MIN_ROWS_IN_BUCKET indicates that the minimum number of rows in a bucket is 10,000. This constant can be specified as 10000.

46.4 DBMS_COMPARISON Views

The DBMS_COMPARISON package uses several views.

These views are listed below:

- DBA_COMPARISON
- USER_COMPARISON
- DBA_COMPARISON_COLUMNS
- USER_COMPARISON_COLUMNS
- DBA_COMPARISON_SCAN
- USER_COMPARISON_SCAN
- DBA_COMPARISON_SCAN_VALUES
- USER_COMPARISON_SCAN_VALUES
- DBA_COMPARISON_ROW_DIF
- USER_COMPARISON_ROW_DIF

See Also:

Oracle Database Reference

46.5 DBMS_COMPARISON Operational Notes

The DBMS_COMPARISON package has certain requirements and operational notes.

These include the following:

- Oracle Database Release Requirements for the DBMS_COMPARISON Package
- Database Character Set Requirements for the DBMS_COMPARISON Package
- Database Object Requirements for the DBMS_COMPARISON Package
- Index Column Requirements for the DBMS_COMPARISON Package
- Datatype Requirements for the DBMS_COMPARISON Package
- Only Converge Rows That Are Not Being Updated

Oracle Database Release Requirements for the DBMS_COMPARISON Package

Meet the following Oracle Database release requirements when running the subprograms in the `DBMS_COMPARISON` package:

- The local database that runs the subprograms in the `DBMS_COMPARISON` package must be an Oracle Database 11g Release 1 (11.1) database.
- The remote database must be an Oracle Database 10g Release 1 (10.1) or later database. Oracle databases before this release and non-Oracle databases are not supported.

Database Character Set Requirements for the DBMS_COMPARISON Package

The database character sets must be the same for the databases that contain the database objects being compared.

See Also:

Oracle Database Globalization Support Guide for information about database character sets

Database Object Requirements for the DBMS_COMPARISON Package

The `DBMS_COMPARISON` package can compare the following types of database objects:

- Tables
- Single-table views
- Materialized views
- Synonyms for tables, single-table views, and materialized views

Database objects of different types can be compared and converged at different databases. For example, a table at one database and a materialized view at another database can be compared and converged with this package.

To run the subprograms in the `DBMS_COMPARISON` package, the specified database objects must have the same shape at each database. Specifically, the database objects must have the same number of columns at each database, and the datatypes of corresponding columns must match.

If a database object being compared contains columns that do not exist in the other database object, then you can compare the database objects by excluding the extra columns during comparison creation. Use the `column_list` parameter in the `CREATE_COMPARISON` procedure to list only the columns that exist in both database objects.

See Also:

[CREATE_COMPARISON Procedure](#)

Index Column Requirements for the DBMS_COMPARISON Package

This section discusses number, timestamp, and interval columns. These include the following datatypes:

- Number columns are of the following datatypes: NUMBER, FLOAT, BINARY_FLOAT, and BINARY_DOUBLE.
- Timestamp columns are of the following datatypes: TIMESTAMP, TIMESTAMP WITH TIME ZONE, and TIMESTAMP WITH LOCAL TIME ZONE
- Interval columns are of the following datatypes: INTERVAL YEAR TO MONTH and INTERVAL DAY TO SECOND.

For all scan modes to be supported by the DBMS_COMPARISON package, the database objects must have one of the following types of indexes:

- A single-column index on a number, timestamp, interval, or DATE datatype column
- A composite index that only includes number, timestamp, interval, or DATE datatype columns. Each column in the composite index must either have a NOT NULL constraint or be part of the primary key.

For the scan modes CMP_SCAN_MODE_FULL and CMP_SCAN_MODE_CUSTOM to be supported, the database objects must have one of the following types of indexes:

- A single-column index on a number, timestamp, interval, DATE, VARCHAR2, or CHAR datatype column
- A composite index that only includes number, timestamp, interval, DATE, VARCHAR2, or CHAR columns. Each column in the composite index must either have a NOT NULL constraint or be part of the primary key.

If the database objects do not have one of these types of indexes, then the DBMS_COMPARISON package does not support the database objects. For example, if the database objects only have a single index on an NVARCHAR2 column, then the DBMS_COMPARISON package does not support them. Or, if the database objects have only one index, and it is a composite index that includes a NUMBER column and an NCHAR column, then the DBMS_COMPARISON package does not support them.

You can specify an index when you create a comparison using the `index_schema_name` and `index_name` parameters in the `CREATE_COMPARISON` procedure. If you specify an index, then make sure the columns in the index meet the requirements of the scan mode used for the comparison.

The index columns in a comparison must uniquely identify every row involved in a comparison. The following constraints satisfy this requirement:

- A primary key constraint
- A unique constraint on one or more non-NULL columns

If these constraints are not present on a table, then use the `index_schema_name` and `index_name` parameters in the `CREATE_COMPARISON` procedure to specify an index whose columns satisfy this requirement.

When a single index value identifies both a local row and a remote row, the two rows must be copies of the same row in the replicated tables. In addition, each pair of copies of the same row must always have the same index value.

The `DBMS_COMPARISON` package can use an index only if all of the columns in the index are included in the `column_list` parameter when the comparison is created with the `CREATE_COMPARISON` procedure.

After a comparison is created, you can determine the index column or columns for it by running the following query:

```
SELECT COLUMN_NAME, COLUMN_POSITION FROM DBA_COMPARISON_COLUMNS
WHERE COMPARISON_NAME = 'COMPARE_CUSTOM' AND
      INDEX_COLUMN     = 'Y';
```

If there are multiple index columns, then the index column with 1 for the `COLUMN_POSITION` is the lead index column in the composite index.

See Also:

- ["Constants"](#) for information about scan modes
- [CREATE_COMPARISON Procedure](#) for information about specifying an index for a comparison

Datatype Requirements for the DBMS_COMPARISON Package

The `DBMS_COMPARISON` package can compare data in columns of the following datatypes:

- VARCHAR2
- NVARCHAR2
- NUMBER
- FLOAT
- DATE
- BINARY_FLOAT
- BINARY_DOUBLE
- TIMESTAMP
- TIMESTAMP WITH TIME ZONE
- TIMESTAMP WITH LOCAL TIME ZONE
- INTERVAL YEAR TO MONTH
- INTERVAL DAY TO SECOND
- RAW
- CHAR
- NCHAR

If a column with datatype `TIMESTAMP WITH LOCAL TIME ZONE` is compared, then the two databases must use the same time zone. Also, if a column with datatype `NVARCHAR2` or `NCHAR` is compared, then the two databases must use the same national character set.

The `DBMS_COMPARISON` package cannot compare data in columns of the following datatypes:

- LONG
- LONG RAW
- ROWID
- UROWID
- CLOB
- NCLOB
- BLOB
- BFILE
- User-defined types (including object types, `REFS`, `varrays`, and nested tables)
- Oracle-supplied types (including any types, XML types, spatial types, and media types)

You can compare database objects that contain unsupported columns by excluding the unsupported columns during comparison creation. Use the `column_list` parameter in the `CREATE_COMPARISON` procedure to list only the supported columns in a shared database object.

See Also:

- [CREATE_COMPARISON Procedure](#)
- *Oracle Database SQL Language Reference* for more information about datatypes
- *Oracle Database Globalization Support Guide* for information about national character sets

Only Converge Rows That Are Not Being Updated

You should only converge rows that are not being updated on either database. For example, if the shared database object is updated by replication components, then only converge rows for which replication changes have been applied and make sure no new changes are in the process of being replicated for these rows. If you compare replicated database objects, then it is typically best to compare them during a time of little or no replication activity to identify persistent differences.

Note:

If a scan identifies that a row is different in the shared database object at two databases, and the row is modified after the scan, then it can result in unexpected data in the row after the `CONVERGE` procedure is run.

46.6 DBMS_COMPARISON Data Structures

The `DBMS_COMPARISON` package defines a `RECORD` type.

Contains information returned by the `COMPARE` function or `CONVERGE` procedure in the `DBMS_COMPARISON` package.



Note:

The `COMPARE` function only returns a value for the `scan_id` field.

46.6.1 COMPARISON_TYPE Record Type

This record type contains information returned by the `COMPARE` function or `CONVERGE` procedure in the `DBMS_COMPARISON` package.



Note:

The `COMPARE` function only returns a value for the `scan_id` field.

Syntax

```
TYPE COMPARISON_TYPE IS RECORD (
  scan_id          NUMBER,
  loc_rows_merged NUMBER,
  rmt_rows_merged NUMBER,
  loc_rows_deleted NUMBER,
  rmt_rows_deleted NUMBER);
```

Table 46-2 COMPARISON_TYPE Attributes

Field	Description
<code>scan_id</code>	The scan ID of the scan
<code>loc_rows_merged</code>	The number of rows in the local database object updated with information from the database object at the remote site
<code>rmt_rows_merged</code>	The number of rows in the database object updated at the remote site with information from the database object at the local site
<code>loc_rows_deleted</code>	The number of rows deleted from the local database object
<code>rmt_rows_deleted</code>	The number of rows deleted from the remote database object

46.7 Summary of DBMS_COMPARISON Subprograms

This table lists the `DBMS_COMPARISON` subprograms and briefly describes them.

Table 46-3 DBMS_COMPARISON Package Subprograms

Subprogram	Description
COMPARE Function	Performs the specified comparison
CONVERGE Procedure	Executes data manipulation language (DML) changes to synchronize the portion of the database object that was compared in the specified scan
CREATE_COMPARISON Procedure	Creates a comparison
DROP_COMPARISON Procedure	Drops a comparison
PURGE_COMPARISON Procedure	Purges the comparison results, or a subset of the comparison results, for a comparison
RECHECK Function	Rechecks the differences in a specified scan for a comparison

46.7.1 COMPARE Function

This function performs the specified comparison.

Each time a comparison is performed, it results in at least one new scan, and each scan has a unique scan ID. You can define and name a comparison using the `CREATE_COMPARISON` procedure.



See Also:

- ["Overview"](#)
- [CREATE_COMPARISON Procedure](#)

Syntax

```
DBMS_COMPARISON.COMPARE (
    comparison_name IN VARCHAR2,
    scan_info       OUT COMPARISON_TYPE,
    min_value       IN VARCHAR2   DEFAULT NULL,
    max_value       IN VARCHAR2   DEFAULT NULL,
    perform_row_dif IN BOOLEAN    DEFAULT FALSE)
RETURN BOOLEAN;
```

Parameters

Table 46-4 COMPARE Function Parameters

Parameter	Description
<code>comparison_name</code>	The name of the comparison.
<code>scan_info</code>	Information about the compare operation returned in the <code>COMPARISON_TYPE</code> datatype. See COMPARISON_TYPE Record Type .

Table 46-4 (Cont.) COMPARE Function Parameters

Parameter	Description
<code>min_value</code>	<p>When the scan mode for the comparison is set to <code>CMP_SCAN_MODE_CUSTOM</code>, specify the minimum index column value for the range of rows that are being compared. To determine the index column for a comparison, query the <code>DBA_COMPARISON_COLUMNS</code> data dictionary view. For a composite index, specify a value for the column with <code>column_position</code> equal to 1 in the <code>DBA_COMPARISON_COLUMNS</code> view. See the index column requirements under DBMS_COMPARISON Operational Notes.</p> <p>If the scan mode is set to a value other than <code>CMP_SCAN_MODE_CUSTOM</code>, then this parameter must be set to <code>NULL</code>.</p> <p>If <code>NULL</code> and the <code>scan_mode</code> parameter is set to <code>CMP_SCAN_MODE_CUSTOM</code>, then an error is raised.</p> <p>To determine the scan mode for the comparison, query the <code>DBA_COMPARISON</code> data dictionary view.</p> <p>See DBMS_COMPARISON Constants for information about scan modes.</p>
<code>max_value</code>	<p>When the scan mode for the comparison is set to <code>CMP_SCAN_MODE_CUSTOM</code>, specify the maximum index column value for the range of rows that are being compared. To determine the index column for a comparison, query the <code>DBA_COMPARISON_COLUMNS</code> data dictionary view. For a composite index, specify a value for the column with <code>column_position</code> equal to 1 in the <code>DBA_COMPARISON_COLUMNS</code> view. See the index column requirements under DBMS_COMPARISON Operational Notes.</p> <p>If the scan mode is set to a value other than <code>CMP_SCAN_MODE_CUSTOM</code>, then this parameter must be set to <code>NULL</code>.</p> <p>If <code>NULL</code> and the <code>scan_mode</code> parameter is set to <code>CMP_SCAN_MODE_CUSTOM</code>, then an error is raised.</p> <p>To determine the scan mode for the comparison, query the <code>DBA_COMPARISON</code> data dictionary view.</p> <p>See DBMS_COMPARISON Constants for information about scan modes.</p>
<code>perform_row_dif</code>	<p>If <code>TRUE</code>, then compares each row individually in the database object being compared after reaching the smallest possible bucket for the comparison.</p> <p>If <code>FALSE</code>, then compares buckets for differences but does not compare each row individually when differences are found in the smallest possible bucket.</p> <p>See DBMS_COMPARISON Overview for information about buckets.</p>

Return Values

This function returns `TRUE` when no differences are found in the database objects being compared. This function returns `FALSE` when differences are found in the database objects being compared.

46.7.2 CONVERGE Procedure

This procedure executes data manipulation language (DML) changes to synchronize the portion of the database objects that was compared in the specified scan.

Syntax

```
DBMS_COMPARISON.CONVERGE (
    comparison_name    IN    VARCHAR2,
```

```

scan_id          IN  NUMBER,
scan_info        OUT COMPARISON_TYPE,
converge_options IN  VARCHAR2  DEFAULT CMP_CONVERGE_LOCAL_WINS,
perform_commit  IN  BOOLEAN    DEFAULT TRUE,
local_converge_tag IN  RAW      DEFAULT NULL,
remote_converge_tag IN  RAW      DEFAULT NULL);

```

Parameters

Table 46-5 CONVERGE Procedure Parameters

Parameter	Description
comparison_name	The name of the comparison.
scan_id	The identifier for the scan that contains the differences between the database objects being converged. See " Overview " for more information about specifying a scan ID in this parameter.
scan_info	Information about the converge operation returned in the COMPARISON_TYPE datatype. See COMPARISON_TYPE Record Type .
converge_options	Either the CMP_CONVERGE_LOCAL_WINS constant or the CMP_CONVERGE_REMOTE_WINS constant. See " Constants " for information about these constants.
perform_commit	If TRUE, then performs a COMMIT periodically while making the DML changes. The CONVERGE procedure might perform more than one COMMIT when this parameter is set to TRUE. If FALSE, then does not perform a COMMIT after making DML changes.
local_converge_tag	The Replication tag to set in the session on the local database before performing any changes to converge the data in the database objects being converged. If non-NULL, then this parameter setting takes precedence over the local_converge_tag parameter in the CREATE_COMPARISON procedure that created the comparison. If NULL, then this parameter is ignored, and the local_converge_tag parameter in the CREATE_COMPARISON procedure that created the comparison is used.
remote_converge_tag	The Replication tag to set in the session on the remote database before performing any changes to converge the data in the database objects being converged. If non-NULL, then this parameter setting takes precedence over the remote_converge_tag parameter in the CREATE_COMPARISON procedure that created the comparison. If NULL, then this parameter is ignored, and the remote_converge_tag parameter in the CREATE_COMPARISON procedure that created the comparison is used.

Usage Notes

If one of the database objects being converged is a read-only materialized view, then the converge_options parameter must be set to ensure that the read-only materialized view "wins" in the converge operation. The CONVERGE procedure raises an error if it tries to make changes to a read-only materialized view.

46.7.3 CREATE_COMPARISON Procedure

This procedure creates a comparison.

Syntax

```
DBMS_COMPARISON.CREATE_COMPARISON(
  comparison_name      IN  VARCHAR2,
  schema_name         IN  VARCHAR2,
  object_name         IN  VARCHAR2,
  dblink_name         IN  VARCHAR2,
  index_schema_name   IN  VARCHAR2  DEFAULT NULL,
  index_name          IN  VARCHAR2  DEFAULT NULL,
  remote_schema_name  IN  VARCHAR2  DEFAULT NULL,
  remote_object_name  IN  VARCHAR2  DEFAULT NULL,
  comparison_mode     IN  VARCHAR2  DEFAULT CMP_COMPARE_MODE_OBJECT,
  column_list         IN  VARCHAR2  DEFAULT '*',
  scan_mode           IN  VARCHAR2  DEFAULT CMP_SCAN_MODE_FULL,
  scan_percent        IN  NUMBER     DEFAULT NULL,
  null_value          IN  VARCHAR2  DEFAULT CMP_NULL_VALUE_DEF,
  local_converge_tag  IN  RAW         DEFAULT NULL,
  remote_converge_tag IN  RAW         DEFAULT NULL,
  max_num_buckets     IN  NUMBER     DEFAULT CMP_MAX_NUM_BUCKETS,
  min_rows_in_bucket  IN  NUMBER     DEFAULT CMP_MIN_ROWS_IN_BUCKET);
```

Parameters

Table 46-6 CREATE_COMPARISON Procedure Parameters

Parameter	Description
comparison_name	The name of the comparison.
schema_name	The name of the schema that contains the local database object to compare.
object_name	The name of the local database object to compare.
dblink_name	Database link to the remote database. The specified database object in the remote database is compared with the database object in the local database. If NULL, then the comparison is configured to compare two database objects in the local database. In this case, parameters that specify the remote database object apply to the second database object in the comparison and to operations on the second database object. For example, specify the second database object in this procedure by using the <code>remote_schema_name</code> and <code>remote_object_name</code> parameters.
index_schema_name	The name of the schema that contains the index. If NULL, then the schema specified in the <code>schema_name</code> parameter is used.

Table 46-6 (Cont.) CREATE_COMPARISON Procedure Parameters

Parameter	Description
index_name	<p>The name of the index.</p> <p>If NULL, then the system determines the index columns for the comparison automatically.</p> <p>If the index_schema_name parameter is non-NULL, then the index_name parameter must also be non-NULL. Otherwise, an error is raised.</p> <p>See Also: "Usage Notes" for more information about specifying an index</p>
remote_schema_name	<p>The name of the schema that contains the database object at the remote database. Specify a non-NULL value if the schema names are different at the two databases.</p> <p>If NULL, then the schema specified in the schema_name parameter is used.</p>
remote_object_name	<p>The name of the database object at the remote database. Specify a non-NULL value if the database object names are different at the two databases.</p> <p>If NULL, then the database object specified in the object_name parameter is used.</p>
comparison_mode	<p>Specify the default value CMP_COMPARE_MODE_OBJECT. Additional modes might be added in future releases.</p>
column_list	<p>Specify '*' to include all of the columns in the database objects being compared.</p> <p>To compare a subset of columns in the database objects, specify a comma-delimited list of the columns to check. Any columns that are not in the list are ignored during a comparison and convergence.</p> <p>See "Usage Notes" for information about columns that are required in the column_list parameter.</p>
scan_mode	<p>Either CMP_SCAN_MODE_FULL, CMP_SCAN_MODE_RANDOM, CMP_SCAN_MODE_CYCLIC, or CMP_SCAN_MODE_CUSTOM.</p> <p>If you specify CMP_SCAN_MODE_CUSTOM, then make sure you specify an index using the index_schema_name and index_name parameters. Specifying an index ensures that you can specify the correct min_value and max_value for the lead index column when you run the COMPARE or RECHECK function.</p> <p>See "Constants" for information about these constants.</p>

Table 46-6 (Cont.) CREATE_COMPARISON Procedure Parameters

Parameter	Description
scan_percent	<p>The percentage of the database object to scan for comparison when the scan_mode parameter is set to either CMP_SCAN_MODE_RANDOM or CMP_SCAN_MODE_CYCLIC. For these scan_mode settings, a non-NULL value that is greater than 0 (zero) and less than 100 is required.</p> <p>If NULL and the scan_mode parameter is set to CMP_SCAN_MODE_FULL, then the entire database object is scanned for comparison.</p> <p>If NULL and the scan_mode parameter is set to CMP_SCAN_MODE_CUSTOM, then the portion of the database object scanned for comparison is specified when the COMPARE function is run.</p> <p>If non-NULL and the scan_mode parameter is set to either CMP_SCAN_MODE_FULL or CMP_SCAN_MODE_CUSTOM, then the scan_percent parameter is ignored.</p> <p>Note: When the scan_percent parameter is non-NULL, and the lead index column for the comparison does not distribute the rows in the database object evenly, the portion of the database object that is compared might be smaller or larger than the specified scan_percent value. See DBMS_COMPARISON Operational Notes for more information about the DBMS_COMPARISON package index requirements for the lead index column.</p>
null_value	<p>The value to substitute for each NULL in the database objects being compared. Specify a value or use the CMP_NULL_VALUE_DEF constant.</p> <p>If a column being compared can contain NULLs, then the value specified for this parameter must be different than any non-NULL value in the column. Otherwise, if the value specified for this parameter can appear in the column, some row differences might not be found.</p> <p>See "Constants" for information about this constant.</p>
local_converge_tag	<p>The Oracle Replication tag to set in the session on the local database before performing any changes to converge the data in the database objects being compared.</p> <p>If the local_converge_tag parameter is non-NULL in the CONVERGE procedure when comparison results for this comparison are converged, then the setting in the CONVERGE procedure takes precedence. See CONVERGE Procedure for more information.</p>
remote_converge_tag	<p>The Oracle Replication tag to set in the session on the remote database before performing any changes to converge the data in the database objects being compared.</p> <p>If the remote_converge_tag parameter is non-NULL in the CONVERGE procedure when comparison results for this comparison are converged, then the setting in the CONVERGE procedure takes precedence. See CONVERGE Procedure for more information.</p>

Table 46-6 (Cont.) CREATE_COMPARISON Procedure Parameters

Parameter	Description
<code>max_num_buckets</code>	Specify the maximum number of buckets to use. Specify a value or use the <code>CMP_MAX_NUM_BUCKETS</code> constant. See "Constants" for information about this constant. See "Overview" for information about buckets. Note: If an index column for a comparison is a <code>VARCHAR2</code> or <code>CHAR</code> column, then the number of buckets might exceed the value specified for the <code>max_num_buckets</code> parameter.
<code>min_rows_in_bucket</code>	Specify the minimum number of rows in each bucket. Specify a value or use the <code>CMP_MIN_ROWS_IN_BUCKET</code> constant. See "Constants" for information about this constant. See "Overview" for information about buckets.

Usage Notes

This section contains usage notes for the `CREATE_COMPARISON` procedure.

Usage Notes for the `index_schema_name` and `index_name` Parameters

When you specify an index for a comparison with the `index_schema_name` and `index_name` parameters, the specified index determines the comparison's index columns and their ordering. The order of the columns in the index determines the index column ordering for the comparison. Therefore, the column in column position 1 in the index is the lead column for the comparison.

The index columns and their ordering affect the details of each SQL statement generated and executed for a comparison. For each SQL statement, the optimizer decides whether to use indexes. If the optimizer decides to use indexes, then the optimizer decides which particular indexes to use. An index specified in `column_list` parameter might or might not be used.

The columns in the specified index must meet the requirements described in [DBMS_COMPARISON Operational Notes](#). If the index columns do not meet these requirements, then an error is raised.

Note:

If you do not specify an index when you create a comparison, then the `CREATE_COMPARISON` procedure selects either the primary key, if it exists, or an existing unique index. The procedure never selects a non-unique index. However, if you specify an index, then the `CREATE_COMPARISON` procedure does not check its uniqueness. Therefore, if you specify a non-unique index, and duplicate index keys exist, then the results might be incorrect when the `CONVERGE` procedure synchronizes data.

Usage Notes for the `column_list` Parameter

When the `column_list` parameter is set to a value other than `'*'`, the following columns are required in the `column_list` parameter:

- Any columns that are required to meet the index column requirements for the DBMS_COMPARISON package. If the `index_name` parameter is non-NULL, then the columns in the specified index must be in the column list. If the `index_name` parameter is NULL, then see [DBMS_COMPARISON Operational Notes](#) for information about the DBMS_COMPARISON index requirements.
- If you plan to use the `CONVERGE` procedure to make changes to a database object based on the comparison, then any columns in this database object that have a NOT NULL constraint but no default value must be included in the column list. If these columns are not included, then the `CONVERGE` procedure returns an error. See [CONVERGE Procedure](#).

46.7.4 DROP_COMPARISON Procedure

This procedure drops a comparison.

Syntax

```
DBMS_COMPARISON.DROP_COMPARISON(
    comparison_name IN VARCHAR2);
```

Parameters

Table 46-7 DROP_COMPARISON Procedure Parameters

Parameter	Description
<code>comparison_name</code>	The name of the comparison.

46.7.5 PURGE_COMPARISON Procedure

This procedure purges the comparison results, or a subset of the comparison results, for a comparison.

Note:

At least one of the following parameters must be set to NULL: `scan_id` or `purge_time`. If both the `scan_id` and `purge_time` parameters are NULL, then this procedure purges all comparison results for the comparison.

Syntax

```
DBMS_COMPARISON.PURGE_COMPARISON(
    comparison_name IN VARCHAR2,
    scan_id         IN NUMBER   DEFAULT NULL,
    purge_time      IN TIMESTAMP DEFAULT NULL);
```

Parameters

Table 46-8 PURGE_COMPARISON Procedure Parameters

Parameter	Description
<code>comparison_name</code>	The name of the comparison.
<code>scan_id</code>	The scan ID of the scan for which results are purged. The scan ID must identify a root scan. If the scan ID does not identify a root scan, then an error is raised. When a root scan ID is specified, it is purged, and all direct and indirect child scans of the specified root scan are purged. If <code>NULL</code> , then no scan ID is considered when purging comparison results for the comparison. See " Overview " for information about scans.
<code>purge_time</code>	The date before which results are purged. If <code>NULL</code> , then no date is considered when purging comparison results for the comparison.

46.7.6 RECHECK Function

This function rechecks the differences in a specified scan for a comparison.

This function performs one of the following actions:

- If the specified scan completed successfully the last time it ran, then this function checks the previously identified differences in the scan.
- If the specified scan completed partially, then this function continues to check the database object from the point where the previous scan ended.

Note:

This function does not compare the shared database object for differences that were not recorded in the specified comparison scan. To check for those differences, run the `COMPARE` function.

See Also:

[COMPARE Function](#)

Syntax

```
DBMS_COMPARISON.RECHECK(
  comparison_name IN VARCHAR2,
  scan_id         IN NUMBER,
  perform_row_dif IN BOOLEAN DEFAULT FALSE)
RETURN BOOLEAN;
```

Parameters

Table 46-9 RECHECK Function Parameters

Parameter	Description
<code>comparison_name</code>	The name of the comparison.
<code>scan_id</code>	The scan ID of the scan to recheck. See " Overview " for more information about specifying a scan ID in this parameter.
<code>perform_row_dif</code>	If <code>TRUE</code> , then compares each row individually in the database objects being compared after reaching the smallest possible bucket for the comparison. If <code>FALSE</code> , then compares buckets for differences but does not compare each row individually when differences are found in the smallest possible bucket. See " Overview " for information about buckets.

Return Values

This function returns `TRUE` when no differences are found in the database objects being compared. This function returns `FALSE` when differences are found in the database objects being compared.

DBMS_COMPRESSION

The `DBMS_COMPRESSION` package provides an interface to facilitate choosing the correct compression level for an application.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Data Structures](#)
- [Summary of DBMS_COMPRESSION Subprograms](#)



See Also:

- *Oracle Database Administrator's Guide*
- *Oracle Database Concepts*
- *Oracle Database SQL Language Reference*
- *Oracle Database Data Warehousing Guide*
- *Oracle Database VLDB and Partitioning Guide*
- *Oracle Database Reference*

47.1 DBMS_COMPRESSION Overview

The `DBMS_COMPRESSION` package gathers compression-related information within a database environment. This includes tools for estimating compressibility of a table for both partitioned and non-partitioned tables, and gathering row-level compression information on previously compressed tables. This gives the user with adequate information to make compression-related decision.

47.2 DBMS_COMPRESSION Security Model

The `DBMS_COMPRESSION` package is defined with `AUTHID CURRENT USER`, so it executes with the privileges of the current user.

47.3 DBMS_COMPRESSION Constants

The `DBMS_COMPRESSION` package uses constants that can be used for specifying parameter values.

These constants are shown in the following table:

Table 47-1 DBMS_COMPRESSION Constants - Compression Types

Constant	Type	Value	Description
COMP_NOCOMPRESS	NUMBER	1	No compression
COMP_ADVANCED	NUMBER	2	Advanced row compression
COMP_QUERY_HIGH	NUMBER	4	High for query warehouse compression (Hybrid Columnar Compression)
COMP_QUERY_LOW	NUMBER	8	Low for query warehouse compression (Hybrid Columnar Compression)
COMP_ARCHIVE_HIGH	NUMBER	16	High archive compression (Hybrid Columnar Compression)
COMP_ARCHIVE_LOW	NUMBER	32	Low archive compression (Hybrid Columnar Compression)
COMP_BLOCK	NUMBER	64	Compressed block
COMP_LOB_HIGH	NUMBER	128	High compression level for LOB operations
COMP_LOB_MEDIUM	NUMBER	256	Medium compression level for LOB operations
COMP_LOB_LOW	NUMBER	512	Low compression level for LOB operations
COMP_INDEX_ADVANCED_H IGH	NUMBER	1024	High compression level for indexes
COMP_INDEX_ADVANCED_L OW	NUMBER	2048	Low compression level for indexes
COMP_RATIO_LOB_MINROW S	NUMBER	1000	Minimum required number of LOBs in the object for which LOB compression ratio is to be estimated
COMP_BASIC	NUMBER	4096	Basic table compression
COMP_RATIO_LOB_MAXROW S	NUMBER	5000	Maximum number of LOBs used to compute the LOB compression ratio
COMP_INMEMORY_NOCOMPR ESS	NUMBER	8192	In-Memory with no compression
COMP_INMEMORY_DML	NUMBER	16384	In-Memory compression level for DML

Table 47-1 (Cont.) DBMS_COMPRESSION Constants - Compression Types

Constant	Type	Value	Description
COMP_INMEMORY_QUERY_LOW	NUMBER	32768	In-Memory compression level optimized for query performance
COMP_INMEMORY_QUERY_HIGH	NUMBER	65536	In-Memory compression level optimized on query performance as well as space saving
COMP_INMEMORY_CAPACITY_LOW	NUMBER	131072	In-Memory low compression level optimizing for capacity
COMP_INMEMORY_CAPACITY_HIGH	NUMBER	262144	In-Memory high compression level optimizing for capacity
COMP_RATIO_MINROWS	NUMBER	1000000	Minimum required number of rows in the object for which HCC ratio is to be estimated
COMP_RATIO_ALLROWS	NUMBER	-1	To indicate the use of all the rows in the object to estimate HCC ratio
OBJTYPE_TABLE	PLS_INTEGER	1	Identifies the object whose compression ratio is estimated as of type table
OBJTYPE_INDEX	PLS_INTEGER	2	Identifies the object whose compression ratio is estimated as of type index

**Note:**

Hybrid columnar compression is a feature of certain Oracle storage systems. See *Oracle Database Concepts* for more information.

47.4 DBMS_COMPRESSION Data Structures

The `DBMS_COMPRESSION` package defines a `RECORD` type and a `TABLE` type.

RECORD TYPES

[COMPREC Record Type](#)

TABLE TYPES

[COMPRECLIST Table Type](#)

47.4.1 COMPREC Record Type

The COMPREC record type is a record for calculating an individual index compression ratio on a table.

Syntax

```
TYPE COMPREC IS RECORD(
  ownname          varchar2(255),
  objname          varchar2(255),
  blkcnt_cmp       PLS_INTEGER,
  blkcnt_uncmp     PLS_INTEGER,
  row_cmp          PLS_INTEGER,
  row_uncmp        PLS_INTEGER,
  cmp_ratio        NUMBER,
  objtype          PLS_INTEGER);
```

Fields

Table 47-2 COMPREC Attributes

Field	Description
ownname	Schema of the object owner
objname	Name of the object
blkcnt_cmp	Number of blocks used by the compressed sample of the object
blkcnt_uncmp	Number of blocks used by the uncompressed sample of the object
row_cmp	Number of rows in a block in compressed sample of the object
row_uncmp	Number of rows in a block in uncompressed sample of the object
cmp_ratio	Compression ratio, blkcnt_uncmp divided by blkcnt_cmp
objtype	Type of the object

47.4.2 COMPRECLIST Table Type

COMPRECLIST is a table type of the COMPREC Record Type.

Syntax

```
TYPE compreclist IS TABLE OF comprec;
```

Related Topics

- [COMPREC Record Type](#)
The COMPREC record type is a record for calculating an individual index compression ratio on a table.

47.5 Summary of DBMS_COMPRESSION Subprograms

The DBMS_COMPRESSION package uses the GET_COMPRESSION_RATIO Procedure and GET_COMPRESSION_TYPE Function subprograms.

Table 47-3 DBMS_COMPRESSION Package Subprograms

Subprogram	Description
GET_COMPRESSION_RATIO Procedure	Analyzes the compression ratio of a table, and gives information about compressibility of a table
GET_COMPRESSION_TYPE Function	Returns the compression type for a specified row

47.5.1 GET_COMPRESSION_RATIO Procedure

Use this procedure to estimate the storage space that you can save by enabling the compression feature for an existing SecureFile LOB. It analyzes the compression ratio of a table or an index and gives information about compressibility of the object. You can provide various parameters to selectively analyze different compression types.

In Oracle Database 23ai, this procedure has been enhanced to estimate the compression ratio faster for LOBs while using less space. Now you can also estimate the compression ratio for BasicFile LOBs. This helps you decide upfront whether you want to compress BasicFile LOBs, before migrating BasicFile LOBs to SecureFile LOBs. You can also estimate the compression ratio at the LOB byte level and the time taken, in hours, to compress the LOB data in the table.

The compression ratio is estimated for the number of rows in the LOB column that you specify. For example, let's consider that the compression ratio is 2.33. It indicates that after you enable the compression feature, you can save around half of the space for the sampled rows in the LOB column.

Disclaimer: The compression ratio is an approximate value, which is calculated based on the sampled rows in the LOB column. The actual space that you save when you enable compression for the complete table may be different.

Syntax

The syntax to get the compression ratio differs for objects, LOBs, IOTs, and indexes on a table.

- Syntax to get the compression ratio for an object (table or index, default is table).

```
DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
  scratchtbsname      IN      VARCHAR2,
  ownname             IN      VARCHAR2,
  objname             IN      VARCHAR2,
  subobjname          IN      VARCHAR2,
  comptype            IN      NUMBER,
  blkcnt_cmp          OUT     PLS_INTEGER,
  blkcnt_uncmp        OUT     PLS_INTEGER,
  row_cmp             OUT     PLS_INTEGER,
  row_uncmp           OUT     PLS_INTEGER,
  cmp_ratio           OUT     NUMBER,
  comptype_str        OUT     VARCHAR2,
  block_compr_ratio   OUT     PLS_INTEGER,
  byte_comp_ratio     OUT     NUMBER,
  subset_numrows      IN      NUMBER DEFAULT COMP_RATIO_MINROWS,
  objtype             IN      PLS_INTEGER DEFAULT OBJTYPE_TABLE);
```

- Syntax to get compression ratio for BasicFile and SecureFile LOBs:

```

DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
  scratchtbsname      IN      VARCHAR2,
  tabowner            IN      VARCHAR2,
  tabname             IN      VARCHAR2,
  lobname             IN      VARCHAR2,
  partname            IN      VARCHAR2,
  comptype            IN      NUMBER,
  blkcnt_cmp          OUT     PLS_INTEGER,
  blkcnt_uncmp        OUT     PLS_INTEGER,
  lobcnt              OUT     PLS_INTEGER,
  cmp_ratio           OUT     NUMBER,
  comptype_str        OUT     VARCHAR2,
  byte_comp_ratio     OUT     NUMBER,
  total_time          OUT     NUMBER
  subset_numrows      IN      NUMBER DEFAULT COMP_RATIO_LOB_MAXROWS);

```

- Syntax to get the compression ratio for all indexes on a table. The compression ratios are returned as a collection.

```

DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
  scratchtbsname      IN      VARCHAR2,
  ownname             IN      VARCHAR2,
  tabname             IN      VARCHAR2,
  comptype            IN      NUMBER,
  index_cr            OUT     DBMS_COMPRESSION.COMPRECLIST,
  comptype_str        OUT     VARCHAR2,
  subset_numrows      IN      NUMBER DEFAULT COMP_RATIO_INDEX_MINROWS);

```

- Syntax to get the compression ratio for IOTs.

```

DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
  scratchtbsname      IN      VARCHAR2,
  ownname             IN      VARCHAR2,
  objname             IN      VARCHAR2,
  subobjname          IN      VARCHAR2,
  comptype            IN      NUMBER,
  iotcomp_cr          OUT     DBMS_COMPRESSION.COMPRECLIST,
  comptype_str        OUT     VARCHAR2,
  subset_numrows      IN      NUMBER DEFAULT COMP_RATIO_INDEX_MINROWS);

```

Parameters

Table 47-4 GET_COMPRESSION_RATIO Procedure Parameters

Parameter	Description
scratchtbsname	Temporary scratch tablespace that can be used for analysis
ownname / tabowner	Schema of the table to analyze
tabname	Name of the table to analyze
objname	Name of the object
subobjname	Name of the partition or sub-partition of the object

Table 47-4 (Cont.) GET_COMPRESSION_RATIO Procedure Parameters

Parameter	Description
comptype	Compression types for which analysis should be performed When the object is an index, only the following compression types are valid: COMP_INDEX_ADVANCED_HIGH (value 1024) and COMP_INDEX_ADVANCED_LOW (value 2048). Note: The following compression types cannot be specified in this parameter for any type of object: COMP_BLOCK (value 64) and COMP_BASIC (value 4096).
blkcnt_cmp	Number of blocks used by compressed sample of the table
blkcnt_uncmp	Number of blocks used by uncompressed sample of the table
row_cmp	Number of rows in a block in compressed sample of the table
row_uncmp	Number of rows in a block in uncompressed sample of the table
cmp_ratio	Compression ratio, blkcnt_uncmp divided by blkcnt_cmp. It provides the ratio of blocks occupied by the uncompressed data to the blocks occupied by the compressed data.
comptype_str	String describing the compression type
subset_numrows	Number of rows sampled to estimate compression ratio.
objtype	Type of the object, either OBJTYPE_TABLE or OBJTYPE_INDEX
lobname	Name of the LOB column
partname	In case of partitioned tables, the related partition name
lobcnt	Number of lobs actually sampled to estimate compression ratio
byte_comp_ratio	Provides the ratio of bytes of uncompressed data to the bytes of compressed data for LOBs.
index_cr	List of indexes and their estimated compression ratios
iotcomp_cr	Compression ratio for the IOT The first object contains the compression ratio for the whole IOT. The second object contains the compression ratio only for the top index section of the IOT (excludes the overflow segment).
total_time	Provides an estimate of the time taken, in hours, to compress the LOB data in the table.

Example: Estimate the compression ratio for inline and out-of-line LOBs

The following example shows how to estimate the compression ratio for LOBs.

```
SET SERVEROUTPUT ON
DECLARE
    bcmp                INTEGER;
    buncmp              INTEGER;
    lobcmp              INTEGER;
    cr                  NUMBER;
    byte_cr             NUMBER;
    cstr                VARCHAR2(2000);
    total_time          NUMBER;
    l_segment_name      VARCHAR2(30);
    l_segment_size_blocks NUMBER;
```

```

        l_segment_size_bytes    NUMBER;
        l_used_blocks           NUMBER;
        l_used_bytes            NUMBER;
        l_expired_blocks        NUMBER;
        l_expired_bytes         NUMBER;
        l_unexpired_blocks      NUMBER;
        l_unexpired_bytes       NUMBER;
BEGIN
    DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
        scratchtbsname         => 'LOBTBSP',
        tabowner                => 'CMPADV',
        tabname                 => p_tablename,
        lobname                 => 'C',
        partname                => NULL,
        comptype                => 256,
        blkcnt_cmp              => bcmp,
        blkcnt_uncmp           => buncmp,
        lobcnt                  => lobcmp,
        cmp_ratio               => cr,
        comptype_str            => cstr,
        subset_numrows          => 1000,
        byte_comp_ratio         => byte_cr,
        total_time              => total_time
    );
    DBMS_OUTPUT.put_line('Estimated ratio of blocks used by the
uncompressed data to the compressed data : ' || cr);
    DBMS_OUTPUT.put_line('Estimated ratio of bytes used by the
uncompressed data to the compressed data : ' || byte_cr);
END;
/

```

To understand the output of this procedure, let's consider `tab_inline`, an inline table, and `tab_outofline`, an out-of-line table as shown in the following example.

```

CREATE TABLE tab_inline
(
    a NUMBER,
    c CLOB
)
LOB(c) STORE AS SECUREFILE (ENABLE STORAGE IN ROW CACHE LOGGING);

CREATE TABLE tab_outofline
(
    a NUMBER,
    c CLOB
)
LOB(c) STORE AS SECUREFILE (DISABLE STORAGE IN ROW CACHE LOGGING);

```

Data is stored in different ways in `tab_inline` and `tab_outofline`. In the `tab_inline` table, if the LOB is less than 4K, then data is stored in the table segment; otherwise, it is stored in the LOB segment. For the `tab_outofline` table, data of all sizes is stored in the LOB segment.

Let's consider that you have inserted 1000 LOBs of 3K each in both the tables, and then calculate the compression ratios. You can use the `dbms_space.space_usage` procedure to calculate the space used by the data that is stored in the LOB segments.

Sample output of compression ratio for inline LOBs.

```
Estimated block compression ratio : 1
Estimated byte compression ratio   : 57.6
Space used(in bytes)               : 0
space used(in blocks)             : 0
```

Sample output of compression ratio for out-of-line LOBs.

```
Estimated block compression ratio : 1
Estimated byte compression ratio   : 56.1
Space used(in bytes)               : 8 MB
space used(in blocks)             : 1000
```

In this example, even though the estimated byte and block compression ratios are almost the same for inline and out-of-line LOBs, the space that is used is different. In the case of `tab_inline`, LOB segment is not used so the space used is 0. In both cases, the data is approximately 3KB, which is small. Therefore, the data before and after compression uses the same number of blocks (that is 1 block), so the block compression ratio is 1. However, the byte level compression ratio, `byte_comp_ratio`, which compares the actual number of bytes used by the LOBs before and after compression is 57.6 or 56.1.

Example: Estimate the compression ratio for indexes on a table with low compression type

The following example shows how to estimate the compression ratio for advanced index compression (low):

```
SET SERVEROUTPUT ON
DECLARE
  l_blkcnt_cmp      PLS_INTEGER;
  l_blkcnt_uncmp   PLS_INTEGER;
  l_row_cmp        PLS_INTEGER;
  l_row_uncmp      PLS_INTEGER;
  l_cmp_ratio      NUMBER;
  l_comptype_str   VARCHAR2(32767);
BEGIN
  DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
    scratchtbsname => 'USERS' ,
    ownname        => 'TEST' ,
    objname        => 'SALES_IDX' ,
    subobjname     => NULL ,
    comptype       => DBMS_COMPRESSION.COMP_INDEX_ADVANCED_LOW,
    blkcnt_cmp     => l_blkcnt_cmp,
    blkcnt_uncmp   => l_blkcnt_uncmp,
    row_cmp        => l_row_cmp,
    row_uncmp      => l_row_uncmp,
    cmp_ratio      => l_cmp_ratio,
    comptype_str   => l_comptype_str,
    subset_numrows => DBMS_COMPRESSION.comp_ratio_minrows,
```



```

        objtype          =>          DBMS_COMPRESSION.objtype_index
    );
    DBMS_OUTPUT.put_line( 'Number of blocks used by the compressed sample
of the object      : ' || 1_blkcnt_cmp);
    DBMS_OUTPUT.put_line( 'Number of blocks used by the uncompressed
sample of the object : ' || 1_blkcnt_uncmp);
    DBMS_OUTPUT.put_line( 'Number of rows in a block in compressed sample
of the object      : ' || 1_row_cmp);
    DBMS_OUTPUT.put_line( 'Number of rows in a block in uncompressed
sample of the object : ' || 1_row_uncmp);
    DBMS_OUTPUT.put_line( 'Estimated Compression Ratio of
Sample              : ' || 1_cmp_ratio);
    DBMS_OUTPUT.put_line( 'Compression
Type                 : ' || 1_comptype_str);
END;
/

```

Output of compression advisor estimate for advanced index compression (Low):

```

Number of blocks used by the compressed sample of the object      : 243
Number of blocks used by the uncompressed sample of the object    : 539
Number of rows in a block in compressed sample of the object     : 499
Number of rows in a block in uncompressed sample of the object   : 145
Estimated Compression Ratio of Sample                            : 2.2
Compression Type                                                 : "Compress Advanced Low"

```

Example: Estimate the compression ratio for LOBs with medium compression type

The following example shows how to estimate the compression ratio for advanced LOB compression (medium):

```

SET SERVEROUTPUT ON
DECLARE
    1_blkcnt_cmp      PLS_INTEGER;
    1_blkcnt_uncmp    PLS_INTEGER;
    1_row_cmp         PLS_INTEGER;
    1_lobcnt          PLS_INTEGER;
    1_cmp_ratio       NUMBER;
    1_comptype_str    VARCHAR2(32767);
BEGIN
    DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
        scratchtbsname => 'USERS' ,
        tabowner       => 'TEST' ,
        tabname        => 'PARTS' ,
        lobname        => 'PART_DESCRIPTION' ,
        partname       => NULL ,
        comptype       => DBMS_COMPRESSION.COMP_LOB_MEDIUM,
        blkcnt_cmp     => 1_blkcnt_cmp,
        blkcnt_uncmp   => 1_blkcnt_uncmp,
        row_cmp        => 1_row_cmp,
        lobcnt         => 1_lobcnt,
        cmp_ratio      => 1_cmp_ratio,
        comptype_str   => 1_comptype_str,
        subset_numrows => DBMS_COMPRESSION.comp_ratio_lob_maxrows
    );

```

```

DBMS_OUTPUT.put_line( 'Number of blocks used by the compressed sample of the
object      : ' || l_blkcnt_cmp);
DBMS_OUTPUT.put_line( 'Number of blocks used by the uncompressed sample of
the object  : ' || l_blkcnt_uncmp);
DBMS_OUTPUT.put_line( 'Number of rows in a block in compressed sample of the
object      : ' || l_row_cmp);
DBMS_OUTPUT.put_line( 'Number of LOBS actually
sampled      : ' || l_lobcnt);
DBMS_OUTPUT.put_line( 'Estimated Compression Ratio of
Sample       : ' || l_cmp_ratio);
DBMS_OUTPUT.put_line( 'Compression
Type                                                : ' || l_comptype_str);
END;
/

```

Output of compression advisor estimate for advanced LOB compression (Medium):

```

Number of blocks used by the compressed sample of the object      : 199
Number of blocks used by the uncompressed sample of the object    : 389
Number of rows in a block in compressed sample of the object      : 293
Number of LOBS actually sampled                                  : 55
Estimated Compression Ratio of Sample                            : 1.9
Compression Type                                                : "Compress Medium"

```

Example: Estimate the compression ratio for IOTs

The following example shows how to estimate the compression ratio for IOTs:

```

SET SERVEROUTPUT ON
DECLARE
  bcmp      INTEGER;
  buncmp    INTEGER;
  rowcmp    INTEGER;
  rowuncmp  INTEGER;
  cr        NUMBER;
  cstr      VARCHAR2(2000);
  iotcomp_cr DBMS_COMPRESSION.COMP_RECLIST;
BEGIN
  DBMS_COMPRESSION.GET_COMPRESSION_RATIO (
    scratchtbsname => 'USERS',
    ownname         => 'TEST',
    objname         => 'SALES',
    subobjname      => NULL,
    comptype        => DBMS_COMPRESSION.COMP_INDEX_ADVANCED_LOW,
    iotcomp_cr      => iotcomp_cr,
    comptype_str    => cstr,
    subset_numrows  => DBMS_COMPRESSION.COMP_RATIO_ALLROWS
  );
  --information about the index and the overflow segment
  DBMS_OUTPUT.put_line( 'Number of blocks used by the compressed sample of
the IOT table          : ' ||
iotcomp_cr(1).blkcnt_cmp);
  DBMS_OUTPUT.put_line( 'Number of blocks used by the uncompressed sample of
the IOT table          : ' ||
iotcomp_cr(1).blkcnt_uncmp);
  DBMS_OUTPUT.put_line( 'Average number of rows in a block in the compressed

```

```

sample of the IOT table                               : ' ||
iotcomp_cr(1).row_cmp);
  DBMS_OUTPUT.put_line( 'Average number of rows in a block in the
uncompressed sample of the IOT table                 : ' ||
iotcomp_cr(1).row_uncmp);
  DBMS_OUTPUT.put_line( 'Estimated Compression Ratio of the
sample                                               : ' ||
iotcomp_cr(1).cmp_ratio);
  --information about the index segment
  DBMS_OUTPUT.put_line( 'Number of blocks used by the compressed sample
of the index segment of the IOT table                 : ' ||
iotcomp_cr(2).blkcnt_cmp);
  DBMS_OUTPUT.put_line( 'Number of blocks used by the uncompressed
sample of the index segment of the IOT table         : ' ||
iotcomp_cr(2).blkcnt_uncmp);
  DBMS_OUTPUT.put_line( 'Average number of rows in a block in the
compressed sample of the index segment of the IOT table : ' ||
iotcomp_cr(2).row_cmp);
  DBMS_OUTPUT.put_line( 'Average number of rows in a block in the
uncompressed sample of the index segment of the IOT table : ' ||
iotcomp_cr(2).row_uncmp);
  DBMS_OUTPUT.put_line( 'Estimated Compression Ratio of the
sample                                               : ' ||
iotcomp_cr(2).cmp_ratio);
END;
/

```

Output of the compression ratio for IOTs:

```

Number of blocks used by the compressed sample of the IOT
table                               : 5027
Number of blocks used by the uncompressed sample of the IOT
table                               : 7950
Average number of rows in a block in the compressed sample of the IOT
table                               : 199
Average number of rows in a block in the uncompressed sample of the IOT
table                               : 126
Estimated Compression Ratio of the
sample                               : 1.58
Number of blocks used by the compressed sample of the index segment of the IOT
table                               : 3238
Number of blocks used by the uncompressed sample of the index segment of the IOT
table                               : 6161
Average number of rows in a block in the compressed sample of the index segment
of the IOT table                    : 309
Average number of rows in a block in the uncompressed sample of the index
segment of the IOT table             : 162
Estimated Compression Ratio of the
sample                               : 1.9

```

Usage Notes

- The procedure creates different tables in the scratch tablespace and runs analysis on these objects. It does not modify anything in the user-specified tables.
- From 23ai onwards, this feature has been enhanced to estimate the compression ratio faster for LOBs while using less space. To get a more accurate result, run the

following command to switch to the old method. The older method to calculate the compression ratio takes more time to return the results and uses more space.

```
alter session set "_kdlf_new_compression_adv"= FALSE;
```

- To understand the impact of compression, use the value of the byte compression ratio for inline LOBs and for out-of-line LOBs, use the value of the block compression ratio and space used.
- You can get more benefits when you compress large volume of data as compared to small volumes of data. If you want to compress small volumes of data, look at the byte ratio instead of the block ratio to understand the impact of compression.

47.5.2 GET_COMPRESSION_TYPE Function

This function returns the compression type for a specified row. If the row is chained, the function returns the compression type of the head piece only, and does not examine the intermediate or the tail piece since head pieces can be differently compressed.

Syntax

```
DBMS_COMPRESSION.GET_COMPRESSION_TYPE (  
    ownname      IN    VARCHAR2,  
    tablename    IN    VARCHAR2,  
    row_id       IN    ROWID,  
    subobjname   IN    VARCHAR2 DEFAULT NULL)  
RETURN NUMBER;
```

Parameters

Table 47-5 GET_COMPRESSION_TYPE Function Parameters

Parameter	Description
ownname	Schema name of the table
tablename	Name of table
rowid	Rowid of the row
subobjname	Name of the table partition or subpartition

Return Values

Flag to indicate the compression type (see [Table 47-1](#)).

DBMS_CONNECTION_POOL

The `DBMS_CONNECTION_POOL` package provides an interface to manage the Database Resident Connection Pools (DRCP).

The database initialization parameter `ENABLE_PER_PDB_DRCP` controls whether DRCP is configured in the CDB `ROOT` DRCP mode or per-PDB DRCP mode. The default value is `FALSE`, which will configure DRCP at the CDB level.

- If the value of the database configuration parameter `ENABLE_PER_PDB_DRCP` is set to `TRUE`, then:
 - Each PDB administrator can manage their pool configuration using the `DBMS_CONNECTION_POOL` package. If the `ROOT` tries to manage the pool configuration using the `DBMS_CONNECTION_POOL` package, then an error is thrown.
 - The values of the `num_cbrok` and `maxconn_cbrok` pool parameters from the `cpool$` table are ignored. The PDB administrator cannot modify these parameters using the `DBMS_CONNECTION_POOL.ALTER_PARAM()` procedure. These parameters can be set using the `CONNECTION_BROKERS` database parameter. Only the `ROOT` can alter these parameters dynamically.
- If the value of the `ENABLE_PER_PDB_DRCP` parameter is set to `FALSE`, then only the `ROOT` can manage the pool configuration, using the `DBMS_CONNECTION_POOL` package. If a PDB administrator tries to manage the pool configuration using the `DBMS_CONNECTION_POOL` package, then an error is thrown.
- The following DRCP parameters can have values ranging from 0 to `SB4MAXVAL` (2147483647) - 1:
 - `minsize`
 - `num_cbrok`
 - `maxconn_cbrok`



See Also:

Oracle Database Concepts for more information on "Database Resident Connection Pooling"

This chapter contains the following topic:

- [Summary of DBMS_CONNECTION_POOL Subprograms](#)

48.1 Summary of DBMS_CONNECTION_POOL Subprograms

This table lists the subprograms of the `DBMS_CONNECTION_POOL` package in an alphabetical order and describes them briefly.

Table 48-1 DBMS_CONNECTION_POOL Package Subprograms

Subprogram	Description
ADD_POOL Procedure	Adds a new pool to the multiple pool DRCP.
ALTER_PARAM Procedure	Alters a specific configuration parameter as a standalone unit, without affecting the other parameters.
CONFIGURE_POOL Procedure	Configures the pool with advanced options.
REMOVE_POOL Procedure	Removes a pool from the multiple pool DRCP.
RESTORE_DEFAULTS Procedure	Restores the pool to the default settings
START_POOL Procedure	Starts the pool for operations. Only after this procedure is called, the pool can be used by the connection clients for creating sessions .
STOP_POOL Procedure	Stops the pool and makes it unavailable for the registered connection clients.

48.1.1 ADD_POOL Procedure

You can use this procedure to add a new DRCP pool.

Syntax

```
DBMS_CONNECTION_POOL.ADD_POOL (
    pool_name          IN VARCHAR2,
    minsize            IN PLS_INTEGER DEFAULT 0,
    maxsize            IN PLS_INTEGER DEFAULT 40,
    incsize            IN PLS_INTEGER DEFAULT 2,
    session_cached_cursors IN PLS_INTEGER DEFAULT 20,
    inactivity_timeout IN PLS_INTEGER DEFAULT 300,
    max_think_time     IN PLS_INTEGER DEFAULT 120,
    max_use_session    IN PLS_INTEGER DEFAULT 500000,
    max_lifetime_session IN PLS_INTEGER DEFAULT 86400,
    max_txn_think_time IN PLS_INTEGER DEFAULT 0);
```

Parameters

Note:

If you are aware of the pool configuration at the time of adding the pool, then you can specify the values for the following parameters. Otherwise, you can call the `CONFIGURE_POOL` subprogram later and specify the new pool name and the configuration options.

Table 48-2 ADD_POOL Procedure Parameters

Parameter	Description
<code>pool_name</code>	The name of the pool to be added to the DRCP.

Table 48-2 (Cont.) ADD_POOL Procedure Parameters

Parameter	Description
<code>minsize</code>	The minimum number of pooled servers in the pool. The default value is 0.
<code>maxsize</code>	The maximum number of pooled servers allowed in the pool. The default value is 40.
<code>incrsz</code>	Pool would increment by this number of pooled server when pooled servers are unavailable at application request time. The default value is 2.
<code>session_cached_cursors</code>	The number of session cursors to cache in each pooled server session. The default value is 20. Turn on <code>SESSION_CACHED_CURSORS</code> for all connections in the pool. This is an existing <code>init.ora</code> parameter.
<code>inactivity_timeout</code>	TTL (Time to live) for an idle session in the pool. This parameter helps to shrink the pool when it is not used to its maximum capacity. If a connection remains in the pool idle for this time, the connection is closed. The default value is 300.
<code>max_think_time</code>	The maximum time of inactivity, in seconds, for a client after it obtains a pooled server from the pool with no open transactions in it. After obtaining a pooled server from the pool, if the client application does not issue a database call for the time specified by <code>MAX_THINK_TIME</code> , the pooled server is freed and the client connection is terminated. The default value is 120.
<code>max_use_session</code>	Maximum number of times a connection can be taken and released to the pool. The default value is 500000.
<code>max_lifetime_session</code>	TTL (Time to live) in seconds for a pooled session. The default value is 86400.
<code>max_txn_think_time</code>	The maximum time of inactivity, in seconds, for a client after it obtains a pooled server from the pool with an open transaction. After obtaining the pooled server from the pool, if the client application does not issue a database call for the time specified by <code>MAX_TXN_THINK_TIME</code> , then the pooled server is freed, and the client connection is terminated. The default value of this parameter is the value of the <code>MAX_THINK_TIME</code> parameter. Applications can set the value of the <code>MAX_TXN_THINK_TIME</code> parameter to a value higher than the <code>MAX_THINK_TIME</code> value to allow more time for the connections with open transactions.

 **Note:**

The `pool_name` parameter has the following validation checks:

- The pool name must be unique.
- It must begin with an alphabetic character.
- It can contain alphanumeric characters in the second and subsequent positions.
- It can contain an underscore (`_`) in the second and subsequent positions.
- The maximum length allowed for the pool name is 128.

 **See Also:**

For the list and description of all the database resident connection pooling parameters that can be configured using this procedure, see the *Oracle Database Administrator's Guide*.

Examples

```
exec dbms_connection_pool.add_pool('mypool')
```

48.1.2 ALTER_PARAM Procedure

This procedure alters a specific Database Resident Connection Pool (DRCP) configuration parameter as a standalone unit, and does not affect other parameters.

Syntax

```
DBMS_CONNECTION_POOL.ALTER_PARAM (
  pool_name      IN  VARCHAR2 DEFAULT 'SYS_DEFAULT_CONNECTION_POOL',
  param_name     IN  VARCHAR2,
  param_value    IN  VARCHAR2);
```

Parameters**Table 48-3 ALTER_PARAM Procedure Parameters**

Parameter	Description
<code>pool_name</code>	Pool to be configured.

Table 48-3 (Cont.) ALTER_PARAM Procedure Parameters

Parameter	Description
param_name	Any parameter name from CONFIGURE_POOL. For broker parameters: NUM_CBROK and MAXCONN_CBROK, these rules apply: <ul style="list-style-type: none"> If per-PDB DRCP is enabled, then ALTER_PARAM() cannot be used to set these parameters. Using the database initialization parameter connection_brokers is the only way to set them. For the CDB ROOT-level DRCP, if these parameters are not set using connection_brokers, then the administrator can use the ALTER_PARAM() procedure to set them. Using connection_brokers is the recommended way to set these parameters.
param_value	Parameter value for param_name.

 **See Also:**

For the list and description of all the DRCP parameters that can be configured using this procedure, see the *Oracle Database Administrator's Guide*.

Exceptions**Table 48-4 ALTER_PARAM Procedure Exceptions**

Exception	Description
ORA-56500	Connection pool not found
ORA-56504	Invalid connection pool configuration parameter name
ORA-56505	Invalid connection pool configuration parameter value
ORA-56507	Connection pool alter configuration failed

Examples

```
DBMS_CONNECTION_POOL.ALTER_PARAM(
  'SYS_DEFAULT_CONNECTION_POOL', 'MAX_LIFETIME_SESSION', '120');
```

48.1.3 CONFIGURE_POOL Procedure

This procedure configures the pool with advanced options.

Syntax

```
DBMS_CONNECTION_POOL.CONFIGURE_POOL (
  pool_name           IN VARCHAR2 DEFAULT 'SYS_DEFAULT_CONNECTION_POOL',
  minsize             IN NUMBER   DEFAULT 4,
  maxsize             IN NUMBER   DEFAULT 40,
  incrsz              IN NUMBER   DEFAULT 2,
```

```

session_cached_cursors  IN NUMBER  DEFAULT 20,
inactivity_timeout      IN NUMBER  DEFAULT 300,
max_think_time          IN NUMBER  DEFAULT 120,
max_use_session         IN NUMBER  DEFAULT 500000,
max_lifetime_session   IN NUMBER  DEFAULT 86400,
max_txn_think_time      IN NUMBER);

```

Parameters

Table 48-5 CONFIGURE_POOL Procedure Parameters

Parameter	Description
pool_name	Pool to be configured.
minsize	Minimum number of pooled servers in the pool
maxsize	Maximum allowed pooled servers in the pool
incrsize	Pool would increment by this number of pooled server when pooled server are unavailable at application request time
session_cached_cursors	Turn on SESSION_CACHED_CURSORS for all connections in the pool. This is an existing <code>init.ora</code> parameter
inactivity_timeout	TTL (Time to live) for an idle session in the pool. This parameter helps to shrink the pool when it is not used to its maximum capacity. If a connection remains in the pool idle for this time, it is killed.
max_think_time	The maximum time of inactivity, in seconds, for a client after it obtains a pooled server from the pool with no open transactions in it. After obtaining a pooled server from the pool, if the client application does not issue a database call for the time specified by MAX_THINK_TIME, the pooled server is freed and the client connection is terminated.
max_use_session	Maximum number of times a connection can be taken and released to the pool
max_lifetime_session	TTL (Time to live) for a pooled session
max_txn_think_time	The maximum time of inactivity, in seconds, for a client after it obtains a pooled server from the pool with an open transaction. After obtaining the pooled server from the pool, if the client application does not issue a database call for the time specified by MAX_TXN_THINK_TIME, then the pooled server is freed, and the client connection is terminated. The default value of this parameter is the value of the MAX_THINK_TIME parameter. Applications can set the value of the MAX_TXN_THINK_TIME parameter to a value higher than the MAX_THINK_TIME value to allow more time for the connections with open transactions.

Exceptions

Table 48-6 CONFIGURE_POOL Procedure Exceptions

Exception	Description
ORA-56500	Connection pool not found
ORA-56507	Connection pool alter configuration failed

Usage Notes

- All expressions of time are in seconds
- All of the parameters should be set based on statistical request patterns.
- `minsize` should be set keeping in mind that it puts a lower bound on server resource consumption. This is to prevent the timeout from dragging the pool too low, because of a brief period of inactivity.
- `maxsize` should be set keeping in mind that it puts an upper bound on concurrency and response-times and also server resource consumption.
- `session_cached_cursors` is typically set to the number of most frequently used statements. It occupies cursor resource on the server
- In doubt, do not set the `increment` and `inactivity_timeout`. The pool will have reasonable defaults.
- `max_use_session` and `max_lifetime_session` allow for software rejuvenation or defensive approaches to potential bugs, leaks, accumulations, and like problems, by getting brand new sessions once in a while.
- The connection pool reserves 5% of the pooled servers for authentication, and at least one pooled server is always reserved for authentication. When setting the `maxsize` parameter, ensure that there are enough pooled servers for both authentication and connections.

48.1.4 REMOVE_POOL Procedure

You can use this procedure to remove a pool from DRCP.

Syntax

```
DBMS_CONNECTION_POOL.REMOVE_POOL (
    pool_name      IN VARCHAR2);
```

Parameters

Table 48-7 REMOVE_POOL Procedure Parameters

Parameter	Description
<code>pool_name</code>	The pool to be removed.

Note:

This procedure generates an error if:

- The specified pool does not exist.
- You try to remove the default pool.
- You try to remove an active pool without stopping it.

Exceptions

Table 48-8 REMOVE_POOL Procedure Exceptions

Exception	Description
ORA-56620	Removing the pool <pool_name> failed because pool doesn't exist.
ORA-56620	Removing the pool <pool_name> failed because database is read only.
ORA-56620	Removing the pool <pool_name> failed because pool is active.
ORA-56620	Removing the pool <pool_name==NULL> failed because pool name cannot be empty.
ORA-56620	Removing the pool SYS_DEFAULT_CONNECTION_POOL failed because default pool cannot be removed.



Note:

The same error number is used for all exception errors because the error message is a dynamic string.

Examples

```
exec dbms_connection_pool.remove_pool('mypool')
```

48.1.5 RESTORE_DEFAULTS Procedure

This procedure restores the pool to default settings.

Syntax

```
DBMS_CONNECTION_POOL.RESTORE_DEFAULTS (
    pool_name IN VARCHAR2 DEFAULT 'SYS_DEFAULT_CONNECTION_POOL');
```

Parameters

Table 48-9 RESTORE_DEFAULTS Procedure Parameters

Parameter	Description
pool_name	Pool to be restored.

Exceptions

Table 48-10 RESTORE_DEFAULTS Procedure Exceptions

Exception	Description
ORA-56500	Connection pool not found
ORA-56507	Connection pool alter configuration failed

48.1.6 START_POOL Procedure

This procedure starts the pool for operations. It is only after this call that the pool could be used by connection classes for creating sessions.

Syntax

```
DBMS_CONNECTION_POOL.START_POOL (  
    pool_name IN VARCHAR2 DEFAULT 'SYS_DEFAULT_CONNECTION_POOL');
```

Parameters

Table 48-11 START_POOL Procedure Parameters

Parameter	Description
pool_name	Pool to be started.

Exceptions

Table 48-12 START_POOL Procedure Exceptions

Exception	Description
ORA-56500	Connection pool not found
ORA-56501	Connection pool startup failed

Usage Notes

If the instance is restarted (shutdown followed by startup), DRCP pools are automatically started.

48.1.7 STOP_POOL Procedure

This procedure stops the pool and makes it unavailable for the registered connection classes.

Syntax

```
DBMS_CONNECTION_POOL.STOP_POOL (  
    pool_name IN VARCHAR2 DEFAULT 'SYS_DEFAULT_CONNECTION_POOL',  
    draintime IN PLS_INTEGER DEFAULT 2147483647);
```

Parameters

Table 48-13 STOP_POOL Procedure Parameters

Parameter	Description
pool_name	Pool to be stopped.

Table 48-13 (Cont.) STOP_POOL Procedure Parameters

Parameter	Description
<code>draintime</code>	<p>Allows active DRCP pools to be closed after a specified connection drain time, or be closed immediately without waiting for the connections to be idle.</p> <p><code>draintime</code> can have the following integer values:</p> <ul style="list-style-type: none"> • 0 to close the bound pooled servers immediately. • x to close the bound pooled servers after x seconds.

 **Note:**

Do not pass the `draintime` parameter if you want to retain the old behavior of closing the pools only after they become idle and inactive.

Exceptions

Table 48-14 STOP_POOL Procedure Exceptions

Exception	Description
ORA-56500	Connection pool not found
ORA-56506	Connection pool shutdown failed

Usage Notes

This stops the pool and takes it offline. This does not destroy the persistent data (such as, the pool name and configuration parameters) associated with the pool.

DBMS_CQ_NOTIFICATION

The `DBMS_CQ_NOTIFICATION` package is part of the database change notification feature that provides the functionality to create registration on queries designated by a client application and so to receive notifications in response to DML or DDL changes on the objects associated with the queries. The notifications are published by the database when the DML or DDL transaction commits.



See Also:

Oracle Database Development Guide regarding implementing database change notification.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Operational Notes](#)
- [Examples](#)
- [Data Structures](#)
- [Summary of DBMS_CQ_NOTIFICATION Subprograms](#)

49.1 DBMS_CQ_NOTIFICATION Overview

The `DBMS_CQ_NOTIFICATION` package provides PL/SQL based registration interfaces. A client can use this interface to create registrations on queries based on objects of interest and specify a PL/SQL callback handler to receive notifications. In case of object level registration, when a transaction changes any of the objects associated with the registered queries and | COMMIT|s, the PL/SQL callback, specified during registration for those objects, is invoked. The application can define client-specific processing inside the implementation of its PL/SQL callback handler.

The interface lets you define a registration block (using a mechanism similar to a `BEGIN-END` block). The recipient of notifications namely the name of the PL/SQL callback handler and a few other registration properties like time-outs can be specified during the `BEGIN` phase. Any queries executed subsequently (inside the registration block) are considered "interesting queries" and objects referenced by those queries during query execution are registered. The registration is completed by `ENDING` the registration block. The registration block lets you create new registrations or add objects to existing registrations.

When a registration is created through the PL/SQL interface, a unique registration ID is assigned to the registration by the RDBMS. The client application can use the registration ID

to keep track of registrations created by it. When a notification is published by the RDBMS, the registration ID will be part of the notification.

Typical Applications

This functionality is useful for example to applications that cache query result sets on mostly read-only objects in the mid-tier to avoid network round trips to the database. Such an application can create a registration on the queries it is interested in caching. On changes to objects referenced inside those queries, the database publishes a notification when the underlying transaction commits. In response to the notification, the mid-tier application can refresh its cache by re-executing the query/queries.

49.2 DBMS_CQ_NOTIFICATION Security Model

The `DBMS_CQ_NOTIFICATION` package requires that the user have the `CHANGE NOTIFICATION` system privilege in order to receive notifications, and be granted `EXECUTE` privilege on the `DBMS_CQ_NOTIFICATION` package.

In addition the user is required to have `SELECT` or `READ` privileges on all objects to be registered. Note that if the `SELECT` or `READ` privilege on an object was granted at the time of registration creation but lost subsequently (due to a revoke), then the registration will be purged and a notification to that effect will be published.

49.3 DBMS_CQ_NOTIFICATION Constants

`DBMS_CQ_NOTIFICATION` constants are used as flag parameters either during registration or when received during the notification.

The `DBMS_CQ_NOTIFICATION` package has sets of constants:

- `EVENT_STARTUP`, `EVENT_SHUTDOWN`, `EVENT_SHUTDOWN_ANY`, `EVENT_DEREG` describe the type of the notification published by the database.
- `INSERTOP`, `DELETEOP`, `UPDATEOP`, `ALTEROP`, `DROPOP` and `UNKNOWNOP` describe the type of operation on a table (during a notification published by the database).
- `QOS_RELIABLE`, `QOS_DEREG_NFY`, `QOS_ROWIDs` describe registration Quality of Service properties that the client requires. These are specified during registration.

The constants are shown in the following table.

Table 49-1 DBMS_CQ_NOTIFICATION Constants

Name	Type	Value	Description
<code>ALL_OPERATIONS</code>	<code>BINARY_INTEGER</code>	0	Interested in being notified on all operations, specified as a parameter during registration
<code>ALL_ROWS</code>	<code>BINARY_INTEGER</code>	1	All rows within the table may have been potentially modified
<code>EVENT_STARTUP</code>	<code>BINARY_INTEGER</code>	1	Instance startup notification
<code>EVENT_SHUTDOWN</code>	<code>BINARY_INTEGER</code>	2	Instance shutdown notification
<code>EVENT_SHUTDOWN_ANY</code>	<code>BINARY_INTEGER</code>	3	Any instance shutdown when running Oracle Real Application Clusters (Oracle RAC)

Table 49-1 (Cont.) DBMS_CQ_NOTIFICATION Constants

Name	Type	Value	Description
EVENT_DEREG	BINARY_INTEGER	5	Registration has been removed
EVENT_OBJCHANGE	BINARY_INTEGER	6	Notification for object change
EVENT_QUERYCHANGE	BINARY_INTEGER	7	Notification for query result set change
INSERTOP	BINARY_INTEGER	2	Insert operation
UPDATEOP	BINARY_INTEGER	4	Update operation
DELETEOP	BINARY_INTEGER	8	Delete operation
ALTEROP	BINARY_INTEGER	16	Table altered
DROPOP	BINARY_INTEGER	32	Table dropped
UNKNOWNOP	BINARY_INTEGER	64	Unknown operation
QOS_RELIABLE	BINARY_INTEGER	1	Reliable or persistent notification. Also implies that the notifications will be inserted into the persistent storage atomically with the committing transaction that results in an object change.
QOS_DEREG_NFY	BINARY_INTEGER	2	Purge registration on first notification
QOS_ROWIDS	BINARY_INTEGER	4	Require rowids of modified rows
QOS_QUERY	BINARY_INTEGER	8	Register at query granularity
QOS_BEST_EFFORT	BINARY_INTEGER	16	Best effort evaluation
NTFN_GROUPING_CLASS_TIME	BINARY_INTEGER	1	Group notifications by time
NTFN_GROUPING_TYPE_SUMMARY	BINARY_INTEGER	1	Summary grouping of notifications
NTFN_GROUPING_TYPE_LAST	BINARY_INTEGER	2	Last notification in the group
NTFN_GROUPING_FOREVER	BINARY_INTEGER	-1	Repeat notifications forever

49.4 DBMS_CQ_NOTIFICATION Operational Notes

The following are DBMS_CQ_NOTIFICATION operational notes.

Object Level Registration

- The notifications are published by the database when a transaction changes the registered objects and `COMMITs`.
- All objects referenced in the queries executed inside the registration block starting from the previous `NEW_REG_START` or `ENABLE_REG` to `REG_END` are considered interesting objects and added to the registration.

Query Result Change Registration

- The notifications are published by the database when a transaction changes the result set of the registered query and `COMMITs`.

Troubleshooting

If you have created a registration and seem to not receive notifications when the underlying tables are changed, please check the following.

- Is the `job_queue_processes` parameter set to a nonzero value? This parameter needs to be configured to a nonzero value in order to receive PL/SQL notifications through the handler.
- Are the registrations being created as a non-SYS user?
- If you are attempting DML changes on the registered object, are you `COMMITting` the transaction? Please note that the notifications are transactional and will be generated when the transaction `COMMITs`.
- It maybe possible that there are run-time errors during the execution of the PL/SQL callback due to implementation errors. If so, they would be logged to the trace file of the `JOBQ` process that attempts to execute the procedure. The trace file would be usually named `<ORACLE_SID>_j*_<PID>.trc.`

For example, if the `ORACLE_SID` is 'dbs1' and the process is 12483, the trace file might be named 'dbs1_j000_12483.trc.

Suppose a registration is created with `chnf_callback` as the notification handler and with `registration_id` 100. Let us suppose the user forgets to define the `chnf_callback` procedure. Then the `JOBQ` trace file might contain a message of the following form.

```
Runtime error during execution of PL/SQL cbk chnf_callback for reg CHNF100
Error in PLSQL notification of msgid:
Queue :
Consumer Name :
PLSQL function :chnf_callback
Exception Occured, Error msg:
ORA-00604: error occurred at recursive SQL level 2
ORA-06550: line 1, column 7:
PLS-00201: identifier 'CHNF_CALLBACK' must be declared
ORA-06550: line 1, column 7:
PL/SQL: Statement ignored
```



See Also:

For more information about troubleshooting Database Change Notification, see *Oracle Database Development Guide*.

49.5 DBMS_CQ_NOTIFICATION Examples

Suppose that a mid-tier application has a lot of queries on the `HR.EMPLOYEES` table. If the `EMPLOYEES` table is infrequently updated, it can obtain better performance by caching rows from the table because that would avoid a round-trip to the backend

database server and server side execution latency. Let us assume that the application has implemented a mid-tier HTTP listener that listens for notifications and updates the mid-tier cache in response to a notification.

Object Change Registration Example

The `DBMS_CQ_NOTIFICATION` package can be utilized in this scenario to send notifications about changes to the table by means of the following steps:

1. Implement a mid-tier listener component of the cache management system (for example, using HTTP) that listens to notification messages sent from the database and refreshes the mid-tier cache in response to the notification.
2. Create a server side stored procedure to process notifications

```
CONNECT system;
Enter password: password
GRANT CHANGE NOTIFICATION TO hr;
GRANT EXECUTE ON DBMS_CQ_NOTIFICATION TO hr;

Rem Enable job queue processes to receive notifications.
ALTER SYSTEM SET "job_queue_processes"=2;

CONNECT hr;
Enter password: password
Rem Create a table to record notification events
CREATE TABLE nfevents(regid number, event_type number);

Rem create a table to record changes to registered tables
CREATE TABLE nftablechanges(regid number, table_name varchar2(100),
                             table_operation number);

Rem create a table to record rowids of changed rows.
CREATE TABLE nfrowchanges(regid number, table_name varchar2(100),
                           row_id varchar2(30));

Rem Create a PL/SQL callback handler to process notifications.
CREATE OR REPLACE PROCEDURE chnf_callback(ntfnds IN SYS.CHNF$_DESC) IS
  regid          NUMBER;
  tbname         VARCHAR2(60);
  event_type     NUMBER;
  numtables      NUMBER;
  operation_type NUMBER;
  numrows        NUMBER;
  row_id         VARCHAR2(20);
BEGIN
  regid          := ntfnds.registration_id;
  numtables      := ntfnds.numtables;
  event_type     := ntfnds.event_type;

  INSERT INTO nfevents VALUES(regid, event_type);
  IF (event_type = DBMS_CQ_NOTIFICATION.EVENT_OBJCHANGE) THEN
    FOR i IN 1..numtables LOOP
      tbname          := ntfnds.table_desc_array(i).table_name;
      operation_type := ntfnds.table_desc_array(i).Opflags;
      INSERT INTO nftablechanges VALUES(regid, tbname, operation_type);
      /* Send the table name and operation_type to client side listener using
      UTL_HTTP */
      /* If interested in the rowids, obtain them as follows */
      IF (bitand(operation_type, DBMS_CQ_NOTIFICATION.ALL_ROWS) = 0) THEN
        numrows := ntfnds.table_desc_array(i).numrows;
```

```

ELSE
    numRows :=0;    /* ROWID INFO NOT AVAILABLE */
END IF;

/* The body of the loop is not executed when numRows is ZERO */
FOR j IN 1..numRows LOOP
    Row_id := ntfnfs.table_desc_array(i).row_desc_array(j).row_id;
    INSERT INTO nfrowchanges VALUES(regid, tbnname, Row_id);
    /* optionally Send out row_ids to client side listener using
UTL_HTTP; */
    END LOOP;

END LOOP;
END IF;
COMMIT;
END;
/

```

In Step 2 we can send as much information about the invalidation as the mid-tier application needs based on the information obtained from the notification descriptor.

Notes

- a. In the above example, a registration was created on the `EMPLOYEES` table with 'chnf_callback' as the PL/SQL handler for notifications. During registration, the client specified reliable notifications (`QOS_RELIABLE`) and rowid notifications (`QOS_ROWIDS`).
- b. The handler accesses the table descriptor array from the notification descriptor only if the notification type is of `EVENT_OBJCHANGE`. In all other cases (e.g `EVENT_DEREG`, `EVENT_SHUTDOWN`), the table descriptor array should not be accessed.
- c. The handler accesses the row descriptor array from the table notification descriptor only if the `ALL_ROWS` bit is not set in the table operation flag. If the `ALL_ROWS` bit is set in the table operation flag, then it means that all rows within the table may have been potentially modified. In addition to operations like `TRUNCATE` that affect all rows in the tables, this bit may also be set if individual rowids have been rolled up into a `FULL` table invalidation.

This can occur if too many rows were modified on a given table in a single transaction (more than 80) or the total shared memory consumption due to rowids on the RDBMS is determined too large (exceeds 1% of the dynamic shared pool size). In this case, the recipient must conservatively assume that the entire table has been invalidated and the callback/application must be able to handle this condition.

Also note that the implementation of the user defined callback is up to the developer. In the above example, the callback was used to record event details into database tables. The application can additionally send the notification details to a mid-tier `HTTP` listener of its cache management system (as in the example) using `UTL_HTTP`. The listener could then refresh its cache by querying from the back-end database.

3. Create a registrations on the tables that we wish to be notified about. We pass in the previously defined procedure name (`chnf_callback`) as the name of the server side PL/SQL procedure to be executed when a notification is generated.

```

Rem Create a REGISTRATION on the EMPLOYEES TABLE
DECLARE
  REGDS      SYS.CHNF$_REG_INFO;
  regid      NUMBER;
  mgr_id     NUMBER;
  dept_id    NUMBER;
  qosflags   NUMBER;
BEGIN
  qosflags := DBMS_CQ_NOTIFICATION.QOS_RELIABLE +
              DBMS_CQ_NOTIFICATION.QOS_ROWIDS;
  REGDS := SYS.CHNF$_REG_INFO ('chnf_callback', qosflags, 0,0,0);
  regid := DBMS_CQ_NOTIFICATION.NEW_REG_START (REGDS);
  SELECT manager_id INTO mgr_id FROM EMPLOYEES WHERE employee_id = 200;
  DBMS_CQ_NOTIFICATION.REG_END;
END;
/

```

Once the registration is created in Step 3 above, the server side PL/SQL procedure defined in Step 2 is executed in response to any COMMITTED changes to the HR.EMPLOYEES table. As an example, let us assume that the following update is performed on the employees table.

```
UPDATE employees SET salary=salary*1.05 WHERE employee_id=203;COMMIT;
```

Once the notification is processed, you will find rows which might look like the following in the nfevents, nftablechanges and nfrowchanges tables.

```
SQL> SELECT * FROM nfevents;
```

REGID	EVENT_TYPE
20045	6

```
SQL> SELECT * FROM nftablechanges;
```

REGID	TABLE_NAME	TABLE_OPERATION
20045	HR.EMPLOYEES	4

```
SQL> select * from nfrowchanges;
```

REGID	TABLE_NAME	ROW_ID
20045	HR.EMPLOYEES	AAAKB/AABAAAJ8zAAF

Query Result Change Registration Example

1. Creating a Callback

```

CONNECT system;
Enter password: password
GRANT CHANGE NOTIFICATION TO hr;
GRANT EXECUTE ON DBMS_CQ_NOTIFICATION TO hr;
CONNECT hr;
Enter password: password
Rem Create a table to record notification events
CREATE TABLE nfevents(regid NUMBER, event_type NUMBER);

```

```
Rem Create a table to record notification queries
CREATE TABLE nfqueries (qid NUMBER, qop NUMBER);

Rem Create a table to record changes to registered tables
CREATE TABLE nftablechanges (
    qid          NUMBER,
    table_name   VARCHAR2(100),
    table_operation  NUMBER);

Rem Create a table to record rowids of changed rows.
CREATE TABLE nfrowchanges (
    qid          NUMBER,
    table_name   VARCHAR2(100),
    row_id       VARCHAR2(2000));

CREATE OR REPLACE PROCEDURE chnf_callback
    (ntfnds IN CQ_NOTIFICATION$_DESCRIPTOR)
IS
    regid          NUMBER;
    tbname         VARCHAR2(60);
    event_type     NUMBER;
    numtables      NUMBER;
    operation_type NUMBER;
    numrows        NUMBER;
    row_id         VARCHAR2(2000);
    numqueries     NUMBER;
    qid            NUMBER;
    qop            NUMBER;

BEGIN
    regid := ntfnds.registration_id;
    event_type := ntfnds.event_type;
    INSERT INTO nfevents VALUES(regid, event_type);
    numqueries :=0;
    IF (event_type = DBMS_CQ_NOTIFICATION.EVENT_QUERYCHANGE) THEN
        numqueries := ntfnds.query_desc_array.count;
        FOR i in 1..numqueries LOOP
            qid := ntfnds.QUERY_DESC_ARRAY(i).queryid;
            qop := ntfnds.QUERY_DESC_ARRAY(i).queryop;
            INSERT INTO nfqueries VALUES(qid, qop);
            numtables := 0;
            numtables := ntfnds.QUERY_DESC_ARRAY(i).table_desc_array.count;
            FOR j IN 1..numtables LOOP
                tbname :=
ntfnds.QUERY_DESC_ARRAY(i).table_desc_array(j).table_name;
                operation_type :=
ntfnds.QUERY_DESC_ARRAY(i).table_desc_array(j).Opflags;
                INSERT INTO nftablechanges VALUES(qid, tbname, operation_type);
                IF (bitand(operation_type, DBMS_CQ_NOTIFICATION.ALL_ROWS) = 0)
                THEN
                    numrows :=
ntfnds.query_desc_array(i).table_desc_array(j).numrows;
                ELSE
                    numrows :=0; /* ROWID INFO NOT AVAILABLE */
                END IF;

                /* The body of the loop is not executed when numrows is ZERO */
                FOR k IN 1..numrows LOOP
                    Row_id :=
ntfnds.query_desc_array(i).table_desc_array(j).row_desc_array(k).row_id;
```

```

        INSERT INTO nfrowchanges VALUES(qid, tname, Row_id);

        END LOOP; /* loop over rows */
    END LOOP; /* loop over tables */
END LOOP; /* loop over queries */
END IF;
COMMIT;
END;
/

```

2. Creates a query registration

```

DECLARE
    reginfo    cq_notification$_reg_info;
    mgr_id     NUMBER;
    dept_id    NUMBER;
    v_cursor   SYS_REFCURSOR;
    regid      NUMBER;
    qosflags   NUMBER;

BEGIN
    /* Register two queries for result-set-change notifications: */

    /* 1. Construct registration information.
       'chnf_callback' is name of notification handler.
       QOS_QUERY specifies result-set-change notifications. */

    qosflags := DBMS_CQ_NOTIFICATION.QOS_QUERY +
                DBMS_CQ_NOTIFICATION.QOS_ROWIDS;

    reginfo := cq_notification$_reg_info('chnf_callback', qosflags,0, 0, 0);

    /* 2. Create registration */

    regid := DBMS_CQ_NOTIFICATION.NEW_REG_START(reginfo);

    OPEN v_cursor FOR
        SELECT DBMS_CQ_NOTIFICATION.CQ_NOTIFICATION_QUERYID, manager_id
        FROM HR.employees
        WHERE employee_id = 7902;
    CLOSE v_cursor;

    OPEN v_cursor for
        SELECT DBMS_CQ_NOTIFICATION.CQ_NOTIFICATION_QUERYID, department_id
        FROM HR.departments
        WHERE department_name = 'IT';
    CLOSE v_cursor;

    DBMS_CQ_NOTIFICATION.REG_END;
END;
/

```

3. After creating the query registrations, the output from USER_CQ_NOTIFICATION_QUERIES would appear as follows.

```

SQL> SELECT queryid, regid, to_char(querytext)
       FROM user_cq_notification_queries;

```

```

      QUERYID      REGID
-----
TO_CHAR(QUERYTEXT)

```

```
-----
---
      22          41
SELECT HR.DEPARTMENTS.DEPARTMENT_ID FROM HR.DEPARTMENTS WHERE
HR.DEPARTMENTS.
DEPARTMENT_NAME = 'IT'

      21          41
SELECT HR.EMPLOYEES.MANAGER_ID FROM HR.EMPLOYEES WHERE
HR.EMPLOYEES.EMPLOYEE_
ID = 7902
```

Now, let us perform an UPDATE that changes the result of the query with queryid 22 by renaming the department with name 'IT' to FINANCE.

```
SQL> update departments set department_name = 'FINANCE' where
department_name = 'IT';
```

1 row updated.

```
SQL> commit;
```

Commit complete.

Now we can query the notifications that we recorded in the callback.

```
SQL> select * from nfevents;
```

REGID	EVENT_TYPE
61	7

Event type 7 corresponds to EVENT_QUERYCHANGE

```
SQL> select * from nfqueries;
```

QID	QOP
42	7

Event type 7 corresponds to EVENT_QUERYCHANGE

```
SQL> select * from nftablechanges;
```

```
SQL> select * from nftablechanges;
```

REGID
42

TABLE_NAME
HR.DEPARTMENTS

TABLE_OPERATION
4

TABLE_OPERATION 4 corresponds to UPDATEOP


```

SQL> select * from nfrowchanges;
          REGID
-----
TABLE_NAME
-----
ROW_ID
-----
          61
HR.DEPARTMENTS
AAANKdAABAAALinAAF

```

49.6 DBMS_CQ_NOTIFICATION Data Structures

The `DBMS_CQ_NOTIFICATION` package defines several `OBJECT` types.

OBJECT Types

- `CQ_NOTIFICATION$_DESCRIPTOR` Object Type
- `CQ_NOTIFICATION$_QUERY` Object Type
- `CQ_NOTIFICATION$_QUERY_ARRAY` Object (Array) Type
- `CQ_NOTIFICATION$_TABLE` Object Type
- `CQ_NOTIFICATION$_TABLE_ARRAY` Object (Array) Type
- `CQ_NOTIFICATION$_ROW` Object Type
- `CQ_NOTIFICATION$_ROW_ARRAY` Object (Array) Type
- `CQ_NOTIFICATION$_REG_INFO` Object Type

49.6.1 CQ_NOTIFICATION\$_DESCRIPTOR Object Type

This is the top level change notification descriptor type. It is a synonym for the `SYS.CHNF$_DESC` type.

Syntax

```

TYPE SYS.CHNF$_DESC IS OBJECT(
  registration_id    NUMBER,
  transaction_id    RAW(8),
  dbname            VARCHAR2(30),
  event_type        NUMBER,
  numtables         NUMBER,
  table_desc_array  CQ_NOTIFICATION$_TABLE_ARRAY,
  query_desc_array  CQ_NOTIFICATION$_QUERY_ARRAY);

```

Attributes

Table 49-2 `CQ_NOTIFICATION$_DESCRIPTOR` Object Type

Attribute	Description
<code>registration_id</code>	Registration ID returned during registration

Table 49-2 (Cont.) CQ_NOTIFICATION\$_DESCRIPTOR Object Type

Attribute	Description
transaction_id	Transaction ID. transaction_id of the transaction that made the change. Will be NULL unless the event_type is EVENT_OBJCHANGE or EVENT_QUERYCHANGE.
dbname	Name of database
event_type	Database event associated with the notification. Can be one of EVENT_OBJCHANGE (change to a registered object), EVENT_STARTUP, or EVENT_QUERYCHANGE, EVENT_SHUTDOWN or EVENT_DEREG (registration has been removed due to a timeout or other reason)
numtables	Number of modified tables. Will be NULL unless the event_type is EVENT_OBJCHANGE.
table_desc_array	Array of table descriptors. Will be NULL unless the event_type is EVENT_OBJCHANGE.
query_desc_array	Array of queries changed. This will be NULL unless event_type is EVENT_QUERYCHANGE

49.6.2 CQ_NOTIFICATION\$_QUERY Object Type

The object type describes the changes to a query result caused by an event such as a transaction commit.

An array of CQ_NOTIFICATION\$_QUERY descriptors is embedded inside the top level notification descriptor (CQ_NOTIFICATION\$_DESCRIPTOR) for events of type EVENT_QUERYCHANGE. The array corresponds to the SET of queryids which were invalidated as a result of the event.

This is a synonym for the base type SYS.CHNF\$_QDESC.

Syntax

```
TYPE SYS.CHNF$_QDESC IS OBJECT (
  queryid          NUMBER,
  queryop          NUMBER,
  table_desc_array CQ_NOTIFICATION$_TABLE_ARRAY);
```

Attributes

Table 49-3 TYPE SYS.CQ_NOTIFICATION\$_QUERY Object Type

Attribute	Description
queryid	Queryid of the changed query
queryop	Operation describing change to the query
table_desc_array	Array of table changes which contributed to the query Result Set change

49.6.3 CQ_NOTIFICATION\$_QUERY_ARRAY Object (Array) Type

This type corresponds to an array of CQ_NOTIFICATION\$_QUERY objects. It is a synonym for the SYS.CHNF\$_QUERY_ARRAY type.

Syntax

```
TYPE CQ_NOTIFICATION$_TABLE_ARRAY IS VARRAY (1073741824) OF CQ_NOTIFICATION$_TABLE;
```

49.6.4 CQ_NOTIFICATION\$_TABLE Object Type

This descriptor type describes a change to a table and is embedded inside the top level change notification descriptor type for EVENT_OBJCHANGE event types. For query result set changes (event type will be set to EVENT_QUERYCHANGE), the array of table descriptors is embedded inside each query change descriptor.

Note that this is a synonym for the type previously named SYS.CHNF\$_TDESC.

Syntax

```
TYPE SYS.CHNF$_TDESC IS OBJECT (
  opflags          NUMBER,
  table_name       VARCHAR2(2*M_IDEN+1),
  numrows         NUMBER,
  row_desc_array   CQ_NOTIFICATION$_ROW_ARRAY)
```

Attributes

Table 49-4 TYPE SYS.CQ_NOTIFICATION\$_TABLE Object Type

Attribute	Description
opflags	Table level operation flags. This is a flag field (bit-vector) that describes the operations that occurred on the table. It can be an OR of the following bit fields - INSERTOP, UPDATEOP, DELETEOP, DROPOP, ALTEROP, ALL_ROWS. If the ALL_ROWS (0x1) bit is set it means that either the entire table is modified (for example, DELETE * FROM t) or row level granularity of information is not requested or not available in the notification and the receiver has to conservatively assume that the entire table has been invalidated.
table_name	Name of modified table
numrows	Number of modified rows within the table. numrows will be NULL and hence should not be accessed if the ALL_ROWS bit is set in the table change descriptor.
row_desc_array	Array of row descriptors. This field will be NULL if the ALL_ROWS bit is set in opflags.

49.6.5 CQ_NOTIFICATION\$_TABLE_ARRAY Object (Array) Type

This type corresponds to an array of CQ_NOTIFICATION\$_TABLE objects. It is a synonym for the SYS.CHNF\$_TDESC_ARRAY type.

Syntax

```
TYPE CQ_NOTIFICATION$_TABLE_ARRAY IS VARRAY (1073741824) OF
CQ_NOTIFICATION$_TABLE;
```

49.6.6 CQ_NOTIFICATION\$_ROW Object Type

An array of CQ_NOTIFICATION\$_ROW is embedded inside a CQ_NOTIFICATION\$_TABLE (table change descriptor), if the QOS_ROWIDS option was chosen at registration and the ALL_ROWS bit is not set in the opflags field of the table change descriptor.

Note that this is a synonym for the type previously named SYS.CHNF\$_RDESC.

Syntax

```
TYPE SYS.CHNF$_RDESC IS OBJECT (
  opflags          NUMBER,
  row_id           VARCHAR2 (2000));
```

Attributes

Table 49-5 TYPE SYS.CQ_NOTIFICATION\$_ROW Object Type

Attribute	Description
opflags	Row level operation flags. The flag field (bit vector) describes the operations in the row (could be INSERTOP, UPDATEOP or DELETEOP).
row_id	The rowid of the modified row

49.6.7 CQ_NOTIFICATION\$_ROW_ARRAY Object (Array) Type

This object type corresponds to an array of CQ_NOTIFICATION\$_ROW objects. It is embedded inside the CQ_NOTIFICATION\$_TABLE if QOS_ROWIDS was specified during registration and the ALL_ROWS bit is not set in the opflags field of the table change descriptor.

This type is a synonym for the SYS.CHNF\$_RDESC_ARRAY type.

Syntax

```
TYPE CQ_NOTIFICATION$_ROW_ARRAY IS VARRAY (1073741824) OF CQ_NOTIFICATION$_ROW;
```

49.6.8 CQ_NOTIFICATIONS\$ REG_INFO Object Type

The object type describes the attributes associated with creating a new registration. It is a synonym for the type previously named `SYS.CHNF$ REG_INFO`.

Syntax

```
TYPE SYS.CHNF$ REG_INFO IS OBJECT (
  callback                VARCHAR2(20),
  qosflags                NUMBER,
  timeout                 NUMBER,
  operations_filter       NUMBER,
  transaction_lag         NUMBER,
  ntfn_grouping_class     NUMBER,
  ntfn_grouping_value     NUMBER,
  ntfn_grouping_type      NUMBER,
  ntfn_grouping_start_time  TIMESTAMP WITH TIME ZONE,
  ntfn_grouping_repeat_count NUMBER);
```

Attributes

Table 49-6 TYPE CQ_NOTIFICATIONS\$ REG_INFO Object Type

Attribute	Description
callback	Name of the server side PL/SQL procedure to be executed on a notification. Prototype is <code><call_backname>(ntfnds IN SYS.chnf\$_desc)</code>
qosflags	Quality of service flags. Can be set to an OR of the following values: <ul style="list-style-type: none"> • <code>QOS_RELIABLE (0x1)</code>: Notifications are reliable (persistent) and survive instance death. This means that on an instance death in an Oracle RAC cluster, surviving instances will be able to deliver any queued invalidations. Similarly, pending invalidations can be delivered on instance restart, in a single instance configuration. The disadvantage is that there is a CPU cost/ latency involved in inserting the invalidation message to a persistent store. If this parameter is false, then server side CPU and latency are minimized, because invalidations are buffered into an in memory queue but the client could lose invalidation messages on an instance shutdown. • <code>QOS_DEREG_NFY (0x2)</code>: The registration will be expunged on the first notification • <code>QOS_ROWIDS (0x4)</code>: The notification needs to include information about the rowids that were modified • <code>QOS_QUERY (0x8)</code>: specifies query result change notification as opposed to object change notification • <code>QOS_BEST_EFFORT (0x10)</code> or <code>QOS_BEST_EFFORT (0x16)</code>: can register simplified versions of queries and minimizes evaluation with some false positives.

Table 49-6 (Cont.) TYPE CQ_NOTIFICATIONS\$ REG_INFO Object Type

Attribute	Description
timeout	<p>If set to a nonzero value, specifies the time in seconds after which the registration is automatically expunged by the database. If zero / NULL, the registration lives until explicitly deregistered. Note that the <code>timeout</code> option can be combined with the purge on notification (<code>QOS_DEREG_NFY</code>) option as well.</p>
operations_filter	<p>if nonzero, specifies a filter to be selectively notified on certain operations. These flags can be used to filter based on specific operation types:</p> <ul style="list-style-type: none"> • 0: Notify on all operations (<code>DBMS_CQ_NOTIFICATION.ALL_OPERATIONS</code>) • 0x2: Notify on every INSERT (<code>DBMS_CQ_NOTIFICATION.INSERTOP</code>) • 0x4: Notify on every UPDATE (<code>DBMS_CQ_NOTIFICATION.UPDATEOP</code>) • 0x8: Notify on every DELETE (<code>DBMS_CQ_NOTIFICATION.DELETEOP</code>) <p>A combination of operations can be specified by using a bitwise OR.</p> <p>Caution: This parameter will be honored for object level registrations but ignored for query result change registrations. To implement notification flow control in 11g, the applications can use the "GROUPING notification" option.</p>
transaction_lag	<p>Lag between consecutive notifications in units of transactions. Can be used to specify the number of transactions/database changes, by which the client is willing to lag behind the database. If 0, it means that the client needs to receive an invalidation message as soon as it is generated.</p> <p>Caution: This parameter will be honored for object level registrations but ignored for query result change notification registrations.</p>
ntfn_grouping_class	<p>When grouping notifications, the class based on which the group is derived. Currently, the only allowed value is <code>DBMS_CQ_NOTIFICATION.NTFN_GROUPING_CLASS_TIME</code> by which notifications are grouped by time.</p>
ntfn_grouping_value	<p>The grouping value. This describes the time interval that defines the group in seconds. For example, if this were set to 900, it would mean that notifications that were generated in each 15 minute interval would be grouped together.</p>
ntfn_grouping_type	<p>The type of grouping desired. It can be one of two allowed values</p> <ul style="list-style-type: none"> • <code>DBMS_CQ_NOTIFICATION.NTFN_GROUPING_TYPE_SUMMARY</code> - all notifications in the group are summarized into a single notification • <code>DBMS_CQ_NOTIFICATION.NTFN_GROUPING_TYPE_LAST</code> - only the last notification in the group is published and the earlier ones discarded

Table 49-6 (Cont.) TYPE CQ_NOTIFICATIONS\$ REG_INFO Object Type

Attribute	Description
ntfn_grouping_start_time	When to start generating notifications. If specified as NULL, it defaults to the current system generated time.
ntfn_grouping_repeat_count	How many times the notification should be repeated. Set this to DBMS_CQ_NOTIFICATION.NTFN_GROUPING_FOREVER to receive notifications for the life time of the registration. Set to a nonzero value if only a certain number of notifications are desired for the life time of the registration.

Usage Notes

- The type declaration incorporates three other alternative constructors. In the first case all other parameters default to their default values.

```
TYPE CQ_NOTIFICATION$ REG_INFO IS OBJECT (
  callback          VARCHAR2(20),
  qosflags          NUMBER,
  timeout           NUMBER);
```

The second option applies to the type constructor defined in a previous release, and which is retained for backward compatibility:

```
TYPE CQ_NOTIFICATION$ REG_INFO IS OBJECT (
  callback          VARCHAR2(20),
  qosflags          NUMBER,
  timeout           NUMBER,
  operations_filter NUMBER,
  transaction_lag   NUMBER);
```

The third definition contains all the members of the type except `transaction_lag` which is being deprecated:

```
TYPE CQ_NOTIFICATION$ REG_INFO IS OBJECT (
  callback          VARCHAR2(20),
  qosflags          NUMBER,
  timeout           NUMBER,
  operations_filter NUMBER,
  ntfn_grouping_class NUMBER,
  ntfn_grouping_value NUMBER,
  ntfn_grouping_type NUMBER,
  ntfn_grouping_start_time  TIMESTAMP WITH TIME ZONE,
  ntfn_grouping_repeat_count NUMBER);
```

- In response to a database change, the server side PL/SQL procedure specified by "callback" is executed. The PL/SQL procedure name has to be specified in the format `schema_name.procedure_name`. The procedure must have the following signature:

```
PROCEDURE <procedure_name>(ntfnds IN SYS.chnf$_desc)
```

CHNF\$_DESC describes the change notification descriptor.

- The `init.ora` parameter `job_queue_processes` must be set to a nonzero value to receive PL/SQL notifications, because the specified procedure is executed inside a job queue process when a notification is generated.

49.7 Summary of DBMS_CQ_NOTIFICATION Subprograms

This table lists the DBMS_CQ_NOTIFICATION subprograms and briefly describes them.

Table 49-7 DBMS_CQ_NOTIFICATION Package Subprograms

Subprogram	Description
CQ_NOTIFICATION_QUERYID Function	Returns the queryid of the most recent query that was attempted to be registered in a registration block
DEREGISTER Procedure	De-subscribes the client with the supplied registration identifier (ID)
ENABLE_REG Procedure	Begins a registration block using an existing registration identifier (ID)
NEW_REG_START Function	Begins a new registration block
REG_END Procedure	Ends the registration boundary
SET_ROWID_THRESHOLD Procedure	Configures the maximum number of rows of a table published in a change notification if the rows of the table are modified in a transaction

49.7.1 CQ_NOTIFICATION_QUERYID Function

This function returns the queryid of the most recent query that was attempted to be registered in a registration block.

Syntax

```
DBMS_CQ_NOTIFICATION.CQ_NOTIFICATION_QUERYID
RETURN NUMBER;
```

Return Values

Returns the queryid of the most recently registered query.

49.7.2 DEREGISTER Procedure

This procedure describes the client with the specified registration identifier (ID).

Syntax

```
DBMS_CQ_NOTIFICATION.DEREGISTER (
    regid IN NUMBER);
```

Parameters

Table 49-8 DEREGISTER Procedure Parameters

Parameter	Description
regid	Client registration ID

Usage Notes

Only the user that created the registration (or the SYS user) will be able to unsubscribe the registration.

49.7.3 ENABLE_REG Procedure

This procedure adds objects to an existing registration identifier (ID).

It is similar to the interface for creating a new registration, except that it takes an existing `regid` to which to add objects. Subsequent execution of queries causes the objects referenced in the queries to be added to the specified `regid`, and the registration is completed on invoking the [REG_END Procedure](#).

Syntax

```
DBMS_CQ_NOTIFICATION.ENABLE_REG (
    regid IN NUMBER);
```

Parameters

Table 49-9 ENABLE_REG Procedure Parameters

Parameter	Description
<code>regid</code>	Client registration ID

Usage Notes

Only the user that created the registration will be able to add further objects to the registration.

49.7.4 NEW_REG_START Function

This procedure begins a new registration block.

Any objects referenced by queries executed within the registration block are considered interesting objects and added to the registration. The registration block ends upon calling the `REG_END` procedure.

Syntax

```
DBMS_CQ_NOTIFICATION.NEW_REG_START (
    regds IN sys.chnf$_reg_info)
RETURN NUMBER;
```

Parameters

Table 49-10 NEW_REG_START Function Parameters

Parameter	Description
<code>sys.chnf\$_reg_info</code>	Registration descriptor describing the notification handler and other properties of the registration

Return Values

The procedure returns a registration-id which is a unique integer assigned by the database to this registration. The registration-id will be echoed back in every notification received for this registration.

Usage Notes

- The only operations permitted inside a registration block are queries (the ones the user wishes to register). DML and DDL operations are not permitted.
- The registration block is a session property and implicitly terminates upon exiting the session. While the registration block is a session property, the registration itself is a persistent database entity. Once created, the registration survives until explicitly deregistered by the client application or timed-out or removed by the database for some other reason (such as loss of privileges).
- The user must have the `CHANGE NOTIFICATION` system privilege and `SELECT` or `READ` privileges on any objects to be registered.
- The `SYS` user will not be permitted to create new registrations.
- Nesting of registration block is not permitted.

49.7.5 REG_END Procedure

This procedure marks the end of the registration block. No newly executed queries are tracked.

Syntax

```
DBMS_CQ_NOTIFICATION.REG_END;
```

49.7.6 SET_ROWID_THRESHOLD Procedure

This procedure configures the maximum number of rows of a table published in a change notification if the rows of the table are modified in a transaction.

Syntax

```
DBMS_CQ_NOTIFICATION.SET_ROWID_THRESHOLD (
  tname      IN  VARCHAR2,
  threshold  IN  NUMBER);
```

Parameters

Table 49-11 SET_ROWID_THRESHOLD Procedure Parameters

Parameter	Description
tname	Table name qualified by the schema name in the form <code>schemaname.tablename</code>
threshold	Maximum number of modified rows of the table to be published in the change notification

Usage Notes

- The table needs to be registered for change notification either at object change granularity or at query result set granularity.
- The threshold set by means of this subprogram applies to that instance only and does not persist across instance startup/shutdown.

DBMS_CREDENTIAL

The `DBMS_CREDENTIAL` package provides an interface for authenticating and impersonating `EXTPROC` callout functions, as well as external jobs, remote jobs and file watchers from the `SCHEDULER`.

See Also:

- *Oracle Database Administrator's Guide* regarding Specifying Job Credentials
- *Oracle Database Security Guide* regarding Guidelines for Securing External Processes

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Operational Notes](#)
- [Summary of DBMS_CREDENTIAL Subprograms](#)

50.1 DBMS_CREDENTIAL Overview

Credentials are database objects that hold a username/password pair for authenticating and impersonating `EXTPROC` callout functions, as well as remote jobs, external jobs and file watchers from the `SCHEDULER`.

They are created using the [CREATE_CREDENTIAL Procedure](#). The procedure also allows you to specify the Windows domain for remote external jobs executed against a Windows server.

50.2 DBMS_CREDENTIAL Security Model

Every Oracle credential has a unique credential name and you can associate a credential through its unique credential name with `EXTPROC` by means of a PL/SQL alias library.

In order to associate a credential with a PL/SQL alias library and external procedure, you must have the `CREATE AND/OR REPLACE LIBRARY` privilege or `CREATE AND/OR REPLACE FUNCTION / PROCEDURE` privilege and read permission of the DLL or shared object that the alias library to be associated with so that you can create and/or replace function or procedure to make use of the alias library.

Once authenticated, `EXTPROC` must act on behalf of the client based on client's identity defined in the supplied user credential. If not authenticated, `EXTPROC` must return an error message.

In order to create or alter a credential, you must have the `CREATE CREDENTIAL` privilege. If you are attempting to create or alter a credential in a schema other than your own, you must have the `CREATE ANY CREDENTIAL` privilege.

50.3 DBMS_CREDENTIAL Operational Notes

As the existing `CREATE OR REPLACE LIBRARY` statement and `CREATE OR REPLACE FUNCTION/PROCEDURE` do not support a `CREDENTIAL` clause, this model requires syntax and semantic changes in `CREATE OR REPLACE LIBRARY` and `CREATE OR REPLACE FUNCTION/PROCEDURE` statements.

For example:

```
CREATE OR REPLACE LIBRARY test
  AS '$ORACLE_HOME/bin/test.so' CREDENTIAL ricky_cred;
CREATE OR REPLACE FUNCTION ftest1
  (x VARCHAR2, y BINARY_INTEGER)
RETURN BINARY_INTEGER
AS LANGUAGE C
LIBRARY test
NAME "negative"
PARAMETERS(x STRING, y INT);
```

The credential name defined in the `CREDENTIAL` clause is a name of a database object. Therefore, do not enclose the credential name with single or double quotes.

An example of a credential being used on an external job:

```
BEGIN
  DBMS_SCHEDULER.CREATE_JOB(
    job_name          => 'example_job',
    job_type          => 'EXECUTABLE',
    job_action        => '/bin/ls',
    credential_name   => 'ricky_cred');
END;
/
```

50.4 Summary of DBMS_CREDENTIAL Subprograms

This table lists the `DBMS_CREDENTIAL` subprograms and briefly describes them.

Table 50-1 DBMS_CREDENTIAL Package Subprograms

Subprogram	Description
CREATE_CREDENTIAL Procedure	Creates a stored username/password pair in a database object called an Oracle credential
DISABLE_CREDENTIAL Procedure	Disables an Oracle credential
DROP_CREDENTIAL Procedure	Drops an Oracle credential
ENABLE_CREDENTIAL Procedure	Enables an Oracle credential
UPDATE_CREDENTIAL Procedure	Updates an existing Oracle credential

50.4.1 CREATE_CREDENTIAL Procedure

This procedure creates a stored username/password pair in a database object called an Oracle credential. You can also use this procedure to manage the credentials used for accessing files stored in cloud object storage.

Syntax

```
DBMS_CREDENTIAL.CREATE_CREDENTIAL (
  credential_name  IN  VARCHAR2,
  username         IN  VARCHAR2,
  password         IN  VARCHAR2,
  database_role    IN  VARCHAR2 DEFAULT NULL,
  windows_domain   IN  VARCHAR2 DEFAULT NULL,
  comments         IN  VARCHAR2 DEFAULT NULL,
  enabled          IN  BOOLEAN DEFAULT TRUE);
```

Parameters

Table 50-2 *CREATE_CREDENTIAL Procedure Parameters*

Parameter	Description
credential_name	Name of the credential. It can optionally be prefixed with a schema. This cannot be set to NULL. It is converted to upper case unless enclosed in double quotes.
username	User name to login to the operating system or remote database to run a job if this credential is chosen. This cannot be set to NULL.
password	Password to login to the remote operating system to run a job if this credential is chosen. It is case sensitive.
database_role	Whether a database job using this credential should attempt to log in with administrative privileges. Values: SYSDBA, SYSDG, SYSADMIN or SYSBACKUP.
windows_domain	For a Windows remote executable target, this is the domain that the specified user belongs to. The domain will be converted to uppercase automatically.
comments	A text string that can be used to describe the credential to the user. The Scheduler does not use this field.
enabled	Determines whether the credential is enabled or not

Usage Notes

- Credentials reside in a particular schema and can be created by any user with the `CREATE CREDENTIAL` or `CREATE ANY CREDENTIAL` system privilege. To create a credential in a schema other than your own, you must have the `CREATE CREDENTIAL` or `CREATE ANY CREDENTIAL` privilege.
- The user name is case sensitive. It cannot contain double quotes or spaces.
- Attempting to create a credential with an existing credential name returns an error. To alter an existing credential, users must drop the existing credential first using the [DROP_CREDENTIAL Procedure](#).

- Attempting to drop an existing credential, which is already referenced by alias libraries, returns an error. To drop an existing credential without any checking, users must set the `force` parameter of [DROP_CREDENTIAL Procedure](#) to `TRUE`.
- You may also alter a credential, by means of the [UPDATE_CREDENTIAL Procedure](#).

Examples

Create a Basic Credential

```
CONN scott
Enter password: password

BEGIN
-- Basic credential.
  DBMS_CREDENTIAL.CREATE_CREDENTIAL(
    credential_name => 'JAMES_SMITH',
    username        => 'james_smith',
    password        => 'password');
END
```

Create a Windows Credential

```
CONN scott
Enter password: password

-- Credential including Windows domain
BEGIN
  DBMS_CREDENTIAL.CREATE_CREDENTIAL(
    credential_name => 'JAMES_SMITH_WIN_CREDENTIAL',
    username        => 'james_smith',
    password        => 'password',
    windows_domain  => 'localdomain');
END
```

Display Information about Credentials

Information about credentials is displayed using the `[DBA|ALL|USER] _CREDENTIALS` views.

```
COLUMN credential_name FORMAT A25
COLUMN username FORMAT A20
COLUMN windows_domain FORMAT A20
SELECT credential_name,
       username,
       windows_domain
FROM   user_credentials
ORDER BY credential_name;
```

CREDENTIAL_NAME	USERNAME	WINDOWS_DOMAIN
JAMES_SMITH_CREDENTIAL	james_smith	
JAMES_SMITH_WIN_CREDENTIAL	james_smith	LOCALDOMAIN

2 rows selected.

SQL>

50.4.2 DISABLE_CREDENTIAL Procedure

This procedure disables an Oracle credential.

Syntax

```
DBMS_CREDENTIAL.DISABLE_CREDENTIAL (  
    credential_name  IN  VARCHAR2,  
    force            IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 50-3 *DISABLE_CREDENTIAL Procedure Parameters*

Parameter	Description
credential_name	Name of the credential. It can optionally be prefixed with a schema. This cannot be set to NULL. It is converted to upper case unless enclosed in double quotes.
force	If FALSE, the credential is not disabled provided it has no dependency on any existing scheduler job or PL/SQL library. An error is returned if the dependency is observed. If TRUE, the credential is disabled whether or not there is any scheduler job or PL/SQL library referencing it.

Usage Notes

- Credentials reside in a particular schema and can be disabled by any user with the `CREATE CREDENTIAL` or `CREATE ANY CREDENTIAL` system privilege. To disable a credential in a schema other than your own, you must have the `CREATE ANY CREDENTIAL` privilege.
- A credential for an OS user can be viewed as an entry point into an operating system as a particular user. Allowing a credential to be disabled lets an administrator (or credential owner) to quickly, easily and reversibly disallow all logins from the database to the OS as a particular user of external jobs, database jobs, file transfers, external procedures, and file watching. To enable an existing disabled credential, you need to use the [ENABLE_CREDENTIAL Procedure](#).
- A library can become invalid if the properties of the credential – windows domain, username, password, its enable/disable bit – are changed.

50.4.3 DROP_CREDENTIAL Procedure

This procedure drops an Oracle credential.

Syntax

```
DBMS_CREDENTIAL.DROP_CREDENTIAL (  
    credential_name  IN  VARCHAR2,  
    force            IN  BOOLEAN DEFAULT FALSE);
```


Parameters

Table 50-4 *DROP_CREDENTIAL Procedure Parameters*

Parameter	Description
credential_name	Name of the credential. It can optionally be prefixed with a schema. This cannot be set to NULL.
force	If set to FALSE, the credential must not be referenced by any EXTPROC alias library or an error is raised. If set to TRUE, the credential is dropped whether or not there are extproc alias libraries referencing it. EXTPROC alias libraries that reference the dropped credential become invalid.

Usage Notes

Only the owner of a credential or a user with the CREATE ANY CREDENTIAL system privilege may drop the credential.

Examples

```
EXEC DBMS_CREDENTIAL.DROP_CREDENTIAL('JAMES_SMITH_CREDENTIAL', FALSE);
EXEC DBMS_CREDENTIAL.DROP_CREDENTIAL('JAMES_SMITH_WIN_CREDENTIAL', FALSE);
```

50.4.4 ENABLE_CREDENTIAL Procedure

This procedure enables an Oracle credential.

Syntax

```
DBMS_CREDENTIAL.ENABLE_CREDENTIAL (
    credential_name IN VARCHAR2);
```

Parameters

Table 50-5 *ENABLE_CREDENTIAL Procedure Parameters*

Parameter	Description
credential_name	Name of the credential. It can optionally be prefixed with a schema. This cannot be set to NULL. It is converted to upper case unless enclosed in double quotes.

Usage Notes

- Credentials reside in a particular schema and can be disabled by any user with the CREATE CREDENTIAL OR CREATE ANY CREDENTIAL system privilege. To disable a credential in a schema other than your own, you must have the CREATE CREDENTIAL OR CREATE ANY CREDENTIAL privilege.
- A credential for an OS user can be viewed as an entry point into an operating system as a particular user. Allowing a credential to be disabled would allow an administrator (or credential owner) to quickly, easily and reversibly disallow all logins from the database to the OS as a particular user (external jobs, file

transfers, external procedures, file watching). To disable an existing credential, you need to use the [DISABLE_CREDENTIAL Procedure](#).

- A library can become invalid if the properties of the credential – windows domain, username, password, its enable/disable bit – are changed.

50.4.5 UPDATE_CREDENTIAL Procedure

This procedure updates an existing Oracle credential.

Syntax

```
DBMS_CREDENTIAL.UPDATE_CREDENTIAL (
  credential_name  IN  VARCHAR2,
  attribute        IN  VARCHAR2,
  value           IN  VARCHAR2);
```

Parameters

Table 50-6 *UPDATE_CREDENTIAL Procedure Parameters*

Parameter	Description
credential_name	Name of the credential. It can optionally be prefixed with a schema. This cannot be set to NULL. It is converted to upper case unless enclosed in double quotation marks.
attribute	Name of attribute to update: USERNAME, PASSWORD, WINDOWS_DOMAIN, DATABASE_ROLE or COMMENTS
value	New value for the selected attribute

Usage Notes

- Credentials reside in a particular schema and can be created by any user with the `CREATE CREDENTIAL` or `CREATE ANY CREDENTIAL` system privilege. To create a credential in a schema other than your own, you must have the `CREATE ANY CREDENTIAL` privilege.
- The user name is case sensitive. It cannot contain double quotes or spaces.
- `EXTPROC` alias libraries that reference the updated credential will become invalid. A library becomes invalid if the properties of the credential – windows domain, username, password, its enable/disable bit – are changed.

Examples

Update a Basic Credential

```
CONN scott
Enter password: password

BEGIN
-- Basic credential.
  DBMS_CREDENTIAL.UPDATE_CREDENTIAL (
    credential_name => 'JAMES_SMITH_CREDENTIAL',
    attribute       => 'password',
    value          => 'password2');

  DBMS_CREDENTIAL.UPDATE_CREDENTIAL (
    credential_name => 'JAMES_SMITH_CREDENTIAL',
```

```

        attribute      => 'username',
        value          => 'james_smith');
END;
```

Update a Windows Credential

```

CONN scott
Enter password: password

-- Credential including Windows domain
BEGIN
  DBMS_CREDENTIAL.UPDATE_CREDENTIAL(
    credential_name => 'JAMES_SMITH_WIN_CREDENTIAL',
    username        => 'james_smith',
    password        => 'password',
    windows_domain  => 'localdomain');
END
```

Display Information about Credentials

Information about credentials is displayed using the [DBA|ALL|USER] _CREDENTIALS views.

```

COLUMN credential_name FORMAT A25
COLUMN username FORMAT A20
COLUMN windows_domain FORMAT A20
SELECT credential_name,
       username,
       windows_domain
FROM   all_credentials
ORDER BY credential_name;
```

CREDENTIAL_NAME	USERNAME	WINDOWS_DOMAIN
JAMES_SMITH_CREDENTIAL	james_smith	
JAMES_SMITH_WIN_CREDENTIAL	james_smith	LOCALDOMAIN

2 rows selected.

SQL>

DBMS_CRYPT

`DBMS_CRYPT` provides an interface to encrypt and decrypt stored data, and can be used in conjunction with PL/SQL programs running network communications. It provides support for several industry-standard encryption and hashing algorithms, including the Advanced Encryption Standard (AES) encryption algorithm. AES has been approved by the National Institute of Standards and Technology (NIST) to replace the Data Encryption Standard (DES).

 **Note:**

- Starting from Oracle Database 23ai Release, the use of the `MD4` algorithm is desupported.
- Starting from Oracle Database 21c Release, the use of the `MD5` and `MD4` algorithms are deprecated.
- Starting from Oracle Database 21c Release, the use of the `SHA-1` algorithm for `SQLNET` and `DBMS_CRYPT` is deprecated.

Oracle recommends that you do not use deprecated values in new applications. Support for deprecated features is for backward compatibility only.

This chapter contains the following topics:

- [DBMS_CRYPT Overview](#)
- [DBMS_CRYPT Security Model](#)
- [DBMS_CRYPT Constants](#)
- [DBMS_CRYPT Datatypes](#)
- [DBMS_CRYPT Algorithms](#)
- [DBMS_CRYPT Restrictions](#)
- [DBMS_CRYPT Exceptions](#)
- [DBMS_CRYPT Operational Notes](#)
- [DBMS_CRYPT Examples](#)
- [Summary of DBMS_CRYPT Subprograms](#)

 **See Also:**

- *Oracle Database Security Guide* for more information about using this package and about encrypting data in general.

51.1 DBMS_CRYPTO Overview

DBMS_CRYPTO contains basic cryptographic functions and procedures. To use this package correctly and securely, a general level of security expertise is assumed.

The DBMS_CRYPTO package enables encryption and decryption for common Oracle datatypes, including RAW and large objects (LOBs), such as images and sound. Specifically, it supports BLOBS and CLOBs. In addition, it provides Globalization Support for encrypting data across different database character sets. It also supports asymmetric key functions.

The following cryptographic algorithms are supported:

- Data Encryption Standard (DES), Triple DES (3DES, 2-key and 3-key) (deprecated)
- Advanced Encryption Standard (AES)
- MD5 (deprecated), SHA-1 (deprecated), and SHA-2 and SHA-3 cryptographic hashes
- MD5, SHA-1, and SHA-2 and SHA-3 Message Authentication Code (MAC), SHA-3 KMACXOF
- SM2, SM3, SM4 (SM stands for ShangMi)

Block cipher modifiers are also provided with DBMS_CRYPTO. You can choose from several padding options, including PKCS (Public Key Cryptographic Standard) #5, and from six block cipher chaining modes, including Cipher Block Chaining (CBC).

Table 51-1 summarizes the DBMS_CRYPTO package features.

Table 51-1 DBMS_CRYPTO Features

Package Feature	DBMS_CRYPTO
Cryptographic algorithms	DES, 3DES, AES, 3DES_2KEY, SM4
PKENCRYPT and PKDECRYPT algorithm	PKENCRYPT_RSA_PKCS1_OAEP_SHA2, SM4
Padding forms	PAD_PKCS5 (PKCS5 padding), PAD_ZERO (zeroes padding) PAD_NONE (no padding), PAD_ORCL (Oracle padding)
Block cipher chaining modes	CBC, CFB, ECB, OFB, GCM, CCM, XTS
Cryptographic hash algorithms	MD5, SHA-1, SHA-2 (SHA-256, SHA-384, SHA-512), SM3, (MD5 and SHA-1 are deprecated; MD4 is desupported) HASH_SHAKE128, HASH_SHAKE256
Keyed hash (MAC) algorithms	HMAC_MD5, HMAC_SH1, HMAC_SH256, HMAC_SH384, HMAC_SH512, HMAC_SHA3_224, HMAC_SHA3_256, HMAC_SHA3_384, HMAC_SHA3_512
Keccak MAC algorithms	KMACXOF_128, KMACXOF_256
Cryptographic pseudo-random number generator	RAW, NUMBER, BINARY_INTEGER
Database types	RAW, CLOB, BLOB

The DBMS_CRYPTO package replaces DBMS_OBFUSCATION_TOOLKIT, providing greater ease of use and support for a range of algorithms to accommodate new and existing

systems. Specifically, `3DES_2KEY` are provided for backward compatibility. It is not recommended that you use these algorithms because they do not provide the same level of security as provided by 3DES, AES, MD5, SHA-1, or SHA-2.

51.2 DBMS_CRYPT Security Model

Oracle Database installs this package in the `SYS` schema. You can then grant package access to existing users and roles as needed.

51.3 DBMS_CRYPT Constants

The `DBMS_CRYPT` package uses the constants listed and described in this topic.

Table 51-2 DBMS_CRYPT Constants

Name	Type	Value	Description
<code>AES_CCM_NONE</code>	<code>PLS_INTEGER</code>	<code>ENCRYPT_AES</code> <code>+ CHAIN_CCM</code> <code>+ PAD_NONE</code>	<p>If you are using <code>DBMS_CRYPT</code> to encrypt a plaintext with AES algorithm in CCM mode, then set the <code>typ</code> argument of <code>DBMS_CRYPT.ENCRYPT</code> to the value <code>AES_CCM_NONE</code> to ensure that padding is disabled, because CCM mode cannot be used together with padding. Provide one extra input AAD (Additional Authenticated Data, optional) and one extra output TAG (non-optional). For example:</p> <pre> ciphertext := dbms_crypto.encrypt (src => plaintext, typ => DBMS_CRYPT.AES_CCM_NONE , key => key_information, iv => iv_information, aad => aad_information, tag); plaintext := dbms_crypto.decrypt (src => ciphertext, typ => DBMS_CRYPT.AES_CCM_NONE , key => key_information, iv => iv_information, aad => aad_information, tag=> tag_information); </pre>

Table 51-2 (Cont.) DBMS_CRYPTO Constants

Name	Type	Value	Description
AES_GCM_NONE	PLS_INTEGER	ENCRYPT_AES + CHAIN_GCM + PAD_NONE	<p>If you are using DBMS_CRYPTO to encrypt a plaintext with AES algorithm in GCM mode, then set the <code>typ</code> argument of DBMS_CRYPTO.ENCRYPT to the value AES_GCM_NONE to ensure that padding is disabled, because GCM mode cannot be used together with padding. Provide one extra input AAD (Additional Authenticated Data, optional) and one extra output TAG (non-optional). For example:</p> <pre> ciphertext := dbms_crypto.encrypt (src => plaintext, typ => DBMS_CRYPTO.AES_GCM_NONE , key => key_information, iv => iv_information, aad => aad_information, tag); plaintext := dbms_crypto.decrypt (src => ciphertext, typ => DBMS_CRYPTO.AES_GCM_NONE , key => key_information, iv => iv_information, aad => aad_information, tag=> tag_information); </pre>
AES_XTS_NONE	PLS_INTEGER	ENCRYPT_AES + CHAIN_XTS + PAD_NONE	<p>Constant for AES encryption algorithm in XTS mode. You can use this constant with DBMS_CRYPTO.ENCRYPT. To use AES with XTS mode, the input must be at least one full block (16 bytes).</p>
DES3_CBC_NONE	PLS_INTEGER	ENCRYPT_3DES + CHAIN_CBC + PAD_NONE	<p>If you are using DBMS_CRYPTO to decipher a triple-DES ciphertext that you created in the past using the desupported DBMS_OBFUSCATION_TOOLKIT, then set the <code>typ</code> argument of DBMS_CRYPTO.decrypt to the value DBMS_CRYPTO.DES3_CBC_NONE to ensure that the PKCS#5 padding is disabled. For example:</p> <pre> plaintext := DBMS_CRYPTO.decrypt (src => ciphertext_from_legacy_DES3Encrypt ,typ => DBMS_CRYPTO.DES3_CBC_NONE ,key => key_information ,iv => hexoraw(DBMS_CRYPTO.LEGACY_DEFAULT_IV)); </pre>
AES_CBC_PKCS5	PLS_INTEGER	ENCRYPT_AES + CHAIN_CBC + PAD_PKCS5	<p>Constant for AES encryption algorithm in CBC mode and PKCS5 padding. You can use this constant with DBMS_CRYPTO.ENCRYPT.</p>

Table 51-2 (Cont.) DBMS_CRYPTO Constants

Name	Type	Value	Description
LEGACY_DEFAULT_IV	VARCHAR2 (16)	0123456789ABCDEF	If you did not provide the IV argument when creating a triple-DES ciphertext using the desupported DBMS_OBFUSCATION_TOOLKIT, then provide IV as hexoraw(DBMS_CRYPTO.LEGACY_DEFAULT_IV) when invoking DBMS_CRYPTO to decrypt the triple-DES ciphertext. For example: <pre>plaintext := DBMS_CRYPTO.decrypt (src => ciphertext_from_legacy_DES3Encrypt ,typ => DBMS_CRYPTO.DES3_CBC_NONE ,key => key_information ,iv => hexoraw(dbms_crypto.LEGACY_DEFAULT_IV));</pre>
SM4_CFB_NONE	PLS_INTEGER	ENCRYPT_SM4 + CHAIN_CFB + PAD_NONE	Cipher suite for the SM4 encryption algorithm in Ciphertext Feedback (CFB) mode. You can only use CFB mode with no padding mode PAD_NONE.
SM4_OFB_NONE	PLS_INTEGER	ENCRYPT_SM4 + CHAIN_OFB + PAD_NONE	Cipher suite for the SM4 encryption algorithm in Output Feedback (OFB) mode. You can only use OFB mode with no padding mode PAD_NONE.

51.4 DBMS_CRYPTO Datatypes

Parameters for the DBMS_CRYPTO subprograms use these datatypes.

Table 51-3 DBMS_CRYPTO Datatypes

Type	Description
BLOB	A source or destination binary LOB
CLOB	A source or destination character LOB (excluding NCLOB)
PLS_INTEGER	Specifies a cryptographic algorithm type (used with BLOB, CLOB, and RAW datatypes)
RAW	A source or destination RAW buffer

51.5 DBMS_CRYPTO Algorithms

The DBMS_CRYPTO package contains predefined cryptographic algorithms, modifiers, and cipher suites.

These are shown in the following tables.

Table 51-4 DBMS_CRYPTO Cryptographic Hash Functions

Name	Description
HASH_MD5	Produces a 128-bit hash, but is more complex than MD4 (which is desupported). Note that MD5 is deprecated.
HASH_SH1	Secure Hash Algorithm (SHA-1) (deprecated). Produces a 160-bit hash.
HASH_SH256	SHA-2, produces a 256-bit hash.
HASH_SH384	SHA-2, produces a 384-bit hash.
HASH_SH512	SHA-2, produces a 512-bit hash.
HASH_SHA3_224	SHA-3, produces a 224-bit hash.
HASH_SHA3_256	SHA-3, produces a 256-bit hash.
HASH_SHA3_384	SHA-3, produces a 384-bit hash.
HASH_SHA3_512	SHA-3, produces a 512-bit hash.
HASH_SHAKE128	Produces variable length hash with 128-bit security level; used for the DBMS_CRYPTO.HASH_LEN only.
HASH_SHAKE256	Produces variable length hash with 256-bit security level; used for the DBMS_CRYPTO.HASH_LEN only.
HASH_SM3	Produces a 256-bit hash

Table 51-5 DBMS_CRYPTO MAC (Message Authentication Code) Functions

Name	Description
HMAC_MD5 (deprecated)	Same as MD5 (deprecated) hash function, except it requires a secret key to verify the hash value.
HMAC_SH1 (deprecated)	Same as SHA hash function, except it requires a secret key to verify the hash value. Complies with IETF RFC 2104 standard.
HMAC_SH256	Same as SHA-2 256-bit hash function, except it requires a secret key to verify the hash value.
HMAC_SH384	Same as SHA-2 384-bit hash function, except it requires a secret key to verify the hash value.
HMAC_SH512	Same as SHA-2 512-bit hash function, except it requires a secret key to verify the hash value.
HMAC_SHA3_224	Same as SHA-3 224-bit hash function, except it requires a secret key to verify the hash value.
HMAC_SHA3_256	Same as SHA-3 256-bit hash function, except it requires a secret key to verify the hash value.
HMAC_SHA3_384	Same as SHA-3 384-bit hash function, except it requires a secret key to verify the hash value.
HMAC_SHA3_512	Same as SHA-3 512-bit hash function, except it requires a secret key to verify the hash value.

Table 51-6 DBMS_CRYPTO KMACXOF Functions

Name	Description
KMACXOF_128	Variable length KMAC with 128-bit security level. KMAC stands for KECCAK Message Authentication Code.
KMACXOF_256	Variable length KMAC with 256-bit security level.

Table 51-7 DBMS_CRYPTO Encryption Algorithms

Name	Description
ENCRYPT_DES (deprecated)	Data Encryption Standard. Block cipher. Uses key length of 56 bits.
ENCRYPT_3DES_2KEY (deprecated)	Data Encryption Standard. Block cipher. Operates on a block 3 times with 2 keys. Effective key length of 112 bits.
ENCRYPT_3DES (deprecated)	Data Encryption Standard. Block cipher. Operates on a block 3 times.
ENCRYPT_AES128	Advanced Encryption Standard. Block cipher. Uses 128-bit key size.
ENCRYPT_AES192	Advanced Encryption Standard. Block cipher. Uses 192-bit key size.
ENCRYPT_AES256	Advanced Encryption Standard. Block cipher. Uses 256-bit key size.
PKENCRYPT_RSA_PKCS1_OAEP (deprecated)	Public key encryption algorithm; only allowed for decryption.
PKENCRYPT_RSA_PKCS1_OAEP_SHA2	Public key encryption algorithm.
PKENCRYPT_SM2	Provides Chinese SM2 signature and encryption algorithm support
ENCRYPT_SM4	Block cipher used in the Chinese National Standard for Wireless LAN WAPI (WLAN Authentication and Privacy Infrastructure) and also used with Transport Layer Security

Table 51-8 DBMS_CRYPTO Block Cipher Suites

Name	Description
AES_CBC_PKCS5	ENCRYPT_AES + CHAIN_CBC + PAD_PKCS5
AES_CCM_NONE	ENCRYPT_AES + CHAIN_GCM + PAD_NONE
AES_GCM_NONE	ENCRYPT_AES + CHAIN_CCM + PAD_NONE
AES_XTS_NONE	ENCRYPT_AES + CHAIN_XTS + PAD_NONE
DES_CBC_PKCS5	ENCRYPT_DES ¹ + CHAIN_CBC ² + PAD_PKCS5 ³
DES3_CBC_PKCS5	ENCRYPT_3DES ¹ + CHAIN_CBC ² + PAD_PKCS5 ³

¹ See [Table 51-7](#)

² See [Table 51-9](#)

³ See [Table 51-10](#)

Table 51-9 DBMS_CRYPTO Block Cipher Chaining Modifiers

Name	Description
CHAIN_CBC	Cipher Block Chaining. Plaintext is XORed with the previous ciphertext block before it is encrypted.
CHAIN_CCM	The Counter with CBC-MAC (CCM) mode. It is a generic authenticated encryption block cipher mode. It can be used with AES (AES_CCM_NONE). The encryption of AES_CCM_NONE takes one extra input AAD (Additional Authenticated Data, optional) and one extra output TAG (non-optional). The decryption of AES_CCM_NONE takes two extra inputs AAD and TAG.
CHAIN_CFB	Cipher-Feedback. Enables encrypting units of data smaller than the block size.
CHAIN_ECB	Electronic Codebook. Encrypts each plaintext block independently.
CHAIN_GCM	The Galois/Counter Mode. It is a generic authenticated encryption block cipher mode. It can be used with AES (AES_GCM_NONE). The encryption of AES_GCM_NONE takes one extra input AAD (Additional Authenticated Data, optional) and one extra output TAG (non-optional). The decryption of AES_GCM_NONE takes two extra inputs AAD and TAG.
CHAIN_OFB	Output-Feedback. Enables running a block cipher as a synchronous stream cipher. Similar to CFB, except that <i>n</i> bits of the previous output block are moved into the right-most positions of the data queue waiting to be encrypted.
CHAIN_XTS	XEX-based modified-codebook mode with ciphertext stealing (XTS), a chain mode for AES. It can be used with the AES algorithm in DBMS_CRYPTO and PAD_NONE

Table 51-10 DBMS_CRYPTO Block Cipher Padding Modifiers

Name	Description
PAD_NONE	Provides option to specify no padding. Caller must ensure that blocksize is correct, else the package returns an error.
PAD_ORCL	Provides padding that adds a single byte containing the pad length to the end of the crypto vector.
PAD_ZERO	Provides padding consisting of zeroes

51.6 DBMS_CRYPTO Restrictions

The `VARCHAR2` datatype is not directly supported by `DBMS_CRYPTO`. Before you can perform cryptographic operations on data of the type `VARCHAR2`, you must convert it to the uniform database character set `AL32UTF8`, and then convert it to the `RAW` datatype.

After performing these conversions, you can then encrypt it with the `DBMS_CRYPT0` package.



See Also:

[DBMS_CRYPT0 Operational Notes](#) for information about the conversion rules for converting datatypes.

[DBMS_CRYPT0 Examples](#) for examples of using the call to `UTL_I18N.STRING_TO_RAW` to allow `VARCHAR2` to be encrypted.

51.7 DBMS_CRYPT0 Exceptions

The following table lists exceptions that have been defined for `DBMS_CRYPT0`.

Table 51-11 DBMS_CRYPT0 Exceptions

Exception	Code	Description
<code>CipherSuiteInvalid</code>	28827	The specified cipher suite is not defined.
<code>CipherSuiteNull</code>	28829	No value has been specified for the cipher suite to be used.
<code>KeyNull</code>	28239	The encryption key has not been specified or contains a <code>NULL</code> value.
<code>KeyBadSize</code>	28234	DES keys: Specified key size is too short. DES keys must be at least 8 bytes (64 bits). AES keys: Specified key size is not supported. AES keys must be 128, 192, or 256 bits in length.
<code>DoubleEncryption</code>	28233	Source data was previously encrypted.

51.8 DBMS_CRYPT0 Operational Notes

This section describes several `DBMS_CRYPT0` operational notes.

- When to Use Encrypt and Decrypt Procedures or Functions
- When to Use Hash or Message Authentication Code (MAC) Functions
- About Generating and Storing Encryption Keys
- Conversion Rules

When to Use Encrypt and Decrypt Procedures or Functions

This package includes both `ENCRYPT` and `DECRYPT` procedures and functions. The procedures are used to encrypt or decrypt `LOB` datatypes (overloaded for `CLOB` and `BLOB` datatypes). In contrast, the `ENCRYPT` and `DECRYPT` functions are used to encrypt and decrypt `RAW` datatypes. Data of type `VARCHAR2` must be converted to `RAW` before you can use `DBMS_CRYPT0` functions to encrypt it.

When to Use Hash or Message Authentication Code (MAC) Functions

This package includes two different types of one-way hash functions: the `HASH` function and the `MAC` function. Hash functions operate on an arbitrary-length input message, and return a fixed-length hash value. One-way hash functions work in one direction only. It is easy to compute a hash value from an input message, but it is extremely difficult to generate an input message that hashes to a particular value. Note that hash values should be at least 256 bits in length to be considered secure.

You can use hash values to verify whether data has been altered. For example, before storing data, the user runs `DBMS_CRYPTO.HASH` against the stored data to create a hash value. On returning the stored data, the user can again run the hash function against it, using the same algorithm. If the second hash value is identical to the first one, then the data has not been altered. Hash values are similar to "file fingerprints" and are used to ensure data integrity.

The `HASH` function included with `DBMS_CRYPTO`, is a one-way hash function that you can use to generate a hash value from either `RAW` or `LOB` data. The `MAC` function is also a one-way hash function, but with the addition of a secret key. It works the same way as the `DBMS_CRYPTO.HASH` function, except only someone with the key can verify the hash value.

MACs can be used to authenticate files between users. They can also be used by a single user to determine if her files have been altered, perhaps by a virus. A user could compute the MAC of his files and store that value in a table. If the user did not use a MAC function, then the virus could compute the new hash value after infection and replace the table entry. A virus cannot do that with a MAC because the virus does not know the key.

About Generating and Storing Encryption Keys

The `DBMS_CRYPTO` package can generate random material for encryption keys, but it does not provide a mechanism for maintaining them. Application developers must take care to ensure that the encryption keys used with this package are securely generated and stored. Also note that the encryption and decryption operations performed by `DBMS_CRYPTO` occur on the server, not on the client. Consequently, if the key is sent over the connection between the client and the server, the connection must be protected by using network encryption. Otherwise, the key is vulnerable to capture over the wire.

Although `DBMS_CRYPTO` cannot generate keys on its own, it does provide tools you can use to aid in key generation. For example, you can use the `RANDOMBYTES` function to generate random material for keys.

When generating encryption keys for DES, it is important to remember that some numbers are considered weak and semiweak keys. Keys are considered weak or semiweak when the pattern of the algorithm combines with the pattern of the initial key value to produce ciphertext that is more susceptible to cryptanalysis. To avoid this, filter out the known weak DES keys. Lists of the known weak and semiweak DES keys are available on several public Internet sites.

 **See Also:**

- *Oracle Database Security Guide* for information about configuring network encryption and SSL
- [RANDOMBYTES Function](#)

Conversion Rules

- To convert `VARCHAR2` to `RAW`, use the `UTL_I18N.STRING_TO_RAW` function to perform the following steps:
 1. Convert `VARCHAR2` in the current database character set to `VARCHAR2` in the `AL32UTF8` database character.
 2. Convert `VARCHAR2` in the `AL32UTF8` database character set to `RAW`.

Syntax example:

```
UTL_I18N.STRING_TO_RAW (string, 'AL32UTF8');
```

- To convert `RAW` to `VARCHAR2`, use the `UTL_I18N.RAW_TO_CHAR` function to perform the following steps:
 1. Convert `RAW` to `VARCHAR2` in the `AL32UTF8` database character set.
 2. Convert `VARCHAR2` in the `AL32UTF8` database character set to `VARCHAR2` in the database character set you wish to use.

Syntax example:

```
UTL_I18N.RAW_TO_CHAR (data, 'AL32UTF8');
```

 **See Also:**

[UTL_I18N](#) for information about using the `UTL_I18N` PL/SQL package.

- If you want to store encrypted data of the `RAW` datatype in a `VARCHAR2` database column, then use `RAWTOHEX` or `UTL_ENCODE.BASE64_ENCODE` to make it suitable for `VARCHAR2` storage. These functions expand data size by 2 and 4/3, respectively.

51.9 DBMS_CRYPTO Examples

The examples in this section demonstrate different types of PL/SQL coding using `DBMS_CRYPTO` functions.

Example 1: AES Encryption with Cipher Block Chaining and PKCS#5 Compliant Padding

This example shows PL/SQL block encrypting and decrypting pre-defined `input_string` using 256-bit AES algorithm with Cipher Block Chaining and PKCS#5 compliant padding.

```
DECLARE
  input_string    VARCHAR2 (200) := 'Secret Message';
  output_string   VARCHAR2 (200);
```

```

encrypted_raw      RAW (2000);          -- stores encrypted binary text
decrypted_raw      RAW (2000);          -- stores decrypted binary text
num_key_bytes      NUMBER := 256/8;    -- key length 256 bits (32 bytes)
key_bytes_raw      RAW (32);           -- stores 256-bit encryption key
encryption_type    PLS_INTEGER :=      -- total encryption type

                                DBMS_CRYPTO.ENCRYPT_AES256
                                + DBMS_CRYPTO.CHAIN_CBC
                                + DBMS_CRYPTO.PAD_PKCS5;

iv_raw             RAW (16);

BEGIN
  DBMS_OUTPUT.PUT_LINE ( 'Original string: ' || input_string);
  key_bytes_raw := DBMS_CRYPTO.RANDOMBYTES (num_key_bytes);
  iv_raw        := DBMS_CRYPTO.RANDOMBYTES (16);
  encrypted_raw := DBMS_CRYPTO.ENCRYPT
  (
    src => UTL_I18N.STRING_TO_RAW (input_string, 'AL32UTF8'),
    typ => encryption_type,
    key => key_bytes_raw,
    iv  => iv_raw
  );

  -- The encrypted value "encrypted_raw" can be used here

  decrypted_raw := DBMS_CRYPTO.DECRYPT
  (
    src => encrypted_raw,
    typ => encryption_type,
    key => key_bytes_raw,
    iv  => iv_raw
  );

  output_string := UTL_I18N.RAW_TO_CHAR (decrypted_raw, 'AL32UTF8');

  DBMS_OUTPUT.PUT_LINE ('Decrypted string: ' || output_string);
END;
```

Example 2: PKENCRYPTION and PKDECRYPTION Functions

```

DECLARE
  ip_str    VARCHAR (200) := 'Secret Message';
  op_str    VARCHAR (200);
  -- Use OpenSSL to generate the private and public key (2048 bit RSA key)
  -- openssl genrsa -out private.pem 2048
  -- openssl rsa -in private.pem -outform PEM -pubout -out public.pem
  pubkey    VARCHAR (2000) := 'public_key';
  prvkey    VARCHAR (2000) := 'private_key';
  enc_raw   RAW (2000);
  dec_raw   RAW (2000);
  eType     PLS_INTEGER := DBMS_CRYPTO.PKENCRYPT_RSA_PKCS1_OAEP_SHA2;
  kType     PLS_INTEGER := DBMS_CRYPTO.KEY_TYPE_RSA;

BEGIN

  DBMS_OUTPUT.PUT_LINE('-----');
  DBMS_OUTPUT.PUT_LINE('Original String := ' || ip_str);
  DBMS_OUTPUT.PUT_LINE('-----');
  enc_raw:= DBMS_CRYPTO.PKENCRYPT
  (
```

```

    src          => UTL_I18N.STRING_TO_RAW(ip_str,'AL32UTF8'),
    pub_key      => UTL_I18N.STRING_TO_RAW( pubkey, 'AL32UTF8'),
    pubkey_alg  => kType,
    enc_alg     => eType
);

dec_raw := DBMS_CRYPTO.PKDECRYPT
(
    src          => enc_raw,
    prv_key      => UTL_I18N.STRING_TO_RAW( prvkey, 'AL32UTF8'),
    pubkey_alg  => kType,
    enc_alg     => eType
);
op_str := UTL_I18N.RAW_TO_CHAR(dec_raw,'AL32UTF8');
dbms_output.put_line('-----');
dbms_output.put_line('Decrypted String := ' || op_str);
dbms_output.put_line('-----');
end;
/

```

Example 3: SIGN and VERIFY Functions

```

DECLARE
    ip_str      VARCHAR2 (200) := 'Secret Message';
    -- Use OpenSSL to generate the private and public key (2048 bit RSA key)
    -- openssl genrsa -out private.pem 2048
    -- openssl rsa -in private.pem -outform PEM -pubout -out public.pem
    pubkey     VARCHAR (2000) := 'public_key';
    prvkey     VARCHAR (2000) := 'private_key';
    sign_raw   RAW (2000);
    returnval  BOOLEAN := false;
    sType      PLS_INTEGER := DBMS_CRYPTO.SIGN_SHA224_RSA;
    kType      PLS_INTEGER := DBMS_CRYPTO.KEY_TYPE_RSA;
BEGIN
    sign_raw := DBMS_CRYPTO.SIGN
    (
        src          => UTL_I18N.STRING_TO_RAW(ip_str,'AL32UTF8'),
        prv key      => UTL_I18N.STRING_TO_RAW( prvkey, 'AL32UTF8'),
        pubkey_alg  => kType,
        sign_alg    => sType
    );
    returnval := DBMS_CRYPTO.VERIFY
    (
        src          => UTL_I18N.STRING_TO_RAW( ip_str,'AL32UTF8'),
        sign         => sign_raw,
        pub_key      => UTL_I18N.STRING_TO_RAW( pubkey, 'AL32UTF8'),
        pubkey_alg  => kType,
        sign_alg    => sType
    );
    DBMS_OUTPUT.PUT_LINE('-----');
    IF returnval THEN
        DBMS_OUTPUT.PUT_LINE('True');
    ELSE
        DBMS_OUTPUT.PUT_LINE('False');
    END IF;
    DBMS_OUTPUT.PUT_LINE('-----');
END;
/

```


Example 4: HASH_SHA3_256 and HASH_SHAKE256 Hash Functions

```
DECLARE
  ip_str VARCHAR2 (200) := 'Secret Message';
  output_string VARCHAR2 (2000);
  source_text_raw RAW (2000);
  hash_raw RAW (2000);
BEGIN
  source_text_raw := UTL_I18N.STRING_TO_RAW(ip_str,'AL32UTF8');
  hash_raw := dbms_crypto.hash(source_text_raw, dbms_crypto.hash_sha3_256);

  output_string := RAWTOHEX(hash_raw);

  DBMS_OUTPUT.PUT_LINE ('Hash string: ' || output_string);
  DBMS_OUTPUT.PUT_LINE (utl_raw.length(hash_raw));
END;
/
```

HASH_SHAKE256:

```
DECLARE
  ip_str VARCHAR2 (200) := 'Secret Message';
  output_string VARCHAR2 (2000);
  source_text_raw RAW (2000);
  hash_raw RAW (2000);
  len PLS_INTEGER := 30;
BEGIN
  source_text_raw := UTL_I18N.STRING_TO_RAW(ip_str,'AL32UTF8');
  hash_raw := dbms_crypto.hash_len(source_text_raw, dbms_crypto.hash_shake256,
  len);

  output_string := RAWTOHEX(hash_raw);

  DBMS_OUTPUT.PUT_LINE ('Hash string: ' || output_string);
END;
/
```

Example 5: HMAC_SHA3_256 and SIGN_SHA3_256_RSA Functions

```
DECLARE
  ip_str VARCHAR2 (200) := 'Secret Message';
  output_string VARCHAR2 (2000);
  source_text_raw RAW (2000);
  hmac_raw RAW (2000);
  testkey RAW (2000);
BEGIN
  source_text_raw := UTL_I18N.STRING_TO_RAW(ip_str,'AL32UTF8');
  -- Use your test key
  testkey := HEXTORAW('');
  hmac_raw := dbms_crypto.mac(source_text_raw, dbms_crypto.HMAC_SHA3_256,
  testkey);

  output_string := RAWTOHEX(hmac_raw);

  DBMS_OUTPUT.PUT_LINE ('Hmac string: ' || output_string);
END;
/
```

SIGN_SHA3_256_RSA:

```

DECLARE
  ip_str VARCHAR2 (200) := 'Secret Message';
  -- Use OpenSSL to generate the private and public key (2048 bit RSA key)
  -- openssl genrsa -out private.pem 2048
  -- openssl rsa -in private.pem -outform PEM -pubout -out public.pem
  pubkey VARCHAR (2000) := 'public_key';
  prvkey VARCHAR (2000) := 'private_key';
  sign_raw RAW (2000);
  returnval BOOLEAN := false;
  sType PLS_INTEGER := DBMS_CRYPT0.SIGN_SHA3_256_RSA;
  kType PLS_INTEGER := DBMS_CRYPT0.KEY_TYPE_RSA;
BEGIN
  sign_raw := DBMS_CRYPT0.SIGN
  (
    src => UTL_I18N.STRING_TO_RAW(ip_str,'AL32UTF8'),
    prv_key => UTL_I18N.STRING_TO_RAW( prvkey, 'AL32UTF8'),
    pubkey_alg => kType,
    sign_alg => sType
  );
  returnval := DBMS_CRYPT0.VERIFY
  (
    src => UTL_I18N.STRING_TO_RAW( ip_str,'AL32UTF8'),
    sign => sign_raw,
    pub_key => UTL_I18N.STRING_TO_RAW( pubkey, 'AL32UTF8'),
    pubkey_alg => kType,
    sign_alg => sType
  );
  DBMS_OUTPUT.PUT_LINE('-----');
  IF returnval THEN
    DBMS_OUTPUT.PUT_LINE('True');
  ELSE
    DBMS_OUTPUT.PUT_LINE('False');
  END IF;
  DBMS_OUTPUT.PUT_LINE('-----');
END;
/

```

51.10 Summary of DBMS_CRYPT0 Subprograms

This table lists the DBMS_CRYPT0 subprograms in alphabetical order and briefly describes them.

Table 51-12 DBMS_CRYPT0 Package Subprograms

Subprogram	Description
DECRYPT Function	Decrypts RAW data using a stream or block cipher with a user supplied key and optional IV (initialization vector)
DECRYPT Procedures	Decrypts LOB data using a stream or block cipher with a user supplied key and optional IV
ECDHDERIVE_SHAREDSECS ECRET Function	Derives shared secret using private key of local application and public key from the remote application
ECDH_GENKEYPAIR Function	Generates an EC public/private key pair
ENCRYPT Function	Encrypts RAW data using a stream or block cipher with a user supplied key and optional IV

Table 51-12 (Cont.) DBMS_CRYPTO Package Subprograms



Subprogram	Description
ENCRYPT Procedures	Encrypts LOB data using a stream or block cipher with a user supplied key and optional IV
HASH Function	Applies one of the supported cryptographic hash algorithms (MD5, SHA-1, or SHA-2) to data.
<div style="border: 1px solid #0070C0; padding: 10px; background-color: #E6F2FF;"> <p> Note:</p> <p>Starting from Oracle Database 20c Release, the use of MD5 and SHA-1 are deprecated. MD4 is desupported. Oracle recommends that you do not use deprecated values in new applications. Support for deprecated features is for backward compatibility only.</p> </div>	
HASH_LEN Function	Similar to the HASH function, except that it includes an extra input length that uses the PLS_INTEGER type
MAC Function	Applies Message Authentication Code algorithms (MD5, SHA-1, or SHA-2) to data to provide keyed message protection.
<div style="border: 1px solid #0070C0; padding: 10px; background-color: #E6F2FF;"> <p> Note:</p> <p>Starting from Oracle Database 20c Release, the use of MD5 and SHA-1 are deprecated. Oracle recommends that you do not use deprecated values in new applications. Support for deprecated features is for backward compatibility only.</p> </div>	
KMACXOF Function	Similar to the MAC function, except that is includes the length and custStr fields.
PKDECRYPT Function	Decrypts RAW data using a private key assisted with key algorithm and encryption algorithm and returns decrypted data.
PKENCRYPT Function	Encrypts RAW data using a public key assisted with key algorithm and encryption algorithm and returns encrypted data
RANDOMBYTES Function	Returns a RAW value containing a cryptographically secure pseudo-random sequence of bytes, and can be used to generate random material for encryption keys
RANDOMINTEGER Function	Returns a random BINARY_INTEGER
RANDOMNUMBER Function	Returns a random 128-bit integer of the NUMBER datatype
SIGN Function	Signs RAW data using a private key assisted with key algorithm and sign algorithm, and returns a signature

Table 51-12 (Cont.) DBMS_CRYPTO Package Subprograms

Subprogram	Description
VERIFY Function	Verifies RAW data using the signature, public key assisted with key algorithm, and sign algorithm. It returns TRUE if the signature was verified

51.10.1 DECRYPT Functions

These functions decrypt RAW data using a stream or block cipher with a user-supplied key and optional IV (initialization vector).

Syntax

```
DBMS_CRYPTO.DECRYPT (
  src IN RAW,
  typ IN PLS_INTEGER,
  key IN RAW,
  iv IN RAW DEFAULT NULL)
RETURN RAW;
```

```
DBMS_CRYPTO.DECRYPT (
  src IN RAW,
  typ IN PLS_INTEGER,
  key IN RAW,
  iv IN RAW DEFAULT NULL,
  aad IN RAW DEFAULT NULL,
  tag IN RAW)
RETURN RAW;
```

Pragmas

```
pragma restrict_references (decrypt, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 51-13 DECRYPT Function Parameters

Parameter Name	Description
src	RAW data to be decrypted.
typ	Stream or block cipher type and modifiers to be used.
key	Key to be used for decryption.
iv	Optional initialization vector for block ciphers. Default is NULL.
aad	Additional authenticated data, which is any string that you pass to an Oracle Cloud key management service as part of the request.
tag	Authentication tag that is used for the authentication check.

Usage Notes

- To retrieve original plaintext data, DECRYPT must be called with the same cipher, modifiers, key, and IV that was used to encrypt the data originally.

 **See Also:**

"Usage Notes" for the `ENCRYPT` function for additional information about the ciphers and modifiers available with this package.

- If `VARCHAR2` data is converted to `RAW` before encryption, then it must be converted back to the appropriate database character set by using the `UTL_I18N` package.

 **See Also:**

[DBMS_CRYPTO Operational Notes](#) for a discussion of the `VARCHAR2` to `RAW` conversion rules

51.10.2 DECRYPT Procedures

These procedures decrypt `LOB` data using a stream or block cipher with a user supplied key and optional IV (initialization vector).

Syntax

```
DBMS_CRYPTO.DECRYPT (
  dst IN OUT NOCOPY BLOB,
  src IN              BLOB,
  typ IN             PLS_INTEGER,
  key IN             RAW,
  iv IN              RAW          DEFAULT NULL);
```

```
DBMS_CRYPT.DECRYPT (
  dst IN OUT NOCOPY CLOB          CHARACTER SET ANY_CS,
  src IN              BLOB,
  typ IN             PLS_INTEGER,
  key IN             RAW,
  iv IN              RAW          DEFAULT NULL);
```

```
DBMS_CRYPTO.DECRYPT (
  dst IN OUT NOCOPY BLOB,
  src IN              BLOB,
  typ IN             PLS_INTEGER,
  key IN             RAW,
  iv IN              RAW DEFAULT NULL,
  aad IN             RAW DEFAULT NULL,
  tag IN             RAW);
```

```
DBMS_CRYPTO.DECRYPT (
  dst IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  src IN              BLOB,
  typ IN             PLS_INTEGER,
  key IN             RAW,
  iv IN              RAW DEFAULT NULL,
  aad IN             RAW DEFAULT NULL,
  tag IN             RAW);
```

Pragmas

```
pragma restrict_references (decrypt, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 51-14 DECRYPT Procedure Parameters

Parameter Name	Description
dst	LOB locator of output data. The value in the output LOB <dst> will be overwritten.
src	LOB locator of input data.
typ	Stream or block cipher type and modifiers to be used.
key	Key to be used for decryption.
iv	Optional initialization vector for block ciphers. Default is all zeroes.
aad	Additional authenticated data, which is any string that you pass to an Oracle Cloud key management service as part of the request.
tag	Authentication tag that is used for the authentication check.

51.10.3 ECDHDERIVE_SHAREDSECRET Function

This function derives shared secret using private key of local application and public key from the remote application.

Syntax

```
DBMS_CRYPT0.  
DBMS_CRYPT0.ECDHDERIVE_SHAREDSECRET (  
    curveid      IN BINARY_INTEGER,  
    pubkey       IN RAW,  
    privkey      IN RAW,  
    sharedsecret OUT RAW);
```

Parameters

Table 51-15 HASH Function Parameters

Parameter Name	Description
curveid	Constants to denote the curve name that the algorithm uses. Example: SECP_256_R1
pubkey	Public key from the other side
privkey	Private key
sharedsecret	Shared secret generated from private key and public key from the other side

Usage Note

The supported curve id SECP_256_R1 denotes NIST Recommended Curve secp256r1.

51.10.4 ECDH_GENKEYPAIR Function

This function generates an EC public/private key pair.

Syntax

```
DBMS_CRYPT0.
DBMS_CRYPT0.ECDH_GENKEYPAIR (
    curveid      IN BINARY_INTEGER,
    pubkey       OUT RAW,
    privkey      OUT RAW);
```

Parameters

Table 51-16 HASH Function Parameters

Parameter Name	Description
curveid	Constants to denote the curve name that the algorithm uses. Example: SECP_256_R1
pubkey	Public key
privkey	Private key

Usage Note

The supported curve id SECP_256_R1 denotes NIST Recommended Curve secp256r1.

51.10.5 ENCRYPT Functions

These functions encrypt RAW data using a stream or block cipher with a user supplied key and optional IV (initialization vector).

Syntax

```
DBMS_CRYPT0.ENCRYPT (
    src IN RAW,
    typ IN PLS_INTEGER,
    key IN RAW,
    iv IN RAW DEFAULT NULL)
RETURN RAW;
```

```
DBMS_CRYPT0.ENCRYPT (
    src IN RAW,
    typ IN PLS_INTEGER,
    key IN RAW,
    iv IN RAW DEFAULT NULL,
    aad IN RAW DEFAULT NULL,
    tag OUT RAW)
RETURN RAW;
```

Pragmas

```
pragma restrict_references (encrypt, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 51-17 ENCRYPT Function Parameters

Parameter Name	Description
src	RAW data to be encrypted.
typ	Stream or block cipher type and modifiers to be used.
key	Encryption key to be used for encrypting data.
iv	Optional initialization vector for block ciphers. Default is NULL.
aad	Additional authenticated data, which is any string that you pass to an Oracle Cloud key management service as part of the request.
tag	Authentication tag that is used for the authentication check.

Usage Notes

- Block ciphers may be modified with chaining and padding type modifiers. The chaining and padding type modifiers are added to the block cipher to produce a cipher suite. Cipher Block Chaining (CBC) is the most commonly used chaining type, and PKCS #5 is the recommended padding type. See [Table 51-9](#) and [Table 51-10](#) for block cipher chaining and padding modifier constants that have been defined for this package.
- To improve readability, you can define your own package-level constants to represent the cipher suites you use for encryption and decryption. For example, the following example defines a cipher suite that uses DES, cipher block chaining mode, and no padding:

```
DES_CBC_NONE CONSTANT PLS_INTEGER := DBMS_CRYPTO.ENCRYPT_DES
                                     + DBMS_CRYPTO.CHAIN_CBC
                                     + DBMS_CRYPTO.PAD_NONE;
```

See [Table 51-8](#) for the block cipher suites already defined as constants for this package.

- To encrypt VARCHAR2 data, it should first be converted to the AL32UTF8 character set.

 **See Also:**

The discussion of conversion rules under [DBMS_CRYPTO Operational Notes](#)

51.10.6 ENCRYPT Procedures

These procedures encrypt LOB data using a stream or block cipher with a user supplied key and optional IV (initialization vector).

Syntax

```
DBMS_CRYPTO.ENCRYPT(
  dst IN OUT NOCOPY BLOB,
  src IN              BLOB,
  typ IN              PLS_INTEGER,
  key IN              RAW,
  iv IN              RAW          DEFAULT NULL);
```



```
DBMS_CRYPTO.ENCRYPT(
  dst IN OUT NOCOPY BLOB,
  src IN              CLOB          CHARACTER SET ANY_CS,
  typ IN             PLS_INTEGER,
  key IN             RAW,
  iv IN              RAW            DEFAULT NULL);
```

```
DBMS_CRYPTO.ENCRYPT (
  dst IN OUT NOCOPY BLOB,
  src IN              BLOB,
  typ IN             PLS_INTEGER,
  key IN             RAW,
  iv IN              RAW DEFAULT NULL,
  aad IN             RAW DEFAULT NULL,
  tag OUT            RAW);
```

```
DBMS_CRYPTO.ENCRYPT(
  dst IN OUT          NOCOPY BLOB,
  src IN              CLOB CHARACTER SET ANY_CS,
  typ IN             PLS_INTEGER,
  key IN             RAW,
  iv IN              RAW DEFAULT NULL,
  aad IN             RAW DEFAULT NULL,
  tag OUT            RAW);
```

Pragmas

```
pragma restrict_references (encrypt, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 51-18 ENCRYPT Procedure Parameters

Parameter Name	Description
dst	LOB locator of output data. The value in the output LOB <dst> will be overwritten.
src	LOB locator of input data.
typ	Stream or block cipher type and modifiers to be used.
key	Encryption key to be used for encrypting data.
iv	Optional initialization vector for block ciphers. Default is NULL.
aad	Additional authenticated data, which is any string that you pass to an Oracle Cloud key management service as part of the request.
tag	Authentication tag that is used for the authentication check.

Usage Notes

- ENCRYPT can use the ENCRYPT_SM4 constant for SM4 encryption algorithm.
- See [DBMS_DEBUG Operational Notes](#) for more information about the conversion rules for the ENCRYPT procedure.

51.10.7 HASH Function

A one-way hash function takes a variable-length input string, the data, and converts it to a fixed-length (generally smaller) output string called a *hash value*. The hash value

serves as a unique identifier (like a fingerprint) of the input data. You can use the hash value to verify whether data has been changed or not.

Note that a one-way hash function is a hash function that works in one direction. It is easy to compute a hash value from the input data, but it is hard to generate data that hashes to a particular value. Consequently, one-way hash functions work well to ensure data integrity. Refer to “When to Use Hash or Message Authentication Code (MAC) Functions” in [DBMS_CRYPT0 Operational Notes](#) for more information about using one-way hash functions.

This function applies to data one of the supported cryptographic hash algorithms listed in [Table 51-4](#).

Syntax

```
DBMS_CRYPT0.HASH (
    src IN RAW,
    typ IN PLS_INTEGER)
RETURN RAW;

DBMS_CRYPT0.HASH (
    src IN BLOB,
    typ IN PLS_INTEGER)
RETURN RAW;

DBMS_CRYPT0.HASH (
    src IN CLOB CHARACTER SET ANY_CS,
    typ IN PLS_INTEGER)
RETURN RAW;
```

Pragmas

```
pragma restrict_references (hash, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 51-19 HASH Function Parameters

Parameter Name	Description
src	The source data to be hashed.
typ	The hash algorithm to be used.

Usage Notes

- Oracle recommends that you use SHA-2 (SHA-256, SHA-384, SHA-512). SHA-1 (HASH_SH1) is deprecated.
- The HASH function can use the HASH_SM3 constant for the SM3 hash algorithm

51.10.8 HASH_LEN Function

HASH_LEN is an extension of the HASH function that can generate variable length hash output.

HASH_LEN includes an extra input length in PLS_INTEGER type, which is hash length. HASH_LEN only supports two types of hash: SHAKE128 and SHAKE256.

Syntax

```

DBMS_CRYPTO.HASH_LEN (
    src IN RAW,
    typ IN PLS_INTEGER,
    length IN PLS_INTEGER)
RETURN RAW DETERMINISTIC;

DBMS_CRYPTO.HASH_LEN (
    src IN BLOB,
    typ IN PLS_INTEGER,
    length IN PLS_INTEGER)
RETURN RAW DETERMINISTIC;

DBMS_CRYPTO.HASH_LEN (
    src IN CLOB CHARACTER SET ANY_CS,
    typ IN PLS_INTEGER,
    length IN PLS_INTEGER)
RETURN RAW DETERMINISTIC;

```

Parameters**Table 51-20 HASH Function Parameters**

Parameter Name	Description
src	The source data to be hashed.
typ	The hash algorithm to be used.
len	The variable length for SHAKE128 and SHAKE256 hash algorithms.

Usage Notes

HASH_LEN can only use hash types HASH_SHAKE128 and HASH_SHAKE256. Other hash types are invalid for this function.

51.10.9 MAC Function

This function applies Message Authentication Code (MAC) algorithms to data to provide keyed message protection.

A MAC is a key-dependent one-way hash function. MACs have the same properties as the one-way hash function described in [HASH Function](#), but they also include a key. Only someone with the identical key can verify the hash. Also refer to “When to Use Hash or Message Authentication Code (MAC) Functions” in [DBMS_CRYPTO Operational Notes](#) for more information about using MACs.

See [Table 51-5](#) for a list of MAC algorithms that have been defined for this package.

Syntax

```

DBMS_CRYPTO.MAC (
    src IN RAW,
    typ IN PLS_INTEGER,
    key IN RAW)
RETURN RAW;

DBMS_CRYPTO.MAC (

```

```

src IN BLOB,
typ IN PLS_INTEGER
key IN RAW)
RETURN RAW;

DBMS_CRYPTO.MAC (
  src IN CLOB CHARACTER SET ANY_CS,
  typ IN PLS_INTEGER
  key IN RAW)
RETURN RAW;

```

Pragmas

```
pragma restrict_references (mac, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 51-21 MAC Function Parameters

Parameter Name	Description
src	Source data to which MAC algorithms are to be applied.
typ	MAC algorithm to be used.
key	Key to be used for MAC algorithm.

51.10.10 KMACXOF Function

KMAC stands for KECCAK Message Authentication Code. This function is similar to the MAC function except that it includes the length and custStr fields.

Syntax

```

DBMS_CRYPTO.KMACXOF (
  src IN RAW,
  typ IN PLS_INTEGER,
  key IN RAW,
  length IN PLS_INTEGER,
  custStr IN RAW)
RETURN RAW;

DBMS_CRYPTO.KMACXOF (
  src IN BLOB,
  typ IN PLS_INTEGER,
  key IN RAW,
  length IN PLS_INTEGER,
  custStr IN RAW)
RETURN RAW;

DBMS_CRYPTO.KMACXOF (
  src IN CLOB CHARACTER SET ANY_CS,
  typ IN PLS_INTEGER,
  key IN RAW,
  length IN PLS_INTEGER,
  custStr IN RAW)
RETURN RAW;

```

Parameters

Table 51-22 KMACXOF Function Parameters

Parameter Name	Description
src	Source data to which KMACXOF algorithms are to be applied.
typ	KMACXOF algorithm to be used.
key	Key to be used for KMACXOF algorithm.
length	Length of KMACXOF output in bytes.
custStr	Custom string for KMACXOF.

51.10.11 PKDECRYPT Function

This function decrypts RAW data using a private key assisted with key algorithm and encryption algorithm and returns decrypted data.

Syntax

```
DBMS_CRYPT0.PKDECRYPT (
    src IN RAW,
    prv_key IN RAW,
    pubkey_alg IN BINARY_INTEGER,
    enc_alg IN BINARY_INTEGER)
RETURN RAW;
```

Parameters

Table 51-23 PKDECRYPT Function Parameters

Parameter Name	Description
src	RAW data to be decrypted.
prv_key	Private key.
pubkey_alg	Specify the KEY_TYPE_RSA RSA key type.
enc_alg	Specify the algorithm PKENCRYPT_RSA_PKCS1_OAEP, for RSA Public Key Cryptosystem with PKCS1 and OAEP padding.

51.10.12 PKENCRYPT Function

This function encrypts RAW data using a public key assisted with key algorithm and encryption algorithm and returns encrypted data.

Syntax

```
DBMS_CRYPT0.PKENCRYPT (
    src IN RAW,
    pub_key IN RAW,
    pubkey_alg IN BINARY_INTEGER,
    enc_alg IN BINARY_INTEGER)
RETURN RAW;
```

Parameters

Table 51-24 PKENCRYPT Function Parameters

Parameter Name	Description
src	RAW data to be encrypted.
pub_key	Public key.
pubkey_alg	Specify the KEY_TYPE_RSA RSA key type.
enc_alg	Specify the algorithm PKENCRYPT_RSA_PKCS1_OAEP, for RSA Public Key Cryptosystem with PKCS1 and OAEP padding.

Usage Notes

You can use the `PKENCRYPT_SM2` constant for the SM2 public key encryption algorithm and the `KEY_TYPE_SM2` constant for SM2 key type.

51.10.13 RANDOMBYTES Function

This function returns a RAW value containing a cryptographically secure pseudo-random sequence of bytes, which can be used to generate random material for encryption keys.

Syntax

```
DBMS_CRYPTO.RANDOMBYTES (
    number_bytes IN POSITIVE)
RETURN RAW;
```

Pragmas

```
pragma restrict_references (randombytes, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 51-25 RANDOMBYTES Function Parameter

Parameter Name	Description
number_bytes	The number of pseudo-random bytes to be generated.

Usage Note

The `number_bytes` value should not exceed the maximum length of a RAW variable.

51.10.14 RANDOMINTEGER Function

This function returns an integer in the complete range available for the Oracle `BINARY_INTEGER` datatype.

Syntax

```
DBMS_CRYPTO.RANDOMINTEGER
RETURN BINARY_INTEGER;
```

Pragmas

```
pragma restrict_references (randominteger, WNDS, RNDS, WNPS, RNPS);
```

51.10.15 RANDOMNUMBER Function

This function returns an integer in the Oracle `NUMBER` datatype in the range of `[0..2**128-1]`.

Syntax

```
DBMS_CRYPTO.RANDOMNUMBER  
RETURN NUMBER;
```

Pragmas

```
pragma restrict_references (randomnumber, WNDS, RNDS, WNPS, RNPS);
```

51.10.16 SIGN Function

This function signs `RAW` data using a private key assisted with key algorithm and sign algorithm, and returns a signature.

Syntax

```
DBMS_CRYPTO.SIGN(  
    src IN RAW,  
    prv_key IN RAW,  
    pubkey_alg IN BINARY_INTEGER,  
    sign_alg IN BINARY_INTEGER)  
RETURN RAW;
```

Parameters

Table 51-26 SIGN Function Parameters

Parameter Name	Description
<code>src</code>	RAW data to be signed.
<code>prv_key</code>	Private key.
<code>pubkey_alg</code>	Specify the <code>KEY_TYPE_RSA</code> RSA key type for RSA algorithms and <code>KEY_TYPE_ECDSA</code> ECDSA key type for ECDSA algorithms.
<code>sign_alg</code>	Specify one of the algorithms that are listed in the Usage Notes.

Usage Notes

Table 51-27 Signature Type Algorithms

Hash Algorithm	Description
<code>SIGN_SHA1_RSA</code>	SHA1 hash function with RSA
<code>SIGN_SHA1_RSA_X931</code>	SHA1 hash function with RSA and X931 padding
<code>SIGN_SHA224_ECDSA</code>	SHA 224-bit hash function with ECDSA

Table 51-27 (Cont.) Signature Type Algorithms

Hash Algorithm	Description
SIGN_SHA224_RSA	SHA 224-bit hash function with RSA
SIGN_SHA256_ECDSA	SHA 256-bit hash function with ECDSA
SIGN_SHA256_RSA	SHA 256-bit hash function with RSA
SIGN_SHA256_RSA_X931	SHA 256-bit hash function with RSA and X931 padding
SIGN_SHA3_224_ECDSA	SHA-3 224-bit hash function with ECDSA
SIGN_SHA3_224_RSA	SHA-3 234-bit hash function with RSA
SIGN_SHA3_256_ECDSA	SHA-3 256-bit hash function with ECDSA
SIGN_SHA3_256_RSA	SHA-3 256-bit hash function with RSA
SIGN_SHA3_384_ECDSA	SHA-3 384-bit hash function with ECDSA
SIGN_SHA3_384_RSA	SHA-3 384-bit hash function with RSA
SIGN_SHA3_512_ECDSA	SHA-3 512-bit hash function with ECDSA
SIGN_SHA3_512_RSA	SHA-3 512-bit hash function with RSA
SIGN_SHA384_ECDSA	SHA 384-bit hash function with ECDSA
SIGN_SHA384_RSA	SHA 384-bit hash function with RSA
SIGN_SHA384_RSA_X931	SHA 384-bit hash function with RSA and X931 padding
SIGN_SHA512_ECDSA	SHA 512-bit hash function with ECDSA
SIGN_SHA512_RSA	SHA 512-bit hash function with RSA
SIGN_SHA512_RSA_X931	SHA 512-bit hash function with RSA and X931 padding
SIGN_SM3_SM2	SM3 256-bit hash function with SM2

Usage Notes

You can use the `SIGN_SM3_SM2` constant for the `SM3_SM2` encryption algorithm

51.10.17 VERIFY Function

This function verifies `RAW` data using the signature, public key assisted with key algorithm, and sign algorithm. It returns `TRUE` if the signature was verified.

Syntax

```
DBMS_CRYPTO.VERIFY (
  src IN RAW,
  sign IN RAW,
  pub_key IN RAW,
  pubkey_alg IN BINARY_INTEGER,
  sign_alg IN BINARY_INTEGER)
RETURN BOOLEAN;
```


Parameters

Table 51-28 VERIFY Function Parameters

Parameter Name	Description
src	RAW data to be verified.
sign	Message signature.
pub_key	Public key.
pubkey_alg	Specify the KEY_TYPE_RSA RSA key type for RSA algorithms and KEY_TYPE_ECDSA ECDSA key type for ECDSA algorithms.
sign_alg	Specify one of the algorithms that are listed the Usage Notes.

Usage Notes

Table 51-29 Verify Type Algorithms

Hash Algorithm	Description
SIGN_SHA1_RSA	SHA hash function with RSA
SIGN_SHA1_RSA_X931	SHA hash function with RSA and X931 padding
SIGN_SHA224_ECDSA	SHA 224-bit hash function with ECDSA
SIGN_SHA224_RSA	SHA 224-bit hash function with RSA
SIGN_SHA256_ECDSA	SHA 256-bit hash function with ECDSA
SIGN_SHA256_RSA	SHA 256-bit hash function with RSA
SIGN_SHA256_RSA_X931	SHA 256-bit hash function with RSA and X931 padding
SIGN_SHA3_224_ECDSA	SHA-3 224-bit hash function with ECDSA
SIGN_SHA3_224_RSA	SHA-3 234-bit hash function with RSA
SIGN_SHA3_256_ECDSA	SHA-3 256-bit hash function with ECDSA
SIGN_SHA3_256_RSA	SHA-3 256-bit hash function with RSA
SIGN_SHA3_384_ECDSA	SHA-3 384-bit hash function with ECDSA
SIGN_SHA3_384_RSA	SHA-3 384-bit hash function with RSA
SIGN_SHA3_512_ECDSA	SHA-3 512-bit hash function with ECDSA
SIGN_SHA3_512_RSA	SHA-3 512-bit hash function with RSA
SIGN_SHA384_ECDSA	SHA 384-bit hash function with ECDSA
SIGN_SHA384_RSA	SHA 384-bit hash function with RSA
SIGN_SHA384_RSA_X931	SHA 384-bit hash function with RSA and X931 padding
SIGN_SHA512_ECDSA	SHA 512-bit hash function with ECDSA
SIGN_SHA512_RSA	SHA 512-bit hash function with RSA
SIGN_SHA512_RSA_X931	SHA 512-bit hash function with RSA and X931 padding

Table 51-29 (Cont.) Verify Type Algorithms

Hash Algorithm	Description
SIGN_SM3_SM2	SM3 256-bit hash function with SM2

Usage Notes

You can use the SIGN_SM3_SM2 constant for the SM3_SM2 encryption algorithm

DBMS_CSX_ADMIN

The `DBMS_CSX_ADMIN` package provides an interface to customize the setup when transporting a tablespace containing binary XML data.

The chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Summary of DBMS_CSX_ADMIN](#)

52.1 DBMS_CSX_ADMIN Overview

This package can be used by DBAs to customize the setup when transporting a tablespace containing binary XML data. The use of the package is not required in order for a transportable tablespace job to run.

By default, all binary XML tables will use the default token table set, which will be replicated during transport on the target database. To avoid the cost of transporting a potentially large token table set, the DBA may opt for registering a new set of token tables for a given tablespace. The package provides routines for token table set registration and lookup.

52.2 DBMS_CSX_ADMIN Security Model

Owned by `XDB`, the `DBMS_CSX_ADMIN` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `SYS` or `XDB` or `DBA`. Subprograms in this package are executed using the privileges of the current user.

52.3 DBMS_CSX_ADMIN Constants

The `DBMS_CSX_ADMIN` package uses several constants.

These are described in the following table.

Table 52-1 DBMS_CSX_ADMIN Constants

Name	Type	Value	Description
<code>DEFAULT_LEVEL</code>	<code>BINARY_INTEGER</code>	0	Default token table
<code>TAB_LEVEL</code>	<code>BINARY_INTEGER</code>	1	Token table set associated with tables, not tablespaces
<code>TBS_LEVEL</code>	<code>BINARY_INTEGER</code>	2	Token table set associated with a tablespace
<code>NO_CREATE</code>	<code>BINARY_INTEGER</code>	0	Token tables already exist, associate them with the given table/tablespace

Table 52-1 (Cont.) DBMS_CSX_ADMIN Constants

Name	Type	Value	Description
NO_INDEXES	BINARY_INTEGER	1	Do not create indexes on the new set of token tables
WITH_INDEXES	BINARY_INTEGER	2	Create indexes on the token tables
DEFAULT_TOKS	BINARY_INTEGER	0	Prepopulate the token tables with default token mappings
NO_DEFAULT_TOKS	BINARY_INTEGER	1	Do not prepopulate the token tables with default token mappings

52.4 Summary of DBMS_CSX_ADMIN Subprograms

This table lists and describes the DBMS_CSX_ADMIN Package subprograms.

Table 52-2 DBMS_CSX_ADMIN Package Subprograms

Subprogram	Description
GETTOKENTABLEINFO Procedure & Function	Returns the GUID of the token table set where token mappings for this table
GETTOKENTABLEINFOBYTABLESPACE Procedure	Returns the GUID and the token table names for this tablespace
NAMESPACEIDTABLE Function	Returns default namespace-ID token table
PATHIDTABLE Function	Returns the default path-ID token table
QNAMEIDTABLE Function	Returns the default qname-ID token table.

52.4.1 GETTOKENTABLEINFO Procedure & Function

This procedure is overloaded. The specific forms of functionality are described along with the syntax declarations.

Given the table name and the owner, the first overload of the procedure returns the globally unique identifier (GUID) of the token table set where token mappings for this table can be found. The procedure returns also the names of the token tables, and whether the token table set is the default one.

Given the object number of a table, the second overload of the procedure returns the GUID of the token table set used by the table, and whether this is the default token table set.

Syntax

```
DBMS_CSX_ADMIN.GETTOKENTABLEINFO (
  ownername      IN  VARCHAR2,
  tablename      IN  VARCHAR2,
  guid           OUT  RAW,
  qnametable     OUT  VARCHAR2,
  nmspctable     OUT  VARCHAR2,
  level         OUT  NUMBER,
  tabno         OUT  NUMBER);
```

```
DBMS_CSX_ADMIN.GETTOKENTABLEINFO (
    tabno      IN  NUMBER,
    guid       OUT RAW);
RETURN BOOLEAN;
```

Parameters

Table 52-3 GETTOKENTABLEINFO Procedure & Function Parameters

Parameter	Description
ownername	Owner of the table
tablename	Name of the table
guid	GUID of the token table set used by the given table
qnametable	Name of the qname-ID table in the new set
nmspctable	Name of the namespace-ID table in the new set
level	DEFAULT_LEVEL if default token table set, TBS_LEVEL if same token table set is used by all tables in the same tablespace as the given table, TAB_LEVEL otherwise
tabno	Table object number

52.4.2 GETTOKENTABLEINFOBYTABLESPACE Procedure

Given a tablespace number, this procedure returns the GUID and the token table names for this tablespace.

Syntax

```
DBMS_CSX_ADMIN.GETTOKENTABLEINFOBYTABLESPACE (
    tsname      IN  VARCHAR2,
    tablespaceno IN  NUMBER,
    guid       OUT  RAW,
    qnametable  OUT  VARCHAR2,
    nmspctable  OUT  VARCHAR2,
    isdefault   OUT  BOOLEAN,
    containTokTab OUT  BOOLEAN);
```

Parameters

Table 52-4 GETTOKENTABLEINFOBYTABLESPACE Procedure Parameters

Parameter	Description
tsname	Tablespace name
tablespaceno	Tablespace number
guid	GUID of the token table set associated with this tablespace (if any)
qnametable	Name of the qname-ID table
nmspctable	Name of the namespace-ID table
isdefault	TRUE if the token table is the default one
containTokTab	TRUE if the tablespace contains its own token table set

52.4.3 NAMESPACEIDTABLE Function

This procedure returns default namespace-ID token table.

Syntax

```
DBMS_CSX_ADMIN.NAMESPACEIDTABLE  
RETURN VARCHAR2;
```

52.4.4 PATHIDTABLE Function

This procedure returns the default path-ID token table. This is used for granting permissions on the default path-ID token table for a user before executing `EXPLAIN PLAN` for a query on an XML table with an XML index.

Syntax

```
DBMS_CSX_ADMIN.PATHIDTABLE  
RETURN VARCHAR2;
```

52.4.5 QNAMEIDTABLE Function

This procedure returns the default qname-ID token table.

Syntax

```
DBMS_CSX_ADMIN.QNAMEIDTABLE  
RETURN VARCHAR2;
```

53

DBMS_DATA_MINING

The `DBMS_DATA_MINING` package is the application programming interface for creating, evaluating, and querying Oracle Machine Learning for SQL models.

In Oracle Database Release 21c, Oracle Data Mining has been rebranded to Oracle Machine Learning for SQL (Oracle Machine Learning for SQL). The PL/SQL package name, however, has not changed and remains `DBMS_DATA_MINING`.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Mining Functions](#)
- [Model Settings](#)
- [Algorithm Specific Settings](#)
- [Solver Settings](#)
- [Datatypes](#)
- [Summary of DBMS_DATA_MINING Subprograms](#)

See Also:

- [Oracle Machine Learning for SQL Concepts](#)
- [Oracle Machine Learning for SQL User's Guide](#)
- [DBMS_DATA_MINING_TRANSFORM](#)
- [DBMS_PREDICTIVE_ANALYTICS](#)

53.1 DBMS_DATA_MINING Overview

Oracle Machine Learning for SQL supports both supervised and unsupervised machine learning. Supervised machine learning predicts a target value based on historical data. Unsupervised machine learning discovers natural groupings and does not use a target. You can use Oracle Machine Learning for SQL procedures on structured data and unstructured text.

Supervised machine learning techniques include:

- Classification
- Regression
- Feature Selection (Attribute Importance)
- Time Series

Unsupervised machine learning techniques include:

- Clustering
- Association
- Feature Extraction
- Anomaly Detection

The steps you use to build and apply a machine learning model depend on the machine learning technique and the algorithm being used. The algorithms supported by Oracle Machine Learning for SQL are listed in the following table.

Table 53-1 Oracle Machine Learning for SQL Algorithms

Algorithm	Abbreviation	Function
Apriori	AR	Association
CUR Matrix Decomposition	CUR	Attribute importance
Decision Tree	DT	Classification
Expectation Maximization	EM	Clustering
Explicit Semantic Analysis	ESA	Feature extraction, classification
Exponential Smoothing	ESM	Time series
Generalized Linear Models	GLM	Classification, regression
<i>k</i> -Means	KM	Clustering
Minimum Descriptor Length	MDL	Attribute importance
Multivariate State Estimation Technique - Sequential Probability Ratio Test	MSET-SPRT	Anomaly detection, classification
Naive Bayes	NB	Classification
Neural Network	NN	Classification, regression
Non-Negative Matrix Factorization	NMF	Feature extraction
Orthogonal Partitioning Clustering	O-Cluster	Clustering
Random Forest	RF	Classification
Singular Value Decomposition and Principal Component Analysis	SVD and PCA	Feature extraction
Support Vector Machine	SVM	Classification, regression, anomaly detection
XGBoost	XGBoost	Classification, regression

Oracle Machine Learning for SQL supports more than one algorithm for the classification, regression, clustering, and feature extraction machine learning techniques. Each of these machine learning techniques has a default algorithm, as shown in the following table.

Table 53-2 Oracle Machine Learning for SQL Default Algorithms

Mining Function	Default Algorithm
Classification	Naive Bayes
Clustering	<i>k</i> -Means

Table 53-2 (Cont.) Oracle Machine Learning for SQL Default Algorithms

Mining Function	Default Algorithm
Feature Extraction	Non-Negative Matrix Factorization
Feature Selection	Minimum Descriptor Length
Regression	Support Vector Machine
Time Series	Exponential Smoothing

53.2 DBMS_DATA_MINING Security Model

The `DBMS_DATA_MINING` package is owned by user `SYS` and is installed as part of database installation. Execution privilege on the package is granted to `public`. The routines in the package are run with invokers' rights (run with the privileges of the current user).

The `DBMS_DATA_MINING` package exposes APIs that are leveraged by the Oracle Machine Learning for SQL. Users who wish to create machine learning models in their own schema require the `CREATE MINING MODEL` system privilege. Users who wish to create machine learning models in other schemas require the `CREATE ANY MINING MODEL` system privilege.

Users have full control over managing models that exist within their own schema. Additional system privileges necessary for managing machine learning models in other schemas include `ALTER ANY MINING MODEL`, `DROP ANY MINING MODEL`, `SELECT ANY MINING MODEL`, `COMMENT ANY MINING MODEL`, and `AUDIT ANY`.

Individual object privileges on machine learning models, `ALTER MINING MODEL` and `SELECT MINING MODEL`, can be used to selectively grant privileges on a model to a different user.

See Also:

Oracle Data Mining User's Guide for more information about the security features of Oracle Machine Learning for SQL

53.3 DBMS_DATA_MINING — Machine Learning Functions

A machine learning **function** refers to the methods for solving a given class of machine learning problems.

The machine learning function must be specified when a model is created. You specify a machine learning function with the `mining_function` parameter of the [CREATE_MODEL Procedure](#) or the [CREATE_MODEL2 Procedure](#).

Table 53-3 Machine Learning Functions

Value	Description
ASSOCIATION	<p>Association is a descriptive machine learning function. An association model identifies relationships and the probability of their occurrence within a data set.</p> <p>Association models use the Apriori algorithm.</p>
ATTRIBUTE_IMPORTANCE	<p>Attribute importance is a predictive machine learning function, also known as feature selection. An attribute importance model identifies the relative importance of an attribute in predicting a given outcome.</p> <p>Attribute importance models can use Minimum Description Length (MDL) or CUR Matrix Decomposition. MDL is the default.</p>
CLASSIFICATION	<p>Classification is a predictive machine learning function. A classification model uses historical data to predict a categorical target.</p> <p>Classification models can use: Decision Tree, logistic regression, Multivariate State Estimation Technique - Sequential Probability Ratio Test, Naive Bayes, Support Vector Machine (SVM), or XGBoost. The default is Naive Bayes.</p> <p>The classification function can also be used for anomaly detection. For anomaly detection, you can use the Multivariate State Estimation Technique - Sequential Probability Ratio Test algorithm or the SVM algorithm with a null target (One-Class SVM), or the EM algorithm with a null target (EM Anomaly).</p>
CLUSTERING	<p>Clustering is a descriptive machine learning function. A clustering model identifies natural groupings within a data set.</p> <p>Clustering models can use <i>k</i>-Means, O-Cluster, or Expectation Maximization. The default is <i>k</i>-Means.</p>
FEATURE_EXTRACTION	<p>Feature extraction is a descriptive machine learning function. A feature extraction model creates an optimized data set on which to base a model.</p> <p>Feature extraction models can use Explicit Semantic Analysis, Non-Negative Matrix Factorization, Singular Value Decomposition, or Principal Component Analysis. Non-Negative Matrix Factorization is the default.</p>
REGRESSION	<p>Regression is a predictive machine learning function. A regression model uses historical data to predict a numerical target.</p> <p>Regression models can use linear regression, Support Vector Machine, or XGBoost. The default is Support Vector Machine.</p>
TIME_SERIES	<p>Time series is a predictive machine learning function. A time series model forecasts the future values of a time-ordered series of historical numeric data over a user-specified time window. Time series models use the Exponential Smoothing algorithm.</p>

 **See Also:**

Oracle Machine Learning for SQL Concepts for more information about mining functions

53.4 DBMS_DATA_MINING — Model Settings

Oracle Machine Learning for SQL uses settings to specify the algorithm and other characteristics of a model. Some settings are general, some are specific to a machine learning function, and some are specific to an algorithm.

All settings have default values. If you want to override one or more of the settings for a model, then you must create a settings table. The settings table must have the column names and data types shown in the following table.

Table 53-4 Required Columns in the Model Settings Table

Column Name	Data Type
SETTING_NAME	VARCHAR2 (30)
SETTING_VALUE	VARCHAR2 (4000)

The information you provide in the settings table is used by the model at build time. The name of the settings table is an optional argument to the [CREATE_MODEL Procedure](#). You can also provide these settings through the [CREATE_MODEL2 Procedure](#).

The settings used by a model can be found by querying the data dictionary view `ALL_MINING_MODEL_SETTINGS`. This view displays the model settings used by the machine learning models to which you have access. All of the default and user-specified setting values are included in the view.

See Also:

- `ALL_MINING_MODEL_SETTINGS` in *Oracle Database Reference*
- *Oracle Machine Learning for SQL User's Guide* for information about specifying model settings

53.4.1 DBMS_DATA_MINING — Algorithm Names

The `ALGO_NAME` setting specifies the model algorithm.

The values for the `ALGO_NAME` setting are listed in the following table.

Table 53-5 Algorithm Names

ALGO_NAME Value	Description	Machine Learning Function
ALGO_AI_MDL	Minimum Description Length	Attribute importance
ALGO_APRIORI_ASSOCIATION_RULES	Apriori	Association rules
ALGO_CUR_DECOMPOSITION	CUR Matrix Decomposition	Attribute importance
ALGO_DECISION_TREE	Decision Tree	Classification
ALGO_EXPECTATION_MAXIMIZATION	Expectation Maximization	Clustering, Classification

Table 53-5 (Cont.) Algorithm Names

ALGO_NAME Value	Description	Machine Learning Function
ALGO_EXPLICIT_SEMANTIC_ANALYS	Explicit Semantic Analysis	Feature extraction Classification
ALGO_EXPONENTIAL_SMOOTHING	Exponential Smoothing	Time series
ALGO_EXTENSIBLE_LANG	Language used for extensible algorithm	All mining functions supported
ALGO_GENERALIZED_LINEAR_MODEL	Generalized Linear Model	Classification, regression; also feature selection and generation
ALGO_KMEANS	Enhanced <i>k</i> -Means	Clustering
ALGO_MSET_SPRT	Multivariate State Estimation Technique - Sequential Probability Ratio Test	Classification
ALGO_NAIVE_BAYES	Naive Bayes	Classification
ALGO_NEURAL_NETWORK	Neural Network	Classification
ALGO_NONNEGATIVE_MATRIX_FACTOR	Non-Negative Matrix Factorization	Feature extraction
ALGO_O_CLUSTER	O-Cluster	Clustering
ALGO_RANDOM_FOREST	Random Forest	Classification
ALGO_SINGULAR_VALUE_DECOMP	Singular Value Decomposition	Feature extraction
ALGO_SUPPORT_VECTOR_MACHINES	Support Vector Machine	Classification and regression
ALGO_XGBOOST	XGBoost	Classification and regression

**See Also:**

Oracle Machine Learning for SQL Concepts for information about algorithms

53.4.2 DBMS_DATA_MINING — Automatic Data Preparation

Oracle Machine Learning for SQL supports fully Automatic Data Preparation (ADP), user-directed general data preparation, and user-specified embedded data preparation. The `PREP_*` settings enable the user to request fully automated or user-directed general data preparation. By default, fully Automatic Data Preparation (`PREP_AUTO_ON`) is enabled.

When you enable ADP, the model uses heuristics to transform the build data according to the requirements of the algorithm. Instead of fully ADP, the user can request that the data be shifted and/or scaled with the `PREP_SCALE*` and `PREP_SHIFT*` settings. The transformation instructions are stored with the model and reused whenever the model is applied. The model settings can be viewed in `USER_MINING_MODEL_SETTINGS`.

You can choose to supplement Automatic Data Preparations by specifying additional transformations in the `xform_list` parameter when you build the model. See "[CREATE_MODEL Procedure](#)" and "[CREATE_MODEL2 Procedure](#)".

If you do not use ADP *and* do not specify transformations in the `xform_list` parameter to `CREATE_MODEL`, you must implement your own transformations separately in the build, test, and scoring data. You must take special care to implement the exact same transformations in each data set.

If you do not use ADP, but you *do* specify transformations in the `xform_list` parameter to `CREATE_MODEL`, OML4SQL embeds the transformation definitions in the model and prepares the test and scoring data to match the build data.

The values for the `PREP_*` setting are described in the following table.

Table 53-6 PREP_* Setting

Setting Name	Setting Value	Description
<code>PREP_AUTO</code>	<ul style="list-style-type: none"> <code>PREP_AUTO_ON</code> <code>PREP_AUTO_OFF</code> 	This setting enables fully automated data preparation. The default is <code>PREP_AUTO_ON</code> .
<code>PREP_SCALE_2DNUM</code>	<ul style="list-style-type: none"> <code>PREP_SCALE_STDDEV</code> <code>PREP_SCALE_RANGE</code> 	This setting enables scaling data preparation for two-dimensional numeric columns. <code>PREP_AUTO</code> must be <code>OFF</code> for this setting to take effect. The following are the possible values: <ul style="list-style-type: none"> <code>PREP_SCALE_STDDEV</code>: A request to divide the column values by the standard deviation of the column and is often provided together with <code>PREP_SHIFT_MEAN</code> to yield z-score normalization. <code>PREP_SCALE_RANGE</code>: A request to divide the column values by the range of values and is often provided together with <code>PREP_SHIFT_MIN</code> to yield a range of [0,1].
<code>PREP_SCALE_NNUM</code>	<code>PREP_SCALE_MAXABS</code>	This setting enables scaling data preparation for nested numeric columns. <code>PREP_AUTO</code> must be <code>OFF</code> for this setting to take effect. If specified, then the valid value for this setting is <code>PREP_SCALE_MAXABS</code> , which yields data in the range of [-1,1].
<code>PREP_SHIFT_2DNUM</code>	<ul style="list-style-type: none"> <code>PREP_SHIFT_MEAN</code> <code>PREP_SHIFT_MIN</code> 	This setting enables centering data preparation for two-dimensional numeric columns. <code>PREP_AUTO</code> must be <code>OFF</code> for this setting to take effect. The following are the possible values: <ul style="list-style-type: none"> <code>PREP_SHIFT_MEAN</code>: Results in subtracting the average of the column from each value. <code>PREP_SHIFT_MIN</code>: Results in subtracting the minimum of the column from each value.



See Also:

[Oracle® Machine Learning for SQL](#) for information about data transformations

53.4.3 DBMS_DATA_MINING — Machine Learning Function Settings

The settings described in this table apply to a machine learning function.

Table 53-7 Machine Learning Function Settings

Machine Learning Function	Setting Name	Setting Value	Description
Association	ASSO_MAX_RULE_LENGTH	TO_CHAR(2< = <i>numeric_exp</i> <i>r</i> <=20)	Maximum rule length for association rules. Default is 4.
Association	ASSO_MIN_CONFIDENCE	TO_CHAR(0< = <i>numeric_exp</i> <i>r</i> <=1)	Minimum confidence for association rules. Default is 0.1.
Association	ASSO_MIN_SUPPORT	TO_CHAR(0< = <i>numeric_exp</i> <i>r</i> <=1)	Minimum support for association rules Default is 0.1.
Association	ASSO_MIN_SUPPORT_INT	a positive integer	Minimum absolute support that each rule must satisfy. The value must be an integer. The default is 1.
Association	ASSO_MIN_REV_CONFIDENCE	TO_CHAR(0< = <i>numeric_exp</i> <i>r</i> <=1)	Sets the Minimum Reverse Confidence that each rule should satisfy. The Reverse Confidence of a rule is defined as the number of transactions in which the rule occurs divided by the number of transactions in which the consequent occurs. The value is real number between 0 and 1. The default is 0.
Association	ASSO_IN_RULES	NULL	Sets Including Rules applied for each association rule: it specifies the list of items that at least one of them must appear in each reported association rule, either as antecedent or as consequent. It is a comma separated string containing the list of including items. If not set, the default behavior is, the filtering is not applied. For example, INSERT INTO sett_tab (setting_name, setting_value) VALUES (dbms_data_mining.asso_in_rules, 'a', 'b');

Table 53-7 (Cont.) Machine Learning Function Settings

Machine Learning Function	Setting Name	Setting Value	Description
Association	ASSO_EX_RULES	NULL	<p>Sets Excluding Rules applied for each association rule: it specifies the list of items that none of them can appear in each reported association rules. It is a comma separated string containing the list of excluded items. No rule can contain any item in the list.</p> <p>The default is NULL.</p> <p>For example,</p> <pre>INSERT INTO sett_tab (setting_name, setting_value) VALUES (dbms_data_mining.asso_ex_rules, '''a','b''');</pre>
Association	ASSO_ANT_IN_RULES	NULL	<p>Sets Including Rules for the antecedent: it specifies the list of items that at least one of them must appear in the antecedent part of each reported association rule. It is a comma separated string containing the list of including items. The antecedent part of each rule must contain at least one item in the list.</p> <p>The default is NULL.</p> <p>For example,</p> <pre>INSERT INTO sett_tab (setting_name, setting_value) VALUES (dbms_data_mining.asso_ant_in_rules, '''a','b''');</pre>
Association	ASSO_ANT_EX_RULES	NULL	<p>Sets Excluding Rules for the antecedent: it specifies the list of items that none of them can appear in the antecedent part of each reported association rule. It is a comma separated string containing the list of excluded items. No rule can contain any item in the list in its antecedent part.</p> <p>The default is NULL.</p> <p>For example,</p> <pre>INSERT INTO sett_tab (setting_name, setting_value) VALUES (dbms_data_mining.asso_ant_ex_rules, '''a','b''');</pre>

Table 53-7 (Cont.) Machine Learning Function Settings

Machine Learning Function	Setting Name	Setting Value	Description
Association	ASSO_CONS_IN_RULES	NULL	<p>Sets Including Rules for the consequent: it specifies the list of items that at least one of them must appear in the consequent part of each reported association rule. It is a comma separated string containing the list of including items. The consequent of each rule must be an item in the list.</p> <p>The default is NULL.</p> <p>For example,</p> <pre>INSERT INTO sett_tab (setting_name, setting_value) VALUES (dbms_data_mining.asso_cons_in_rules , 'a','b');</pre>
Association	ASSO_CONS_EX_RULES	NULL	<p>Sets Excluding Rules for the consequent: it specifies the list of items that none of them can appear in the consequent part of each reported association rule. It is a comma separated string containing the list of excluded items. No rule can have any item in the list as its consequent.</p> <p>The excluding rule can be used to reduce the data that must be stored, but the user may be required to build an extra model for executing different including or Excluding Rules.</p> <p>The default is NULL.</p> <p>For example,</p> <pre>INSERT INTO sett_tab (setting_name, setting_value) VALUES (dbms_data_mining.asso_cons_ex_rules , 'a','b');</pre>

Table 53-7 (Cont.) Machine Learning Function Settings

Machine Learning Function	Setting Name	Setting Value	Description
Association	ASSO_AGGREGATES	NULL	<p>Specifies the columns to be aggregated. It is a comma separated string containing the names of the columns for aggregation. The number of columns in the list must be ≤ 10.</p> <p>You can set ASSO_AGGREGATES if ODMS_ITEM_ID_COLUMN_NAME is set indicating transactional input data. See DBMS_DATA_MINING - Global Settings. The data table must have valid column names such as ITEM_ID and CASE_ID which are derived from ODMS_ITEM_ID_COLUMN_NAME and case_id_column_name respectively. Numeric values are supported.</p> <p>ITEM_VALUE is not a mandatory value.</p> <p>The default is NULL.</p> <p>For each item, the user may supply several columns to aggregate. It requires more memory to buffer the extra data. Also, the performance impact can be seen because of the larger input data set and more operation.</p>
Association	ASSO_ABS_ERROR	$0 < \text{ASSO_ABS_ERROR} \leq \text{MAX}(\text{ASSO_MIN_SUPPORT}, \text{ASSO_MIN_CONFIDENCE})$	<p>Specifies the absolute error for the association rules sampling.</p> <p>A smaller value of ASSO_ABS_ERROR obtains a larger sample size which gives accurate results but takes longer computational time. Set a reasonable value for ASSO_ABS_ERROR, such as its default value, to avoid large sample size. The default value is $0.5 * \text{MAX}(\text{ASSO_MIN_SUPPORT}, \text{ASSO_MIN_CONFIDENCE})$.</p>
Association	ASSO_CONF_LEVEL	$0 < \text{ASSO_CONF_LEVEL} \leq 1$	<p>Specifies the confidence level for an association rules sample.</p> <p>A larger value of ASSO_CONF_LEVEL obtains a larger sample size. Any value between 0.9 and 1 is suitable. The default value is 0.95.</p>
Classification	CLAS_COST_TABLE_NAME	<i>table_name</i>	<p>(Decision tree only) Name of a table that stores a cost matrix to be used by the algorithm in building the model. The cost matrix specifies the costs associated with misclassifications.</p> <p>Only decision tree models can use a cost matrix at build time. All classification algorithms can use a cost matrix at apply time.</p> <p>The cost matrix table is user-created. See "ADD_COST_MATRIX Procedure" for the column requirements.</p> <p>See <i>Oracle Machine Learning for SQL Concepts</i> for information about costs.</p>

Table 53-7 (Cont.) Machine Learning Function Settings

Machine Learning Function	Setting Name	Setting Value	Description
Classification	CLAS_PRIORS_TABLE_NAME	<i>table_name</i>	(Naive Bayes) Name of a table that stores prior probabilities to offset differences in distribution between the build data and the scoring data. The priors table is user-created. See <i>Oracle Machine Learning for SQL User's Guide</i> for the column requirements. See <i>Oracle Machine Learning for SQL Concepts</i> for additional information about priors.
Classification	CLAS_WEIGHTS_TABLE_NAME	<i>table_name</i>	(GLM and SVM only) Name of a table that stores weighting information for individual target values in SVM classification and GLM logistic regression models. The weights are used by the algorithm to bias the model in favor of higher weighted classes. The class weights table is user-created. See <i>Oracle Machine Learning for SQL User's Guide</i> for the column requirements. See <i>Oracle Machine Learning for SQL Concepts</i> for additional information about class weights.
Classification	CLAS_WEIGHTS_BALANCED	ON OFF	This setting indicates that the algorithm must create a model that balances the target distribution. This setting is most relevant in the presence of rare targets, as balancing the distribution may enable better average accuracy (average of per-class accuracy) instead of overall accuracy (which favors the dominant class). The default value is OFF.
Classification	CLAS_MAX_SUP_BINS	For Decision Tree: $2 \leq a \text{ number} \leq 2147483647$ For Random Forest: $2 \leq a \text{ number} \leq 254$	This parameter specifies the maximum number of bins for each attribute. The default value is 32. See, DBMS_DATA_MINING — Automatic Data Preparation

Table 53-7 (Cont.) Machine Learning Function Settings

Machine Learning Function	Setting Name	Setting Value	Description
Clustering	CLUS_NUM_CLUSTERS	TO_CHAR(numeric_expr >=1)	<p>The maximum number of leaf clusters generated by a clustering algorithm. The algorithm may return fewer clusters, depending on the data.</p> <p>Enhanced <i>k</i>-Means usually produces the exact number of clusters specified by CLUS_NUM_CLUSTERS, unless there are fewer distinct data points.</p> <p>When Expectation maximization (EM) is used for clustering, it may return fewer clusters than the number specified by CLUS_NUM_CLUSTERS depending on the data. The number of clusters returned by EM cannot be greater than the number of components, which is governed by algorithm-specific settings. (See <i>Expectation Maximization Settings for Learning</i> table)</p> <p>Depending on these settings, there may be fewer clusters than components. If component clustering is disabled, the number of clusters equals the number of components. The setting can be used only for EM Clustering algorithm.</p> <p>For EM Clustering algorithm, the default value of CLUS_NUM_CLUSTERS is system-determined. For <i>k</i>-Means and O-Cluster, the default is 10.</p>
Feature extraction	FEAT_NUM_FEATURES	TO_CHAR(numeric_expr >=1)	<p>The number of features to be extracted by a feature extraction model.</p> <p>The default is estimated from the data by the algorithm. If the matrix rank is smaller than this number, fewer features will be returned.</p> <p>For CUR Matrix Decomposition, the FEAT_NUM_FEATURES value is the same as the CURS_SVD_RANK value.</p>

**See Also:**

Oracle Machine Learning for SQL Concepts for information about machine learning functions

53.4.4 DBMS_DATA_MINING — Global Settings

The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

Table 53-8 Global Settings

Setting Name	Setting Value	Description
ODMS_BOXCOX	ODMS_BOXCOX_ENABLE ODMS_BOXCOX_DISABLE	This setting enables the Box-Cox variance-stabilization transformation. It is useful when the variance increases as the target value increases. It reduces variance and transforms a multiplicative relationship with the target, with a simpler additive relationship. This setting is applicable only to the Exponential Smoothing algorithm. When a value for EXSM_MODEL setting is not specified, the default value is ODMS_BOXCOX_ENABLE and when a value for the EXSM_MODEL setting is provided, the default value is ODMS_BOXCOX_DISABLE.
ODMS_EXPLOSION_MIN_SUPP	A positive integer	It is the minimum required support for categorical values that must be included in the explosion mapping. It removes categorical values with insufficient row instances to have a statistically significant effect on the model, however, they could potentially degrade performance. The default is system determined depending on the number of rows in the dataset. A value of 1 results into mapping all categorical values.
ODMS_ITEM_ID_COLUMN_NAME	column_name	(Association rules only) Name of a column that contains the items in a transaction. When this setting is specified, the algorithm expects the data to be presented in a native transactional format, consisting of two columns: <ul style="list-style-type: none"> • Case ID, either categorical or numeric • Item ID, either categorical or numeric

 **Note:**

Oracle Machine Learning does not support `BOOLEAN` values for this setting.

A typical example of transactional data is market basket data, wherein a case represents a basket that may contain many items. Each item is stored in a separate row, and many rows may be needed to represent a case. The case ID values do not uniquely identify each row. Transactional data is also called multi-record case data.

Association rules function is normally used with transactional data, but it can also be applied to single-record case data (similar to other algorithms).

For more information about single-record and multi-record case data, see *Oracle SQL Developer Data Modeler User's Guide*.

Table 53-8 (Cont.) Global Settings

Setting Name	Setting Value	Description
ODMS_ITEM_VALUE_COLUMN_NAME	<i>column_name</i>	<p>(Association rules only) Name of a column that contains a value associated with each item in a transaction. This setting is only used when a value has been specified for ODMS_ITEM_ID_COLUMN_NAME indicating that the data is presented in native transactional format.</p> <p>If ASSO_AGGREGATES is used, then the build data must include the following three columns and the columns specified in the AGGREGATES setting.</p> <ul style="list-style-type: none"> • Case ID, either categorical or numeric • Item ID, either categorical or numeric, specified by ODMS_ITEM_ID_COLUMN_NAME • Item value, either categorical or numeric, specified by ODMS_ITEM_VALUE_COLUMN_NAME
ODMS_MISSING_VALUE_TREATMENT	ODMS_MISSING_VALUE_MEAN_MODE ODMS_MISSING_VALUE_DELETE_ROW ODMS_MISSING_VALUE_AUTO	<p>If ASSO_AGGREGATES, Case ID, and Item ID column are present, then the Item Value column may or may not appear.</p> <p>The Item Value column may specify information such as the number of items (for example, three apples) or the type of the item (for example, macintosh apples).</p> <p>For details on ASSO_AGGREGATES, see DBMS_DATA_MINING - Mining Function Settings.</p> <p>Indicates how to treat missing values in the training data. This setting does not affect the scoring data. The default value is ODMS_MISSING_VALUE_AUTO.</p> <p>ODMS_MISSING_VALUE_MEAN_MODE replaces missing values with the mean (numeric attributes) or the mode (categorical attributes) both at build time and apply time where appropriate. ODMS_MISSING_VALUE_AUTO performs different strategies for different algorithms.</p> <p>When ODMS_MISSING_VALUE_TREATMENT is set to ODMS_MISSING_VALUE_DELETE_ROW, the rows in the training data that contain missing values are deleted. However, if you want to replicate this missing value treatment in the scoring data, then you must perform the transformation explicitly.</p> <p>The value ODMS_MISSING_VALUE_DELETE_ROW applies to all algorithms.</p>



Note:

Oracle Machine Learning does not support BOOLEAN values for this setting.

Table 53-8 (Cont.) Global Settings

Setting Name	Setting Value	Description
ODMS_ROW_WEIGHT_COLUMN_NAME	<i>column_name</i>	(GLM only) Name of a column in the training data that contains a weighting factor for the rows. The column data type must be numeric. Oracle Machine Learning does not support <code>BOOLEAN</code> values for this setting. Row weights can be used as a compact representation of repeated rows, as in the design of experiments where a specific configuration is repeated several times. Row weights can also be used to emphasize certain rows during model construction. For example, to bias the model towards rows that are more recent and away from potentially obsolete data.
ODMS_TEXT_POLICY_NAME	The name of an Oracle Text <code>POLICY</code> created using <code>CTX_DDL.CREATE_POLICY</code> .	Affects how individual tokens are extracted from unstructured text. For details about <code>CTX_DDL.CREATE_POLICY</code> , see <i>Oracle Text Reference</i> .
ODMS_TEXT_MAX_FEATURES	<code>1 <= value</code>	The maximum number of distinct features, across all text attributes, to use from a document set passed to <code>CREATE_MODEL</code> . The default is 3000. ESA has the default value of 300000.
ODMS_TEXT_MIN_DOCUMENTS	Non-negative value	This is a text processing setting the controls how in how many documents a token needs to appear to be used as a feature. The default is 1. ESA has a default of 3.
ODMS_PARTITION_COLUMNS	Comma separated list of machine learning attributes	This setting indicates a request to build a partitioned model. The setting value is a comma-separated list of the machine learning attributes used to determine the in-list partition key values. Oracle Machine Learning supports numeric and categorical values including <code>BOOLEAN</code> for this setting. These machine learning attributes are taken from the input columns unless an <code>XFORM_LIST</code> parameter is passed to <code>CREATE_MODEL</code> or <code>CREATE_MODEL2</code> . If the <code>XFORM_LIST</code> parameter is passed to during model building, then the machine learning attributes are taken from the attributes produced by these transformations.
ODMS_MAX_PARTITIONS	<code>1 < value <= 1000000</code>	This setting indicates the maximum number of partitions allowed for the model. The default is 1000.
ODMS_SAMPLING	<code>ODMS_SAMPLING_ENABLE</code> <code>ODMS_SAMPLING_DISABLE</code>	This setting allows the user to request a sampling of the build data. The default is <code>ODMS_SAMPLING_DISABLE</code> .
ODMS_SAMPLE_SIZE	<code>0 < Value</code>	This setting determines how many rows will be sampled (approximately). It can be set only if <code>ODMS_SAMPLING</code> is enabled. The default value is the system determined.

Table 53-8 (Cont.) Global Settings

Setting Name	Setting Value	Description
ODMS_PARTITION_BUILD_TY PE	ODMS_PARTITION_BUILD _INTRA ODMS_PARTITION_BUILD _INTER ODMS_PARTITION_BUILD _HYBRID	<p>This setting controls the parallel build of partitioned models.</p> <p>ODMS_PARTITION_BUILD_INTRA — Each partition is built in parallel using all replicas.</p> <p>ODMS_PARTITION_BUILD_INTER — Each partition is built entirely in a single slave, but multiple partitions may be built at the same time since multiple replicas are active.</p> <p>ODMS_PARTITION_BUILD_HYBRID — It is a combination of the other two types and is recommended for most situations to adapt to dynamic environments.</p> <p>The default mode is ODMS_PARTITION_BUILD_HYBRID</p>
ODMS_TABLESPACE_NAME	<i>tablespace_name</i>	<p>This setting controls the storage specifications.</p> <p>If you explicitly sets this to the name of a tablespace (for which you have sufficient quota), then the specified tablespace storage creates the resulting model content. If you do not provide this setting, then the default tablespace of the user creates the resulting model content.</p>
ODMS_RANDOM_SEED	The value must be a non-negative integer	<p>The hash function with a random number seed generates a random number with uniform distribution. Users can control the random number seed by this setting. The default is 0.</p> <p>This setting is used by Random Forest, Neural Network, and CUR Matrix Decomposition.</p>
ODMS_DETAILS	<ul style="list-style-type: none"> • ODMS_ENABLE • ODMS_DISABLE 	<p>This setting reduces the space that is used while creating a model, especially a partitioned model. The default value is ODMS_ENABLE.</p> <p>When the setting is ODMS_ENABLE, it creates model tables and views when the model is created. You can query the model with SQL. When the setting is ODMS_DISABLE, model views are not created and tables relevant to model details are not created either.</p> <p>The reduction in space depends on the model. Reduction on the order of 10x can be achieved.</p>

 **See Also:**

Oracle Machine Learning for SQL Concepts for information about GLM

Oracle Machine Learning for SQL Concepts for information about association rules

Oracle Machine Learning for SQL User's Guide for information about machine learning unstructured text

53.5 DBMS_DATA_MINING — Algorithm Specific Model Settings

Oracle Machine Learning for SQL uses algorithm specific settings to define the characteristics of a model.

All settings have default values. If you want to override one or more of the settings for a model, then you must specify those settings.

The information you provide in the settings table is used by the model at build time. The name of the settings table is an optional argument to the [CREATE_MODEL Procedure](#). You can also provide these settings through the [CREATE_MODEL2 Procedure](#).

The settings used by a model can be found by querying the data dictionary view `ALL_MINING_MODEL_SETTINGS`. This view displays the model settings used by the machine learning models to which you have access. All of the default and user-specified setting values are included in the view.

See Also:

- `ALL_MINING_MODEL_SETTINGS` in *Oracle Database Reference*
- *Oracle Machine Learning for SQL User's Guide* for information about specifying model settings

53.5.1 DBMS_DATA_MINING — Algorithm Settings: ALGO_EXTENSIBLE_LANG

The settings listed in the following table configure the behavior of the machine learning model with an extensible algorithm. The model is built in the R language.

The `RALG_*_FUNCTION` specifies the R script that is used to build, score, and view an R model and must be registered in the Oracle Machine Learning for R script repository. The R scripts are registered through Oracle Machine Learning for R with special privileges. When `ALGO_EXTENSIBLE_LANG` is set to R in the `MINING_MODEL_SETTING` table, the machine learning model is built in the R language. After the R model is built, the names of the R scripts are recorded in the `MINING_MODEL_SETTING` table in the `SYS` schema. The scripts must exist in the script repository for the R model to function. The amount of R memory used to build, score, and view the R model through these R scripts can be controlled by Oracle Machine Learning for R.

All algorithm-independent `DBMS_DATA_MINING` subprograms can operate on an R model for machine learning functions such as association, attribute importance, classification, clustering, feature extraction, and regression.

The supported `DBMS_DATA_MINING` subprograms include, but are not limited, to the following:

- `ADD_COST_MATRIX` Procedure

- COMPUTE_CONFUSION_MATRIX Procedure
- COMPUTE_LIFT Procedure
- COMPUTE_ROC Procedure
- CREATE_MODEL Procedure
- DROP_MODEL Procedure
- EXPORT_MODEL Procedure
- GET_MODEL_COST_MATRIX Function
- IMPORT_MODEL Procedure
- REMOVE_COST_MATRIX Procedure
- RENAME_MODEL Procedure

Table 53-9 ALGO_EXTENSIBLE_LANG Settings

Setting Name	Setting Value	Description
RALG_BUILD_FUNCTION	R_BUILD_FUNCTION_SCRIPT_NAME	Specifies the name of an existing registered R script for the R algorithm machine learning model build function. The R script defines an R function for the first input argument for training data and returns an R model object. For clustering and feature extraction machine learning function model build, the R attributes <code>dm\$nclus</code> and <code>dm\$nfeat</code> must be set on the R model to indicate the number of clusters and features respectively. The <code>RALG_BUILD_FUNCTION</code> must be set along with <code>ALGO_EXTENSIBLE_LANG</code> in the <code>model_setting_table</code> .
RALG_BUILD_PARAMETER	SELECT <i>value</i> param_name, ...FROM DUAL	Specifies a list of numeric and string scalar for optional input parameters of the model build function.
RALG_SCORE_FUNCTION	R_SCORE_FUNCTION_SCRIPT_NAME	Specifies the name of an existing registered R script to score data. The script returns a <code>data.frame</code> containing the corresponding prediction results. The setting is used to score data for machine learning functions such as regression, classification, clustering, and feature extraction. This setting does not apply to the association and the attribute importance functions.
RALG_WEIGHT_FUNCTION	R_WEIGHT_FUNCTION_SCRIPT_NAME	Specifies the name of an existing registered R script for the R algorithm that computes the weight (contribution) for each attribute in scoring. The script returns a <code>data.frame</code> containing the contributing weight for each attribute in a row. This function setting is needed for the <code>PREDICTION_DETAILS SQL</code> function.
RALG_DETAILS_FUNCTION	R_DETAILS_FUNCTION_SCRIPT_NAME	Specifies the name of an existing registered R script for the R algorithm that produces the model information. This setting is required to generate a model view.

Table 53-9 (Cont.) ALGO_EXTENSIBLE_LANG Settings

Setting Name	Setting Value	Description
RALG_DETAILS_FORMAT	SELECT <i>type_value</i> <i>column_name</i> , ... FROM DUAL	Specifies the SELECT query for the list of numeric and string scalars for the output column type and the column name of the generated model view. This setting is required to generate a model view.

**See Also:**

Oracle Machine Learning for SQL User's Guide

53.5.2 DBMS_DATA_MINING — Algorithm Settings: CUR Matrix Decomposition

The following settings affects the behavior of the CUR Matrix Decomposition algorithm.

Table 53-10 CUR Matrix Decomposition Settings

Setting Name	Setting Value	Description
CURS_APPROX_ATTR_NUM	The value must be a positive integer	Defines the approximate number of attributes to be selected. The default value is the number of attributes.
CURS_ROW_IMPORTANCE	CURS_ROW_IMP_ENABLE CURS_ROW_IMP_DISABLE	Defines the flag indicating whether or not to perform row selection. The default value is CURS_ROW_IMP_DISABLE.
CURS_APPROX_ROW_NUM	The value must be a positive integer	Defines the approximate number of rows to be selected. This parameter is only used when users decide to perform row selection (CURS_ROW_IMP_ENABLE). The default value is the total number of rows.
CURS_SVD_RANK	The value must be a positive integer	Defines the rank parameter used in the column/row leverage score calculation. If users do not provide an input value, the value is determined by the system.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

**See Also:***Oracle Machine Learning for SQL Concepts*

53.5.3 DBMS_DATA_MINING — Algorithm Settings: Decision Tree

These settings configure the behavior of the Decision Tree algorithm. Note that the Decision Tree settings are also used to configure the behavior of Random Forest as it constructs each individual decision tree.

Table 53-11 Decision Tree Settings

Setting Name	Setting Value	Description
TREE_IMPURITY_METRIC	TREE_IMPURITY_ENTROPY TREE_IMPURITY_GINI	Tree impurity metric for Decision Tree. Tree algorithms seek the best test question for splitting data at each node. The best splitter and split values are those that result in the largest increase in target value homogeneity (purity) for the entities in the node. Purity is by a metric. Decision trees can use either Gini (TREE_IMPURITY_GINI) or entropy (TREE_IMPURITY_ENTROPY) as the purity metric. By default, the algorithm uses TREE_IMPURITY_GINI.
TREE_TERM_MAX_DEPTH	For Decision Tree: $2 \leq a \text{ number} \leq 20$ For Random Forest: $2 \leq a \text{ number} \leq 100$	Criteria for splits: maximum tree depth (the maximum number of nodes between the root and any leaf node, including the leaf node). For Decision Tree, the default is 7. For Random Forest, the default is 16.
TREE_TERM_MINPCT_NODE	$0 \leq a \text{ number} \leq 10$	The minimum number of training rows in a node expressed as a percentage of the rows in the training data. Default is 0.05, indicating 0.05%.
TREE_TERM_MINPCT_SPLI T	$0 < a \text{ number} \leq 20$	The minimum number of rows required to consider splitting a node expressed as a percentage of the training rows. Default is 0.1, indicating 0.1%.
TREE_TERM_MINREC_NODE	$a \text{ number} \geq 0$	The minimum number of rows in a node. Default is 10.
TREE_TERM_MINREC_SPLI T	$a \text{ number} > 1$	Criteria for splits: minimum number of records in a parent node expressed as a value. No split is attempted if the number of records is below this value. Default is 20.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.

- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

**See Also:**

Oracle Machine Learning for SQL Concepts for information about Decision Tree

53.5.4 DBMS_DATA_MINING — Algorithm Settings: Expectation Maximization

These algorithm settings configure the behavior of the Expectation Maximization algorithm.

**See Also:**

Oracle Data Mining Concepts for information about Expectation Maximization

Table 53-12 Expectation Maximization Settings for Data Preparation and Analysis

Setting Name	Setting Value	Description
EMCS_ATTRIBUTE_FILTER	EMCS_ATTR_FILTER_ENABLE EMCS_ATTR_FILTER_DISABLE	Whether or not to include uncorrelated attributes in the model. When EMCS_ATTRIBUTE_FILTER is enabled, uncorrelated attributes are not included.
		<div data-bbox="1019 1268 1065 1312" data-label="Image"></div> <div data-bbox="1065 1270 1153 1306" data-label="Section-Header">Note:</div> <div data-bbox="1065 1329 1336 1415" data-label="Text"> <p>This setting applies only to attributes that are not nested.</p> </div>
EMCS_MAX_NUM_ATTR_2D	TO_CHAR(<i>numeric_expr</i> >=1)	<p>For Clustering, the default is system-determined. For anomaly detection, the default is EMCS_ATTR_FILTER_DISABLE.</p> <p>Maximum number of correlated attributes to include in the model.</p> <p>Note: This setting applies only to attributes that are not nested (2D). Default is 50.</p>

Table 53-12 (Cont.) Expectation Maximization Settings for Data Preparation and Analysis

Setting Name	Setting Value	Description
EMCS_NUM_DISTRIBUTION	EMCS_NUM_DISTR_BERNOULLI EMCS_NUM_DISTR_GAUSSIAN EMCS_NUM_DISTR_SYSTEM	The distribution for modeling numeric attributes. Applies to the input table or view as a whole and does not allow per-attribute specifications. The options include Bernoulli, Gaussian, or system-determined distribution. When Bernoulli or Gaussian distribution is chosen, all numeric attributes are modeled using the same type of distribution. When the distribution is system-determined, individual attributes may use different distributions (either Bernoulli or Gaussian), depending on the data. Default is EMCS_NUM_DISTR_SYSTEM.
EMCS_NUM_EQUIWIDTH_BINS	TO_CHAR(1 <numeric_expr <=255)	Number of equi-width bins that will be used for gathering cluster statistics for numeric columns. Default is 11.
EMCS_NUM_PROJECTIONS	TO_CHAR(numeric_expr >=1)	Specifies the number of projections that will be used for each nested column. If a column has fewer distinct attributes than the specified number of projections, the data will not be projected. The setting applies to all nested columns. Default is 50.
EMCS_NUM_QUANTILE_BINS	TO_CHAR(1 <numeric_expr <=255)	Specifies the number of quantile bins that will be used for modeling numeric columns with multivalued Bernoulli distributions. Default is system-determined.
EMCS_NUM_TOPN_BINS	TO_CHAR(1 <numeric_expr <=255)	Specifies the number of top-N bins that will be used for modeling categorical columns with multivalued Bernoulli distributions. Default is system-determined.

Table 53-13 Expectation Maximization Settings for Learning

Setting Name	Setting Value	Description
EMCS_CONVERGENCE_CRITERION	EMCS_CONV_CRIT_HELDA SIDE EMCS_CONV_CRIT_BIC	The convergence criterion for EM. The convergence criterion may be based on a held-aside data set, or it may be Bayesian Information Criterion. Default is system determined.
EMCS_LOGLIKE_IMPROVEMENT	TO_CHAR(0 < numeric_expr < 1)	When the convergence criterion is based on a held-aside data set (EMCS_CONVERGENCE_CRITERION = EMCS_CONV_CRIT_HELDA SIDE), this setting specifies the percentage improvement in the value of the log likelihood function that is required for adding a new component to the model. Default value is 0.001.

Table 53-13 (Cont.) Expectation Maximization Settings for Learning

Setting Name	Setting Value	Description
EMCS_NUM_COMPONENTS	TO_CHAR(<i>numeric_expr</i> >=1)	Maximum number of components in the model. If model search is enabled, the algorithm automatically determines the number of components based on improvements in the likelihood function or based on regularization, up to the specified maximum. For EM Clustering, the number of components must be greater than or equal to the number of clusters. Default is 20 for both EM Clustering and EM Anomaly.
EMCS_NUM_ITERATIONS	TO_CHAR(<i>numeric_expr</i> >=1)	Specifies the maximum number of iterations in the EM algorithm. Default is 100.
EMCS_MODEL_SEARCH	EMCS_MODEL_SEARCH_ENABLE EMCS_MODEL_SEARCH_DISABLE (default).	This setting enables model search in EM where different model sizes are explored and a best size is selected. The default is EMCS_MODEL_SEARCH_DISABLE.
EMCS_REMOVE_COMPONENTS	EMCS_REMOVE_COMPS_ENABLE (default) EMCS_REMOVE_COMPS_DISABLE	This setting allows the EM algorithm to remove a small component from the solution. The default is EMCS_REMOVE_COMPS_ENABLE.
EMCS_RANDOM_SEED	Non-negative integer	This setting controls the seed of the random generator used in EM. The default is 0.

Table 53-14 Expectation Maximization Settings for Component Clustering

Setting Name	Setting Value	Description
EMCS_CLUSTER_COMPONENTS	EMCS_CLUSTER_COMP_ENABLE EMCS_CLUSTER_COMP_DISABLE	Enables or disables the grouping of EM components into high-level clusters. When disabled, the components themselves are treated as clusters. The setting can be used only for EM Clustering. When component clustering is enabled, model scoring through the SQL CLUSTER function will produce assignments to the higher level clusters. When clustering is disabled, the CLUSTER function will produce assignments to the original components. Default is EMCS_CLUSTER_COMP_ENABLE.
EMCS_CLUSTER_THRESH	TO_CHAR(<i>numeric_expr</i> >=1)	Dissimilarity threshold that controls the clustering of EM components. When the dissimilarity measure is less than the threshold, the components are combined into a single cluster. The setting can be used only for EM Clustering. A lower threshold may produce more clusters that are more compact. A higher threshold may produce fewer clusters that are more spread out. Default is 2.

Table 53-14 (Cont.) Expectation Maximization Settings for Component Clustering

Setting Name	Setting Value	Description
EMCS_LINKAGE_FUNCTION	EMCS_LINKAGE_SINGLE EMCS_LINKAGE_AVERAGE EMCS_LINKAGE_COMPLETE	<p>Allows the specification of a linkage function for the agglomerative clustering step. The setting can be used only for EM Clustering.</p> <p>EMCS_LINKAGE_SINGLE uses the nearest distance within the branch. The clusters tend to be larger and have arbitrary shapes.</p> <p>EMCS_LINKAGE_AVERAGE uses the average distance within the branch. There is less chaining effect and the clusters are more compact.</p> <p>EMCS_LINKAGE_COMPLETE uses the maximum distance within the branch. The clusters are smaller and require strong component overlap.</p> <p>Default is EMCS_LINKAGE_SINGLE.</p>

Table 53-15 Expectation Maximization Settings for Cluster Statistics

Setting Name	Setting Value	Description
EMCS_CLUSTER_STATISTICS	EMCS_CLUS_STATS_ENABLE EMCS_CLUS_STATS_DISABLE	<p>Enables or disables the gathering of descriptive statistics for clusters (centroids, histograms, and rules). When statistics are disabled, model size is reduced, and GET_MODEL_DETAILS_EM only returns taxonomy (hierarchy) and cluster counts. The setting can be used only for EM Clustering.</p> <p>Default is EMCS_CLUS_STATS_ENABLE.</p>
EMCS_MIN_PCT_ATTR_SUPPORT	TO_CHAR(0 < numeric_expr < 1)	<p>Minimum support required for including an attribute in the cluster rule. The support is the percentage of the data rows assigned to a cluster that must have non-null values for the attribute. The setting can be used only for EM Clustering.</p> <p>Default is 0.1.</p>

Table 53-16 Expectation Maximization Settings for Anomaly Detection

Setting Name	Setting Value	Description
EMCS_OUTLIER_RATE	TO_CHAR(0 < numeric_expr < 1)	<p>The desired rate of outliers in the training data. The setting can be used only for EM Anomaly.</p> <p>Default is 0.05.</p>

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

53.5.5 DBMS_DATA_MINING — Algorithm Settings: Explicit Semantic Analysis

Explicit Semantic Analysis (ESA) is a useful technique for extracting meaningful and interpretable features.

The settings listed in the following table configure the ESA values.

Table 53-17 Explicit Semantic Analysis Settings

Setting Name	Setting Value	Description
ESAS_EMBEDDINGS	ESAS_EMBEDDINGS_ENABLE ESAS_EMBEDDINGS_DISABLE	This setting applies to feature extraction models. The default value is ESAS_EMBEDDINGS_DISABLE. When you set ESAS_EMBEDDINGS_ENABLE: <ul style="list-style-type: none"> • ESA generates embeddings during scoring • The FEATURE_ID of the generated embeddings is of the datatype NUMBER • The CASE_ID_COLUMN_NAME argument of the DBMS_DATA_MINING.CREATE_MODEL and DBMS_DATA_MINING.CREATE_MODEL2 function is optional.
ESAS_EMBEDDING_SIZE	A positive integer less than or equal to 4096	This setting applies to feature extraction models. This setting specifies the size of the vectors representing embeddings. You can set this parameter only if you have enabled ESAS_EMBEDDINGS. The default size is 1024. If this value is less than the number of distinct features in the training set, then the actual number of explicit features is used as the size of embedding vectors instead.
ESAS_MIN_ITEMS	Text input 100 Non-text input is 0	This setting determines the minimum number of non-zero entries that need to be present in an input row. The default is 100 for text input and 0 for non-text input.
ESAS_TOPN_FEATURES	A positive integer	This setting controls the maximum number of features per attribute. The default is 1000.
ESAS_VALUE_THRESHOLD	Non-negative number	This setting thresholds a small value for attribute weights in the transformed build data. The default is 1e-8.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.

- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

**See Also:**

Oracle Machine Learning for SQL Concepts for information about ESA.

53.5.6 DBMS_DATA_MINING — Algorithm Settings: Exponential Smoothing

These settings configure the behavior of the Exponential Smoothing (ESM) algorithm.

The settings listed in the following table specify the setting names and possible values for Exponential Smoothing. The Constant Value column specifies constants using the prefix `DBMS_DATA_MINING`.

For Global settings, see [DBMS_DATA_MINING — Global Settings](#).

Table 53-18 Exponential Smoothing Settings

Setting Name	Setting Value	Description
EXSM_MODEL	EXSM_SIMPLE	This setting specifies the model.
	EXSM_SIMPLE_MULT_ERR	EXSM_SIMPLE: Simple exponential smoothing model is applied.
	EXSM_HOLT	EXSM_SIMPLE_MULT_ERR: Simple exponential smoothing model with multiplicative error is applied.
	EXSM_HOLT_DAMPED	EXSM_HOLT: Holt linear exponential smoothing model is applied.
	EXSM_MULT_TREND	EXSM_HOLT_DAMPED: Holt linear exponential smoothing model with damped trend is applied.
	EXSM_MULT_TREND_DAMPED	EXSM_MULT_TREND: Exponential smoothing model with multiplicative trend is applied.
	EXSM_SEASON_ADD	EXSM_MULT_TREND_DAMPED: Exponential smoothing model with multiplicative damped trend is applied.
	EXSM_SEASON_MUL	EXSM_SEASON_ADD: Exponential smoothing with additive seasonality, but no trend, is applied.
	EXSM_WINTERS	EXSM_SEASON_MUL: Exponential smoothing with multiplicative seasonality, but no trend, is applied.
	EXSM_WINTERS_DAMPED	EXSM_WINTERS: Holt-Winters triple exponential smoothing model, additive trend, multiplicative seasonality is applied.
	EXSM_ADDWINTERS	EXSM_WINTERS_DAMPED: Holt-Winters multiplicative exponential smoothing model with damped trend, additive trend, multiplicative seasonality is applied.
	EXSM_ADDWINTERS_DAMPED	EXSM_ADDWINTERS: Holt-Winters additive exponential smoothing model, additive trend, additive seasonality is applied.
	EXSM_WINTERS_MUL_TREND	EXSM_ADDWINTERS_DAMPED: Holt-Winters additive exponential smoothing model with damped trend, additive trend, additive seasonality is applied.
	EXSM_WINTERS_MUL_TREND_DMP	EXSM_WINTERS_MUL_TREND: Holt-Winters multiplicative exponential smoothing model with multiplicative trend, multiplicative trend, multiplicative seasonality is applied.
	EXSM_WINTERS_MUL_TREND_DMP: Holt-Winters multiplicative exponential smoothing model with damped multiplicative trend, multiplicative trend, multiplicative seasonality is applied.	
	The default value is EXSM_SIMPLE.	

Table 53-18 (Cont.) Exponential Smoothing Settings

Setting Name	Setting Value	Description
EXSM_SEASONALITY	positive integer > 1	<p>This setting specifies a positive integer value as the length of seasonal cycle. The value it takes must be larger than 1. For example, setting value 4 means that every group of four observations forms a seasonal cycle.</p> <p>This setting is only applicable and must be provided for models with seasonality, otherwise the model throws an error.</p> <p>When EXSM_INTERVAL is not set, this setting applies to the original input time series. When EXSM_INTERVAL is set, this setting applies to the accumulated time series.</p>
EXSM_INTERVAL	EXSM_INTERVAL_YEAR EXSM_INTERVAL_QTR EXSM_INTERVAL_MONTH EXSM_INTERVAL_WEEK EXSM_INTERVAL_DAY EXSM_INTERVAL_HOUR EXSM_INTERVAL_MINUTE EXSM_INTERVAL_SECOND	<p>This setting only applies and must be provided when the time column (<i>case_id</i> column) has datetime type. It specifies the spacing interval of the accumulated equally spaced time series.</p> <p>The model throws an error if the time column of input table is of datetime type and setting EXSM_INTERVAL is not provided.</p> <p>The model throws an error if the time column of input table is of oracle number type and setting EXSM_INTERVAL is provided.</p>

Table 53-18 (Cont.) Exponential Smoothing Settings


Setting Name	Setting Value	Description
EXSM_INITVL_OPTIMIZE	EXSM_INITVL_OPTIMIZE_ENABLE EXSM_INITVL_OPTIMIZE_DISABLE	The setting EXSM_INITVL_OPTIMIZE determines whether initial values are optimized during model build. The default value is EXSM_INITVL_OPTIMIZE_ENABLE.
		<div style="border-left: 2px solid #0070C0; border-right: 2px solid #0070C0; border-bottom: 2px solid #0070C0; padding: 10px; background-color: #E6F2FF;"> <p> Note:</p> <p>EXSM_INITVL_OPTIMIZE can only be set to EXSM_INITVL_OPTIMIZE_DISABLE if the user has set EXSM_MODEL to EXSM_HW or EXSM_HW_ADD SEA. If EXSM_MODEL is set to another model type or is not specified, error 40213 (conflicting settings) is thrown and the model is not built.</p> </div>
EXSM_ACCUMULATE	EXSM_ACCU_TOTAL EXSM_ACCU_STD EXSM_ACCU_MAX EXSM_ACCU_MIN EXSM_ACCU_AVG EXSM_ACCU_MEDIAN EXSM_ACCU_COUNT	This setting only applies and must be provided when the time column has datetime type. It specifies how to generate the value of the accumulated time series from the input time series.

Table 53-18 (Cont.) Exponential Smoothing Settings


Setting Name	Setting Value	Description
EXSM_SETMISSING	Specify an option: EXSM_MISS_MIN EXSM_MISS_MAX EXSM_MISS_AVG EXSM_MISS_MEDIAN EXSM_MISS_LAST EXSM_MISS_FIRST EXSM_MISS_PREV EXSM_MISS_NEXT EXSM_MISS_AUTO	<p>This setting specifies how to handle missing values, which may come from input data and/or the accumulation process of time series. You can specify either a number or an option. If a number is specified, all the missing values are set to that number.</p> <p>EXSM_MISS_MIN: Replaces missing value with minimum of the accumulated time series.</p> <p>EXSM_MISS_MAX: Replaces missing value with maximum of the accumulated time series.</p> <p>EXSM_MISS_AVG: Replaces missing value with average of the accumulated time series.</p> <p>EXSM_MISS_MEDIAN: Replaces missing value with median of the accumulated time series.</p> <p>EXSM_MISS_LAST: Replaces missing value with last non-missing value of the accumulated time series.</p> <p>EXSM_MISS_FIRST: Replaces missing value with first non-missing value of the accumulated time series.</p> <p>EXSM_MISS_PREV: Replaces missing value with the previous non-missing value of the accumulated time series.</p> <p>EXSM_MISS_NEXT: Replaces missing value with the next non-missing value of the accumulated time series.</p> <p>EXSM_MISS_AUTO: EXSM model treats the input data as an irregular (non-uniformly spaced) time series.</p> <p>If this setting is not provided, EXSM_MISS_AUTO is the default value. In such a case, the model treats the input time series as irregular time series, viewing missing values as gaps.</p>
EXSM_PREDICTION_STEP	It must be set to a number between 1-30.	<p>This setting specifies how many steps ahead the predictions are to be made.</p> <p>If it is not set, the default value is 1: the model gives one-step-ahead prediction. A value greater than 30 results in an error.</p>
EXSM_CONFIDENCE_LEVEL	It must be a number between 0 and 1, exclusive.	<p>This setting specifies the desired confidence level for prediction.</p> <p>The lower and upper bounds of the specified confidence interval is reported. If this setting is not specified, the default confidence level is 95%.</p>

Table 53-18 (Cont.) Exponential Smoothing Settings

Setting Name	Setting Value	Description
EXSM_OPT_CRITERION	EXSM_OPT_CRIT_LIK EXSM_OPT_CRIT_MSE EXSM_OPT_CRIT_AMSE EXSM_OPT_CRIT_SIG EXSM_OPT_CRIT_MAE	<p>This setting specifies the desired optimization criterion. The optimization criterion is useful as a diagnostic for comparing models' fit to the same data.</p> <p>EXSM_OPT_CRIT_LIK: Minus twice the log-likelihood of a model.</p> <p>EXSM_OPT_CRIT_MSE: Mean square error of a model.</p> <p>EXSM_OPT_CRIT_AMSE: Average mean square error over user-specified time window.</p> <p>EXSM_OPT_CRIT_SIG: Model's standard deviation of residuals.</p> <p>EXSM_OPT_CRIT_MAE: Mean absolute error of a model.</p> <p>The default value is EXSM_OPT_CRIT_LIK.</p>
EXSM_NMSE	positive integer	<p>This setting specifies the length of the window used in computing the error metric average mean square error (AMSE).</p>

Table 53-18 (Cont.) Exponential Smoothing Settings

Setting Name	Setting Value	Description
EXSM_SERIES_LIST	Comma delimited list of time series columns	<p>This setting allows you to forecast up to twenty predictor series in addition to the target series.</p> <p>The column names in EXSM_SERIES_LIST are enclosed in single quotes.</p>

 **Note:**

The list is enclosed in single quotes, not the individual column names.

For example:

```
INSERT INTO
<settings_table_name
VALUES (dbms_data_mining.exsm_ser
ies_list,
'<column1>,<column2>,<column3>,<
column4>');
```

For the prefix DM\$ must be added to the build and scoring data sets and column names must be less than 125 characters long. See Model Detail Views for Exponential Smoothing.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

See Also:

Oracle Machine Learning for SQL Concepts for information about ESM.

53.5.7 DBMS_DATA_MINING — Algorithm Settings: Generalized Linear Model

The settings listed in the following table configure the behavior of the Generalized Linear Model algorithm.

Table 53-19 DBMS_DATA_MINING GLM Settings

Setting Name	Setting Value	Description
GLMS_CONF_LEVEL	TO_CHAR(0 < numeric_expr < 1)	The confidence level for coefficient confidence intervals. The default confidence level is 0.95.
GLMS_FTR_GEN_METHOD	GLMS_FTR_GEN_QUADRATIC GLMS_FTR_GEN_CUBIC	Whether feature generation is quadratic or cubic. When feature generation is enabled, the algorithm automatically chooses the most appropriate feature generation method based on the data.
GLMS_FTR_GENERATION	GLMS_FTR_GENERATION_ENABLED GLMS_FTR_GENERATION_DISABLED	Whether or not feature generation is enabled for GLM. By default, feature generation is not enabled. Note: Feature generation can only be enabled when feature selection is also enabled.
GLMS_FTR_SEL_CRIT	GLMS_FTR_SEL_AIC GLMS_FTR_SEL_SBIC GLMS_FTR_SEL_RIC GLMS_FTR_SEL_ALPHA_INV	Feature selection penalty criterion for adding a feature to the model. When feature selection is enabled, the algorithm automatically chooses the penalty criterion based on the data.
GLMS_FTR_SELECTION	GLMS_FTR_SELECTION_ENABLED GLMS_FTR_SELECTION_DISABLED	Whether or not feature selection is enabled for GLM. By default, feature selection is not enabled.
GLMS_MAX_FEATURES	TO_CHAR(0 < numeric_expr <= 2000)	When feature selection is enabled, this setting specifies the maximum number of features that can be selected for the final model. By default, the algorithm limits the number of features to ensure sufficient memory.
GLMS_PRUNE_MODEL	GLMS_PRUNE_MODEL_ENABLED GLMS_PRUNE_MODEL_DISABLED	Prune enable or disable for features in the final model. Pruning is based on T-Test statistics for linear regression, or Wald Test statistics for logistic regression. Features are pruned in a loop until all features are statistically significant with respect to the full data. When feature selection is enabled, the algorithm automatically prunes based on the data.
GLMS_REFERENCE_CLASS_NAME	target_value	The target value used as the reference class in a binary logistic regression model. Probabilities are produced for the other class. By default, the algorithm chooses the value with the highest prevalence (the most cases) for the reference class.

Table 53-19 (Cont.) DBMS_DATA_MINING GLM Settings

Setting Name	Setting Value	Description
GLMS_RIDGE_REGRESSION	GLMS_RIDGE_REG_ENABLE GLMS_RIDGE_REG_DISABLE	<p>Enable or disable ridge regression. Ridge applies to both regression and classification machine learning functions.</p> <p>When ridge is enabled, prediction bounds are not produced by the PREDICTION_BOUNDS SQL function.</p> <p>Note: Ridge may only be enabled when feature selection is not specified, or has been explicitly disabled. If ridge regression and feature selection are both explicitly enabled, then an exception is raised.</p>
GLMS_RIDGE_VALUE	TO_CHAR (numeric_expr > 0)	<p>The value of the ridge parameter. This setting is only used when the algorithm is configured to use ridge regression.</p> <p>If ridge regression is enabled internally by the algorithm, then the ridge parameter is determined by the algorithm.</p>
GLMS_ROW_DIAGNOSTICS	GLMS_ROW_DIAG_ENABLE GLMS_ROW_DIAG_DISABLE (default).	Enable or disable row diagnostics.
GLMS_CONV_TOLERANCE	The range is (0, 1) non-inclusive.	Convergence Tolerance setting of the GLM algorithm. The default value is system-determined.
GLMS_NUM_ITERATIONS	Positive integer	Maximum number of iterations for the GLM algorithm. The default value is system-determined.
GLMS_BATCH_ROWS	0 or Positive integer	<p>Number of rows in a batch used by the SGD solver. The value of this parameter sets the size of the batch for the SGD solver. An input of 0 triggers a data driven batch size estimate.</p> <p>The default is 2000</p>

Table 53-19 (Cont.) DBMS_DATA_MINING GLM Settings

Setting Name	Setting Value	Description
GLMS_SOLVER	GLMS_SOLVER_SGD (StochasticGradient Descent) GLMS_SOLVER_CHOL (Cholesky) GLMS_SOLVER_QR GLMS_SOLVER_LBFGS_ADM M	<p>This setting allows the user to choose the GLM solver. The solver cannot be selected if GLMS_FTR_SELECTION setting is enabled.</p> <p>The following are the options:</p> <ul style="list-style-type: none"> GLMS_SOLVER_SGD: Optimizes generalized linear models by iteratively updating parameters using a subset of the data to minimize errors. GLMS_SOLVER_CHOL: Solves generalized linear models using the Cholesky decomposition method, which provides a stable and efficient solution by transforming the model into a simpler form. GLMS_SOLVER_QR: Utilizes the QR decomposition technique to solve generalized linear models, ensuring numerical stability and accuracy by decomposing the problem into orthogonal and triangular components. GLMS_SOLVER_LBFGS_ADM: Combines L-BFGS, an approximation of the Broyden-Fletcher-Goldfarb-Shanno optimization algorithm, with ADMM for solving large-scale generalized linear model problems efficiently. <p>The default value is system determined.</p>
GLMS_SPARSE_SOLVER	GLMS_SPARSE_SOLVER_EN ABLE GLMS_SPARSE_SOLVER_DI SABLE (default).	<p>This setting allows the user to use sparse solver if it is available. The default value is GLMS_SPARSE_SOLVER_DISABLE.</p>
GLMS_LINK_FUNCTION	GLMS_IDENTITY_LINK GLMS_LOGIT_LINK GLMS_PROBIT_LINK GLMS_CLOGLOG_LINK GLMS_CAUCHIT_LINK	<p>This setting allows the user to specify the link function for building a GLM model. The link functions are specific to the mining function. For classification, the following are applicable:</p> <ul style="list-style-type: none"> GLMS_LOGIT_LINK (default) GLMS_PROBIT_LINK GLMS_CLOGLOG_LINK GLMS_CAUCHIT_LINK <p>For regression, the following is applicable:</p> <ul style="list-style-type: none"> GLMS_IDENTITY_LINK (default)

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
 A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
 The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

- [DBMS_DATA_MINING — Algorithm Settings: Neural Network](#)
The settings listed in the following table configure the behavior of the Neural Network algorithm.
- [DBMS_DATA_MINING — Solver Settings: LBFGS](#)
The settings listed in the following table configure the behavior of L-BFGS. Neural Network and Generalized Linear Model (GLM) use these settings.
- [DBMS_DATA_MINING — Solver Settings: ADMM](#)
The settings listed in the following table configure the behavior of Alternating Direction Method of Multipliers (ADMM). The Generalized Linear Model (GLM) algorithm uses these settings.
- *Oracle Machine Learning for SQL Concepts*

 **See Also:**

Oracle Machine Learning for SQL Concepts for information about GLM.

53.5.8 DBMS_DATA_MINING — Algorithm Settings: k-Means

The settings listed in the following table configure the behavior of the *k*-Means algorithm.

Table 53-20 k-Means Settings

Setting Name	Setting Value	Description
KMNS_CONV_TOLERANCE	TO_CHAR(0<numeric_expr<1)	Minimum Convergence Tolerance for <i>k</i> -Means. The algorithm iterates until the minimum Convergence Tolerance is satisfied or until the maximum number of iterations, specified in KMNS_ITERATIONS, is reached. Decreasing the Convergence Tolerance produces a more accurate solution but may result in longer run times. The default Convergence Tolerance is 0.001.
KMNS_DISTANCE	KMNS_COSINE KMNS_EUCLIDEAN	Distance function for <i>k</i> -Means. The default distance function is KMNS_EUCLIDEAN.
KMNS_ITERATIONS	TO_CHAR(positive_numeric_expr)	Maximum number of iterations for <i>k</i> -Means. The algorithm iterates until either the maximum number of iterations is reached or the minimum Convergence Tolerance, specified in KMNS_CONV_TOLERANCE, is satisfied. The default number of iterations is 20.
KMNS_MIN_PCT_ATTR_SUPPORT	TO_CHAR(0<=numeric_expr<=1)	Minimum percentage of attribute values that must be non-null in order for the attribute to be included in the rule description for the cluster. If the data is sparse or includes many missing values, a minimum support that is too high can cause very short rules or even empty rules. The default minimum support is 0.1.

Table 53-20 (Cont.) k-Means Settings

Setting Name	Setting Value	Description
KMNS_NUM_BINS	TO_CHAR(<i>numeric_expr</i> >0)	Number of bins in the attribute histogram produced by <i>k</i> -means. The bin boundaries for each attribute are computed globally on the entire training data set. The binning method is equi-width. All attributes have the same number of bins with the exception of attributes with a single value that have only one bin. The default number of histogram bins is 11.
KMNS_SPLIT_CRITERION	KMNS_SIZE KMNS_VARIANCE	Split criterion for <i>k</i> -means. The split criterion controls the initialization of new <i>k</i> -Means clusters. The algorithm builds a binary tree and adds one new cluster at a time. When the split criterion is based on size, the new cluster is placed in the area where the largest current cluster is located. When the split criterion is based on the variance, the new cluster is placed in the area of the most spread-out cluster. The default split criterion is the KMNS_VARIANCE.
KMNS_RANDOM_SEED	Non-negative integer	This setting controls the seed of the random generator used during the <i>k</i> -Means initialization. It must be a non-negative integer value. The default is 0.
KMNS_DETAILS	KMNS_DETAILS_NONE KMNS_DETAILS_HIERARCHY KMNS_DETAILS_ALL	This setting determines the level of cluster detail that are computed during the build. KMNS_DETAILS_NONE: No cluster details are computed. Only the scoring information is persisted. KMNS_DETAILS_HIERARCHY: Cluster hierarchy and cluster record counts are computed. This is the default value. KMNS_DETAILS_ALL: Cluster hierarchy, record counts, descriptive statistics (means, variances, modes, histograms, and rules) are computed.

Table 53-20 (Cont.) k-Means Settings

Setting Name	Setting Value	Description
KMNS_WINSORIZE	KMNS_WINSORIZE_ENABLE KMNS_WINSORIZE_DISABLE	To winorize data, enable or disable this parameter. Data is restricted in a window size of six standard deviations around the mean value when winsorize is enabled. This functionality can be used with <code>AUTO_DATA_PREP</code> turned ON and OFF. The values outside the range are replaced with the ends of the interval. Winsorize is not enabled by default.

 **Note:**

Winsorize is only available when the `KMNS_EUCLIDEAN` distance function is used. An exception is raised if Winsorize is enabled and other distance functions are set.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

 **See Also:**

- For generic machine learning function settings related to Clustering, see [DBMS_DATA_MINING — Machine Learning Functions](#).
- *Oracle Machine Learning for SQL Concepts* for information about *k*-Means

53.5.9 DBMS_DATA_MINING - Algorithm Settings: Multivariate State Estimation Technique - Sequential Probability Ratio Test

Settings that configure the training calibration behavior of the Multivariate State Estimation Technique - Sequential Probability Ratio Test algorithm.

Table 53-21 MSET-SPRT Settings

Setting Name	Setting Value	Description
MSET_ADB_HEIGHT	A positive double	Estimates the band within which signal values normally oscillate. The default value is 0.05.
MSET_ALERT_COUNT	A positive integer	The number of the last n signals (the alert window) that should have passed the threshold to raise an alert. The alert count should be lower or equal to the alert window. The default value is 5.
MSET_ALERT_WINDOW	A positive integer greater than or equal to MSET_ALERT_COUNT	The number of signals to consider in the SPRT hypothesis consolidation logic. The default value is 5.
MSET_ALPHA_PROB	A positive double between 0 and 1	False Alarm Probability FAP (false positive). The default is 0.01.
MSET_BETA_PROB	A positive double between 0 and 1	Missed Alarm Probability MAP (false negative). The default is 0.10.
MSET_HELDASIDE	A positive integer	The approximate number of data rows used for MSET model calibration. You can use ODMS_RANDOM_SEED to change the held-aside sample. The default value is 10000.
MSET_MEMORY_VECTORS	A positive integer	The default value is data driven.
MSET_PROJECTION_THRESHOLD	A positive integer >0, <=10000	Specifies whether to use random projections. When the number of sensors exceeds the setting value, random projections are used. To turn off random projections, set the threshold to a value that is equal to or greater than the number of sensors. The default value is 500.
MSET_STD_TOLERANCE	A positive integer	The tolerance in standard deviations used in the SPRT calculation. The default value is 3.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

53.5.10 DBMS_DATA_MINING — Algorithm Settings: Naive Bayes

The settings listed in the following table configure the behavior of the Naive Bayes algorithm.

Table 53-22 Naive Bayes Settings

Setting Name	Setting Value	Description
NABS_PAIRWISE_THRESHO LD	TO_CHAR(0<= <i>numeric_expr</i> <=1)	Value of pairwise threshold for NB algorithm Default is 0.
NABS_SINGLETON_THRESH OLD	TO_CHAR(0<= <i>numeric_expr</i> <=1)	Value of singleton threshold for NB algorithm Default value is 0.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.



See Also:

Oracle Machine Learning for SQL Concepts for information about Naive Bayes

53.5.11 DBMS_DATA_MINING — Algorithm Settings: Neural Network

The settings listed in the following table configure the behavior of the Neural Network algorithm.

Table 53-23 DBMS_DATA_MINING Neural Network Settings

Setting Name	Setting Value	Description
NNET_SOLVER	One of the following strings: <ul style="list-style-type: none"> • NNET_SOLVER_ADAM • NNET_SOLVER_LBFGS 	Specifies the method of optimization. The default value is system determined.

Table 53-23 (Cont.) DBMS_DATA_MINING Neural Network Settings

Setting Name	Setting Value	Description
NNET_ACTIVATIONS	<p>One or more of the following strings:</p> <ul style="list-style-type: none"> • NNET_ACTIVATIONS_ARCTAN • NNET_ACTIVATIONS_BIPOLAR_SIG • NNET_ACTIVATIONS_LINEAR • NNET_ACTIVATIONS_LOG_SIG • NNET_ACTIVATIONS_RELU • NNET_ACTIVATIONS_TANH 	<p>Specifies the activation functions for the hidden layers. You can specify a single activation function, which is then applied to each hidden layer, or you can specify an activation function for each layer individually. Different layers can have different activation functions. To apply a different activation function to one or more of the layers, you must specify an activation function for each layer. The number of activation functions you specify must be consistent with the NNET_HIDDEN_LAYERS and NNET_NODES_PER_LAYER values.</p> <p>For example, if you have three hidden layers, you could specify the use of the same activation function for all three layers with the following settings value:</p> <pre>('NNET_ACTIVATIONS', 'NNET_ACTIVATIONS_TANH')</pre> <p>The following settings value specifies a different activation function for each layer:</p> <pre>('NNET_ACTIVATIONS', ' 'NNET_ACTIVATIONS_TANH' ', ' 'NNET_ACTIVATIONS_LOG_SIG' ', ' 'NNET_ACTIVATIONS_ARCTAN' ')</pre>
NNET_HELDASIDE_MAX_FAIL	A positive integer	<p>The default value is NNET_ACTIVATIONS_LOG_SIG.</p> <p>With NNET_REGULARIZER_HELDASIDE, the training process is stopped early if the network performance on the validation data fails to improve or remains the same for NNET_HELDASIDE_MAX_FAIL epochs in a row.</p> <p>The default value is 6.</p>
NNET_HELDASIDE_RATIO	0 <= numeric_expr <=1	<p>Define the held ratio for the held-aside method.</p> <p>The default value is 0.25.</p>

 **Note:**

You specify the different activation functions as strings within a single string. All quotes are single and two single quotes are used to escape a single quote in SQL statements and PL/SQL blocks.

Table 53-23 (Cont.) DBMS_DATA_MINING Neural Network Settings

Setting Name	Setting Value	Description
NNET_HIDDEN_LAYERS	A positive integer	Defines the topology by the number of hidden layers. The default value is 1.
NNET_ITERATIONS	A positive integer	Specifies the maximum number of iterations in the Neural Network algorithm. For the DMSSET_NN_SOLVER_LBFGS solver, the default value is 200. For the DMSSET_NN_SOLVER_ADAM solver, the default value is 10000.
NNET_NODES_PER_LAYER	A positive integer or a list of positive integers	Defines the topology by the number of nodes per layer. Different layers can have different numbers of nodes. To specify the same number of nodes for each layer, you can provide a single value, which is then applied to each layer. To specify a different number of nodes for one or more layers, provide a list of comma-separated positive integers, one for each layer. For example, '10, 20, 5' for three layers. The setting values must be consistent with the NNET_HIDDEN_LAYERS value. The default number of nodes per layer is the number of attributes or 50 (if the number of attributes > 50).
NNET_REG_LAMBDA	TO_CHAR(numeric_expr >=0)	Defines the L2 regularization parameter lambda. This can not be set together with NNET_REGULARIZER_HELDASIDE. The default value is 1.
NNET_REGULARIZER	One of the following strings: <ul style="list-style-type: none"> • NNET_REGULARIZER_HELDASIDE • NNET_REGULARIZER_L2 • NNET_REGULARIZER_NONE 	Regularization setting for Neural Network algorithm. If the total number of training rows is greater than 50000, the default is NNET_REGULARIZER_HELDASIDE. If the total number of training rows is less than or equal to 50000, the default is NNET_REGULARIZER_NONE.
NNET_TOLERANCE	TO_CHAR(0 < numeric_expr < 1)	Defines the convergence tolerance setting of the Neural Network algorithm. The default value is 0.000001.

Table 53-23 (Cont.) DBMS_DATA_MINING Neural Network Settings

Setting Name	Setting Value	Description
NNET_WEIGHT_LOWER_BOUND	A real number	<p>The setting specifies the lower bound of the region where weights are randomly initialized.</p> <p>NNET_WEIGHT_LOWER_BOUND and NNET_WEIGHT_UPPER_BOUND must be set together. Setting one and not setting the other raises an error. NNET_WEIGHT_LOWER_BOUND must not be greater than NNET_WEIGHT_UPPER_BOUND. The default value is $\sqrt{6/(l_nodes+r_nodes)}$. The value of l_nodes for:</p> <ul style="list-style-type: none"> input layer dense attributes is (1+number of dense attributes) input layer sparse attributes is number of sparse attributes each hidden layer is (1+number of nodes in that hidden layer) <p>The value of r_nodes is the number of nodes in the layer that the weight is connecting to.</p>
NNET_WEIGHT_UPPER_BOUND	A real number	<p>This setting specifies the upper bound of the region where weights are initialized. It should be set in pairs with NNET_WEIGHT_LOWER_BOUND and its value must not be smaller than the value of NNET_WEIGHT_LOWER_BOUND. If not specified, the values of NNET_WEIGHT_LOWER_BOUND and NNET_WEIGHT_UPPER_BOUND are system determined. The default value is $\sqrt{6/(l_nodes+r_nodes)}$. See NNET_WEIGHT_LOWER_BOUND.</p>

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
 A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
 The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.
- [DBMS_DATA_MINING — Solver Settings: LBFGS](#)
 The settings listed in the following table configure the behavior of L-BFGS. Neural Network and Generalized Linear Model (GLM) use these settings.

See Also:

Oracle Machine Learning for SQL Concepts for information about Neural Network.

53.5.12 DBMS_DATA_MINING — Algorithm Settings: Non-Negative Matrix Factorization

The settings listed in the following table configure the behavior of the Non-negative Matrix Factorization algorithm.

You can query the data dictionary view `*_MINING_MODEL_SETTINGS` (using the `ALL`, `USER`, or `DBA` prefix) to find the setting values for a model. See *Oracle Database Reference* for information about `*_MINING_MODEL_SETTINGS`.

Table 53-24 NMF Settings

Setting Name	Setting Value	Description
NMFS_CONV_TOLERANCE	TO_CHAR(0 < numeric_expr <= 0.5)	Convergence tolerance for NMF algorithm Default is 0.05
NMFS_NONNEGATIVE_SCORING	NMFS_NONNEG_SCORING_ENABLE NMFS_NONNEG_SCORING_DISABLE	Whether negative numbers should be allowed in scoring results. When set to NMFS_NONNEG_SCORING_ENABLE, negative feature values will be replaced with zeros. When set to NMFS_NONNEG_SCORING_DISABLE, negative feature values will be allowed. Default is NMFS_NONNEG_SCORING_ENABLE
NMFS_NUM_ITERATIONS	TO_CHAR(1 <= numeric_expr <= 500)	Number of iterations for NMF algorithm Default is 50
NMFS_RANDOM_SEED	TO_CHAR(numeric_expr)	Random seed for NMF algorithm. Default is -1.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

See Also:

Oracle Machine Learning for SQL Concepts for information about NMF

53.5.13 DBMS_DATA_MINING — Algorithm Settings: O-Cluster

The settings in the table configure the behavior of the O-Cluster algorithm.

Table 53-25 O-Cluster Settings

Setting Name	Setting Value	Description
OCLT_SENSITIVITY	TO_CHAR(0 <=numeric_expr <=1)	A fraction that specifies the peak density required for separating a new cluster. The fraction is related to the global uniform density. Default is 0.5.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.



See Also:

Oracle Machine Learning for SQL Concepts for information about O-Cluster

53.5.14 DBMS_DATA_MINING — Algorithm Settings: Random Forest

These settings configure the behavior of the Random Forest algorithm. Random Forest makes use of the Decision Tree settings to configure the construction of individual trees.

Table 53-26 Random Forest Settings

Setting Name	Setting Value	Description
RFOR_MTRY	a number >= 0	Size of the random subset of columns to be considered when choosing a split at a node. For each node, the size of the pool remains the same, but the specific candidate columns change. The default is half of the columns in the model signature. The special value 0 indicates that the candidate pool includes all columns.
RFOR_NUM_TREES	1<= a number <=65535	Number of trees in the forest Default is 20.
RFOR_SAMPLING_RATIO	0< a fraction<=1	Fraction of the training data to be randomly sampled for use in the construction of an individual tree. The default is half of the number of rows in the training data.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.
- [DBMS_DATA_MINING — Algorithm Settings: Decision Tree](#)
These settings configure the behavior of the Decision Tree algorithm. Note that the Decision Tree settings are also used to configure the behavior of Random Forest as it constructs each individual decision tree.



See Also:

Oracle Machine Learning for SQL Concepts for information about Random Forest

53.5.15 DBMS_DATA_MINING — Algorithm Constants and Settings: Singular Value Decomposition

The following settings configure the behavior of the Singular Value Decomposition algorithm.

Table 53-27 Singular Value Decomposition Settings

Setting Name	Setting Value	Description
SVDS_U_MATRIX_OUTPUT	SVDS_U_MATRIX_ENABLED	Indicates whether or not to persist the U Matrix produced by SVD.
	SVDS_U_MATRIX_DISABLED	The U matrix in SVD has as many rows as the number of rows in the build data. To avoid creating a large model, the U matrix is persisted only when <code>SVDS_U_MATRIX_OUTPUT</code> is enabled.
		When <code>SVDS_U_MATRIX_OUTPUT</code> is enabled, the build data must include a case ID. If no case ID is present and the U matrix is requested, then an exception is raised.
		Default is <code>SVDS_U_MATRIX_DISABLED</code> .
SVDS_SCORING_MODE	SVDS_SCORING_SVD	Whether to use SVD or PCA scoring for the model.
	SVDS_SCORING_PCA	When the build data is scored with SVD, the projections will be the same as the U matrix. When the build data is scored with PCA, the projections will be the product of the U and S matrices.
		Default is <code>SVDS_SCORING_SVD</code> .

Table 53-27 (Cont.) Singular Value Decomposition Settings

Setting Name	Setting Value	Description
SVDS_SOLVER	SVDS_SOLVER_TSSVD SVDS_SOLVER_TSEIGEN SVDS_SOLVER_SSDV SVDS_SOLVER_STEIGEN	<p>This setting indicates the solver to be used for computing SVD of the data. In the case of PCA, the solver setting indicates the type of SVD solver used to compute the PCA for the data. When this setting is not specified the solver type selection is data driven. If the number of attributes is greater than 3240, then the default wide solver is used. Otherwise, the default narrow solver is selected.</p> <p>The following are the group of solvers:</p> <ul style="list-style-type: none"> Narrow data solvers: for matrices with up to 11500 attributes (TSEIGEN) or up to 8100 attributes (TSSVD). Wide data solvers: for matrices up to 1 million attributes. <p>For narrow data solvers:</p> <ul style="list-style-type: none"> Tall-Skinny SVD uses QR computation TSVD (SVDS_SOLVER_TSSVD) Tall-Skinny SVD uses eigenvalue computation, TSEIGEN (SVDS_SOLVER_TSEIGEN), is the default solver for narrow data. <p>For wide data solvers:</p> <ul style="list-style-type: none"> Stochastic SVD uses QR computation SSDV (SVDS_SOLVER_SSDV), is the default solver for wide data solvers. Stochastic SVD uses eigenvalue computations, STEIGEN (SVDS_SOLVER_STEIGEN).
SVDS_TOLERANCE	Range [0, 1]	This setting is used to prune features. Define the minimum value the eigenvalue of a feature as a share of the first eigenvalue to not to prune. Default value is data driven.
SVDS_RANDOM_SEED	Range [0 - 4,294,967,296]	The random seed value is used for initializing the sampling matrix used by the Stochastic SVD solver. The default is 0. The SVD Solver must be set to SSDV or STEIGEN.
SVDS_OVER_SAMPLING	Range [1, 5000].	This setting is configures the number of columns in the sampling matrix used by the Stochastic SVD solver. The number of columns in this matrix is equal to the requested number of features plus the oversampling setting. The SVD Solver must be set to SSDV or STEIGEN.
SVDS_POWER_ITERATIONS	Range [0, 20].	The power iteration setting improves the accuracy of the SSDV solver. The default is 2. The SVD Solver must be set to SSDV or STEIGEN.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
 A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
 The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

**See Also:***Oracle Machine Learning for SQL Concepts*

53.5.16 DBMS_DATA_MINING — Algorithm Settings: Support Vector Machine

The settings listed in the following table configure the behavior of the Support Vector Machine algorithm.

Table 53-28 SVM Settings

Setting Name	Setting Value	Description
SVMS_COMPLEXITY_FACTOR	TO_CHAR(numeric_expr >0)	Regularization setting that balances the complexity of the model against model robustness to achieve good generalization on new data. SVM uses a data-driven approach to finding the complexity factor. Value of complexity factor for SVM algorithm (both classification and regression). Default value estimated from the data by the algorithm.
SVMS_CONV_TOLERANCE	TO_CHAR(numeric_expr >0)	Convergence tolerance for SVM algorithm. Default is 0.0001.
SVMS_EPSILON	TO_CHAR(numeric_expr >0)	Regularization setting for regression, similar to complexity factor. Epsilon specifies the allowable residuals, or noise, in the data. Value of epsilon factor for SVM regression. Default is 0.1.
SVMS_KERNEL_FUNCTION	SVMS_GAUSSIAN SVMS_LINEAR	Kernel for Support Vector Machine. Linear or Gaussian. The default value is SVMS_LINEAR.
SVMS_OUTLIER_RATE	TO_CHAR(0 < numeric_expr < 1)	The desired rate of outliers in the training data. Valid for One-Class SVM models only (anomaly detection). Default is 0.01.
SVMS_STD_DEV	TO_CHAR(numeric_expr >0)	Controls the spread of the Gaussian kernel function. SVM uses a data-driven approach to find a standard deviation value that is on the same scale as distances between typical cases. Value of standard deviation for SVM algorithm. This is applicable only for Gaussian kernel. Default value estimated from the data by the algorithm.
SVMS_NUM_ITERATIONS	Positive integer	This setting sets an upper limit on the number of SVM iterations. The default is system determined because it depends on the SVM solver.
SVMS_NUM_PIVOTS	Range [1; 10000]	This setting sets an upper limit on the number of pivots used in the Incomplete Cholesky decomposition. It can be set only for non-linear kernels. The default value is 200.

Table 53-28 (Cont.) SVM Settings

Setting Name	Setting Value	Description
SVMS_BATCH_ROWS	Positive integer	This setting applies to SVM models with linear kernel. This setting sets the size of the batch for the SGD solver. An input of 0 triggers a data driven batch size estimate. The default is 20000.
SVMS_REGULARIZER	SVMS_REGULARIZER_L 1 SVMS_REGULARIZER_L 2	This setting controls the type of regularization that the SGD SVM solver uses. The setting can be used only for linear SVM models. The default is system determined because it depends on the potential model size.
SVMS_SOLVER	SVMS_SOLVER_SGD (Sub-Gradient Descend) SVMS_SOLVER_IPM (Interior Point Method)	This setting allows the user to choose the SVM solver. The SGD solver cannot be selected if the kernel is non-linear. The default value is system determined.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.



See Also:

Oracle Machine Learning for SQL Concepts for information about SVM

53.5.17 DBMS_DATA_MINING — Algorithm Settings: XGBoost

Settings that configure the behavior of the XGBoost gradient boosting algorithm.

The XGBoost settings are case sensitive. Enter the settings as they appear in the settings table. These settings match the XGBoost settings available in open source. OML4SQL XGBoost is based on the 1.7.4 version of XGBoost. For Global settings, see [DBMS_DATA_MINING — Global Settings](#).

For generic machine learning technique settings, see [DBMS_DATA_MINING — Machine Learning Functions](#).

Table 53-29 General Settings

Setting Name	Setting Value	Description
booster	A string that is one of the following: dart gblinear gbtree	The booster to use: <ul style="list-style-type: none"> • dart • gblinear • gbtree The <code>dart</code> and <code>gbtree</code> boosters use tree-based models whereas <code>gblinear</code> uses linear functions. The default value is <code>gbtree</code> .
num_round	A non-negative integer.	The number of rounds for boosting. The default value is 10.

Table 53-30 Settings for Tree Boosting

Setting Name	Setting Value	Description
alpha	A non-negative number	L1 regularization term on weights. Increasing this value makes the model more conservative. The default value is 0.
colsample_bylevel	A number in the range (0, 1]	Subsample ratio of columns for each split, in each level. Subsampling occurs each time a new split is made. This parameter has no effect when <code>tree_method</code> is set to <code>hist</code> . The default value is 1.
colsample_bynode	A number in the range (0, 1]	The subsample ratio of columns for each node (split). Subsampling occurs once every time a new split is evaluated. Columns are subsampled from the set of columns chosen for the current level. The default value is 1.
colsample_bytree	A number in the range (0, 1]	Subsample ratio of columns when constructing each tree. Subsampling occurs once in every boosting iteration. The default value is 1.
eta	A number in the range [0, 1]	Step-size shrinkage used in the update step to prevent overfitting. After each boosting step, <code>eta</code> shrinks the feature weights to make the boosting process more conservative. The default value is 0.3.
gamma	A number in the range [0, ∞]	Minimum loss reduction required to make a further partition on a leaf node of the tree. The larger gamma value is, the more conservative the algorithm is. The default value is 0.

Table 53-30 (Cont.) Settings for Tree Boosting

Setting Name	Setting Value	Description
grow_policy	A string; one of the following: <ul style="list-style-type: none"> depthwise lossguide 	Controls the way new nodes are added to the tree: <ul style="list-style-type: none"> depthwise splits at nodes closest to the root lossguide splits at nodes with the highest loss change Valid only if tree_method is set to hist. The default value is depthwise.
xgboost_interaction_const raints	[[x0, x1, x2], [x0, x4], [x5, x6]] where xn are feature names or columns	This setting specifies permitted interactions in the model. Specify the constrains in the form of a nested list where each inner list is a group of features (column names) that are allowed to interact with each other. If a single column is passed in the interactions then, the input is ignored. Here, features x0, x1, and x2 are allowed to interact with each other but with no other feature. Similarly, x0 and x4 are allowed to interact with each other but with no other feature and so on. This setting is applicable to 2-Dimensional features. An error occurs if you pass columns of non-supported type and non-existing feature names.
lambda	A non-negative number	L2 regularization term on weights. The default value is 1.
max_bin	A non-negative integer	Maximum number of discrete bins to bucket continuous features. Increasing this number improves the optimality of splits at the cost of higher computation time. This parameter is valid only when tree_method is set to hist. The default value is 256.
max_delta_step	A number in the range [0, ∞]	Maximum delta step allowed for each leaf output. Setting this to a positive value can help make the update step more conservative. Usually this parameter is not needed, but it might help in logistic regression when the class is extremely imbalanced. Setting it to value from 1 to 10 might help control the update. The default value is 0, which means there is no constraint.

Table 53-30 (Cont.) Settings for Tree Boosting

Setting Name	Setting Value	Description
<code>max_depth</code>	An integer in the range $[0, \infty]$	<p>Maximum depth of a tree. Increasing this value makes the model more complex and more likely to overfit.</p> <p>Setting this to 0 indicates no limit.</p>
		<p>The default value is 6.</p>
<code>max_leaves</code>	A non-negative number	<p>Maximum number of nodes to add.</p> <p>Use this setting only when <code>grow_policy</code> is set to <code>lossguide</code>.</p> <p>The default value is 0.</p>
<code>min_child_weight</code>	A number in the range $[0, \infty]$	<p>Minimum sum of instance weight (hessian) needed in a child. If the tree partition step results in a leaf node with a sum of instance weight less than <code>min_child_weight</code>, then the building process stops partitioning. In a linear regression task, this corresponds to the minimum number of instances needed in each node. The larger <code>min_child_weight</code> is, the more conservative the algorithm is.</p> <p>The default value is 1.</p>
<code>xgboost_decrease_constraints</code>	<code>[x4,x5]</code>	<p>This setting specifies the features (column names) that must obey decreasing constraint. The feature names are separated by a comma. For example, setting value <code>'x4,x5'</code> sets decreasing constraint on features <code>x4</code> and <code>x5</code>. This setting applies to numeric columns and 2-Dimensional features. An error occurs if you pass columns of non-supported type and non-existing feature names.</p>

 **Note:**

You must set a `max_depth` limit when the `grow_policy` setting is `depthwise`.

Table 53-30 (Cont.) Settings for Tree Boosting

Setting Name	Setting Value	Description
xgboost_increase_constraints	[x0,x3]	This setting specifies the features (column names) that must obey increasing constraint. The feature names are separated by a comma. For example, setting value 'x0,x3' sets increasing constraint on features x0 and x3. This setting is applicable to 2-Dimensional features. An error occurs if you pass columns of non-supported type and non-existing feature names.
num_parallel_tree	A non-negative integer	Number of parallel trees constructed during each iteration. Use this option to support a boosted random forest. The default value is 1.
scale_pos_weight	A non-negative number	Controls the balance of positive and negative weights, which is useful for unbalanced classes. A typical value to consider: $\frac{\text{sum}(\text{negative cases})}{\text{sum}(\text{positive cases})}$. The default value is 1.
sketch_eps	A number in the range (0, 1)	Increases enumeration accuracy. Valid only for the approximate greedy tree method. Compared to directly selecting the number of bins, this setting comes with a theoretical guarantee with sketch accuracy. You usually do not need to change this setting, but you might consider setting a lower number for more accurate enumeration. The default value is 0.03.
subsample	A number in the range (0, 1]	Subsample ratio of the training instances. A setting of 0.5 means that XGBoost randomly samples half of the training data prior to growing trees, which prevents overfitting. Subsampling occurs once in every boosting iteration. The default value is 1.

Table 53-30 (Cont.) Settings for Tree Boosting

Setting Name	Setting Value	Description
tree_method	A string that is one of the following: <ul style="list-style-type: none"> approx auto exact hist 	Tree construction algorithm used in XGBoost: <ul style="list-style-type: none"> approx: Approximate greedy algorithm using sketching and histogram. auto: Use a heuristic to choose the faster algorithm: <ul style="list-style-type: none"> For a small to medium sized data set, uses the exact greedy algorithm. For a very large data set, uses the approximate greedy algorithm. exact: Exact greedy algorithm. hist: Fast histogram optimized approximate greedy algorithm; uses some performance improvements such as bins caching. <p>The default value is auto.</p>
updater	A comma-separated string; one or more of the following: <ul style="list-style-type: none"> grow_colmaker grow_histmaker grow_skmaker grow_quantile_histmaker prune sync 	Defines the sequence of tree updaters to run, which provides a modular way to construct and to modify the trees. This is an advanced parameter that is usually set automatically, depending on some other parameters. However, you can also explicitly specify a setting. <p>The setting values are:</p> <ul style="list-style-type: none"> grow_colmaker: Non-distributed column-based construction of trees. grow_histmaker: Distributed tree construction with row-based data splitting based on a global proposal of histogram counting. grow_skmaker: Uses the approximate sketching algorithm. grow_quantile_histmaker: Grow tree using quantized histogram. prune: Prunes the splits where loss < min_split_loss (or gamma). sync: Synchronizes trees in all distributed nodes.

Table 53-31 Settings for the Dart Booster

Setting Name	Setting Value	Description
one_drop	A number that is 0 or 1	When set to 1, at least one tree is always dropped during the dropout. When set to 0, at least one tree is not always dropped during the dropout. The default value is 0.

Table 53-31 (Cont.) Settings for the Dart Booster

Setting Name	Setting Value	Description
normalize_type	A string; either: <ul style="list-style-type: none"> forest tree 	Type of normalization algorithm: <ul style="list-style-type: none"> forest: New trees have the same weight as the sum of the dropped trees (forest): <ul style="list-style-type: none"> The weight of new trees is $1 / (1 + \text{learning_rate})$ Dropped trees are scaled by a factor of $1 / (1 + \text{learning_rate})$ tree: New trees have the same weight as dropped trees: <ul style="list-style-type: none"> The weight of new trees is $1 / (k + \text{learning_rate})$ Dropped trees are scaled by a factor of $k / (k + \text{learning_rate})$ <p>The default value is tree.</p>
rate_drop	A number in the range [0.0, 1.0]	Dropout rate (a fraction of the previous trees to drop during the dropout). The default value is 0.0.
sample_type	A string; either: <ul style="list-style-type: none"> uniform weighted 	Type of sampling algorithm: <ul style="list-style-type: none"> uniform: Dropped trees are selected uniformly weighted: Dropped trees are selected in proportion to weight <p>The default value is uniform.</p>
skip_drop	A number in the range [0.0, 1.0]	Probability of skipping the dropout procedure during a boosting iteration. If a dropout is skipped, new trees are added in the same manner as gbtrees. A non-zero skip_drop has higher priority than rate_drop or one_drop. The default value is 0.0.

Table 53-32 Settings for the Linear Booster

Setting Name	Setting Value	Description
alpha	A non-negative number	L1 regularization term on weights, normalized to the number of training examples. Increasing this value makes the model more conservative. The default value is 0.

Table 53-32 (Cont.) Settings for the Linear Booster

Setting Name	Setting Value	Description
feature_selector	A string that is one of the following: <ul style="list-style-type: none"> cyclic greedy random shuffle thrifty 	<p>Feature selection and ordering method:</p> <ul style="list-style-type: none"> cyclic: Deterministic selection by cycling through the features one at a time. greedy: Selects the coordinate with the greatest gradient magnitude. This method: <ul style="list-style-type: none"> Has $O(\text{num_feature}^2)$ complexity Is fully deterministic Allows restricting the selection to the <code>top_k</code> features per group with the largest magnitude of univariate weight change, by setting the <code>top_k</code> parameter; doing so reduces the complexity to $O(\text{num_feature} * \text{top_k})$. random: A random (with replacement) coordinate selector. shuffle: Similar to <code>cyclic</code> but with random feature shuffling prior to each update. thrifty: Thrifty, approximately-greedy feature selector. Prior to cyclic updates, reorders features in descending magnitude of their univariate weight changes. This operation is multithreaded and is a linear complexity approximation of the quadratic greedy selection. Restricts the selection per group to the <code>top_k</code> features with the largest magnitude of univariate weight change. <p>The default value is <code>cyclic</code>.</p>
lambda	A non-negative number	<p>L2 regularization term on weights, normalized to the number of training examples. Increasing this value makes the model more conservative.</p> <p>The default value is 0.</p>
top_k	A non-negative integer	<p>Number of top features to select for the <code>greedy</code> or <code>thrifty</code> feature selector. The value of 0 uses all of the features.</p> <p>The default value is 0.</p>
updater	A string that is one of the following: <ul style="list-style-type: none"> coord_descent shotgun 	<p>Algorithm to fit the linear model:</p> <ul style="list-style-type: none"> coord_descent: Ordinary coordinate descent algorithm; multithreaded but still produces a deterministic solution. shotgun: Parallel coordinate descent algorithm based on the <code>shotgun</code> algorithm; uses "hogwild" parallelism and therefore produces a nondeterministic solution on each run. <p>The default value is <code>shotgun</code>.</p>

Table 53-33 Settings for Tweedie Regression

Setting Name	Setting Value	Description
<code>tweedie_variance_power</code>	A number in the range (1, 2)	Controls the variance of the Tweedie distribution $\text{var}(y) \sim E(y)^{\text{tweedie_variance_power}}$. A setting closer to 1 shifts towards a Poisson distribution. A setting closer to 2 shifts towards a gamma distribution. The default value is 1.5.

Some XGBoost objectives apply only to classification function models and other objectives apply only to regression function models. If you specify an incompatible objective value, an error is raised. In the `DBMS_DATA_MINING.CREATE_MODEL` procedure, if you specify `DBMS_DATA_MINING.CLASSIFICATION` as the function, then the only objective values that you can use are the `binary` and `multi` values. The one exception is `binary: logitraw`, which produces a continuous value and applies only to a regression model. If you specify `DBMS_DATA_MINING.REGRESSION` as the function, then you can specify `binary: logitraw` or any of the `count`, `rank`, `reg`, and `survival` values as the objective.

Table 53-34 Settings for Learning Tasks

Setting Name	Setting Value	Description
objective	<p>For a classification model, a string that is one of the following:</p> <ul style="list-style-type: none"> binary:hinge binary:logistic multi:softmax multi:softprob <p>For a regression model, a string that is one of the following:</p> <ul style="list-style-type: none"> binary:logitraw count:poisson rank:map rank:ndcg rank:pairwise reg:gamma reg:logistic reg:tweedie survival:aft survival:cox reg:squarederror reg:squaredlogerror 	<p>Settings for a Classification model:</p> <ul style="list-style-type: none"> binary:hinge: Hinge loss for binary classification. This setting makes predictions of 0 or 1, rather than producing probabilities. binary:logistic: Logistic regression for binary classification. The output is the probability. multi:softmax: Performs multiclass classification using the softmax objective; you must also set <code>num_class(number_of_classes)</code>. multi:softprob: Same as softmax, except the output is a vector of <code>ndata * nclass</code>, which can be further reshaped to an <code>ndata * nclass</code> matrix. The result contains the predicted probability of each data point belonging to each class. <p>The default objective value for classification is <code>multi:softprob</code>.</p> <p>Settings for a Regression model:</p> <ul style="list-style-type: none"> binary:logitraw: Logistic regression for binary classification; the output is the score before logistic transformation. count:poisson: Poisson regression for count data; the output is the mean of the Poisson distribution. The <code>max_delta_step</code> value is set to 0.7 by default in Poisson regression to safeguard optimization. rank:map: Using LambdaMART, performs list-wise ranking in which the Mean Average Precision (MAP) is maximized. rank:ndcg: Using LambdaMART, performs list-wise ranking in which the Normalized Discounted Cumulative Gain (NDCG) is maximized. rank:pairwise: Performs ranking by minimizing the pairwise loss. reg:gamma: Gamma regression with log-link; the output is the mean of the gamma distribution. This setting might be useful for any outcome that might be gamma-distributed, such as modeling insurance claims severity. reg:logistic: Logistic regression. reg:tweedie: Tweedie regression with log-link. This setting might be useful for any outcome that might be Tweedie-distributed, such as modeling total loss in insurance. survival:aft: Applies the Accelerated Failure Time (AFT) model for censored survival time data. When you select this option, <code>eval_metric</code> uses <code>aft-nloglik</code> as the default value. survival:cox: Cox regression for right-censored survival time data (negative values are

Table 53-34 (Cont.) Settings for Learning Tasks


Setting Name	Setting Value	Description
		<p>considered right-censored). Predictions are returned on the hazard ratio scale (that is, as $HR = \exp(\text{marginal_prediction})$ in the proportional hazard function $h(t) = h_0(t) * HR$).</p> <ul style="list-style-type: none"> • <code>reg:squarederror</code>: Regression with squared loss. • <code>reg:squaredlogerror</code>: Regression with squared log loss. All input labels must be greater than -1. <p>The default objective value for regression is <code>reg:squarederror</code>.</p>
<code>xgboost_aft_loss_distribution</code>	[normal, logistic, extreme]	Specifies the distribution of the Z term in the AFT model. It specifies the Probability Density Function used by <code>survival:aft</code> objective and <code>aft-nloglik</code> evaluation metric. The default value is <code>normal</code> .
<code>xgboost_aft_loss_distribution_scale</code>	A positive number	Specifies the scaling factor σ , which scales the size of Z term in the AFT model. The default value is 1.
<code>xgboost_aft_right_bound_column_name</code>	<i>column_name</i>	Specifies the column containing the right bounds of the labels for an AFT model. You cannot select this parameter for a non-AFT model.
		<div style="border: 1px solid #0070C0; padding: 10px; background-color: #E6F2FF;"> <p> Note:</p> <p>Oracle Machine Learning does not support <code>BOOLEAN</code> values for this setting.</p> </div>
<code>base_score</code>	A number	<p>Initial prediction score of all instances, global bias. For a sufficient number of iterations, changing this value does not have much effect.</p> <p>The default value is 0.5.</p>

Table 53-34 (Cont.) Settings for Learning Tasks

Setting Name	Setting Value	Description
eval_metric	<p>A comma-separated string; one or more of the following:</p> <ul style="list-style-type: none"> • aft-nloglik • auc • aucpr • cox-nloglik • error • error@t • gamma-deviance • gamma-nloglik • logloss • mae • map • map@n • merror • mlogloss • ndcg • ndcg@n • poisson-nloglik • rmse • tweedie-nloglik@rho • ndcg- • map- • rmsle 	<p>Evaluation metrics for validation data. You can specify one or more of these evaluation metrics:</p> <ul style="list-style-type: none"> • aft-nloglik: Sets the <code>eval_metric</code> to negative log likelihood of AFT model. • auc: Area under the curve. • aucpr: Area under the PR curve. • cox-nloglik: Negative partial log-likelihood for Cox proportional hazards regression. • error: Binary classification error rate, calculated as the number of wrong cases divided by the number of all cases. For the predictions, the evaluation regards the instances with a prediction value larger than 0.5 as positive instances, and the others as negative instances. • error@t: You can specify a binary classification threshold value other than 0.5 by specifying a numerical value <i>t</i>, for example, <code>error@0.8</code>. • gamma-deviance: Residual deviance for gamma regression. • gamma-nloglik: Negative log-likelihood for gamma regression. • logloss: Negative log-likelihood. • mae: Mean absolute error. • map: Mean average precision. • map@n: Assigns the integer <i>n</i> as the cut-off value for the top positions in the lists for evaluation. • merror: Multiclass classification error rate calculated as the number of wrong cases divided by the number of all cases; the objective must be <code>multi:softprob</code> or <code>multi:softmax</code>. • mlogloss: Multiclass logloss; the objective must be <code>multi:softprob</code> or <code>multi:softmax</code>. • ndcg: Normalized Discounted Cumulative Gain. • ndcg@n: Assigns the integer <i>n</i> as the cut-off value for the top positions in the lists for evaluation. • poisson-nloglik: Negative log-likelihood for Poisson regression • rmse: Root Mean Square Error. • tweedie-nloglik@rho: Negative log-likelihood for Tweedie regression (at a specified value <i>rho</i> of the <code>tweedie_variance_power</code> parameter); <i>rho</i> must be a number in the range (1, 2); for example, <code>tweedie-nloglik@1.8</code>. • ndcg- and map-: In XGBoost, NDCG and MAP will evaluate the score of a list without any positive samples as 1. By adding "-" in the evaluation metric XGBoost will evaluate these score as 0 to be consistent under some conditions.

Table 53-34 (Cont.) Settings for Learning Tasks

Setting Name	Setting Value	Description
		<ul style="list-style-type: none"> <code>rmsle</code>: It is root mean square log error. This is the default metric of <code>reg:squaredlogerror</code> objective. This metric reduces errors generated by outliers in dataset. But because log function is employed, <code>rmsle</code> might output nan when prediction value is less than -1. <p>A default metric is assigned according to the objective:</p> <ul style="list-style-type: none"> <code>error</code> for classification mean average precision for ranking <code>rmse</code> for regression
<code>seed</code>	A non-negative integer	Random number seed. The default value is 0.

Related Topics

- [DBMS_DATA_MINING — Machine Learning Functions](#)
A machine learning **function** refers to the methods for solving a given class of machine learning problems.
- [DBMS_DATA_MINING — Global Settings](#)
The configuration settings in this table are applicable to any type of model, but are currently only implemented for specific algorithms.

**See Also:**

<https://github.com/oracle/oracle-db-examples/tree/master/machine-learning/sql/>, select the release, and browse for an example of XGBoost.

53.6 DBMS_DATA_MINING — Solver Settings

Oracle Machine Learning for SQL algorithms can use different solvers. Solver settings can be provided at build time in the settings table.

Related Topics

- [DBMS_DATA_MINING - Solver Settings: Adam](#)
These settings configure the behavior of the Adaptive Moment Estimation (Adam) solver.
- [DBMS_DATA_MINING — Solver Settings: ADMM](#)
The settings listed in the following table configure the behavior of Alternating Direction Method of Multipliers (ADMM). The Generalized Linear Model (GLM) algorithm uses these settings.
- [DBMS_DATA_MINING — Solver Settings: LBFGS](#)
The settings listed in the following table configure the behavior of L-BFGS. Neural Network and Generalized Linear Model (GLM) use these settings.

53.6.1 DBMS_DATA_MINING - Solver Settings: Adam

These settings configure the behavior of the Adaptive Moment Estimation (Adam) solver. Neural Network models use these settings.

Table 53-35 DBMS_DATA_MINING Adam Settings

Setting Name	Setting Value	Description
ADAM_ALPHA	A non-negative double precision floating point number in the interval (0; 1]	The learning rate for Adam. The default value is 0.001.
ADAM_BATCH_ROWS	A positive integer	The number of rows per batch. The default value is 10000.
ADAM_BETA1	A positive double precision floating point number in the interval [0; 1)	The exponential decay rate for the 1st moment estimates. The default value is 0.9.
ADAM_BETA2	A positive double precision floating point number in the interval [0; 1)	The exponential decay rate for the 2nd moment estimates. The default value is 0.99.
ADAM_GRADIENT_TOLERANCE	A positive double precision floating point number	The gradient infinity norm tolerance for Adam. The default value is 1E-9.

Related Topics

- [DBMS_DATA_MINING — Algorithm Settings: Neural Network](#)
The settings listed in the following table configure the behavior of the Neural Network algorithm.

53.6.2 DBMS_DATA_MINING — Solver Settings: ADMM

The settings listed in the following table configure the behavior of Alternating Direction Method of Multipliers (ADMM). The Generalized Linear Model (GLM) algorithm uses these settings.

Table 53-36 DBMS_DATA_MINING ADMM Settings

Settings Name	Setting Value	Description
ADMM_CONSENSUS	A positive integer	It is a ADMM's consensus parameter. The value must be a positive number. The default value is 0.1.
ADMM_ITERATIONS	A positive integer	The number of ADMM iterations. The value must be a positive integer. The default value is 50.
ADMM_TOLERANCE	A positive integer	It is a tolerance parameter. The value must be a positive number. The default value is 0.0001

Related Topics

- [DBMS_DATA_MINING — Algorithm Settings: Generalized Linear Model](#)
The settings listed in the following table configure the behavior of the Generalized Linear Model algorithm.
- *Oracle Machine Learning for SQL Concepts*

**See Also:**

Oracle Machine Learning for SQL Concepts for information about neural network

53.6.3 DBMS_DATA_MINING — Solver Settings: LBFGS

The settings listed in the following table configure the behavior of L-BFGS. Neural Network and Generalized Linear Model (GLM) use these settings.

Table 53-37 DBMS_DATA_MINING L-BFGS Settings

Setting Name	Setting Value	Description
LBFGS_GRADIENT_TOLERANCE	TO_CHAR (numeric_expr >0)	Defines gradient infinity norm tolerance for L-BFGS. Default value is 1E-9.
LBFGS_HISTORY_DEPTH	The value must be a positive integer.	Defines the number of historical copies kept in L-BFGS solver. The default value is 20.
LBFGS_SCALE_HESSIAN	LBFGS_SCALE_HESSIAN_ENABLE LBFGS_SCALE_HESSIAN_DISABLE	Defines whether to scale Hessian in L-BFGS or not. Default value is LBFGS_SCALE_HESSIAN_ENABLE.

Related Topics

- [DBMS_DATA_MINING — Algorithm Settings: Neural Network](#)
The settings listed in the following table configure the behavior of the Neural Network algorithm.
- [DBMS_DATA_MINING — Algorithm Settings: Generalized Linear Model](#)
The settings listed in the following table configure the behavior of the Generalized Linear Model algorithm.

**See Also:**

Oracle Machine Learning for SQL Concepts for information about neural network

53.7 DBMS_DATA_MINING Datatypes

The `DBMS_DATA_MINING` package defines object data types for processing transactional data. The package also defines a type for user-specified transformations. These types are called `DM_NESTED_n`, where *n* identifies the Oracle data type of the nested attributes.

The Oracle Machine Learning for SQL object data types are described in the following table:

Table 53-38 DBMS_DATA_MINING Summary of Data Types

Datatype	Description
<code>DM_NESTED_BINARY_DOUBLE</code>	The name and value of a numerical attribute of type <code>BINARY_DOUBLE</code> .
<code>DM_NESTED_BINARY_DOUBLES</code>	A collection of <code>DM_NESTED_BINARY_DOUBLE</code> .
<code>DM_NESTED_BINARY_FLOAT</code>	The name and value of a numerical attribute of type <code>BINARY_FLOAT</code> .
<code>DM_NESTED_BINARY_FLOATS</code>	A collection of <code>DM_NESTED_BINARY_FLOAT</code> .
<code>DM_NESTED_CATEGORICAL</code>	The name and value of a categorical attribute of type <code>CHAR</code> , <code>VARCHAR</code> , or <code>VARCHAR2</code> .
<code>DM_NESTED_CATEGORICALS</code>	A collection of <code>DM_NESTED_CATEGORICAL</code> .
<code>DM_NESTED_NUMERICAL</code>	The name and value of a numerical attribute of type <code>NUMBER</code> or <code>FLOAT</code> .
<code>DM_NESTED_NUMERICALS</code>	A collection of <code>DM_NESTED_NUMERICAL</code> .
<code>ORA_MINING_VARCHAR2_NT</code>	A table of <code>VARCHAR2</code> (4000).
<code>TRANSFORM_LIST</code>	A list of user-specified transformations for a model. Accepted as a parameter by the CREATE_MODEL Procedure . This collection type is defined in the DBMS_DATA_MINING_TRANSFORM package.

For more information about processing nested data, see *Oracle Machine Learning for SQL User's Guide*.

Note:

Starting from Oracle Database 12c Release 2, `*GET_MODEL_DETAILS` are deprecated and are replaced with *Model Detail Views*. See *Oracle Machine Learning for SQL User's Guide*.

53.7.1 Deprecated Types

This topic contains tables listing deprecated types.

The `DBMS_DATA_MINING` package defines object datatypes for storing information about model attributes. Most of these types are returned by the table functions `GET_n`, where *n* identifies the type of information to return. These functions take a model name as input and return the requested information as a collection of rows.

For a list of the `GET` functions, see "[Summary of DBMS_DATA_MINING Subprograms](#)".

All the table functions use pipelining, which causes each row of output to be materialized as it is read from model storage, without waiting for the generation of the complete table object. For more information on pipelined, parallel table functions, consult the *Oracle Database PL/SQL Language Reference*.

Table 53-39 DBMS_DATA_MINING Summary of Deprecated Datatypes

Datatype	Description
DM_CENTROID	The centroid of a cluster.
DM_CENTROIDS	A collection of DM_CENTROID. A member of DM_CLUSTER.
DM_CHILD	A child node of a cluster.
DM_CHILDREN	A collection of DM_CHILD. A member of DM_CLUSTER.
DM_CLUSTER	A cluster. A cluster includes DM_PREDICATES, DM_CHILDREN, DM_CENTROIDS, and DM_HISTOGRAMS. It also includes a DM_RULE. See also, DM_CLUSTER Fields .
DM_CLUSTERS	A collection of DM_CLUSTER. Returned by GET_MODEL_DETAILS_KM Function , GET_MODEL_DETAILS_OC Function , and GET_MODEL_DETAILS_EM Function . See also, DM_CLUSTER Fields .
DM_CONDITIONAL	The conditional probability of an attribute in a Naive Bayes model.
DM_CONDITIONALS	A collection of DM_CONDITIONAL. Returned by GET_MODEL_DETAILS_NB Function .
DM_COST_ELEMENT	The actual and predicted values in a cost matrix.
DM_COST_MATRIX	A collection of DM_COST_ELEMENT. Returned by GET_MODEL_COST_MATRIX Function .
DM_EM_COMPONENT	A component of an Expectation Maximization model.
DM_EM_COMPONENT_SET	A collection of DM_EM_COMPONENT. Returned by GET_MODEL_DETAILS_EM_COMP Function .
DM_EM_PROJECTION	A projection of an Expectation Maximization model.
DM_EM_PROJECTION_SET	A collection of DM_EM_PROJECTION. Returned by GET_MODEL_DETAILS_EM_PROJ Function .
DM_GLM_COEFF	The coefficient and associated statistics of an attribute in a Generalized Linear Model.
DM_GLM_COEFF_SET	A collection of DM_GLM_COEFF. Returned by GET_MODEL_DETAILS_GLM Function .
DM_HISTOGRAM_BIN	A histogram associated with a cluster.
DM_HISTOGRAMS	A collection of DM_HISTOGRAM_BIN. A member of DM_CLUSTER. See also, DM_CLUSTER Fields .
DM_ITEM	An item in an association rule.
DM_ITEMS	A collection of DM_ITEM.
DM_ITEMSET	A collection of DM_ITEMS.

Table 53-39 (Cont.) DBMS_DATA_MINING Summary of Deprecated Datatypes

Datatype	Description
DM_ITEMSETS	A collection of DM_ITEMSET. Returned by GET_FREQUENT_ITEMSETS Function .
DM_MODEL_GLOBAL_DETAIL	High-level statistics about a model.
DM_MODEL_GLOBAL_DETAILS	A collection of DM_MODEL_GLOBAL_DETAIL. Returned by GET_MODEL_DETAILS_GLOBAL Function .
DM_NB_DETAIL	Information about an attribute in a Naive Bayes model.
DM_NB_DETAILS	A collection of DM_DB_DETAIL. Returned by GET_MODEL_DETAILS_NB Function .
DM_NMF_ATTRIBUTE	An attribute in a feature of a Non-Negative Matrix Factorization model.
DM_NMF_ATTRIBUTE_SET	A collection of DM_NMF_ATTRIBUTE. A member of DM_NMF_FEATURE.
DM_NMF_FEATURE	A feature in a Non-Negative Matrix Factorization model.
DM_NMF_FEATURE_SET	A collection of DM_NMF_FEATURE. Returned by GET_MODEL_DETAILS_NMF Function .
DM_PREDICATE	Antecedent and consequent in a rule.
DM_PREDICATES	A collection of DM_PREDICATE. A member of DM_RULE and DM_CLUSTER. Predicates are returned by GET_ASSOCIATION_RULES Function , GET_MODEL_DETAILS_EM Function , GET_MODEL_DETAILS_KM Function , and GET_MODEL_DETAILS_OC Function . See also, DM_CLUSTER Fields .
DM_RANKED_ATTRIBUTE	An attribute ranked by its importance in an Attribute Importance model.
DM_RANKED_ATTRIBUTES	A collection of DM_RANKED_ATTRIBUTE. Returned by GET_MODEL_DETAILS_AI Function .
DM_RULE	A rule that defines a conditional relationship. The rule can be one of the association rules returned by GET_ASSOCIATION_RULES Function , or it can be a rule associated with a cluster in the collection of clusters returned by GET_MODEL_DETAILS_KM Function and GET_MODEL_DETAILS_OC Function . See also, DM_CLUSTER Fields .
DM_RULES	A collection of DM_RULE. Returned by GET_ASSOCIATION_RULES Function . See also, DM_CLUSTER Fields .
DM_SVD_MATRIX	A factorized matrix S, V, or U returned by a Singular Value Decomposition model.
DM_SVD_MATRIX_SET	A collection of DM_SVD_MATRIX. Returned by GET_MODEL_DETAILS_SVD Function .
DM_SVM_ATTRIBUTE	The name, value, and coefficient of an attribute in a Support Vector Machine model.

Table 53-39 (Cont.) DBMS_DATA_MINING Summary of Deprecated Datatypes

Datatype	Description
DM_SVM_ATTRIBUTE_SET	A collection of DM_SVM_ATTRIBUTE. Returned by GET_MODEL_DETAILS_SVM Function . Also a member of DM_SVM_LINEAR_COEFF.
DM_SVM_LINEAR_COEFF	The linear coefficient of each attribute in a Support Vector Machine model.
DM_SVM_LINEAR_COEFF_SET	A collection of DM_SVM_LINEAR_COEFF. Returned by GET_MODEL_DETAILS_SVM Function for an SVM model built using the linear kernel.
DM_TRANSFORM	The transformation and reverse transformation expressions for an attribute.
DM_TRANSFORMS	A collection of DM_TRANSFORM. Returned by GET_MODEL_TRANSFORMATIONS Function .

Return Values for Clustering Algorithms

The table contains description of DM_CLUSTER return value columns, nested table columns, and rows.

Table 53-40 DM_CLUSTER Return Values for Clustering Algorithms

Return Value	Description																						
DM_CLUSTERS	<p>A set of rows of type DM_CLUSTER. The rows have the following columns:</p> <table border="0"> <tr> <td>(id</td> <td>NUMBER,</td> </tr> <tr> <td>cluster_id</td> <td>VARCHAR2(4000),</td> </tr> <tr> <td>record_count</td> <td>NUMBER,</td> </tr> <tr> <td>parent</td> <td>NUMBER,</td> </tr> <tr> <td>tree_level</td> <td>NUMBER,</td> </tr> <tr> <td>dispersion</td> <td>NUMBER,</td> </tr> <tr> <td>split_predicate</td> <td>DM_PREDICATES,</td> </tr> <tr> <td>child</td> <td>DM_CHILDREN,</td> </tr> <tr> <td>centroid</td> <td>DM_CENTROIDS,</td> </tr> <tr> <td>histogram</td> <td>DM_HISTOGRAMS,</td> </tr> <tr> <td>rule</td> <td>DM_RULE)</td> </tr> </table>	(id	NUMBER,	cluster_id	VARCHAR2(4000),	record_count	NUMBER,	parent	NUMBER,	tree_level	NUMBER,	dispersion	NUMBER,	split_predicate	DM_PREDICATES,	child	DM_CHILDREN,	centroid	DM_CENTROIDS,	histogram	DM_HISTOGRAMS,	rule	DM_RULE)
(id	NUMBER,																						
cluster_id	VARCHAR2(4000),																						
record_count	NUMBER,																						
parent	NUMBER,																						
tree_level	NUMBER,																						
dispersion	NUMBER,																						
split_predicate	DM_PREDICATES,																						
child	DM_CHILDREN,																						
centroid	DM_CENTROIDS,																						
histogram	DM_HISTOGRAMS,																						
rule	DM_RULE)																						
DM_PREDICATE	<p>The antecedent and consequent columns each return nested tables of type DM_PREDICATES. The rows, of type DM_PREDICATE, have the following columns:</p> <table border="0"> <tr> <td>(attribute_name</td> <td>VARCHAR2(4000),</td> </tr> <tr> <td>attribute_subname</td> <td>VARCHAR2(4000),</td> </tr> <tr> <td>conditional_operator</td> <td>CHAR(2)/*=, <>, <, >, <=, >=*/,</td> </tr> <tr> <td>attribute_num_value</td> <td>NUMBER,</td> </tr> <tr> <td>attribute_str_value</td> <td>VARCHAR2(4000),</td> </tr> <tr> <td>attribute_support</td> <td>NUMBER,</td> </tr> <tr> <td>attribute_confidence</td> <td>NUMBER)</td> </tr> </table>	(attribute_name	VARCHAR2(4000),	attribute_subname	VARCHAR2(4000),	conditional_operator	CHAR(2)/*=, <>, <, >, <=, >=*/,	attribute_num_value	NUMBER,	attribute_str_value	VARCHAR2(4000),	attribute_support	NUMBER,	attribute_confidence	NUMBER)								
(attribute_name	VARCHAR2(4000),																						
attribute_subname	VARCHAR2(4000),																						
conditional_operator	CHAR(2)/*=, <>, <, >, <=, >=*/,																						
attribute_num_value	NUMBER,																						
attribute_str_value	VARCHAR2(4000),																						
attribute_support	NUMBER,																						
attribute_confidence	NUMBER)																						

DM_CLUSTER Fields

The following table describes DM_CLUSTER fields.

Table 53-41 DM_CLUSTER Fields

Column Name	Description
id	Cluster identifier
cluster_id	The ID of a cluster in the model
record_count	Specifies the number of records
parent	Parent ID
tree_level	Specifies the number of splits from the root
dispersion	A measure used to quantify whether a set of observed occurrences are dispersed compared to a standard statistical model.
split_predicate	<p>The <code>split_predicate</code> column of <code>DM_CLUSTER</code> returns a nested table of type <code>DM_PREDICATES</code>. Each row, of type <code>DM_PREDICATE</code>, has the following columns:</p> <pre> (attribute_name VARCHAR2(4000), attribute_subname VARCHAR2(4000), conditional_operator CHAR(2) / *=<>, <>, <, >, <=, >= */ attribute_num_value NUMBER, attribute_str_value VARCHAR2(4000), attribute_support NUMBER, attribute_confidence NUMBER) </pre> <p>Note: The Expectation Maximization algorithm uses all the fields except dispersion and <code>split_predicate</code>.</p>
child	The <code>child</code> column of <code>DM_CLUSTER</code> returns a nested table of type <code>DM_CHILDREN</code> . The rows, of type <code>DM_CHILD</code> , have a single column of type <code>NUMBER</code> , which contains the identifiers of each child.
centroid	<p>The <code>centroid</code> column of <code>DM_CLUSTER</code> returns a nested table of type <code>DM_CENTROIDS</code>. The rows, of type <code>DM_CENTROID</code>, have the following columns:</p> <pre> (attribute_name VARCHAR2(4000), attribute_subname VARCHAR2(4000), mean NUMBER, mode_value VARCHAR2(4000), variance NUMBER) </pre>
histogram	<p>The <code>histogram</code> column of <code>DM_CLUSTER</code> returns a nested table of type <code>DM_HISTOGRAMS</code>. The rows, of type <code>DM_HISTOGRAM_BIN</code>, have the following columns:</p> <pre> (attribute_name VARCHAR2(4000), attribute_subname VARCHAR2(4000), bin_id NUMBER, lower_bound NUMBER, upper_bound NUMBER, label VARCHAR2(4000), count NUMBER) </pre>

Table 53-41 (Cont.) DM_CLUSTER Fields

Column Name	Description																		
rule	The rule column of DM_CLUSTER returns a single row of type DM_RULE. The columns are: <table border="0" style="margin-left: 40px;"> <tr><td>(rule_id</td><td>INTEGER,</td></tr> <tr><td>antecedent</td><td>DM_PREDICATES,</td></tr> <tr><td>consequent</td><td>DM_PREDICATES,</td></tr> <tr><td>rule_support</td><td>NUMBER,</td></tr> <tr><td>rule_confidence</td><td>NUMBER,</td></tr> <tr><td>rule_lift</td><td>NUMBER,</td></tr> <tr><td>antecedent_support</td><td>NUMBER,</td></tr> <tr><td>consequent_support</td><td>NUMBER,</td></tr> <tr><td>number_of_items</td><td>INTEGER)</td></tr> </table>	(rule_id	INTEGER,	antecedent	DM_PREDICATES,	consequent	DM_PREDICATES,	rule_support	NUMBER,	rule_confidence	NUMBER,	rule_lift	NUMBER,	antecedent_support	NUMBER,	consequent_support	NUMBER,	number_of_items	INTEGER)
(rule_id	INTEGER,																		
antecedent	DM_PREDICATES,																		
consequent	DM_PREDICATES,																		
rule_support	NUMBER,																		
rule_confidence	NUMBER,																		
rule_lift	NUMBER,																		
antecedent_support	NUMBER,																		
consequent_support	NUMBER,																		
number_of_items	INTEGER)																		

Usage Notes

- The table function pipes out rows of type DM_CLUSTER. For information on Oracle Machine Learning for SQL data types and piped output from table functions, see "Data Types".
- For descriptions of predicates (DM_PREDICATE) and rules (DM_RULE), see [GET_ASSOCIATION_RULES Function](#).

53.8 Summary of DBMS_DATA_MINING Subprograms

This table summarizes the subprograms included in the DBMS_DATA_MINING package.

The GET_* interfaces are replaced by model views. Oracle recommends that users leverage model detail views instead. For more information, refer to Model Detail Views in *Oracle Machine Learning for SQL User's Guide* and Static Data Dictionary Views: ALL_ALL_TABLES to ALL_OUTLINES in *Oracle Database Reference*.

Table 53-42 DBMS_DATA_MINING Package Subprograms

Subprogram	Purpose
ADD_COST_MATRIX Procedure	Adds a cost matrix to a classification model
ADD_PARTITION Procedure	Adds single or multiple partitions in an existing partition model
ALTER_REVERSE_EXPRESSION Procedure	Changes the reverse transformation expression to an expression that you specify
APPLY Procedure	Applies a model to a data set (scores the data)
COMPUTE_CONFUSION_MATRIX Procedure	Computes the confusion matrix for a classification model
COMPUTE_CONFUSION_MATRIX_PART Procedure	Computes the evaluation matrix for partitioned models
COMPUTE_LIFT Procedure	Computes lift for a classification model
COMPUTE_LIFT_PART Procedure	Computers lift for partitioned models
COMPUTE_ROC Procedure	Computes Receiver Operating Characteristic (ROC) for a classification model

Table 53-42 (Cont.) DBMS_DATA_MINING Package Subprograms

Subprogram	Purpose
COMPUTE_ROC_PART Procedure	Computes Receiver Operating Characteristic (ROC) for a partitioned model
CREATE_MODEL Procedure	Creates a model
CREATE_MODEL2 Procedure	Creates a model without extra persistent stages
Create Model Using Registration Information	Fetches setting information from JSON object
DROP_ALGORITHM Procedure	Drops the registered algorithm information.
DROP_PARTITION Procedure	Drops a single partition
DROP_MODEL Procedure	Drops a model
EXPORT_MODEL Procedure	Exports a model to a dump file
EXPORT_SERMODEL Procedure	Exports a model in a serialized format
FETCH_JSON_SCHEMA Procedure	Fetches and reads JSON schema from <code>all_mining_algorithms</code> view
GET_MODEL_COST_MATRIX Function	Returns the cost matrix for a model
IMPORT_MODEL Procedure	Imports a model into a user schema
IMPORT_ONNX_MODEL Procedure	Imports an ONNX model into the Database
IMPORT_SERMODEL Procedure	Imports a serialized model back into the database
JSON Schema for R Extensible Algorithm	Displays flexibility in creating JSON schema for R Extensible
REGISTER_ALGORITHM Procedure	Registers a new algorithm
RANK_APPLY Procedure	Ranks the predictions from the <code>APPLY</code> results for a classification model
REMOVE_COST_MATRIX Procedure	Removes a cost matrix from a model
RENAME_MODEL Procedure	Renames a model

Deprecated GET_MODEL_DETAILS

Starting from Oracle Database 12c Release 2, the following `GET_MODEL_DETAILS` are deprecated:

Table 53-43 Deprecated GET_MODEL_DETAILS Functions

Subprogram	Purpose
GET_ASSOCIATION_RULES Function	Returns the rules from an association model
GET_FREQUENT_ITEMSETS Function	Returns the frequent itemsets for an association model
GET_MODEL_DETAILS_AI Function	Returns details about an attribute importance model
GET_MODEL_DETAILS_EM Function	Returns details about an Expectation Maximization model

Table 53-43 (Cont.) Deprecated GET_MODEL_DETAILS Functions

Subprogram	Purpose
GET_MODEL_DETAILS_EM_COMP Function	Returns details about the parameters of an Expectation Maximization model
GET_MODEL_DETAILS_EM_PROJ Function	Returns details about the projects of an Expectation Maximization model
GET_MODEL_DETAILS_GLM Function	Returns details about a Generalized Linear Model model
GET_MODEL_DETAILS_GLOBAL Function	Returns high-level statistics about a model
GET_MODEL_DETAILS_KM Function	Returns details about a <i>k</i> -Means model
GET_MODEL_DETAILS_NB Function	Returns details about a Naive Bayes model
GET_MODEL_DETAILS_NMF Function	Returns details about a Non-Negative Matrix Factorization model
GET_MODEL_DETAILS_OC Function	Returns details about an O-Cluster model
GET_MODEL_SETTINGS Function	Returns the settings used to build the given model This function is replaced with <code>USER/ALL/DBA_MINING_MODEL_SETTINGS</code>
GET_MODEL_SIGNATURE Function	Returns the list of columns from the build input table This function is replaced with <code>USER/ALL/DBA_MINING_MODEL_ATTRIBUTES</code>
GET_MODEL_DETAILS_SVD Function	Returns details about a Singular Value Decomposition model
GET_MODEL_DETAILS_SVM Function	Returns details about a Support Vector Machine model with a linear kernel
GET_MODEL_TRANSFORMATIONS Function	Returns the transformations embedded in a model This function is replaced with <code>USER/ALL/DBA_MINING_MODEL_XFORMS</code>
GET_MODEL_DETAILS_XML Function	Returns details about a Decision Tree model
GET_TRANSFORM_LIST Procedure	Converts between two different transformation specification formats

Related Topics

- *Oracle Machine Learning for SQL User's Guide*
- *Oracle Database Reference*

53.8.1 ADD_COST_MATRIX Procedure

The `ADD_COST_MATRIX` procedure associates a cost matrix table with a classification model. The cost matrix biases the model by assigning costs or benefits to specific model outcomes.

The cost matrix is stored with the model and taken into account when the model is scored.

You can also specify a cost matrix inline when you invoke an Oracle Machine Learning for SQL function for scoring. To view the scoring matrix for a model, query the `DM$VC` prefixed model view. Refer to Model Detail View for Classification Algorithm.

To obtain the default scoring matrix for a model, query the `DM$VC` prefixed model view. To remove the default scoring matrix from a model, use the `REMOVE_COST_MATRIX` procedure. See [REMOVE_COST_MATRIX Procedure](#).

 **See Also:**

- "Biasing a Classification Model" in *Oracle Machine Learning for SQL Concepts* for more information about costs
- *Oracle Database SQL Language Reference* for syntax of inline cost matrix
- Specifying Costs in *Oracle Machine Learning for SQL User's Guide*

Syntax

```
DBMS_DATA_MINING.ADD_COST_MATRIX (
    model_name           IN VARCHAR2,
    cost_matrix_table_name IN VARCHAR2,
    cost_matrix_schema_name IN VARCHAR2 DEFAULT NULL);
partition_name         IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 53-44 ADD_COST_MATRIX Procedure Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is assumed.
<code>cost_matrix_table_name</code>	Name of the cost matrix table (described in Table 53-45).
<code>cost_matrix_schema_name</code>	Schema of the cost matrix table. If no schema is specified, then the current schema is used.
<code>partition_name</code>	Name of the partition in a partitioned model

Usage Notes

1. If the model is not in your schema, then `ADD_COST_MATRIX` requires the `ALTER ANY MINING MODEL` system privilege or the `ALTER` object privilege for the machine learning model.
2. The cost matrix table must have the columns shown in [Table 53-45](#).

Table 53-45 Required Columns in a Cost Matrix Table

Column Name	Data Type
<code>ACTUAL_TARGET_VALUE</code>	Valid target data type
<code>PREDICTED_TARGET_VALUE</code>	Valid target data type
<code>COST</code>	NUMBER, FLOAT, BINARY_DOUBLE, or BINARY_FLOAT

 **See Also:**

Oracle Machine Learning for SQL User's Guide for valid target data types

- The types of the actual and predicted target values must be the same as the type of the model target. For example, if the target of the model is `BINARY_DOUBLE`, then the actual and predicted values must be `BINARY_DOUBLE`. If the actual and predicted values are `CHAR` or `VARCHAR`, then `ADD_COST_MATRIX` treats them as `VARCHAR2` internally.

If the types do not match, or if the actual or predicted value is not a valid target value, then the `ADD_COST_MATRIX` procedure raises an error.

 **Note:**

If a reverse transformation is associated with the target, then the actual and predicted values must be consistent with the target after the reverse transformation has been applied.

See “Reverse Transformations and Model Transparency” under the “About Transformation Lists” section in [DBMS_DATA_MINING_TRANSFORM Operational Notes](#) for more information.

- Since a benefit can be viewed as a negative cost, you can specify a benefit for a given outcome by providing a negative number in the `costs` column of the cost matrix table.
- All classification algorithms can use a cost matrix for scoring. The Decision Tree algorithm can also use a cost matrix at build time. If you want to build a Decision Tree model with a cost matrix, specify the cost matrix table name in the `CLAS_COST_TABLE_NAME` setting in the settings table for the model. See [Table 53-7](#).
The cost matrix used to create a Decision Tree model becomes the default scoring matrix for the model. If you want to specify different costs for scoring, use the `REMOVE_COST_MATRIX` procedure to remove the cost matrix and the `ADD_COST_MATRIX` procedure to add a new one.
- Scoring on a partitioned model is partition-specific. Scoring cost matrices can be added to or removed from an individual partition in a partitioned model. If `PARTITION_NAME` is `NOT NULL`, then the model must be a partitioned model. The `COST_MATRIX` is added to that partition of the partitioned model.

If the `PARTITION_NAME` is `NULL`, but the model is a partitioned model, then the `COST_MATRIX` table is added to every partition in the model.

Example

This example creates a cost matrix table called `COSTS_NB` and adds it to a Naive Bayes model called `NB_SH_CLAS_SAMPLE`. The model has a binary target: 1 means that the customer responds to a promotion; 0 means that the customer does not respond. The cost matrix assigns a cost of .25 to misclassifications of customers who do not respond and a cost of .75 to misclassifications of customers who do respond. This

means that it is three times more costly to misclassify responders than it is to misclassify non-responders.

```
CREATE TABLE costs_nb (
  actual_target_value      NUMBER,
  predicted_target_value   NUMBER,
  cost                     NUMBER);
INSERT INTO costs_nb values (0, 0, 0);
INSERT INTO costs_nb values (0, 1, .25);
INSERT INTO costs_nb values (1, 0, .75);
INSERT INTO costs_nb values (1, 1, 0);
COMMIT;

EXEC dbms_data_mining.add_cost_matrix('nb_sh_clas_sample', 'costs_nb');

SELECT cust_gender, COUNT(*) AS cnt, ROUND(AVG(age)) AS avg_age
FROM mining_data_apply_v
WHERE PREDICTION(nb_sh_clas_sample COST MODEL
  USING cust_marital_status, education, household_size) = 1
GROUP BY cust_gender
ORDER BY cust_gender;
```

C	CNT	AVG_AGE
F	72	39
M	555	44

53.8.2 ADD_PARTITION Procedure

ADD_PARTITION procedure supports a single or multiple partition addition to an existing partitioned model.

The ADD_PARTITION procedure derives build settings and user-defined expressions from the existing model. The target column must exist in the input data query when adding partitions to a supervised model.

Syntax

```
DBMS_DATA_MINING.ADD_PARTITION (
  model_name          IN VARCHAR2,
  data_query          IN CLOB,
  add_options         IN VARCHAR2 DEFAULT ERROR);
```


Parameters

Table 53-46 ADD_PARTITION Procedure Parameters

Parameter	Description
model_name	Name of the model in the form [<i>schema_name</i>]. <i>model_name</i> . If you do not specify a schema, then your own schema is used.
data_query	An arbitrary SQL statement that provides data to the model build. The user must have privilege to evaluate this query.

Table 53-46 (Cont.) ADD_PARTITION Procedure Parameters

Parameter	Description
add_options	<p>Allows users to control the conditional behavior of ADD for cases where rows in the input dataset conflict with existing partitions in the model. The following are the possible values:</p> <ul style="list-style-type: none"> REPLACE: Replaces the existing partition for which the conflicting keys are found. ERROR: Terminates the ADD operation without adding any partitions. IGNORE: Eliminates the rows having the conflicting keys.

 **Note:**

For better performance, Oracle recommends using DROP_PARTITION followed by the ADD_PARTITION instead of using the REPLACE option.

53.8.3 ALTER_REVERSE_EXPRESSION Procedure

This procedure replaces a reverse transformation expression with an expression that you specify. If the attribute does not have a reverse expression, the procedure creates one from the specified expression.

You can also use this procedure to customize the output of clustering, feature extraction, and anomaly detection models.

Syntax

```
DBMS_DATA_MINING.ALTER_REVERSE_EXPRESSION (
    model_name          VARCHAR2,
    expression          CLOB,
    attribute_name      VARCHAR2 DEFAULT NULL,
    attribute_subname   VARCHAR2 DEFAULT NULL);
```

Parameters

Table 53-47 ALTER_REVERSE_EXPRESSION Procedure Parameters

Parameter	Description
model_name	Name of the model in the form <i>[schema_name.]model_name</i> . If you do not specify a schema, your own schema is used.
expression	An expression to replace the reverse transformation associated with the attribute.
attribute_name	Name of the attribute. Specify NULL if you wish to apply <i>expression</i> to a cluster, feature, or One-Class SVM prediction.
attribute_subname	Name of the nested attribute if <i>attribute_name</i> is a nested column, otherwise NULL.

Usage Notes

1. For purposes of model transparency, Oracle Machine Learning for SQL provides reverse transformations for transformations that are embedded in a model. Reverse transformations are applied to the attributes returned in model detail views and to the scored target of predictive models.

 **See Also:**

- “About Transformation Lists” under [DBMS_DATA_MINING_TRANSFORM Operational Notes](#)
- Model Detail Views in *Oracle Machine Learning for SQL User's Guide*

2. If you alter the reverse transformation for the target of a model that has a cost matrix, you must specify a transformation expression that has the same type as the actual and predicted values in the cost matrix. Also, the reverse transformation that you specify must result in values that are present in the cost matrix.

 **See Also:**

"[ADD_COST_MATRIX Procedure](#)" and *Oracle Machine Learning for SQL Concepts* for information about cost matrixes.

3. To prevent reverse transformation of an attribute, you can specify `NULL` for *expression*.
4. The reverse transformation expression can contain a reference to a PL/SQL function that returns a valid Oracle data type. For example, you could define a function like the following for a categorical attribute named `blood_pressure` that has values 'Low', 'Medium' and 'High'.

```
CREATE OR REPLACE FUNCTION numx(c char) RETURN NUMBER IS
BEGIN
  CASE c WHEN 'Low' THEN RETURN 1;
         WHEN 'Medium' THEN RETURN 2;
         WHEN 'High' THEN RETURN 3;
         ELSE RETURN null;
  END CASE;
END numx;
```

Then you could invoke `ALTER_REVERSE_EXPRESSION` for `blood_pressure` as follows.

```
EXEC dbms_data_mining.alter_reverse_expression(
      '<model_name>', 'NUMX(blood_pressure)', 'blood_pressure');
```

5. You can use `ALTER_REVERSE_EXPRESSION` to label clusters produced by clustering models and features produced by feature extraction.

You can use `ALTER_REVERSE_EXPRESSION` to replace the zeros and ones returned by anomaly-detection models. By default, anomaly-detection models label anomalous records with 0 and all other records with 1.

 **See Also:**

Oracle Machine Learning for SQL Concepts for information about anomaly detection

Examples

1. In this example, the target (`affinity_card`) of the model `CLASS_MODEL` is manipulated internally as `yes` or `no` instead of 1 or 0 but returned as 1s and 0s when scored. The `ALTER_REVERSE_EXPRESSION` procedure causes the target values to be returned as `TRUE` or `FALSE`.

```

DECLARE
    v_xlst dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
    dbms_data_mining_transform.SET_TRANSFORM(v_xlst,
        'affinity_card', NULL,
        'decode(affinity_card, 1, 'yes', 'no')',
        'decode(affinity_card, 'yes', 1, 0)');
    dbms_data_mining.CREATE_MODEL(
        model_name           => 'CLASS_MODEL',
        mining_function      => dbms_data_mining.classification,
        data_table_name     => 'mining_data_build',
        case_id_column_name => 'cust_id',
        target_column_name  => 'affinity_card',
        settings_table_name => NULL,
        data_schema_name    => 'oml_user',
        settings_schema_name => NULL,
        xform_list          => v_xlst );
END;
/
SELECT cust_income_level, occupation,
       PREDICTION(CLASS_MODEL USING *) predict_response
FROM   mining_data_test WHERE age = 60 AND cust_gender IN 'M'
ORDER BY cust_income_level;

```

CUST_INCOME_LEVEL	OCCUPATION	PREDICT_RESPONSE
A: Below 30,000	Transp.	1
E: 90,000 - 109,999	Transp.	1
E: 90,000 - 109,999	Sales	1
G: 130,000 - 149,999	Handler	0
G: 130,000 - 149,999	Crafts	0
H: 150,000 - 169,999	Prof.	1
J: 190,000 - 249,999	Prof.	1
J: 190,000 - 249,999	Sales	1

```

BEGIN
    dbms_data_mining.ALTER_REVERSE_EXPRESSION (
        model_name           => 'CLASS_MODEL',
        expression          => 'decode(affinity_card, 'yes', 'TRUE',
        'FALSE')',
        attribute_name      => 'affinity_card');
END;
/
column predict_response on
column predict_response format a20
SELECT cust_income_level, occupation,

```

```

        PREDICTION(CLASS_MODEL USING *) predict_response
FROM mining_data_test WHERE age = 60 AND cust_gender IN 'M'
ORDER BY cust_income_level;

```

CUST_INCOME_LEVEL	OCCUPATION	PREDICT_RESPONSE
A: Below 30,000	Transp.	TRUE
E: 90,000 - 109,999	Transp.	TRUE
E: 90,000 - 109,999	Sales	TRUE
G: 130,000 - 149,999	Handler	FALSE
G: 130,000 - 149,999	Crafts	FALSE
H: 150,000 - 169,999	Prof.	TRUE
J: 190,000 - 249,999	Prof.	TRUE
J: 190,000 - 249,999	Sales	TRUE

- This example specifies labels for the clusters that result from the `sh_clus` model. The labels consist of the word "Cluster" and the internal numeric identifier for the cluster.

```

BEGIN
  dbms_data_mining.ALTER_REVERSE_EXPRESSION( 'sh_clus', ''Cluster '||value');
END;
/

SELECT cust_id, cluster_id(sh_clus using *) cluster_id
FROM sh_aprep_num
WHERE cust_id < 100011
ORDER by cust_id;

CUST_ID CLUSTER_ID
-----
100001 Cluster 18
100002 Cluster 14
100003 Cluster 14
100004 Cluster 18
100005 Cluster 19
100006 Cluster 7
100007 Cluster 18
100008 Cluster 14
100009 Cluster 8
100010 Cluster 8

```

53.8.4 APPLY Procedure

The `APPLY` procedure applies a machine learning model to the data of interest, and generates the results in a table. The `APPLY` procedure is also referred to as **scoring**.

For predictive machine learning functions, the `APPLY` procedure generates predictions in a target column. For descriptive machine learning functions such as Clustering, the `APPLY` process assigns each case to a cluster with a probability.

In Oracle Machine Learning for SQL, the `APPLY` procedure is not applicable to Association models and Attribute Importance models.



Note:

Scoring can also be performed directly in SQL using the OML4SQL functions. See

- Oracle Machine Learning for SQL Functions in *Oracle Database SQL Language Reference*
- Scoring and Deployment in *Oracle Machine Learning for SQL User's Guide*

Syntax

```
DBMS_DATA_MINING.APPLY (
    model_name           IN VARCHAR2,
    data_table_name      IN VARCHAR2,
    case_id_column_name  IN VARCHAR2,
    result_table_name    IN VARCHAR2,
    data_schema_name     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 53-48 APPLY Procedure Parameters

Parameter	Description
model_name	Name of the model in the form [schema_name.]model_name. If you do not specify a schema, then your own schema is used.
data_table_name	Name of table or view containing the data to be scored
case_id_column_name	Name of the case identifier column
result_table_name	Name of the table in which to store apply results
data_schema_name	Name of the schema containing the data to be scored

Usage Notes

1. The data provided for APPLY must undergo the same preprocessing as the data used to create and test the model. When you use Automatic Data Preparation, the preprocessing required by the algorithm is handled for you by the model: both at build time and apply time. (See "[Automatic Data Preparation](#)".)
2. APPLY creates a table in the user's schema to hold the results. The columns are algorithm-specific.

The columns in the results table are listed in [Table 53-49](#) through [Table 53-53](#). The case ID column name in the results table will match the case ID column name provided by you. The type of the incoming case ID column is also preserved in APPLY output.

 **Note:**

Make sure that the case ID column does not have the same name as one of the columns that will be created by `APPLY`. For example, when applying a Classification model, the case ID in the scoring data must not be `PREDICTION` or `PROBABILITY` (See [Table 53-49](#)).

3. The data type for the `PREDICTION`, `CLUSTER_ID`, and `FEATURE_ID` output columns is influenced by any reverse expression that is embedded in the model by the user. If the user does not provide a reverse expression that alters the scored value type, then the types will conform to the descriptions in the following tables. See "[ALTER_REVERSE_EXPRESSION Procedure](#)".
4. If the model is partitioned, the `result_table_name` can contain results from different partitions depending on the data from the input data table. An additional column called `PARTITION_NAME` is added to the result table indicating the partition name that is associated with each row.

For a non-partitioned model, the behavior does not change.

Classification

The results table for Classification has the columns described in [Table 53-49](#). If the target of the model is categorical, the `PREDICTION` column will have a `VARCHAR2` data type. If the target has a binary type, the `PREDICTION` column will have the binary type of the target.

Table 53-49 APPLY Results Table for Classification

Column Name	Data type
<i>Case ID column name</i>	Type of the case ID
<code>PREDICTION</code>	Type of the target
<code>PROBABILITY</code>	<code>BINARY_DOUBLE</code>

Anomaly Detection

The results table for Anomaly Detection has the columns described in [Table 53-50](#).

Table 53-50 APPLY Results Table for Anomaly Detection

Column Name	Data Type
<i>Case ID column name</i>	Type of the case ID
<code>PREDICTION</code>	<code>NUMBER</code>
<code>PROBABILITY</code>	<code>BINARY_DOUBLE</code>

Regression

The results table for Regression has the columns described in [APPLY Procedure](#).

Table 53-51 APPLY Results Table for Regression

Column Name	Data Type
<i>Case ID column name</i>	Type of the case ID
PREDICTION	Type of the target

Clustering

Clustering is an unsupervised machine learning function, and hence there are no targets. The results of an `APPLY` procedure contain simply the cluster identifier corresponding to a case, and the associated probability. The results table has the columns described in [Table 53-52](#).

Table 53-52 APPLY Results Table for Clustering

Column Name	Data Type
<i>Case ID column name</i>	Type of the case ID
CLUSTER_ID	NUMBER
PROBABILITY	BINARY_DOUBLE

Feature Extraction

Feature Extraction is also an unsupervised machine learning function, hence there are no targets. The results of an `APPLY` procedure will contain simply the feature identifier corresponding to a case, and the associated match quality. The results table has the columns described in [Table 53-53](#).

Table 53-53 APPLY Results Table for Feature Extraction

Column Name	Data Type
<i>Case ID column name</i>	Type of the case ID
FEATURE_ID	NUMBER
MATCH_QUALITY	BINARY_DOUBLE

Examples

This example applies the GLM Regression model `GLMR_SH_REGR_SAMPLE` to the data in the `MINING_DATA_APPLY_V` view. The `APPLY` results are output of the table `REGRESSION_APPLY_RESULT`.

```
SQL> BEGIN
      DBMS_DATA_MINING.APPLY (
        model_name      => 'glmr_sh_regr_sample',
        data_table_name => 'mining_data_apply_v',
        case_id_column_name => 'cust_id',
        result_table_name => 'regression_apply_result');
      END;
      /

SQL> SELECT * FROM regression_apply_result WHERE cust_id > 101485;
```



```
CUST_ID PREDICTION
-----
101486 22.8048824
101487 25.0261101
101488 48.6146619
101489 51.82595
101490 22.6220714
101491 61.3856816
101492 24.1400748
101493 58.034631
101494 45.7253149
101495 26.9763318
101496 48.1433425
101497 32.0573434
101498 49.8965531
101499 56.270656
101500 21.1153047
```

53.8.5 COMPUTE_CONFUSION_MATRIX Procedure

This procedure computes a confusion matrix, stores it in a table in the user's schema, and returns the model accuracy.

A confusion matrix is a test metric for classification models. It compares the predictions generated by the model with the actual target values in a set of test data. The confusion matrix lists the number of times each class was correctly predicted and the number of times it was predicted to be one of the other classes.

COMPUTE_CONFUSION_MATRIX accepts three input streams:

- The predictions generated on the test data. The information is passed in three columns:
 - Case ID column
 - Prediction column
 - Scoring criterion column containing either probabilities or costs
- The known target values in the test data. The information is passed in two columns:
 - Case ID column
 - Target column containing the known target values
- (Optional) A cost matrix table with predefined columns. See the Usage Notes for the column requirements.

See Also:

Oracle Machine Learning for SQL Concepts for more details about confusion matrixes and other test metrics for classification

["COMPUTE_LIFT Procedure"](#)

["COMPUTE_ROC Procedure"](#)

Syntax

```
DBMS_DATA_MINING.COMPUTE_CONFUSION_MATRIX (
    accuracy                OUT NUMBER,
    apply_result_table_name IN VARCHAR2,
    target_table_name       IN VARCHAR2,
    case_id_column_name     IN VARCHAR2,
    target_column_name      IN VARCHAR2,
    confusion_matrix_table_name IN VARCHAR2,
    score_column_name       IN VARCHAR2 DEFAULT 'PREDICTION',
    score_criterion_column_name IN VARCHAR2 DEFAULT 'PROBABILITY',
    cost_matrix_table_name  IN VARCHAR2 DEFAULT NULL,
    apply_result_schema_name IN VARCHAR2 DEFAULT NULL,
    target_schema_name      IN VARCHAR2 DEFAULT NULL,
    cost_matrix_schema_name IN VARCHAR2 DEFAULT NULL,
    score_criterion_type    IN VARCHAR2 DEFAULT 'PROBABILITY');
```

Parameters

Table 53-54 COMPUTE_CONFUSION_MATRIX Procedure Parameters

Parameter	Description
accuracy	Output parameter containing the overall percentage accuracy of the predictions.
apply_result_table_name	Table containing the predictions.
target_table_name	Table containing the known target values from the test data.
case_id_column_name	Case ID column in the apply results table. Must match the case identifier in the targets table.
target_column_name	Target column in the targets table. Contains the known target values from the test data.
confusion_matrix_table_name	Table containing the confusion matrix. The table will be created by the procedure in the user's schema. The columns in the confusion matrix table are described in the Usage Notes.
score_column_name	Column containing the predictions in the apply results table. The default column name is PREDICTION, which is the default name created by the APPLY procedure (See "APPLY Procedure").
score_criterion_column_name	Column containing the scoring criterion in the apply results table. Contains either the probabilities or the costs that determine the predictions. By default, scoring is based on probability; the class with the highest probability is predicted for each case. If scoring is based on cost, the class with the lowest cost is predicted. The score_criterion_type parameter indicates whether probabilities or costs will be used for scoring. The default column name is 'PROBABILITY', which is the default name created by the APPLY procedure (See "APPLY Procedure"). See the Usage Notes for additional information.

Table 53-54 (Cont.) COMPUTE_CONFUSION_MATRIX Procedure Parameters

Parameter	Description
<code>cost_matrix_table_name</code>	(Optional) Table that defines the costs associated with misclassifications. If a cost matrix table is provided and the <code>score_criterion_type</code> parameter is set to 'COSTS', the costs in this table will be used as the scoring criteria. The columns in a cost matrix table are described in the Usage Notes.
<code>apply_result_schema_name</code>	Schema of the apply results table. If null, the user's schema is assumed.
<code>target_schema_name</code>	Schema of the table containing the known targets. If null, the user's schema is assumed.
<code>cost_matrix_schema_name</code>	Schema of the cost matrix table, if one is provided. If null, the user's schema is assumed.
<code>score_criterion_type</code>	Whether to use probabilities or costs as the scoring criterion. Probabilities or costs are passed in the column identified in the <code>score_criterion_column_name</code> parameter. The default value of <code>score_criterion_type</code> is 'PROBABILITY'. To use costs as the scoring criterion, specify 'COST'. If <code>score_criterion_type</code> is set to 'COST' but no cost matrix is provided and if there is a scoring cost matrix associated with the model, then the associated costs are used for scoring. See the Usage Notes and the Examples.

Usage Notes

- The predictive information you pass to `COMPUTE_CONFUSION_MATRIX` may be generated using SQL `PREDICTION` functions, the `DBMS_DATA_MINING.APPLY` procedure, or some other mechanism. As long as you pass the appropriate data, the procedure can compute the confusion matrix.
- Instead of passing a cost matrix to `COMPUTE_CONFUSION_MATRIX`, you can use a scoring cost matrix associated with the model. A scoring cost matrix can be embedded in the model or it can be defined dynamically when the model is applied. To use a scoring cost matrix, invoke the `SQL_PREDICTION_COST` function to populate the score criterion column.
- The predictions that you pass to `COMPUTE_CONFUSION_MATRIX` are in a table or view specified in `apply_result_table_name`.

```
CREATE TABLE apply_result_table_name AS (
    case_id_column_name          VARCHAR2,
    score_column_name            VARCHAR2,
    score_criterion_column_name  VARCHAR2);
```

- A cost matrix must have the columns described in [Table 53-55](#).

Table 53-55 Columns in a Cost Matrix

Column Name	Data Type
actual_target_value	Type of the target column in the build data
predicted_target_value	Type of the predicted target in the test data. The type of the predicted target must be the same as the type of the actual target unless the predicted target has an associated reverse transformation.
cost	BINARY_DOUBLE

 **See Also:**

Oracle Machine Learning for SQL User's Guide for valid target data types

Oracle Machine Learning for SQL Concepts for more information about cost matrixes

- The confusion matrix created by `COMPUTE_CONFUSION_MATRIX` has the columns described in [Table 53-56](#).

Table 53-56 Columns in a Confusion Matrix

Column Name	Data Type
actual_target_value	Type of the target column in the build data
predicted_target_value	Type of the predicted target in the test data. The type of the predicted target is the same as the type of the actual target unless the predicted target has an associated reverse transformation.
value	BINARY_DOUBLE

 **See Also:**

Oracle Machine Learning for SQL Concepts for more information about confusion matrixes

Examples

These examples use the Naive Bayes model `nb_sh_clas_sample`.

Compute a Confusion Matrix Based on Probabilities

The following statement applies the model to the test data and stores the predictions and probabilities in a table.

```
CREATE TABLE nb_apply_results AS
  SELECT cust_id,
         PREDICTION(nb_sh_clas_sample USING *) prediction,
```

```

        PREDICTION_PROBABILITY(nb_sh_clas_sample USING *) probability
FROM mining_data_test_v;

```

Using probabilities as the scoring criterion, you can compute the confusion matrix as follows.

```

DECLARE
  v_accuracy    NUMBER;
BEGIN
  DBMS_DATA_MINING.COMPUTE_CONFUSION_MATRIX (
    accuracy              => v_accuracy,
    apply_result_table_name => 'nb_apply_results',
    target_table_name     => 'mining_data_test_v',
    case_id_column_name   => 'cust_id',
    target_column_name    => 'affinity_card',
    confusion_matrix_table_name => 'nb_confusion_matrix',
    score_column_name     => 'PREDICTION',
    score_criterion_column_name => 'PROBABILITY',
    cost_matrix_table_name => null,
    apply_result_schema_name => null,
    target_schema_name    => null,
    cost_matrix_schema_name => null,
    score_criterion_type  => 'PROBABILITY');
  DBMS_OUTPUT.PUT_LINE('**** MODEL ACCURACY ****: ' || ROUND(v_accuracy,4));
END;
/

```

The confusion matrix and model accuracy are shown as follows.

```
**** MODEL ACCURACY ****: .7847
```

```

SQL>SELECT * from nb_confusion_matrix;
ACTUAL_TARGET_VALUE PREDICTED_TARGET_VALUE      VALUE
-----
                1                0                60
                0                0               891
                1                1               286
                0                1               263

```

Compute a Confusion Matrix Based on a Cost Matrix Table

The confusion matrix in the previous example shows a high rate of false positives. For 263 cases, the model predicted 1 when the actual value was 0. You could use a cost matrix to minimize this type of error.

The cost matrix table `nb_cost_matrix` specifies that a false positive is 3 times more costly than a false negative.

```

SQL> SELECT * from nb_cost_matrix;
ACTUAL_TARGET_VALUE PREDICTED_TARGET_VALUE      COST
-----
                0                0                0
                0                1               .75
                1                0               .25
                1                1                0

```

This statement shows how to generate the predictions using `APPLY`.

```

BEGIN
  DBMS_DATA_MINING.APPLY(
    model_name           => 'nb_sh_clas_sample',
    data_table_name      => 'mining_data_test_v',
    case_id_column_name  => 'cust_id',

```

```

        result_table_name => 'nb_apply_results');
    END;
/

```

This statement computes the confusion matrix using the cost matrix table. The score criterion column is named 'PROBABILITY', which is the name generated by APPLY.

```

DECLARE
    v_accuracy    NUMBER;
BEGIN
    DBMS_DATA_MINING.COMPUTE_CONFUSION_MATRIX (
        accuracy                => v_accuracy,
        apply_result_table_name => 'nb_apply_results',
        target_table_name       => 'mining_data_test_v',
        case_id_column_name     => 'cust_id',
        target_column_name      => 'affinity_card',
        confusion_matrix_table_name => 'nb_confusion_matrix',
        score_column_name       => 'PREDICTION',
        score_criterion_column_name => 'PROBABILITY',
        cost_matrix_table_name  => 'nb_cost_matrix',
        apply_result_schema_name => null,
        target_schema_name     => null,
        cost_matrix_schema_name => null,
        score_criterion_type    => 'COST');
    DBMS_OUTPUT.PUT_LINE('**** MODEL ACCURACY ****: ' || ROUND(v_accuracy,4));
END;
/

```

The resulting confusion matrix shows a decrease in false positives (212 instead of 263).

```
**** MODEL ACCURACY ****: .798
```

```

SQL> SELECT * FROM nb_confusion_matrix;
ACTUAL_TARGET_VALUE PREDICTED_TARGET_VALUE    VALUE
-----
                1                0            91
                0                0           942
                1                1           255
                0                1           212

```

Compute a Confusion Matrix Based on Embedded Costs

You can use the `ADD_COST_MATRIX` procedure to embed a cost matrix in a model. The embedded costs can be used instead of probabilities for scoring. This statement adds the previously-defined cost matrix to the model.

```

BEGIN    DBMS_DATA_MINING.ADD_COST_MATRIX ('nb_sh_clas_sample',
'nb_cost_matrix');END;/

```

The following statement applies the model to the test data using the embedded costs and stores the results in a table.

```

CREATE TABLE nb_apply_results AS
    SELECT cust_id,
           PREDICTION(nb_sh_clas_sample COST MODEL USING *) prediction,
           PREDICTION_COST(nb_sh_clas_sample COST MODEL USING *) cost
    FROM mining_data_test_v;

```

You can compute the confusion matrix using the embedded costs.

```

DECLARE
  v_accuracy          NUMBER;
BEGIN
  DBMS_DATA_MINING.COMPUTE_CONFUSION_MATRIX (
    accuracy           => v_accuracy,
    apply_result_table_name => 'nb_apply_results',
    target_table_name  => 'mining_data_test_v',
    case_id_column_name => 'cust_id',
    target_column_name => 'affinity_card',
    confusion_matrix_table_name => 'nb_confusion_matrix',
    score_column_name  => 'PREDICTION',
    score_criterion_column_name => 'COST',
    cost_matrix_table_name => null,
    apply_result_schema_name => null,
    target_schema_name  => null,
    cost_matrix_schema_name => null,
    score_criterion_type => 'COST');

END;
/

```

The results are:

```
**** MODEL ACCURACY ****: .798
```

```

SQL> SELECT * FROM nb_confusion_matrix;
ACTUAL_TARGET_VALUE PREDICTED_TARGET_VALUE      VALUE
-----
                1                0                91
                0                0               942
                1                1               255
                0                1               212

```

53.8.6 COMPUTE_CONFUSION_MATRIX_PART Procedure

The `COMPUTE_CONFUSION_MATRIX_PART` procedure computes a confusion matrix, stores it in a table in the user's schema, and returns the model accuracy.

`COMPUTE_CONFUSION_MATRIX_PART` provides support to computation of evaluation metrics per-partition for partitioned models. For non-partitioned models, refer to [COMPUTE_CONFUSION_MATRIX Procedure](#).

A confusion matrix is a test metric for classification models. It compares the predictions generated by the model with the actual target values in a set of test data. The confusion matrix lists the number of times each class was correctly predicted and the number of times it was predicted to be one of the other classes.

`COMPUTE_CONFUSION_MATRIX_PART` accepts three input streams:

- The predictions generated on the test data. The information is passed in three columns:
 - Case ID column
 - Prediction column
 - Scoring criterion column containing either probabilities or costs
- The known target values in the test data. The information is passed in two columns:
 - Case ID column
 - Target column containing the known target values

- (Optional) A cost matrix table with predefined columns. See the Usage Notes for the column requirements.



See Also:

Oracle Machine Learning for SQL Concepts for more details about confusion matrixes and other test metrics for classification

"COMPUTE_LIFT_PART Procedure"

"COMPUTE_ROC_PART Procedure"

Syntax

```
DBMS_DATA_MINING.compute_confusion_matrix_part(
    accuracy                OUT DM_NESTED_NUMERICALS,
    apply_result_table_name IN VARCHAR2,
    target_table_name       IN VARCHAR2,
    case_id_column_name     IN VARCHAR2,
    target_column_name      IN VARCHAR2,
    confusion_matrix_table_name IN VARCHAR2,
    score_column_name       IN VARCHAR2 DEFAULT 'PREDICTION',
    score_criterion_column_name IN VARCHAR2 DEFAULT 'PROBABILITY',
    score_partition_column_name IN VARCHAR2 DEFAULT 'PARTITION_NAME',
    cost_matrix_table_name  IN VARCHAR2 DEFAULT NULL,
    apply_result_schema_name IN VARCHAR2 DEFAULT NULL,
    target_schema_name      IN VARCHAR2 DEFAULT NULL,
    cost_matrix_schema_name IN VARCHAR2 DEFAULT NULL,
    score_criterion_type    IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 53-57 COMPUTE_CONFUSION_MATRIX_PART Procedure Parameters

Parameter	Description
accuracy	Output parameter containing the overall percentage accuracy of the predictions The output argument is changed from NUMBER to DM_NESTED_NUMERICALS
apply_result_table_name	Table containing the predictions
target_table_name	Table containing the known target values from the test data
case_id_column_name	Case ID column in the apply results table. Must match the case identifier in the targets table.
target_column_name	Target column in the targets table. Contains the known target values from the test data.
confusion_matrix_table_name	Table containing the confusion matrix. The table will be created by the procedure in the user's schema. The columns in the confusion matrix table are described in the Usage Notes.

Table 53-57 (Cont.) COMPUTE_CONFUSION_MATRIX_PART Procedure Parameters

Parameter	Description
score_column_name	Column containing the predictions in the apply results table. The default column name is PREDICTION, which is the default name created by the APPLY procedure (See "APPLY Procedure").
score_criterion_column_name	Column containing the scoring criterion in the apply results table. Contains either the probabilities or the costs that determine the predictions. By default, scoring is based on probability; the class with the highest probability is predicted for each case. If scoring is based on cost, then the class with the lowest cost is predicted. The score_criterion_type parameter indicates whether probabilities or costs will be used for scoring. The default column name is PROBABILITY, which is the default name created by the APPLY procedure (See "APPLY Procedure"). See the Usage Notes for additional information.
score_partition_column_name	(Optional) Parameter indicating the column which contains the name of the partition. This column slices the input test results such that each partition has independent evaluation matrices computed.
cost_matrix_table_name	(Optional) Table that defines the costs associated with misclassifications. If a cost matrix table is provided and the score_criterion_type parameter is set to COSTS, the costs in this table will be used as the scoring criteria. The columns in a cost matrix table are described in the Usage Notes.
apply_result_schema_name	Schema of the apply results table. If null, then the user's schema is assumed.
target_schema_name	Schema of the table containing the known targets. If null, then the user's schema is assumed.
cost_matrix_schema_name	Schema of the cost matrix table, if one is provided. If null, then the user's schema is assumed.
score_criterion_type	Whether to use probabilities or costs as the scoring criterion. Probabilities or costs are passed in the column identified in the score_criterion_column_name parameter. The default value of score_criterion_type is PROBABILITY. To use costs as the scoring criterion, specify COST. If score_criterion_type is set to COST but no cost matrix is provided and if there is a scoring cost matrix associated with the model, then the associated costs are used for scoring. See the Usage Notes and the Examples.

Usage Notes

- The predictive information you pass to `COMPUTE_CONFUSION_MATRIX_PART` may be generated using SQL PREDICTION functions, the `DBMS_DATA_MINING.APPLY` procedure, or some other mechanism. As long as you pass the appropriate data, the procedure can compute the confusion matrix.
- Instead of passing a cost matrix to `COMPUTE_CONFUSION_MATRIX_PART`, you can use a scoring cost matrix associated with the model. A scoring cost matrix can be embedded in the model or it can be defined dynamically when the model is applied. To use a scoring cost matrix, invoke the `SQL_PREDICTION_COST` function to populate the score criterion column.
- The predictions that you pass to `COMPUTE_CONFUSION_MATRIX_PART` are in a table or view specified in `apply_result_table_name`.

```
CREATE TABLE apply_result_table_name AS (
    case_id_column_name          VARCHAR2,
    score_column_name           VARCHAR2,
    score_criterion_column_name VARCHAR2);
```

- A cost matrix must have the columns described in [Table 53-55](#).

Table 53-58 Columns in a Cost Matrix

Column Name	Data Type
<code>actual_target_value</code>	Type of the target column in the test data
<code>predicted_target_value</code>	Type of the predicted target in the test data. The type of the predicted target must be the same as the type of the actual target unless the predicted target has an associated reverse transformation.
<code>cost</code>	BINARY_DOUBLE

See Also:

Oracle Machine Learning for SQL User's Guide for valid target data types

Oracle Machine Learning for SQL Concepts for more information about cost matrixes

- The confusion matrix created by `COMPUTE_CONFUSION_MATRIX_PART` has the columns described in [Table 53-56](#).

Table 53-59 Columns in a Confusion Matrix Part

Column Name	Data Type
<code>actual_target_value</code>	Type of the target column in the test data
<code>predicted_target_value</code>	Type of the predicted target in the test data. The type of the predicted target is the same as the type of the actual target unless the predicted target has an associated reverse transformation.

Table 53-59 (Cont.) Columns in a Confusion Matrix Part

Column Name	Data Type
value	BINARY_DOUBLE

 **See Also:**

Oracle Machine Learning for SQL Concepts for more information about confusion matrixes

Examples

These examples use the Naive Bayes model `nb_sh_clas_sample`.

Compute a Confusion Matrix Based on Probabilities

The following statement applies the model to the test data and stores the predictions and probabilities in a table.

```
CREATE TABLE nb_apply_results AS
  SELECT cust_id,
         PREDICTION(nb_sh_clas_sample USING *) prediction,
         PREDICTION_PROBABILITY(nb_sh_clas_sample USING *) probability
  FROM mining_data_test_v;
```

Using probabilities as the scoring criterion, you can compute the confusion matrix as follows.

```
DECLARE
  v_accuracy NUMBER;
BEGIN
  DBMS_DATA_MINING.COMPUTE_CONFUSION_MATRIX_PART (
    accuracy => v_accuracy,
    apply_result_table_name => 'nb_apply_results',
    target_table_name => 'mining_data_test_v',
    case_id_column_name => 'cust_id',
    target_column_name => 'affinity_card',
    confusion_matrix_table_name => 'nb_confusion_matrix',
    score_column_name => 'PREDICTION',
    score_criterion_column_name => 'PROBABILITY',
    score_partition_column_name => 'PARTITION_NAME',
    cost_matrix_table_name => null,
    apply_result_schema_name => null,
    target_schema_name => null,
    cost_matrix_schema_name => null,
    score_criterion_type => 'PROBABILITY');
  DBMS_OUTPUT.PUT_LINE('**** MODEL ACCURACY ****: ' || ROUND(v_accuracy,4));
END;
```

The confusion matrix and model accuracy are shown as follows.

```
**** MODEL ACCURACY ****: .7847

SELECT * FROM NB_CONFUSION_MATRIX;
ACTUAL_TARGET_VALUE PREDICTED_TARGET_VALUE VALUE
-----
1 0 60
```

0	0	891
1	1	286
0	1	263

Compute a Confusion Matrix Based on a Cost Matrix Table

The confusion matrix in the previous example shows a high rate of false positives. For 263 cases, the model predicted 1 when the actual value was 0. You could use a cost matrix to minimize this type of error.

The cost matrix table `nb_cost_matrix` specifies that a false positive is 3 times more costly than a false negative.

```
SELECT * from NB_COST_MATRIX;
ACTUAL_TARGET_VALUE PREDICTED_TARGET_VALUE      COST
-----
                0                0                0
                0                1              .75
                1                0              .25
                1                1                0
```

This statement shows how to generate the predictions using `APPLY`.

```
BEGIN
  DBMS_DATA_MINING.APPLY(
    model_name          => 'nb_sh_clas_sample',
    data_table_name     => 'mining_data_test_v',
    case_id_column_name => 'cust_id',
    result_table_name   => 'nb_apply_results');
END;
/
```

This statement computes the confusion matrix using the cost matrix table. The score criterion column is named 'PROBABILITY', which is the name generated by `APPLY`.

```
DECLARE
  v_accuracy NUMBER;
BEGIN
  DBMS_DATA_MINING.COMPUTE_CONFUSION_MATRIX_PART (
    accuracy              => v_accuracy,
    apply_result_table_name => 'nb_apply_results',
    target_table_name     => 'mining_data_test_v',
    case_id_column_name   => 'cust_id',
    target_column_name    => 'affinity_card',
    confusion_matrix_table_name => 'nb_confusion_matrix',
    score_column_name     => 'PREDICTION',
    score_criterion_column_name => 'PROBABILITY',
    score_partition_column_name => 'PARTITION_NAME',
    cost_matrix_table_name => 'nb_cost_matrix',
    apply_result_schema_name => null,
    target_schema_name    => null,
    cost_matrix_schema_name => null,
    score_criterion_type  => 'COST');
  DBMS_OUTPUT.PUT_LINE('**** MODEL ACCURACY ****: ' || ROUND(v_accuracy,4));
END;
/
```

The resulting confusion matrix shows a decrease in false positives (212 instead of 263).

```
**** MODEL ACCURACY ****: .798
```

```
SELECT * FROM NB_CONFUSION_MATRIX;
ACTUAL_TARGET_VALUE PREDICTED_TARGET_VALUE      VALUE
-----
                1                0                91
                0                0                942
                1                1                255
                0                1                212
```

Compute a Confusion Matrix Based on Embedded Costs

You can use the `ADD_COST_MATRIX` procedure to embed a cost matrix in a model. The embedded costs can be used instead of probabilities for scoring. This statement adds the previously-defined cost matrix to the model.

```
BEGIN
DBMS_DATA_MINING.ADD_COST_MATRIX ('nb_sh_clas_sample', 'nb_cost_matrix');
END;/
```

The following statement applies the model to the test data using the embedded costs and stores the results in a table.

```
CREATE TABLE nb_apply_results AS
  SELECT cust_id,
         PREDICTION(nb_sh_clas_sample COST MODEL USING *) prediction,
         PREDICTION_COST(nb_sh_clas_sample COST MODEL USING *) cost
  FROM mining_data_test_v;
```

You can compute the confusion matrix using the embedded costs.

```
DECLARE
  v_accuracy          NUMBER;
BEGIN
  DBMS_DATA_MINING.COMPUTE_CONFUSION_MATRIX_PART (
    accuracy           => v_accuracy,
    apply_result_table_name => 'nb_apply_results',
    target_table_name  => 'mining_data_test_v',
    case_id_column_name => 'cust_id',
    target_column_name => 'affinity_card',
    confusion_matrix_table_name => 'nb_confusion_matrix',
    score_column_name  => 'PREDICTION',
    score_criterion_column_name => 'COST',
    score_partition_column_name => 'PARTITION_NAME',
    cost_matrix_table_name => null,
    apply_result_schema_name => null,
    target_schema_name  => null,
    cost_matrix_schema_name => null,
    score_criterion_type => 'COST');
END;
/
```

The results are:

```
**** MODEL ACCURACY ****: .798
```

```
SELECT * FROM NB_CONFUSION_MATRIX;
ACTUAL_TARGET_VALUE PREDICTED_TARGET_VALUE      VALUE
-----
                1                0                91
                0                0                942
```

1	1	255
0	1	212

53.8.7 COMPUTE_LIFT Procedure

This procedure computes lift and stores the results in a table in the user's schema.

Lift is a test metric for binary classification models. To compute lift, one of the target values must be designated as the positive class. `COMPUTE_LIFT` compares the predictions generated by the model with the actual target values in a set of test data. Lift measures the degree to which the model's predictions of the positive class are an improvement over random chance.

Lift is computed on scoring results that have been ranked by probability (or cost) and divided into quantiles. Each quantile includes the scores for the same number of cases.

`COMPUTE_LIFT` calculates quantile-based and cumulative statistics. The number of quantiles and the positive class are user-specified. Additionally, `COMPUTE_LIFT` accepts three input streams:

- The predictions generated on the test data. The information is passed in three columns:
 - Case ID column
 - Prediction column
 - Scoring criterion column containing either probabilities or costs associated with the predictions
- The known target values in the test data. The information is passed in two columns:
 - Case ID column
 - Target column containing the known target values
- (Optional) A cost matrix table with predefined columns. See the Usage Notes for the column requirements.

See Also:

Oracle Machine Learning for SQL Concepts for more details about lift and test metrics for classification

["COMPUTE_CONFUSION_MATRIX Procedure"](#)

["COMPUTE_ROC Procedure"](#)

Syntax

```
DBMS_DATA_MINING.COMPUTE_LIFT (
  apply_result_table_name      IN VARCHAR2,
  target_table_name           IN VARCHAR2,
  case_id_column_name         IN VARCHAR2,
  target_column_name          IN VARCHAR2,
  lift_table_name              IN VARCHAR2,
```

```

positive_target_value      IN VARCHAR2,
score_column_name         IN VARCHAR2 DEFAULT 'PREDICTION',
score_criterion_column_name IN VARCHAR2 DEFAULT 'PROBABILITY',
num_quantiles             IN NUMBER DEFAULT 10,
cost_matrix_table_name    IN VARCHAR2 DEFAULT NULL,
apply_result_schema_name  IN VARCHAR2 DEFAULT NULL,
target_schema_name        IN VARCHAR2 DEFAULT NULL,
cost_matrix_schema_name   IN VARCHAR2 DEFAULT NULL
score_criterion_type      IN VARCHAR2 DEFAULT 'PROBABILITY');

```

Parameters

Table 53-60 COMPUTE_LIFT Procedure Parameters

Parameter	Description
apply_result_table_name	Table containing the predictions.
target_table_name	Table containing the known target values from the test data.
case_id_column_name	Case ID column in the apply results table. Must match the case identifier in the targets table.
target_column_name	Target column in the targets table. Contains the known target values from the test data.
lift_table_name	Table containing the lift statistics. The table will be created by the procedure in the user's schema. The columns in the lift table are described in the Usage Notes.
positive_target_value	The positive class. This should be the class of interest, for which you want to calculate lift. If the target column is a NUMBER, you can use the TO_CHAR() operator to provide the value as a string.
score_column_name	Column containing the predictions in the apply results table. The default column name is 'PREDICTION', which is the default name created by the APPLY procedure (See " APPLY Procedure ").
score_criterion_column_name	Column containing the scoring criterion in the apply results table. Contains either the probabilities or the costs that determine the predictions. By default, scoring is based on probability; the class with the highest probability is predicted for each case. If scoring is based on cost, the class with the lowest cost is predicted. The score_criterion_type parameter indicates whether probabilities or costs will be used for scoring. The default column name is 'PROBABILITY', which is the default name created by the APPLY procedure (See " APPLY Procedure ").
num_quantiles	See the Usage Notes for additional information. Number of quantiles to be used in calculating lift. The default is 10.

Table 53-60 (Cont.) COMPUTE_LIFT Procedure Parameters

Parameter	Description
<code>cost_matrix_table_name</code>	(Optional) Table that defines the costs associated with misclassifications. If a cost matrix table is provided and the <code>score_criterion_type</code> parameter is set to 'COST', the costs will be used as the scoring criteria. The columns in a cost matrix table are described in the Usage Notes.
<code>apply_result_schema_name</code>	Schema of the apply results table. If null, the user's schema is assumed.
<code>target_schema_name</code>	Schema of the table containing the known targets. If null, the user's schema is assumed.
<code>cost_matrix_schema_name</code>	Schema of the cost matrix table, if one is provided. If null, the user's schema is assumed.
<code>score_criterion_type</code>	Whether to use probabilities or costs as the scoring criterion. Probabilities or costs are passed in the column identified in the <code>score_criterion_column_name</code> parameter. The default value of <code>score_criterion_type</code> is 'PROBABILITY'. To use costs as the scoring criterion, specify 'COST'. If <code>score_criterion_type</code> is set to 'COST' but no cost matrix is provided and if there is a scoring cost matrix associated with the model, then the associated costs are used for scoring. See the Usage Notes and the Examples.

Usage Notes

- The predictive information you pass to `COMPUTE_LIFT` may be generated using SQL `PREDICTION` functions, the `DBMS_DATA_MINING.APPLY` procedure, or some other mechanism. As long as you pass the appropriate data, the procedure can compute the lift.
- Instead of passing a cost matrix to `COMPUTE_LIFT`, you can use a scoring cost matrix associated with the model. A scoring cost matrix can be embedded in the model or it can be defined dynamically when the model is applied. To use a scoring cost matrix, invoke the `SQL_PREDICTION_COST` function to populate the score criterion column.
- The predictions that you pass to `COMPUTE_LIFT` are in a table or view specified in `apply_results_table_name`.

```
CREATE TABLE apply_result_table_name AS (
    case_id_column_name          VARCHAR2,
    score_column_name           VARCHAR2,
    score_criterion_column_name VARCHAR2);
```

- A cost matrix must have the columns described in [Table 53-61](#).

Table 53-61 Columns in a Cost Matrix

Column Name	Data Type
actual_target_value	Type of the target column in the build data
predicted_target_value	Type of the predicted target in the test data. The type of the predicted target must be the same as the type of the actual target unless the predicted target has an associated reverse transformation.
cost	NUMBER

 **See Also:**

Oracle Machine Learning for SQL Concepts for more information about cost matrixes

- The table created by `COMPUTE_LIFT` has the columns described in [Table 53-62](#)

Table 53-62 Columns in a Lift Table

Column Name	Data Type
quantile_number	NUMBER
probability_threshold	NUMBER
gain_cumulative	NUMBER
quantile_total_count	NUMBER
quantile_target_count	NUMBER
percent_records_cumulative	NUMBER
lift_cumulative	NUMBER
target_density_cumulative	NUMBER
targets_cumulative	NUMBER
non_targets_cumulative	NUMBER
lift_quantile	NUMBER
target_density	NUMBER

 **See Also:**

Oracle Machine Learning for SQL Concepts for details about the information in the lift table

- When a cost matrix is passed to `COMPUTE_LIFT`, the cost threshold is returned in the `probability_threshold` column of the lift table.

Examples

This example uses the Naive Bayes model `nb_sh_clas_sample`.

The example illustrates lift based on probabilities. For examples that show computation based on costs, see "[COMPUTE_CONFUSION_MATRIX Procedure](#)".

The following statement applies the model to the test data and stores the predictions and probabilities in a table.

```
CREATE TABLE nb_apply_results AS
  SELECT cust_id, t.prediction, t.probability
  FROM mining_data_test_v, TABLE(PREDICTION_SET(nb_sh_clas_sample USING *)) t;
```

Using probabilities as the scoring criterion, you can compute lift as follows.

```
BEGIN
  DBMS_DATA_MINING.COMPUTE_LIFT (
    apply_result_table_name      => 'nb_apply_results',
    target_table_name           => 'mining_data_test_v',
    case_id_column_name         => 'cust_id',
    target_column_name          => 'affinity_card',
    lift_table_name             => 'nb_lift',
    positive_target_value       => to_char(1),
    score_column_name           => 'PREDICTION',
    score_criterion_column_name => 'PROBABILITY',
    num_quantiles               => 10,
    cost_matrix_table_name      => null,
    apply_result_schema_name    => null,
    target_schema_name          => null,
    cost_matrix_schema_name     => null,
    score_criterion_type        => 'PROBABILITY');
  END;
/
```

This query displays some of the statistics from the resulting lift table.

```
SQL>SELECT quantile_number, probability_threshold, gain_cumulative,
  quantile_total_count
  FROM nb_lift;
```

QUANTILE_NUMBER	PROBABILITY_THRESHOLD	GAIN_CUMULATIVE	QUANTILE_TOTAL_COUNT
1	.989335775	.15034965	55
2	.980534911	.26048951	55
3	.968506098	.374125874	55
4	.958975196	.493006993	55
5	.946705997	.587412587	55
6	.927454174	.66958042	55
7	.904403627	.748251748	55
8	.836482525	.839160839	55
10	.500184953	1	54

53.8.8 COMPUTE_LIFT_PART Procedure

The `COMPUTE_LIFT_PART` procedure computes lift and stores the results in a table in the user's schema. This procedure provides support to the computation of evaluation metrics per-partition for partitioned models.

Lift is a test metric for binary classification models. To compute lift, one of the target values must be designated as the positive class. `COMPUTE_LIFT_PART` compares the predictions generated by the model with the actual target values in a set of test data. Lift measures the degree to which the model's predictions of the positive class are an improvement over random chance.

Lift is computed on scoring results that have been ranked by probability (or cost) and divided into quantiles. Each quantile includes the scores for the same number of cases.

COMPUTE_LIFT_PART calculates quantile-based and cumulative statistics. The number of quantiles and the positive class are user-specified. Additionally, COMPUTE_LIFT_PART accepts three input streams:

- The predictions generated on the test data. The information is passed in three columns:
 - Case ID column
 - Prediction column
 - Scoring criterion column containing either probabilities or costs associated with the predictions
- The known target values in the test data. The information is passed in two columns:
 - Case ID column
 - Target column containing the known target values
- (Optional) A cost matrix table with predefined columns. See the Usage Notes for the column requirements.



See Also:

Oracle Machine Learning for SQL Concepts for more details about Lift and test metrics for classification

["COMPUTE_LIFT Procedure"](#)

["COMPUTE_CONFUSION_MATRIX Procedure"](#)

["COMPUTE_CONFUSION_MATRIX_PART Procedure"](#)

["COMPUTE_ROC Procedure"](#)

["COMPUTE_ROC_PART Procedure"](#)

Syntax

```
DBMS_DATA_MINING.COMPUTE_LIFT_PART (
  apply_result_table_name  IN VARCHAR2,
  target_table_name        IN VARCHAR2,
  case_id_column_name      IN VARCHAR2,
  target_column_name       IN VARCHAR2,
  lift_table_name          IN VARCHAR2,
  positive_target_value    IN VARCHAR2,
  score_column_name        IN VARCHAR2 DEFAULT 'PREDICTION',
  score_criterion_column_name IN VARCHAR2 DEFAULT 'PROBABILITY',
  score_partition_column_name IN VARCHAR2 DEFAULT 'PARTITION_NAME',
  num_quantiles            IN NUMBER   DEFAULT 10,
  cost_matrix_table_name   IN VARCHAR2 DEFAULT NULL,
  apply_result_schema_name IN VARCHAR2 DEFAULT NULL,
  target_schema_name       IN VARCHAR2 DEFAULT NULL,
  cost_matrix_schema_name  IN VARCHAR2 DEFAULT NULL,
  score_criterion_type     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 53-63 COMPUTE_LIFT_PART Procedure Parameters

Parameter	Description
<code>apply_result_table_name</code>	Table containing the predictions
<code>target_table_name</code>	Table containing the known target values from the test data
<code>case_id_column_name</code>	Case ID column in the apply results table. Must match the case identifier in the targets table.
<code>target_column_name</code>	Target column in the targets table. Contains the known target values from the test data.
<code>lift_table_name</code>	Table containing the Lift statistics. The table will be created by the procedure in the user's schema. The columns in the Lift table are described in the Usage Notes.
<code>positive_target_value</code>	The positive class. This should be the class of interest, for which you want to calculate Lift. If the target column is a <code>NUMBER</code> , then you can use the <code>TO_CHAR()</code> operator to provide the value as a string.
<code>score_column_name</code>	Column containing the predictions in the apply results table. The default column name is <code>PREDICTION</code> , which is the default name created by the <code>APPLY</code> procedure (See " APPLY Procedure ").
<code>score_criterion_column_name</code>	Column containing the scoring criterion in the apply results table. Contains either the probabilities or the costs that determine the predictions. By default, scoring is based on probability; the class with the highest probability is predicted for each case. If scoring is based on cost, then the class with the lowest cost is predicted. The <code>score_criterion_type</code> parameter indicates whether probabilities or costs will be used for scoring. The default column name is <code>PROBABILITY</code> , which is the default name created by the <code>APPLY</code> procedure (See " APPLY Procedure "). See the Usage Notes for additional information.
<code>score_partition_column_name</code>	Optional parameter indicating the column containing the name of the partition. This column slices the input test results such that each partition has independent evaluation matrices computed.
<code>num_quantiles</code>	Number of quantiles to be used in calculating Lift. The default is 10.
<code>cost_matrix_table_name</code>	(Optional) Table that defines the costs associated with misclassifications. If a cost matrix table is provided and the <code>score_criterion_type</code> parameter is set to <code>COST</code> , then the costs will be used as the scoring criteria. The columns in a cost matrix table are described in the Usage Notes.

Table 53-63 (Cont.) COMPUTE_LIFT_PART Procedure Parameters

Parameter	Description
<code>apply_result_schema_name</code>	Schema of the apply results table If null, then the user's schema is assumed.
<code>target_schema_name</code>	Schema of the table containing the known targets If null, then the user's schema is assumed.
<code>cost_matrix_schema_name</code>	Schema of the cost matrix table, if one is provided If null, then the user's schema is assumed.
<code>score_criterion_type</code>	Whether to use probabilities or costs as the scoring criterion. Probabilities or costs are passed in the column identified in the <code>score_criterion_column_name</code> parameter. The default value of <code>score_criterion_type</code> is <code>PROBABILITY</code> . To use costs as the scoring criterion, specify <code>COST</code> . If <code>score_criterion_type</code> is set to <code>COST</code> but no cost matrix is provided and if there is a scoring cost matrix associated with the model, then the associated costs are used for scoring. See the Usage Notes and the Examples.

Usage Notes

- The predictive information you pass to `COMPUTE_LIFT_PART` may be generated using SQL `PREDICTION` functions, the `DBMS_DATA_MINING.APPLY` procedure, or some other mechanism. As long as you pass the appropriate data, the procedure can compute the Lift.
- Instead of passing a cost matrix to `COMPUTE_LIFT_PART`, you can use a scoring cost matrix associated with the model. A scoring cost matrix can be embedded in the model or it can be defined dynamically when the model is applied. To use a scoring cost matrix, invoke the SQL `PREDICTION_COST` function to populate the score criterion column.
- The predictions that you pass to `COMPUTE_LIFT_PART` are in a table or view specified in `apply_results_table_name`.

```
CREATE TABLE apply_result_table_name AS (
    case_id_column_name          VARCHAR2,
    score_column_name           VARCHAR2,
    score_criterion_column_name VARCHAR2);
```

- A cost matrix must have the columns described in [Table 53-61](#).

Table 53-64 Columns in a Cost Matrix

Column Name	Data Type
<code>actual_target_value</code>	Type of the target column in the test data
<code>predicted_target_value</code>	Type of the predicted target in the test data. The type of the predicted target must be the same as the type of the actual target unless the predicted target has an associated reverse transformation.

Table 53-64 (Cont.) Columns in a Cost Matrix

Column Name	Data Type
cost	NUMBER

 **See Also:**

Oracle Machine Learning for SQL Concepts for more information about cost matrixes

- The table created by `COMPUTE_LIFT_PART` has the columns described in [Table 53-62](#)

Table 53-65 Columns in a COMPUTE_LIFT_PART Table

Column Name	Data Type
quantile_number	NUMBER
probability_threshold	NUMBER
gain_cumulative	NUMBER
quantile_total_count	NUMBER
quantile_target_count	NUMBER
percent_records_cumulative	NUMBER
lift_cumulative	NUMBER
target_density_cumulative	NUMBER
targets_cumulative	NUMBER
non_targets_cumulative	NUMBER
lift_quantile	NUMBER
target_density	NUMBER

 **See Also:**

Oracle Machine Learning for SQL Concepts for details about the information in the Lift table

- When a cost matrix is passed to `COMPUTE_LIFT_PART`, the cost threshold is returned in the `probability_threshold` column of the Lift table.

Examples

This example uses the Naive Bayes model `nb_sh_clas_sample`.

The example illustrates Lift based on probabilities. For examples that show computation based on costs, see "[COMPUTE_CONFUSION_MATRIX Procedure](#)".

For a partitioned model example, see "[COMPUTE_CONFUSION_MATRIX_PART Procedure](#)".

The following statement applies the model to the test data and stores the predictions and probabilities in a table.

```
CREATE TABLE nb_apply_results AS
  SELECT cust_id, t.prediction, t.probability
  FROM mining_data_test_v, TABLE(PREDICTION_SET(nb_sh_clas_sample USING *)) t;
```

Using probabilities as the scoring criterion, you can compute Lift as follows.

```
BEGIN
  DBMS_DATA_MINING.COMPUTE_LIFT_PART (
    apply_result_table_name => 'nb_apply_results',
    target_table_name       => 'mining_data_test_v',
    case_id_column_name    => 'cust_id',
    target_column_name     => 'affinity_card',
    lift_table_name        => 'nb_lift',
    positive_target_value  => to_char(1),
    score_column_name      => 'PREDICTION',
    score_criterion_column_name => 'PROBABILITY',
    score_partition_column_name => 'PARTITION_NAME',
    num_quantiles          => 10,
    cost_matrix_table_name => null,
    apply_result_schema_name => null,
    target_schema_name     => null,
    cost_matrix_schema_name => null,
    score_criterion_type   => 'PROBABILITY');
END;
/
```

This query displays some of the statistics from the resulting Lift table.

```
SELECT quantile_number, probability_threshold, gain_cumulative,
       quantile_total_count
  FROM nb_lift;
```

QUANTILE_NUMBER	PROBABILITY_THRESHOLD	GAIN_CUMULATIVE	QUANTILE_TOTAL_COUNT
1	.989335775	.15034965	55
2	.980534911	.26048951	55
3	.968506098	.374125874	55
4	.958975196	.493006993	55
5	.946705997	.587412587	55
6	.927454174	.66958042	55
7	.904403627	.748251748	55
8	.836482525	.839160839	55
10	.500184953	1	54

53.8.9 COMPUTE_ROC Procedure

This procedure computes the receiver operating characteristic (ROC), stores the results in a table in the user's schema, and returns a measure of the model accuracy.

ROC is a test metric for binary classification models. To compute ROC, one of the target values must be designated as the positive class. `COMPUTE_ROC` compares the predictions generated by the model with the actual target values in a set of test data.

ROC measures the impact of changes in the probability threshold. The probability threshold is the decision point used by the model for predictions. In binary classification, the default probability threshold is 0.5. The value predicted for each case is the one with a probability greater than 50%.

ROC can be plotted as a curve on an X-Y axis. The false positive rate is placed on the X axis. The true positive rate is placed on the Y axis. A false positive is a positive prediction for a case that is negative in the test data. A true positive is a positive prediction for a case that is positive in the test data.

`COMPUTE_ROC` accepts two input streams:

- The predictions generated on the test data. The information is passed in three columns:
 - Case ID column
 - Prediction column
 - Scoring criterion column containing probabilities
- The known target values in the test data. The information is passed in two columns:
 - Case ID column
 - Target column containing the known target values



See Also:

Oracle Machine Learning for SQL Concepts for more details about ROC and test metrics for classification

["COMPUTE_CONFUSION_MATRIX Procedure"](#)

["COMPUTE_LIFT Procedure"](#)

Syntax

```
DBMS_DATA_MINING.COMPUTE_ROC (
    roc_area_under_curve      OUT NUMBER,
    apply_result_table_name   IN VARCHAR2,
    target_table_name         IN VARCHAR2,
    case_id_column_name       IN VARCHAR2,
    target_column_name        IN VARCHAR2,
    roc_table_name            IN VARCHAR2,
    positive_target_value     IN VARCHAR2,
    score_column_name         IN VARCHAR2 DEFAULT 'PREDICTION',
```



```

score_criterion_column_name IN VARCHAR2 DEFAULT 'PROBABILITY',
apply_result_schema_name   IN VARCHAR2 DEFAULT NULL,
target_schema_name         IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 53-66 COMPUTE_ROC Procedure Parameters

Parameter	Description
roc_area_under_the_curve	Output parameter containing the area under the ROC curve (AUC). The AUC measures the likelihood that an actual positive will be predicted as positive. The greater the AUC, the greater the flexibility of the model in accommodating trade-offs between positive and negative class predictions. AUC can be especially important when one target class is rarer or more important to identify than another.
apply_result_table_name	Table containing the predictions.
target_table_name	Table containing the known target values from the test data.
case_id_column_name	Case ID column in the apply results table. Must match the case identifier in the targets table.
target_column_name	Target column in the targets table. Contains the known target values from the test data.
roc_table_name	Table containing the ROC output. The table will be created by the procedure in the user's schema. The columns in the ROC table are described in the Usage Notes.
positive_target_value	The positive class. This should be the class of interest, for which you want to calculate ROC. If the target column is a NUMBER, you can use the TO_CHAR() operator to provide the value as a string.
score_column_name	Column containing the predictions in the apply results table. The default column name is 'PREDICTION', which is the default name created by the APPLY procedure (See " APPLY Procedure ").
score_criterion_column_name	Column containing the scoring criterion in the apply results table. Contains the probabilities that determine the predictions. The default column name is 'PROBABILITY', which is the default name created by the APPLY procedure (See " APPLY Procedure ").
apply_result_schema_name	Schema of the apply results table. If null, the user's schema is assumed.
target_schema_name	Schema of the table containing the known targets. If null, the user's schema is assumed.

Usage Notes

- The predictive information you pass to COMPUTE_ROC may be generated using SQL PREDICTION functions, the DBMS_DATA_MINING.APPLY procedure, or some other

mechanism. As long as you pass the appropriate data, the procedure can compute the receiver operating characteristic.

- The predictions that you pass to `COMPUTE_ROC` are in a table or view specified in `apply_results_table_name`.

```
CREATE TABLE apply_result_table_name AS (
    case_id_column_name          VARCHAR2,
    score_column_name            VARCHAR2,
    score_criterion_column_name  VARCHAR2);
```

- The table created by `COMPUTE_ROC` has the columns shown in [Table 53-67](#).

Table 53-67 COMPUTE_ROC Output

Column	Datatype
probability	BINARY_DOUBLE
true_positives	NUMBER
false_negatives	NUMBER
false_positives	NUMBER
true_negatives	NUMBER
true_positive_fraction	NUMBER
false_positive_fraction	NUMBER

 **See Also:**

Oracle Machine Learning for SQL Concepts for details about the output of `COMPUTE_ROC`

- ROC is typically used to determine the most desirable probability threshold. This can be done by examining the true positive fraction and the false positive fraction. The true positive fraction is the percentage of all positive cases in the test data that were correctly predicted as positive. The false positive fraction is the percentage of all negative cases in the test data that were incorrectly predicted as positive.

Given a probability threshold, the following statement returns the positive predictions in an apply result table ordered by probability.

```
SELECT case_id_column_name
       FROM apply_result_table_name
       WHERE probability > probability_threshold
       ORDER BY probability DESC;
```

- There are two approaches to identifying the most desirable probability threshold. Which approach you use depends on whether or not you know the relative cost of positive versus negative class prediction errors.

If the costs are known, you can apply the relative costs to the ROC table to compute the minimum cost probability threshold. Suppose the relative cost ratio is: Positive Class Error Cost / Negative Class Error Cost = 20. Then execute a query like this.

```

WITH cost AS (
  SELECT probability_threshold, 20 * false_negatives + false_positives cost
  FROM ROC_table
  GROUP BY probability_threshold),
minCost AS (
  SELECT min(cost) minCost
  FROM cost)
SELECT max(probability_threshold)probability_threshold
  FROM cost, minCost
 WHERE cost = minCost;

```

If relative costs are not well known, you can simply scan the values in the ROC table (in sorted order) and make a determination about which of the displayed trade-offs (misclassified positives versus misclassified negatives) is most desirable.

```

SELECT * FROM ROC_table
  ORDER BY probability_threshold;

```

Examples

This example uses the Naive Bayes model `nb_sh_clas_sample`.

The following statement applies the model to the test data and stores the predictions and probabilities in a table.

```

CREATE TABLE nb_apply_results AS
  SELECT cust_id, t.prediction, t.probability
  FROM mining_data_test_v, TABLE(PREDICTION_SET(nb_sh_clas_sample USING *)) t;

```

Using the predictions and the target values from the test data, you can compute ROC as follows.

```

DECLARE
  v_area_under_curve NUMBER;
BEGIN
  DBMS_DATA_MINING.COMPUTE_ROC (
    roc_area_under_curve      => v_area_under_curve,
    apply_result_table_name   => 'nb_apply_results',
    target_table_name         => 'mining_data_test_v',
    case_id_column_name       => 'cust_id',
    target_column_name        => 'mining_data_test_v',
    roc_table_name            => 'nb_roc',
    positive_target_value     => '1',
    score_column_name         => 'PREDICTION',
    score_criterion_column_name => 'PROBABILITY');
  DBMS_OUTPUT.PUT_LINE('**** AREA UNDER ROC CURVE ****: ' ||
    ROUND(v_area_under_curve,4));
END;
/

```

The resulting AUC and a selection of columns from the ROC table are shown as follows.

```

**** AREA UNDER ROC CURVE ****: .8212

SELECT PROBABILITY, TRUE_POSITIVE_FRACTION, FALSE_POSITIVE_FRACTION
  FROM NB_ROC;

```

PROBABILITY	TRUE_POSITIVE_FRACTION	FALSE_POSITIVE_FRACTION
.00000	1	1
.50018	.826589595	.227902946
.53851	.823699422	.221837088
.54991	.820809249	.217504333
.55628	.815028902	.215771231
.55628	.817919075	.215771231
.57563	.800578035	.214904679
.57563	.812138728	.214904679
.	.	.
.	.	.
.	.	.

53.8.10 COMPUTE_ROC_PART Procedure

The `COMPUTE_ROC_PART` procedure computes Receiver Operating Characteristic (ROC), stores the results in a table in the user's schema, and returns a measure of the model accuracy. This procedure provides support to computation of evaluation metrics per-partition for partitioned models.

ROC is a test metric for binary classification models. To compute ROC, one of the target values must be designated as the positive class. `COMPUTE_ROC_PART` compares the predictions generated by the model with the actual target values in a set of test data.

ROC measures the impact of changes in the probability threshold. The probability threshold is the decision point used by the model for predictions. In binary classification, the default probability threshold is 0.5. The value predicted for each case is the one with a probability greater than 50%.

ROC can be plotted as a curve on an x-y axis. The false positive rate is placed on the x-axis. The true positive rate is placed on the y-axis. A false positive is a positive prediction for a case that is negative in the test data. A true positive is a positive prediction for a case that is positive in the test data.

`COMPUTE_ROC_PART` accepts two input streams:

- The predictions generated on the test data. The information is passed in three columns:
 - Case ID column
 - Prediction column
 - Scoring criterion column containing probabilities
- The known target values in the test data. The information is passed in two columns:
 - Case ID column
 - Target column containing the known target values

 **See Also:**

Oracle Machine Learning for SQL Concepts for more details about ROC and test metrics for Classification

"[COMPUTE_ROC Procedure](#)"

"[COMPUTE_CONFUSION_MATRIX Procedure](#)"

"[COMPUTE_LIFT_PART Procedure](#)"

"[COMPUTE_LIFT Procedure](#)"

Syntax

```
DBMS_DATA_MINING.compute_roc_part(
    roc_area_under_curve      OUT DM_NESTED_NUMERICALS,
    apply_result_table_name   IN  VARCHAR2,
    target_table_name         IN  VARCHAR2,
    case_id_column_name       IN  VARCHAR2,
    target_column_name        IN  VARCHAR2,
    roc_table_name            IN  VARCHAR2,
    positive_target_value     IN  VARCHAR2,
    score_column_name         IN  VARCHAR2 DEFAULT 'PREDICTION',
    score_criterion_column_name IN VARCHAR2 DEFAULT 'PROBABILITY',
    score_partition_column_name IN VARCHAR2 DEFAULT 'PARTITION_NAME',
    apply_result_schema_name  IN  VARCHAR2 DEFAULT NULL,
    target_schema_name        IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 53-68 COMPUTE_ROC_PART Procedure Parameters

Parameter	Description
roc_area_under_the_curve	Output parameter containing the area under the ROC curve (AUC). The AUC measures the likelihood that an actual positive will be predicted as positive. The greater the AUC, the greater the flexibility of the model in accommodating trade-offs between positive and negative class predictions. AUC can be especially important when one target class is rarer or more important to identify than another. The output argument is changed from NUMBER to DM_NESTED_NUMERICALS.
apply_result_table_name	Table containing the predictions.
target_table_name	Table containing the known target values from the test data.
case_id_column_name	Case ID column in the apply results table. Must match the case identifier in the targets table.
target_column_name	Target column in the targets table. Contains the known target values from the test data.

Table 53-68 (Cont.) COMPUTE_ROC_PART Procedure Parameters

Parameter	Description
<code>roc_table_name</code>	Table containing the ROC output. The table will be created by the procedure in the user's schema. The columns in the ROC table are described in the Usage Notes.
<code>positive_target_value</code>	The positive class. This should be the class of interest, for which you want to calculate ROC. If the target column is a <code>NUMBER</code> , then you can use the <code>TO_CHAR()</code> operator to provide the value as a string.
<code>score_column_name</code>	Column containing the predictions in the apply results table. The default column name is <code>PREDICTION</code> , which is the default name created by the <code>APPLY</code> procedure (See " APPLY Procedure ").
<code>score_criterion_column_name</code>	Column containing the scoring criterion in the apply results table. Contains the probabilities that determine the predictions. The default column name is <code>PROBABILITY</code> , which is the default name created by the <code>APPLY</code> procedure (See " APPLY Procedure ").
<code>score_partition_column_name</code>	Optional parameter indicating the column which contains the name of the partition. This column slices the input test results such that each partition has independent evaluation matrices computed.
<code>apply_result_schema_name</code>	Schema of the apply results table. If null, then the user's schema is assumed.
<code>target_schema_name</code>	Schema of the table containing the known targets. If null, then the user's schema is assumed.

Usage Notes

- The predictive information you pass to `COMPUTE_ROC_PART` may be generated using SQL `PREDICTION` functions, the `DBMS_DATA_MINING.APPLY` procedure, or some other mechanism. As long as you pass the appropriate data, the procedure can compute the receiver operating characteristic.
- The predictions that you pass to `COMPUTE_ROC_PART` are in a table or view specified in `apply_results_table_name`.

```
CREATE TABLE apply_result_table_name AS (
    case_id_column_name          VARCHAR2,
    score_column_name           VARCHAR2,
    score_criterion_column_name VARCHAR2);
```

- The `COMPUTE_ROC_PART` table has the following columns:

Table 53-69 COMPUTE_ROC_PART Output

Column	Data Type
<code>probability</code>	<code>BINARY_DOUBLE</code>

Table 53-69 (Cont.) COMPUTE_ROC_PART Output

Column	Data Type
true_positives	NUMBER
false_negatives	NUMBER
false_positives	NUMBER
true_negatives	NUMBER
true_positive_fraction	NUMBER
false_positive_fraction	NUMBER

 **See Also:**

Oracle Machine Learning for SQL Concepts for details about the output of COMPUTE_ROC_PART

- ROC is typically used to determine the most desirable probability threshold. This can be done by examining the true positive fraction and the false positive fraction. The true positive fraction is the percentage of all positive cases in the test data that were correctly predicted as positive. The false positive fraction is the percentage of all negative cases in the test data that were incorrectly predicted as positive.

Given a probability threshold, the following statement returns the positive predictions in an apply result table ordered by probability.

```
SELECT case_id_column_name
       FROM apply_result_table_name
       WHERE probability > probability_threshold
       ORDER BY probability DESC;
```

- There are two approaches to identify the most desirable probability threshold. The approach you use depends on whether you know the relative cost of positive versus negative class prediction errors.

If the costs are known, then you can apply the relative costs to the ROC table to compute the minimum cost probability threshold. Suppose the relative cost ratio is: Positive Class Error Cost / Negative Class Error Cost = 20. Then execute a query as follows:

```
WITH cost AS (
  SELECT probability_threshold, 20 * false_negatives + false_positives cost
  FROM ROC_table
  GROUP BY probability_threshold),
  minCost AS (
  SELECT min(cost) minCost
  FROM cost)
SELECT max(probability_threshold) probability_threshold
FROM cost, minCost
WHERE cost = minCost;
```

If relative costs are not well known, then you can simply scan the values in the ROC table (in sorted order) and make a determination about which of the displayed trade-offs (misclassified positives versus misclassified negatives) is most desirable.

```
SELECT * FROM ROC_table
ORDER BY probability_threshold;
```

Examples

This example uses the Naive Bayes model `nb_sh_clas_sample`.

The following statement applies the model to the test data and stores the predictions and probabilities in a table.

```
CREATE TABLE nb_apply_results AS
SELECT cust_id, t.prediction, t.probability
FROM mining_data_test_v, TABLE(PREDICTION_SET(nb_sh_clas_sample USING *)) t;
```

Using the predictions and the target values from the test data, you can compute ROC as follows.

```
DECLARE
    v_area_under_curve NUMBER;
BEGIN
    DBMS_DATA_MINING.COMPUTE_ROC_PART (
        roc_area_under_curve => v_area_under_curve,
        apply_result_table_name => 'nb_apply_results',
        target_table_name => 'mining_data_test_v',
        case_id_column_name => 'cust_id',
        target_column_name => 'affinity_card',
        roc_table_name => 'nb_roc',
        positive_target_value => '1',
        score_column_name => 'PREDICTION',
        score_criterion_column_name => 'PROBABILITY');
    DBMS_OUTPUT.PUT_LINE('**** AREA UNDER ROC CURVE ****: ' ||
        ROUND(v_area_under_curve,4));
END;
/
```

The resulting AUC and a selection of columns from the ROC table are shown as follows.

```
**** AREA UNDER ROC CURVE ****: .8212

SELECT PROBABILITY, TRUE_POSITIVE_FRACTION, FALSE_POSITIVE_FRACTION
FROM NB_ROC;
```

PROBABILITY	TRUE_POSITIVE_FRACTION	FALSE_POSITIVE_FRACTION
.00000	1	1
.50018	.826589595	.227902946
.53851	.823699422	.221837088
.54991	.820809249	.217504333
.55628	.815028902	.215771231
.55628	.817919075	.215771231
.57563	.800578035	.214904679
.57563	.812138728	.214904679
.	.	.
.	.	.
.	.	.

53.8.11 CREATE_MODEL Procedure

This procedure creates an Oracle Machine Learning for SQL model with a given machine learning function.

Syntax

```
DBMS_DATA_MINING.CREATE_MODEL (
    model_name           IN VARCHAR2,
    mining_function      IN VARCHAR2,
    data_table_name      IN VARCHAR2,
    case_id_column_name  IN VARCHAR2,
    target_column_name   IN VARCHAR2 DEFAULT NULL,
    settings_table_name  IN VARCHAR2 DEFAULT NULL,
    data_schema_name     IN VARCHAR2 DEFAULT NULL,
    settings_schema_name IN VARCHAR2 DEFAULT NULL,
    xform_list           IN TRANSFORM_LIST DEFAULT NULL);
```

Parameters

Table 53-70 CREATE_MODEL Procedure Parameters

Parameter	Description
model_name	Name of the model in the form [<i>schema_name</i> .] <i>model_name</i> . If you do not specify a schema, then your own schema is used. See the Usage Notes for model naming restrictions.
mining_function	The machine learning function. Values are listed in Table 53-3 .
data_table_name	Table or view containing the build data
case_id_column_name	Case identifier column in the build data.
target_column_name	For supervised models, the target column in the build data. NULL for unsupervised models.
settings_table_name	Table containing build settings for the model. NULL if there is no settings table (only default settings are used).
data_schema_name	Schema hosting the build data. If NULL, then the user's schema is assumed.
settings_schema_name	Schema hosting the settings table. If NULL then the user's schema is assumed.

Table 53-70 (Cont.) CREATE_MODEL Procedure Parameters

Parameter	Description
xform_list	<p>A list of transformations to be used in addition to or instead of automatic transformations, depending on the value of the <code>PREP_AUTO</code> setting. (See "Automatic Data Preparation".)</p> <p>The datatype of <code>xform_list</code> is <code>TRANSFORM_LIST</code>, which consists of records of type <code>TRANSFORM_REC</code>. Each <code>TRANSFORM_REC</code> specifies the transformation information for a single attribute.</p> <pre> TYPE TRANSFORM_REC IS RECORD (attribute_name VARCHAR2(4000), attribute_subname VARCHAR2(4000), expression EXPRESSION_REC, reverse_expression EXPRESSION_REC, attribute_spec VARCHAR2(4000)); </pre> <p>The <code>expression</code> field stores a SQL expression for transforming the attribute. The <code>reverse_expression</code> field stores a SQL expression for reversing the transformation in model details and, if the attribute is a target, in the results of scoring. The SQL expressions are manipulated by routines in the <code>DBMS_DATA_MINING_TRANSFORM</code> package:</p> <ul style="list-style-type: none"> • SET_EXPRESSION Procedure • GET_EXPRESSION Function • SET_TRANSFORM Procedure <p>The <code>attribute_spec</code> field identifies individualized treatment for the attribute. See the Usage Notes for details.</p> <p>See Table 54-1 for details about the <code>TRANSFORM_REC</code> type.</p>

Usage Notes

1. You can use the `attribute_spec` field of the `xform_list` argument to identify an attribute as unstructured text or to disable Automatic Data Preparation for the attribute. The `attribute_spec` can have the following values:

- **TEXT:** Indicates that the attribute contains unstructured text. The `TEXT` value may optionally be followed by `POLICY_NAME`, `TOKEN_TYPE`, `MAX_FEATURES`, and `MIN_DOCUMENTS` parameters.

`TOKEN_TYPE` has the following possible values: `NORMAL`, `STEM`, `THEME`, `SYNONYM`, `BIGRAM`, `STEM_BIGRAM`. `SYNONYM` may be optionally followed by a thesaurus name in square brackets.

`MAX_FEATURES` specifies the maximum number of tokens extracted from the text.

`MIN_DOCUMENTS` specifies the minimal number of documents in which every selected token shall occur. (For information about creating a text policy, see `CTX_DDL.CREATE_POLICY` in *Oracle Text Reference*).

Oracle Machine Learning for SQL can process columns of `VARCHAR2/CHAR`, `CLOB`, `BLOB`, and `BFILE` as text. If the column is `VARCHAR2` or `CHAR` and you do not specify `TEXT`, then OML4SQL processes the column as categorical data. If the column is `CLOB`, then OML4SQL processes it as text by default (You do not need to specify it as `TEXT`. However, you do need to provide an Oracle Text

Policy in the settings). If the column is BLOB or BFILE, then you must specify it as TEXT, otherwise CREATE_MODEL returns an error.

If you specify TEXT for a nested column or for an attribute in a nested column, then CREATE_MODEL returns an error.

- NOPREP: Disables ADP for the attribute. When ADP is OFF, the NOPREP value is ignored.

You can specify NOPREP for a nested column, but not for an attribute in a nested column. If you specify NOPREP for an attribute in a nested column when ADP is on, then CREATE_MODEL will return an error.

2. You can obtain information about a model by querying the Data Dictionary views.

```
ALL/USER/DBA_MINING_MODELS
ALL/USER/DBA_MINING_MODEL_ATTRIBUTES
ALL/USER/DBA_MINING_MODEL_SETTINGS
ALL/USER/DBA_MINING_MODEL_VIEWS
ALL/USER/DBA_MINING_MODEL_PARTITIONS
ALL/USER/DBA_MINING_MODEL_XFORMS
```

You can obtain information about model attributes by querying the model details through model views. Refer to *Oracle Machine Learning for SQL User's Guide*.

3. The naming rules for models are more restrictive than the naming rules for most database schema objects. A model name must satisfy the following additional requirements:

- It must be 123 or fewer characters long.
- It must be a nonquoted identifier. Oracle requires that nonquoted identifiers contain only alphanumeric characters, the underscore (_), dollar sign (\$), and pound sign (#); the initial character must be alphabetic. Oracle strongly discourages the use of the dollar sign and pound sign in nonquoted literals.

Naming requirements for schema objects are fully documented in *Oracle Database SQL Language Reference*.

4. To build a partitioned model, you must provide additional settings.

The setting for partitioning columns are as follows:

```
INSERT INTO settings_table VALUES ('ODMS_PARTITION_COLUMNS', 'GENDER,
AGE');
```

To set user-defined partition number for a model, the setting is as follows:

```
INSERT INTO settings_table VALUES ('ODMS_MAX_PARTITIONS', '10');
```

The default value for maximum number of partitions is 1000.

5. By passing an xform_list to CREATE_MODEL, you can specify a list of transformations to be performed on the input data. If the PREP_AUTO setting is ON, the transformations are used in addition to the automatic transformations. If the PREP_AUTO setting is OFF, the specified transformations are the only ones implemented by the model. In both cases, transformation definitions are embedded in the model and run automatically whenever the model is applied. See "[Automatic Data Preparation](#)". Other transforms that can be

specified with `xform_list` include `FORCE_IN`. Refer to *Oracle Machine Learning for SQL User's Guide*.

Examples

The first example builds a classification model using the Support Vector Machine algorithm.

```
-- Create the settings table
CREATE TABLE svm_model_settings (
  setting_name VARCHAR2(30),
  setting_value VARCHAR2(30));

-- Populate the settings table
-- Specify SVM. By default, Naive Bayes is used for classification.
-- Specify ADP. By default, ADP is not used.
BEGIN
  INSERT INTO svm_model_settings (setting_name, setting_value) VALUES
    (dbms_data_mining.algo_name, dbms_data_mining.algo_support_vector_machines);
  INSERT INTO svm_model_settings (setting_name, setting_value) VALUES
    (dbms_data_mining.prep_auto, dbms_data_mining.prep_auto_on);
  COMMIT;
END;
/

-- Create the model using the specified settings
BEGIN
  DBMS_DATA_MINING.CREATE_MODEL(
    model_name          => 'svm_model',
    mining_function     => dbms_data_mining.classification,
    data_table_name    => 'mining_data_build_v',
    case_id_column_name => 'cust_id',
    target_column_name => 'affinity_card',
    settings_table_name => 'svm_model_settings');
END;
/
```

You can display the model settings with the following query:

```
SELECT * FROM user_mining_model_settings
       WHERE model_name IN 'SVM_MODEL';
```

MODEL_NAME	SETTING_NAME	SETTING_VALUE	SETTING
SVM_MODEL	ALGO_NAME	ALGO_SUPPORT_VECTOR_MACHINES	INPUT
SVM_MODEL	SVMS_STD_DEV	3.004524	DEFAULT
SVM_MODEL	PREP_AUTO	ON	INPUT
SVM_MODEL	SVMS_COMPLEXITY_FACTOR	1.887389	DEFAULT
SVM_MODEL	SVMS_KERNEL_FUNCTION	SVMS_LINEAR	DEFAULT
SVM_MODEL	SVMS_CONV_TOLERANCE	.001	DEFAULT

The following is an example of querying a model view instead of the older `GEL_MODEL_DETAILS_SVM` routine.

```
SELECT target_value, attribute_name, attribute_value, coefficient
       FROM DM$VLSVM_MODEL;
```

The second example creates an anomaly detection model. Anomaly detection uses SVM classification without a target. This example uses the same settings table created for the SVM classification model in the first example.

```
BEGIN
  DBMS_DATA_MINING.CREATE_MODEL(
    model_name          => 'anomaly_detect_model',
    mining_function     => dbms_data_mining.classification,
    data_table_name     => 'mining_data_build_v',
    case_id_column_name => 'cust_id',
    target_column_name  => null,
    settings_table_name => 'svm_model_settings');
END;
/
```

This query shows that the models created in these examples are the only ones in your schema.

```
SELECT model_name, mining_function, algorithm FROM user_mining_models;
```

MODEL_NAME	MINING_FUNCTION	ALGORITHM
SVM_MODEL	CLASSIFICATION	SUPPORT_VECTOR_MACHINES
ANOMALY_DETECT_MODEL	CLASSIFICATION	SUPPORT_VECTOR_MACHINES

This query shows that only the SVM classification model has a target.

```
SELECT model_name, attribute_name, attribute_type, target
       FROM user_mining_model_attributes
       WHERE target = 'YES';
```

MODEL_NAME	ATTRIBUTE_NAME	ATTRIBUTE_TYPE	TARGET
SVM_MODEL	AFFINITY_CARD	CATEGORICAL	YES

53.8.12 CREATE_MODEL2 Procedure

The `CREATE_MODEL2` procedure is an alternate procedure to the `CREATE_MODEL` procedure, which enables creating a model without extra persistence stages. In the `CREATE_MODEL` procedure, the input is a table or a view and if such an object is not already present, the user must create it. By using the `CREATE_MODEL2` procedure, the user does not need to create such transient database objects.

Syntax

```
DBMS_DATA_MINING.CREATE_MODEL2 (
  model_name          IN VARCHAR2,
  mining_function     IN VARCHAR2,
  data_query          IN CLOB,
  set_list            IN SETTING_LIST,
  case_id_column_name IN VARCHAR2 DEFAULT NULL,
  target_column_name  IN VARCHAR2 DEFAULT NULL,
  xform_list          IN TRANSFORM_LIST DEFAULT NULL);
```

Parameters

Table 53-71 CREATE_MODEL2 Procedure Parameters

Parameter	Description
model_name	Name of the model in the form [schema_name.]model_name. If you do not specify a schema, then the current schema is used. See the Usage Notes, CREATE_MODEL Procedure for model naming restrictions.
mining_function	The machine learning function. Values are listed in DBMS_DATA_MINING — Machine Learning Function Settings .
data_query	A query which provides training data for building the model.
set_list	Specifies the SETTING_LIST SETTING_LIST is a table of CLOB index by VARCHAR2(30); Where the index is the setting name and the CLOB is the setting value for that name.
case_id_column_name	Case identifier column in the build data.
target_column_name	For supervised models, the target column in the build data. NULL for unsupervised models.
xform_list	Refer to CREATE_MODEL Procedure .

Usage Notes

Refer to [CREATE_MODEL Procedure](#) for Usage Notes.

Examples

The following example uses the Support Vector Machine algorithm.

```

declare
  v_setlst DBMS_DATA_MINING.SETTING_LIST;

BEGIN
  v_setlst(dbms_data_mining.algo_name) :=
dbms_data_mining.algo_support_vector_machines;
  v_setlst(dbms_data_mining.prep_auto) :=
dbms_data_mining.prep_auto_on;

DBMS_DATA_MINING.CREATE_MODEL2(
  model_name          => 'svm_model',
  mining_function     => dbms_data_mining.classification,
  data_query          => 'select * from mining_data_build_v',
  data_table_name     => 'mining_data_build_v',
  case_id_column_name=> 'cust_id',
  target_column_name => 'affinity_card',
  set_list            => v_setlst,
  case_id_column_name=> 'cust_id',
  target_column_name => 'affinity_card');
END;
/

```

53.8.13 Create Model Using Registration Information

Create model function fetches the setting information from JSON object.

Usage Notes

If an algorithm is registered, user can create model using the registered algorithm name. Since all R scripts and default setting values are already registered, providing the value through the setting table is not necessary. This makes the use of this algorithm easier.

Examples

The first example builds a Classification model using the GLM algorithm.

```
CREATE TABLE GLM_RDEMO_SETTINGS_CL (

    setting_name  VARCHAR2(30),
    setting_value VARCHAR2(4000));
BEGIN
    INSERT INTO GLM_RDEMO_SETTINGS_CL VALUES
        ('ALGO_EXTENSIBLE_LANG', 'R');
    INSERT INTO GLM_RDEMO_SETTINGS_CL VALUES
        (dbms_data_mining.ralg_registration_algo_name, 't1');
    INSERT INTO GLM_RDEMO_SETTINGS_CL VALUES
        (dbms_data_mining.odms_formula,
        'AGE + EDUCATION + HOUSEHOLD_SIZE + OCCUPATION');
    INSERT INTO GLM_RDEMO_SETTINGS_CL VALUES
        ('RALG_PARAMETER_FAMILY', 'binomial(logit) ');
END;
/
BEGIN
    DBMS_DATA_MINING.CREATE_MODEL(
        model_name          => 'GLM_RDEMO_CLASSIFICATION',
        mining_function     => dbms_data_mining.classification,
        data_table_name     => 'mining_data_build_v',
        case_id_column_name => 'CUST_ID',
        target_column_name  => 'AFFINITY_CARD',
        settings_table_name => 'GLM_RDEMO_SETTINGS_CL');
END;
/
```

53.8.14 DROP_ALGORITHM Procedure

This function is used to drop the registered algorithm information.

Syntax

```
DBMS_DATA_MINING.DROP_ALGORITHM (algorithm_name IN VARCHAR2(30),
                                cascade         IN BOOLEAN default FALSE)
```

Parameters

Table 53-72 DROP_ALGORITHM Procedure Parameters

Parameter	Description
algorithm_name	Name of the algorithm.
cascade	If the cascade option is <code>TRUE</code> , all the models with this algorithms are forced to drop. There after, the algorithm is dropped. The default value is <code>FALSE</code> .

Usage Note

- To drop a machine learning model, you must be the owner or you must have the `RQADMIN` privilege. See *Oracle Machine Learning for SQL User's Guide* for information about privileges for machine learning.
- Make sure a model is not built on the algorithm, then drop the algorithm from the system table.
- If you try to drop an algorithm with a model built on it, then an error is displayed.

53.8.15 DROP_PARTITION Procedure

Syntax

```
DBMS_DATA_MINING.DROP_PARTITION (
    model_name          IN VARCHAR2,
    partition_name      IN VARCHAR2);
```

Parameters

Table 53-73 DROP_PARTITION Procedure Parameters

Parameters	Description
model_name	Name of the machine learning model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is used.
partition_name	Name of the partition that must be dropped.

53.8.16 DROP_MODEL Procedure

This procedure deletes the specified machine learning model.

Syntax

```
DBMS_DATA_MINING.DROP_MODEL (model_name IN VARCHAR2,
                             force       IN BOOLEAN DEFAULT FALSE);
```


Parameters

Table 53-74 DROP_MODEL Procedure Parameters

Parameter	Description
model_name	Name of the machine learning model in the form [schema_name.]model_name. If you do not specify a schema, then your own schema is used.
force	Forces the machine learning model to be dropped even if it is invalid. A machine learning model may be invalid if a serious system error interrupted the model build process.

Usage Note

To drop a machine learning model, you must be the owner or you must have the `DROP ANY MINING MODEL` privilege. See *Oracle Data Mining User's Guide* for information about privileges for Oracle Machine Learning for SQL.

Example

You can use the following command to delete a valid machine learning model named `nb_sh_clas_sample` that exists in your schema.

```
BEGIN
  DBMS_DATA_MINING.DROP_MODEL(model_name => 'nb_sh_clas_sample');
END;
/
```

53.8.17 EXPORT_MODEL Procedure

This procedure exports the specified machine learning models to a dump file set.

To import the models from the dump file set, use the [IMPORT_MODEL Procedure](#). `EXPORT_MODEL` and `IMPORT_MODEL` use Oracle Data Pump technology.

When Oracle Data Pump is used to export/import an entire schema or database, the machine learning models in the schema or database are included. However, `EXPORT_MODEL` and `IMPORT_MODEL` are the only utilities that support the export/import of individual models.



See Also:

Oracle Database Utilities for information about Oracle Data Pump

Oracle Machine Learning for SQL User's Guide for more information about exporting and importing machine learning models

Syntax

```
DBMS_DATA_MINING.EXPORT_MODEL (
  filename          IN VARCHAR2,
  directory         IN VARCHAR2,
  model_filter      IN VARCHAR2 DEFAULT NULL,
  filesize          IN VARCHAR2 DEFAULT NULL,
  operation         IN VARCHAR2 DEFAULT NULL,
```

```
remote_link      IN VARCHAR2 DEFAULT NULL,
jobname         IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 53-75 EXPORT_MODEL Procedure Parameters

Parameter	Description
filename	<p>Name of the dump file set to which the models should be exported. The name must be unique within the schema.</p> <p>The dump file set can contain one or more files. The number of files in a dump file set is determined by the size of the models being exported (both metadata and data) and a specified or estimated maximum file size. You can specify the file size in the <code>filesize</code> parameter, or you can use the <code>operation</code> parameter to cause Oracle Data Pump to estimate the file size. If the size of the models to export is greater than the maximum file size, one or more additional files are created.</p> <p>When the export operation completes successfully, the name of the dump file set is automatically expanded to <code>filename01.dmp</code>, even if there is only one file in the dump set. If there are additional files, they are named sequentially as <code>filename02.dmp</code>, <code>filename03.dmp</code>, and so forth.</p>
directory	<p>Name of a pre-defined directory object that specifies where the dump file set should be created.</p> <p>The exporting user must have read/write privileges on the directory object and on the file system directory that it identifies.</p> <p>See <i>Oracle Database SQL Language Reference</i> for information about directory objects.</p>
model_filter	<p>Optional parameter that specifies which model or models to export. If you do not specify a value for <code>model_filter</code>, all models in the schema are exported. You can also specify <code>NULL</code> (the default) or <code>'ALL'</code> to export all models.</p> <p>You can export individual models by name and groups of models based on machine learning function or algorithm. For instance, you could export all regression models or all Naive Bayes models. Examples are provided in Table 53-76.</p>
filesize	<p>Optional parameter that specifies the maximum size of a file in the dump file set. The size may be specified in bytes, kilobytes (K), megabytes (M), or gigabytes (G). The default size is 50 MB.</p> <p>If the size of the models to export is larger than <code>filesize</code>, one or more additional files are created within the dump set. See the description of the <code>filename</code> parameter for more information.</p>
operation	<p>Optional parameter that specifies whether or not to estimate the size of the files in the dump set. By default the size is not estimated and the value of the <code>filesize</code> parameter determines the size of the files.</p> <p>You can specify either of the following values for <code>operation</code>:</p> <ul style="list-style-type: none"> • <code>'EXPORT'</code> — Export all or the specified models. (Default) • <code>'ESTIMATE'</code> — Estimate the size of the exporting models.

Table 53-75 (Cont.) EXPORT_MODEL Procedure Parameters

Parameter	Description
<code>remote_link</code>	Optional parameter that specifies the name of a database link to a remote system. The default value is <code>NULL</code> . A database link is a schema object in a local database that enables access to objects in a remote database. When you specify a value for <code>remote_link</code> , you can export the models in the remote database. The <code>EXP_FULL_DATABASE</code> role is required for exporting the remote models. The <code>EXP_FULL_DATABASE</code> privilege, the <code>CREATE DATABASE LINK</code> privilege, and other privileges may also be required.
<code>jobname</code>	Optional parameter that specifies the name of the export job. By default, the name has the form <code>username_exp_nnnn</code> , where <code>nnnn</code> is a number. For example, a job name in the <code>SCOTT</code> schema might be <code>SCOTT_exp_134</code> . If you specify a job name, it must be unique within the schema. The maximum length of the job name is 30 characters. A log file for the export job, named <code>jobname.log</code> , is created in the same directory as the dump file set.

Usage Notes

The `model_filter` parameter specifies which models to export. You can list the models by name, or you can specify all models that have the same machine learning function or algorithm. You can query the `USER_MINING_MODELS` view to list the models in your schema.

```
SQL> describe user_mining_models
Name                                         Null?    Type
-----
MODEL_NAME                                 NOT NULL VARCHAR2(30)
MINING_FUNCTION                             VARCHAR2(30)
ALGORITHM                                   VARCHAR2(30)
CREATION_DATE                               NOT NULL DATE
BUILD_DURATION                               NUMBER
MODEL_SIZE                                  NUMBER
COMMENTS                                    VARCHAR2(4000)
```

Examples of model filters are provided in [Table 53-76](#).

Table 53-76 Sample Values for the Model Filter Parameter

Sample Value	Meaning
<code>'mymodel'</code>	Export the model named <code>mymodel</code>
<code>'name= 'mymodel'''</code>	Export the model named <code>mymodel</code>
<code>'name IN ('mymodel2','mymodel3')'</code>	Export the models named <code>mymodel2</code> and <code>mymodel3</code>
<code>'ALGORITHM_NAME = 'NAIVE_BAYES'''</code>	Export all Naive Bayes models. See Table 53-5 for a list of algorithm names.
<code>'FUNCTION_NAME ='CLASSIFICATION'''</code>	Export all classification models. See Table 53-3 for a list of machine learning functions.

Examples

1. The following statement exports all the models in the `oml_user3` schema to a dump file set called `models_out` in the directory `$ORACLE_HOME/rdbms/log`. This directory is mapped to a directory object called `DATA_PUMP_DIR`. The `oml_user3` user has read/write access to the directory and to the directory object.

```
SQL>execute dbms_data_mining.export_model ('models_out', 'DATA_PUMP_DIR');
```

You can exit SQL*Plus and list the resulting dump file and log file.

```
SQL>EXIT
>cd $ORACLE_HOME/rdbms/log
>ls
>oml_user3_exp_1027.log  models_out01.dmp
```

2. The following example uses the same directory object and is run by the same user. This example exports the models called `NMF_SH_SAMPLE` and `SVMR_SH_REGR_SAMPLE` to a different dump file set in the same directory.

```
SQL>EXECUTE DBMS_DATA_MINING.EXPORT_MODEL ( 'models2_out', 'DATA_PUMP_DIR',
      'name in (''NMF_SH_SAMPLE'', ''SVMR_SH_REGR_SAMPLE'')');
```

```
SQL>EXIT
>cd $ORACLE_HOME/rdbms/log
>ls
>oml_user3_exp_1027.log  models_out01.dmp
  oml_user3_exp_924.log  models2_out01.dmp
```

3. The following examples show how to export models with specific algorithm and machine learning function names.

```
SQL>EXECUTE DBMS_DATA_MINING.EXPORT_MODEL('algo.dmp', 'DM_DUMP',
      'ALGORITHM_NAME IN (''O_CLUSTER'', ''GENERALIZED_LINEAR_MODEL'',
      ''SUPPORT_VECTOR_MACHINES'', ''NAIVE_BAYES'')');
```

```
SQL>EXECUTE DBMS_DATA_MINING.EXPORT_MODEL('func.dmp', 'DM_DUMP',
      'FUNCTION_NAME IN (CLASSIFICATION,CLUSTERING,FEATURE_EXTRACTION)');
```

53.8.18 EXPORT_SERMODEL Procedure

This procedure exports the model in a serialized format so that they can be moved to another platform for scoring.

When exporting a model in serialized format, the user must pass in an empty `BLOB` locator and specify the model name to be exported. If the model is partitioned, the user can optionally select an individual partition to export, otherwise all partitions are exported. The returned `BLOB` contains the content that can be deployed.

Syntax

```
DBMS_DATA_MINING.EXPORT_SERMODEL (
  model_data      IN OUT NOCOPY BLOB,
  model_name     IN VARCHAR2,
  partition_name IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 53-77 EXPORT_SERMODEL Procedure Parameters

Parameter	Description
model_data	Provides serialized model data.
model_name	Name of the machine learning model in the form [schema_name.]model_name. If you do not specify a schema, then your own schema is used.
partition_name	Name of the partition that must be exported.

Examples

The following statement exports all of the models in a serialized format.

```

DECLARE
  v_blob blob;
BEGIN
  dbms_lob.createtemporary(v_blob, FALSE);
  dbms_data_mining.export_sermodel(v_blob, 'MY_MODEL');
  -- save v_blob somewhere (e.g., bfile, etc.)
  dbms_lob.freetemporary(v_blob);
END;
/

```

See Also:

Oracle Machine Learning for SQL User's Guide for more information about exporting and importing machine learning models

53.8.19 FETCH_JSON_SCHEMA Procedure

User can fetch and read JSON schema from the ALL_MINING_ALGORITHMS view. This function returns the pre-registered JSON schema for R extensible algorithms.

Syntax

```
DBMS_DATA_MINING.FETCH_JSON_SCHEMA RETURN CLOB;
```

Parameters

Table 53-78 FETCH_JSON_SCHEMA Procedure Parameters

Parameter	Description
RETURN	This function returns the pre-registered JSON schema for R extensibility. The default value is CLOB.

Usage Note

If a user wants to register a new algorithm using the algorithm registration function, they must fetch and follow the pre-registered JSON schema using this function, when they create the required JSON object metadata, and then pass it to the registration function.

53.8.20 GET_ASSOCIATION_RULES Function

The `GET_ASSOCIATION_RULES` function returns the rules produced by an association model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

You can specify filtering criteria to `GET_ASSOCIATION_RULES` to return a subset of the rules. Filtering criteria can improve the performance of the table function. If the number of rules is large, then the greatest performance improvement will result from specifying the `topn` parameter.

Syntax

```
DBMS_DATA_MINING.get_association_rules(
    model_name      IN VARCHAR2,
    topn            IN NUMBER DEFAULT NULL,
    rule_id         IN INTEGER DEFAULT NULL,
    min_confidence  IN NUMBER DEFAULT NULL,
    min_support     IN NUMBER DEFAULT NULL,
    max_rule_length IN INTEGER DEFAULT NULL,
    min_rule_length IN INTEGER DEFAULT NULL,
    sort_order      IN ORA_MINING_VARCHAR2_NT DEFAULT NULL,
    antecedent_items IN DM_ITEMS DEFAULT NULL,
    consequent_items IN DM_ITEMS DEFAULT NULL,
    min_lift        IN NUMBER DEFAULT NULL,
    partition_name  IN VARCHAR2 DEFAULT NULL)
RETURN DM_Rules PIPELINED;
```

Parameters

Table 53-79 GET_ASSOCIATION_RULES Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is used. This is the only required parameter of <code>GET_ASSOCIATION_RULES</code> . All other parameters specify optional filters on the rules to return.
<code>topn</code>	Returns the <i>n</i> top rules ordered by confidence and then support, both descending. If you specify a sort order, then the top <i>n</i> rules are derived after the sort is performed. If <code>topn</code> is specified and no maximum or minimum rule length is specified, then the only columns allowed in the sort order are <code>RULE_CONFIDENCE</code> and <code>RULE_SUPPORT</code> . If <code>topn</code> is specified and a maximum or minimum rule length is specified, then <code>RULE_CONFIDENCE</code> , <code>RULE_SUPPORT</code> , and <code>NUMBER_OF_ITEMS</code> are allowed in the sort order.

Table 53-79 (Cont.) GET_ASSOCIATION_RULES Function Parameters

Parameter	Description
<code>rule_id</code>	Identifier of the rule to return. If you specify a value for <code>rule_id</code> , do not specify values for the other filtering parameters.
<code>min_confidence</code>	Returns the rules with confidence greater than or equal to this number.
<code>min_support</code>	Returns the rules with support greater than or equal to this number.
<code>max_rule_length</code>	Returns the rules with a length less than or equal to this number. Rule length refers to the number of items in the rule (See <code>NUMBER_OF_ITEMS</code> in Table 53-80). For example, in the rule <code>A=>B</code> (if A, then B), the number of items is 2. If <code>max_rule_length</code> is specified, then the <code>NUMBER_OF_ITEMS</code> column is permitted in the sort order.
<code>min_rule_length</code>	Returns the rules with a length greater than or equal to this number. See <code>max_rule_length</code> for a description of rule length. If <code>min_rule_length</code> is specified, then the <code>NUMBER_OF_ITEMS</code> column is permitted in the sort order.
<code>sort_order</code>	Sorts the rules by the values in one or more of the returned columns. Specify one or more column names, each followed by <code>ASC</code> for ascending order or <code>DESC</code> for descending order. (See Table 53-80 for the column names.) For example, to sort the result set in descending order first by the <code>NUMBER_OF_ITEMS</code> column, then by the <code>RULE_CONFIDENCE</code> column, you must specify: <pre>ORA_MINING_VARCHAR2_NT('NUMBER_OF_ITEMS DESC', 'RULE_CONFIDENCE DESC')</pre> If you specify <code>topn</code> , the results will vary depending on the sort order. By default, the results are sorted by Confidence in descending order, then by Support in descending order.
<code>antecedent_items</code>	Returns the rules with these items in the antecedent.
<code>consequent_items</code>	Returns the rules with this item in the consequent.
<code>min_lift</code>	Returns the rules with lift greater than or equal to this number.
<code>partition_name</code>	Specifies a partition in a partitioned model.

Return Values

The object type returned by `GET_ASSOCIATION_RULES` is described in [Table 53-80](#). For descriptions of each field, see the Usage Notes.

Table 53-80 GET_ASSOCIATION RULES Function Return Values

Return Value	Description
DM_RULES	<p>A set of rows of type DM_RULE. The rows have the following columns:</p> <pre>(rule_id INTEGER, antecedent DM_PREDICATES, consequent DM_PREDICATES, rule_support NUMBER, rule_confidence NUMBER, rule_lift NUMBER, antecedent_support NUMBER, consequent_support NUMBER, number_of_items INTEGER)</pre>
DM_PREDICATE S	<p>The antecedent and consequent columns each return nested tables of type DM_PREDICATES. The rows, of type DM_PREDICATE, have the following columns:</p> <pre>(attribute_name VARCHAR2 (4000) , attribute_subname VARCHAR2 (4000) , conditional_operator CHAR (2) /*=, <>, <, >, <=, >=*/, attribute_num_value NUMBER, attribute_str_value VARCHAR2 (4000) , attribute_support NUMBER, attribute_confidence NUMBER)</pre>

Usage Notes

1. This table function pipes out rows of type DM_RULES. For information on machine learning data types and piped output from table functions, see "Datatypes".
2. The columns returned by GET_ASSOCIATION_RULES are described as follows:

Column in DM_RULES	Description
rule_id	Unique identifier of the rule

Column in DM_RULES	Description
antecedent	<p>The independent condition in the rule. When this condition exists, the dependent condition in the consequent also exists.</p> <p>The condition is a combination of attribute values called a predicate (DM_PREDICATE). The predicate specifies a condition for each attribute. The condition may specify equality (=), inequality (<>), greater than (>), less than (<), greater than or equal to (>=), or less than or equal to (<=) a given value.</p> <p>Support and Confidence for each attribute condition in the antecedent is returned in the predicate. Support is the number of transactions that satisfy the antecedent. Confidence is the likelihood that a transaction will satisfy the antecedent.</p> <p>Note: The occurrence of the attribute as a DM_PREDICATE indicates the presence of the item in the transaction. The actual value for attribute_num_value or attribute_str_value is meaningless. For example, the following predicate indicates that 'Mouse Pad' is present in the transaction <i>even though</i> the attribute value is NULL.</p> <pre>DM_PREDICATE('PROD_NAME', 'Mouse Pad', '= ', NULL, NULL, NULL, NULL)</pre>
consequent	<p>The dependent condition in the rule. This condition exists when the antecedent exists.</p> <p>The consequent, like the antecedent, is a predicate (DM_PREDICATE).</p> <p>Support and confidence for each attribute condition in the consequent is returned in the predicate. Support is the number of transactions that satisfy the consequent. Confidence is the likelihood that a transaction will satisfy the consequent.</p>
rule_support	The number of transactions that satisfy the rule.
rule_confidence	The likelihood of a transaction satisfying the rule.
rule_lift	The degree of improvement in the prediction over random chance when the rule is satisfied.
antecedent_support	The ratio of the number of transactions that satisfy the antecedent to the total number of transactions.
consequent_support	The ratio of the number of transactions that satisfy the consequent to the total number of transactions.
number_of_items	The total number of attributes referenced in the antecedent and consequent of the rule.

Examples

The following example demonstrates an association model build followed by several invocations of the GET_ASSOCIATION_RULES table function:

```
-- prepare a settings table to override default settings
CREATE TABLE market_settings AS
SELECT *
  FROM TABLE(DBMS_DATA_MINING.GET_DEFAULT_SETTINGS)
 WHERE setting_name LIKE 'ASSO_%';
BEGIN
-- update the value of the minimum confidence
```

```

UPDATE market_settings
  SET setting_value = TO_CHAR(0.081)
  WHERE setting_name = DBMS_DATA_MINING.asso_min_confidence;

-- build an AR model
DBMS_DATA_MINING.CREATE_MODEL(
  model_name => 'market_model',
  function => DBMS_DATA_MINING.ASSOCIATION,
  data_table_name => 'market_build',
  case_id_column_name => 'item_id',
  target_column_name => NULL,
  settings_table_name => 'market_settings');
END;
/
-- View the (unformatted) rules
SELECT rule_id, antecedent, consequent, rule_support,
       rule_confidence
  FROM TABLE(DBMS_DATA_MINING.GET_ASSOCIATION_RULES('market_model'));

```

In the previous example, you view all rules. To view just the top 20 rules, use the following statement.

```

-- View the top 20 (unformatted) rules
SELECT rule_id, antecedent, consequent, rule_support,
       rule_confidence
  FROM TABLE(DBMS_DATA_MINING.GET_ASSOCIATION_RULES('market_model', 20));

```

The following query uses the association model AR_SH_SAMPLE.

```

SELECT * FROM TABLE (
  DBMS_DATA_MINING.GET_ASSOCIATION_RULES (
    'AR_SH_SAMPLE', 10, NULL, 0.5, 0.01, 2, 1,
    ORA_MINING_VARCHAR2_NT (
      'NUMBER_OF_ITEMS DESC', 'RULE_CONFIDENCE DESC', 'RULE_SUPPORT DESC'),
    DM_ITEMS(DM_ITEM('CUSTPRODS', 'Mouse Pad', 1, NULL),
              DM_ITEM('CUSTPRODS', 'Standard Mouse', 1, NULL)),
    DM_ITEMS(DM_ITEM('CUSTPRODS', 'Extension Cable', 1, NULL))););

```

The query returns three rules, shown as follows:

```

13  DM_PREDICATES(
      DM_PREDICATE('CUSTPRODS', 'Mouse Pad', '= ', 1, NULL, NULL, NULL),
      DM_PREDICATE('CUSTPRODS', 'Standard Mouse', '= ', 1, NULL, NULL, NULL))
  DM_PREDICATES(
      DM_PREDICATE('CUSTPRODS', 'Extension Cable', '= ', 1, NULL, NULL, NULL))
  .15532      .84393  2.7075      .18404      .3117  2

11  DM_PREDICATES(
      DM_PREDICATE('CUSTPRODS', 'Standard Mouse', '= ', 1, NULL, NULL, NULL))
  DM_PREDICATES(
      DM_PREDICATE('CUSTPRODS', 'Extension Cable', '= ', 1, NULL, NULL, NULL))
  .18085      .56291  1.8059      .32128      .3117  1

9   DM_PREDICATES(
      DM_PREDICATE('CUSTPRODS', 'Mouse Pad', '= ', 1, NULL, NULL, NULL))
  DM_PREDICATES(
      DM_PREDICATE('CUSTPRODS', 'Extension Cable', '= ', 1, NULL, NULL, NULL))
  .17766      .55116  1.7682      .32234      .3117  1

```

**See Also:**

Table 53-80 for the `DM_RULE` column data types.

53.8.21 GET_FREQUENT_ITEMSETS Function

The `GET_FREQUENT_ITEMSETS` function returns a set of rows that represent the frequent itemsets from an association model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead..

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

For a detailed description of frequent itemsets, consult *Oracle Machine Learning for SQL Concepts*.

Syntax

```
DBMS_DATA_MINING.get_frequent_itemsets(
    model_name IN VARCHAR2,
    topn IN NUMBER DEFAULT NULL,
    max_itemset_length IN NUMBER DEFAULT NULL,
    partition_name IN VARCHAR2 DEFAULT NULL)
RETURN DM_ItemSets PIPELINED;
```

Parameters

Table 53-81 GET_FREQUENT_ITEMSETS Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is used.
<code>topn</code>	When not NULL, return the top <i>n</i> rows ordered by support in descending order
<code>max_itemset_length</code>	Maximum length of an item set.
<code>partition_name</code>	Specifies a partition in a partitioned model.

**Note:**

The `partition_name` columns applies only when the model is partitioned.

Return Values

Table 53-82 GET_FREQUENT_ITEMSETS Function Return Values

Return Value	Description
DM_ITEMSETS	A set of rows of type DM_ITEMSET. The rows have the following columns: (partition_name VARCHAR2(128) itemsets_id NUMBER, items DM_ITEMS, support NUMBER, number_of_items NUMBER)

 **Note:**

The partition_name columns applies only when the model is partitioned.

The items column returns a nested table of type DM_ITEMS. The rows have type DM_ITEM:

```
(attribute_name      VARCHAR2(4000),
 attribute_subname   VARCHAR2(4000),
 attribute_num_value NUMBER,
 attribute_str_value VARCHAR2(4000))
```

Usage Notes

This table function pipes out rows of type DM_ITEMSETS. For information on machine learning data types and piped output from table functions, see "Data Types".

Examples

The following example demonstrates an association model build followed by an invocation of GET_FREQUENT_ITEMSETS table function from Oracle SQL.

```
-- prepare a settings table to override default settings
CREATE TABLE market_settings AS

    SELECT *

    FROM TABLE(DBMS_DATA_MINING.GET_DEFAULT_SETTINGS)
    WHERE setting_name LIKE 'ASSO_%';
BEGIN
-- update the value of the minimum confidence
UPDATE market_settings
    SET setting_value = TO_CHAR(0.081)
    WHERE setting_name = DBMS_DATA_MINING.asso_min_confidence;

/* build a AR model */
DBMS_DATA_MINING.CREATE_MODEL(
    model_name          => 'market_model',
    function             => DBMS_DATA_MINING.ASSOCIATION,
    data_table_name     => 'market_build',
    case_id_column_name => 'item_id',
```

```

    target_column_name => NULL,
    settings_table_name => 'market_settings');
END;
/

-- View the (unformatted) Itemsets from SQL*Plus
SELECT itemset_id, items, support, number_of_items
   FROM TABLE(DBMS_DATA_MINING.GET_FREQUENT_ITEMSETS('market_model'));

```

In the example above, you view all itemsets. To view just the top 20 itemsets, use the following statement:

```

-- View the top 20 (unformatted) Itemsets from SQL*Plus
SELECT itemset_id, items, support, number_of_items
   FROM TABLE(DBMS_DATA_MINING.GET_FREQUENT_ITEMSETS('market_model', 20));

```

53.8.22 GET_MODEL_COST_MATRIX Function

The `GET_*` interfaces are replaced by model views, and Oracle recommends that users leverage the views instead.

The `GET_MODEL_COST_MATRIX` function is replaced by the `DM$VC` prefixed view, Scoring Cost Matrix. The cost matrix used when building a Decision Tree is made available by the `DM$VM` prefixed view, Decision Tree build cost matrix.

Refer to Model Detail View for Classification Algorithm.

The `GET_MODEL_COST_MATRIX` function returns the rows of a cost matrix associated with the specified model.

By default, this function returns the scoring cost matrix that was added to the model with the `ADD_COST_MATRIX` procedure. If you wish to obtain the cost matrix used to create a model, specify `cost_matrix_type_create` as the `matrix_type`. See [Table 53-83](#).

See also [ADD_COST_MATRIX Procedure](#).

Syntax

```

DBMS_DATA_MINING.GET_MODEL_COST_MATRIX (
    model_name           IN VARCHAR2,
    matrix_type          IN VARCHAR2 DEFAULT cost_matrix_type_score)
    partition_name      IN VARCHAR2 DEFAULT NULL);
RETURN DM_COST_MATRIX PIPELINED;

```

Parameters

Table 53-83 GET_MODEL_COST_MATRIX Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is used.
<code>matrix_type</code>	The type of cost matrix. <code>COST_MATRIX_TYPE_SCORE</code> — cost matrix used for scoring. (Default.) <code>COST_MATRIX_TYPE_CREATE</code> — cost matrix used to create the model (Decision Tree only).
<code>partition_name</code>	Name of the partition in a partitioned model

Return Values

Table 53-84 GET_MODEL_COST_MATRIX Function Return Values

Return Value	Description				
DM_COST_MATRIX	A set of rows of type DM_COST_ELEMENT. The rows have the following columns: <table> <tr> <td>actual</td> <td>VARCHAR2(4000), NUMBER,</td> </tr> <tr> <td>predicted</td> <td>VARCHAR2(4000), cost NUMBER)</td> </tr> </table>	actual	VARCHAR2(4000), NUMBER,	predicted	VARCHAR2(4000), cost NUMBER)
actual	VARCHAR2(4000), NUMBER,				
predicted	VARCHAR2(4000), cost NUMBER)				

Usage Notes

Only Decision Tree models can be built with a cost matrix. If you want to build a Decision Tree model with a cost matrix, specify the cost matrix table name in the CLAS_COST_TABLE_NAME setting in the settings table for the model. See [Table 53-7](#).

The cost matrix used to create a Decision Tree model becomes the default scoring matrix for the model. If you want to specify different costs for scoring, you can use the REMOVE_COST_MATRIX procedure to remove the cost matrix and the ADD_COST_MATRIX procedure to add a new one.

The GET_MODEL_COST_MATRIX may return either the build or scoring cost matrix defined for a model or model partition.

If you do not specify a partitioned model name, then an error is displayed.

Example

This example returns the scoring cost matrix associated with the Naive Bayes model NB_SH_CLAS_SAMPLE.

```
column actual format a10
column predicted format a10
SELECT *
      FROM TABLE(dbms_data_mining.get_model_cost_matrix('nb_sh_clas_sample'))
      ORDER BY predicted, actual;
```

ACTUAL	PREDICTED	COST
0	0	.00
1	0	.75
0	1	.25
1	1	.00

53.8.23 GET_MODEL_DETAILS_AI Function

The GET_MODEL_DETAILS_AI function returns a set of rows that provide the details of an attribute importance model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

Syntax

```
DBMS_DATA_MINING.get_model_details_ai(
    model_name IN VARCHAR2,
    partition_name IN VARCHAR2 DEFAULT NULL)
RETURN dm_ranked_attributes pipelined;
```

Parameters

Table 53-85 GET_MODEL_DETAILS_AI Function Parameters

Parameter	Description
model_name	Name of the model in the form [<i>schema_name</i>]. <i>model_name</i> . If you do not specify a schema, then your own schema is used.
partition_name	Specifies a partition in a partitioned model.

Return Values

Table 53-86 GET_MODEL_DETAILS_AI Function Return Values

Return Value	Description								
DM_RANKED_ATTRIBUTES	A set of rows of type DM_RANKED_ATTRIBUTE. The rows have the following columns: <table border="0" style="margin-left: 40px;"> <tr> <td>(attribute_name</td> <td>VARCHAR2(4000),</td> </tr> <tr> <td>attribute_subname</td> <td>VARCHAR2(4000),</td> </tr> <tr> <td>importance_value</td> <td>NUMBER,</td> </tr> <tr> <td>rank</td> <td>NUMBER(38))</td> </tr> </table>	(attribute_name	VARCHAR2(4000),	attribute_subname	VARCHAR2(4000),	importance_value	NUMBER,	rank	NUMBER(38))
(attribute_name	VARCHAR2(4000),								
attribute_subname	VARCHAR2(4000),								
importance_value	NUMBER,								
rank	NUMBER(38))								

Examples

The following example returns model details for the attribute importance model AI_SH_sample, which was created by the sample program dmaidemo.sql.

```
SELECT attribute_name, importance_value, rank
FROM TABLE(DBMS_DATA_MINING.GET_MODEL_DETAILS_AI('AI_SH_sample'))
ORDER BY RANK;
```

ATTRIBUTE_NAME	IMPORTANCE_VALUE	RANK
HOUSEHOLD_SIZE	.151685183	1
CUST_MARITAL_STATUS	.145294546	2
YRS_RESIDENCE	.07838928	3
AGE	.075027496	4
Y_BOX_GAMES	.063039952	5
EDUCATION	.059605314	6
HOME_THEATER_PACKAGE	.056458722	7
OCCUPATION	.054652937	8
CUST_GENDER	.035264741	9
BOOKKEEPING_APPLICATION	.019204751	10
PRINTER_SUPPLIES	0	11
OS_DOC_SET_KANJI	-.00050013	12
FLAT_PANEL_MONITOR	-.00509564	13
BULK_PACK_DISKETTES	-.00540822	14

COUNTRY_NAME	-.01201116	15
CUST_INCOME_LEVEL	-.03951311	16

53.8.24 GET_MODEL_DETAILS_EM Function

The `GET_MODEL_DETAILS_EM` function returns a set of rows that provide statistics about the clusters produced by an expectation maximization model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

By default, the EM algorithm groups components into high-level clusters, and `GET_MODEL_DETAILS_EM` returns only the high-level clusters with their hierarchies. Alternatively, you can configure EM model to disable the grouping of components into high-level clusters. In this case, `GET_MODEL_DETAILS_EM` returns the components themselves as clusters with their hierarchies. See [Table 53-12](#).

Syntax

```
DBMS_DATA_MINING.get_model_details_em(
    model_name VARCHAR2,
    cluster_id NUMBER DEFAULT NULL,
    attribute VARCHAR2 DEFAULT NULL,
    centroid NUMBER DEFAULT 1,
    histogram NUMBER DEFAULT 1,
    rules NUMBER DEFAULT 2,
    attribute_subname VARCHAR2 DEFAULT NULL,
    topn_attributes NUMBER DEFAULT NULL,
    partition_name IN VARCHAR2 DEFAULT NULL)
RETURN dm_clusters PIPELINED;
```

Parameters

Table 53-87 GET_MODEL_DETAILS_EM Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form <code>[schema_name].model_name</code> . If you do not specify a schema, then your own schema is used.
<code>cluster_id</code>	The ID of a cluster in the model. When a valid cluster ID is specified, only the details of this cluster are returned. Otherwise, the details for all clusters are returned.
<code>attribute</code>	The name of an attribute. When a valid attribute name is specified, only the details of this attribute are returned. Otherwise, the details for all attributes are returned.
<code>centroid</code>	This parameter accepts the following values: <ul style="list-style-type: none"> • 1: Details about centroids are returned (default) • 0: Details about centroids are not returned
<code>histogram</code>	This parameter accepts the following values: <ul style="list-style-type: none"> • 1: Details about histograms are returned (default) • 0: Details about histograms are not returned
<code>rules</code>	This parameter accepts the following values: <ul style="list-style-type: none"> • 2: Details about rules are returned (default) • 1: Rule summaries are returned • 0: No information about rules is returned

Table 53-87 (Cont.) GET_MODEL_DETAILS_EM Function Parameters

Parameter	Description
<code>attribute_subname</code>	The name of a nested attribute. The full name of a nested attribute has the form: <i>attribute_name.attribute_subname</i> where <i>attribute_name</i> is the name of the column and <i>attribute_subname</i> is the name of the nested attribute in that column. If the attribute is not nested, then <code>attribute_subname</code> is null.
<code>topn_attributes</code>	Restricts the number of attributes returned in the centroid, histogram, and rules objects. Only the <i>n</i> attributes with the highest confidence values in the rules are returned. If the number of attributes included in the rules is less than <i>topn</i> , then, up to <i>n</i> additional attributes in alphabetical order are returned. If both the <code>attribute</code> and <code>topn_attributes</code> parameters are specified, then <code>topn_attributes</code> is ignored.
<code>partition_name</code>	Specifies a partition in a partitioned model.

Usage Notes

1. For information on Oracle Machine Learning for SQL data types and return values for Clustering algorithms piped output from table functions, see "[Data Types](#)".
2. `GET_MODEL_DETAILS` functions preserve model transparency by automatically reversing the transformations applied during the build process. Thus the attributes returned in the model details are the original attributes (or a close approximation of the original attributes) used to build the model.
3. When cluster statistics are disabled (`EMCS_CLUSTER_STATISTICS` is set to `EMCS_CLUS_STATS_DISABLE`), `GET_MODEL_DETAILS_EM` does not return centroids, histograms, or rules. Only taxonomy (hierarchy) and cluster counts are returned.
4. When the `partition_name` is NULL for a partitioned model, an exception is thrown. When the value is not null, it must contain the desired partition name.

53.8.25 GET_MODEL_DETAILS_EM_COMP Function

The `GET_MODEL_DETAILS_EM_COMP` table function returns a set of rows that provide details about the parameters of an expectation maximization model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

Syntax

```
DBMS_DATA_MINING.get_model_details_em_comp(
    model_name IN VARCHAR2,
    partition_name IN VARCHAR2 DEFAULT NULL)
RETURN DM_EM_COMPONENT_SET PIPELINED;
```

Parameters

Table 53-88 GET_MODEL_DETAILS_EM_COMP Function Parameters

Parameter	Description
model_name	Name of the model in the form [schema_name.]model_name. If you do not specify a schema, then your own schema is used.
partition_name	Specifies a partition in a partitioned model to retrieve details for.

Return Values

Table 53-89 GET_MODEL_DETAILS_EM_COMP Function Return Values

Return Value	Description
DM_EM_COMPONENT_SET	<p>A set of rows of type DM_EM_COMPONENT. The rows have the following columns:</p> <pre>(info_type VARCHAR2(30), component_id NUMBER, cluster_id NUMBER, attribute_name VARCHAR2(4000), covariate_name VARCHAR2(4000), attribute_value VARCHAR2(4000), value NUMBER)</pre>

Usage Notes

1. This table function pipes out rows of type DM_EM_COMPONENT. For information on Oracle Machine Learning for SQL data types and piped output from table functions, see "[Data Types](#)".

The columns in each row returned by GET_MODEL_DETAILS_EM_COMP are described as follows:

Column in DM_EM_COMPONENT	Description
info_type	<p>The type of information in the row. The following information types are supported:</p> <ul style="list-style-type: none"> • cluster • prior • mean • covariance • frequency
component_id	Unique identifier of a component
cluster_id	Unique identifier of the high-level leaf cluster for each component

Column in DM_EM_COMPONENT	Description
attribute_name	Name of an original attribute or a derived feature ID. The derived feature ID is used in models built on data with nested columns. The derived feature definitions can be obtained from the GET_MODEL_DETAILS_EM_PROJ Function .
covariate_name	Name of an original attribute or a derived feature ID used in variance/covariance definition
attribute_value	Categorical value or bin interval for binned numerical attributes
value	Encodes different information depending on the value of info_type, as follows: <ul style="list-style-type: none"> cluster — The value field is NULL prior — The value field returns the component prior mean — The value field returns the mean of the attribute specified in attribute_name covariance — The value field returns the covariance of the attributes specified in attribute_name and covariate_name. Using the same attribute in attribute_name and covariate_name, returns the variance. frequency— The value field returns the multivalued Bernoulli frequency parameter for the attribute/value combination specified by attribute_name and attribute_value <p>See Usage Note 2 for details.</p>

2. The following table shows which fields are used for each info_type. The blank cells represent NULLs.

info_type	component_id	cluster_id	attribute_name	covariate_name	attribute_value	value
cluster	X	X				
prior	X	X				X
mean	X	X	X			X
covariance	X	X	X	X		X
frequency	X	X	X		X	X

3. GET_MODEL_DETAILS functions preserve model transparency by automatically reversing the transformations applied during the build process. Thus the attributes returned in the model details are the original attributes (or a close approximation of the original attributes) used to build the model.
4. When the value is NULL for a partitioned model, an exception is thrown. When the value is not null, it must contain the desired partition name.

53.8.26 GET_MODEL_DETAILS_EM_PROJ Function

The `GET_MODEL_DETAILS_EM_PROJ` function returns a set of rows that provide statistics about the projections produced by an expectation maximization model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

Syntax

```
DBMS_DATA_MINING.get_model_details_em_proj(
    model_name IN VARCHAR2,
    partition_name IN VARCHAR2 DEFAULT NULL)
RETURN DM_EM_PROJECTION_SET PIPELINED;
```

Parameters

Table 53-90 GET_MODEL_DETAILS_EM_PROJ Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form <code>[schema_name].model_name</code> . If you do not specify a schema, then your own schema is used.
<code>partition_name</code>	Specifies a partition in a partitioned model

Return Values

Table 53-91 GET_MODEL_DETAILS_EM_PROJ Function Return Values

Return Value	Description										
<code>DM_EM_PROJECTION_SET</code>	<p>A set of rows of type <code>DM_EM_PROJECTION</code>. The rows have the following columns:</p> <table border="0"> <tr> <td><code>feature_name</code></td> <td><code>VARCHAR2(4000)</code>,</td> </tr> <tr> <td><code>attribute_name</code></td> <td><code>VARCHAR2(4000)</code>,</td> </tr> <tr> <td><code>attribute_subname</code></td> <td><code>VARCHAR2(4000)</code>,</td> </tr> <tr> <td><code>attribute_value</code></td> <td><code>VARCHAR2(4000)</code>,</td> </tr> <tr> <td><code>coefficient</code></td> <td><code>NUMBER</code>)</td> </tr> </table> <p>See Usage Notes for details.</p>	<code>feature_name</code>	<code>VARCHAR2(4000)</code> ,	<code>attribute_name</code>	<code>VARCHAR2(4000)</code> ,	<code>attribute_subname</code>	<code>VARCHAR2(4000)</code> ,	<code>attribute_value</code>	<code>VARCHAR2(4000)</code> ,	<code>coefficient</code>	<code>NUMBER</code>)
<code>feature_name</code>	<code>VARCHAR2(4000)</code> ,										
<code>attribute_name</code>	<code>VARCHAR2(4000)</code> ,										
<code>attribute_subname</code>	<code>VARCHAR2(4000)</code> ,										
<code>attribute_value</code>	<code>VARCHAR2(4000)</code> ,										
<code>coefficient</code>	<code>NUMBER</code>)										

Usage Notes

1. This table function pipes out rows of type `DM_EM_PROJECTION`. For information on machine learning data types and piped output from table functions, see "[Datatypes](#)".

The columns in each row returned by `GET_MODEL_DETAILS_EM_PROJ` are described as follows:

Column in DM_EM_PROJECTION	Description
feature_name	Name of a derived feature. The feature maps to the attribute_name returned by the GET_MODEL_DETAILS_EM Function .
attribute_name	Name of a column in the build data
attribute_subname	Subname in a nested column
attribute_value	Categorical value
coefficient	Projection coefficient. The representation is sparse; only the non-zero coefficients are returned.

2. GET_MODEL_DETAILS functions preserve model transparency by automatically reversing the transformations applied during the build process. Thus the attributes returned in the model details are the original attributes (or a close approximation of the original attributes) used to build the model.

The coefficients are related to the transformed, not the original, attributes. When returned directly with the model details, the coefficients may not provide meaningful information.

3. When the value is NULL for a partitioned model, an exception is thrown. When the value is not null, it must contain the desired partition name.

Related Topics

- *Oracle Machine Learning for SQL User's Guide*

53.8.27 GET_MODEL_DETAILS_GLM Function

The GET_MODEL_DETAILS_GLM function returns the coefficient statistics for a generalized linear model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

The same set of statistics is returned for both linear and logistic regression, but statistics that do not apply to the machine learning function are returned as NULL. For more details, see the Usage Notes.

Syntax

```
DBMS_DATA_MINING.get_model_details_glm(
    model_name IN VARCHAR2,
    partition_name IN VARCHAR2 DEFAULT NULL)
RETURN DM_GLM_Coeff_Set PIPELINED;
```

Parameters

Table 53-92 GET_MODEL_DETAILS_GLM Function Parameters

Parameter	Description
model_name	Name of the model in the form [schema_name.]model_name. If you do not specify a schema, then your own schema is used.
partition_name	Specifies a partition in a partitioned model

Return Values

Table 53-93 GET_MODEL_DETAILS_GLM Return Values

Return Value	Description																																
DM_GLM_COEFF_SET	<p>A set of rows of type DM_GLM_COEFF. The rows have the following columns:</p> <table border="1"> <tbody> <tr><td>class</td><td>VARCHAR2(4000),</td></tr> <tr><td>attribute_name</td><td>VARCHAR2(4000),</td></tr> <tr><td>attribute_subname</td><td>VARCHAR2(4000),</td></tr> <tr><td>attribute_value</td><td>VARCHAR2(4000),</td></tr> <tr><td>feature_expression</td><td>VARCHAR2(4000),</td></tr> <tr><td>coefficient</td><td>NUMBER,</td></tr> <tr><td>std_error</td><td>NUMBER,</td></tr> <tr><td>test_statistic</td><td>NUMBER,</td></tr> <tr><td>p_value</td><td>NUMBER,</td></tr> <tr><td>VIF</td><td>NUMBER,</td></tr> <tr><td>std_coefficient</td><td>NUMBER,</td></tr> <tr><td>lower_coeff_limit</td><td>NUMBER,</td></tr> <tr><td>upper_coeff_limit</td><td>NUMBER,</td></tr> <tr><td>exp_coefficient</td><td>BINARY_DOUBLE,</td></tr> <tr><td>exp_lower_coeff_limit</td><td>BINARY_DOUBLE,</td></tr> <tr><td>exp_upper_coeff_limit</td><td>BINARY_DOUBLE)</td></tr> </tbody> </table>	class	VARCHAR2(4000),	attribute_name	VARCHAR2(4000),	attribute_subname	VARCHAR2(4000),	attribute_value	VARCHAR2(4000),	feature_expression	VARCHAR2(4000),	coefficient	NUMBER,	std_error	NUMBER,	test_statistic	NUMBER,	p_value	NUMBER,	VIF	NUMBER,	std_coefficient	NUMBER,	lower_coeff_limit	NUMBER,	upper_coeff_limit	NUMBER,	exp_coefficient	BINARY_DOUBLE,	exp_lower_coeff_limit	BINARY_DOUBLE,	exp_upper_coeff_limit	BINARY_DOUBLE)
class	VARCHAR2(4000),																																
attribute_name	VARCHAR2(4000),																																
attribute_subname	VARCHAR2(4000),																																
attribute_value	VARCHAR2(4000),																																
feature_expression	VARCHAR2(4000),																																
coefficient	NUMBER,																																
std_error	NUMBER,																																
test_statistic	NUMBER,																																
p_value	NUMBER,																																
VIF	NUMBER,																																
std_coefficient	NUMBER,																																
lower_coeff_limit	NUMBER,																																
upper_coeff_limit	NUMBER,																																
exp_coefficient	BINARY_DOUBLE,																																
exp_lower_coeff_limit	BINARY_DOUBLE,																																
exp_upper_coeff_limit	BINARY_DOUBLE)																																

GET_MODEL_DETAILS_GLM returns a row of statistics for each attribute and one extra row for the intercept, which is identified by a null value in the attribute name. Each row has the DM_GLM_COEFF data type. The statistics are described in [Table 53-94](#).

Table 53-94 DM_GLM_COEFF Data Type Description

Column	Description
class	<p>The non-reference target class for logistic regression. The model is built to predict the probability of this class.</p> <p>The other class (the reference class) is specified in the model setting GLMS_REFERENCE_CLASS_NAME. See Table 53-19.</p> <p>For Linear Regression, class is null.</p>
attribute_name	<p>The attribute name when there is no subname, or first part of the attribute name when there is a subname. The value of attribute_name is also the name of the column in the case table that is the source for this attribute.</p> <p>For the intercept, attribute_name is null. Intercepts are equivalent to the bias term in SVM models.</p>
attribute_subname	<p>The name of an attribute in a nested table. The full name of a nested attribute has the form:</p> <p><i>attribute_name.attribute_subname</i></p> <p>where <i>attribute_name</i> is the name of the nested column in the case table that is the source for this attribute.</p> <p>If the attribute is not nested, then attribute_subname is null. If the attribute is an intercept, then both the attribute_name and the attribute_subname are null.</p>

Table 53-94 (Cont.) DM_GLM_COEFF Data Type Description

Column	Description
attribute_value	The value of the attribute (categorical attribute only). For numeric attributes, attribute_value is null.
feature_expression	The feature name constructed by the algorithm when feature generation is enabled and higher-order features are found. If feature selection is not enabled, then the feature name is simply the fully-qualified attribute name (<i>attribute_name.attribute_subname</i> if the attribute is in a nested column). For categorical attributes, the algorithm constructs a feature name that has the following form: <i>fully-qualified_attribute_name.attribute_value</i> For numeric attributes, the algorithm constructs a name for the higher-order feature by taking the product of the resulting values: <i>(attrib1)*(attrib2)*.....</i> where <i>attrib1</i> and <i>attrib2</i> are fully-qualified attribute names.
coefficient	The linear coefficient estimate.
std_error	Standard error of the coefficient estimate.
test_statistic	For linear regression, the t-value of the coefficient estimate. For logistic regression, the Wald chi-square value of the coefficient estimate.
p-value	Probability of the test_statistic. Used to analyze the significance of specific attributes in the model.
VIF	Variance Inflation Factor. The value is zero for the intercept. For logistic regression, VIF is null. VIF is not computed if the solver is Cholesky.
std_coefficient	Standardized estimate of the coefficient.
lower_coeff_limit	Lower confidence bound of the coefficient.
upper_coeff_limit	Upper confidence bound of the coefficient.
exp_coefficient	Exponentiated coefficient for logistic regression. For linear regression, exp_coefficient is null.
exp_lower_coeff_limit	Exponentiated coefficient for lower confidence bound of the coefficient for logistic regression. For linear regression, exp_lower_coeff_limit is null.
exp_upper_coeff_limit	Exponentiated coefficient for upper confidence bound of the coefficient for logistic regression. For linear regression, exp_lower_coeff_limit is null.

Usage Notes

Not all statistics are necessarily returned for each coefficient. Statistics will be null if:

- They do not apply to the machine learning function. For example, exp_coefficient does not apply to linear regression.
- They cannot be computed from a theoretical standpoint. For information on ridge regression, see [Table 53-19](#).

- They cannot be computed because of limitations in system resources.
- Their values would be infinity.
- When the value is NULL for a partitioned model, an exception is thrown. When the value is not null, it must contain the desired partition name.

Examples

The following example returns some of the model details for the GLM regression model `GLMR_SH_Regr_sample`.

```
SET line 120
SET pages 99
column attribute_name format a30
column attribute_subname format a20
column attribute_value format a20
col coefficient format 990.9999
col std_error format 990.9999
SQL> SELECT * FROM
(SELECT attribute_name, attribute_value, coefficient, std_error
 FROM DM$VDGLMR_SH_REGR_SAMPLE order by 1,2)
WHERE rownum < 11;
```

ATTRIBUTE_NAME	ATTRIBUTE_VALUE	COEFFICIENT	STD_ERROR
AFFINITY_CARD		-0.5797	0.5283
BOOKKEEPING_APPLICATION		-0.4689	3.8872
BULK_PACK_DISKETTES		-0.9819	2.5430
COUNTRY_NAME	Argentina	-1.2020	1.1876
COUNTRY_NAME	Australia	-0.0071	5.1146
COUNTRY_NAME	Brazil	5.2931	1.9233
COUNTRY_NAME	Canada	4.0191	2.4108
COUNTRY_NAME	China	0.8706	3.5889
COUNTRY_NAME	Denmark	-2.9822	3.1803
COUNTRY_NAME	France	-1.1044	7.1811

Related Topics

- *Oracle Machine Learning for SQL User's Guide*

53.8.28 GET_MODEL_DETAILS_GLOBAL Function

The `GET_MODEL_DETAILS_GLOBAL` function returns statistics about the model as a whole. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

Global details are available for Generalized Linear Models, Association Rules, Singular Value Decomposition, and Expectation Maximization. There are new Global model views which show global information for all algorithms. Oracle recommends that users leverage the views instead. Refer to Model Details View Global.

Syntax

```
DBMS_DATA_MINING.get_model_details_global(
    model_name IN VARCHAR2,
    partition_name IN VARCHAR2 DEFAULT NULL)
RETURN DM_model_global_details PIPELINED;
```


Parameters

Table 53-95 GET_MODEL_DETAILS_GLOBAL Function Parameters

Parameter	Description
model_name	Name of the model in the form [schema_name.]model_name. If you do not specify a schema, then your own schema is used.
partition_name	Specifies a partition in a partitioned model.

Return Values

Table 53-96 GET_MODEL_DETAILS_GLOBAL Function Return Values

Return Value	Description
DM_MODEL_GLOBAL_DETAILS	A collection of rows of type DM_MODEL_GLOBAL_DETAIL. The rows have the following columns: (global_detail_name VARCHAR2(30), global_detail_value NUMBER)

Examples

The following example returns the global model details for the GLM regression model GLMR_SH_Regr_sample.

```
SELECT *
  FROM TABLE(dbms_data_mining.get_model_details_global(
              'GLMR_SH_Regr_sample'))
ORDER BY global_detail_name;
GLOBAL_DETAIL_NAME          GLOBAL_DETAIL_VALUE
-----
ADJUSTED_R_SQUARE          .731412557
AIC                        5931.814
COEFF_VAR                  18.1711243
CORRECTED_TOTAL_DF        1499
CORRECTED_TOT_SS          278740.504
DEPENDENT_MEAN             38.892
ERROR_DF                   1433
ERROR_MEAN_SQUARE          49.9440956
ERROR_SUM_SQUARES         71569.8891
F_VALUE                    62.8492452
GMSEP                      52.280819
HOCKING_SP                 .034877162
J_P                        52.1749319
MODEL_CONVERGED            1
MODEL_DF                   66
MODEL_F_P_VALUE            0
MODEL_MEAN_SQUARE         3138.94871
MODEL_SUM_SQUARES         207170.615
NUM_PARAMS                 67
NUM_ROWS                   1500
ROOT_MEAN_SQ              7.06711367
R_SQ                      .743238288
SBIC                      6287.79977
VALID_COVARIANCE_MATRIX   1
```

Related Topics

- *Oracle Machine Learning for SQL User's Guide*

53.8.29 GET_MODEL_DETAILS_KM Function

The `GET_MODEL_DETAILS_KM` function returns a set of rows that provide the details of a *k*-means clustering model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

You can provide input to `GET_MODEL_DETAILS_KM` to request specific information about the model, thus improving the performance of the query. If you do not specify filtering parameters, then `GET_MODEL_DETAILS_KM` returns all the information about the model.

Syntax

```
DBMS_DATA_MINING.get_model_details_km(
    model_name VARCHAR2,
    cluster_id NUMBER    DEFAULT NULL,
    attribute  VARCHAR2  DEFAULT NULL,
    centroid  NUMBER    DEFAULT 1,
    histogram NUMBER    DEFAULT 1,
    rules     NUMBER    DEFAULT 2,
    attribute_subname VARCHAR2 DEFAULT NULL,
    topn_attributes NUMBER DEFAULT NULL,
    partition_name VARCHAR2 DEFAULT NULL)
RETURN dm_clusters PIPELINED;
```

Parameters

Table 53-97 GET_MODEL_DETAILS_KM Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form [<i>schema_name</i> .] <i>model_name</i> . If you do not specify a schema, then your own schema is used.
<code>cluster_id</code>	The ID of a cluster in the model. When a valid cluster ID is specified, only the details of this cluster are returned. Otherwise the details for all clusters are returned.
<code>attribute</code>	The name of an attribute. When a valid attribute name is specified, only the details of this attribute are returned. Otherwise, the details for all attributes are returned
<code>centroid</code>	This parameter accepts the following values: <ul style="list-style-type: none"> • 1: Details about centroids are returned (default) • 0: Details about centroids are not returned
<code>histogram</code>	This parameter accepts the following values: <ul style="list-style-type: none"> • 1: Details about histograms are returned (default) • 0: Details about histograms are not returned
<code>rules</code>	This parameter accepts the following values: <ul style="list-style-type: none"> • 2: Details about rules are returned (default) • 1: Rule summaries are returned • 0: No information about rules is returned

Table 53-97 (Cont.) GET_MODEL_DETAILS_KM Function Parameters

Parameter	Description
attribute_subname	The name of a nested attribute. The full name of a nested attribute has the form: <i>attribute_name.attribute_subname</i> where <i>attribute_name</i> is the name of the column and <i>attribute_subname</i> is the name of the nested attribute in that column. If the attribute is not nested, attribute_subname is null.
topn_attributes	Restricts the number of attributes returned in the centroid, histogram, and rules objects. Only the <i>n</i> attributes with the highest confidence values in the rules are returned. If the number of attributes included in the rules is less than <i>topn</i> , then up to <i>n</i> additional attributes in alphabetical order are returned. If both the <i>attribute</i> and <i>topn_attributes</i> parameters are specified, then <i>topn_attributes</i> is ignored.
partition_name	Specifies a partition in a partitioned model.

Usage Notes

1. The table function pipes out rows of type `DM_CLUSTERS`. For information on machine learning data types and Return Value for Clustering Algorithms piped output from table functions, see "Data Types".
2. When the value is NULL for a partitioned model, an exception is thrown. When the value is not null, it must contain the desired partition name.

Examples

The following example returns model details for the *k*-means clustering model `KM_SH_Clus_sample`.

```
SELECT T.id          clu_id,
       T.record_count rec_cnt,
       T.parent      parent,
       T.tree_level  tree_level,
       T.dispersion  dispersion
FROM (SELECT *
      FROM TABLE(DBMS_DATA_MINING.GET_MODEL_DETAILS_KM(
                  'KM_SH_Clus_sample'))
      ORDER BY id) T
WHERE ROWNUM < 6;
```

CLU_ID	REC_CNT	PARENT	TREE_LEVEL	DISPERSION
1	1500		1	5.9152211
2	638	1	2	3.98458982
3	862	1	2	5.83732097
4	376	3	3	5.05192137
5	486	3	3	5.42901522

Related Topics

- *Oracle Machine Learning for SQL User's Guide*

53.8.30 GET_MODEL_DETAILS_NB Function

The `GET_MODEL_DETAILS_NB` function returns a set of rows that provide the details of a naive Bayes model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

Syntax

```
DBMS_DATA_MINING.get_model_details_nb(
    model_name IN VARCHAR2,
    partition_name IN VARCHAR2 DEFAULT NULL)
RETURN DM_NB_Details PIPELINED;
```

Parameters

Table 53-98 GET_MODEL_DETAILS_NB Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is used.
<code>partition_name</code>	Specifies a partition in a partitioned model

Return Values

Table 53-99 GET_MODEL_DETAILS_NB Function Return Values

Return Value	Description
<code>DM_NB_DETAILS</code>	<p>A set of rows of type <code>DM_NB_DETAIL</code>. The rows have the following columns:</p> <pre>(target_attribute_name VARCHAR2(30), target_attribute_str_value VARCHAR2(4000), target_attribute_num_value NUMBER, prior_probability NUMBER, conditionals DM_CONDITIONALS)</pre> <p>The conditionals column of <code>DM_NB_DETAIL</code> returns a nested table of type <code>DM_CONDITIONALS</code>. The rows, of type <code>DM_CONDITIONAL</code>, have the following columns:</p> <pre>(attribute_name VARCHAR2(4000), attribute_subname VARCHAR2(4000), attribute_str_value VARCHAR2(4000), attribute_num_value NUMBER, conditional_probability NUMBER)</pre>

Usage Notes

- The table function pipes out rows of type `DM_NB_DETAILS`. For information on machine learning data types and piped output from table functions, see "[Data Types](#)".

- When the value is NULL for a partitioned model, an exception is thrown. When the value is not null, it must contain the desired partition name.

Examples

The following query is from the sample program `dmnbdemo.sql`. It returns model details about the model `NB_SH_Clas_sample`. For information about the sample programs, see *Oracle Machine Learning for SQL User's Guide*.

The query creates labels from the bin boundary tables that were used to bin the training data. It replaces the attribute values with the labels. For numeric bins, the labels are (*lower_boundary,upper_boundary*]; for categorical bins, the label matches the value it represents. (This method of categorical label representation will only work for cases where one value corresponds to one bin.) The target was not binned.

```
WITH
  bin_label_view AS (
    SELECT col, bin, (DECODE(bin,'1','[' || lv || ',' || val || ']') label
      FROM (SELECT col,
                  bin,
                  LAST_VALUE(val) OVER (
                    PARTITION BY col ORDER BY val
                    ROWS BETWEEN UNBOUNDED PRECEDING AND 1 PRECEDING) lv,
                  val
              FROM nb_sh_sample_num)
    UNION ALL
    SELECT col, bin, val label
      FROM nb_sh_sample_cat
  ),
  model_details AS (
    SELECT T.target_attribute_name                                tname,
           NVL(TO_CHAR(T.target_attribute_num_value,T.target_attribute_str_value)) tval,
           C.attribute_name                                     pname,
           NVL(L.label, NVL(C.attribute_str_value, C.attribute_num_value)) pval,
           T.prior_probability                                priorp,
           C.conditional_probability                         condp
      FROM TABLE(DBMS_DATA_MINING.GET_MODEL_DETAILS_NB('NB_SH_Clas_sample')) T,
           TABLE(T.conditionals) C,
           bin_label_view L
     WHERE C.attribute_name = L.col (+) AND
           (NVL(C.attribute_str_value,C.attribute_num_value) = L.bin(+))
     ORDER BY 1,2,3,4,5,6
  )
  SELECT tname, tval, pname, pval, priorp, condp
     FROM model_details
     WHERE ROWNUM < 11;
```

TNAME	TVAL	PNAME	PVAL	PRIORP	CONDP
AFFINITY_CARD	0	AGE	(24,30]	.6500	.1714
AFFINITY_CARD	0	AGE	(30,35]	.6500	.1509
AFFINITY_CARD	0	AGE	(35,40]	.6500	.1125
AFFINITY_CARD	0	AGE	(40,46]	.6500	.1134
AFFINITY_CARD	0	AGE	(46,53]	.6500	.1071
AFFINITY_CARD	0	AGE	(53,90]	.6500	.1312
AFFINITY_CARD	0	AGE	[17,24]	.6500	.2134
AFFINITY_CARD	0	BOOKKEEPING_APPLICATION	0	.6500	.1500
AFFINITY_CARD	0	BOOKKEEPING_APPLICATION	1	.6500	.8500
AFFINITY_CARD	0	BULK_PACK_DISKETTES	0	.6500	.3670

Related Topics

- *Oracle Machine Learning for SQL User's Guide*

53.8.31 GET_MODEL_DETAILS_NMF Function

The `GET_MODEL_DETAILS_NMF` function returns a set of rows that provide the details of a non-negative matrix factorization model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

Syntax

```
DBMS_DATA_MINING.get_model_details_nmf(
    model_name IN VARCHAR2,
    partition_name VARCHAR2 DEFAULT NULL)
RETURN DM_NMF_Feature_Set PIPELINED;
```

Parameters

Table 53-100 GET_MODEL_DETAILS_NMF Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form [<i>schema_name</i> .] <i>model_name</i> . If you do not specify a schema, then your own schema is used.
<code>partition_name</code>	Specifies a partition in a partitioned model

Return Values

Table 53-101 GET_MODEL_DETAILS_NMF Function Return Values

Return Value	Description
<code>DM_NMF_FEATURE_SET</code>	<p>A set of rows of <code>DM_NMF_FEATURE</code>. The rows have the following columns:</p> <pre>(feature_id NUMBER, mapped_feature_id VARCHAR2(4000), attribute_set DM_NMF_ATTRIBUTE_SET)</pre> <p>The <code>attribute_set</code> column of <code>DM_NMF_FEATURE</code> returns a nested table of type <code>DM_NMF_ATTRIBUTE_SET</code>. The rows, of type <code>DM_NMF_ATTRIBUTE</code>, have the following columns:</p> <pre>(attribute_name VARCHAR2(4000), attribute_subname VARCHAR2(4000), attribute_value VARCHAR2(4000), coefficient NUMBER)</pre>

Usage Notes

- The table function pipes out rows of type `DM_NMF_FEATURE_SET`. For information on machine learning data types and piped output from table functions, see "[Data Types](#)".

- When the value is NULL for a partitioned model, an exception is thrown. When the value is not null, it must contain the desired partition name.

Examples

The following example returns model details for the feature extraction model NMF_SH_Sample.

```
SELECT * FROM (
SELECT F.feature_id,
      A.attribute_name,
      A.attribute_value,
      A.coefficient
  FROM TABLE(DBMS_DATA_MINING.GET_MODEL_DETAILS_NMF('NMF_SH_Sample')) F,
       TABLE(F.attribute_set) A
 ORDER BY feature_id,attribute_name,attribute_value
) WHERE ROWNUM < 11;
```

FEATURE_ID	ATTRIBUTE_NAME	ATTRIBUTE_VALUE	COEFFICIENT
1	AFFINITY_CARD		.051208078859308
1	AGE		.0390513260041573
1	BOOKKEEPING_APPLICATION		.0512734004239326
1	BULK_PACK_DISKETTES		.232471260895683
1	COUNTRY_NAME	Argentina	.00766817464479959
1	COUNTRY_NAME	Australia	.000157637881096675
1	COUNTRY_NAME	Brazil	.0031409632415604
1	COUNTRY_NAME	Canada	.00144213099311427
1	COUNTRY_NAME	China	.000102279310968754
1	COUNTRY_NAME	Denmark	.000242424084307513

Related Topics

- *Oracle Machine Learning for SQL User's Guide*

53.8.32 GET_MODEL_DETAILS_OC Function

The `GET_MODEL_DETAILS_OC` function returns a set of rows that provide the details of an O-cluster clustering model. The rows are an enumeration of the clustering patterns generated during the creation of the model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

You can provide input to `GET_MODEL_DETAILS_OC` to request specific information about the model, thus improving the performance of the query. If you do not specify filtering parameters, then `GET_MODEL_DETAILS_OC` returns all the information about the model.

Syntax

```
DBMS_DATA_MINING.get_model_details_oc(
  model_name VARCHAR2,
  cluster_id NUMBER DEFAULT NULL,
  attribute VARCHAR2 DEFAULT NULL,
  centroid NUMBER DEFAULT 1,
  histogram NUMBER DEFAULT 1,
  rules NUMBER DEFAULT 2,
  topn_attributes NUMBER DEFAULT NULL,
  partition_name VARCHAR2 DEFAULT NULL)
RETURN dm_clusters PIPELINED;
```

Parameters

Table 53-102 GET_MODEL_DETAILS_OC Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is used.
<code>cluster_id</code>	The ID of a cluster in the model. When a valid cluster ID is specified, only the details of this cluster are returned. Otherwise the details for all clusters are returned.
<code>attribute</code>	The name of an attribute. When a valid attribute name is specified, only the details of this attribute are returned. Otherwise, the details for all attributes are returned
<code>centroid</code>	This parameter accepts the following values: <ul style="list-style-type: none"> • 1: Details about centroids are returned (default) • 0: Details about centroids are not returned
<code>histogram</code>	This parameter accepts the following values: <ul style="list-style-type: none"> • 1: Details about histograms are returned (default) • 0: Details about histograms are not returned
<code>rules</code>	This parameter accepts the following values: <ul style="list-style-type: none"> • 2: Details about rules are returned (default) • 1: Rule summaries are returned • 0: No information about rules is returned
<code>topn_attributes</code>	Restricts the number of attributes returned in the centroid, histogram, and rules objects. Only the <i>n</i> attributes with the highest confidence values in the rules are returned. If the number of attributes included in the rules is less than <i>topn</i> , then up to <i>n</i> additional attributes in alphabetical order are returned. If both the <code>attribute</code> and <code>topn_attributes</code> parameters are specified, then <code>topn_attributes</code> is ignored.
<code>partition_name</code>	Specifies a partition in a partitioned model.

Usage Notes

1. For information about machine learning data types and return values for clustering algorithms piped output from table functions, see ["Data Types"](#).
2. When the value is NULL for a partitioned model, an exception is thrown. When the value is not null, it must contain the desired partition name.

Examples

The following example returns model details for the clustering model `OC_SH_Clus_sample`.

For each cluster in this example, the split predicate indicates the attribute and the condition used to assign records to the cluster's children during model build. It provides an important piece of information on how the population within a cluster can be divided up into two smaller clusters.

```
SELECT clu_id, attribute_name, op, s_value
       FROM (SELECT a.id clu_id, sp.attribute_name, sp.conditional_operator op,
```



```

        sp.attribute_str_value s_value
    FROM TABLE(DBMS_DATA_MINING.GET_MODEL_DETAILS_OC(
        'OC_SH_Clus_sample')) a,
        TABLE(a.split_predicate) sp
    ORDER BY a.id, op, s_value)
WHERE ROWNUM < 11;

```

CLU_ID	ATTRIBUTE_NAME	OP	S_VALUE
1	OCCUPATION	IN	?
1	OCCUPATION	IN	Armed-F
1	OCCUPATION	IN	Cleric.
1	OCCUPATION	IN	Crafts
2	OCCUPATION	IN	?
2	OCCUPATION	IN	Armed-F
2	OCCUPATION	IN	Cleric.
3	OCCUPATION	IN	Exec.
3	OCCUPATION	IN	Farming
3	OCCUPATION	IN	Handler

Related Topics

- *Oracle Machine Learning for SQL User's Guide*

53.8.33 GET_MODEL_SETTINGS Function

The `GET_MODEL_SETTINGS` function returns the settings used to build the given model. Starting from Oracle Database 12c Release 2, this function is deprecated. See "Static Data Dictionary Views: ALL_ALL_TABLES to ALL_OUTLINES" in *Oracle Database Reference*.

Syntax

```

FUNCTION get_model_settings(model_name IN VARCHAR2)
    RETURN DM_Model_Settings PIPELINED;

```

Parameters

Table 53-103 GET_MODEL_SETTINGS Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is used.

Return Values

Table 53-104 GET_MODEL_SETTINGS Function Return Values

Return Value	Description
DM_MODEL_SETTINGS	<p>A set of rows of type DM_MODEL_SETTINGS. The rows have the following columns:</p> <pre> DM_MODEL_SETTINGS TABLE OF SYS.DM_MODEL_SETTING Name Type ----- SETTING_NAME VARCHAR2(30) SETTING_VALUE VARCHAR2(4000) </pre>

Usage Notes

1. This table function pipes out rows of type DM_MODEL_SETTINGS. For information on machine learning data types and piped output from table functions, see ["DBMS_DATA_MINING Datatypes"](#).
2. The setting names/values include both those specified by the user and any defaults assigned by the build process.

Examples

The following example returns model model settings for an example naive Bayes model.

```

SETTING_NAME                               SETTING_VALUE
-----
ALGO_NAME                                  ALGO_NAIVE_BAYES
PREP_AUTO                                  ON
ODMS_MAX_PARTITIONS                        1000
NABS_SINGLETON_THRESHOLD                   0
CLAS_WEIGHTS_BALANCED                      OFF
NABS_PAIRWISE_THRESHOLD                    0
ODMS_PARTITION_COLUMNS                     GENDER,Y_BOX_GAMES
ODMS_MISSING_VALUE_TREATMENT                ODMS_MISSING_VALUE_AUTO
ODMS_SAMPLING                              ODMS_SAMPLING_DISABLE

```

9 rows selected.

Related Topics

- [Oracle Database Reference](#)

53.8.34 GET_MODEL_SIGNATURE Function

The GET_MODEL_SIGNATURE function returns the list of columns from the build input table that were used by the build process to train the model. Starting from Oracle Database 12c Release 2, this function is deprecated. See "Static Data Dictionary Views: ALL_ALL_TABLES to ALL_OUTLINES" in *Oracle Database Reference*.

Syntax

```
FUNCTION get_model_signature (model_name IN VARCHAR2)
RETURN DM_Model_Signature PIPELINED;
```

Parameters

Table 53-105 GET_MODEL_SIGNATURE Function Parameters

Parameter	Description
model_name	Name of the model in the form [schema_name.]model_name. If you do not specify a schema, then your own schema is used.

Return Values

Table 53-106 GET_MODEL_SIGNATURE Function Return Values

Return Value	Description
DM_MODEL_SIGNATURE	<p>A set of rows of type DM_MODEL_SIGNATURE. The rows have the following columns:</p> <pre> DM_MODEL_SIGNATURE TABLE OF SYS.DM_MODEL_SIGNATURE_ATTRIBUTE Name Type ----- ATTRIBUTE_NAME VARCHAR2 (130) ATTRIBUTE_TYPE VARCHAR2 (106)</pre>

Usage Notes

1. This table function pipes out rows of type DM_MODEL_SIGNATURE. For information on machine learning data types and piped output from table functions, see ["DBMS_DATA_MINING Datatypes"](#).
2. The signature names or types include only those attributes used by the build process.

Examples

The following example returns model settings for an example naive Bayes model.

```

ATTRIBUTE_NAME          ATTRIBUTE_TYPE
-----
AGE                     NUMBER
ANNUAL_INCOME          NUMBER
AVERAGE__ITEMS_PURCHASED  NUMBER
BOOKKEEPING_APPLICATION  NUMBER
BULK_PACK_DISKETTES     NUMBER
BULK_PURCH_AVE_AMT     NUMBER
DISABLE_COOKIES        NUMBER
EDUCATION              VARCHAR2
FLAT_PANEL_MONITOR     NUMBER
GENDER                 VARCHAR2
HOME_THEATER_PACKAGE   NUMBER
HOUSEHOLD_SIZE         VARCHAR2
MAILING_LIST           NUMBER
MARITAL_STATUS         VARCHAR2
```

```

NO_DIFFERENT_KIND_ITEMS      NUMBER
OCCUPATION                   VARCHAR2
OS_DOC_SET_KANJI             NUMBER
PETS                          NUMBER
PRINTER_SUPPLIES             NUMBER
PROMO_RESPOND                NUMBER
SHIPPING_ADDRESS_COUNTRY     VARCHAR2
SR_CITIZEN                   NUMBER
TOP_REASON_FOR_SHOPPING      VARCHAR2
WKS_SINCE_LAST_PURCH         NUMBER
WORKCLASS                    VARCHAR2
YRS_RESIDENCE                NUMBER
Y_BOX_GAMES                  NUMBER

```

27 rows selected.

Related Topics

- [Oracle Database Reference](#)

53.8.35 GET_MODEL_DETAILS_SVD Function

The `GET_MODEL_DETAILS_SVD` function returns a set of rows that provide the details of a singular value decomposition model. Oracle recommends to use model details view settings. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

Refer to [Model Details View for Singular Value Decomposition](#).

Syntax

```

DBMS_DATA_MINING.get_model_details_svd(
    model_name IN VARCHAR2,
    matrix_type IN VARCHAR2 DEFAULT NULL,
    partition_name VARCHAR2 DEFAULT NULL)
RETURN DM_SVD_MATRIX_Set PIPELINED;

```

Parameters

Table 53-107 GET_MODEL_DETAILS_SVD Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is used.
<code>matrix_type</code>	Specifies which of the three SVD matrix types to return. Values are: U, S, V, and NULL. When <code>matrix_type</code> is null (default), all matrices are returned. The U matrix is only computed when the <code>SVDS_U_MATRIX_OUTPUT</code> setting is enabled. It is not computed by default. If the model does not contain U matrices and you set <code>matrix_type</code> to U, an empty set of rows is returned. See Table 53-27 .
<code>partition_name</code>	A partition in a partitioned model.

Return Values

Table 53-108 GET_MODEL_DETAILS_SVD Function Return Values

Return Value	Description
DM_SVD_MATRIX_SET	<p>A set of rows of type DM_SVD_MATRIX. The rows have the following columns:</p> <pre>(matrix_type CHAR(1), feature_id NUMBER, mapped_feature_id VARCHAR2(4000), attribute_name VARCHAR2(4000), attribute_subname VARCHAR2(4000), case_id VARCHAR2(4000), value NUMBER, variance NUMBER, pct_cum_variance NUMBER)</pre>

See Usage Notes for details.

Usage Notes

1. This table function pipes out rows of type DM_SVD_MATRIX. For information on machine learning data types and piped output from table functions, see ["Data Types"](#).

The columns in each row returned by GET_MODEL_DETAILS_SVD are described as follows:

Column in DM_SVD_MATRIX_SET	Description
matrix_type	The type of matrix. Possible values are S , V , and U . This field is never null.
feature_id	The feature that the matrix entry refers to.
mapped_feature_id	A descriptive name for the feature.
attribute_name	Column name in the V matrix component bases. This field is null for the S and U matrices.
attribute_subname	Subname in the V matrix component bases. This is relevant only in the case of a nested column. This field is null for the S and U matrices.
case_id	Unique identifier of the row in the build data described by the U matrix projection. This field is null for the S and V matrices.
value	The matrix entry value.
variance	The variance explained by a component. It is non-null only for S matrix entries. This column is non-null only for S matrix entries and for SVD models with setting <code>dbms_data_mining.svds_scoring_mode</code> set to <code>dbms_data_mining.svds_scoring_pca</code> and the build data is centered, either manually or because the setting <code>dbms_data_mining.prep_auto</code> is set to <code>dbms_data_mining.prep_auto_on</code> .

Column in DM_SVD_MATRIX_SET	Description
pct_cum_variance	<p>The percent cumulative variance explained by the components thus far. The components are ranked by the explained variance in descending order.</p> <p>This column is non-null only for S matrix entries and for SVD models with setting <code>dbms_data_mining.svds_scoring_mode</code> set to <code>dbms_data_mining.svds_scoring_pca</code> and the build data is centered, either manually or because the setting <code>dbms_data_mining.prep_auto</code> is set to <code>dbms_data_mining.prep_auto_on</code>.</p>

- The output of `GET_MODEL_DETAILS` is in sparse format. Zero values are not returned. Only the diagonal elements of the **S** matrix, the non-zero coefficients in the **V** matrix bases, and the non-zero **U** matrix projections are returned.

There is one exception: If the data row does not produce non-zero **U** Matrix projections, the case ID for that row is returned with `NULL` for the `feature_id` and value. This is done to avoid losing any records from the original data.
- `GET_MODEL_DETAILS` functions preserve model transparency by automatically reversing the transformations applied during the build process. Thus the attributes returned in the model details are the original attributes (or a close approximation of the original attributes) used to build the model.
- When the value is `NULL` for a partitioned model, an exception is thrown. When the value is not null, it must contain the preferred partition name.

Related Topics

- Oracle Machine Learning for SQL User's Guide*

53.8.36 GET_MODEL_DETAILS_SVM Function

The `GET_MODEL_DETAILS_SVM` function returns a set of rows that provide the details of a linear support vector machines (SVM) model. If invoked for nonlinear SVM, it returns `ORA-40215`. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views in *Oracle Machine Learning for SQL User's Guide*.

In linear SVM models, only nonzero coefficients are stored. This reduces storage and speeds up model loading. As a result, if an attribute is missing in the coefficient list returned by `GET_MODEL_DETAILS_SVM`, then the coefficient of this attribute should be interpreted as zero.

Syntax

```
DBMS_DATA_MINING.get_model_details_svm(
    model_name    VARCHAR2,
    reverse_coef  NUMBER DEFAULT 0,
    partition_name VARCHAR2 DEFAULT NULL)
RETURN DM_SVM_Linear_Coeff_Set PIPELINED;
```

Parameters

Table 53-109 GET_MODEL_DETAILS_SVM Function Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form [<i>schema_name</i> .] <i>model_name</i> . If you do not specify a schema, then your own schema is used.
<code>reverse_coef</code>	Whether or not <code>GET_MODEL_DETAILS_SVM</code> should transform the attribute coefficients using the original attribute transformations. When <code>reverse_coef</code> is set to 0 (default), <code>GET_MODEL_DETAILS_SVM</code> returns the coefficients directly from the model without applying transformations. When <code>reverse_coef</code> is set to 1, <code>GET_MODEL_DETAILS_SVM</code> transforms the coefficients and bias by applying the normalization shifts and scales that were generated using automatic data preparation. See Usage Note 4.
<code>partition_name</code>	Specifies a partition in a partitioned model.

Return Values

Table 53-110 GET_MODEL_DETAILS_SVM Function Return Values

Return Value	Description
<code>DM_SVM_LINEAR_COEFF_SET</code>	A set of rows of type <code>DM_SVM_LINEAR_COEFF</code> . The rows have the following columns: <pre>(class VARCHAR2(4000), attribute_set DM_SVM_ATTRIBUTE_SET)</pre> <p>The <code>attribute_set</code> column returns a nested table of type <code>DM_SVM_ATTRIBUTE_SET</code>. The rows, of type <code>DM_SVM_ATTRIBUTE</code>, have the following columns:</p> <pre>(attribute_name VARCHAR2(4000), attribute_subname VARCHAR2(4000), attribute_value VARCHAR2(4000), coefficient NUMBER)</pre> <p>See Usage Notes.</p>

Usage Notes

1. This table function pipes out rows of type `DM_SVM_LINEAR_COEFF`. For information on machine learning data types and piped output from table functions, see "Data Types".
2. The `class` column of `DM_SVM_LINEAR_COEFF` contains classification target values. For SVM Regression models, `class` is null. For each classification target value, a set of coefficients is returned. For binary classification, one-class classification, and regression models, only a single set of coefficients is returned.
3. The `attribute_value` column in `DM_SVM_ATTRIBUTE_SET` is used for categorical attributes.
4. `GET_MODEL_DETAILS` functions preserve model transparency by automatically reversing the transformations applied during the build process. Thus the attributes returned in the

model details are the original attributes (or a close approximation of the original attributes) used to build the model.

The coefficients are related to the transformed, not the original, attributes. When returned directly with the model details, the coefficients may not provide meaningful information. If you want `GET_MODEL_DETAILS_SVM` to transform the coefficients such that they relate to the original attributes, set the `reverse_coef` parameter to 1.

5. When the value is `NULL` for a partitioned model, an exception is thrown. When the value is not null, it must contain the desired partition name.

Examples

The following example returns model details for the SVM classification model `SVMC_SH_Clas_sample`, which was created by the sample program `dmsvcdem.sql`. For information about the sample programs, see *Oracle Machine Learning for SQL User's Guide*.

```
WITH
  mod_dtls AS (
    SELECT *
      FROM TABLE(DBMS_DATA_MINING.GET_MODEL_DETAILS_SVM('SVMC_SH_Clas_sample'))
  ),
  model_details AS (
    SELECT D.class, A.attribute_name, A.attribute_value, A.coefficient
      FROM mod_dtls D,
           TABLE(D.attribute_set) A
     ORDER BY D.class, ABS(A.coefficient) DESC
  )
SELECT class, attribute_name aname, attribute_value aval, coefficient coeff
  FROM model_details
 WHERE ROWNUM < 11;
```

CLASS	ANAME	AVAL	COEFF
1			-2.85
1	BOOKKEEPING_APPLICATION		1.11
1	OCCUPATION	Other	-.94
1	HOUSEHOLD_SIZE	4-5	.88
1	CUST_MARITAL_STATUS	Married	.82
1	YRS_RESIDENCE		.76
1	HOUSEHOLD_SIZE	6-8	-.74
1	OCCUPATION	Exec.	.71
1	EDUCATION	11th	-.71
1	EDUCATION	Masters	.63

Related Topics

- *Oracle Machine Learning for SQL User's Guide*

53.8.37 GET_MODEL_DETAILS_XML Function

This function returns an XML object that provides the details of a decision tree model. Starting from Oracle Database 12c Release 2, this function is deprecated. Use model detail views instead.

See Model Detail Views for Decision Tree in *Oracle Machine Learning for SQL User's Guide*.

Syntax

```
DBMS_DATA_MINING.get_model_details_xml(
    model_name IN VARCHAR2,
    partition_name IN VARCHAR2 DEFAULT NULL)
RETURN XMLType;
```

Parameters

Table 53-111 GET_MODEL_DETAILS_XML Function Parameters

Parameter	Description
model_name	Name of the model in the form [<i>schema_name</i>]. <i>model_name</i> . If you do not specify a schema, then your own schema is used.
partition_name	Specifies a partition in a partitioned model.

Return Values

Table 53-112 GET_MODEL_DETAILS_XML Function Return Value

Return Value	Description
XMLTYPE	<p>The XML definition for the decision tree model. See "XMLTYPE" for details.</p> <p>The XML definition conforms to the Data Mining Group Predictive Model Markup Language (PMML) version 2.1 specification. The specification is available at https://dmg.org.</p> <p>If a nested attribute is used as a splitter, the attribute will appear in the XML document as field="<column_name>.<subname>", as opposed to the non-nested attributes which appear in the document as field="<column_name>".</p>

 **Note:**

The column names are surrounded by single quotes and a period separates the column_name from the subname.

The rest of the document style remains unchanged.

Usage Notes

Special characters that cannot be displayed by Oracle XML are converted to '#'.

Examples

The following statements in SQL*Plus return the details of the decision tree model dt_sh_clas_sample.

Note: The """ characters you will see in the XML output are a result of SQL*Plus behavior. To display the XML in proper format, cut and past it into a file and open the file in a browser.

```
column dt_details format a320
SELECT
  dbms_data_mining.get_model_details_xml('dt_sh_clas_sample')
  AS DT_DETAILS
FROM dual;
```

DT_DETAILS

```
-----
<PMML version="2.1">
  <Header copyright="Copyright (c) 2004, Oracle Corporation. All rights
    reserved."/>
  <DataDictionary numberOfFields="9">
    <DataField name="AFFINITY_CARD" optype="categorical"/>
    <DataField name="AGE" optype="continuous"/>
    <DataField name="BOOKKEEPING_APPLICATION" optype="continuous"/>
    <DataField name="CUST_MARITAL_STATUS" optype="categorical"/>
    <DataField name="EDUCATION" optype="categorical"/>
    <DataField name="HOUSEHOLD_SIZE" optype="categorical"/>
    <DataField name="OCCUPATION" optype="categorical"/>
    <DataField name="YRS_RESIDENCE" optype="continuous"/>
    <DataField name="Y_BOX_GAMES" optype="continuous"/>
  </DataDictionary>
  <TreeModel modelName="DT_SH_CLAS_SAMPLE" functionName="classification"
    splitCharacteristic="binarySplit">
    <Extension name="buildSettings">
      <Setting name="TREE_IMPURITY_METRIC" value="TREE_IMPURITY_GINI"/>
      <Setting name="TREE_TERM_MAX_DEPTH" value="7"/>
      <Setting name="TREE_TERM_MINPCT_NODE" value=".05"/>
      <Setting name="TREE_TERM_MINPCT_SPLIT" value=".1"/>
      <Setting name="TREE_TERM_MINREC_NODE" value="10"/>
      <Setting name="TREE_TERM_MINREC_SPLIT" value="20"/>
    <costMatrix>
      <costElement>
        <actualValue>0</actualValue>
        <predictedValue>0</predictedValue>
        <cost>0</cost>
      </costElement>
      <costElement>
        <actualValue>0</actualValue>
        <predictedValue>1</predictedValue>
        <cost>1</cost>
      </costElement>
      <costElement>
        <actualValue>1</actualValue>
        <predictedValue>0</predictedValue>
        <cost>8</cost>
      </costElement>
      <costElement>
        <actualValue>1</actualValue>
        <predictedValue>1</predictedValue>
        <cost>0</cost>
      </costElement>
    </costMatrix>
  </Extension>
</MiningSchema>
.
.
.
.
.
```

```

        .
    </Node>
</Node>
</TreeModel>
</PMML>

```

53.8.38 GET_MODEL_TRANSFORMATIONS Function

This function returns the transformation expressions embedded in the specified model. Starting from Oracle Database 12c Release 2, this function is deprecated. See "Static Data Dictionary Views: ALL_ALL_TABLES to ALL_OUTLINES" in *Oracle Database Reference*.

All GET_* interfaces are replaced by model views, and Oracle recommends that users reference the model views to retrieve the relevant information. The GET_MODEL_TRANSFORMATIONS function is replaced by the following:

- USER(/DBA/ALL)_MINING_MODEL_XFORMS: provides the user-embedded transformations
- DM\$VX prefixed model view: provides text feature extraction information
- D\$VN prefixed mode view: provides normalization and missing value information
- DM\$VB: provides binning information

See Also:

"About Transformation Lists" in [DBMS_DATA_MINING_TRANSFORM Operational Notes](#)

"GET_TRANSFORM_LIST Procedure"

"CREATE_MODEL Procedure"

"ALL_MINING_MODEL_XFORMS" in *Oracle Database Reference*

"DBA_MINING_MODEL_XFORMS" in *Oracle Database Reference*

"USER_MINING_MODEL_XFORMS" in *Oracle Database Reference*

Model Details View for Binning

Normalization and Missing Value Handling

Data Preparation for Text Features

Syntax

```

DBMS_DATA_MINING.get_model_transformations(
    model_name IN VARCHAR2,
    partition_name IN VARCHAR2 DEFAULT NULL)
RETURN DM_Transforms PIPELINED;

```

Parameters

Table 53-113 GET_MODEL_TRANSFORMATIONS Function Parameters

Parameter	Description
<code>model_name</code>	Indicates the name of the model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is used.
<code>partition_name</code>	Specifies a partition in a partitioned model

Return Values

Table 53-114 GET_MODEL_TRANSFORMATIONS Function Return Value

Return Value	Description								
<code>DM_TRANSFORMS</code>	<p>The transformation expressions embedded in <code>model_name</code>.</p> <p>The <code>DM_TRANSFORMS</code> type is a table of <code>DM_TRANSFORM</code> objects. Each <code>DM_TRANSFORM</code> has these fields:</p> <table border="1" style="margin-left: 40px;"> <tbody> <tr> <td><code>attribute_name</code></td> <td><code>VARCHAR2(4000)</code></td> </tr> <tr> <td><code>attribute_subname</code></td> <td><code>VARCHAR2(4000)</code></td> </tr> <tr> <td><code>expression</code></td> <td><code>CLOB</code></td> </tr> <tr> <td><code>reverse_expression</code></td> <td><code>CLOB</code></td> </tr> </tbody> </table>	<code>attribute_name</code>	<code>VARCHAR2(4000)</code>	<code>attribute_subname</code>	<code>VARCHAR2(4000)</code>	<code>expression</code>	<code>CLOB</code>	<code>reverse_expression</code>	<code>CLOB</code>
<code>attribute_name</code>	<code>VARCHAR2(4000)</code>								
<code>attribute_subname</code>	<code>VARCHAR2(4000)</code>								
<code>expression</code>	<code>CLOB</code>								
<code>reverse_expression</code>	<code>CLOB</code>								

Usage Notes

When Automatic Data Preparation (ADP) is enabled, both automatic and user-defined transformations may be associated with an attribute. In this case, the user-defined transformations are evaluated before the automatic transformations.

When invoked for a partitioned model, the `partition_name` parameter must be specified.

Examples

In this example, several columns in the `SH.CUSTOMERS` table are used to create a naive Bayes model. A transformation expression is specified for one of the columns. The model does not use ADP.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_year_of_birth, cust_income_level, cust_credit_limit
  FROM sh.customers;
```

```
describe mining_data
```

Name	Null?	Type
CUST_ID	NOT NULL	NUMBER
CUST_YEAR_OF_BIRTH	NOT NULL	NUMBER(4)
CUST_INCOME_LEVEL		VARCHAR2(30)
CUST_CREDIT_LIMIT		NUMBER

```
CREATE TABLE settings_nb(
  setting_name VARCHAR2(30),
  setting_value VARCHAR2(30));
```

```

BEGIN
  INSERT INTO settings_nb (setting_name, setting_value) VALUES
    (dbms_data_mining.algo_name, dbms_data_mining.algo_naive_bayes);
  INSERT INTO settings_nb (setting_name, setting_value) VALUES
    (dbms_data_mining.prep_auto, dbms_data_mining.prep_auto_off);
  COMMIT;
END;
/
DECLARE
  mining_data_xforms  dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.SET_TRANSFORM (
    xform_list          => mining_data_xforms,
    attribute_name      => 'cust_year_of_birth',
    attribute_subname   => null,
    expression          => 'cust_year_of_birth + 10',
    reverse_expression  => 'cust_year_of_birth - 10');
  dbms_data_mining.CREATE_MODEL (
    model_name          => 'new_model',
    mining_function     => dbms_data_mining.classification,
    data_table_name     => 'mining_data',
    case_id_column_name => 'cust_id',
    target_column_name  => 'cust_income_level',
    settings_table_name => 'settings_nb',
    data_schema_name    => null,
    settings_schema_name => null,
    xform_list          => mining_data_xforms );
END;
/
SELECT attribute_name, TO_CHAR(expression), TO_CHAR(reverse_expression)
       FROM TABLE (dbms_data_mining.GET_MODEL_TRANSFORMATIONS('new_model'));

ATTRIBUTE_NAME      TO_CHAR(EXPRESSION)      TO_CHAR(REVERSE_EXPRESSION)
-----
CUST_YEAR_OF_BIRTH  cust_year_of_birth + 10    cust_year_of_birth - 10

```

Related Topics

- [Oracle Database Reference](#)

53.8.39 GET_TRANSFORM_LIST Procedure

This procedure converts transformation expressions specified as `DM_TRANSFORMS` to a transformation list (`TRANSFORM_LIST`) that can be used in creating a model. `DM_TRANSFORMS` is returned by the `GET_MODEL_TRANSFORMATIONS` function.

You can also use routines in the `DBMS_DATA_MINING_TRANSFORM` package to construct a transformation list.

See Also:

- ["About Transformation Lists" in DBMS_DATA_MINING_TRANSFORM](#)
- ["GET_MODEL_TRANSFORMATIONS Function"](#)
- ["CREATE_MODEL Procedure"](#)

Syntax

```
DBMS_DATA_MINING.GET_TRANSFORM_LIST (
    xform_list          OUT NOCOPY TRANSFORM_LIST,
    model_xforms       IN  DM_TRANSFORMS);
```

Parameters

Table 53-115 GET_TRANSFORM_LIST Procedure Parameters

Parameter	Description										
xform_list	<p>A list of transformation specifications that can be embedded in a model. Accepted as a parameter to the CREATE_MODEL Procedure.</p> <p>The TRANSFORM_LIST type is a table of TRANSFORM_REC objects. Each TRANSFORM_REC has these fields:</p> <table border="1"> <tr> <td>attribute_name</td> <td>VARCHAR2(30)</td> </tr> <tr> <td>attribute_subname</td> <td>VARCHAR2(4000)</td> </tr> <tr> <td>expression</td> <td>EXPRESSION_REC</td> </tr> <tr> <td>reverse_expression</td> <td>EXPRESSION_REC</td> </tr> <tr> <td>attribute_spec</td> <td>VARCHAR2(4000)</td> </tr> </table> <p>For details about the TRANSFORM_LIST collection type, see Table 54-1.</p>	attribute_name	VARCHAR2(30)	attribute_subname	VARCHAR2(4000)	expression	EXPRESSION_REC	reverse_expression	EXPRESSION_REC	attribute_spec	VARCHAR2(4000)
attribute_name	VARCHAR2(30)										
attribute_subname	VARCHAR2(4000)										
expression	EXPRESSION_REC										
reverse_expression	EXPRESSION_REC										
attribute_spec	VARCHAR2(4000)										
model_xforms	<p>A list of embedded transformation expressions returned by the GET_MODEL_TRANSFORMATIONS Function for a specific model.</p> <p>The DM_TRANSFORMS type is a table of DM_TRANSFORM objects. Each DM_TRANSFORM has these fields:</p> <table border="1"> <tr> <td>attribute_name</td> <td>VARCHAR2(4000)</td> </tr> <tr> <td>attribute_subname</td> <td>VARCHAR2(4000)</td> </tr> <tr> <td>expression</td> <td>CLOB</td> </tr> <tr> <td>reverse_expression</td> <td>CLOB</td> </tr> </table>	attribute_name	VARCHAR2(4000)	attribute_subname	VARCHAR2(4000)	expression	CLOB	reverse_expression	CLOB		
attribute_name	VARCHAR2(4000)										
attribute_subname	VARCHAR2(4000)										
expression	CLOB										
reverse_expression	CLOB										

Examples

In this example, a model `mod1` is trained using several columns in the `SH.CUSTOMERS` table. The model uses ADP, which automatically bins one of the columns.

A second model `mod2` is trained on the same data without ADP, but it uses a transformation list that was obtained from `mod1`. As a result, both `mod1` and `mod2` have the same embedded transformation expression.

```
CREATE OR REPLACE VIEW mining_data AS
    SELECT cust_id, cust_year_of_birth, cust_income_level, cust_credit_limit
    FROM sh.customers;
```

```
describe mining_data
Name                                     Null?    Type
-----
CUST_ID                                 NOT NULL NUMBER
CUST_YEAR_OF_BIRTH                      NOT NULL NUMBER(4)
CUST_INCOME_LEVEL                        VARCHAR2(30)
CUST_CREDIT_LIMIT                        NUMBER
```

```
CREATE TABLE setmod1(setting_name VARCHAR2(30),setting_value VARCHAR2(30));
BEGIN
```

```

INSERT INTO setmod1 VALUES (dbms_data_mining.algo_name, dbms_data_mining.algo_naive_bayes);
INSERT INTO setmod1 VALUES (dbms_data_mining.prep_auto,dbms_data_mining.prep_auto_on);
dbms_data_mining.CREATE_MODEL (
    model_name           => 'mod1',
    mining_function      => dbms_data_mining.classification,
    data_table_name     => 'mining_data',
    case_id_column_name => 'cust_id',
    target_column_name  => 'cust_income_level',
    settings_table_name => 'setmod1');
    COMMIT;
END;
/
CREATE TABLE setmod2(setting_name VARCHAR2(30),setting_value VARCHAR2(30));
BEGIN
    INSERT INTO setmod2
        VALUES (dbms_data_mining.algo_name, dbms_data_mining.algo_naive_bayes);
    COMMIT;
END;
/
DECLARE
    v_xform_list        dbms_data_mining_transform.TRANSFORM_LIST;
    dmx                 DM_TRANSFORMS;
BEGIN
    EXECUTE IMMEDIATE
        'SELECT dm_transform(attribute_name, attribute_subname,expression, reverse_expression)
        FROM TABLE(dbms_data_mining.GET_MODEL_TRANSFORMATIONS (''mod1''))'
        BULK COLLECT INTO dmx;
    dbms_data_mining.GET_TRANSFORM_LIST (
        xform_list       => v_xform_list,
        model_xforms     => dmx);
    dbms_data_mining.CREATE_MODEL(
        model_name       => 'mod2',
        mining_function  => dbms_data_mining.classification,
        data_table_name  => 'mining_data',
        case_id_column_name => 'cust_id',
        target_column_name => 'cust_income_level',
        settings_table_name => 'setmod2',
        xform_list       => v_xform_list);
END;
/

-- Transformation expression embedded in mod1
SELECT TO_CHAR(expression) FROM TABLE (dbms_data_mining.GET_MODEL_TRANSFORMATIONS('mod1'));

TO_CHAR(EXPRESSION)
-----
CASE WHEN "CUST_YEAR_OF_BIRTH"<1915 THEN 0 WHEN "CUST_YEAR_OF_BIRTH"<=1915 THEN 0
WHEN "CUST_YEAR_OF_BIRTH"<=1920.5 THEN 1 WHEN "CUST_YEAR_OF_BIRTH"<=1924.5 THEN 2
.
.
.
.5 THEN 29 WHEN "CUST_YEAR_OF_BIRTH" IS NOT NULL THEN 30 END

-- Transformation expression embedded in mod2
SELECT TO_CHAR(expression) FROM TABLE (dbms_data_mining.GET_MODEL_TRANSFORMATIONS('mod2'));

TO_CHAR(EXPRESSION)
-----
CASE WHEN "CUST_YEAR_OF_BIRTH"<1915 THEN 0 WHEN "CUST_YEAR_OF_BIRTH"<=1915 THEN 0
WHEN "CUST_YEAR_OF_BIRTH"<=1920.5 THEN 1 WHEN "CUST_YEAR_OF_BIRTH"<=1924.5 THEN 2
.

```

```
.
.
.5 THEN 29 WHEN "CUST_YEAR_OF_BIRTH" IS NOT NULL THEN 30 END

-- Reverse transformation expression embedded in mod1
SELECT TO_CHAR(reverse_expression) FROM TABLE
(dbms_data_mining.GET_MODEL_TRANSFORMATIONS('mod1'));

TO_CHAR(REVERSE_EXPRESSION)
-----
DECODE("CUST_YEAR_OF_BIRTH",0,'( ; 1915)', [1915; 1915]',1,'(1915; 1920.5]',2,'(1
920.5; 1924.5]',3,'(1924.5; 1928.5]',4,'(1928.5; 1932.5]',5,'(1932.5; 1936.5]',6
.
.
.
8,'(1987.5; 1988.5]',29,'(1988.5; 1989.5]',30,'(1989.5; )',NULL,'NULL')

-- Reverse transformation expression embedded in mod2
SELECT TO_CHAR(reverse_expression) FROM TABLE
(dbms_data_mining.GET_MODEL_TRANSFORMATIONS('mod2'));

TO_CHAR(REVERSE_EXPRESSION)
-----
DECODE("CUST_YEAR_OF_BIRTH",0,'( ; 1915)', [1915; 1915]',1,'(1915; 1920.5]',2,'(1
920.5; 1924.5]',3,'(1924.5; 1928.5]',4,'(1928.5; 1932.5]',5,'(1932.5; 1936.5]',6
.
.
.
8,'(1987.5; 1988.5]',29,'(1988.5; 1989.5]',30,'(1989.5; )',NULL,'NULL')
```

53.8.40 IMPORT_MODEL Procedure

This procedure imports one or more machine learning models. The procedure is overloaded. You can call it to import machine learning models from a dump file set, or you can call it to import a single machine learning model from a PMML document.

Import from a dump file set

You can import machine learning models from a dump file set that was created by the [EXPORT_MODEL Procedure](#). `IMPORT_MODEL` and `EXPORT_MODEL` use Oracle Data Pump technology to export to and import from a dump file set.

When Oracle Data Pump is used directly to export/import an entire schema or database, the machine learning models in the schema or database are included. `EXPORT_MODEL` and `IMPORT_MODEL` export/import machine learning models only.

Import from PMML

You can import a machine learning model represented in Predictive Model Markup Language (PMML). The model must be of type `RegressionModel`, either linear regression or binary logistic regression.

PMML is an XML-based standard specified by the Data Mining Group (<https://dmg.org>). Applications that are PMML-compliant can deploy PMML-compliant models that were created by any vendor. Oracle Machine Learning for SQL supports the core features of PMML 3.1 for regression models.

 **See Also:**

Oracle Machine Learning for SQL User's Guide for more information about exporting and importing machine learning models

Oracle Database Utilities for information about Oracle Data Pump

<https://dmg.org/dmg-faq.html> for more information about PMML

Syntax

Imports a machine learning model from a dump file set:

```
DBMS_DATA_MINING.IMPORT_MODEL (
    filename           IN  VARCHAR2,
    directory          IN  VARCHAR2,
    model_filter       IN  VARCHAR2 DEFAULT NULL,
    operation          IN  VARCHAR2 DEFAULT NULL,
    remote_link        IN  VARCHAR2 DEFAULT NULL,
    jobname            IN  VARCHAR2 DEFAULT NULL,
    schema_remap       IN  VARCHAR2 DEFAULT NULL,
    tablespace_remap   IN  VARCHAR2 DEFAULT NULL);
```

Imports a machine learning model from a PMML document:

```
DBMS_DATA_MINING.IMPORT_MODEL (
    model_name         IN  VARCHAR2,
    pmml_doc           IN  XMLTYPE,
    strict_check       IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 53-116 IMPORT_MODEL Procedure Parameters

Parameter	Description
filename	Name of the dump file set from which the models should be imported. The dump file set must have been created by the EXPORT_MODEL procedure or the expdp export utility of Oracle Data Pump. The dump file set can contain one or more files. (Refer to " EXPORT_MODEL Procedure " for details.) If the dump file set contains multiple files, you can specify 'filename%U' instead of listing them. For example, if your dump file set contains 3 files, archive01.dmp, archive02.dmp, and archive03.dmp, you can import them by specifying 'archive%U'.
directory	Name of a pre-defined directory object that specifies where the dump file set is located. Both the exporting and the importing user must have read/write access to the directory object and to the file system directory that it identifies. Note: The target database must also have read/write access to the file system directory.

Table 53-116 (Cont.) IMPORT_MODEL Procedure Parameters

Parameter	Description
model_filter	<p>Optional parameter that specifies one or more models to import. If you do not specify a value for <code>model_filter</code>, all models in the dump file set are imported. You can also specify <code>NULL</code> (the default) or <code>'ALL'</code> to import all models.</p> <p>The value of <code>model_filter</code> can be one or more model names. The following are valid filters.</p> <pre>'mymodel1'</pre> <pre>'name IN ('mymodel2','mymodel3')'</pre> <p>The first causes <code>IMPORT_MODEL</code> to import a single model named <code>mymodel1</code>. The second causes <code>IMPORT_MODEL</code> to import two models, <code>mymodel2</code> and <code>mymodel3</code>.</p>
operation	<p>Optional parameter that specifies whether to import the models or the SQL statements that create the models. By default, the models are imported.</p> <p>You can specify either of the following values for <code>operation</code>:</p> <ul style="list-style-type: none"> 'IMPORT' — Import the models (Default) 'SQL_FILE' — Write the SQL DDL for creating the models to a text file. The text file is named <code>job_name.sql</code> and is located in the dump set directory.
remote_link	<p>Optional parameter that specifies the name of a database link to a remote system. The default value is <code>NULL</code>. A database link is a schema object in a local database that enables access to objects in a remote database. When you specify a value for <code>remote_link</code>, you can import models into the local database from the remote database. The import is fileless; no dump file is involved. The <code>IMP_FULL_DATABASE</code> role is required for importing the remote models. The <code>EXP_FULL_DATABASE</code> privilege, the <code>CREATE DATABASE LINK</code> privilege, and other privileges may also be required. (See Example 2.)</p>
jobname	<p>Optional parameter that specifies the name of the import job. By default, the name has the form <code>username_imp_nnnn</code>, where <code>nnnn</code> is a number. For example, a job name in the <code>SCOTT</code> schema might be <code>SCOTT_imp_134</code>.</p> <p>If you specify a job name, it must be unique within the schema. The maximum length of the job name is 30 characters.</p> <p>A log file for the import job, named <code>jobname.log</code>, is created in the same directory as the dump file set.</p>
schema_remap	<p>Optional parameter for importing into a different schema. By default, models are exported and imported within the same schema.</p> <p>If the dump file set belongs to a different schema, you must specify a schema mapping in the form <code>export_user:import_user</code>. For example, you would specify <code>'SCOTT:MARY'</code> to import a model exported by <code>SCOTT</code> into the <code>MARY</code> schema.</p> <p>Note: In some cases, you may need to have the <code>IMP_FULL_DATABASE</code> privilege or the <code>SYS</code> role to import a model from a different schema.</p>
tablespace_remap	<p>Optional parameter for importing into a different tablespace. By default, models are exported and imported within the same tablespace.</p> <p>If the dump file set belongs to a different tablespace, you must specify a tablespace mapping in the form <code>export_tablespace:import_tablespace</code>. For example, you would specify <code>'TBLSPC01:TBLSPC02'</code> to import a model that was exported from tablespace <code>TBLSPC01</code> into tablespace <code>TBLSPC02</code>.</p> <p>Note: In some cases, you may need to have the <code>IMP_FULL_DATABASE</code> privilege or the <code>SYS</code> role to import a model from a different tablespace.</p>

Table 53-116 (Cont.) IMPORT_MODEL Procedure Parameters

Parameter	Description
model_name	Name for the new model that will be created in the database as a result of an import from PMML. The name must be unique within the user's schema.
pmml doc	The PMML document representing the model to be imported. The PMML document has an XMLTYPE object type. See "XMLTYPE" for details.
strict_check	Whether or not an error occurs when the PMML document contains sections that are not part of core PMML (for example, Output or Targets). OML4SQL supports only core PMML; any non-core features may affect the scoring representation. If the PMML does not strictly conform to core PMML and strict_check is set to TRUE, then IMPORT_MODEL returns an error. If strict_check is FALSE (the default), then the error is suppressed. The model may be imported and scored.

Examples

1. This example shows a model being exported and imported within the schema oml_user2. Then the same model is imported into the oml_user3 schema. The oml_user3 user has the IMP_FULL_DATABASE privilege. The oml_user2 user has been assigned the USER2 tablespace; oml_user3 has been assigned the USER3 tablespace.

```
SQL> connect oml_user2
Enter password: oml_user2_password
Connected.
SQL> select model_name from user_mining_models;

MODEL_NAME
-----
NMF_SH_SAMPLE
SVMO_SH_CLAS_SAMPLE
SVMR_SH_REGR_SAMPLE

-- export the model called NMF_SH_SAMPLE to a dump file in same schema
SQL>EXECUTE DBMS_DATA_MINING.EXPORT_MODEL (
        filename =>'NMF_SH_SAMPLE_out',
        directory =>'DATA_PUMP_DIR',
        model_filter => 'name = 'NMF_SH_SAMPLE''');

-- import the model back into the same schema
SQL>EXECUTE DBMS_DATA_MINING.IMPORT_MODEL (
        filename => 'NMF_SH_SAMPLE_out01.dmp',
        directory => 'DATA_PUMP_DIR',
        model_filter => 'name = 'NMF_SH_SAMPLE''');

-- connect as different user
-- import same model into that schema
SQL> connect oml_user3
Enter password: oml_user3_password
Connected.
SQL>EXECUTE DBMS_DATA_MINING.IMPORT_MODEL (
        filename => 'NMF_SH_SAMPLE_out01.dmp',
        directory => 'DATA_PUMP_DIR',
        model_filter => 'name = 'NMF_SH_SAMPLE'',
        operation =>'IMPORT',
        remote_link => NULL,
```

```

jobname => 'nmf_imp_job',
schema_remap => 'oml_user2:oml_user3',
tablespace_remap => 'USER2:USER3');

```

The following example shows user MARY importing all models from a dump file, model_exp_001.dmp, which was created by user SCOTT. User MARY has been assigned a tablespace named USER2; user SCOTT was assigned the tablespace USERS when the models were exported into the dump file model_exp_001.dmp. The dump file is located in the file system directory mapped to a directory object called DM_DUMP. If user MARY does not have IMP_FULL_DATABASE privileges, IMPORT_MODEL will raise an error.

```

-- import all models
DECLARE
  file_name VARCHAR2(40);
BEGIN
  file_name := 'model_exp_001.dmp';
  DBMS_DATA_MINING.IMPORT_MODEL(
    filename=> 'file_name',
    directory=>'DM_DUMP',
    schema_remap=>'SCOTT:MARY',
    tablespace_remap=>'USERS:USER2');
  DBMS_OUTPUT.PUT_LINE(
    'DBMS_DATA_MINING.IMPORT_MODEL of all models from SCOTT done!');
END;
/

```

2. This example shows how the user xuser could import the model oml_user.r1mod from a remote database. The SQL*Net connection alias for the remote database is R1DB. The user xuser is assigned the SYSAUX tablespace; the user oml_user is assigned the TBS_1 tablespace.

```

CONNECT / AS SYSDBA;
GRANT CREATE DATABASE LINK TO xuser;
GRANT imp_full_database TO xuser;
CONNECT xuser/xuserpassword
CREATE DATABASE LINK oml_user_link
  CONNECT TO oml_user IDENTIFIED BY oml_userpassword USING 'R1DB';
EXEC dbms_data_mining.import_model (
  NULL,
  'oml_user_DIR',
  'R1MOD',
  remote_link => 'oml_user_LINK', schema_remap => 'oml_user:XUSER',
  tablespace_remap => 'TBS_1:SYSAUX' );
SELECT name FROM dm_user_models;

```

```

NAME
-----
R1MOD

```

3. This example shows how a PMML document called SamplePMML1.xml could be imported from a location referenced by directory object PMMLDIR into the schema of the current user. The imported model will be called PMMLMODEL1.

```

BEGIN
  dbms_data_mining.import_model ('PMMLMODEL1',
    XMLType (bfilename ('PMMLDIR', 'SamplePMML1.xml'),
      nls_charset_id ('AL32UTF8')
    ));
END;

```

53.8.41 IMPORT_ONNX_MODEL Procedure

This procedure enables you to import an ONNX model into the Database.

Syntax

```
DBMS_DATA_MINING.IMPORT_ONNX_MODEL (
model_name  IN  VARCHAR2,
model_data  IN  BLOB,
metadata    IN  JSON);
```

Parameters

Table 53-117 IMPORT_ONNX_MODEL Procedure Parameters

Parameter	Description
model_name	Name of the model in the form [schema_name.]model_name. If you do not specify a schema, then your own schema is used.
model_data	It is a BLOB holding the ONNX representation of the model. The BLOB contains the identical byte sequence as the one stored in an ONNX file.
metadata	A JSON description of the metadata describing the model. The metadata at minimum must describe the machine learning function supported by the model. The model's metadata parameters are described in JSON Metadata Parameters for ONNX Models .

Example

The following example illustrates a code snippet of using the DBMS_DATA_MINING.IMPORT_ONNX_MODEL procedure. The complete step-by-step example is illustrated in Import ONNX Models and Generate Embeddings.

```
DBMS_DATA_MINING.IMPORT_ONNX_MODEL('my_embedding_model.onnx',
                                     'doc_model',
                                     JSON('{"function" : "embedding",
                                             "embeddingOutput" : "embedding" ,
                                             "input":{"input": ["DATA"]}}'));
```

Usage Notes

The name of the model follows the same restrictions as those used for other machine learning models, namely:

- The schema name, if provided, is limited to 128 characters.
- The model name is limited to 123 characters and must follow the rules of unquoted identifiers: they contain only alphanumeric characters, the underscore (_), dollar sign (\$), and pound sign (#). The initial character must be alphabetic.
- The model size is limited to 1 gigabyte.
- The model must not depend on external initializers. To know more about initializers and other ONNX concepts, see <https://onnx.ai/onnx/intro/concepts.html>.

53.8.42 IMPORT_SERMODEL Procedure

This procedure imports the serialized format of the model back into a database.

The import routine takes the serialized content in the `BLOB` and the name of the model to be created with the content. This import does not create model views or tables that are needed for querying model details. The import procedure only provides the ability to score the model.

Syntax

```
DBMS_DATA_MINING.IMPORT_SERMODEL (  
    model_data      IN BLOB,  
    model_name     IN VARCHAR2,);
```

Parameters

Table 53-118 IMPORT_SERMODEL Procedure Parameters

Parameter	Description
<code>model_data</code>	Provides model data in <code>BLOB</code> format.
<code>model_name</code>	Name of the machine learning model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is used.

Examples

The following statement imports the serialized format of the models.

```
declare  
    v_blob blob;  
BEGIN  
    dbms_lob.createtemporary(v_blob, FALSE);  
    -- fill in v_blob from somewhere (e.g., bfile, etc.)  
    dbms_data_mining.import_sermodel(v_blob, 'MY_MODEL');  
    dbms_lob.freetemporary(v_blob);  
END;  
/
```

Related Topics

- [EXPORT_SERMODEL Procedure](#)
This procedure exports the model in a serialized format so that they can be moved to another platform for scoring.

See Also:

Oracle Machine Learning for SQL User's Guide for more information about exporting and importing machine learning models

53.8.43 JSON Schema for R Extensible Algorithm

Provides some flexibility when creating a new JSON object following the JSON schema.

Usage Note

Some flexibility when creating a new JSON object is as follows:

- Partial registration is allowed. For example, the detail function can be missing.
- Different orders are allowed. For example, the detail function can be written before the build function or after it.

Example 53-1 JSON Schema

JSON schema 1.1 for R extensible algorithm:

```
{
  "type": "object",
  "properties": {
    "algo_name_display": { "type" : "object",
                          "properties" : {
                            "language" : { "type" :
"string",
"enum" : ["English", "Spanish", "French"],
"default" : "English"},
                            "name" : { "type" : "string"}}
},
    "function_language": {"type": "string" },
    "mining_function": {
      "type" : "array",
      "items" : [
        { "type" : "object",
          "properties" : {
            "mining_function_name" : { "type" : "string"},
            "build_function": {
              "type": "object",
              "properties": {
                "function_body": { "type": "CLOB" }
              }
            }
          }
        },
        { "type": "object",
          "properties": {
            "function_body": { "type": "CLOB" },
            "view_columns": { "type" : "array",
                              "items" :
{
```

```

"type" : "object",
  "properties" : {
    "name" : { "type" : "string"},
    "type" : { "type" : "string",
              "enum" : ["VARCHAR2",
                       "NUMBER",
                       "DATE",
                       "BOOLEAN"]}
  }
}
}
}
],
"score_function": {
  "type": "object",
  "properties": {
    "function_body": { "type": "CLOB" }
  },
  "weight_function": {
    "type": "object",
    "properties": {
      "function_body": { "type": "CLOB" },
    }
  }
}
}],
"algo_setting": {
  "type" : "array",
  "items" : [
    { "type" : "object",
      "properties" : {
        "name" : { "type" : "string"},
        "name_display": { "type" : "object"},
      }
    }
  ]
},
"properties" : {
  "language" :
{ "type" : "string",
  "enum" : ["English", "Spanish", "French"],

```



```

        "default" : "English"},
        "string"}}
        "name" : { "type" :
                    },
        "type" : { "type" : "string",
                  "enum" : ["string", "integer",
                           "number", "boolean"]},
        "optional": {"type" : "BOOLEAN",
                    "default" : "FALSE"},
        "value" : { "type" : "string"},
        "min_value" : { "type": "object",
                       "properties": {
                           "min_value":
{"type": "number"},
                           "inclusive":
{ "type": "boolean",
  "default" : TRUE},
                       }
                    },
        "max_value" : {"type": "object",
                       "properties": {
                           "max_value":
{"type": "number"},
                           "inclusive":
{ "type": "boolean",
  "default" : TRUE},
                       }
                    },
        "categorical choices" : { "type": "array",
                                  "items": {
"string"
                                  }
                                  },
        "description_display": { "type" : "object",
        "properties" : {
        "language" : { "type" : "string",
                      "enum" : ["English", "Spanish", "French"],
                      "default" : "English"},
        { "type" : "string"}}
        "name" :
        }
        }
    }
}

```

```

    ]
  }
}

```

Example 53-2 JSON object example

The following is an JSON object example that must be passed to the registration procedure:

```

{ "algo_name_display" : {"English", "t1"},
  "function_language" : "R",
  "mining_function" : {
    "mining_function_name" : "CLASSIFICATION",
    "build_function" : {"function_body":
"function(dat, formula, family)
{
set.seed(1234);
                                mod <- glm(formula =
formula, data=dat,
                                family=
eval(parse(text=family));
mod}}",
    "score_function" : { "function_body": "function(mod, dat) {
                                res <- predict(mod,
newdata = dat,
type='response
                                ');
                                res2=data.frame(1-res,
res); res2}}"}},
  "algo_setting" : [{"name" :
"dbms_data_mining.odms_m
issuing_value_treatment",
  "name_display" : {"English",
"dbms_data_mining.odms_missing_value
_treatment"},
  "type" : "string",
  "optional" : "TRUE",
  "value" :
"dbms_data_mining.odms_missing_value_mean_mode",
  "categorical_choices" :
[ "dbms_data_mining.odms_missing_value_mean_mode",
  "dbms_data_mining.odms_missing_value_auto",
  "dbms_data_mining.odms_missing_value_delete_row"],
  "description" : {"English",
"how to treat missing values"}
}],
}

```

```

{"name"           : "RALG_PARAMETER_FAMILY",
 "name_display"  : {"English",
 "RALG_PARAMETER_FAMILY"},
 "type"          : "string",
 "optional"      : "TRUE",
 "value"         : "",
 "description"   : {"English", "R family
parameter in build function"}
},
}

```

53.8.44 REGISTER_ALGORITHM Procedure

Use this function to register a new algorithm by providing the algorithm name, machine learning function, and all other algorithm metadata.

Syntax

```

DBMS_DATA_MINING.REGISTER_ALGORITHM (
    algorithm_name      IN VARCHAR2,
    algorithm_metadata  IN CLOB,
    algorithm_description IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 53-119 REGISTER_ALGORITHM Procedure Parameters

Parameter	Description
algorithm_name	Name of the algorithm.
algorithm_metadata	Metadata of the algorithm.
algorithm_description	Description of the algorithm.

Usage Notes

The registration procedure performs the following:

- Checks whether `algorithm_metadata` has correct JSON syntax.
- Checks whether the input JSON object follows the predefined JSON schema.
- Checks whether current user has `RQADMIN` privilege.
- Checks duplicate algorithms so that the same algorithm is not registered twice.
- Checks for missing entries. For example, algorithm name, algorithm type, metadata, and build function.

Register Algorithms After the JSON Object Is Created

SQL users can register new algorithms by creating a JSON object following the JSON schema and passing it to the `REGISTER_ALGORITHM` procedure.

```

BEGIN
  DBMS_DATA_MINING.register_algorithm(
    algorithm_name           => 't1',
    algorithm_metadata       =>
      '{"function_language" : "R",
       "mining_function" :
         { "mining_function_name" : "CLASSIFICATION",
           "build_function" : {"function_body": "function(dat,
formula, family) { set.seed(1234);
                                mod <- glm(formula =
formula, data=dat,
family=eval(parse(text=family)));
mod}}",
           "score_function" : {"function_body": "function(mod, dat) {
                                res <- predict(mod,
newdata = dat, type=''response'');
                                res2=data.frame(1-res,
res); res2}}"}',
    algorithm_description => 't1');
END;
/

```

53.8.45 RANK_APPLY Procedure

This procedure ranks the results of an `APPLY` operation based on a top-N specification for predictive and descriptive model results.

For classification models, you can provide a cost matrix as input, and obtain the ranked results with costs applied to the predictions.

Syntax

```

DBMS_DATA_MINING.RANK_APPLY (
  apply_result_table_name  IN VARCHAR2,
  case_id_column_name      IN VARCHAR2,
  score_column_name        IN VARCHAR2,
  score_criterion_column_name  IN VARCHAR2,
  ranked_apply_table_name IN VARCHAR2,
  top_N                    IN NUMBER (38) DEFAULT 1,
  cost_matrix_table_name   IN VARCHAR2   DEFAULT NULL,
  apply_result_schema_name IN VARCHAR2   DEFAULT NULL,
  cost_matrix_schema_name  IN VARCHAR2   DEFAULT NULL);

```

Parameters

Table 53-120 RANK_APPLY Procedure Parameters

Parameter	Description
<code>apply_result_table_name</code>	Name of the table or view containing the results of an <code>APPLY</code> operation on the test data set (see Usage Notes)
<code>case_id_column_name</code>	Name of the case identifier column. This must be the same as the one used for generating <code>APPLY</code> results.
<code>score_column_name</code>	Name of the prediction column in the apply results table
<code>score_criterion_column_name</code>	Name of the probability column in the apply results table
<code>ranked_apply_result_table_name</code>	Name of the table containing the ranked apply results
<code>top_N</code>	Top N predictions to be considered from the <code>APPLY</code> results for precision recall computation
<code>cost_matrix_table_name</code>	Name of the cost matrix table
<code>apply_result_schema_name</code>	Name of the schema hosting the <code>APPLY</code> results table
<code>cost_matrix_schema_name</code>	Name of the schema hosting the cost matrix table

Usage Notes

You can use `RANK_APPLY` to generate ranked apply results, based on a top-N filter and also with application of cost for predictions, if the model was built with costs.

The behavior of `RANK_APPLY` is similar to that of `APPLY` with respect to other DDL-like operations such as `CREATE_MODEL`, `DROP_MODEL`, and `RENAME_MODEL`. The procedure does not depend on the model; the only input of relevance is the apply results generated in a fixed schema table from `APPLY`.

The main intended use of `RANK_APPLY` is for the generation of the final `APPLY` results against the scoring data in a production setting. You can apply the model against test data using `APPLY`, compute various test metrics against various cost matrix tables, and use the candidate cost matrix for `RANK_APPLY`.

The schema for the apply results from each of the supported algorithms is listed in subsequent sections. The `case_id` column will be the same case identifier column as that of the apply results.

Classification Models — NB and SVM

For numerical targets, the ranked results table will have the definition as shown:

```
(case_id      VARCHAR2/NUMBER,
 prediction   NUMBER,
 probability  NUMBER,
 cost        NUMBER,
 rank        INTEGER)
```

For categorical targets, the ranked results table will have the following definition:

```
(case_id      VARCHAR2/NUMBER,
prediction    VARCHAR2,
probability   NUMBER,
cost         NUMBER,
rank         INTEGER)
```

Clustering Using *k*-Means or O-Cluster

Clustering is an unsupervised machine learning function, and hence there are no targets. The results of an `APPLY` operation contains simply the cluster identifier corresponding to a case, and the associated probability. Cost matrix is not considered here. The ranked results table will have the definition as shown, and contains the cluster ids ranked by `top-N`.

```
(case_id      VARCHAR2/NUMBER,
cluster_id    NUMBER,
probability   NUMBER,
rank         INTEGER)
```

Feature Extraction using NMF

Feature extraction is also an unsupervised machine learning function, and hence there are no targets. The results of an `APPLY` operation contains simply the feature identifier corresponding to a case, and the associated match quality. Cost matrix is not considered here. The ranked results table will have the definition as shown, and contains the feature ids ranked by `top-N`.

```
(case_id      VARCHAR2/NUMBER,
feature_id    NUMBER,
match_quality NUMBER,
rank         INTEGER)
```

Examples

```
BEGIN
/* build a model with name census_model.
 * (See example under CREATE_MODEL)
 */

/* if training data was pre-processed in any manner,
 * perform the same pre-processing steps on apply
 * data also.
 * (See examples in the section on DBMS_DATA_MINING_TRANSFORM)
 */

/* apply the model to data to be scored */
DBMS_DATA_MINING.RANK_APPLY(
  apply_result_table_name => 'census_apply_result',
  case_id_column_name     => 'person_id',
  score_column_name       => 'prediction',
  score_criterion_column_name => 'probability'
  ranked_apply_result_tab_name => 'census_ranked_apply_result',
  top_N                   => 3,
  cost_matrix_table_name  => 'census_cost_matrix');
END;
/

-- View Ranked Apply Results
SELECT *
  FROM census_ranked_apply_result;
```

53.8.46 REMOVE_COST_MATRIX Procedure

The `REMOVE_COST_MATRIX` procedure removes the default scoring matrix from a classification model.

See Also:

- ["ADD_COST_MATRIX Procedure"](#)
- ["REMOVE_COST_MATRIX Procedure"](#)

Syntax

```
DBMS_DATA_MINING.REMOVE_COST_MATRIX (
    model_name IN VARCHAR2);
```

Parameters

Table 53-121 Remove_Cost_Matrix Procedure Parameters

Parameter	Description
<code>model_name</code>	Name of the model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, your own schema is used.

Usage Notes

If the model is not in your schema, then `REMOVE_COST_MATRIX` requires the `ALTER ANY MINING MODEL` system privilege or the `ALTER` object privilege for the machine learning model.

Example

The naive Bayes model `NB_SH_CLAS_SAMPLE` has an associated cost matrix that can be used for scoring the model.

```
SQL>SELECT *
      FROM TABLE(dbms_data_mining.get_model_cost_matrix('nb_sh_clas_sample'))
      ORDER BY predicted, actual;
```

ACTUAL	PREDICTED	COST
0	0	0
1	0	.75
0	1	.25
1	1	0

You can remove the cost matrix with `REMOVE_COST_MATRIX`.

```
SQL>EXECUTE dbms_data_mining.remove_cost_matrix('nb_sh_clas_sample');
```

```
SQL>SELECT *
      FROM TABLE(dbms_data_mining.get_model_cost_matrix('nb_sh_clas_sample'))
      ORDER BY predicted, actual;
```

no rows selected

53.8.47 RENAME_MODEL Procedure

This procedure changes the name of the machine learning model indicated by *model_name* to the name that you specify as *new_model_name*.

If a model with *new_model_name* already exists, then the procedure optionally renames *new_model_name* to *versioned_model_name* before renaming *model_name* to *new_model_name*.

The model name is in the form [*schema_name*].*model_name*. If you do not specify a schema, your own schema is used. For machine learning model naming restrictions, see the Usage Notes for "[CREATE_MODEL Procedure](#)".

Syntax

```
DBMS_DATA_MINING.RENAME_MODEL (
  model_name          IN VARCHAR2,
  new_model_name      IN VARCHAR2,
  versioned_model_name IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 53-122 RENAME_MODEL Procedure Parameters

Parameter	Description
<i>model_name</i>	Model to be renamed.
<i>new_model_name</i>	New name for the model <i>model_name</i> .
<i>versioned_model_name</i>	New name for the model <i>new_model_name</i> if it already exists.

Usage Notes

If you attempt to rename a model while it is being applied, then the model will be renamed but the apply operation will return indeterminate results.

Examples

- This example changes the name of model `census_model` to `census_model_2012`.

```
BEGIN
  DBMS_DATA_MINING.RENAME_MODEL(
    model_name      => 'census_model',
    new_model_name  => 'census_model_2012');
END;
/
```

- In this example, there are two classification models in the user's schema: `clas_mod`, the working model, and `clas_mod_tst`, a test model. The `RENAME_MODEL` procedure preserves `clas_mod` as `clas_mod_old` and makes the test model the new working model.

```
SELECT model_name FROM user_mining_models;
MODEL_NAME
-----
CLAS_MOD
```



```
CLAS_MOD_TST
```

```
BEGIN
```

```
  DBMS_DATA_MINING.RENAME_MODEL(  
    model_name      => 'clas_mod_tst',  
    new_model_name  => 'clas_mod',  
    versioned_model_name => 'clas_mod_old');
```

```
END;
```

```
/
```

```
SELECT model_name FROM user_mining_models;
```

```
MODEL_NAME
```

```
-----  
CLAS_MOD
```

```
CLAS_MOD_OLD
```

DBMS_DATA_MINING_TRANSFORM

DBMS_DATA_MINING_TRANSFORM implements a set of transformations that are commonly used in machine learning.

This chapter contains the following topics:

- [Overview](#)
- [Operational Notes](#)
- [Security Model](#)
- [Datatypes](#)
- [Constants](#)
- [Summary of DBMS_DATA_MINING_TRANSFORM Subprograms](#)



See Also:

- [DBMS_DATA_MINING](#)
- *Oracle Machine Learning for SQL User's Guide*

54.1 DBMS_DATA_MINING_TRANSFORM Overview

A transformation is a SQL expression that modifies the data in one or more columns.

Data must typically undergo certain transformations before it can be used to build a machine learning model. Many machine learning algorithms have specific transformation requirements.

Data that will be scored must be transformed in the same way as the data that was used to create (train) the model.

External or Embedded Transformations

DBMS_DATA_MINING_TRANSFORM offers two approaches to implementing transformations. For a given model, you can either:

- Create a list of transformation expressions and pass it to the [CREATE_MODEL Procedure](#)
- or
- Create a view that implements the transformations and pass the name of the view to the [CREATE_MODEL Procedure](#)

If you create a transformation list and pass it to CREATE_MODEL, the transformation expressions are embedded in the model and automatically implemented whenever the model is applied.

If you create a view, the transformation expressions are external to the model. You will need to re-create the transformations whenever you apply the model.

**Note:**

Embedded transformations significantly enhance the model's usability while simplifying the process of model management.

Automatic Transformations

Oracle Machine Learning for SQL supports an Automatic Data Preparation (ADP) mode. When ADP is enabled, most algorithm-specific transformations are *automatically* embedded. Any additional transformations must be explicitly provided in an embedded transformation list or in a view.

If ADP is enabled and you create a model with a transformation list, both sets of transformations are embedded. The model will execute the user-specified transformations from the transformation list before executing the automatic transformations specified by ADP.

Within a transformation list, you can selectively disable ADP for individual attributes.

**See Also:**

["Automatic Data Preparation"](#)

Oracle Machine Learning for SQL User's Guide for a more information about ADP

["DBMS_DATA_MINING_TRANSFORM-About Transformation Lists"](#)

Transformations in DBMS_DATA_MINING_TRANSFORM

The transformations supported by `DBMS_DATA_MINING_TRANSFORM` are summarized in this section.

Binning

Binning refers to the mapping of continuous or discrete values to discrete values of reduced cardinality.

- Supervised Binning (Categorical and Numerical)
Binning is based on intrinsic relationships in the data as determined by a decision tree model.
See ["INSERT_BIN_SUPER Procedure"](#).
- Top-N Frequency Categorical Binning
Binning is based on the number of cases in each category.
See ["INSERT_BIN_CAT_FREQ Procedure"](#)
- Equi-Width Numerical Binning

Binning is based on equal-range partitions.

See "[INSERT_BIN_NUM_EQWIDTH Procedure](#)".

- Quantile Numerical Binning

Binning is based on quantiles computed using the SQL `NTILE` function.

See "[INSERT_BIN_NUM_QTILE Procedure](#)".

Linear Normalization

Normalization is the process of scaling continuous values down to a specific range, often between zero and one. Normalization transforms each numerical value by subtracting a number (the **shift**) and dividing the result by another number (the **scale**).

```
x_new = (x_old-shift)/scale
```

- Min-Max Normalization

Normalization is based on the minimum and maximum with the following shift and scale:

```
shift = min
scale = max-min
```

See "[INSERT_NORM_LIN_MINMAX Procedure](#)".

- Scale Normalization

Normalization is based on the minimum and maximum with the following shift and scale:

```
shift = 0
scale = max{abs(max), abs(min)}
```

See "[INSERT_NORM_LIN_SCALE Procedure](#)".

- Z-Score Normalization

Normalization is based on the mean and standard deviation with the following shift and scale:

```
shift = mean
scale = standard_deviation
```

See "[INSERT_NORM_LIN_ZSCORE Procedure](#)".

Outlier Treatment

An outlier is a numerical value that is located far from the rest of the data. Outliers can artificially skew the results of machine learning.

- Winsorizing

Outliers are replaced with the nearest value that is not an outlier.

See "[INSERT_CLIP_WINSOR_TAIL Procedure](#)".

- Trimming

Outliers are set to `NULL`.

See "[INSERT_CLIP_TRIM_TAIL Procedure](#)".

Missing Value Treatment

Missing data may indicate sparsity or it may indicate that some values are missing at random. `DBMS_DATA_MINING_TRANSFORM` supports the following transformations for minimizing the effects of missing values:

- Missing numerical values are replaced with the mean.
See "[INSERT_MISS_NUM_MEAN Procedure](#)".
- Missing categorical values are replaced with the mode.
See "[INSERT_MISS_CAT_MODE Procedure](#)".

**Note:**

Oracle Machine Learning for SQL also has default mechanisms for handling missing data. See *Oracle Machine Learning for SQL User's Guide* for details.

54.2 DBMS_DATA_MINING_TRANSFORM Operational Notes

The `DBMS_DATA_MINING_TRANSFORM` package offers a flexible framework for specifying data transformations. If you choose to embed transformations in the model (the preferred method), you create a **transformation list** object and pass it to the `CREATE_MODEL` Procedure. If you choose to transform the data without embedding, you create a view.

When specified in a transformation list, the transformation expressions are run by the model. When specified in a view, the transformation expressions are run by the view.

Transformation Definitions

Transformation definitions are used to generate the SQL expressions that transform the data. For example, the transformation definitions for normalizing a numeric column are the shift and scale values for that data.

With the `DBMS_DATA_MINING_TRANSFORM` package, you can call procedures to compute the transformation definitions, or you can compute them yourself, or you can do both.

Transformation Definition Tables

`DBMS_DATA_MINING_TRANSFORM` provides **INSERT** procedures that compute transformation definitions and insert them in transformation definition tables. You can modify the values in the transformation definition tables or populate them yourself.

XFORM routines use populated definition tables to transform data in external views. **STACK** routines use populated definition tables to build transformation lists.

To specify transformations based on definition tables, follow these steps:

1. Use **CREATE** routines to create transformation definition tables.

The tables have columns to hold the transformation definitions for a given type of transformation. For example, the [CREATE_BIN_NUM Procedure](#) creates a definition table that has a column for storing data values and another column for storing the associated bin identifiers.

2. Use **INSERT** routines to compute and insert transformation definitions in the tables.

Each **INSERT** routine uses a specific technique for computing the transformation definitions. For example, the [INSERT_BIN_NUM_EQWIDTH Procedure](#) computes bin boundaries by identifying the minimum and maximum values then setting the bin boundaries at equal intervals.

3. Use **STACK** or **XFORM** routines to generate transformation expressions based on the information in the definition tables:
 - Use **STACK** routines to add the transformation expressions to a transformation list. Pass the transformation list to the [CREATE_MODEL Procedure](#). The transformation expressions will be assembled into one long SQL query and embedded in the model.
 - Use **XFORM** routines to execute the transformation expressions within a view. The transformations will be external to the model and will need to be re-created whenever the model is applied to new data.

Transformations Without Definition Tables

STACK routines are not the only method for adding transformation expressions to a transformation list. You can also build a transformation list without using definition tables.

To specify transformations without using definition tables, follow these steps:

1. Write a SQL expression for transforming an attribute.
2. Write a SQL expression for reversing the transformation. (See "Reverse Transformations and Model Transparency" in "[DBMS_DATA_MINING_TRANSFORM-About Transformation Lists](#)".)
3. Determine whether or not to disable ADP for the attribute. By default ADP is enabled for the attribute if it is specified for the model. (See "Disabling Automatic Data Preparation" in "[DBMS_DATA_MINING_TRANSFORM - About Transformation Lists](#)".)
4. Specify the SQL expressions and ADP instructions in a call to the [SET_TRANSFORM Procedure](#), which adds the information to a transformation list.
5. Repeat steps 1 through 4 for each attribute that you wish to transform.
6. Pass the transformation list to the [CREATE_MODEL Procedure](#). The transformation expressions will be assembled into one long SQL query and embedded in the model.

Note:

SQL expressions that you specify with `SET_TRANSFORM` must fit within a `VARCHAR2`. To specify a longer expression, you can use the [SET_EXPRESSION Procedure](#). With `SET_EXPRESSION`, you can build an expression by appending rows to a `VARCHAR2` array.

About Stacking

Transformation lists are built by stacking transformation records. Transformation lists are evaluated from bottom to top. Each transformation expression depends on the result of the transformation expression below it in the stack.

Related Topics

- [CREATE_MODEL Procedure](#)
This procedure creates an Oracle Machine Learning for SQL model with a given machine learning function.
- [DBMS_DATA_MINING_TRANSFORM — About Transformation Lists](#)
The elements of a transformation list are **transformation records**. Each transformation record provides all the information needed by the model for managing the transformation of a single attribute.
- [DBMS_DATA_MINING_TRANSFORM — About Stacking and Stack Procedures](#)
Transformation lists are built by stacking transformation records. Transformation lists are evaluated from bottom to top. Each transformation expression depends on the result of the transformation expression below it in the stack.
- [DBMS_DATA_MINING_TRANSFORM — Nested Data Transformations](#)
The `CREATE` routines create transformation definition tables that include two columns, `col` and `att`, for identifying attributes.

54.2.1 DBMS_DATA_MINING_TRANSFORM — About Transformation Lists

The elements of a transformation list are **transformation records**. Each transformation record provides all the information needed by the model for managing the transformation of a single attribute.

Each transformation record includes the following fields:

- *attribute_name* — Name of the column of data to be transformed
- *attribute_subname* — Name of the nested attribute if *attribute_name* is a nested column, otherwise `NULL`
- *expression* — SQL expression for transforming the attribute
- *reverse_expression* — SQL expression for reversing the transformation
- *attribute_spec* — Identifies special treatment for the attribute during the model build. See [Table 54-33](#) for details.



See Also:

- [Table 54-1](#) for details about the `TRANSFORM_LIST` and `TRANSFORM_REC` object types
- [SET_TRANSFORM Procedure](#)
- [CREATE_MODEL Procedure](#)

Reverse Transformations and Model Transparency

An algorithm manipulates transformed attributes to train and score a model. The transformed attributes, however, may not be meaningful to an end user. For example, if attribute *x* has been transformed into bins 1 — 4, the bin names 1, 2, 3, and 4 are

manipulated by the algorithm, but a user is probably not interested in the model details about bins 1 — 4 or in predicting the numbers 1 — 4.

To return original attribute values in model details and predictions, you can provide a reverse expression in the transformation record for the attribute. For example, if you specify the transformation expression `'log(10, y)'` for attribute `y`, you could specify the reverse transformation expression `'power(10, y)'`.

Reverse transformations enable **model transparency**. They make internal processing transparent to the user.

 **Note:**

STACK procedures automatically reverse normalization transformations, but they do not provide a mechanism for reversing binning, clipping, or missing value transformations.

You can use the `DBMS_DATA_MINING.ALTER_REVERSE_EXPRESSION` procedure to specify or update reverse transformations expressions for an existing model.

 **See Also:**

[Table 54-1](#)

["ALTER_REVERSE_EXPRESSION Procedure"](#)

["Summary of DBMS_DATA_MINING Subprograms"](#) for links to the model details functions

Disabling Automatic Data Preparation

ADP is controlled by a model-specific setting (`PREP_AUTO`). The `PREP_AUTO` setting affects all model attributes unless you disable it for individual attributes.

If ADP is enabled and you set `attribute_spec` to `NOPREP`, only the transformations that you specify for that attribute will be evaluated. If ADP is enabled and you do *not* set `attribute_spec` to `NOPREP`, the automatic transformations will be evaluated *after* the transformations that you specify for the attribute.

If ADP is not enabled for the model, the `attribute_spec` field of the transformation record is ignored.

 **See Also:**

["Automatic Data Preparation"](#) for information about the `PREP_AUTO` setting

Adding Transformation Records to a Transformation List

A transformation list is a stack of transformation records. When a new transformation record is added, it is appended to the top of the stack. (See "[About Stacking](#)" for details.)

When you use `SET_TRANSFORM` to add a transformation record to a transformation list, you can specify values for all the fields in the transformation record.

When you use `STACK` procedures to add transformation records to a transformation list, only the transformation expression field is populated. For normalization transformations, the reverse transformation expression field is also populated.

You can use both `STACK` procedures and `SET_TRANSFORM` to build one transformation list. Each `STACK` procedure call adds transformation records for all the attributes in a specified transformation definition table. Each `SET_TRANSFORM` call adds a transformation record for a single attribute.

54.2.2 DBMS_DATA_MINING_TRANSFORM — About Stacking and Stack Procedures

Transformation lists are built by stacking transformation records. Transformation lists are evaluated from bottom to top. Each transformation expression depends on the result of the transformation expression below it in the stack.

Stack Procedures

`STACK` procedures create transformation records from the information in transformation definition tables. For example `STACK_BIN_NUM` builds a transformation record for each attribute specified in a definition table for numeric binning. `STACK` procedures stack the transformation records as follows:

- If an attribute is specified in the definition table but not in the transformation list, the `STACK` procedure creates a transformation record, computes the reverse transformation (if possible), inserts the transformation and reverse transformation in the transformation record, and appends the transformation record to the top of the transformation list.
- If an attribute is specified in the transformation list but not in the definition table, the `STACK` procedure takes no action.
- If an attribute is specified in the definition table *and* in the transformation list, the `STACK` procedure stacks the transformation expression from the definition table on top of the transformation expression in the transformation record and updates the reverse transformation. See [Table 54-1](#) and [Example 54-4](#).

Example 54-1 Stacking a Clipping Transformation

This example shows how [STACK_CLIP Procedure](#) would add transformation records to a transformation list. Note that the clipping transformations are not reversed in `COL1` and `COL2` after stacking (as described in "Reverse Transformations and Model Transparency" in "[DBMS_DATA_MINING_TRANSFORM-About Transformation Lists](#)").

Refer to:

- [CREATE_CLIP Procedure](#) — Creates the definition table

- [INSERT_CLIP_TRIM_TAIL Procedure](#) — Inserts definitions in the table
- [INSERT_CLIP_WINSOR_TAIL Procedure](#) — Inserts definitions in the table
- [Table 54-1](#) — Describes the structure of the transformation list (TRANSFORM_LIST object)

Assume a clipping definition table populated as follows.

col	att	lcut	lval	rcut	rval
COL1	null	-1.5	-1.5	4.5	4.5
COL2	null	0	0	1	1

Assume the following transformation list before stacking.

```

-----
transformation record #1:
-----
    attribute_name      = COL1
    attribute_subname   = null
    expression          = log(10, COL1)
    reverse_expression  = power(10, COL1)
-----
transformation record #2:
-----
    attribute_name      = COL3
    attribute_subname   = null
    expression          = ln(COL3)
    reverse_expression  = exp(COL3)

```

After stacking, the transformation list is as follows.

```

-----
transformation record #1:
-----
    attribute_name      = COL1
    attribute_subname   = null
    expression          = CASE WHEN log(10, COL1) < -1.5 THEN -1.5
                          WHEN log(10, COL1) > 4.5 THEN 4.5
                          ELSE log(10, COL1)
                          END;
    reverse_expression  = power(10, COL1)
-----
transformation record #2:
-----
    attribute_name      = COL3
    attribute_subname   = null
    expression          = ln(COL3)
    reverse_expression  = exp(COL3)
-----
transformation record #3:
-----
    attribute_name      = COL2
    attribute_subname   = null
    expression          = CASE WHEN COL2 < 0 THEN 0
                          WHEN COL2 > 1 THEN 1
                          ELSE COL2
                          END;
    reverse_expression  = null

```

54.2.3 DBMS_DATA_MINING_TRANSFORM — Nested Data Transformations

The `CREATE` routines create transformation definition tables that include two columns, `col` and `att`, for identifying attributes.

The column `col` holds the name of a column in the data table. If the data column is not nested, then `att` is null, and the name of the attribute is `col`. If the data column is nested, then `att` holds the name of the nested attribute, and the name of the attribute is `col.att`. The `INSERT` and `XFORM` routines ignore the `att` column in the definition tables. Neither the `INSERT` nor the `XFORM` routines support nested data.

Only the `STACK` procedures and `SET_TRANSFORM` support nested data. Nested data transformations are always embedded in the model.

Nested columns in Oracle Machine Learning for SQL can have the following types:

```
DM_NESTED_NUMERICALS
DM_NESTED_CATEGORICALS
DM_NESTED_BINARY_DOUBLES
DM_NESTED_BINARY_FLOATS
```



See Also:

"Constants"

Oracle Machine Learning for SQL User's Guide for details about nested attributes in Oracle Machine Learning for SQL

Specifying Nested Attributes in a Transformation Record

A transformation record (`TRANSFORM_REC`) includes two fields, `attribute_name` and `attribute_subname`, for identifying the attribute. The field `attribute_name` holds the name of a column in the data table. If the data column is not nested, then `attribute_subname` is null, and the name of the attribute is `attribute_name`. If the data column is nested, then `attribute_subname` holds the name of the nested attribute, and the name of the attribute is `attribute_name.attribute_subname`.

Transforming Individual Nested Attributes

You can specify different transformations for different attributes in a nested column, and you can specify a default transformation for all the remaining attributes in the column. To specify a default nested transformation, specify null in the `attribute_name` field and the name of the nested column in the `attribute_subname` field as shown in [Example 54-2](#). Note that the keyword `VALUE` is used to represent the value of a nested attribute in a transformation expression.

Example 54-2 Transforming a Nested Column

The following statement transforms two of the nested attributes in `COL_N1`. Attribute `ATTR1` is transformed with normalization; Attribute `ATTR2` is set to null, which causes

attribute removal transformation (ATTR2 is not used in training the model). All the remaining attributes in COL_N1 are divided by 10.

```
DECLARE
  stk dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.SET_TRANSFORM(
    stk,'COL_N1', 'ATTR1', '(VALUE - (-1.5))/20', 'VALUE *20 + (-1.5)');
  dbms_data_mining_transform.SET_TRANSFORM(
    stk,'COL_N1', 'ATTR2', NULL, NULL);
  dbms_data_mining_transform.SET_TRANSFORM(
    stk, NULL, 'COL_N1', 'VALUE/10', 'VALUE*10');
END;
/
```

The following SQL is generated from this statement.

```
CAST(MULTISET(SELECT DM_NESTED_NUMERICAL(
  "ATTRIBUTE_NAME",
  DECODE("ATTRIBUTE_NAME",
    'ATTR1', ("VALUE" - (-1.5))/20,
    "VALUE"/10))
  FROM TABLE("COL_N1")
  WHERE "ATTRIBUTE_NAME" IS NOT IN ('ATTR2'))
  AS DM_NESTED_NUMERICALS)
```

If transformations are not specified for COL_N1.ATTR1 and COL_N1.ATTR2, then the default transformation is used for all the attributes in COL_N1, and the resulting SQL does not include a DECODE.

```
CAST(MULTISET(SELECT DM_NESTED_NUMERICAL(
  "ATTRIBUTE_NAME",
  "VALUE"/10)
  FROM TABLE("COL_N1"))
  AS DM_NESTED_NUMERICALS)
```

Since DECODE is limited to 256 arguments, multiple DECODE functions are nested to support an arbitrary number of individual nested attribute specifications.

Adding a Nested Column

You can specify a transformation that adds a nested column to the data, as shown in [Example 54-3](#).

Example 54-3 Adding a Nested Column to a Transformation List

```
DECLARE
  v_xlst dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.SET_TRANSFORM(v_xlst,
    'YOB_CREDLIM', NULL,
    'dm_nested_numericals(
      dm_nested_numerical(
        'CUST_YEAR_OF_BIRTH', cust_year_of_birth),
      dm_nested_numerical(
        'CUST_CREDIT_LIMIT', cust_credit_limit))',
    NULL);
  dbms_data_mining_transform.SET_TRANSFORM(
    v_xlst, 'CUST_YEAR_OF_BIRTH', NULL, NULL, NULL);
  dbms_data_mining_transform.SET_TRANSFORM(
    v_xlst, 'CUST_CREDIT_LIMIT', NULL, NULL, NULL);
```

```

        dbms_data_mining_transform.XFORM_STACK(
            v_xlst, 'mining_data', 'mining_data_v');
END;
/

set long 2000
SELECT text FROM user_views WHERE view_name IN 'MINING_DATA_V';

TEXT
-----
SELECT "CUST_ID","CUST_POSTAL_CODE",dm_nested_numericals(
    dm_nested_numerical(
        'CUST_YEAR_OF_BIRTH', cust_year_of_birth),
    dm_nested_numerical(
        'CUST_CREDIT_LIMIT', cust_credit_limit)) "YOB_CREDLIM" FROM
mining_data

SELECT * FROM mining_data_v WHERE cust_id = 104500;

CUST_ID CUST_POSTAL_CODE YOB_CREDLIM(ATTRIBUTE_NAME, VALUE)
-----
-----
104500 68524          DM_NESTED_NUMERICALS(DM_NESTED_NUMERICAL(
                        'CUST_YEAR_OF_BIRTH', 1962),
                        DM_NESTED_NUMERICAL('CUST_CREDIT_LIMIT', 15000))

```

Stacking Nested Transformations

[Example 54-4](#) shows how the [STACK_NORM_LIN Procedure](#) would add transformation records for nested column COL_N to a transformation list.

Refer to:

- [CREATE_NORM_LIN Procedure](#) — Creates the definition table
- [INSERT_NORM_LIN_MINMAX Procedure](#) — Inserts definitions in the table
- [INSERT_NORM_LIN_SCALE Procedure](#) — Inserts definitions in the table
- [INSERT_NORM_LIN_ZSCORE Procedure](#) — Inserts definitions in the table
- [Table 54-1](#) — Describes the structure of the transformation list

Example 54-4 Stacking a Nested Normalization Transformation

Assume a linear normalization definition table populated as follows.

col	att	shift	scale
COL_N	ATT2	0	20
null	COL_N	0	10

Assume the following transformation list before stacking.

```

-----
transformation record #1:
-----
attribute_name      = COL_N
attribute_subname   = ATT1
expression          = log(10, VALUE)
reverse_expression  = power(10, VALUE)

```

```

-----
transformation record #2:
-----
attribute_name      = null
attribute_subname   = COL_N
expression          = ln(VALUE)
reverse_expression  = exp(VALUE)

```

After stacking, the transformation list is as follows.

```

-----
transformation record #1:
-----
attribute_name      = COL_N
attribute_subname   = ATT1
expression          = (log(10, VALUE) - 0)/10
reverse_expression  = power(10, VALUE*10 + 0)
-----
transformation record #2:
-----
attribute_name      = NULL
attribute_subname   = COL_N
expression          = (ln(VALUE)- 0)/10
reverse_expression  = exp(VALUE *10 + 0)
-----
transformation record #3:
-----
attribute_name      = COL_N
attribute_subname   = ATT2
expression          = (ln(VALUE) - 0)/20
reverse_expression  = exp(VALUE * 20 + 0)

```

54.3 DBMS_DATA_MINING_TRANSFORM Security Model

The `DBMS_DATA_MINING_TRANSFORM` package is owned by user `SYS` and is installed as part of database installation. Execution privilege on the package is granted to public. The routines in the package are run with invokers' rights (run with the privileges of the current user).

The `DBMS_DATA_MINING_TRANSFORM.INSERT_*` procedures have a `data_table_name` parameter that enables the user to provide the input data for transformation purposes. The value of `data_table_name` can be the name of a physical table or a view. The `data_table_name` parameter can also accept an inline query.

Note:

Because an inline query can be used to specify the data for transformation, Oracle strongly recommends that the calling routine perform any necessary SQL injection checks on the input string.

See Also:

"Operational Notes" for a description of the `DBMS_DATA_MINING_TRANSFORM.INSERT_*` procedures

54.4 DBMS_DATA_MINING_TRANSFORM Datatypes

DBMS_DATA_MINING_TRANSFORM defines the datatypes described in the following table.

Table 54-1 Datatypes in DBMS_DATA_MINING_TRANSFORM

List Type	List Elements	Description
COLUMN_LIST	VARRAY(1000) OF varchar2(32)	<p>COLUMN_LIST stores quoted and non-quoted identifiers for column names.</p> <p>COLUMN_LIST is the datatype of the <i>exclude_list</i> parameter in the INSERT procedures. See "INSERT_AUTOBIN_NUM_EQWIDTH Procedure" for an example.</p> <p>See <i>Oracle Database PL/SQL Language Reference</i> for information about populating VARRAY structures.</p>
DESCRIBE_LIST	<pre> DBMS_SQL.DESC_TAB2 TYPE desc_tab2 IS TABLE OF desc_rec2 INDEX BY BINARY_INTEGER TYPE desc_rec2 IS RECORD (col_type BINARY_INTEGER := 0, col_max_len BINARY_INTEGER := 0, col_name VARCHAR2(32767) := '', col_name_len BINARY_INTEGER := 0, col_schema_name VARCHAR2(32) := '', col_schema_name_len BINARY_INTEGER := 0, col_precision BINARY_INTEGER := 0, col_scale BINARY_INTEGER := 0, col_charsetid BINARY_INTEGER := 0, col_charsetform BINARY_INTEGER := 0, col_null_ok BOOLEAN := TRUE); </pre>	<p>DESCRIBE_LIST describes the columns of the data table after the transformation list has been applied. A DESCRIBE_LIST is returned by the DESCRIBE_STACK Procedure.</p> <p>The DESC_TAB2 and DESC_REC2 types are defined in the DBMS_SQL package. See "DESC_REC2 Record Type".</p> <p>The col_type field of DESC_REC2 identifies the datatype of the column. The datatype is expressed as a numeric constant that represents a built-in datatype. For example, a 1 indicates a variable length character string. The codes for Oracle built-in datatypes are listed in <i>Oracle Database SQL Language Reference</i>. The codes for the Oracle Machine Learning for SQL nested types are described in "Constants".</p> <p>The col_name field of DESC_REC2 identifies the column name. It may be populated with a column name, an alias, or an expression. If the column name is a SELECT expression, it may be very long. If the expression is longer than 30 bytes, it cannot be used in a view unless it is given an alias.</p>

Table 54-1 (Cont.) Datatypes in DBMS_DATA_MINING_TRANSFORM

List Type	List Elements	Description
TRANSFORM	TABLE OF transform_rec	TRANSFORM_LIST is a list of transformations that can be embedded in a model. A TRANSFORM_LIST is accepted as an argument by the CREATE_MODEL Procedure .
_LIST	<pre> TYPE transform_rec IS RECORD (attribute_name VARCHAR2(30), attribute_subname VARCHAR2(4000), expression EXPRESSION_REC, reverse_expression EXPRESSION_REC, attribute_spec VARCHAR2(4000)); TYPE expression_rec IS RECORD (lstmt DBMS_SQL.VARCHAR2A, lb BINARY_INTEGER DEFAULT 1, ub BINARY_INTEGER DEFAULT 0); TYPE varchar2a IS TABLE OF VARCHAR2(32767) INDEX BY BINARY_INTEGER; </pre>	<p>Each element in a TRANSFORM_LIST is a TRANSFORM_REC that specifies how to transform a single attribute. The attribute_name is a column name. The attribute_subname is the nested attribute name if the column is nested, otherwise attribute_subname is null.</p> <p>The expression field holds a SQL expression for transforming the attribute. See "About Transformation Lists" for an explanation of reverse expressions.</p> <p>The attribute_spec field can be used to cause the attribute to be handled in a specific way during the model build. See Table 54-33 for details.</p> <p>The expressions in a TRANSFORM_REC have type EXPRESSION_REC. The lstmt field stores a VARCHAR2A, which is a table of VARCHAR2(32767). The VARCHAR2A datatype allows transformation expressions to be very long, as they can be broken up across multiple rows of VARCHAR2. The VARCHAR2A type is defined in the DBMS_SQL package. See "VARCHAR2A Table Type".</p> <p>The ub (upper bound) and lb (lower bound) fields indicate how many rows there are in the VARCHAR2A table. If ub < lb (default) the EXPRESSION_REC is empty; if lb=ub=1 there is one row; if lb=1 and ub=2 there are 2 rows, and so on.</p>

54.5 DBMS_DATA_MINING_TRANSFORM Constants

DBMS_DATA_MINING_TRANSFORM defines the constants described in the following table.

Table 54-2 Constants in DBMS_DATA_MINING_TRANSFORM

Constant	Value	Description				
NEST_NUM_COL_TYPE	100001	Indicates that an attribute in the transformation list comes from a row in a column of DM_NESTED_NUMERICALS. Nested numerical attributes are defined as follows:				
		<table> <tr> <td>attribute_name</td> <td>VARCHAR2(4000)</td> </tr> <tr> <td>value</td> <td>NUMBER</td> </tr> </table>	attribute_name	VARCHAR2(4000)	value	NUMBER
attribute_name	VARCHAR2(4000)					
value	NUMBER					

Table 54-2 (Cont.) Constants in DBMS_DATA_MINING_TRANSFORM

Constant	Value	Description				
NEST_CAT_COL_TYPE	100002	Indicates that an attribute in the transformation list comes from a row in a column of DM_NESTED_CATEGORICALS. Nested categorical attributes are defined as follows: <table border="0"> <tr> <td>attribute_name</td> <td>VARCHAR2(4000)</td> </tr> <tr> <td>value</td> <td>VARCHAR2(4000)</td> </tr> </table>	attribute_name	VARCHAR2(4000)	value	VARCHAR2(4000)
attribute_name	VARCHAR2(4000)					
value	VARCHAR2(4000)					
NEST_BD_COL_TYPE	100003	Indicates that an attribute in the transformation list comes from a row in a column of DM_NESTED_BINARY_DOUBLES. Nested binary double attributes are defined as follows: <table border="0"> <tr> <td>attribute_name</td> <td>VARCHAR2(4000)</td> </tr> <tr> <td>value</td> <td>BINARY_DOUBLE</td> </tr> </table>	attribute_name	VARCHAR2(4000)	value	BINARY_DOUBLE
attribute_name	VARCHAR2(4000)					
value	BINARY_DOUBLE					
NEST_BF_COL_TYPE	100004	Indicates that an attribute in the transformation list comes from a row in a column of DM_NESTED_BINARY_FLOATS. <table border="0"> <tr> <td>attribute_name</td> <td>VARCHAR2(4000)</td> </tr> <tr> <td>value</td> <td>BINARY_FLOAT</td> </tr> </table>	attribute_name	VARCHAR2(4000)	value	BINARY_FLOAT
attribute_name	VARCHAR2(4000)					
value	BINARY_FLOAT					



See Also:

Oracle Machine Learning for SQL User's Guide for information about nested data in Oracle Machine Learning for SQL

54.6 Summary of DBMS_DATA_MINING_TRANSFORM Subprograms

This table lists the DBMS_DATA_MINING_TRANSFORM subprograms in alphabetical order and briefly describes them.

Table 54-3 DBMS_DATA_MINING_TRANSFORM Package Subprograms

Subprogram	Purpose
CREATE_BIN_CAT Procedure	Creates a transformation definition table for categorical binning
CREATE_BIN_NUM Procedure	Creates a transformation definition table for numerical binning
CREATE_CLIP Procedure	Creates a transformation definition table for clipping
CREATE_COL_REM Procedure	Creates a transformation definition table for column removal
CREATE_MISS_CAT Procedure	Creates a transformation definition table for categorical missing value treatment
CREATE_MISS_NUM Procedure	Creates a transformation definition table for numerical missing values treatment

Table 54-3 (Cont.) DBMS_DATA_MINING_TRANSFORM Package Subprograms

Subprogram	Purpose
CREATE_NORM_LIN Procedure	Creates a transformation definition table for linear normalization
DESCRIBE_STACK Procedure	Describes the transformation list
GET_EXPRESSION Function	Returns a VARCHAR2 chunk from a transformation expression
INSERT_AUTOBIN_NUM_EQWIDTH Procedure	Inserts numeric automatic equi-width binning definitions in a transformation definition table
INSERT_BIN_CAT_FREQ Procedure	Inserts categorical frequency-based binning definitions in a transformation definition table
INSERT_BIN_NUM_EQWIDTH Procedure	Inserts numeric equi-width binning definitions in a transformation definition table
INSERT_BIN_NUM_QTILE Procedure	Inserts numeric quantile binning expressions in a transformation definition table
INSERT_BIN_SUPER Procedure	Inserts supervised binning definitions in numerical and categorical transformation definition tables
INSERT_CLIP_TRIM_TAIL Procedure	Inserts numerical trimming definitions in a transformation definition table
INSERT_CLIP_WINSOR_TAIL Procedure	Inserts numerical winsorizing definitions in a transformation definition table
INSERT_MISS_CAT_MODE Procedure	Inserts categorical missing value treatment definitions in a transformation definition table
INSERT_MISS_NUM_MEAN Procedure	Inserts numerical missing value treatment definitions in a transformation definition table
INSERT_NORM_LIN_MINMAX Procedure	Inserts linear min-max normalization definitions in a transformation definition table
INSERT_NORM_LIN_SCALE Procedure	Inserts linear scale normalization definitions in a transformation definition table
INSERT_NORM_LIN_ZSCORE Procedure	Inserts linear zscore normalization definitions in a transformation definition table
SET_EXPRESSION Procedure	Adds a VARCHAR2 chunk to an expression
SET_TRANSFORM Procedure	Adds a transformation record to a transformation list
STACK_BIN_CAT Procedure	Adds a categorical binning expression to a transformation list
STACK_BIN_NUM Procedure	Adds a numerical binning expression to a transformation list
STACK_CLIP Procedure	Adds a clipping expression to a transformation list
STACK_COL_REM Procedure	Adds a column removal expression to a transformation list
STACK_MISS_CAT Procedure	Adds a categorical missing value treatment expression to a transformation list
STACK_MISS_NUM Procedure	Adds a numerical missing value treatment expression to a transformation list
STACK_NORM_LIN Procedure	Adds a linear normalization expression to a transformation list
XFORM_BIN_CAT Procedure	Creates a view of the data table with categorical binning transformations

Table 54-3 (Cont.) DBMS_DATA_MINING_TRANSFORM Package Subprograms

Subprogram	Purpose
XFORM_BIN_NUM Procedure	Creates a view of the data table with numerical binning transformations
XFORM_CLIP Procedure	Creates a view of the data table with clipping transformations
XFORM_COL_REM Procedure	Creates a view of the data table with column removal transformations
XFORM_EXPR_NUM Procedure	Creates a view of the data table with the specified numeric transformations
XFORM_EXPR_STR Procedure	Creates a view of the data table with the specified categorical transformations
XFORM_MISS_CAT Procedure	Creates a view of the data table with categorical missing value treatment
XFORM_MISS_NUM Procedure	Creates a view of the data table with numerical missing value treatment
XFORM_NORM_LIN Procedure	Creates a view of the data table with linear normalization transformations
XFORM_STACK Procedure	Creates a view of the transformation list

54.6.1 CREATE_BIN_CAT Procedure

This procedure creates a transformation definition table for categorical binning.

The columns are described in the following table.

Table 54-4 Columns in a Transformation Definition Table for Categorical Binning

Name	Datatype	Description
col	VARCHAR2(30)	Name of a column of categorical data. If the column is not nested, the column name is also the attribute name. For information about attribute names, see <i>Oracle Machine Learning for SQL User's Guide</i> .
att	VARCHAR2(4000)	The attribute subname if <i>col</i> is a nested column. If <i>col</i> is nested, the attribute name is <i>col.att</i> . If <i>col</i> is not nested, <i>att</i> is null.
val	VARCHAR2(4000)	Values of the attribute
bin	VARCHAR2(4000)	Bin assignments for the values

Syntax

```
DBMS_DATA_MINING_TRANSFORM.CREATE_BIN_CAT (
    bin_table_name    IN VARCHAR2,
    bin_schema_name  IN VARCHAR2 DEFAULT NULL );
```

Parameters

Table 54-5 CREATE_BIN_CAT Procedure Parameters

Parameter	Description
<code>bin_table_name</code>	Name of the transformation definition table to be created
<code>bin_schema_name</code>	Schema of <code>bin_table_name</code> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about categorical data.
2. See "Nested Data Transformations" for information about transformation definition tables and nested data.
3. You can use the following procedures to populate the transformation definition table:
 - [INSERT_BIN_CAT_FREQ Procedure](#) — frequency-based binning
 - [INSERT_BIN_SUPER Procedure](#) — supervised binning

See Also:

"Binning" in [DBMS_DATA_MINING_TRANSFORM Overview](#)
"Operational Notes"

Examples

The following statement creates a table called `bin_cat_xtbl` in the current schema. The table has columns that can be populated with bin assignments for categorical attributes.

```
BEGIN
    DBMS_DATA_MINING_TRANSFORM.CREATE_BIN_CAT('bin_cat_xtbl');
END;
/
DESCRIBE bin_cat_xtbl
```

Name	Null?	Type
COL		VARCHAR2(30)
ATT		VARCHAR2(4000)
VAL		VARCHAR2(4000)
BIN		VARCHAR2(4000)

54.6.2 CREATE_BIN_NUM Procedure

This procedure creates a transformation definition table for numerical binning.

The columns are described in the following table.

Table 54-6 Columns in a Transformation Definition Table for Numerical Binning

Name	Datatype	Description
col	VARCHAR2(30)	Name of a column of numerical data. If the column is not nested, the column name is also the attribute name. For information about attribute names, see <i>Oracle Machine Learning for SQL User's Guide</i> .
att	VARCHAR2(4000)	The attribute subname if <i>col</i> is a nested column. If <i>col</i> is nested, the attribute name is <i>col.att</i> . If <i>col</i> is not nested, <i>att</i> is null.
val	NUMBER	Values of the attribute
bin	VARCHAR2(4000)	Bin assignments for the values

Syntax

```
DBMS_DATA_MINING_TRANSFORM.CREATE_BIN_NUM (
    bin_table_name    IN VARCHAR2,
    bin_schema_name  IN VARCHAR2 DEFAULT NULL );
```

Parameters**Table 54-7 CREATE_BIN_NUM Procedure Parameters**

Parameter	Description
bin_table_name	Name of the transformation definition table to be created
bin_schema_name	Schema of <i>bin_table_name</i> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.
2. See "[Nested Data Transformations](#)" for information about transformation definition tables and nested data.
3. You can use the following procedures to populate the transformation definition table:
 - [INSERT_AUTOBIN_NUM_EQWIDTH Procedure](#) — automatic equi-width binning
 - [INSERT_BIN_NUM_EQWIDTH Procedure](#) — user-specified equi-width binning
 - [INSERT_BIN_NUM_QTILE Procedure](#) — quantile binning
 - [INSERT_BIN_SUPER Procedure](#) — supervised binning

 **See Also:**

"Binning" in [DBMS_DATA_MINING_TRANSFORM Overview](#)
"Operational Notes"

Examples

The following statement creates a table called `bin_num_xtbl` in the current schema. The table has columns that can be populated with bin assignments for numerical attributes.

```
BEGIN
  DBMS_DATA_MINING_TRANSFORM.CREATE_BIN_NUM('bin_num_xtbl');
END;
/

DESCRIBE bin_num_xtbl
Name                                         Null?    Type
-----
COL                                         VARCHAR2(30)
ATT                                         VARCHAR2(4000)
VAL                                         NUMBER
BIN                                         VARCHAR2(4000)
```

54.6.3 CREATE_CLIP Procedure

This procedure creates a transformation definition table for clipping or winsorizing to minimize the effect of outliers.

The columns are described in the following table.

Table 54-8 Columns in a Transformation Definition Table for Clipping or Winsorizing

Name	Datatype	Description
<code>col</code>	<code>VARCHAR2(30)</code>	Name of a column of numerical data. If the column is not nested, the column name is also the attribute name. For information about attribute names, see <i>Oracle Machine Learning for SQL User's Guide</i> .
<code>att</code>	<code>VARCHAR2(4000)</code>	The attribute subname if <code>col</code> is a nested column of <code>DM_NESTED_NUMERICALS</code> . If <code>col</code> is nested, the attribute name is <code>col.att</code> . If <code>col</code> is not nested, <code>att</code> is null.
<code>lcut</code>	<code>NUMBER</code>	The lowest typical value for the attribute. If the attribute values were plotted on an <i>xy</i> axis, <code>lcut</code> would be the left-most boundary of the range of values considered typical for this attribute. Any values to the left of <code>lcut</code> are outliers.
<code>lval</code>	<code>NUMBER</code>	Value assigned to an outlier to the left of <code>lcut</code>

Table 54-8 (Cont.) Columns in a Transformation Definition Table for Clipping or Winsorizing

Name	Datatype	Description
<code>rcut</code>	NUMBER	The highest typical value for the attribute If the attribute values were plotted on an <i>xy</i> axis, <i>rcut</i> would be the right-most boundary of the range of values considered typical for this attribute. Any values to the right of <i>rcut</i> are outliers.
<code>rval</code>	NUMBER	Value assigned to an outlier to the right of <i>rcut</i>

Syntax

```
DBMS_DATA_MINING_TRANSFORM.CREATE_CLIP (
    clip_table_name    IN VARCHAR2,
    clip_schema_name   IN VARCHAR2 DEFAULT NULL );
```

Parameters

Table 54-9 CREATE_CLIP Procedure Parameters

Parameter	Description
<code>clip_table_name</code>	Name of the transformation definition table to be created
<code>clip_schema_name</code>	Schema of <i>clip_table_name</i> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.
2. See "[Nested Data Transformations](#)" for information about transformation definition tables and nested data.
3. You can use the following procedures to populate the transformation definition table:
 - [INSERT_CLIP_TRIM_TAIL Procedure](#) — replaces outliers with nulls
 - [INSERT_CLIP_WINSOR_TAIL Procedure](#) — replaces outliers with an average value

See Also:

"Outlier Treatment" in [DBMS_DATA_MINING_TRANSFORM Overview](#)
"Operational Notes"

Examples

The following statement creates a table called `clip_xtbl` in the current schema. The table has columns that can be populated with clipping instructions for numerical attributes.

```
BEGIN
  DBMS_DATA_MINING_TRANSFORM.CREATE_CLIP('clip_xtbl');
END;
/

DESCRIBE clip_xtbl
Name                                         Null?    Type
-----
COL                                         VARCHAR2(30)
ATT                                         VARCHAR2(4000)
LCUT                                        NUMBER
LVAL                                        NUMBER
RCUT                                        NUMBER
RVAL                                        NUMBER
```

54.6.4 CREATE_COL_REM Procedure

This procedure creates a transformation definition table for removing columns from the data table.

The columns are described in the following table.

Table 54-10 Columns in a Transformation Definition Table for Column Removal

Name	Datatype	Description
<code>col</code>	<code>VARCHAR2(30)</code>	Name of a column of data. If the column is not nested, the column name is also the attribute name. For information about attribute names, see <i>Oracle Machine Learning for SQL User's Guide</i> .
<code>att</code>	<code>VARCHAR2(4000)</code>	The attribute subname if <code>col</code> is nested (<code>DM_NESTED_NUMERICALS</code> or <code>DM_NESTED_CATEGORICALS</code>). If <code>col</code> is nested, the attribute name is <code>col.att</code> . If <code>col</code> is not nested, <code>att</code> is null.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.CREATE_COL_REM (
  rem_table_name          VARCHAR2,
  rem_schema_name        VARCHAR2 DEFAULT NULL );
```

Parameters

Table 54-11 CREATE_COL_REM Procedure Parameters

Parameter	Description
<code>rem_table_name</code>	Name of the transformation definition table to be created
<code>rem_schema_name</code>	Schema of <code>rem_table_name</code> . If no schema is specified, the current schema is used.

Usage Notes

1. See "[Nested Data Transformations](#)" for information about transformation definition tables and nested data.
2. See "[Operational Notes](#)".

Examples

The following statement creates a table called `rem_att_xtbl` in the current schema. The table has columns that can be populated with the names of attributes to exclude from the data to be mined.

```
BEGIN
  DBMS_DATA_MINING_TRANSFORM.CREATE_COL_REM ('rem_att_xtbl');
END;
/
DESCRIBE rem_att_xtbl
Name                                                    Null?    Type
-----
COL                                                    VARCHAR2(30)
ATT                                                    VARCHAR2(4000)
```

54.6.5 CREATE_MISS_CAT Procedure

This procedure creates a transformation definition table for replacing categorical missing values.

The columns are described in the following table.

Table 54-12 Columns in a Transformation Definition Table for Categorical Missing Value Treatment

Name	Datatype	Description
<code>col</code>	<code>VARCHAR2(30)</code>	Name of a column of categorical data. If the column is not nested, the column name is also the attribute name. For information about attribute names, see <i>Oracle Machine Learning for SQL User's Guide</i> .
<code>att</code>	<code>VARCHAR2(4000)</code>	The attribute subname if <code>col</code> is a nested column of <code>DM_NESTED_CATEGORICALS</code> . If <code>col</code> is nested, the attribute name is <code>col.att</code> . If <code>col</code> is not nested, <code>att</code> is null.
<code>val</code>	<code>VARCHAR2(4000)</code>	Replacement for missing values in the attribute

Syntax

```
DBMS_DATA_MINING_TRANSFORM.CREATE_MISS_CAT (
  miss_table_name      IN VARCHAR2,
  miss_schema_name     IN VARCHAR2 DEFAULT NULL );
```

Parameters

Table 54-13 CREATE_MISS_CAT Procedure Parameters

Parameter	Description
<code>miss_table_name</code>	Name of the transformation definition table to be created
<code>miss_schema_name</code>	Schema of <code>miss_table_name</code> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about categorical data.
2. See "[Nested Data Transformations](#)" for information about transformation definition tables and nested data.
3. You can use the [INSERT_MISS_CAT_MODE Procedure](#) to populate the transformation definition table.

See Also:

"Missing Value Treatment" in [DBMS_DATA_MINING_TRANSFORM Overview](#)
"Operational Notes"

Examples

The following statement creates a table called `miss_cat_xtbl` in the current schema. The table has columns that can be populated with values for missing data in categorical attributes.

```
BEGIN
    DBMS_DATA_MINING_TRANSFORM.CREATE_MISS_CAT('miss_cat_xtbl');
END;
/

DESCRIBE miss_cat_xtbl
Name                                     Null?    Type
-----
COL                                       VARCHA2 (30)
ATT                                       VARCHA2 (4000)
VAL                                       VARCHA2 (4000)
```

54.6.6 CREATE_MISS_NUM Procedure

This procedure creates a transformation definition table for replacing numerical missing values.

The columns are described in [Table 54-14](#).

Table 54-14 Columns in a Transformation Definition Table for Numerical Missing Value Treatment

Name	Datatype	Description
col	VARCHAR2 (30)	Name of a column of numerical data. If the column is not nested, the column name is also the attribute name. For information about attribute names, see <i>Oracle Machine Learning for SQL User's Guide</i> .
att	VARCHAR2 (4000)	The attribute subname if <i>col</i> is a nested column of DM_NESTED_NUMERICALS. If <i>col</i> is nested, the attribute name is <i>col.att</i> . If <i>col</i> is not nested, <i>att</i> is null.
val	NUMBER	Replacement for missing values in the attribute

Syntax

```
DBMS_DATA_MINING_TRANSFORM.CREATE_MISS_NUM (
    miss_table_name      IN VARCHAR2,
    miss_schema_name     IN VARCHAR2 DEFAULT NULL );
```

Parameters

Table 54-15 CREATE_MISS_NUM Procedure Parameters

Parameter	Description
miss_table_name	Name of the transformation definition table to be created
miss_schema_name	Schema of <i>miss_table_name</i> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.
2. See "[Nested Data Transformations](#)" for information about transformation definition tables and nested data.
3. You can use the [INSERT_MISS_NUM_MEAN Procedure](#) to populate the transformation definition table.

See Also:

"Missing Value Treatment" in [DBMS_DATA_MINING_TRANSFORM Overview](#)

"Operational Notes"

Example

The following statement creates a table called `miss_num_xtbl` in the current schema. The table has columns that can be populated with values for missing data in numerical attributes.

```
BEGIN
    DBMS_DATA_MINING_TRANSFORM.CREATE_MISS_NUM('miss_num_xtbl');
END;
/
```

```
DESCRIBE miss_num_xtbl
Name                                     Null?    Type
-----
COL                                     VARCHA2 (30)
ATT                                     VARCHA2 (4000)
VAL                                     NUMBER
```

54.6.7 CREATE_NORM_LIN Procedure

This procedure creates a transformation definition table for linear normalization.

The columns are described in [Table 54-16](#).

Table 54-16 Columns in a Transformation Definition Table for Linear Normalization

Name	Datatype	Description
<code>col</code>	<code>VARCHAR2(30)</code>	Name of a column of numerical data. If the column is not nested, the column name is also the attribute name. For information about attribute names, see <i>Oracle Machine Learning for SQL User's Guide</i> .
<code>att</code>	<code>VARCHAR2(4000)</code>	The attribute subname if <code>col</code> is a nested column of <code>DM_NESTED_NUMERICALS</code> . If <code>col</code> is nested, the attribute name is <code>col.att</code> . If <code>col</code> is not nested, <code>att</code> is null.
<code>shift</code>	<code>NUMBER</code>	A constant to subtract from the attribute values
<code>scale</code>	<code>NUMBER</code>	A constant by which to divide the shifted values

Syntax

```
DBMS_DATA_MINING_TRANSFORM.CREATE_NORM_LIN (
    norm_table_name      IN VARCHAR2,
    norm_schema_name    IN VARCHAR2 DEFAULT NULL );
```

Parameters

Table 54-17 CREATE_NORM_LIN Procedure Parameters

Parameter	Description
<code>norm_table_name</code>	Name of the transformation definition table to be created
<code>norm_schema_name</code>	Schema of <code>norm_table_name</code> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.
2. See "[Nested Data Transformations](#)" for information about transformation definition tables and nested data.
3. You can use the following procedures to populate the transformation definition table:
 - [INSERT_NORM_LIN_MINMAX Procedure](#) — Uses linear min-max normalization
 - [INSERT_NORM_LIN_SCALE Procedure](#) — Uses linear scale normalization
 - [INSERT_NORM_LIN_ZSCORE Procedure](#) — Uses linear zscore normalization

 **See Also:**

"Linear Normalization" in [DBMS_DATA_MINING_TRANSFORM Overview](#)
 "Operational Notes"

Examples

The following statement creates a table called `norm_xtbl` in the current schema. The table has columns that can be populated with shift and scale values for normalizing numerical attributes.

```
BEGIN
    DBMS_DATA_MINING_TRANSFORM.CREATE_NORM_LIN('norm_xtbl');
END;
/
```

```
DESCRIBE norm_xtbl
```

Name	Null?	Type
COL		VARCHAR2 (30)
ATT		VARCHAR2 (4000)
SHIFT		NUMBER
SCALE		NUMBER

54.6.8 DESCRIBE_STACK Procedure

This procedure describes the columns of the data table after a list of transformations has been applied.

Only the columns that are specified in the transformation list are transformed. The remaining columns in the data table are included in the output without changes.

To create a view of the data table after the transformations have been applied, use the [XFORM_STACK Procedure](#).

Syntax

```
DBMS_DATA_MINING_TRANSFORM.DESCRIBE_STACK (
    xform_list          IN  TRANSFORM_LIST,
    data_table_name     IN  VARCHAR2,
    describe_list       OUT DESCRIBE_LIST,
    data_schema_name    IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 54-18 DESCRIBE_STACK Procedure Parameters

Parameter	Description
<code>xform_list</code>	A list of transformations. See Table 54-1 for a description of the <code>TRANSFORM_LIST</code> object type.
<code>data_table_name</code>	Name of the table containing the data to be transformed
<code>describe_list</code>	Descriptions of the columns in the data table after the transformations specified in <code>xform_list</code> have been applied. See Table 54-1 for a description of the <code>DESCRIBE_LIST</code> object type.
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)" for information about transformation lists and embedded transformations.

Examples

This example shows the column name and datatype, the column name length, and the column maximum length for the view `oml_user.cust_info` after the transformation list has been applied. All the transformations are user-specified. The results of `DESCRIBE_STACK` do not include one of the columns in the original table, because the `SET_TRANSFORM` procedure sets that column to `NULL`.

```
CREATE OR REPLACE VIEW cust_info AS
    SELECT a.cust_id, c.country_id, c.cust_year_of_birth,
    CAST(COLLECT(DM_Nested_Numerical(
        b.prod_name, 1))
    AS DM_Nested_Numericals) custprods
    FROM sh.sales a, sh.products b, sh.customers c
    WHERE a.prod_id = b.prod_id AND
        a.cust_id=c.cust_id and
        a.cust_id between 100001 AND 105000
    GROUP BY a.cust_id, country_id, cust_year_of_birth;

describe cust_info
Name                                                    Null?    Type
-----
CUST_ID                                                NOT NULL NUMBER
COUNTRY_ID                                             NOT NULL NUMBER
CUST_YEAR_OF_BIRTH                                     NOT NULL NUMBER(4)
CUSTPRODS                                             SYS.DM_NESTED_NUMERICALS

DECLARE
    cust_stack    dbms_data_mining_transform.TRANSFORM_LIST;
```

```

cust_cols    dbms_data_mining_transform.DESCRIBE_LIST;
BEGIN
  dbms_data_mining_transform.SET_TRANSFORM (cust_stack,
    'country_id', NULL, 'country_id/10', 'country_id*10');
  dbms_data_mining_transform.SET_TRANSFORM (cust_stack,
    'cust_year_of_birth', NULL, NULL, NULL);
  dbms_data_mining_transform.SET_TRANSFORM (cust_stack,
    'custprods', 'Mouse Pad', 'value*100', 'value/100');
  dbms_data_mining_transform.DESCRIBE_STACK(
    xform_list => cust_stack,
    data_table_name => 'cust_info',
    describe_list => cust_cols);
  dbms_output.put_line('====');
  for i in 1..cust_cols.COUNT loop
    dbms_output.put_line('COLUMN_NAME:      ||cust_cols(i).col_name);
    dbms_output.put_line('COLUMN_TYPE:      ||cust_cols(i).col_type);
    dbms_output.put_line('COLUMN_NAME_LEN:  ||cust_cols(i).col_name_len);
    dbms_output.put_line('COLUMN_MAX_LEN:  ||cust_cols(i).col_max_len);
    dbms_output.put_line('====');
  END loop;
END;
/
====
COLUMN_NAME:      CUST_ID
COLUMN_TYPE:      2
COLUMN_NAME_LEN:  7
COLUMN_MAX_LEN:   22
====
COLUMN_NAME:      COUNTRY_ID
COLUMN_TYPE:      2
COLUMN_NAME_LEN:  10
COLUMN_MAX_LEN:   22
====
COLUMN_NAME:      CUSTPRODS
COLUMN_TYPE:      100001
COLUMN_NAME_LEN:  9
COLUMN_MAX_LEN:   40
====

```

54.6.9 GET_EXPRESSION Function

This function returns a row from a VARCHAR2 array that stores a transformation expression. The array is built by calls to the SET_EXPRESSION Procedure.

The array can be used for specifying SQL expressions that are too long to be used with the SET_TRANSFORM Procedure.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.GET_EXPRESSION (
  expression          IN EXPRESSION_REC,
  chunk_num           IN PLS_INTEGER DEFAULT NULL);
RETURN VARCHAR2;

```

Parameters

Table 54-19 GET_EXPRESSION Function Parameters

Parameter	Description
expression	An expression record (<code>EXPRESSION_REC</code>) that specifies a transformation expression or a reverse transformation expression for an attribute. Each expression record includes a <code>VARCHAR2</code> array and index fields for specifying upper and lower boundaries within the array. There are two <code>EXPRESSION_REC</code> fields within a transformation record (<code>TRANSFORM_REC</code>): one for the transformation expression; the other for the reverse transformation expression. See Table 54-1 for a description of the <code>EXPRESSION_REC</code> type.
chunk	A <code>VARCHAR2</code> chunk (row) to be appended to <i>expression</i> .

Usage Notes

1. Chunk numbering starts with one. For chunks outside of the range, the return value is null. When a chunk number is null the whole expression is returned as a string. If the expression is too big, a `VALUE_ERROR` is raised.
2. See "[About Transformation Lists](#)".
3. See "[Operational Notes](#)".

Examples

See the example for the [SET_EXPRESSION Procedure](#).

Related Topics

- [SET_EXPRESSION Procedure](#)
This procedure appends a row to a `VARCHAR2` array that stores a SQL expression.
- [SET_TRANSFORM Procedure](#)
This procedure appends the transformation instructions for an attribute to a transformation list.

54.6.10 INSERT_AUTOBIN_NUM_EQWIDTH Procedure

This procedure performs numerical binning and inserts the transformation definitions in a transformation definition table. The procedure identifies the minimum and maximum values and computes the bin boundaries at equal intervals.

`INSERT_AUTOBIN_NUM_EQWIDTH` computes the number of bins separately for each column. If you want to use equi-width binning with the same number of bins for each column, use the [INSERT_BIN_NUM_EQWIDTH Procedure](#).

`INSERT_AUTOBIN_NUM_EQWIDTH` bins all the `NUMBER` and `FLOAT` columns in the data source unless you specify a list of columns to ignore.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.INSERT_AUTOBIN_NUM_EQWIDTH (
    bin_table_name      IN VARCHAR2,
    data_table_name     IN VARCHAR2,
```



```

bin_num          IN PLS_INTEGER DEFAULT 3,
max_bin_num     IN PLS_INTEGER DEFAULT 100,
exclude_list    IN COLUMN_LIST DEFAULT NULL,
round_num       IN PLS_INTEGER DEFAULT 6,
sample_size     IN PLS_INTEGER DEFAULT 50000,
bin_schema_name IN VARCHAR2 DEFAULT NULL,
data_schema_name IN VARCHAR2 DEFAULT NULL,
rem_table_name  IN VARCHAR2 DEFAULT NULL,
rem_schema_name IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-20 INSERT_AUTOBIN_NUM_EQWIDTH Procedure Parameters

Parameter	Description
bin_table_name	<p>Name of the transformation definition table for numerical binning. You can use the CREATE_BIN_NUM Procedure to create the definition table. The following columns are required:</p> <pre> COL VARCHAR2(30) VAL NUMBER BIN VARCHAR2(4000) </pre> <p>CREATE_BIN_NUM creates an additional column, ATT, which may be used for specifying nested attributes. This column is not used by INSERT_AUTOBIN_NUM_EQWIDTH.</p>
data_table_name	Name of the table containing the data to be transformed
bin_num	<p>Minimum number of bins. If <i>bin_num</i> is 0 or NULL, it is ignored. The default value of <i>bin_num</i> is 3.</p>
max_bin_num	<p>Maximum number of bins. If <i>max_bin_num</i> is 0 or NULL, it is ignored. The default value of <i>max_bin_num</i> is 100.</p>
exclude_list	<p>List of numerical columns to be excluded from the binning process. If you do not specify <i>exclude_list</i>, all numerical columns in the data source are binned.</p> <p>The format of <i>exclude_list</i> is:</p> <pre> dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln') </pre>
round_num	<p>Specifies how to round the number in the VAL column of the transformation definition table.</p> <p>When <i>round_num</i> is positive, it specifies the most significant digits to retain. When <i>round_num</i> is negative, it specifies the least significant digits to remove. In both cases, the result is rounded to the specified number of digits. See the Usage Notes for an example.</p> <p>The default value of <i>round_num</i> is 6.</p>
sample_size	<p>Size of the data sample. If <i>sample_size</i> is less than the total number of non-NULL values in the column, then <i>sample_size</i> is used instead of the SQL COUNT function in computing the number of bins. If <i>sample_size</i> is 0 or NULL, it is ignored. See the Usage Notes.</p> <p>The default value of <i>sample_size</i> is 50,000.</p>
bin_schema_name	Schema of <i>bin_table_name</i> . If no schema is specified, the current schema is used.

Table 54-20 (Cont.) INSERT_AUTOBIN_NUM_EQWIDTH Procedure Parameters

Parameter	Description
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.
<code>rem_table_name</code>	Name of a transformation definition table for column removal. The table must have the columns described in " CREATE_COL_REM Procedure ". <code>INSERT_AUTOBIN_NUM_EQWIDTH</code> ignores columns with all nulls or only one unique value. If you specify a value for <code>rem_table_name</code> , these columns are removed from the mining data. If you do not specify a value for <code>rem_table_name</code> , these unbinned columns remain in the data.
<code>rem_schema_name</code>	Schema of <code>rem_table_name</code> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.
2. `INSERT_AUTOBIN_NUM_EQWIDTH` computes the number of bins for a column based on the number of non-null values (`COUNT`), the maximum (`MAX`), the minimum (`MIN`), the standard deviation (`STDDEV`), and the constant $C=3.49/0.9$:

$$N = \text{floor}(\text{power}(\text{COUNT}, 1/3) * (\text{max} - \text{min}) / (c * \text{dev}))$$

If the `sample_size` parameter is specified, it is used instead of `COUNT`.

See *Oracle Machine Learning for SQL User's Guide* for information about the `COUNT`, `MAX`, `MIN`, `STDDEV`, `FLOOR`, and `POWER` functions.

3. `INSERT_AUTOBIN_NUM_EQWIDTH` uses absolute values to compute the number of bins. The sign of the parameters `bin_num`, `max_bin_num`, and `sample_size` has no effect on the result.
4. In computing the number of bins, `INSERT_AUTOBIN_NUM_EQWIDTH` evaluates the following criteria in the following order:
 - a. The minimum number of bins (`bin_num`)
 - b. The maximum number of bins (`max_bin_num`)
 - c. The maximum number of bins for integer columns, calculated as the number of distinct values in the range $\text{max} - \text{min} + 1$.
5. The `round_num` parameter controls the rounding of column values in the transformation definition table, as follows:

For a value of 308.162:

```

when round_num = 1      result is 300
when round_num = 2      result is 310
when round_num = 3      result is 308
when round_num = 0      result is 308.162
when round_num = -1     result is 308.16
when round_num = -2     result is 308.2

```

Examples

In this example, `INSERT_AUTOBIN_NUM_EQWIDTH` computes the bin boundaries for the `cust_year_of_birth` column in `sh.customers` and inserts the transformations in a transformation definition table. The `STACK_BIN_NUM Procedure` creates a transformation list from the contents of the definition table. The `CREATE_MODEL Procedure` embeds the transformation list in a new model called `nb_model`.

The transformation and reverse transformation expressions embedded in `nb_model` are returned by the `GET_MODEL_TRANSFORMATIONS Function`.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_year_of_birth, cust_postal_code
  FROM sh.customers;

DESCRIBE mining_data
Name                               Null?    Type
-----
CUST_ID                             NOT NULL NUMBER
CUST_YEAR_OF_BIRTH                   NOT NULL NUMBER(4)
CUST_POSTAL_CODE                     NOT NULL VARCHAR2(10)

BEGIN
  dbms_data_mining_transform.CREATE_BIN_NUM(
    bin_table_name => 'bin_tbl');
  dbms_data_mining_transform.INSERT_AUTOBIN_NUM_EQWIDTH (
    bin_table_name => 'bin_tbl',
    data_table_name => 'mining_data',
    bin_num         => 3,
    max_bin_num    => 5,
    exclude_list   => dbms_data_mining_transform.COLUMN_LIST('cust_id'));
END;
/

set numwidth 4
column val off
SELECT col, val, bin FROM bin_tbl
       ORDER BY val ASC;

COL                               VAL BIN
-----
CUST_YEAR_OF_BIRTH                1913
CUST_YEAR_OF_BIRTH                1928 1
CUST_YEAR_OF_BIRTH                1944 2
CUST_YEAR_OF_BIRTH                1959 3
CUST_YEAR_OF_BIRTH                1975 4
CUST_YEAR_OF_BIRTH                1990 5

DECLARE
  year_birth_xform  dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.STACK_BIN_NUM (
    bin_table_name => 'bin_tbl',
    xform_list     => year_birth_xform);
  dbms_data_mining.CREATE_MODEL(
    model_name     => 'nb_model',
    mining_function => dbms_data_mining.classification,
    data_table_name => 'mining_data',
    case_id_column_name => 'cust_id',
    target_column_name => 'cust_postal_code',
```

```

        settings_table_name    => null,
        data_schema_name      => null,
        settings_schema_name  => null,
        xform_list            => year_birth_xform);
END;
/

SELECT attribute_name
       FROM TABLE(dbms_data_mining.GET_MODEL_TRANSFORMATIONS('nb_model'));

ATTRIBUTE_NAME
-----
CUST_YEAR_OF_BIRTH

SELECT expression
       FROM TABLE(dbms_data_mining.GET_MODEL_TRANSFORMATIONS('nb_model'));

EXPRESSION
-----
CASE WHEN "CUST_YEAR_OF_BIRTH"<1913 THEN NULL WHEN "CUST_YEAR_OF_BIRTH"<=1928.4
 THEN '1' WHEN "CUST_YEAR_OF_BIRTH"<=1943.8 THEN '2' WHEN "CUST_YEAR_OF_BIRTH"
<=1959.2 THEN '3' WHEN "CUST_YEAR_OF_BIRTH"<=1974.6 THEN '4' WHEN
"CUST_YEAR_OF_BIRTH" <=1990 THEN '5' END

SELECT reverse_expression
       FROM TABLE(dbms_data_mining.GET_MODEL_TRANSFORMATIONS('nb_model'));

REVERSE_EXPRESSION
-----
DECODE("CUST_YEAR_OF_BIRTH",'5','(1974.6; 1990]','1','[1913; 1928.4]','2','(1928
.4; 1943.8]','3','(1943.8; 1959.2]','4','(1959.2; 1974.6]','NULL','( ; 1913), (199
0; ), NULL')

```

54.6.11 INSERT_BIN_CAT_FREQ Procedure

This procedure performs categorical binning and inserts the transformation definitions in a transformation definition table. The procedure computes the bin boundaries based on frequency.

`INSERT_BIN_CAT_FREQ` bins all the `CHAR` and `VARCHAR2` columns in the data source unless you specify a list of columns to ignore.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.INSERT_BIN_CAT_FREQ (
    bin_table_name          IN VARCHAR2,
    data_table_name        IN VARCHAR2,
    bin_num                 IN PLS_INTEGER DEFAULT 9,
    exclude_list           IN COLUMN_LIST DEFAULT NULL,
    default_num            IN PLS_INTEGER DEFAULT 2,
    bin_support            IN NUMBER DEFAULT NULL,
    bin_schema_name        IN VARCHAR2 DEFAULT NULL,
    data_schema_name       IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-21 INSERT_BIN_CAT_FREQ Procedure Parameters

Parameter	Description
<code>bin_table_name</code>	<p>Name of the transformation definition table for categorical binning. You can use the CREATE_BIN_CAT Procedure to create the definition table. The following columns are required:</p> <pre>COL VARCHAR2(30) VAL VARCHAR2(4000) BIN VARCHAR2(4000)</pre> <p><code>CREATE_BIN_CAT</code> creates an additional column, <code>ATT</code>, which may be used for specifying nested attributes. This column is not used by <code>INSERT_BIN_CAT_FREQ</code>.</p>
<code>data_table_name</code>	Name of the table containing the data to be transformed
<code>bin_num</code>	<p>The number of bins to fill using frequency-based binning. The total number of bins will be <code>bin_num+1</code>. The additional bin is the default bin. Classes that are not assigned to a frequency-based bin will be assigned to the default bin.</p> <p>The default binning order is from highest to lowest: the most frequently occurring class is assigned to the first bin, the second most frequently occurring class is assigned to the second bin, and so on. You can reverse the binning order by specifying a negative number for <code>bin_num</code>. The negative sign causes the binning order to be from lowest to highest.</p> <p>If the total number of distinct values (classes) in the column is less than <code>bin_num</code>, then a separate bin will be created for each value and the default bin will be empty.</p> <p>If you specify <code>NULL</code> or <code>0</code> for <code>bin_num</code>, no binning is performed.</p> <p>The default value of <code>bin_num</code> is 9.</p>
<code>exclude_list</code>	<p>List of categorical columns to be excluded from the binning process. If you do not specify <code>exclude_list</code>, all categorical columns in the data source are binned.</p> <p>The format of <code>exclude_list</code> is:</p> <pre>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln')</pre>
<code>default_num</code>	<p>The number of class occurrences (rows of the same class) required for assignment to the default bin.</p> <p>By default, <code>default_num</code> is the minimum number of occurrences required for assignment to the default bin. For example, if <code>default_num</code> is 3 and a given class occurs only once, it will not be assigned to the default bin. You can change the occurrence requirement from minimum to maximum by specifying a negative number for <code>default_num</code>. For example, if <code>default_num</code> is -3 and a given class occurs only once, it <i>will</i> be assigned to the default bin, but a class that occurs four or more times will not be included.</p> <p>If you specify <code>NULL</code> or <code>0</code> for <code>default_bin</code>, there are no requirements for assignment to the default bin.</p> <p>The default value of <code>default_num</code> is 2.</p>

Table 54-21 (Cont.) INSERT_BIN_CAT_FREQ Procedure Parameters

Parameter	Description
<code>bin_support</code>	<p>The number of class occurrences (rows of the same class) required for assignment to a frequency-based bin. <code>bin_support</code> is expressed as a fraction of the total number of rows.</p> <p>By default, <code>bin_support</code> is the minimum percentage required for assignment to a frequency-based bin. For example, if there are twenty rows of data and you specify .2 for <code>bin_support</code>, then there must be four or more occurrences of a class (.2*20) in order for it to be assigned to a frequency-based bin. You can change <code>bin_support</code> from a minimum percentage to a maximum percentage by specifying a negative number for <code>bin_support</code>. For example, if there are twenty rows of data and you specify -.2 for <code>bin_support</code>, then there must be four or less occurrences of a class in order for it to be assigned to a frequency-based bin.</p> <p>Classes that occur less than a positive <code>bin_support</code> or more than a negative <code>bin_support</code> will be assigned to the default bin.</p> <p>If you specify NULL or 0 for <code>bin_support</code>, then there is no support requirement for frequency-based binning.</p> <p>The default value of <code>bin_support</code> is NULL.</p>
<code>bin_schema_name</code>	Schema of <code>bin_table_name</code> . If no schema is specified, the current schema is used.
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about categorical data.
2. If values occur with the same frequency, `INSERT_BIN_CAT_FREQ` assigns them in descending order when binning is from most to least frequent, or in ascending order when binning is from least to most frequent.

Examples

1. In this example, `INSERT_BIN_CAT_FREQ` computes the bin boundaries for the `cust_postal_code` and `cust_city` columns in `sh.customers` and inserts the transformations in a transformation definition table. The [STACK_BIN_CAT Procedure](#) creates a transformation list from the contents of the definition table, and the [CREATE_MODEL Procedure](#) embeds the transformation list in a new model called `nb_model`.

The transformation and reverse transformation expressions embedded in `nb_model` are returned by the [GET_MODEL_TRANSFORMATIONS Function](#).

```
CREATE OR REPLACE VIEW mining_data AS
SELECT cust_id, cust_year_of_birth, cust_postal_code, cust_city
FROM sh.customers;
```

```
DESCRIBE mining_data
```

Name	Null?	Type
CUST_ID	NOT NULL	NUMBER
CUST_YEAR_OF_BIRTH	NOT NULL	NUMBER(4)

```

CUST_POSTAL_CODE          NOT NULL VARCHAR2(10)
CUST_CITY                 NOT NULL VARCHAR2(30)

```

```

BEGIN
  dbms_data_mining_transform.CREATE_BIN_CAT(
    bin_table_name => 'bin_tbl_1');
  dbms_data_mining_transform.INSERT_BIN_CAT_FREQ (
    bin_table_name => 'bin_tbl_1',
    data_table_name => 'mining_data',
    bin_num        => 4);
END;
/

```

```

column col format a18
column val format a15
column bin format a10
SELECT col, val, bin
       FROM bin_tbl_1
       ORDER BY col ASC, bin ASC;

```

COL	VAL	BIN
CUST_CITY	Los Angeles	1
CUST_CITY	Greenwich	2
CUST_CITY	Killarney	3
CUST_CITY	Montara	4
CUST_CITY		5
CUST_POSTAL_CODE	38082	1
CUST_POSTAL_CODE	63736	2
CUST_POSTAL_CODE	55787	3
CUST_POSTAL_CODE	78558	4
CUST_POSTAL_CODE		5

```

DECLARE
  city_xform  dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.STACK_BIN_CAT (
    bin_table_name => 'bin_tbl_1',
    xform_list     => city_xform);
  dbms_data_mining.CREATE_MODEL(
    model_name     => 'nb_model',
    mining_function => dbms_data_mining.classification,
    data_table_name => 'mining_data',
    case_id_column_name => 'cust_id',
    target_column_name => 'cust_city',
    settings_table_name => null,
    data_schema_name   => null,
    settings_schema_name => null,
    xform_list        => city_xform);
END;
/

SELECT attribute_name
       FROM TABLE(dbms_data_mining.GET_MODEL_TRANSFORMATIONS('nb_model'));

ATTRIBUTE_NAME
-----
CUST_CITY
CUST_POSTAL_CODE

SELECT expression

```

```

FROM TABLE(dbms_data_mining.GET_MODEL_TRANSFORMATIONS('nb_model'));

EXPRESSION
-----
DECODE("CUST_CITY", 'Greenwich', '2', 'Killarney', '3', 'Los Angeles', '1',
'Montara', '4', NULL, NULL, '5')
DECODE("CUST_POSTAL_CODE", '38082', '1', '55787', '3', '63736', '2', '78558', '4', NULL, NULL, '5')

SELECT reverse_expression
       FROM TABLE(dbms_data_mining.GET_MODEL_TRANSFORMATIONS('nb_model'));

REVERSE_EXPRESSION
-----
DECODE("CUST_CITY", '2', ''Greenwich'', '3', ''Killarney'', '1',
''Los Angeles'', '4', ''Montara'', NULL, 'NULL', '5', 'DEFAULT')
DECODE("CUST_POSTAL_CODE", '1', ''38082'', '3', ''55787'', '2', ''63736'',
'4', ''78558'', NULL, 'NULL', '5', 'DEFAULT')

```

2. The binning order in example 1 is from most frequent to least frequent. The following example shows reverse order binning (least frequent to most frequent). The binning order is reversed by setting *bin_num* to -4 instead of 4.

```

BEGIN
  dbms_data_mining_transform.CREATE_BIN_CAT(
    bin_table_name => 'bin_tbl_reverse');
  dbms_data_mining_transform.INSERT_BIN_CAT_FREQ (
    bin_table_name => 'bin_tbl_reverse',
    data_table_name => 'mining_data',
    bin_num        => -4);
END;
/

column col format a20
SELECT col, val, bin
       FROM bin_tbl_reverse
       ORDER BY col ASC, bin ASC;

```

COL	VAL	BIN
CUST_CITY	Tokyo	1
CUST_CITY	Sliedrecht	2
CUST_CITY	Haarlem	3
CUST_CITY	Diemen	4
CUST_CITY		5
CUST_POSTAL_CODE	49358	1
CUST_POSTAL_CODE	80563	2
CUST_POSTAL_CODE	74903	3
CUST_POSTAL_CODE	71349	4
CUST_POSTAL_CODE		5

54.6.12 INSERT_BIN_NUM_EQWIDTH Procedure

This procedure performs numerical binning and inserts the transformation definitions in a transformation definition table. The procedure identifies the minimum and maximum values and computes the bin boundaries at equal intervals.

`INSERT_BIN_NUM_EQWIDTH` computes a specified number of bins (*n*) and assigns $(max-min)/n$ values to each bin. The number of bins is the same for each column. If you want to use equi-width binning, but you want the number of bins to be calculated on a per-column basis, use the [INSERT_AUTOBIN_NUM_EQWIDTH Procedure](#).

INSERT_BIN_NUM_EQWIDTH bins all the NUMBER and FLOAT columns in the data source unless you specify a list of columns to ignore.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.INSERT_BIN_NUM_EQWIDTH (
  bin_table_name      IN VARCHAR2,
  data_table_name     IN VARCHAR2,
  bin_num             IN PLS_INTEGER DEFAULT 10,
  exclude_list       IN COLUMN_LIST DEFAULT NULL,
  round_num          IN PLS_INTEGER DEFAULT 6,
  bin_schema_name    IN VARCHAR2 DEFAULT NULL,
  data_schema_name   IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 54-22 INSERT_BIN_NUM_EQWIDTH Procedure Parameters

Parameter	Description
bin_table_name	Name of the transformation definition table for numerical binning. You can use the CREATE_BIN_NUM Procedure to create the definition table. The following columns are required: COL VARCHAR2 (30) VAL NUMBER BIN VARCHAR2 (4000) CREATE_BIN_NUM creates an additional column, ATT, which may be used for specifying nested attributes. This column is not used by INSERT_BIN_NUM_EQWIDTH.
data_table_name	Name of the table containing the data to be transformed
bin_num	Number of bins. No binning occurs if <i>bin_num</i> is 0 or NULL. The default number of bins is 10.
exclude_list	List of numerical columns to be excluded from the binning process. If you do not specify <i>exclude_list</i> , all numerical columns in the data source are binned. The format of <i>exclude_list</i> is: dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln')
round_num	Specifies how to round the number in the VAL column of the transformation definition table. When <i>round_num</i> is positive, it specifies the most significant digits to retain. When <i>round_num</i> is negative, it specifies the least significant digits to remove. In both cases, the result is rounded to the specified number of digits. See the Usage Notes for an example. The default value of <i>round_num</i> is 6.
bin_schema_name	Schema of <i>bin_table_name</i> . If no schema is specified, the current schema is used.
data_schema_name	Schema of <i>data_table_name</i> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.
2. The `round_num` parameter controls the rounding of column values in the transformation definition table, as follows:

For a value of 308.162:

```

when round_num = 1      result is 300
when round_num = 2      result is 310
when round_num = 3      result is 308
when round_num = 0      result is 308.162
when round_num = -1     result is 308.16
when round_num = -2     result is 308.2
    
```

3. `INSERT_BIN_NUM_EQWIDTH` ignores columns with all NULL values or only one unique value.

Examples

In this example, `INSERT_BIN_NUM_EQWIDTH` computes the bin boundaries for the `affinity_card` column in `mining_data_build` and inserts the transformations in a transformation definition table. The [STACK_BIN_NUM Procedure](#) creates a transformation list from the contents of the definition table. The [CREATE_MODEL Procedure](#) embeds the transformation list in a new model called `glm_model`.

The transformation and reverse transformation expressions embedded in `glm_model` are returned by the [GET_MODEL_TRANSFORMATIONS Function](#).

```

CREATE OR REPLACE VIEW mining_data AS
    SELECT cust_id, cust_income_level, cust_gender, affinity_card
    FROM mining_data_build;

DESCRIBE mining_data
Name                                Null?    Type
-----
CUST_ID                             NOT NULL NUMBER
CUST_INCOME_LEVEL                    VARCHA2(30)
CUST_GENDER                           VARCHA2(1)
AFFINITY_CARD                          NUMBER(10)

BEGIN
    dbms_data_mining_transform.CREATE_BIN_NUM(
        bin_table_name => 'bin_tbl');
    dbms_data_mining_transform.INSERT_BIN_NUM_EQWIDTH (
        bin_table_name => 'bin_tbl',
        data_table_name => 'mining_data',
        bin_num         => 4,
        exclude_list   => dbms_data_mining_transform.COLUMN_LIST('cust_id'));
END;
/

set numwidth 10
column val off
column col format a20
column bin format a10
SELECT col, val, bin FROM bin_tbl
    ORDER BY val ASC;

COL                                VAL  BIN
    
```

```

-----
AFFINITY_CARD          0
AFFINITY_CARD          .25  1
AFFINITY_CARD          .5   2
AFFINITY_CARD          .75  3
AFFINITY_CARD          1   4

CREATE TABLE glmsettings(
    setting_name VARCHAR2(30),
    setting_value VARCHAR2(30));

BEGIN
    INSERT INTO glmsettings (setting_name, setting_value) VALUES
        (dbms_data_mining.algo_name,
        dbms_data_mining.algo_generalized_linear_model);
    COMMIT;
END;
/

DECLARE
    xforms dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
    dbms_data_mining_transform.STACK_BIN_NUM (
        bin_table_name      => 'bin_tbl',
        xform_list          => xforms,
        literal_flag        => TRUE);
    dbms_data_mining.CREATE_MODEL(
        model_name          => 'glm_model',
        mining_function     => dbms_data_mining.regression,
        data_table_name     => 'mining_data',
        case_id_column_name => 'cust_id',
        target_column_name  => 'affinity_card',
        settings_table_name => 'glmsettings',
        data_schema_name    => null,
        settings_schema_name => null,
        xform_list          => xforms);
END;
/

SELECT attribute_name
    FROM TABLE(dbms_data_mining.GET_MODEL_TRANSFORMATIONS('glm_model'));

ATTRIBUTE_NAME
-----
AFFINITY_CARD

SELECT expression
    FROM TABLE(dbms_data_mining.GET_MODEL_TRANSFORMATIONS('glm_model'));

EXPRESSION
-----
CASE WHEN "AFFINITY_CARD"<0 THEN NULL WHEN "AFFINITY_CARD"<=.25 THEN 1 WHEN
"AFFINITY_CARD"<=.5 THEN 2 WHEN "AFFINITY_CARD"<=.75 THEN 3 WHEN
"AFFINITY_CARD"<=1 THEN 4 END

SELECT reverse_expression
    FROM TABLE(dbms_data_mining.GET_MODEL_TRANSFORMATIONS('glm_model'));

REVERSE_EXPRESSION
-----

```

```
DECODE("AFFINITY_CARD",4,'(.75; 1]',1,'[0; .25]',2,'(.25; .5]',3,'(.5; .75]',
NULL,'( ; 0), (1; ), NULL')
```

54.6.13 INSERT_BIN_NUM_QTILE Procedure

This procedure performs numerical binning and inserts the transformation definitions in a transformation definition table. The procedure calls the SQL `NTILE` function to order the data and divide it equally into the specified number of bins (quantiles).

`INSERT_BIN_NUM_QTILE` bins all the `NUMBER` and `FLOAT` columns in the data source unless you specify a list of columns to ignore.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.INSERT_BIN_NUM_QTILE (
  bin_table_name      IN VARCHAR2,
  data_table_name     IN VARCHAR2,
  bin_num             IN PLS_INTEGER DEFAULT 10,
  exclude_list        IN COLUMN_LIST DEFAULT NULL,
  bin_schema_name     IN VARCHAR2 DEFAULT NULL,
  data_schema_name    IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 54-23 INSERT_BIN_NUM_QTILE Procedure Parameters

Parameter	Description
<code>bin_table_name</code>	Name of the transformation definition table for numerical binning. You can use the CREATE_BIN_NUM Procedure to create the definition table. The following columns are required: <pre>COL VARCHAR2(30) VAL NUMBER BIN VARCHAR2(4000)</pre> <code>CREATE_BIN_NUM</code> creates an additional column, <code>ATT</code> , which may be used for specifying nested attributes. This column is not used by <code>INSERT_BIN_NUM_QTILE</code> .
<code>data_table_name</code>	Name of the table containing the data to be transformed
<code>bin_num</code>	Number of bins. No binning occurs if <code>bin_num</code> is 0 or <code>NULL</code> . The default number of bins is 10.
<code>exclude_list</code>	List of numerical columns to be excluded from the binning process. If you do not specify <code>exclude_list</code> , all numerical columns in the data source are binned. The format of <code>exclude_list</code> is: <pre>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln')</pre>
<code>bin_schema_name</code>	Schema of <code>bin_table_name</code> . If no schema is specified, the current schema is used.
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.
2. After dividing the data into quantiles, the `NTILE` function distributes any remainder values one for each quantile, starting with the first. See *Oracle Database SQL Language Reference* for details.
3. Columns with all `NULL` values are ignored by `INSERT_BIN_NUM_QTILE`.

Examples

In this example, `INSERT_BIN_NUM_QTILE` computes the bin boundaries for the `cust_year_of_birth` and `cust_credit_limit` columns in `sh.customers` and inserts the transformations in a transformation definition table. The [STACK_BIN_NUM Procedure](#) creates a transformation list from the contents of the definition table.

The SQL expression that computes the transformation is shown in `STACK_VIEW`. The view is for display purposes only; it cannot be used to embed the transformations in a model.

```
CREATE OR REPLACE VIEW mining_data AS
    SELECT cust_id, cust_year_of_birth, cust_credit_limit, cust_city
    FROM sh.customers;
```

```
DESCRIBE mining_data
```

Name	Null?	Type
CUST_ID	NOT NULL	NUMBER
CUST_YEAR_OF_BIRTH	NOT NULL	NUMBER(4)
CUST_CREDIT_LIMIT		NUMBER
CUST_CITY	NOT NULL	VARCHAR2(30)

```
BEGIN
    dbms_data_mining_transform.CREATE_BIN_NUM(
        bin_table_name => 'bin_tbl');
    dbms_data_mining_transform.INSERT_BIN_NUM_QTILE (
        bin_table_name => 'bin_tbl',
        data_table_name => 'mining_data',
        bin_num         => 3,
        exclude_list    => dbms_data_mining_transform.COLUMN_LIST('cust_id'));
END;
```

```
/
```

```
set numwidth 8
column val off
column col format a20
column bin format a10
SELECT col, val, bin
    FROM bin_tbl
    ORDER BY col ASC, val ASC;
```

COL	VAL	BIN
CUST_CREDIT_LIMIT	1500	
CUST_CREDIT_LIMIT	3000	1
CUST_CREDIT_LIMIT	9000	2
CUST_CREDIT_LIMIT	15000	3
CUST_YEAR_OF_BIRTH	1913	

```

CUST_YEAR_OF_BIRTH      1949 1
CUST_YEAR_OF_BIRTH      1965 2
CUST_YEAR_OF_BIRTH      1990 3

DECLARE
  xforms  dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.STACK_BIN_NUM (
    bin_table_name      => 'bin_tbl',
    xform_list          => xforms);
  dbms_data_mining_transform.XFORM_STACK (
    xform_list          => xforms,
    data_table_name     => 'mining_data',
    xform_view_name     => 'stack_view');
END;
/

set long 3000
SELECT text FROM user_views WHERE view_name in 'STACK_VIEW';

TEXT
-----
SELECT "CUST_ID",CASE WHEN "CUST_YEAR_OF_BIRTH"<1913 THEN NULL WHEN "CUST_YEAR_O
F_BIRTH"<=1949 THEN '1' WHEN "CUST_YEAR_OF_BIRTH"<=1965 THEN '2' WHEN "CUST_YEAR
_OF_BIRTH"<=1990 THEN '3' END "CUST_YEAR_OF_BIRTH",CASE WHEN "CUST_CREDIT_LIMIT"
<1500 THEN NULL WHEN "CUST_CREDIT_LIMIT"<=3000 THEN '1' WHEN "CUST_CREDIT_LIMIT"
<=9000 THEN '2' WHEN "CUST_CREDIT_LIMIT"<=15000 THEN '3' END "CUST_CREDIT_LIMIT"
,"CUST_CITY" FROM mining_data

```

54.6.14 INSERT_BIN_SUPER Procedure

This procedure performs numerical and categorical binning and inserts the transformation definitions in transformation definition tables. The procedure computes bin boundaries based on intrinsic relationships between predictors and a target.

INSERT_BIN_SUPER uses an intelligent binning technique known as **supervised binning**. It builds a single-predictor decision tree and derives the bin boundaries from splits within the tree.

INSERT_BIN_SUPER bins all the VARCHAR2, CHAR, NUMBER, and FLOAT columns in the data source unless you specify a list of columns to ignore.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.INSERT_BIN_SUPER (
  num_table_name      IN VARCHAR2,
  cat_table_name      IN VARCHAR2,
  data_table_name     IN VARCHAR2,
  target_column_name  IN VARCHAR2,
  max_bin_num         IN PLS_INTEGER DEFAULT 1000,
  exclude_list        IN COLUMN_LIST  DEFAULT NULL,
  num_schema_name     IN VARCHAR2     DEFAULT NULL,
  cat_schema_name     IN VARCHAR2     DEFAULT NULL,
  data_schema_name    IN VARCHAR2     DEFAULT NULL,
  rem_table_name      IN VARCHAR2     DEFAULT NULL,
  rem_schema_name     IN VARCHAR2     DEFAULT NULL);

```

Parameters

Table 54-24 INSERT_BIN_SUPER Procedure Parameters

Parameter	Description
num_table_name	<p>Name of the transformation definition table for numerical binning. You can use the CREATE_BIN_NUM Procedure to create the definition table. The following columns are required:</p> <pre>COL VARCHAR2(30) VAL VNUMBER BIN VARCHAR2(4000)</pre> <p>CREATE_BIN_NUM creates an additional column, ATT, which may be used for specifying nested attributes. This column is not used by INSERT_BIN_SUPER.</p>
cat_table_name	<p>Name of the transformation definition table for categorical binning. You can use the CREATE_BIN_CAT Procedure to create the definition table. The following columns are required:</p> <pre>COL VARCHAR2(30) VAL VARCHAR2(4000) BIN VARCHAR2(4000)</pre> <p>CREATE_BIN_CAT creates an additional column, ATT, which is used for specifying nested attributes. This column is not used by INSERT_BIN_SUPER.</p>
data_table_name	Name of the table containing the data to be transformed
target_column_name	Name of a column to be used as the target for the decision tree models
max_bin_num	The maximum number of bins. The default is 1000.
exclude_list	<p>List of columns to be excluded from the binning process. If you do not specify <i>exclude_list</i>, all numerical and categorical columns in the data source are binned.</p> <p>The format of <i>exclude_list</i> is:</p> <pre>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln')</pre>
num_schema_name	Schema of <i>num_table_name</i> . If no schema is specified, the current schema is used.
cat_schema_name	Schema of <i>cat_table_name</i> . If no schema is specified, the current schema is used.
data_schema_name	Schema of <i>data_table_name</i> . If no schema is specified, the current schema is used.
rem_table_name	Name of a column removal definition table. The table must have the columns described in " CREATE_COL_REM Procedure ". You can use CREATE_COL_REM to create the table. See Usage Notes.
rem_schema_name	Schema of <i>rem_table_name</i> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about numerical and categorical data.
2. Columns that have no significant splits are not binned. You can remove the unbinned columns from the mining data by specifying a column removal definition table. If you do not specify a column removal definition table, the unbinned columns remain in the mining data.
3. See *Oracle Machine Learning for SQL Concepts* to learn more about decision trees in Oracle Machine Learning for SQL.

Examples

In this example, `INSERT_BIN_SUPER` computes the bin boundaries for predictors of `cust_credit_limit` and inserts the transformations in transformation definition tables. One predictor is numerical, the other is categorical. (`INSERT_BIN_SUPER` determines that the `cust_postal_code` column is not a significant predictor.) `STACK` procedures create transformation lists from the contents of the definition tables.

The SQL expressions that compute the transformations are shown in the views `MINING_DATA_STACK_NUM` and `MINING_DATA_STACK_CAT`. The views are for display purposes only; they cannot be used to embed the transformations in a model.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_year_of_birth, cust_marital_status,
         cust_postal_code, cust_credit_limit
  FROM sh.customers;
```

```
DESCRIBE mining_data
```

Name	Null?	Type
CUST_ID	NOT NULL	NUMBER
CUST_YEAR_OF_BIRTH	NOT NULL	NUMBER(4)
CUST_MARITAL_STATUS		VARCHAR2(20)
CUST_POSTAL_CODE	NOT NULL	VARCHAR2(10)
CUST_CREDIT_LIMIT		NUMBER

```
BEGIN
  dbms_data_mining_transform.CREATE_BIN_NUM(
    bin_table_name => 'bin_num_tbl');
  dbms_data_mining_transform.CREATE_BIN_CAT(
    bin_table_name => 'bin_cat_tbl');
  dbms_data_mining_transform.CREATE_COL_REM(
    rem_table_name => 'rem_tbl');
END;
/

BEGIN
  COMMIT;
  dbms_data_mining_transform.INSERT_BIN_SUPER (
    num_table_name => 'bin_num_tbl',
    cat_table_name => 'bin_cat_tbl',
    data_table_name => 'mining_data',
    target_column_name => 'cust_credit_limit',
    max_bin_num => 4,
    exclude_list => dbms_data_mining_transform.COLUMN_LIST('cust_id'),
    num_schema_name => 'oml_user',
    cat_schema_name => 'oml_user',
```



```

        data_schema_name => 'oml_user',
        rem_table_name    => 'rem_tbl',
        rem_schema_name   => 'oml_user');
    COMMIT;
END;
/

set numwidth 8
column val off
SELECT col, val, bin FROM bin_num_tbl
       ORDER BY bin ASC;

COL                VAL BIN
-----
CUST_YEAR_OF_BIRTH 1923.5 1
CUST_YEAR_OF_BIRTH 1923.5 1
CUST_YEAR_OF_BIRTH 1945.5 2
CUST_YEAR_OF_BIRTH 1980.5 3
CUST_YEAR_OF_BIRTH          4

column val on
column val format a20
SELECT col, val, bin FROM bin_cat_tbl
       ORDER BY bin ASC;

COL                VAL                BIN
-----
CUST_MARITAL_STATUS married                1
CUST_MARITAL_STATUS single                2
CUST_MARITAL_STATUS Mar-AF                3
CUST_MARITAL_STATUS Mabsent                3
CUST_MARITAL_STATUS Divorc.                3
CUST_MARITAL_STATUS Married                3
CUST_MARITAL_STATUS Widowed                3
CUST_MARITAL_STATUS NeverM                3
CUST_MARITAL_STATUS Separ.                3
CUST_MARITAL_STATUS divorced                4
CUST_MARITAL_STATUS widow                4

SELECT col from rem_tbl;

COL
-----
CUST_POSTAL_CODE

DECLARE
    xforms_num      dbms_data_mining_transform.TRANSFORM_LIST;
    xforms_cat      dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
    dbms_data_mining_transform.STACK_BIN_NUM (
        bin_table_name => 'bin_num_tbl',
        xform_list      => xforms_num);
    dbms_data_mining_transform.XFORM_STACK (
        xform_list      => xforms_num,
        data_table_name => 'mining_data',
        xform_view_name => 'mining_data_stack_num');
    dbms_data_mining_transform.STACK_BIN_CAT (
        bin_table_name => 'bin_cat_tbl',
        xform_list      => xforms_cat);
    dbms_data_mining_transform.XFORM_STACK (
        xform_list      => xforms_cat,

```

```

        data_table_name => 'mining_data',
        xform_view_name => 'mining_data_stack_cat');
    END;
/

set long 3000
SELECT text FROM user_views WHERE view_name IN 'MINING_DATA_STACK_NUM';

TEXT
-----
SELECT "CUST_ID",CASE WHEN "CUST_YEAR_OF_BIRTH"<1923.5 THEN '1' WHEN "CUST_YEAR_
OF_BIRTH"<=1923.5 THEN '1' WHEN "CUST_YEAR_OF_BIRTH"<=1945.5 THEN '2' WHEN "CUST
_YEAR_OF_BIRTH"<=1980.5 THEN '3' WHEN "CUST_YEAR_OF_BIRTH" IS NOT NULL THEN '4'
END "CUST_YEAR_OF_BIRTH","CUST_MARITAL_STATUS","CUST_POSTAL_CODE","CUST_CREDIT_L
IMIT" FROM mining_data

SELECT text FROM user_views WHERE view_name IN 'MINING_DATA_STACK_CAT';

TEXT
-----
SELECT "CUST_ID","CUST_YEAR_OF_BIRTH",DECODE("CUST_MARITAL_STATUS",'Divorc.','3'
,'Mabsent','3','Mar-AF','3','Married','3','NeverM','3','Separ.','3','Widowed','3
','divorced','4','married','1','single','2','widow','4') "CUST_MARITAL_STATUS","
CUST_POSTAL_CODE","CUST_CREDIT_LIMIT" FROM mining_data

```

54.6.15 INSERT_CLIP_TRIM_TAIL Procedure

This procedure replaces numeric outliers with nulls and inserts the transformation definitions in a transformation definition table.

`INSERT_CLIP_TRIM_TAIL` computes the boundaries of the data based on a specified percentage. It removes the values that fall outside the boundaries (tail values) from the data. If you wish to replace the tail values instead of removing them, use the [INSERT_CLIP_WINSOR_TAIL Procedure](#).

`INSERT_CLIP_TRIM_TAIL` clips all the `NUMBER` and `FLOAT` columns in the data source unless you specify a list of columns to ignore.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.INSERT_CLIP_TRIM_TAIL (
    clip_table_name    IN VARCHAR2,
    data_table_name    IN VARCHAR2,
    tail_frac          IN NUMBER DEFAULT 0.025,
    exclude_list       IN COLUMN_LIST DEFAULT NULL,
    clip_schema_name   IN VARCHAR2 DEFAULT NULL,
    data_schema_name   IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-25 INSERT_CLIP_TRIM_TAIL Procedure Parameters

Parameter	Description										
<code>clip_table_name</code>	<p>Name of the transformation definition table for numerical clipping. You can use the CREATE_CLIP Procedure to create the definition table. The following columns are required:</p> <table border="1" style="margin-left: 20px;"> <tr> <td><code>COL</code></td> <td><code>VARCHAR2(30)</code></td> </tr> <tr> <td><code>LCUT</code></td> <td><code>NUMBER</code></td> </tr> <tr> <td><code>LVAL</code></td> <td><code>NUMBER</code></td> </tr> <tr> <td><code>RCUT</code></td> <td><code>NUMBER</code></td> </tr> <tr> <td><code>RVAL</code></td> <td><code>NUMBER</code></td> </tr> </table> <p><code>CREATE_CLIP</code> creates an additional column, <code>ATT</code>, which may be used for specifying nested attributes. This column is not used by <code>INSERT_CLIP_TRIM_TAIL</code>.</p>	<code>COL</code>	<code>VARCHAR2(30)</code>	<code>LCUT</code>	<code>NUMBER</code>	<code>LVAL</code>	<code>NUMBER</code>	<code>RCUT</code>	<code>NUMBER</code>	<code>RVAL</code>	<code>NUMBER</code>
<code>COL</code>	<code>VARCHAR2(30)</code>										
<code>LCUT</code>	<code>NUMBER</code>										
<code>LVAL</code>	<code>NUMBER</code>										
<code>RCUT</code>	<code>NUMBER</code>										
<code>RVAL</code>	<code>NUMBER</code>										
<code>data_table_name</code>	Name of the table containing the data to be transformed										
<code>tail_frac</code>	<p>The percentage of non-null values to be designated as outliers at each end of the data. For example, if <code>tail_frac</code> is .01, then 1% of the data at the low end and 1% of the data at the high end will be treated as outliers.</p> <p>If <code>tail_frac</code> is greater than or equal to .5, no clipping occurs.</p> <p>The default value of <code>tail_frac</code> is 0.025.</p>										
<code>exclude_list</code>	<p>List of numerical columns to be excluded from the clipping process. If you do not specify <code>exclude_list</code>, all numerical columns in the data are clipped.</p> <p>The format of <code>exclude_list</code> is:</p> <pre>dbms_data_mining_transform.COLUMN_LIST('col1', 'col2', ... 'coln')</pre>										
<code>clip_schema_name</code>	Schema of <code>clip_table_name</code> . If no schema is specified, the current schema is used.										
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.										

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.
2. The `DBMS_DATA_MINING_TRANSFORM` package provides two clipping procedures: `INSERT_CLIP_TRIM_TAIL` and `INSERT_CLIP_WINSOR_TAIL`. Both procedures compute the boundaries as follows:
 - Count the number of non-null values, n , and sort them in ascending order
 - Calculate the number of outliers, t , as $n * tail_frac$
 - Define the lower boundary $lcut$ as the value at position $1 + floor(t)$
 - Define the upper boundary $rcut$ as the value at position $n - floor(t)$

(The SQL `FLOOR` function returns the largest integer less than or equal to t .)

- All values that are $\leq lcut$ or $\geq rcut$ are designated as outliers.

INSERT_CLIP_TRIM_TAIL replaces the outliers with nulls, effectively removing them from the data.

INSERT_CLIP_WINSOR_TAIL assigns $lcut$ to the low outliers and $rcut$ to the high outliers.

Examples

In this example, INSERT_CLIP_TRIM_TAIL trims 10% of the data in two columns (5% from the high end and 5% from the low end) and inserts the transformations in a transformation definition table. The STACK_CLIP Procedure creates a transformation list from the contents of the definition table.

The SQL expression that computes the trimming is shown in the view MINING_DATA_STACK. The view is for display purposes only; it cannot be used to embed the transformations in a model.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_year_of_birth, cust_credit_limit, cust_city
  FROM sh.customers;

DESCRIBE mining_data
Name                               Null?    Type
-----
CUST_ID                            NOT NULL NUMBER
CUST_YEAR_OF_BIRTH                 NOT NULL NUMBER(4)
CUST_CREDIT_LIMIT                  NUMBER
CUST_CITY                          NOT NULL VARCHAR2(30)

BEGIN
  dbms_data_mining_transform.CREATE_CLIP(
    clip_table_name => 'clip_tbl');
  dbms_data_mining_transform.INSERT_CLIP_TRIM_TAIL(
    clip_table_name => 'clip_tbl',
    data_table_name => 'mining_data',
    tail_frac       => 0.05,
    exclude_list    => DBMS_DATA_MINING_TRANSFORM.COLUMN_LIST('cust_id'));
END;
/

SELECT col, lcut, lval, rcut, rval
  FROM clip_tbl
  ORDER BY col ASC;

COL          LCUT    LVAL    RCUT    RVAL
-----
CUST_CREDIT_LIMIT      1500          11000
CUST_YEAR_OF_BIRTH     1934          1982

DECLARE
  xforms      dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.STACK_CLIP (
    clip_table_name => 'clip_tbl',
    xform_list      => xforms);
  dbms_data_mining_transform.XFORM_STACK (
    xform_list      => xforms,
    data_table_name => 'mining_data',
    xform_view_name => 'mining_data_stack');
END;
```

```

/

set long 3000
SELECT text FROM user_views WHERE view_name IN 'MINING_DATA_STACK';

TEXT
-----
SELECT "CUST_ID",CASE WHEN "CUST_YEAR_OF_BIRTH" < 1934 THEN NULL WHEN "CUST_YEAR
_OF_BIRTH" > 1982 THEN NULL ELSE "CUST_YEAR_OF_BIRTH" END "CUST_YEAR_OF_BIRTH",C
ASE WHEN "CUST_CREDIT_LIMIT" < 1500 THEN NULL WHEN "CUST_CREDIT_LIMIT" > 11000 T
HEN NULL ELSE "CUST_CREDIT_LIMIT" END "CUST_CREDIT_LIMIT","CUST_CITY" FROM minin
g_data

```

54.6.16 INSERT_CLIP_WINSOR_TAIL Procedure

This procedure replaces numeric outliers with the upper or lower boundary values. It inserts the transformation definitions in a transformation definition table.

INSERT_CLIP_WINSOR_TAIL computes the boundaries of the data based on a specified percentage. It replaces the values that fall outside the boundaries (tail values) with the related boundary value. If you wish to set tail values to null, use the [INSERT_CLIP_TRIM_TAIL Procedure](#).

INSERT_CLIP_WINSOR_TAIL clips all the NUMBER and FLOAT columns in the data source unless you specify a list of columns to ignore.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.INSERT_CLIP_WINSOR_TAIL (
    clip_table_name      IN VARCHAR2,
    data_table_name      IN VARCHAR2,
    tail_frac            IN NUMBER DEFAULT 0.025,
    exclude_list         IN COLUMN_LIST DEFAULT NULL,
    clip_schema_name     IN VARCHAR2 DEFAULT NULL,
    data_schema_name     IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-26 INSERT_CLIP_WINSOR_TAIL Procedure Parameters

Parameter	Description										
clip_table_name	Name of the transformation definition table for numerical clipping. You can use the CREATE_CLIP Procedure to create the definition table. The following columns are required: <table border="0" style="margin-left: 20px;"> <tr> <td>COL</td> <td>VARCHAR2 (30)</td> </tr> <tr> <td>LCUT</td> <td>NUMBER</td> </tr> <tr> <td>LVAL</td> <td>NUMBER</td> </tr> <tr> <td>RCUT</td> <td>NUMBER</td> </tr> <tr> <td>RVAL</td> <td>NUMBER</td> </tr> </table> CREATE_CLIP creates an additional column, ATT, which may be used for specifying nested attributes. This column is not used by INSERT_CLIP_WINSOR_TAIL.	COL	VARCHAR2 (30)	LCUT	NUMBER	LVAL	NUMBER	RCUT	NUMBER	RVAL	NUMBER
COL	VARCHAR2 (30)										
LCUT	NUMBER										
LVAL	NUMBER										
RCUT	NUMBER										
RVAL	NUMBER										
data_table_name	Name of the table containing the data to be transformed										

Table 54-26 (Cont.) INSERT_CLIP_WINSOR_TAIL Procedure Parameters

Parameter	Description
<code>tail_frac</code>	<p>The percentage of non-null values to be designated as outliers at each end of the data. For example, if <code>tail_frac</code> is .01, then 1% of the data at the low end and 1% of the data at the high end will be treated as outliers.</p> <p>If <code>tail_frac</code> is greater than or equal to .5, no clipping occurs.</p> <p>The default value of <code>tail_frac</code> is 0.025.</p>
<code>exclude_list</code>	<p>List of numerical columns to be excluded from the clipping process. If you do not specify <code>exclude_list</code>, all numerical columns in the data are clipped.</p> <p>The format of <code>exclude_list</code> is:</p> <pre>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln')</pre>
<code>clip_schema_name</code>	<p>Schema of <code>clip_table_name</code>. If no schema is specified, the current schema is used.</p>
<code>data_schema_name</code>	<p>Schema of <code>data_table_name</code>. If no schema is specified, the current schema is used.</p>

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.
2. The `DBMS_DATA_MINING_TRANSFORM` package provides two clipping procedures: `INSERT_CLIP_WINSOR_TAIL` and `INSERT_CLIP_TRIM_TAIL`. Both procedures compute the boundaries as follows:

- Count the number of non-null values, n , and sort them in ascending order
 - Calculate the number of outliers, t , as $n * tail_frac$
 - Define the lower boundary $lcut$ as the value at position $1 + floor(t)$
 - Define the upper boundary $rcut$ as the value at position $n - floor(t)$
- (The SQL `FLOOR` function returns the largest integer less than or equal to t .)
- All values that are $\leq lcut$ or $\geq rcut$ are designated as outliers.

`INSERT_CLIP_WINSOR_TAIL` assigns $lcut$ to the low outliers and $rcut$ to the high outliers.

`INSERT_CLIP_TRIM_TAIL` replaces the outliers with nulls, effectively removing them from the data.

Examples

In this example, `INSERT_CLIP_WINSOR_TAIL` winsorizes 10% of the data in two columns (5% from the high end, and 5% from the low end) and inserts the transformations in a transformation definition table. The [STACK_CLIP Procedure](#) creates a transformation list from the contents of the definition table.

The SQL expression that computes the transformation is shown in the view `MINING_DATA_STACK`. The view is for display purposes only; it cannot be used to embed the transformations in a model.

```

CREATE OR REPLACE VIEW mining_data AS
    SELECT cust_id, cust_year_of_birth, cust_credit_limit, cust_city
    FROM sh.customers;

describe mining_data
Name                                                    Null?   Type
-----
CUST_ID                                                NOT NULL NUMBER
CUST_YEAR_OF_BIRTH                                    NOT NULL NUMBER(4)
CUST_CREDIT_LIMIT                                     NUMBER
CUST_CITY                                              NOT NULL VARCHAR2(30)

BEGIN
  dbms_data_mining_transform.CREATE_CLIP(
    clip_table_name => 'clip_tbl');
  dbms_data_mining_transform.INSERT_CLIP_WINSOR_TAIL(
    clip_table_name => 'clip_tbl',
    data_table_name => 'mining_data',
    tail_frac       => 0.05,
    exclude_list    => DBMS_DATA_MINING_TRANSFORM.COLUMN_LIST('cust_id'));
END;
/

SELECT col, lcut, lval, rcut, rval FROM clip_tbl
    ORDER BY col ASC;
COL                LCUT      LVAL      RCUT      RVAL
-----
CUST_CREDIT_LIMIT  1500     1500     11000    11000
CUST_YEAR_OF_BIRTH 1934     1934     1982     1982

DECLARE
  xforms          dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.STACK_CLIP (
    clip_table_name => 'clip_tbl',
    xform_list      => xforms);
  dbms_data_mining_transform.XFORM_STACK (
    xform_list      => xforms,
    data_table_name => 'mining_data',
    xform_view_name => 'mining_data_stack');
END;
/

set long 3000
SQL> SELECT text FROM user_views WHERE view_name IN 'MINING_DATA_STACK';

TEXT
-----
SELECT "CUST_ID",CASE WHEN "CUST_YEAR_OF_BIRTH" < 1934 THEN 1934 WHEN "CUST_YEAR
_OF_BIRTH" > 1982 THEN 1982 ELSE "CUST_YEAR_OF_BIRTH" END "CUST_YEAR_OF_BIRTH",C
ASE WHEN "CUST_CREDIT_LIMIT" < 1500 THEN 1500 WHEN "CUST_CREDIT_LIMIT" > 11000 T
HEN 11000 ELSE "CUST_CREDIT_LIMIT" END "CUST_CREDIT_LIMIT","CUST_CITY" FROM mini
ng_data

```

54.6.17 INSERT_MISS_CAT_MODE Procedure

This procedure replaces missing categorical values with the value that occurs most frequently in the column (the mode). It inserts the transformation definitions in a transformation definition table.

`INSERT_MISS_CAT_MODE` replaces missing values in all `VARCHAR2` and `CHAR` columns in the data source unless you specify a list of columns to ignore.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.INSERT_MISS_CAT_MODE (
  miss_table_name    IN VARCHAR2,
  data_table_name    IN VARCHAR2,
  exclude_list       IN COLUMN_LIST DEFAULT NULL,
  miss_schema_name   IN VARCHAR2 DEFAULT NULL,
  data_schema_name   IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 54-27 INSERT_MISS_CAT_MODE Procedure Parameters

Parameter	Description				
<code>miss_table_name</code>	Name of the transformation definition table for categorical missing value treatment. You can use the CREATE_MISS_CAT Procedure to create the definition table. The following columns are required: <table border="0" style="margin-left: 20px;"> <tr> <td style="padding-right: 10px;"><code>COL</code></td> <td><code>VARCHAR2(30)</code></td> </tr> <tr> <td><code>VAL</code></td> <td><code>VARCHAR2(4000)</code></td> </tr> </table> <p><code>CREATE_MISS_CAT</code> creates an additional column, <code>ATT</code>, which may be used for specifying nested attributes. This column is not used by <code>INSERT_MISS_CAT_MODE</code>.</p>	<code>COL</code>	<code>VARCHAR2(30)</code>	<code>VAL</code>	<code>VARCHAR2(4000)</code>
<code>COL</code>	<code>VARCHAR2(30)</code>				
<code>VAL</code>	<code>VARCHAR2(4000)</code>				
<code>data_table_name</code>	Name of the table containing the data to be transformed				
<code>exclude_list</code>	List of categorical columns to be excluded from missing value treatment. If you do not specify <code>exclude_list</code> , all categorical columns are transformed. The format of <code>exclude_list</code> is: <pre>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln')</pre>				
<code>miss_schema_name</code>	Schema of <code>miss_table_name</code> . If no schema is specified, the current schema is used.				
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.				

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about categorical data.
2. If you wish to replace categorical missing values with a value other than the mode, you can edit the transformation definition table.

 **See Also:**

Oracle Machine Learning for SQL User's Guide for information about default missing value treatment in Oracle Machine Learning for SQL

Example

In this example, `INSERT_MISS_CAT_MODE` computes missing value treatment for `cust_city` and inserts the transformation in a transformation definition table. The [STACK_MISS_CAT Procedure](#) creates a transformation list from the contents of the definition table.

The SQL expression that computes the transformation is shown in the view `MINING_DATA_STACK`. The view is for display purposes only; it cannot be used to embed the transformations in a model.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_year_of_birth, cust_city
  FROM sh.customers;
```

```
describe mining_data
```

Name	Null?	Type
CUST_ID	NOT NULL	NUMBER
CUST_YEAR_OF_BIRTH	NOT NULL	NUMBER(4)
CUST_CITY	NOT NULL	VARCHAR2(30)

```
BEGIN
  dbms_data_mining_transform.create_miss_cat(
    miss_table_name => 'missc_tbl');
  dbms_data_mining_transform.insert_miss_cat_mode(
    miss_table_name => 'missc_tbl',
    data_table_name => 'mining_data');
END;
```

```
/
```

```
SELECT stats_mode(cust_city) FROM mining_data;
```

```
STATS_MODE(CUST_CITY)
```

```
-----
Los Angeles
```

```
SELECT col, val
  from missc_tbl;
```

COL	VAL
CUST_CITY	Los Angeles

```
DECLARE
  xforms      dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
```

```
  dbms_data_mining_transform.STACK_MISS_CAT (
    miss_table_name => 'missc_tbl',
    xform_list      => xforms);
  dbms_data_mining_transform.XFORM_STACK (
    xform_list      => xforms,
    data_table_name => 'mining_data',
```

```

        xform_view_name    => 'mining_data_stack');
END;
/

set long 3000
SELECT text FROM user_views WHERE view_name IN 'MINING_DATA_STACK';

TEXT
-----
SELECT "CUST_ID", "CUST_YEAR_OF_BIRTH", NVL("CUST_CITY", 'Los Angeles') "CUST_CITY"
FROM mining_data

```

54.6.18 INSERT_MISS_NUM_MEAN Procedure

This procedure replaces missing numerical values with the average (the mean) and inserts the transformation definitions in a transformation definition table.

INSERT_MISS_NUM_MEAN replaces missing values in all NUMBER and FLOAT columns in the data source unless you specify a list of columns to ignore.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.INSERT_MISS_NUM_MEAN (
    miss_table_name    IN VARCHAR2,
    data_table_name    IN VARCHAR2,
    exclude_list       IN COLUMN_LIST DEFAULT NULL,
    round_num          IN PLS_INTEGER DEFAULT 6,
    miss_schema_name   IN VARCHAR2 DEFAULT NULL,
    data_schema_name   IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-28 INSERT_MISS_NUM_MEAN Procedure Parameters

Parameter	Description				
miss_table_name	<p>Name of the transformation definition table for numerical missing value treatment. You can use the CREATE_MISS_NUM Procedure to create the definition table.</p> <p>The following columns are required by INSERT_MISS_NUM_MEAN:</p> <table border="1"> <tr> <td>COL</td> <td>VARCHAR2 (30)</td> </tr> <tr> <td>VAL</td> <td>NUMBER</td> </tr> </table> <p>CREATE_MISS_NUM creates an additional column, ATT, which may be used for specifying nested attributes. This column is not used by INSERT_MISS_NUM_MEAN.</p>	COL	VARCHAR2 (30)	VAL	NUMBER
COL	VARCHAR2 (30)				
VAL	NUMBER				
data_table_name	Name of the table containing the data to be transformed				
exclude_list	<p>List of numerical columns to be excluded from missing value treatment. If you do not specify <i>exclude_list</i>, all numerical columns are transformed.</p> <p>The format of <i>exclude_list</i> is:</p> <pre>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln')</pre>				
round_num	<p>The number of significant digits to use for the mean.</p> <p>The default number is 6.</p>				

Table 54-28 (Cont.) INSERT_MISS_NUM_MEAN Procedure Parameters

Parameter	Description
miss_schema_name	Schema of <i>miss_table_name</i> . If no schema is specified, the current schema is used.
data_schema_name	Schema of <i>data_table_name</i> . If no schema is specified, the current schema is used.

Usage Notes

1. See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.
2. If you wish to replace numerical missing values with a value other than the mean, you can edit the transformation definition table.

 **See Also:**

Oracle Machine Learning for SQL User's Guide for information about default missing value treatment in Oracle Machine Learning for SQL

Example

In this example, `INSERT_MISS_NUM_MEAN` computes missing value treatment for `cust_year_of_birth` and inserts the transformation in a transformation definition table. The [STACK_MISS_NUM Procedure](#) creates a transformation list from the contents of the definition table.

The SQL expression that computes the transformation is shown in the view `MINING_DATA_STACK`. The view is for display purposes only; it cannot be used to embed the transformations in a model.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_year_of_birth, cust_city
  FROM sh.customers;

DESCRIBE mining_data
Name                                     Null?      Type
-----
CUST_ID                                 NOT NULL   NUMBER
CUST_YEAR_OF_BIRTH                      NOT NULL   NUMBER(4)
CUST_CITY                                NOT NULL   VARCHAR2(30)

BEGIN
  dbms_data_mining_transform.create_miss_num(
    miss_table_name => 'missn_tbl');
  dbms_data_mining_transform.insert_miss_num_mean(
    miss_table_name => 'missn_tbl',
    data_table_name => 'mining_data',
    exclude_list   => DBMS_DATA_MINING_TRANSFORM.COLUMN_LIST('cust_id'));
END;
/

set numwidth 4
column val off
```

```

SELECT col, val
   FROM missn_tbl;

COL                VAL
-----
CUST_YEAR_OF_BIRTH 1957

SELECT avg(cust_year_of_birth) FROM mining_data;

AVG(CUST_YEAR_OF_BIRTH)
-----
                        1957

DECLARE
  xforms          dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.STACK_MISS_NUM (
    miss_table_name => 'missn_tbl',
    xform_list      => xforms);
  dbms_data_mining_transform.XFORM_STACK (
    xform_list      => xforms,
    data_table_name => 'mining_data',
    xform_view_name => 'mining_data_stack');
END;
/

set long 3000
SELECT text FROM user_views WHERE view_name IN 'MINING_DATA_STACK';

TEXT
-----
SELECT "CUST_ID",NVL("CUST_YEAR_OF_BIRTH",1957.4) "CUST_YEAR_OF_BIRTH","CUST_CIT
Y" FROM mining_data

```

54.6.19 INSERT_NORM_LIN_MINMAX Procedure

This procedure performs linear normalization and inserts the transformation definitions in a transformation definition table.

INSERT_NORM_LIN_MINMAX computes the minimum and maximum values from the data and sets the value of *shift* and *scale* as follows:

```

shift = min
scale = max - min

```

Normalization is computed as:

$$x_{new} = (x_{old} - shift) / scale$$

INSERT_NORM_LIN_MINMAX rounds the value of *scale* to a specified number of significant digits before storing it in the transformation definition table.

INSERT_NORM_LIN_MINMAX normalizes all the NUMBER and FLOAT columns in the data source unless you specify a list of columns to ignore.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.INSERT_NORM_LIN_MINMAX (
  norm_table_name      IN VARCHAR2,
  data_table_name      IN VARCHAR2,

```

```

exclude_list      IN COLUMN_LIST DEFAULT NULL,
round_num         IN PLS_INTEGER DEFAULT 6,
norm_schema_name  IN VARCHAR2 DEFAULT NULL,
data_schema_name  IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-29 *INSERT_NORM_LIN_MINMAX Procedure Parameters*

Parameter	Description						
norm_table_name	Name of the transformation definition table for linear normalization. You can use the CREATE_NORM_LIN Procedure to create the definition table. The following columns are required: <table border="0" style="margin-left: 20px;"> <tr> <td>COL</td> <td>VARCHAR2(30)</td> </tr> <tr> <td>SHIFT</td> <td>NUMBER</td> </tr> <tr> <td>SCALE</td> <td>NUMBER</td> </tr> </table> CREATE_NORM_LIN creates an additional column, ATT, which may be used for specifying nested attributes. This column is not used by INSERT_NORM_LIN_MINMAX.	COL	VARCHAR2(30)	SHIFT	NUMBER	SCALE	NUMBER
COL	VARCHAR2(30)						
SHIFT	NUMBER						
SCALE	NUMBER						
data_table_name	Name of the table containing the data to be transformed						
exclude_list	List of numerical columns to be excluded from normalization. If you do not specify <i>exclude_list</i> , all numerical columns are transformed. The format of <i>exclude_list</i> is: <pre>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ... 'coln')</pre>						
round_num	The number of significant digits to use for the minimum and maximum. The default number is 6.						
norm_schema_name	Schema of <i>norm_table_name</i> . If no schema is specified, the current schema is used.						
data_schema_name	Schema of <i>data_table_name</i> . If no schema is specified, the current schema is used.						

Usage Notes

See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.

Examples

In this example, INSERT_NORM_LIN_MINMAX normalizes the *cust_year_of_birth* column and inserts the transformation in a transformation definition table. The [STACK_NORM_LIN Procedure](#) creates a transformation list from the contents of the definition table.

The SQL expression that computes the transformation is shown in the view MINING_DATA_STACK. The view is for display purposes only; it cannot be used to embed the transformations in a model.

```

CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_gender, cust_year_of_birth
  FROM sh.customers;

```

```
describe mining_data
```

```

Name                               Null?   Type
-----
CUST_ID                             NOT NULL NUMBER
CUST_GENDER                          NOT NULL CHAR(1)
CUST_YEAR_OF_BIRTH                   NOT NULL NUMBER(4)

BEGIN
  dbms_data_mining_transform.CREATE_NORM_LIN(
    norm_table_name => 'norm_tbl');
  dbms_data_mining_transform.INSERT_NORM_LIN_MINMAX(
    norm_table_name => 'norm_tbl',
    data_table_name => 'mining_data',
    exclude_list   => dbms_data_mining_transform.COLUMN_LIST( 'cust_id'),
    round_num      => 3);
END;
/

SELECT col, shift, scale FROM norm_tbl;

COL                                SHIFT      SCALE
-----
CUST_YEAR_OF_BIRTH                 1910       77

DECLARE
  xforms      dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.STACK_NORM_LIN (
    norm_table_name => 'norm_tbl',
    xform_list      => xforms);
  dbms_data_mining_transform.XFORM_STACK (
    xform_list      => xforms,
    data_table_name => 'mining_data',
    xform_view_name => 'mining_data_stack');
END;
/

set long 3000
SELECT text FROM user_views WHERE view_name IN 'MINING_DATA_STACK';

TEXT
-----
SELECT "CUST_ID","CUST_GENDER",("CUST_YEAR_OF_BIRTH"-1910)/77 "CUST_YEAR_OF_BIRTH" FROM mining_data

```

54.6.20 INSERT_NORM_LIN_SCALE Procedure

This procedure performs linear normalization and inserts the transformation definitions in a transformation definition table.

`INSERT_NORM_LIN_SCALE` computes the minimum and maximum values from the data and sets the value of *shift* and *scale* as follows:

```

shift = 0
scale = max(abs(max), abs(min))

```

Normalization is computed as:

```

x_new = (x_old)/scale

```

INSERT_NORM_LIN_SCALE rounds the value of *scale* to a specified number of significant digits before storing it in the transformation definition table.

INSERT_NORM_LIN_SCALE normalizes all the NUMBER and FLOAT columns in the data source unless you specify a list of columns to ignore.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.INSERT_NORM_LIN_SCALE (
    norm_table_name      IN VARCHAR2,
    data_table_name      IN VARCHAR2,
    exclude_list         IN COLUMN_LIST DEFAULT NULL,
    round_num            IN PLS_INTEGER DEFAULT 6,
    norm_schema_name     IN VARCHAR2 DEFAULT NULL,
    data_schema_name     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 54-30 INSERT_NORM_LIN_SCALE Procedure Parameters

Parameter	Description						
norm_table_name	Name of the transformation definition table for linear normalization. You can use the CREATE_NORM_LIN Procedure to create the definition table. The following columns are required: <table border="0"> <tr> <td>COL</td> <td>VARCHAR2(30)</td> </tr> <tr> <td>SHIFT</td> <td>NUMBER</td> </tr> <tr> <td>SCALE</td> <td>NUMBER</td> </tr> </table> CREATE_NORM_LIN creates an additional column, ATT, which may be used for specifying nested attributes. This column is not used by INSERT_NORM_LIN_SCALE.	COL	VARCHAR2(30)	SHIFT	NUMBER	SCALE	NUMBER
COL	VARCHAR2(30)						
SHIFT	NUMBER						
SCALE	NUMBER						
data_table_name	Name of the table containing the data to be transformed						
exclude_list	List of numerical columns to be excluded from normalization. If you do not specify <i>exclude_list</i> , all numerical columns are transformed. The format of <i>exclude_list</i> is: dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln')						
round_num	The number of significant digits to use for <i>scale</i> . The default number is 6.						
norm_schema_name	Schema of <i>norm_table_name</i> . If no schema is specified, the current schema is used.						
data_schema_name	Schema of <i>data_table_name</i> . If no schema is specified, the current schema is used.						

Usage Notes

See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.

Examples

In this example, INSERT_NORM_LIN_SCALE normalizes the *cust_year_of_birth* column and inserts the transformation in a transformation definition table. The

STACK_NORM_LIN Procedure creates a transformation list from the contents of the definition table.

The SQL expression that computes the transformation is shown in the view `MINING_DATA_STACK`. The view is for display purposes only; it cannot be used to embed the transformations in a model.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_gender, cust_year_of_birth
  FROM sh.customers;

DESCRIBE mining_data
Name                               Null?    Type
-----
CUST_ID                             NOT NULL NUMBER
CUST_GENDER                          NOT NULL CHAR(1)
CUST_YEAR_OF_BIRTH                   NOT NULL NUMBER(4)

BEGIN
  dbms_data_mining_transform.CREATE_NORM_LIN(
    norm_table_name => 'norm_tbl');
  dbms_data_mining_transform.INSERT_NORM_LIN_SCALE(
    norm_table_name => 'norm_tbl',
    data_table_name => 'mining_data',
    exclude_list   => dbms_data_mining_transform.COLUMN_LIST('cust_id'),
    round_num      => 3);
END;
/

SELECT col, shift, scale FROM norm_tbl;

COL                SHIFT SCALE
-----
CUST_YEAR_OF_BIRTH      0  1990

DECLARE
  xforms      dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.STACK_NORM_LIN (
    norm_table_name  => 'norm_tbl',
    xform_list       => xforms);
  dbms_data_mining_transform.XFORM_STACK (
    xform_list       => xforms,
    data_table_name  => 'mining_data',
    xform_view_name  => 'mining_data_stack');
END;
/

set long 3000
SELECT text FROM user_views WHERE view_name IN 'MINING_DATA_STACK';

TEXT
-----
SELECT "CUST_ID","CUST_GENDER",("CUST_YEAR_OF_BIRTH"-0)/1990 "CUST_YEAR_OF_BIRTH
" FROM mining_data
```


54.6.21 INSERT_NORM_LIN_ZSCORE Procedure

This procedure performs linear normalization and inserts the transformation definitions in a transformation definition table.

INSERT_NORM_LIN_ZSCORE computes the mean and the standard deviation from the data and sets the value of *shift* and *scale* as follows:

```
shift = mean
scale = stddev
```

Normalization is computed as:

$$x_{new} = (x_{old} - shift) / scale$$

INSERT_NORM_LIN_ZSCORE rounds the value of *scale* to a specified number of significant digits before storing it in the transformation definition table.

INSERT_NORM_LIN_ZSCORE normalizes all the NUMBER and FLOAT columns in the data unless you specify a list of columns to ignore.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.INSERT_NORM_LIN_ZSCORE (
    norm_table_name      IN VARCHAR2,
    data_table_name      IN VARCHAR2,
    exclude_list         IN COLUMN_LIST DEFAULT NULL,
    round_num            IN PLS_INTEGER DEFAULT 6,
    norm_schema_name     IN VARCHAR2 DEFAULT NULL,
    data_schema_name     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 54-31 INSERT_NORM_LIN_ZSCORE Procedure Parameters

Parameter	Description						
norm_table_name	Name of the transformation definition table for linear normalization. You can use the CREATE_NORM_LIN Procedure to create the definition table. The following columns are required: <table border="1" data-bbox="646 1423 925 1507"> <tr> <td>COL</td> <td>VARCHAR2(30)</td> </tr> <tr> <td>SHIFT</td> <td>NUMBER</td> </tr> <tr> <td>SCALE</td> <td>NUMBER</td> </tr> </table> CREATE_NORM_LIN creates an additional column, ATT, which may be used for specifying nested attributes. This column is not used by INSERT_NORM_LIN_ZSCORE.	COL	VARCHAR2(30)	SHIFT	NUMBER	SCALE	NUMBER
COL	VARCHAR2(30)						
SHIFT	NUMBER						
SCALE	NUMBER						
data_table_name	Name of the table containing the data to be transformed						
exclude_list	List of numerical columns to be excluded from normalization. If you do not specify <i>exclude_list</i> , all numerical columns are transformed. The format of <i>exclude_list</i> is: <pre>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ... 'coln')</pre>						

Table 54-31 (Cont.) INSERT_NORM_LIN_ZSCORE Procedure Parameters

Parameter	Description
round_num	The number of significant digits to use for <i>scale</i> . The default number is 6.
norm_schema_name	Schema of <i>norm_table_name</i> . If no schema is specified, the current schema is used.
data_schema_name	Schema of <i>data_table_name</i> . If no schema is specified, the current schema is used.

Usage Notes

See *Oracle Machine Learning for SQL User's Guide* for details about numerical data.

Examples

In this example, `INSERT_NORM_LIN_ZSCORE` normalizes the `cust_year_of_birth` column and inserts the transformation in a transformation definition table. The [STACK_NORM_LIN Procedure](#) creates a transformation list from the contents of the definition table.

The SQL expression that computes the transformation is shown in the view `MINING_DATA_STACK`. The view is for display purposes only; it cannot be used to embed the transformations in a model.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_gender, cust_year_of_birth
  FROM sh.customers;

DESCRIBE mining_data
Name                               Null?    Type
-----
CUST_ID                             NOT NULL NUMBER
CUST_GENDER                          NOT NULL CHAR(1)
CUST_YEAR_OF_BIRTH                   NOT NULL NUMBER(4)

BEGIN
  dbms_data_mining_transform.CREATE_NORM_LIN(
    norm_table_name => 'norm_tbl');
  dbms_data_mining_transform.INSERT_NORM_LIN_ZSCORE(
    norm_table_name => 'norm_tbl',
    data_table_name => 'mining_data',
    exclude_list   => dbms_data_mining_transform.COLUMN_LIST('cust_id'),
    round_num      => 3);
END;
/

SELECT col, shift, scale FROM norm_tbl;

COL                SHIFT SCALE
-----
CUST_YEAR_OF_BIRTH 1960    15

DECLARE
  xforms      dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.STACK_NORM_LIN (
    norm_table_name => 'norm_tbl',
```

```

        xform_list      => xforms);
dbms_data_mining_transform.XFORM_STACK (
    xform_list          => xforms,
    data_table_name     => 'mining_data',
    xform_view_name     => 'mining_data_stack');
END;
/

set long 3000
SQL> SELECT text FROM user_views WHERE view_name IN 'MINING_DATA_STACK';

TEXT
-----
SELECT "CUST_ID","CUST_GENDER", ("CUST_YEAR_OF_BIRTH"-1960)/15 "CUST_YEAR_OF_BIRTH"
H" FROM mining_data

```

54.6.22 SET_EXPRESSION Procedure

This procedure appends a row to a `VARCHAR2` array that stores a SQL expression.

The array can be used for specifying a transformation expression that is too long to be used with the [SET_TRANSFORM Procedure](#).

The [GET_EXPRESSION Function](#) returns a row in the array.

When you use `SET_EXPRESSION` to build a transformation expression, you must build a corresponding reverse transformation expression, create a transformation record, and add the transformation record to a transformation list.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.SET_EXPRESSION (
    expression      IN OUT NOCOPY EXPRESSION_REC,
    chunk           VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-32 SET_EXPRESSION Procedure Parameters

Parameter	Description
<code>expression</code>	<p>An expression record (<code>EXPRESSION_REC</code>) that specifies a transformation expression or a reverse transformation expression for an attribute. Each expression record includes a <code>VARCHAR2</code> array and index fields for specifying upper and lower boundaries within the array.</p> <p>There are two <code>EXPRESSION_REC</code> fields within a transformation record (<code>TRANSFORM_REC</code>): one for the transformation expression; the other for the reverse transformation expression.</p> <p>See Table 54-1 for a description of the <code>EXPRESSION_REC</code> type.</p>
<code>chunk</code>	A <code>VARCHAR2</code> chunk (row) to be appended to <code>expression</code> .

Notes

1. You can pass `NULL` in the `chunk` argument to `SET_EXPRESSION` to clear the previous chunk. The default value of `chunk` is `NULL`.
2. See "[About Transformation Lists](#)".

3. See "Operational Notes".

Examples

In this example, two calls to `SET_EXPRESSION` construct a transformation expression and two calls construct the reverse transformation.

Note:

This example is for illustration purposes only. It shows how `SET_EXPRESSION` appends the text provided in `chunk` to the text that already exists in `expression`. The `SET_EXPRESSION` procedure is meant for constructing very long transformation expressions that cannot be specified in a `VARCHAR2` argument to `SET_TRANSFORM`.

Similarly while transformation lists are intended for embedding in a model, the transformation list `v_xlst` is shown in an external view for illustration purposes.

```

CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_year_of_birth, cust_postal_code, cust_credit_limit
  FROM sh.customers;

DECLARE
  v_expr dbms_data_mining_transform.EXPRESSION_REC;
  v_rexp dbms_data_mining_transform.EXPRESSION_REC;
  v_xrec dbms_data_mining_transform.TRANSFORM_REC;
  v_xlst dbms_data_mining_transform.TRANSFORM_LIST :=
    dbms_data_mining_transform.TRANSFORM_LIST (NULL);

BEGIN
  dbms_data_mining_transform.SET_EXPRESSION(
    EXPRESSION => v_expr,
    CHUNK      => '("CUST_YEAR_OF_BIRTH"-1910)');
  dbms_data_mining_transform.SET_EXPRESSION(
    EXPRESSION => v_expr,
    CHUNK      => '/77');
  dbms_data_mining_transform.SET_EXPRESSION(
    EXPRESSION => v_rexp,
    CHUNK      => '"CUST_YEAR_OF_BIRTH"*77');
  dbms_data_mining_transform.SET_EXPRESSION(
    EXPRESSION => v_rexp,
    CHUNK      => '+1910');

  v_xrec := null;
  v_xrec.attribute_name := 'CUST_YEAR_OF_BIRTH';
  v_xrec.expression := v_expr;
  v_xrec.reverse_expression := v_rexp;
  v_xlst.TRIM;
  v_xlst.extend(1);
  v_xlst(1) := v_xrec;

  dbms_data_mining_transform.XFORM_STACK (
    xform_list      => v_xlst,
    data_table_name => 'mining_data',
    xform_view_name => 'v_xlst_view');

  dbms_output.put_line('====');
  FOR i IN 1..v_xlst.count LOOP
    dbms_output.put_line('ATTR: '||v_xlst(i).attribute_name);
  
```

```

dbms_output.put_line('SUBN: '||v_xlst(i).attribute_subname);
FOR j IN v_xlst(i).expression.lb..v_xlst(i).expression.ub LOOP
    dbms_output.put_line('EXPR: '||v_xlst(i).expression.lstmt(j));
END LOOP;
FOR j IN v_xlst(i).reverse_expression.lb..
    v_xlst(i).reverse_expression.ub LOOP
    dbms_output.put_line('REXP: '||v_xlst(i).reverse_expression.lstmt(j));
END LOOP;
dbms_output.put_line('====');
END LOOP;
END;
/
====
ATTR: CUST_YEAR_OF_BIRTH
SUBN:
EXPR: ("CUST_YEAR_OF_BIRTH"-1910)
EXPR: /77
REXP: "CUST_YEAR_OF_BIRTH"*77
REXP: +1910
====

```

54.6.23 SET_TRANSFORM Procedure

This procedure appends the transformation instructions for an attribute to a transformation list.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.SET_TRANSFORM (
    xform_list          IN OUT NOCOPY TRANSFORM_LIST,
    attribute_name      VARCHAR2,
    attribute_subname   VARCHAR2,
    expression          VARCHAR2,
    reverse_expression  VARCHAR2,
    attribute_spec      VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-33 SET_TRANSFORM Procedure Parameters

Parameter	Description
xform_list	A transformation list. See Table 54-1 for a description of the TRANSFORM_LIST object type.
attribute_name	Name of the attribute to be transformed
attribute_subname	Name of the nested attribute if <i>attribute_name</i> is a nested column, otherwise NULL.
expression	A SQL expression that specifies the transformation of the attribute.
reverse_expression	A SQL expression that reverses the transformation for readability in model details and in the target of a supervised model (if the attribute is a target)

Table 54-33 (Cont.) SET_TRANSFORM Procedure Parameters

Parameter	Description
attribute_spec	<p>One or more keywords that identify special treatment for the attribute during model build. Values are:</p> <ul style="list-style-type: none"> • NOPREP — When ADP is on, prevents automatic transformation of the attribute. If ADP is not on, this value has no effect. • TEXT — Causes the attribute to be treated as unstructured text data • FORCE_IN — Forces the inclusion of the attribute in the model build. Applies only to GLM models with feature selection enabled (<code>ftr_selection_enable = yes</code>). Feature selection is disabled by default. <p>If the model is not using GLM with feature selection, this value has no effect.</p> <p>See "Specifying Transformation Instructions for an Attribute" in <i>Oracle Machine Learning for SQL User's Guide</i> for more information about <code>attribute_spec</code>.</p>

Usage Notes

1. See the following relevant sections in "[Operational Notes](#)":
 - About Transformation Lists
 - Nested Data Transformations
2. As shown in the following example, you can eliminate an attribute by specifying a null transformation expression and reverse expression. You can also use the `STACK` interface to remove a column ([CREATE_COL_REM Procedure](#) and [STACK_COL_REM Procedure](#)).

54.6.24 STACK_BIN_CAT Procedure

This procedure adds categorical binning transformations to a transformation list.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.STACK_BIN_CAT (
  bin_table_name      IN          VARCHAR2,
  xform_list          IN OUT NOCOPY TRANSFORM_LIST,
  literal_flag        IN          BOOLEAN DEFAULT FALSE,
  bin_schema_name     IN          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 54-34 STACK_BIN_CAT Procedure Parameters

Parameter	Description
<code>bin_table_name</code>	Name of the transformation definition table for categorical binning. You can use the CREATE_BIN_CAT Procedure to create the definition table. The table must be populated with transformation definitions before you call <code>STACK_BIN_CAT</code> . To populate the table, you can use one of the <code>INSERT</code> procedures for categorical binning or you can write your own SQL. See Table 54-4
<code>xform_list</code>	A transformation list. See Table 54-1 for a description of the <code>TRANSFORM_LIST</code> object type.
<code>literal_flag</code>	Indicates whether the values in the <code>bin</code> column in the transformation definition table are valid SQL literals. When <code>literal_flag</code> is <code>FALSE</code> (the default), the bin identifiers will be transformed to SQL literals by surrounding them with single quotes. Set <code>literal_flag</code> to <code>TRUE</code> if the bin identifiers are numbers that should have a numeric datatype, as is the case for an O-Cluster model. See " INSERT_BIN_NUM_EQWIDTH Procedure " for an example.
<code>bin_schema_name</code>	Schema of <code>bin_table_name</code> . If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)". The following sections are especially relevant:

- "[About Transformation Lists](#)"
- "[About Stacking](#)"
- "[Nested Data Transformations](#)"

Examples

This example shows how a binning transformation for the categorical column `cust_postal_code` could be added to a stack called `mining_data_stack`.

**Note:**

This example invokes the [XFORM_STACK Procedure](#) to show how the data is transformed by the stack. `XFORM_STACK` simply generates an external view of the transformed data. The actual purpose of the `STACK` procedures is to assemble a list of transformations for embedding in a model. The transformations are passed to `CREATE_MODEL` in the `xform_list` parameter. See [INSERT_BIN_NUM_EQWIDTH Procedure](#) for an example.

```
CREATE or REPLACE VIEW mining_data AS
  SELECT cust_id, cust_postal_code, cust_credit_limit
  FROM sh.customers
```

```

        WHERE cust_id BETWEEN 100050 AND 100100;
BEGIN
    dbms_data_mining_transform.CREATE_BIN_CAT ('bin_cat_tbl');
    dbms_data_mining_transform.INSERT_BIN_CAT_FREQ (
        bin_table_name => 'bin_cat_tbl',
        data_table_name => 'mining_data',
        bin_num        => 3);
END;
/
DECLARE
    MINING_DATA_STACK dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
    dbms_data_mining_transform.STACK_BIN_CAT (
        bin_table_name => 'bin_cat_tbl',
        xform_list     => mining_data_stack);
    dbms_data_mining_transform.XFORM_STACK (
        xform_list     => mining_data_stack,
        data_table_name => 'mining_data',
        xform_view_name => 'mining_data_stack_view');
END;
/
-- Before transformation
column cust_postal_code format a16
SELECT * from mining_data
        WHERE cust_id BETWEEN 100050 AND 100053
        ORDER BY cust_id;

    CUST_ID CUST_POSTAL_CODE CUST_CREDIT_LIMIT
-----
    100050 76486                1500
    100051 73216                9000
    100052 69499                5000
    100053 45704                7000

-- After transformation
SELECT * FROM mining_data_stack_view
        WHERE cust_id BETWEEN 100050 AND 100053
        ORDER BY cust_id;

    CUST_ID CUST_POSTAL_CODE CUST_CREDIT_LIMIT
-----
    100050 4                    1500
    100051 1                    9000
    100052 4                    5000
    100053 4                    7000

```

54.6.25 STACK_BIN_NUM Procedure

This procedure adds numerical binning transformations to a transformation list.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.STACK_BIN_NUM (
    bin_table_name    IN          VARCHAR2,
    xform_list        IN OUT      NOCOPY TRANSFORM_LIST,
    literal_flag      IN          BOOLEAN DEFAULT FALSE,
    bin_schema_name   IN          VARCHAR2 DEFAULT NULL);

```


Parameters

Table 54-35 STACK_BIN_NUM Procedure Parameters

Parameter	Description
<code>bin_table_name</code>	Name of the transformation definition table for numerical binning. You can use the CREATE_BIN_NUM Procedure to create the definition table. The table must be populated with transformation definitions before you call <code>STACK_BIN_NUM</code> . To populate the table, you can use one of the <code>INSERT</code> procedures for numerical binning or you can write your own SQL. See Table 54-6 .
<code>xform_list</code>	A transformation list. See Table 54-1 for a description of the <code>TRANSFORM_LIST</code> object type.
<code>literal_flag</code>	Indicates whether the values in the <code>bin</code> column in the transformation definition table are valid SQL literals. When <code>literal_flag</code> is <code>FALSE</code> (the default), the bin identifiers will be transformed to SQL literals by surrounding them with single quotes. Set <code>literal_flag</code> to <code>TRUE</code> if the bin identifiers are numbers that should have a numeric datatype, as is the case for an O-Cluster model. See " INSERT_BIN_NUM_EQWIDTH Procedure " for an example.
<code>bin_schema_name</code>	Schema of <code>bin_table_name</code> . If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)". The following sections are especially relevant:

- "[About Transformation Lists](#)"
- "[About Stacking](#)"
- "[Nested Data Transformations](#)"

Examples

This example shows how a binning transformation for the numerical column `cust_credit_limit` could be added to a stack called `mining_data_stack`.

 **Note:**

This example invokes the [XFORM_STACK Procedure](#) to show how the data is transformed by the stack. `XFORM_STACK` simply generates an external view of the transformed data. The actual purpose of the `STACK` procedures is to assemble a list of transformations for embedding in a model. The transformations are passed to `CREATE_MODEL` in the `xform_list` parameter. See [INSERT_BIN_NUM_EQWIDTH Procedure](#) for an example.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_postal_code, cust_credit_limit
```

```

        FROM sh.customers
        WHERE cust_id BETWEEN 100050 and 100100;
BEGIN
    dbms_data_mining_transform.create_bin_num ('bin_num_tbl');
    dbms_data_mining_transform.insert_bin_num_qtile (
        bin_table_name => 'bin_num_tbl',
        data_table_name => 'mining_data',
        bin_num        => 5,
        exclude_list   => dbms_data_mining_transform.COLUMN_LIST('cust_id'));
END;
/
DECLARE
    MINING_DATA_STACK dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
    dbms_data_mining_transform.STACK_BIN_CAT (
        bin_table_name => 'bin_num_tbl',
        xform_list     => mining_data_stack);
    dbms_data_mining_transform.XFORM_STACK (
        xform_list     => mining_data_stack,
        data_table_name => 'mining_data',
        xform_view_name => 'mining_data_stack_view');
END;
/
-- Before transformation
SELECT cust_id, cust_postal_code, ROUND(cust_credit_limit) FROM mining_data
    WHERE cust_id BETWEEN 100050 AND 100055
    ORDER BY cust_id;
CUST_ID  CUST_POSTAL_CODE  ROUND(CUST_CREDIT_LIMIT)
-----  -
100050   76486              1500
100051   73216              9000
100052   69499              5000
100053   45704              7000
100055   74673             11000
100055   74673             11000

-- After transformation
SELECT cust_id, cust_postal_code, ROUND(cust_credit_limit)
    FROM mining_data_stack_view
    WHERE cust_id BETWEEN 100050 AND 100055
    ORDER BY cust_id;
CUST_ID  CUST_POSTAL_CODE  ROUND(CUST_CREDIT_LIMIT)
-----  -
100050   76486
100051   73216              2
100052   69499              1
100053   45704
100054   88021              3
100055   74673              3

```

54.6.26 STACK_CLIP Procedure

This procedure adds clipping transformations to a transformation list.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.STACK_CLIP (
    clip_table_name    IN          VARCHAR2,
    xform_list         IN OUT NOCOPY TRANSFORM_LIST,
    clip_schema_name   IN          VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-36 STACK_CLIP Procedure Parameters

Parameter	Description
<code>clip_table_name</code>	Name of the transformation definition table for clipping. You can use the CREATE_CLIP Procedure to create the definition table. The table must be populated with transformation definitions before you call <code>STACK_CLIP</code> . To populate the table, you can use one of the <code>INSERT</code> procedures for clipping or you can write your own SQL. See Table 54-8
<code>xform_list</code>	A transformation list. See Table 54-1 for a description of the <code>TRANSFORM_LIST</code> object type.
<code>clip_schema_name</code>	Schema of <code>clip_table_name</code> . If no schema is specified, the current schema is used.

Usage Notes

See [DBMS_DATA_MINING_TRANSFORM Operational Notes](#). The following sections are especially relevant:

- “About Transformation Lists”
- “About Stacking”
- “Nested Data Transformations”

Examples

This example shows how a clipping transformation for the numerical column `cust_credit_limit` could be added to a stack called `mining_data_stack`.

Note:

This example invokes the [XFORM_STACK Procedure](#) to show how the data is transformed by the stack. `XFORM_STACK` simply generates an external view of the transformed data. The actual purpose of the `STACK` procedures is to assemble a list of transformations for embedding in a model. The transformations are passed to `CREATE_MODEL` in the `xform_list` parameter. See [INSERT_BIN_NUM_EQWIDTH Procedure](#) for an example.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, cust_postal_code, cust_credit_limit
  FROM sh.customers
  WHERE cust_id BETWEEN 100050 AND 100100;
BEGIN
  dbms_data_mining_transform.create_clip ('clip_tbl');
  dbms_data_mining_transform.insert_clip_winsor_tail (
    clip_table_name => 'clip_tbl',
    data_table_name => 'mining_data',
    tail_frac       => 0.25,
    exclude_list    => dbms_data_mining_transform.COLUMN_LIST('cust_id'));
END;
```

```

END;
/
DECLARE
    MINING_DATA_STACK  dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
    dbms_data_mining_transform.STACK_CLIP (
        clip_table_name => 'clip_tbl',
        xform_list      => mining_data_stack);
    dbms_data_mining_transform.XFORM_STACK (
        xform_list      => mining_data_stack,
        data_table_name => 'mining_data',
        xform_view_name => 'mining_data_stack_view');
END;
/
-- Before transformation
SELECT cust_id, cust_postal_code, round(cust_credit_limit)
   FROM mining_data
   WHERE cust_id BETWEEN 100050 AND 100054
   ORDER BY cust_id;

CUST_ID  CUST_POSTAL_CODE  ROUND(CUST_CREDIT_LIMIT)
-----  -
100050   76486             1500
100051   73216             9000
100052   69499             5000
100053   45704             7000
100054   88021            11000

-- After transformation
SELECT cust_id, cust_postal_code, round(cust_credit_limit)
   FROM mining_data_stack_view
   WHERE cust_id BETWEEN 100050 AND 100054
   ORDER BY cust_id;

CUST_ID  CUST_POSTAL_CODE  ROUND(CUST_CREDIT_LIMIT)
-----  -
100050   76486             5000
100051   73216             9000
100052   69499             5000
100053   45704             7000
100054   88021            11000

```

54.6.27 STACK_COL_REM Procedure

This procedure adds column removal transformations to a transformation list.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.STACK_COL_REM (
    rem_table_name      IN          VARCHAR2,
    xform_list          IN OUT NOCOPY TRANSFORM_LIST,
    rem_schema_name     IN          VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-37 STACK_COL_REM Procedure Parameters

Parameter	Description
rem_table_name	Name of the transformation definition table for column removal. You can use the CREATE_COL_REM Procedure to create the definition table. See Table 54-10 . The table must be populated with column names before you call STACK_COL_REM. The INSERT_BIN_SUPER Procedure and the INSERT_AUTOBIN_NUM_EQWIDTH Procedure can optionally be used to populate the table. You can also use SQL INSERT statements.
xform_list	A transformation list. See Table 54-1 for a description of the TRANSFORM_LIST object type.
rem_schema_name	Schema of rem_table_name. If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)". The following sections are especially relevant:

- "[About Transformation Lists](#)"
- "[About Stacking](#)"
- "[Nested Data Transformations](#)"

Examples

This example shows how the column cust_credit_limit could be removed in a transformation list called mining_data_stack.

**Note:**

This example invokes the [XFORM_STACK Procedure](#) to show how the data is transformed by the stack. XFORM_STACK simply generates an external view of the transformed data. The actual purpose of the STACK procedures is to assemble a list of transformations for embedding in a model. The transformations are passed to CREATE_MODEL in the xform_list parameter. See [INSERT_BIN_NUM_EQWIDTH Procedure](#) for an example.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, country_id, cust_postal_code, cust_credit_limit
     FROM sh.customers;

BEGIN
  dbms_data_mining_transform.create_col_rem ('rem_tbl');
END;
/

INSERT into rem_tbl VALUES (upper('cust_postal_code'), null);

DECLARE
```

```

MINING_DATA_STACK dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.stack_col_rem (
    rem_table_name => 'rem_tbl',
    xform_list     => mining_data_stack);
  dbms_data_mining_transform.XFORM_STACK (
    xform_list     => mining_data_stack,
    data_table_name => 'mining_data',
    xform_view_name => 'mining_data_stack_view');
END;
/

SELECT * FROM mining_data
  WHERE cust_id BETWEEN 100050 AND 100051
  ORDER BY cust_id;

CUST_ID  COUNTRY_ID  CUST_POSTAL_CODE  CUST_CREDIT_LIMIT
-----  -
100050      52773      76486                1500
100051      52790      73216                9000

SELECT * FROM mining_data_stack_view
  WHERE cust_id BETWEEN 100050 AND 100051
  ORDER BY cust_id;

CUST_ID  COUNTRY_ID  CUST_CREDIT_LIMIT
-----  -
100050      52773                1500
100051      52790                9000

```

54.6.28 STACK_MISS_CAT Procedure

This procedure adds categorical missing value transformations to a transformation list.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.STACK_MISS_CAT (
  miss_table_name  IN  VARCHAR2,
  xform_list       IN OUT NOCOPY TRANSFORM_LIST,
  miss_schema_name IN  VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-38 STACK_MISS_CAT Procedure Parameters

Parameter	Description
miss_table_name	Name of the transformation definition table for categorical missing value treatment. You can use the CREATE_MISS_CAT Procedure to create the definition table. The table must be populated with transformation definitions before you call STACK_MISS_CAT. To populate the table, you can use the INSERT_MISS_CAT_MODE Procedure or you can write your own SQL. See Table 54-12 .
xform_list	A transformation list. See Table 54-1 for a description of the TRANSFORM_LIST object type.
miss_schema_name	Schema of <i>miss_table_name</i> . If no schema is specified, the current schema is used.

Usage Notes

See ["Operational Notes"](#). The following sections are especially relevant:

- ["About Transformation Lists"](#)
- ["About Stacking"](#)
- ["Nested Data Transformations"](#)

Examples

This example shows how the missing values in the column `cust_marital_status` could be replaced with the mode in a transformation list called `mining_data_stack`.



Note:

This example invokes the [XFORM_STACK Procedure](#) to show how the data is transformed by the stack. `XFORM_STACK` simply generates an external view of the transformed data. The actual purpose of the `STACK` procedures is to assemble a list of transformations for embedding in a model. The transformations are passed to `CREATE_MODEL` in the `xform_list` parameter. See [INSERT_BIN_NUM_EQWIDTH Procedure](#) for an example.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, country_id, cust_marital_status
     FROM sh.customers
     where cust_id BETWEEN 1 AND 10;

BEGIN
  dbms_data_mining_transform.create_miss_cat ('miss_cat_tbl');
  dbms_data_mining_transform.insert_miss_cat_mode ('miss_cat_tbl',
'mining_data');
END;
/

DECLARE
  MINING_DATA_STACK  dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.stack_miss_cat (
    miss_table_name => 'miss_cat_tbl',
    xform_list      => mining_data_stack);
  dbms_data_mining_transform.XFORM_STACK (
    xform_list      => mining_data_stack,
    data_table_name => 'mining_data',
    xform_view_name => 'mining_data_stack_view');
END;
/
SELECT * FROM mining_data
  ORDER BY cust_id;
```

CUST_ID	COUNTRY_ID	CUST_MARITAL_STATUS
1	52789	
2	52778	
3	52770	

```

4      52770
5      52789
6      52769      single
7      52790      single
8      52790      married
9      52770      divorced
10     52790      widow

```

```

SELECT * FROM mining_data_stack_view
ORDER By cust_id;

```

```

CUST_ID  COUNTRY_ID  CUST_MARITAL_STATUS
-----  -
1         52789       single
2         52778       single
3         52770       single
4         52770       single
5         52789       single
6         52769       single
7         52790       single
8         52790       married
9         52770       divorced
10        52790       widow

```

54.6.29 STACK_MISS_NUM Procedure

This procedure adds numeric missing value transformations to a transformation list.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.STACK_MISS_NUM (
    miss_table_name      IN      VARCHAR2,
    xform_list           IN OUT  NOCOPY TRANSFORM_LIST,
    miss_schema_name     IN      VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-39 STACK_MISS_NUM Procedure Parameters

Parameter	Description
miss_table_name	Name of the transformation definition table for numerical missing value treatment. You can use the CREATE_MISS_NUM Procedure to create the definition table. The table must be populated with transformation definitions before you call STACK_MISS_NUM. To populate the table, you can use the INSERT_MISS_NUM_MEAN Procedure or you can write your own SQL. See Table 54-14 .
xform_list	A transformation list. See Table 54-1 for a description of the TRANSFORM_LIST object type.
miss_schema_name	Schema of miss_table_name. If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)". The following sections are especially relevant:

- "[About Transformation Lists](#)"

- ["About Stacking"](#)
- ["Nested Data Transformations"](#)

Examples

This example shows how the missing values in the column `cust_credit_limit` could be replaced with the mean in a transformation list called `mining_data_stack`.

Note:

This example invokes the [XFORM_STACK Procedure](#) to show how the data is transformed by the stack. `XFORM_STACK` simply generates an external view of the transformed data. The actual purpose of the `STACK` procedures is to assemble a list of transformations for embedding in a model. The transformations are passed to `CREATE_MODEL` in the `xform_list` parameter. See [INSERT_BIN_NUM_EQWIDTH Procedure](#) for an example.

```
describe mining_data
Name                                                    Null?   Type
-----
CUST_ID                                                NOT NULL NUMBER
CUST_CREDIT_LIMIT                                     NUMBER

BEGIN
  dbms_data_mining_transform.create_miss_num ('miss_num_tbl');
  dbms_data_mining_transform.insert_miss_num_mean
('miss_num_tbl','mining_data');
END;
/
SELECT * FROM miss_num_tbl;

COL           ATT           VAL
-----
CUST_ID              5.5
CUST_CREDIT_LIMIT   185.71

DECLARE
  MINING_DATA_STACK  dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.STACK_MISS_NUM (
    miss_table_name => 'miss_num_tbl',
    xform_list      => mining_data_stack);
  dbms_data_mining_transform.XFORM_STACK (
    xform_list      => mining_data_stack,
    data_table_name => 'mining_data',
    xform_view_name => 'mining_data_stack_view');
END;
/
-- Before transformation
SELECT * FROM mining_data
  ORDER BY cust_id;
CUST_ID CUST_CREDIT_LIMIT
-----
      1             100
      2
      3             200
```

```

4
5          150
6          400
7          150
8
9          100
10         200

-- After transformation
SELECT * FROM mining_data_stack_view
ORDER BY cust_id;
CUST_ID CUST_CREDIT_LIMIT
-----
1          100
2         185.71
3          200
4         185.71
5          150
6          400
7          150
8         185.71
9          100
10         200

```

54.6.30 STACK_NORM_LIN Procedure

This procedure adds linear normalization transformations to a transformation list.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.STACK_NORM_LIN (
    norm_table_name      IN      VARCHAR2,
    xform_list           IN OUT  NOCOPY TRANSFORM_LIST,
    norm_schema_name     IN      VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-40 STACK_NORM_LIN Procedure Parameters

Parameter	Description
norm_table_name	Name of the transformation definition table for linear normalization. You can use the CREATE_NORM_LIN Procedure to create the definition table. The table must be populated with transformation definitions before you call STACK_NORM_LIN. To populate the table, you can use one of the INSERT procedures for normalization or you can write your own SQL. See Table 54-16 .
xform_list	A transformation list. See Table 54-1 for a description of the TRANSFORM_LIST object type.
norm_schema_name	Schema of norm_table_name. If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)". The following sections are especially relevant:

- "[About Transformation Lists](#)"

- ["About Stacking"](#)
- ["Nested Data Transformations"](#)

Examples

This example shows how the column `cust_credit_limit` could be normalized in a transformation list called `mining_data_stack`.

Note:

This example invokes the [XFORM_STACK Procedure](#) to show how the data is transformed by the stack. `XFORM_STACK` simply generates an external view of the transformed data. The actual purpose of the `STACK` procedures is to assemble a list of transformations for embedding in a model. The transformations are passed to `CREATE_MODEL` in the `xform_list` parameter. See [INSERT_BIN_NUM_EQWIDTH Procedure](#) for an example.

```
CREATE OR REPLACE VIEW mining_data AS
  SELECT cust_id, country_id, cust_postal_code, cust_credit_limit
     FROM sh.customers;
BEGIN
  dbms_data_mining_transform.create_norm_lin ('norm_lin_tbl');
  dbms_data_mining_transform.insert_norm_lin_minmax (
    norm_table_name => 'norm_lin_tbl',
    data_table_name => 'mining_data',
    exclude_list   => dbms_data_mining_transform.COLUMN_LIST('cust_id',
                                                                'country_id'));
END;
/
SELECT * FROM norm_lin_tbl;
COL          ATT      SHIFT  SCALE
-----
CUST_CREDIT_LIMIT          1500  13500

DECLARE
  MINING_DATA_STACK  dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.stack_norm_lin (
    norm_table_name => 'norm_lin_tbl',
    xform_list      => mining_data_stack);
  dbms_data_mining_transform.XFORM_STACK (
    xform_list      => mining_data_stack,
    data_table_name => 'mining_data',
    xform_view_name => 'mining_data_stack_view');
END;
/
SELECT * FROM mining_data
  WHERE cust_id between 1 and 10
     ORDER BY cust_id;
CUST_ID COUNTRY_ID CUST_POSTAL_CODE      CUST_CREDIT_LIMIT
-----
      1      52789 30828                9000
      2      52778 86319               10000
      3      52770 88666                1500
      4      52770 87551                1500
      5      52789 59200                1500
```

```

6      52769 77287      1500
7      52790 38763      1500
8      52790 58488      3000
9      52770 63033      3000
10     52790 52602      3000

```

```

SELECT * FROM mining_data_stack_view
WHERE cust_id between 1 and 10
ORDER BY cust_id;
CUST_ID COUNTRY_ID CUST_POSTAL_CODE      CUST_CREDIT_LIMIT
-----
1      52789 30828                      .55556
2      52778 86319                      .62963
3      52770 88666                      0
4      52770 87551                      0
5      52789 59200                      0
6      52769 77287                      0
7      52790 38763                      0
8      52790 58488                      .11111
9      52770 63033                      .11111
10     52790 52602                      .11111

```

54.6.31 XFORM_BIN_CAT Procedure

This procedure creates a view that implements the categorical binning transformations specified in a definition table. Only the columns that are specified in the definition table are transformed; the remaining columns from the data table are present in the view, but they are not changed.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.XFORM_BIN_CAT (
  bin_table_name      IN VARCHAR2,
  data_table_name     IN VARCHAR2,
  xform_view_name     IN VARCHAR2,
  literal_flag        IN BOOLEAN DEFAULT FALSE,
  bin_schema_name     IN VARCHAR2 DEFAULT NULL,
  data_schema_name    IN VARCHAR2 DEFAULT NULL,
  xform_schema_name   IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-41 XFORM_BIN_CAT Procedure Parameters

Parameter	Description
<code>bin_table_name</code>	Name of the transformation definition table for categorical binning. You can use the CREATE_BIN_CAT Procedure to create the definition table. The table must be populated with transformation definitions before you call <code>XFORM_BIN_CAT</code> . To populate the table, you can use one of the <code>INSERT</code> procedures for categorical binning or you can write your own SQL. See Table 54-4 .
<code>data_table_name</code>	Name of the table containing the data to be transformed.
<code>xform_view_name</code>	Name of the view to be created. The view presents columns in <code>data_table_name</code> with the transformations specified in <code>bin_table_name</code> .

Table 54-41 (Cont.) XFORM_BIN_CAT Procedure Parameters

Parameter	Description
<code>literal_flag</code>	<p>Indicates whether the values in the <code>bin</code> column in the transformation definition table are valid SQL literals. When <code>literal_flag</code> is <code>FALSE</code> (the default), the bin identifiers will be transformed to SQL literals by surrounding them with single quotes.</p> <p>Set <code>literal_flag</code> to <code>TRUE</code> if the bin identifiers are numbers that should have a numeric datatype, as is the case for an O-Cluster model.</p> <p>See "INSERT_BIN_NUM_EQWIDTH Procedure" for an example.</p>
<code>bin_schema_name</code>	Schema of <code>bin_table_name</code> . If no schema is specified, the current schema is used.
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.
<code>xform_schema_name</code>	Schema of <code>xform_view_name</code> . If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)".

Examples

This example creates a view that bins the `cust_postal_code` column. The data source consists of three columns from `sh.customer`.

```
describe mining_data
Name                                     Null?    Type
-----
CUST_ID                                 NOT NULL NUMBER
CUST_POSTAL_CODE                         NOT NULL VARCHAR2(10)
CUST_CREDIT_LIMIT                        NUMBER

SELECT * FROM mining_data WHERE cust_id between 104066 and 104069;

      CUST_ID CUST_POSTAL_CODE
CUST_CREDIT_LIMIT
-----
      104066 69776
7000
      104067 52602
9000
      104068 55787
11000
      104069 55977
5000

BEGIN
  dbms_data_mining_transform.create_bin_cat(
    bin_table_name => 'bin_cat_tbl');
  dbms_data_mining_transform.insert_bin_cat_freq(
    bin_table_name => 'bin_cat_tbl',
    data_table_name => 'mining_data',
    bin_num        => 10);
  dbms_data_mining_transform.xform_bin_cat(
```

```

        bin_table_name    => 'bin_cat_tbl',
        data_table_name   => 'mining_data',
        xform_view_name   => 'bin_cat_view');
END;
/

SELECT * FROM bin_cat_view WHERE cust_id between 104066 and 104069;

      CUST_ID CUST_POSTAL_CODE
CUST_CREDIT_LIMIT
-----
-----
      104066 6
7000
      104067 11
9000
      104068 3
11000
      104069 11
5000

SELECT text FROM user_views WHERE view_name IN 'BIN_CAT_VIEW';

TEXT
-----

SELECT
"CUST_ID",DECODE("CUST_POSTAL_CODE",'38082','1','45704','9','48346','5','
55787','3','63736','2','67843','7','69776','6','72860','10','78558','4','80841',
'8',NULL,NULL,'11') "CUST_POSTAL_CODE","CUST_CREDIT_LIMIT" FROM
mining_data

```

54.6.32 XFORM_BIN_NUM Procedure

This procedure creates a view that implements the numerical binning transformations specified in a definition table. Only the columns that are specified in the definition table are transformed; the remaining columns from the data table are present in the view, but they are not changed.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.XFORM_BIN_NUM (
    bin_table_name    IN VARCHAR2,
    data_table_name   IN VARCHAR2,
    xform_view_name   IN VARCHAR2,
    literal_flag      IN BOOLEAN DEFAULT FALSE,
    bin_schema_name   IN VARCHAR2 DEFAULT NULL,
    data_schema_name  IN VARCHAR2 DEFAULT NULL,
    xform_schema_name IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-42 XFORM_BIN_NUM Procedure Parameters

Parameter	Description
<code>bin_table_name</code>	Name of the transformation definition table for numerical binning. You can use the CREATE_BIN_NUM Procedure to create the definition table. The table must be populated with transformation definitions before you call <code>XFORM_BIN_NUM</code> . To populate the table, you can use one of the <code>INSERT</code> procedures for numerical binning or you can write your own SQL. See " Table 54-6 ".
<code>data_table_name</code>	Name of the table containing the data to be transformed
<code>xform_view_name</code>	Name of the view to be created. The view presents columns in <code>data_table_name</code> with the transformations specified in <code>bin_table_name</code> .
<code>literal_flag</code>	Indicates whether the values in the <code>bin</code> column in the transformation definition table are valid SQL literals. When <code>literal_flag</code> is <code>FALSE</code> (the default), the bin identifiers will be transformed to SQL literals by surrounding them with single quotes. Set <code>literal_flag</code> to <code>TRUE</code> if the bin identifiers are numbers that should have a numeric datatype, as is the case for an O-Cluster model. See " INSERT_BIN_NUM_EQWIDTH Procedure " for an example.
<code>bin_schema_name</code>	Schema of <code>bin_table_name</code> . If no schema is specified, the current schema is used.
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.
<code>xform_schema_name</code>	Schema of <code>xform_view_name</code> . If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)".

Examples

This example creates a view that bins the `cust_credit_limit` column. The data source consists of three columns from `sh.customer`.

```
describe mining_data
Name                                     Null?   Type
-----
CUST_ID                                 NOT NULL NUMBER
CUST_POSTAL_CODE                       NOT NULL VARCHAR2(10)
CUST_CREDIT_LIMIT                       NUMBER

column cust_credit_limit off
SELECT * FROM mining_data WHERE cust_id between 104066 and 104069;

      CUST_ID CUST_POSTAL_CODE
-----
-----
```

```

-----
    104066 69776
7000
    104067 52602
9000
    104068 55787
11000
    104069 55977
5000

BEGIN
  dbms_data_mining_transform.create_bin_num(
    bin_table_name => 'bin_num_tbl');
  dbms_data_mining_transform.insert_autobin_num_eqwidth(
    bin_table_name => 'bin_num_tbl',
    data_table_name => 'mining_data',
    bin_num => 5,
    max_bin_num => 10,
    exclude_list => dbms_data_mining_transform.COLUMN_LIST('cust_id'));
  dbms_data_mining_transform.xform_bin_num(
    bin_table_name => 'bin_num_tbl',
    data_table_name => 'mining_data',
    xform_view_name => 'mining_data_view');
END;
/
describe mining_data_view
Name                                                    Null?    Type
-----
CUST_ID                                                NOT NULL NUMBER
CUST_POSTAL_CODE                                       NOT NULL VARCHAR2(10)
CUST_CREDIT_LIMIT                                       VARCHAR2(2)

col cust_credit_limit on
col cust_credit_limit format a25
SELECT * FROM mining_data_view WHERE cust_id between 104066 and 104069;

    CUST_ID CUST_POSTAL_CODE
CUST_CREDIT_LIMIT
-----
    104066 69776
5
    104067 52602
6
    104068 55787
8
    104069 55977
3

set long 2000
SELECT text FROM user_views WHERE view_name IN 'MINING_DATA_VIEW';

TEXT
-----

SELECT "CUST_ID","CUST_POSTAL_CODE",CASE WHEN "CUST_CREDIT_LIMIT"<1500 THEN
NULL
  WHEN "CUST_CREDIT_LIMIT"<=2850 THEN '1' WHEN "CUST_CREDIT_LIMIT"<=4200 THEN
'2'
  WHEN "CUST_CREDIT_LIMIT"<=5550 THEN '3' WHEN "CUST_CREDIT_LIMIT"<=6900 THEN

```



```
'4'
  WHEN "CUST_CREDIT_LIMIT"<=8250 THEN '5' WHEN "CUST_CREDIT_LIMIT"<=9600 THEN
'6'
  WHEN "CUST_CREDIT_LIMIT"<=10950 THEN '7' WHEN "CUST_CREDIT_LIMIT"<=12300 THEN
,
8' WHEN "CUST_CREDIT_LIMIT"<=13650 THEN '9' WHEN "CUST_CREDIT_LIMIT"<=15000
THEN
  '10' END "CUST_CREDIT_LIMIT" FROM
mining_data
```

54.6.33 XFORM_CLIP Procedure

This procedure creates a view that implements the clipping transformations specified in a definition table. Only the columns that are specified in the definition table are transformed; the remaining columns from the data table are present in the view, but they are not changed.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.XFORM_CLIP (
  clip_table_name      IN VARCHAR2,
  data_table_name      IN VARCHAR2,
  xform_view_name      IN VARCHAR2,
  clip_schema_name     IN VARCHAR2 DEFAULT NULL,
  data_schema_name     IN VARCHAR2,DEFAULT NULL,
  xform_schema_name    IN VARCHAR2,DEFAULT NULL);
```

Parameters

Table 54-43 XFORM_CLIP Procedure Parameters

Parameter	Description
clip_table_name	Name of the transformation definition table for clipping. You can use the CREATE_CLIP Procedure to create the definition table. The table must be populated with transformation definitions before you call XFORM_CLIP. To populate the table, you can use one of the INSERT procedures for clipping you can write your own SQL. See Table 54-8 .
data_table_name	Name of the table containing the data to be transformed
xform_view_name	Name of the view to be created. The view presents columns in <i>data_table_name</i> with the transformations specified in <i>clip_table_name</i> .
clip_schema_name	Schema of <i>clip_table_name</i> . If no schema is specified, the current schema is used.
data_schema_name	Schema of <i>data_table_name</i> . If no schema is specified, the current schema is used.
xform_schema_name	Schema of <i>xform_view_name</i> . If no schema is specified, the current schema is used.

Examples

This example creates a view that clips the `cust_credit_limit` column. The data source consists of three columns from `sh.customer`.

```

describe mining_data
Name                               Null?   Type
-----
CUST_ID                             NOT NULL NUMBER
CUST_POSTAL_CODE                     NOT NULL VARCHAR2(10)
CUST_CREDIT_LIMIT                    NUMBER

BEGIN
  dbms_data_mining_transform.create_clip(
    clip_table_name => 'clip_tbl');
  dbms_data_mining_transform.insert_clip_trim_tail(
    clip_table_name => 'clip_tbl',
    data_table_name => 'mining_data',
    tail_frac       => 0.05,
    exclude_list    => dbms_data_mining_transform.COLUMN_LIST('cust_id'));
  dbms_data_mining_transform.xform_clip(
    clip_table_name => 'clip_tbl',
    data_table_name => 'mining_data',
    xform_view_name => 'clip_view');
END;
/
describe clip_view
Name                               Null?   Type
-----
CUST_ID                             NOT NULL NUMBER
CUST_POSTAL_CODE                     NOT NULL VARCHAR2(10)
CUST_CREDIT_LIMIT                    NUMBER

SELECT MIN(cust_credit_limit), MAX(cust_credit_limit) FROM mining_data;

MIN(CUST_CREDIT_LIMIT) MAX(CUST_CREDIT_LIMIT)
-----
                1500                15000

SELECT MIN(cust_credit_limit), MAX(cust_credit_limit) FROM clip_view;

MIN(CUST_CREDIT_LIMIT) MAX(CUST_CREDIT_LIMIT)
-----
                1500                11000

set long 2000
SELECT text FROM user_views WHERE view_name IN 'CLIP_VIEW';

TEXT
-----
SELECT "CUST_ID","CUST_POSTAL_CODE",CASE WHEN "CUST_CREDIT_LIMIT" < 1500 THEN NU
LL WHEN "CUST_CREDIT_LIMIT" > 11000 THEN NULL ELSE "CUST_CREDIT_LIMIT" END "CUST
_CREDIT_LIMIT" FROM mining_data

```

54.6.34 XFORM_COL_REM Procedure

This procedure creates a view that implements the column removal transformations specified in a definition table. Only the columns that are specified in the definition table are removed; the remaining columns from the data table are present in the view.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.XFORM_COL_REM (
  rem_table_name  IN      VARCHAR2,
  data_table_name IN      VARCHAR2,

```

```

xform_view_name    IN      VARCHAR2,
rem_schema_name    IN      VARCHAR2 DEFAULT NULL,
data_schema_name   IN      VARCHAR2 DEFAULT NULL,
xform_schema_name  IN      VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-44 XFORM_COL_REM Procedure Parameters

Parameter	Description
rem_table_name	Name of the transformation definition table for column removal. You can use the CREATE_COL_REM Procedure to create the definition table. See Table 54-10 . The table must be populated with column names before you call XFORM_COL_REM. The INSERT_BIN_SUPER Procedure and the INSERT_AUTOBIN_NUM_EQWIDTH Procedure can optionally be used to populate the table. You can also use SQL INSERT statements.
data_table_name	Name of the table containing the data to be transformed
xform_view_name	Name of the view to be created. The view presents the columns in <i>data_table_name</i> that are not specified in <i>rem_table_name</i> .
rem_schema_name	Schema of <i>rem_table_name</i> . If no schema is specified, the current schema is used.
data_schema_name	Schema of <i>data_table_name</i> . If no schema is specified, the current schema is used.
xform_schema_name	Schema of <i>xform_view_name</i> . If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)".

Examples

This example creates a view that includes all but one column from the table `customers` in the current schema.

```

describe customers
Name                                     Null?    Type
-----
CUST_ID                                 NOT NULL NUMBER
CUST_MARITAL_STATUS                     VARCHAR2(20)
OCCUPATION                               VARCHAR2(21)
AGE                                       NUMBER
YRS_RESIDENCE                           NUMBER

BEGIN
  DBMS_DATA_MINING_TRANSFORM.CREATE_COL_REM ('colrem_xtbl');
END;
/
INSERT INTO colrem_xtbl VALUES('CUST_MARITAL_STATUS', null);

```

NOTE: This currently doesn't work. See bug 9310319

```

BEGIN
  DBMS_DATA_MINING_TRANSFORM.XFORM_COL_REM (
    rem_table_name      => 'colrem_xtbl',
    data_table_name     => 'customers',
    xform_view_name     => 'colrem_view');
END;
/
describe colrem_view

```

Name	Null?	Type
CUST_ID	NOT NULL	NUMBER
OCCUPATION		VARCHAR2 (21)
AGE		NUMBER
YRS_RESIDENCE		NUMBER

54.6.35 XFORM_EXPR_NUM Procedure

This procedure creates a view that implements the specified numeric transformations. Only the columns that you specify are transformed; the remaining columns from the data table are present in the view, but they are not changed.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.XFORM_EXPR_NUM (
  expr_pattern      IN      VARCHAR2,
  data_table_name  IN      VARCHAR2,
  xform_view_name  IN      VARCHAR2,
  exclude_list     IN      COLUMN_LIST DEFAULT NULL,
  include_list     IN      COLUMN_LIST DEFAULT NULL,
  col_pattern      IN      VARCHAR2 DEFAULT ':col',
  data_schema_name IN      VARCHAR2 DEFAULT NULL,
  xform_schema_name IN     VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-45 XFORM_EXPR_NUM Procedure Parameters

Parameter	Description
<code>expr_pattern</code>	A numeric transformation expression
<code>data_table_name</code>	Name of the table containing the data to be transformed
<code>xform_view_name</code>	Name of the view to be created. The view presents columns in <code>data_table_name</code> with the transformations specified in <code>expr_pattern</code> and <code>col_pattern</code> .
<code>exclude_list</code>	List of numerical columns to exclude. If NULL, no numerical columns are excluded. The format of <code>exclude_list</code> is: <code>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ... 'coln')</code>

Table 54-45 (Cont.) XFORM_EXPR_NUM Procedure Parameters

Parameter	Description
<code>include_list</code>	List of numeric columns to include. If NULL, all numeric columns are included. The format of <code>include_list</code> is: <pre>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln')</pre>
<code>col_pattern</code>	The value within <code>expr_pattern</code> that will be replaced with a column name. The value of <code>col_pattern</code> is case-sensitive. The default value of <code>col_pattern</code> is <code>:col</code>
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.
<code>xform_schema_name</code>	Schema of <code>xform_view_name</code> . If no schema is specified, the current schema is used.

Usage Notes

1. The XFORM_EXPR_NUM procedure constructs numeric transformation expressions from the specified expression pattern (`expr_pattern`) by replacing every occurrence of the specified column pattern (`col_pattern`) with an actual column name.

XFORM_EXPR_NUM uses the SQL REPLACE function to construct the transformation expressions.

```
REPLACE (expr_pattern,col_pattern,'"column_name"' || '"column_name"')
```

If there is a column match, then the replacement is made in the transformation expression; if there is not a match, then the column is used without transformation.

 **See:**

Oracle Database SQL Language Reference for information about the REPLACE function

2. Because of the include and exclude list parameters, the XFORM_EXPR_NUM and XFORM_EXPR_STR procedures allow you to easily specify individual columns for transformation within large data sets. The other XFORM_* procedures support an exclude list only. In these procedures, you must enumerate every column that you do not want to transform.
3. See "Operational Notes"

Examples

This example creates a view that transforms the datatype of numeric columns.

```
describe customers
Name                               Null?    Type
-----
```

```

CUST_ID                                NOT NULL NUMBER
CUST_MARITAL_STATUS                    VARCHAR2 (20)
OCCUPATION                              VARCHAR2 (21)
AGE                                     NUMBER
YRS_RESIDENCE                           NUMBER

BEGIN
  DBMS_DATA_MINING_TRANSFORM.XFORM_EXPR_NUM(
    expr_pattern      => 'to_char(:col)',
    data_table_name   => 'customers',
    xform_view_name   => 'cust_nonum_view',
    exclude_list      => dbms_data_mining_transform.COLUMN_LIST( 'cust_id'),
    include_list      => null,
    col_pattern       => ':col');
END;
/
describe cust_nonum_view
Name                                Null?    Type
-----
CUST_ID                              NOT NULL NUMBER
CUST_MARITAL_STATUS                    VARCHAR2 (20)
OCCUPATION                              VARCHAR2 (21)
AGE                                     VARCHAR2 (40)
YRS_RESIDENCE                           VARCHAR2 (40)

```

54.6.36 XFORM_EXPR_STR Procedure

This procedure creates a view that implements the specified categorical transformations. Only the columns that you specify are transformed; the remaining columns from the data table are present in the view, but they are not changed.

Syntax

```

DBMS_DATA_MINING_TRANSFORM.XFORM_EXPR_STR (
  expr_pattern      IN      VARCHAR2,
  data_table_name   IN      VARCHAR2,
  xform_view_name   IN      VARCHAR2,
  exclude_list      IN      COLUMN_LIST DEFAULT NULL,
  include_list      IN      COLUMN_LIST DEFAULT NULL,
  col_pattern       IN      VARCHAR2 DEFAULT ':col',
  data_schema_name IN      VARCHAR2 DEFAULT NULL,
  xform_schema_name IN      VARCHAR2 DEFAULT NULL);

```

Parameters

Table 54-46 XFORM_EXPR_STR Procedure Parameters

Parameter	Description
<code>expr_pattern</code>	A character transformation expression
<code>data_table_name</code>	Name of the table containing the data to be transformed
<code>xform_view_name</code>	Name of the view to be created. The view presents columns in <code>data_table_name</code> with the transformations specified in <code>expr_pattern</code> and <code>col_pattern</code> .

Table 54-46 (Cont.) XFORM_EXPR_STR Procedure Parameters

Parameter	Description
<code>exclude_list</code>	<p>List of categorical columns to exclude. If NULL, no categorical columns are excluded.</p> <p>The format of <code>exclude_list</code> is:</p> <pre>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln')</pre>
<code>include_list</code>	<p>List of character columns to include. If NULL, all character columns are included.</p> <p>The format of <code>include_list</code> is:</p> <pre>dbms_data_mining_transform.COLUMN_LIST('col1','col2', ...'coln')</pre>
<code>col_pattern</code>	<p>The value within <code>expr_pattern</code> that will be replaced with a column name. The value of <code>col_pattern</code> is case-sensitive.</p> <p>The default value of <code>col_pattern</code> is <code>':col'</code></p>
<code>data_schema_name</code>	<p>Schema of <code>data_table_name</code>. If no schema is specified, the current schema is used.</p>
<code>xform_schema_name</code>	<p>Schema of <code>xform_view_name</code>. If no schema is specified, the current schema is used.</p>

Usage Notes

1. The `XFORM_EXPR_STR` procedure constructs character transformation expressions from the specified expression pattern (`expr_pattern`) by replacing every occurrence of the specified column pattern (`col_pattern`) with an actual column name.

`XFORM_EXPR_STR` uses the SQL `REPLACE` function to construct the transformation expressions.

```
REPLACE (expr_pattern, col_pattern, "column_name") || "column_name"
```

If there is a column match, then the replacement is made in the transformation expression; if there is not a match, then the column is used without transformation.

 **See:**

Oracle Database SQL Language Reference for information about the `REPLACE` function

2. Because of the include and exclude list parameters, the `XFORM_EXPR_STR` and `XFORM_EXPR_NUM` procedures allow you to easily specify individual columns for transformation within large data sets. The other `XFORM_*` procedures support an exclude list only. In these procedures, you must enumerate every column that you do not want to transform.
3. See ["Operational Notes"](#)

Examples

This example creates a view that transforms character columns to upper case.

```
describe customers
Name                                     Null?   Type
-----
CUST_ID                                 NOT NULL NUMBER
CUST_MARITAL_STATUS                     VARCHAR2(20)
OCCUPATION                               VARCHAR2(21)
AGE                                       NUMBER
YRS_RESIDENCE                            NUMBER

SELECT cust_id, cust_marital_status, occupation FROM customers
       WHERE cust_id > 102995
       ORDER BY cust_id desc;

CUST_ID CUST_MARITAL_STATUS OCCUPATION
-----
103000 Divorc.           Cleric.
102999 Married           Cleric.
102998 Married           Exec.
102997 Married           Exec.
102996 NeverM           Other

BEGIN
  DBMS_DATA_MINING_TRANSFORM.XFORM_EXPR_STR(
    expr_pattern      => 'upper(:col)',
    data_table_name   => 'customers',
    xform_view_name   => 'cust_upcase_view');
END;
/
describe cust_upcase_view
Name                                     Null?   Type
-----
CUST_ID                                 NOT NULL NUMBER
CUST_MARITAL_STATUS                     VARCHAR2(20)
OCCUPATION                               VARCHAR2(21)
AGE                                       NUMBER
YRS_RESIDENCE                            NUMBER

SELECT cust_id, cust_marital_status, occupation FROM cust_upcase_view
       WHERE cust_id > 102995
       ORDER BY cust_id desc;

CUST_ID CUST_MARITAL_STATUS OCCUPATION
-----
103000 DIVORC.           CLERIC.
102999 MARRIED           CLERIC.
102998 MARRIED           EXEC.
102997 MARRIED           EXEC.
102996 NEVERM           OTHER
```

54.6.37 XFORM_MISS_CAT Procedure

This procedure creates a view that implements the categorical missing value treatment transformations specified in a definition table. Only the columns that are specified in the

definition table are transformed; the remaining columns from the data table are present in the view, but they are not changed.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.XFORM_MISS_CAT (
    miss_table_name      IN VARCHAR2,
    data_table_name     IN VARCHAR2,
    xform_view_name     IN VARCHAR2,
    miss_schema_name    IN VARCHAR2 DEFAULT NULL,
    data_schema_name    IN VARCHAR2 DEFAULT NULL,
    xform_schema_name   IN VARCHAR2 DEFAULT NULL;
```

Parameters

Table 54-47 XFORM_MISS_CAT Procedure Parameters

Parameter	Description
<code>miss_table_name</code>	Name of the transformation definition table for categorical missing value treatment. You can use the CREATE_MISS_CAT Procedure to create the definition table. The table must be populated with transformation definitions before you call <code>XFORM_MISS_CAT</code> . To populate the table, you can use the INSERT_MISS_CAT_MODE Procedure or you can write your own SQL. See Table 54-12 .
<code>data_table_name</code>	Name of the table containing the data to be transformed
<code>xform_view_name</code>	Name of the view to be created. The view presents columns in <code>data_table_name</code> with the transformations specified in <code>miss_table_name</code> .
<code>miss_schema_name</code>	Schema of <code>miss_table_name</code> . If no schema is specified, the current schema is used.
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.
<code>xform_schema_name</code>	Schema of <code>xform_view_name</code> . If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)".

Examples

This example creates a view that replaces missing categorical values with the mode.

```
SELECT * FROM geog;
```

```
REG_ID REGION
-----
```

```
1 NE
2 SW
3 SE
4 SW
5
6 NE
7 NW
8 NW
```

```

    9
    10
    11 SE
    12 SE
    13 NW
    14 SE
    15 SE

SELECT STATS_MODE(region) FROM geog;

STATS_MODE(REGION)
-----
SE

BEGIN
  DBMS_DATA_MINING_TRANSFORM.CREATE_MISS_CAT('misscat_xtbl');
  DBMS_DATA_MINING_TRANSFORM.INSERT_MISS_CAT_MODE (
    miss_table_name      => 'misscat_xtbl',
    data_table_name     => 'geog' );
END;
/

SELECT col, val FROM misscat_xtbl;

COL          VAL
-----
REGION      SE

BEGIN
  DBMS_DATA_MINING_TRANSFORM.XFORM_MISS_CAT (
    miss_table_name      => 'misscat_xtbl',
    data_table_name     => 'geog',
    xform_view_name     => 'geogxf_view');
END;
/

SELECT * FROM geogxf_view;

REG_ID REGION
-----
    1 NE
    2 SW
    3 SE
    4 SW
    5 SE
    6 NE
    7 NW
    8 NW
    9 SE
   10 SE
   11 SE
   12 SE
   13 NW
   14 SE
   15 SE

```

54.6.38 XFORM_MISS_NUM Procedure

This procedure creates a view that implements the numerical missing value treatment transformations specified in a definition table. Only the columns that are specified in the definition table are transformed; the remaining columns from the data table are present in the view, but they are not changed.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.XFORM_MISS_NUM (
    miss_table_name      IN VARCHAR2,
    data_table_name     IN VARCHAR2,
    xform_view_name     IN VARCHAR2,
    miss_schema_name    IN VARCHAR2 DEFAULT NULL,
    data_schema_name    IN VARCHAR2 DEFAULT NULL,
    xform_schema_name   IN VARCHAR2 DEFAULT NULL;
```

Parameters

Table 54-48 XFORM_MISS_NUM Procedure Parameters

Parameter	Description
<code>miss_table_name</code>	Name of the transformation definition table for numerical missing value treatment. You can use the CREATE_MISS_NUM Procedure to create the definition table. The table must be populated with transformation definitions before you call <code>XFORM_MISS_NUM</code> . To populate the table, you can use the INSERT_MISS_NUM_MEAN Procedure or you can write your own SQL. See Table 54-14 .
<code>data_table_name</code>	Name of the table containing the data to be transformed
<code>xform_view_name</code>	Name of the view to be created. The view presents columns in <code>data_table_name</code> with the transformations specified in <code>miss_table_name</code> .
<code>miss_schema_name</code>	Schema of <code>miss_table_name</code> . If no schema is specified, the current schema is used.
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.
<code>xform_schema_name</code>	Schema of <code>xform_view_name</code> . If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)".

Examples

This example creates a view that replaces missing numerical values with the mean.

```
SELECT * FROM items;
```

```
ITEM_ID      QTY
-----
aa           200
bb           200
```

```

cc          250
dd
ee
ff          100
gg          250
hh          200
ii
jj          200

SELECT AVG(qty) FROM items;

AVG(QTY)
-----
      200

BEGIN
  DBMS_DATA_MINING_TRANSFORM.CREATE_MISS_NUM('misnum_xtbl');
  DBMS_DATA_MINING_TRANSFORM.INSERT_MISS_NUM_MEAN (
    miss_table_name      => 'misnum_xtbl',
    data_table_name      => 'items' );
END;
/

SELECT col, val FROM misnum_xtbl;

COL          VAL
-----
QTY          200

BEGIN
  DBMS_DATA_MINING_TRANSFORM.XFORM_MISS_NUM (
    miss_table_name      => 'misnum_xtbl',
    data_table_name      => 'items',
    xform_view_name      => 'items_view');
END;
/

SELECT * FROM items_view;

ITEM_ID      QTY
-----
aa           200
bb           200
cc           250
dd           200
ee           200
ff           100
gg           250
hh           200
ii           200
jj           200

```

54.6.39 XFORM_NORM_LIN Procedure

This procedure creates a view that implements the linear normalization transformations specified in a definition table. Only the columns that are specified in the definition table are

transformed; the remaining columns from the data table are present in the view, but they are not changed.

Syntax

```
DBMS_DATA_MINING_TRANSFORM.XFORM_NORM_LIN (
    norm_table_name      IN VARCHAR2,
    data_table_name      IN VARCHAR2,
    xform_view_name      IN VARCHAR2,
    norm_schema_name     IN VARCHAR2 DEFAULT NULL,
    data_schema_name     IN VARCHAR2 DEFAULT NULL,
    xform_schema_name    IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 54-49 XFORM_NORM_LIN Procedure Parameters

Parameter	Description
<code>norm_table_name</code>	Name of the transformation definition table for linear normalization. You can use the CREATE_NORM_LIN Procedure to create the definition table. The table must be populated with transformation definitions before you call <code>XFORM_NORM_LIN</code> . To populate the table, you can use one of the <code>INSERT</code> procedures for normalization or you can write your own SQL. See Table 54-12 .
<code>data_table_name</code>	Name of the table containing the data to be transformed
<code>xform_view_name</code>	Name of the view to be created. The view presents columns in <code>data_table_name</code> with the transformations specified in <code>miss_table_name</code> .
<code>norm_schema_name</code>	Schema of <code>miss_table_name</code> . If no schema is specified, the current schema is used.
<code>data_schema_name</code>	Schema of <code>data_table_name</code> . If no schema is specified, the current schema is used.
<code>xform_schema_name</code>	Schema of <code>xform_view_name</code> . If no schema is specified, the current schema is used.

Usage Notes

See "[Operational Notes](#)".

Examples

This example creates a view that normalizes the `cust_year_of_birth` and `cust_credit_limit` columns. The data source consists of three columns from `sh.customer`.

```
CREATE OR REPLACE VIEW mining_data AS
    SELECT cust_id, cust_year_of_birth, cust_credit_limit
    FROM sh.customers;
```

```
describe mining_data
```

Name	Null?	Type
CUST_ID	NOT NULL	NUMBER
CUST_YEAR_OF_BIRTH	NOT NULL	NUMBER(4)

```

CUST_CREDIT_LIMIT                                NUMBER

SELECT * FROM mining_data WHERE cust_id > 104495
        ORDER BY cust_year_of_birth;

CUST_ID CUST_YEAR_OF_BIRTH CUST_CREDIT_LIMIT
-----
104496          1947          3000
104498          1954         10000
104500          1962         15000
104499          1970          3000
104497          1976          3000

BEGIN
  dbms_data_mining_transform.CREATE_NORM_LIN(
    norm_table_name      => 'normx_tbl');
  dbms_data_mining_transform.INSERT_NORM_LIN_MINMAX(
    norm_table_name      => 'normx_tbl',
    data_table_name      => 'mining_data',
    exclude_list         => dbms_data_mining_transform.COLUMN_LIST( 'cust_id'),
    round_num            => 3);
END;
/

SELECT col, shift, scale FROM normx_tbl;

COL                                SHIFT    SCALE
-----
CUST_YEAR_OF_BIRTH                 1910     77
CUST_CREDIT_LIMIT                   1500   13500

BEGIN
  DBMS_DATA_MINING_TRANSFORM.XFORM_NORM_LIN (
    norm_table_name      => 'normx_tbl',
    data_table_name      => 'mining_data',
    xform_view_name      => 'norm_view');
END;
/

SELECT * FROM norm_view WHERE cust_id > 104495
        ORDER BY cust_year_of_birth;

CUST_ID CUST_YEAR_OF_BIRTH CUST_CREDIT_LIMIT
-----
104496          .4805195          .1111111
104498          .5714286          .6296296
104500          .6753247              1
104499          .7792208          .1111111
104497          .8571429          .1111111

set long 2000
SQL> SELECT text FROM user_views WHERE view_name IN 'NORM_VIEW';

TEXT
-----
SELECT "CUST_ID", ("CUST_YEAR_OF_BIRTH"-1910)/77 "CUST_YEAR_OF_BIRTH", ("CUST
_CREDIT_LIMIT"-1500)/13500 "CUST_CREDIT_LIMIT" FROM mining_data

```

54.6.40 XFORM_STACK Procedure

This procedure creates a view that implements the transformations specified by the stack. Only the columns and nested attributes that are specified in the stack are transformed. Any remaining columns and nested attributes from the data table appear in the view without changes.

To create a list of objects that describe the transformed columns, use the [DESCRIBE_STACK Procedure](#).



See Also:

["Overview"](#)

Oracle Machine Learning for SQL User's Guide for more information about machine learning attributes

Syntax

```
DBMS_DATA_MINING_TRANSFORM.XFORM_STACK (
  xform_list          IN      TRANSFORM_list,
  data_table_name    IN      VARCHAR2,
  xform_view_name    IN      VARCHAR2,
  data_schema_name   IN      VARCHAR2 DEFAULT NULL,
  xform_schema_name  IN      VARCHAR2 DEFAULT NULL);
```

Parameters

Table 54-50 XFORM_STACK Procedure Parameters

Parameter	Description
xform_list	The transformation list. See Table 54-1 for a description of the TRANSFORM_LIST object type.
data_table_name	Name of the table containing the data to be transformed
xform_view_name	Name of the view to be created. The view applies the transformations in <i>xform_list</i> to <i>data_table_name</i> .
data_schema_name	Schema of <i>data_table_name</i> . If no schema is specified, the current schema is used.
xform_schema_name	Schema of <i>xform_view_name</i> . If no schema is specified, the current schema is used.

Usage Notes

See ["Operational Notes"](#). The following sections are especially relevant:

- ["About Transformation Lists"](#)
- ["About Stacking"](#)
- ["Nested Data Transformations"](#)

Examples

This example applies a transformation list to the view `oml_user.cust_info` and shows how the data is transformed. The `CREATE` statement for `cust_info` is shown in "[DESCRIBE_STACK Procedure](#)".

```
BEGIN
  dbms_data_mining_transform.CREATE_BIN_NUM ('birth_yr_bins');
  dbms_data_mining_transform.INSERT_BIN_NUM_QTILE (
    bin_table_name => 'birth_yr_bins',
    data_table_name => 'cust_info',
    bin_num        => 6,
    exclude_list   => dbms_data_mining_transform.column_list(
                      'cust_id','country_id'));
END;
/
SELECT * FROM birth_yr_bins;
```

COL	ATT	VAL	BIN
CUST_YEAR_OF_BIRTH		1922	
CUST_YEAR_OF_BIRTH		1951	1
CUST_YEAR_OF_BIRTH		1959	2
CUST_YEAR_OF_BIRTH		1966	3
CUST_YEAR_OF_BIRTH		1973	4
CUST_YEAR_OF_BIRTH		1979	5
CUST_YEAR_OF_BIRTH		1986	6

```
DECLARE
  cust_stack dbms_data_mining_transform.TRANSFORM_LIST;
BEGIN
  dbms_data_mining_transform.SET_TRANSFORM (cust_stack,
    'country_id', NULL, 'country_id/10', 'country_id*10');
  dbms_data_mining_transform.STACK_BIN_NUM ('birth_yr_bins',
    cust_stack);
  dbms_data_mining_transform.SET_TRANSFORM (cust_stack,
    'custprods', 'Mouse Pad', 'value*100', 'value/100');
  dbms_data_mining_transform.XFORM_STACK(
    xform_list      => cust_stack,
    data_table_name => 'cust_info',
    xform_view_name => 'cust_xform_view');
END;
/

-- Two rows of data without transformations
SELECT * from cust_info WHERE cust_id BETWEEN 100010 AND 100011;
```

CUST_ID	COUNTRY_ID	CUST_YEAR_OF_BIRTH	CUSTPRODS (ATTRIBUTE_NAME, VALUE)
100010	52790	1975	DM_NESTED_NUMERICALS (DM_NESTED_NUMERICAL ('18" Flat Panel Graphics Monitor', 1), DM_NESTED_NUMERICAL ('SIMM- 16MB PCMCIAII card', 1))
100011	52775	1972	DM_NESTED_NUMERICALS (DM_NESTED_NUMERICAL ('External 8X CD-ROM', 1), DM_NESTED_NUMERICAL ('Mouse Pad', 1), DM_NESTED_NUMERICAL (


```

        'SIMM- 16MB PCMCIAII card', 1),
        DM_NESTED_NUMERICAL(
        'Keyboard Wrist Rest', 1),
        DM_NESTED_NUMERICAL(
        '18" Flat Panel Graphics Monitor', 1),
        DM_NESTED_NUMERICAL(
        'O/S Documentation Set - English', 1))

-- Same two rows of data with transformations
SELECT * FROM cust_xform_view WHERE cust_id BETWEEN 100010 AND 100011;

CUST_ID  COUNTRY_ID  C  CUSTPRODS(ATTRIBUTE_NAME, VALUE)
-----  -
100010      5279      5  DM_NESTED_NUMERICALS(
        DM_NESTED_NUMERICAL(
        '18" Flat Panel Graphics Monitor', 1),
        DM_NESTED_NUMERICAL(
        'SIMM- 16MB PCMCIAII card', 1))
100011      5277.5    4  DM_NESTED_NUMERICALS(
        DM_NESTED_NUMERICAL(
        'External 8X CD-ROM', 1),
        DM_NESTED_NUMERICAL(
        'Mouse Pad', 100),
        DM_NESTED_NUMERICAL(
        'SIMM- 16MB PCMCIAII card', 1),
        DM_NESTED_NUMERICAL(
        'Keyboard Wrist Rest', 1),
        DM_NESTED_NUMERICAL(
        '18" Flat Panel Graphics Monitor', 1),
        DM_NESTED_NUMERICAL(
        'O/S Documentation Set - English', 1))

```

DBMS_DATAPUMP

The `DBMS_DATAPUMP` package is used to move all, or part of, a database between databases, including both data and metadata.



See Also:

Oracle Database Utilities for more information on the concepts behind the `DBMS_DATAPUMP` API, how it works, and how it is implemented in the Data Pump Export and Import utilities

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Data Structures](#)
- [Summary of DBMS_DATAPUMP Subprograms](#)

55.1 DBMS_DATAPUMP Overview

`DBMS_DATAPUMP` provides the following support and functionality.

- The source and target databases can have different hardware, operating systems, character sets, time zones, and versions.
- All object types and datatypes existing in Oracle Database 11g and higher are supported.
- Data and metadata can be transferred between databases without using any intermediary files.
- A subset of a database can be moved based upon object type and names of objects.
- Schema names, data file names, tablespace names, and data can be transformed at import time.
- Previously aborted export and import jobs can be restarted without duplicating or omitting any data or metadata from the original job.
- The resources applied to an export or import job can be modified.
- Data in an Oracle proprietary format can be unloaded and loaded.

55.2 DBMS_DATAPUMP Security Model

Security for the `DBMS_DATAPUMP` package is implemented through roles.

The `DATAPUMP_EXP_FULL_DATABASE` and `DATAPUMP_IMP_FULL_DATABASE` roles allow privileged users to take full advantage of the API. The Data Pump API will use these roles to determine whether privileged application roles should be assigned to the processes comprising the job.

- `DATAPUMP_EXP_FULL_DATABASE`

The `DATAPUMP_EXP_FULL_DATABASE` role affects only Export operations. It allows users running these operations to do the following:

- Perform the operation outside of the scope of their schema
- Monitor jobs that were initiated by another user
- Export objects (for example, `TABLESPACE` definitions) that unprivileged users cannot reference

Although the `SYS` schema does not have the `DATAPUMP_EXP_FULL_DATABASE` role assigned to it, all security checks performed by Data Pump that require the `DATAPUMP_EXP_FULL_DATABASE` role will also grant access to the `SYS` schema.

- `DATAPUMP_IMP_FULL_DATABASE`

The `DATAPUMP_IMP_FULL_DATABASE` role affects only Import and `SQL_FILE` operations. It allows users running these operations to do the following:

- Perform the operation outside of the scope of their schema
- Monitor jobs that were initiated by another user
- Import objects (for example, `DIRECTORY` definitions) that unprivileged users cannot create

Although the `SYS` schema does not have the `DATAPUMP_IMP_FULL_DATABASE` role assigned to it, all security checks performed by Data Pump that require the `DATAPUMP_IMP_FULL_DATABASE` role will also grant access to the `SYS` schema.

55.3 DBMS_DATAPUMP Constants

There are several public constants defined for use with the `DBMS_DATAPUMP.GET_STATUS` procedure. All such constants are defined as part of the `DBMS_DATAPUMP` package. Any references to these constants must be prefixed by `DBMS_DATAPUMP.` and followed by the symbols in the following lists:

Mask Bit Definitions

The following mask bit definitions are used for controlling the return of data through the `DBMS_DATAPUMP.GET_STATUS` procedure.

- `KU$_STATUS_WIP` CONSTANT BINARY_INTEGER := 1;
- `KU$_STATUS_JOB_DESC` CONSTANT BINARY_INTEGER := 2;
- `KU$_STATUS_JOB_STATUS` CONSTANT BINARY_INTEGER := 4;
- `KU$_STATUS_JOB_ERROR` CONSTANT BINARY_INTEGER := 8;

Dump File Type Definitions

The following definitions are used for identifying types of dump files returned through the `DBMS_DATAPUMP.GET_STATUS` procedure.

- `KU$_DUMPFILTYPE_DISK` CONSTANT BINARY_INTEGER := 0;
- `KU$_DUMPFILTYPE_TEMPLATE` CONSTANT BINARY_INTEGER := 3;

55.4 DBMS_DATAPUMP Data Structures

The `DBMS_DATAPUMP` package defines `OBJECT` types. The types described in this section are defined in the `SYS` schema for use by the `GET_STATUS` function. *The way in which these types are defined and used may be different than what you are accustomed to. Be sure to read this section carefully.*

The collection of types defined for use with the `GET_STATUS` procedure are version-specific and include version information in the names of the types. Once introduced, these types will always be provided and supported in future versions of Oracle Database and will not change. However, in future releases of Oracle Database, new versions of these types might be created that provide new or different information. The new versions of these types will have different version information embedded in the type names.

For example, in Oracle Database 12c, Release 1 (12.1), there is a `sys.ku$_Status1210` type, and in the next Oracle Database release, there could be a `sys.ku$_Status1310` type defined. Both types could be used with the `GET_STATUS` procedure.

Public synonyms have been defined for each of the types used with the `GET_STATUS` procedure. This makes it easier to use the types and means that you do not have to be concerned with changes to the actual type names or schemas where they reside. Oracle recommends that you use these synonyms whenever possible.

For each of the types, there is a version-specific synonym and a generic synonym. For example, the version-specific synonym `ku$_Status1210` is defined for the `sys.ku$_Status1210` type.

The generic synonym always describes the latest version of that type. For example, in Oracle Database 12c, Release 1 (12.1), the generic synonym `ku$_Status` is defined as `ku$_Status1210`. In a future release, there might be a `ku$_Status1310` synonym for `sys.ku$_Status1310`. Because the `ku$_Status` generic synonym always points to the latest definition, it would then point to `ku$_Status1310` rather than to `ku$_Status1210`.

The choice of whether to use version-specific synonyms or generic synonyms makes a significant difference in how you work. Using version-specific names protects your code from changes in future releases of Oracle Database because those types will continue to exist and be supported. However, access to new information will require code changes to use new synonym names for each of the types. Using the generic names implies that you always want the latest definition of the types and are prepared to deal with changes in different releases of Oracle Database.

When the version of Oracle Database that you are using changes, any C code that accesses types through generic synonym names will need to be recompiled.

 **Note:**

Languages other than PL/SQL must ensure that their type definitions are properly aligned with the version-specific definitions.

 **See Also:**

[GET_STATUS Procedure](#) for additional information about how types are used

Data Structures — Object Types

The `DBMS_DATAPUMP` package defines the following kinds of `OBJECT` types:

- Worker Status Types
- Log Entry and Error Types
- Job Status Types
- Job Description Types
- Status Types

Worker Status Types

The worker status types describe what each worker process in a job is doing. The schema, object name, and object type of an object being processed will be provided. For workers processing user data, the partition name for a partitioned table (if any), the number of bytes processed in the partition, and the number of rows processed in the partition are also returned. Workers processing metadata provide status on the last object that was processed. No status for idle threads is returned.

The `percent_done` refers to the amount completed for the current data item being processed. It is not updated for metadata objects.

The worker status types are defined as follows:

```
CREATE TYPE sys.ku$_WorkerStatus1010 AS OBJECT
(
    worker_number    NUMBER,           -- Worker process identifier
    process_name     VARCHAR2(30),    -- Worker process name
    state            VARCHAR2(30),    -- Worker process state
    schema           VARCHAR2(30),    -- Schema name
    name             VARCHAR2(4000),  -- Object name
    object_type      VARCHAR2(200),   -- Object type
    partition        VARCHAR2(30),    -- Partition name
    completed_objects NUMBER,         -- Completed number of objects
    total_objects    NUMBER,         -- Total number of objects
    completed_rows   NUMBER,         -- Number of rows completed
    completed_bytes  NUMBER,         -- Number of bytes completed
    percent_done     NUMBER          -- Percent done current object
)

CREATE OR REPLACE PUBLIC SYNONYM ku$_WorkerStatus1010
FOR sys.ku$_WorkerStatus1010;
```

```
CREATE TYPE sys.ku$WorkerStatus1020 AS OBJECT
(
    worker_number    NUMBER,          -- Worker process identifier
    process_name     VARCHAR2(30),    -- Worker process name
    state            VARCHAR2(30),    -- Worker process state
    schema          VARCHAR2(30),    -- Schema name
    name            VARCHAR2(4000),   -- Object name
    object_type     VARCHAR2(200),   -- Object type
    partition       VARCHAR2(30),    -- Partition name
    completed_objects NUMBER,        -- Completed number of objects
    total_objects   NUMBER,          -- Total number of objects
    completed_rows  NUMBER,          -- Number of rows completed
    completed_bytes NUMBER,          -- Number of bytes completed
    percent_done    NUMBER,          -- Percent done current object
    degree         NUMBER            -- Degree of parallelism
)
```

```
CREATE OR REPLACE PUBLIC SYNONYM ku$WorkerStatus1020
FOR sys.ku$WorkerStatus1020;
```

```
CREATE TYPE sys.ku$WorkerStatus1120 AS OBJECT
(
    worker_number    NUMBER,          -- Worker process identifier
    process_name     VARCHAR2(30),    -- Worker process name
    state            VARCHAR2(30),    -- Worker process state
    schema          VARCHAR2(30),    -- Schema name
    name            VARCHAR2(4000),   -- Object name
    object_type     VARCHAR2(200),   -- Object type
    partition       VARCHAR2(30),    -- Partition name
    completed_objects NUMBER,        -- Completed number of objects
    total_objects   NUMBER,          -- Total number of objects
    completed_rows  NUMBER,          -- Number of rows completed
    completed_bytes NUMBER,          -- Number of bytes completed
    percent_done    NUMBER,          -- Percent done current object
    degree         NUMBER,          -- Degree of parallelism
    instance_id     NUMBER            -- Instance ID where running
)
```

```
CREATE OR REPLACE PUBLIC SYNONYM ku$WorkerStatus1120
FOR sys.ku$WorkerStatus1120;
```

```
CREATE TYPE sys.ku$WorkerStatus1210 AS OBJECT
(
    worker_number    NUMBER,          -- Worker process identifier
    process_name     VARCHAR2(30),    -- Worker process name
    state            VARCHAR2(30),    -- Worker process state
    schema          VARCHAR2(30),    -- Schema name
    name            VARCHAR2(4000),   -- Object name
    object_type     VARCHAR2(200),   -- Object type
    partition       VARCHAR2(30),    -- Partition name
    completed_objects NUMBER,        -- Completed number of objects
    total_objects   NUMBER,          -- Total number of objects
    completed_rows  NUMBER,          -- Number of rows completed
    completed_bytes NUMBER,          -- Number of bytes completed
    percent_done    NUMBER,          -- Percent done current object
    degree         NUMBER,          -- Degree of parallelism
    instance_id     NUMBER,          -- Instance ID where running
    instance_name   VARCHAR2(60),    -- Instance Name where running
    host_name       VARCHAR2(64)     -- Host name where running
)
```

```

CREATE OR REPLACE PUBLIC SYNONYM ku$WorkerStatus1210
  FOR sys.ku$WorkerStatus1210;

CREATE TYPE sys.ku$WorkerStatus1220 AS OBJECT
  (
    worker_number      NUMBER,          -- Worker process identifier
    process_name       VARCHAR2(128), -- Worker process name
    state              VARCHAR2(30),   -- Worker process state
    schema             VARCHAR2(128), -- Schema name
    name               VARCHAR2(4000), -- Object name
    object_type        VARCHAR2(200), -- Object type
    partition          VARCHAR2(128), -- Partition name
    completed_objects  NUMBER,          -- Completed number of objects
    total_objects      NUMBER,          -- Total number of objects
    completed_rows     NUMBER,          -- Number of rows completed
    completed_bytes    NUMBER,          -- Number of bytes completed
    percent_done       NUMBER,          -- Percent done current object
    degree             NUMBER,          -- Degree of parallelism
    instance_id        NUMBER,          -- Instance ID where running
    instance_name      VARCHAR2(60),   -- Instance Name where running
    host_name          VARCHAR2(101),  -- Host name where running
    access_method       VARCHAR2(16),  -- Access Method of object
    obj_start_time     DATE,           -- Object start time
    obj_status         DATE             -- Object status at current time
  )

CREATE OR REPLACE PUBLIC SYNONYM ku$WorkerStatus1220
  FOR sys.ku$WorkerStatus1220;

CREATE OR REPLACE PUBLIC SYNONYM ku$WorkerStatus FOR ku$WorkerStatus1220;

CREATE TYPE sys.ku$WorkerStatusList1010 AS TABLE OF sys.ku$WorkerStatus1010
CREATE TYPE sys.ku$WorkerStatusList1020 AS TABLE OF sys.ku$WorkerStatus1020
CREATE TYPE sys.ku$WorkerStatusList1120 AS TABLE OF sys.ku$WorkerStatus1120
CREATE TYPE sys.ku$WorkerStatusList1210 AS TABLE OF sys.ku$WorkerStatus1210
CREATE TYPE sys.ku$WorkerStatusList1220 AS TABLE OF sys.ku$WorkerStatus1220

CREATE OR REPLACE PUBLIC SYNONYM ku$WorkerStatusList1010
  FOR sys.ku$WorkerStatusList1010;
CREATE OR REPLACE PUBLIC SYNONYM ku$WorkerStatusList1020
  FOR sys.ku$WorkerStatusList1020;
CREATE OR REPLACE PUBLIC SYNONYM ku$WorkerStatusList1120
  FOR sys.ku$WorkerStatusList1120;
CREATE OR REPLACE PUBLIC SYNONYM ku$WorkerStatusList1210
  FOR sys.ku$WorkerStatusList1210;
CREATE OR REPLACE PUBLIC SYNONYM ku$WorkerStatusList1220
  FOR sys.ku$WorkerStatusList1220;

CREATE OR REPLACE PUBLIC SYNONYM ku$WorkerStatusList
  FOR ku$WorkerStatusList1220;

```

Log Entry and Error Types

These types provide informational and error text to attached clients and the log stream. The `ku$LogLine.errorNumber` type is set to `NULL` for informational messages but is specified for error messages. Each log entry may contain several lines of text messages.

The log entry and error types are defined as follows:

```

CREATE TYPE sys.ku$_LogLine1010 AS OBJECT (
    logLineNumber    NUMBER,
    errorNumber      NUMBER,
    LogText          VARCHAR2(2000))

CREATE OR REPLACE PUBLIC SYNONYM ku$_LogLine1010 FOR sys.ku$_LogLine1010;
CREATE OR REPLACE PUBLIC SYNONYM ku$_LogLine1020 FOR sys.ku$_LogLine1010;
CREATE OR REPLACE PUBLIC SYNONYM ku$_LogLine FOR ku$_LogLine1010;
CREATE TYPE sys.ku$_LogEntry1010 AS TABLE OF sys.ku$_LogLine1010

CREATE OR REPLACE PUBLIC SYNONYM ku$_LogEntry1010 FOR sys.ku$_LogEntry1010;
CREATE OR REPLACE PUBLIC SYNONYM ku$_LogEntry1020 FOR sys.ku$_LogEntry1010;
CREATE OR REPLACE PUBLIC SYNONYM ku$_LogEntry FOR ku$_LogEntry1010;

```

Job Status Types

The job status type returns status about a job. Usually, the status concerns a running job, but it could also be about a stopped job when a client attaches. It is typically requested at attach time, when the client explicitly requests status from interactive mode and every *N* seconds when the client has requested status periodically.

The job status types are defined as follows (`percent_done` applies to data only):

```

CREATE TYPE sys.ku$_JobStatus1010 IS OBJECT
(
    job_name          VARCHAR2(30),          -- Name of the job
    operation         VARCHAR2(30),          -- Current operation
    job_mode          VARCHAR2(30),          -- Current mode
    bytes_processed   NUMBER,                -- Bytes so far
    total_bytes       NUMBER,                -- Total bytes for job
    percent_done      NUMBER,                -- Percent done
    degree            NUMBER,                -- Of job parallelism
    error_count       NUMBER,                -- #errors so far
    state             VARCHAR2(30),          -- Current job state
    phase             NUMBER,                -- Job phase
    restart_count     NUMBER,                -- #Job restarts
    worker_status_list ku$_WorkerStatusList1010, -- For (non-idle)
                                                    -- job worker processes
    files             ku$_DumpFileSet1010   -- Dump file info
)

CREATE OR REPLACE PUBLIC SYNONYM ku$_JobStatus1010 FOR sys.ku$_JobStatus1010;

CREATE TYPE sys.ku$_JobStatus1020 IS OBJECT
(
    job_name          VARCHAR2(30),          -- Name of the job
    operation         VARCHAR2(30),          -- Current operation
    job_mode          VARCHAR2(30),          -- Current mode
    bytes_processed   NUMBER,                -- Bytes so far
    total_bytes       NUMBER,                -- Total bytes for job
    percent_done      NUMBER,                -- Percent done
    degree            NUMBER,                -- Of job parallelism
    error_count       NUMBER,                -- #errors so far
    state             VARCHAR2(30),          -- Current job state
    phase             NUMBER,                -- Job phase
    restart_count     NUMBER,                -- #Job restarts
    worker_status_list ku$_WorkerStatusList1020, -- For (non-idle)
                                                    -- job worker processes
    files             ku$_DumpFileSet1010   -- Dump file info
)

```



```
CREATE OR REPLACE PUBLIC SYNONYM ku$_JobStatus1020 FOR sys.ku$_JobStatus1020;

CREATE TYPE sys.ku$_JobStatus1120 IS OBJECT
(
    job_name          VARCHAR2(30),          -- Name of the job
    operation         VARCHAR2(30),          -- Current operation
    job_mode          VARCHAR2(30),          -- Current mode
    bytes_processed   NUMBER,                -- Bytes so far
    total_bytes       NUMBER,                -- Total bytes for job
    percent_done      NUMBER,                -- Percent done
    degree            NUMBER,                -- Of job parallelism
    error_count       NUMBER,                -- #errors so far
    state             VARCHAR2(30),          -- Current job state
    phase             NUMBER,                -- Job phase
    restart_count     NUMBER,                -- #Job restarts
    worker_status_list ku$_WorkerStatusList1120, -- For (non-idle)
                                                    -- job worker processes
    files             ku$_DumpFileSet1010    -- Dump file info
)

CREATE OR REPLACE PUBLIC SYNONYM ku$_JobStatus1120 FOR sys.ku$_JobStatus1120;

CREATE TYPE sys.ku$_JobStatus1210 IS OBJECT
(
    job_name          VARCHAR2(30),          -- Name of the job
    operation         VARCHAR2(30),          -- Current operation
    job_mode          VARCHAR2(30),          -- Current mode
    bytes_processed   NUMBER,                -- Bytes so far
    total_bytes       NUMBER,                -- Total bytes for job
    percent_done      NUMBER,                -- Percent done
    degree            NUMBER,                -- Of job parallelism
    error_count       NUMBER,                -- #errors so far
    state             VARCHAR2(30),          -- Current job state
    phase             NUMBER,                -- Job phase
    restart_count     NUMBER,                -- #Job restarts
    worker_status_list ku$_WorkerStatusList1210, -- For (non-idle)
                                                    -- job worker processes
    files             ku$_DumpFileSet1010    -- Dump file info
)

CREATE OR REPLACE PUBLIC SYNONYM ku$_JobStatus1210 FOR sys.ku$_JobStatus1210;

CREATE TYPE sys.ku$_JobStatus1220 IS OBJECT
(
    job_name          VARCHAR2(128),         -- Name of the job
    operation         VARCHAR2(30),          -- Current operation
    job_mode          VARCHAR2(30),          -- Current mode
    bytes_processed   NUMBER,                -- Bytes so far
    total_bytes       NUMBER,                -- Total bytes for job
    percent_done      NUMBER,                -- Percent done
    degree            NUMBER,                -- Of job parallelism
    error_count       NUMBER,                -- #errors so far
    state             VARCHAR2(30),          -- Current job state
    phase             NUMBER,                -- Job phase
    restart_count     NUMBER,                -- #Job restarts
    heartbeat         NUMBER,                -- Job heartbeat
    worker_status_list ku$_WorkerStatusList1220, -- For (non-idle)
                                                    -- job worker processes
    files             ku$_DumpFileSet1010    -- Dump file info
)
```

```
CREATE OR REPLACE PUBLIC SYNONYM ku$_JobStatus1220 FOR sys.ku$_JobStatus1220;

CREATE OR REPLACE PUBLIC SYNONYM ku$_JobStatus FOR ku$_JobStatus1220;
```

Job Description Types

The job description type holds all the environmental information about the job such as parameter settings and dump file set members. There are a couple of subordinate types required as well.

The job description types are defined as follows:

```
CREATE TYPE sys.ku$_JobDesc1010 IS OBJECT
(
    job_name          VARCHAR2(30),          -- The job name
    guid              RAW(16),              -- The job GUID
    operation          VARCHAR2(30),        -- Current operation
    job_mode           VARCHAR2(30),        -- Current mode
    remote_link        VARCHAR2(4000),      -- DB link, if any
    owner              VARCHAR2(30),        -- Job owner
    instance           VARCHAR2(16),        -- The instance name
    db_version         VARCHAR2(30),        -- Version of objects
    creator_privs      VARCHAR2(30),        -- Privs of job
    start_time         DATE,                -- This job start time
    max_degree         NUMBER,              -- Max. parallelism
    log_file           VARCHAR2(4000),      -- Log file name
    sql_file           VARCHAR2(4000),      -- SQL file name
    params             ku$_ParamValues1010 -- Parameter list
)

```

```
CREATE OR REPLACE PUBLIC SYNONYM ku$_JobDesc1010 FOR sys.ku$_JobDesc1010;
```

```
CREATE TYPE sys.ku$_JobDesc1020 IS OBJECT
(
    job_name          VARCHAR2(30),          -- The job name
    guid              RAW(16),              -- The job GUID
    operation          VARCHAR2(30),        -- Current operation
    job_mode           VARCHAR2(30),        -- Current mode
    remote_link        VARCHAR2(4000),      -- DB link, if any
    owner              VARCHAR2(30),        -- Job owner
    platform           VARCHAR2(101),       -- Current job platform
    exp_platform       VARCHAR2(101),       -- Export platform
    global_name        VARCHAR2(4000),      -- Current global name
    exp_global_name    VARCHAR2(4000),      -- Export global name
    instance           VARCHAR2(16),        -- The instance name
    db_version         VARCHAR2(30),        -- Version of objects
    exp_db_version     VARCHAR2(30),        -- Export version
    scn                NUMBER,              -- Job SCN
    creator_privs      VARCHAR2(30),        -- Privs of job
    start_time         DATE,                -- This job start time
    exp_start_time     DATE,                -- Export start time
    term_reason        NUMBER,              -- Job termination code
    max_degree         NUMBER,              -- Max. parallelism
    log_file           VARCHAR2(4000),      -- Log file name
    sql_file           VARCHAR2(4000),      -- SQL file name
    params             ku$_ParamValues1010 -- Parameter list
)

```

```

CREATE OR REPLACE PUBLIC SYNONYM ku$_JobDesc1020 FOR sys.ku$_JobDesc1020;

CREATE TYPE sys.ku$_JobDesc1210 IS OBJECT
(
    job_name          VARCHAR2(30),          -- The job name
    guid              RAW(16),              -- The job GUID
    operation          VARCHAR2(30),        -- Current operation
    job_mode           VARCHAR2(30),        -- Current mode
    remote_link        VARCHAR2(4000),     -- DB link, if any
    owner              VARCHAR2(30),        -- Job owner
    platform           VARCHAR2(101),       -- Current job platform
    exp_platform       VARCHAR2(101),       -- Export platform
    global_name        VARCHAR2(4000),     -- Current global name
    exp_global_name    VARCHAR2(4000),     -- Export global name
    instance           VARCHAR2(16),       -- The instance name
    db_version         VARCHAR2(30),        -- Cur. server software
version
    exp_db_version     VARCHAR2(30),        -- Export svr. software
version
    job_version        VARCHAR2(30),        -- Negotiated data
version
    scn                NUMBER,              -- Job SCN
    creator_privs      VARCHAR2(30),        -- Privs of job
    start_time         DATE,                -- This job start time
    exp_start_time     DATE,                -- Export start time
    term_reason        NUMBER,              -- Job termination code
    max_degree         NUMBER,              -- Max. parallelism
    timezone           VARCHAR2(64),        -- Cur. server timezone
    exp_timezone       VARCHAR2(64),        -- Exp. server timezone
    tstz_version       NUMBER,              -- Cur. server timezone
version
    exp_tstz_version   NUMBER,              -- Exp. server timezone
    endianness         VARCHAR2(16),        -- Cur. platform's
endianness
    exp_endianness     VARCHAR2(16),        -- Exp. platform's
endianness
    -- endianness is 'BIG' or 'LITTLE'
    charset            VARCHAR2(28),        -- Cur. server charset
    exp_charset        VARCHAR2(28),        -- Exp. server charset
    ncharset           VARCHAR2(28),        -- Cur. server national
charset
    exp_ncharset       VARCHAR2(28),        -- Exp. server national
charset
    log_file           VARCHAR2(4000),     -- Log file name
    sql_file           VARCHAR2(4000),     -- SQL file name
    params             ku$_ParamValues1010 -- Parameter list
)

CREATE OR REPLACE PUBLIC SYNONYM ku$_JobDesc1210 FOR sys.ku$_JobDesc1210;

CREATE TYPE sys.ku$_JobDesc1220 IS OBJECT
(
    job_name          VARCHAR2(128),       -- The job name
    guid              RAW(16),              -- The job GUID
    operation          VARCHAR2(30),        -- Current operation
    job_mode           VARCHAR2(30),        -- Current mode
    remote_link        VARCHAR2(4000),     -- DB link, if any
    owner              VARCHAR2(128),      -- Job owner
    platform           VARCHAR2(101),       -- Current job platform
    exp_platform       VARCHAR2(101),       -- Export platform

```

```

        global_name      VARCHAR2(4000),      -- Current global name
        exp_global_name  VARCHAR2(4000),      -- Export global name
        instance        VARCHAR2(60),        -- The instance name
        db_version       VARCHAR2(60),        -- Cur. server software version
        exp_db_version   VARCHAR2(60),        -- Export svr. software version
        job_version      VARCHAR2(60),        -- Negotiated data version
        scn              NUMBER,              -- Job SCN
        creator_privs    VARCHAR2(30),        -- Privs of job
        start_time       DATE,                -- This job start time
        exp_start_time   DATE,                -- Export start time
        term_reason      NUMBER,              -- Job termination code
        max_degree       NUMBER,              -- Max. parallelism
        timezone         VARCHAR2(64),        -- Cur. server timezone
        exp_timezone     VARCHAR2(64),        -- Exp. server timezone
        tstz_version     NUMBER,              -- Cur. server timezone version
        exp_tstz_version NUMBER,              -- Exp. server timezone
        endianness       VARCHAR2(16),        -- Cur. platform's endianness
        exp_endianness   VARCHAR2(16),        -- Exp. platform's endianness
-- endianness is 'BIG' or 'LITTLE'
        charset          VARCHAR2(28),        -- Cur. server charset
        exp_charset      VARCHAR2(28),        -- Exp. server charset
        ncharset         VARCHAR2(28),        -- Cur. server national charset
        exp_ncharset     VARCHAR2(28),        -- Exp. server national charset
        log_file         VARCHAR2(4000),      -- Log file name
        sql_file         VARCHAR2(4000),      -- SQL file name
        params           ku$_ParamValues1010 -- Parameter list
    )

```

```
CREATE OR REPLACE PUBLIC SYNONYM ku$_JobDesc1220 FOR sys.ku$_JobDesc1220;
```

```
CREATE OR REPLACE PUBLIC SYNONYM ku$_JobDesc FOR ku$_JobDesc1220;
```

Status Types

The status type is an aggregate of some the previous types defined and is the return value for the `GET_STATUS` call. The mask attribute indicates which types of information are being returned to the caller. It is created by a client's shadow process from information it retrieves off the status queue or directly from the master table.

For errors, the `ku$_LogEntry` that is returned has already had its log lines ordered for proper output. That is, the original `ku$_LogEntry` objects have been ordered from outermost context to innermost.

The status types are defined as follows:

```
CREATE TYPE sys.ku$_Status1010 IS OBJECT
(
    mask          NUMBER,          -- Status types present
    wip           ku$_LogEntry1010, -- Work in progress
    job_description ku$_JobDesc1010, -- Complete job description
    job_status    ku$_JobStatus1010, -- Detailed job status
    error         ku$_LogEntry1010 -- Multi-level context errors
)

```

```
CREATE OR REPLACE PUBLIC SYNONYM ku$_Status1010 FOR sys.ku$_Status1010;
```

```
CREATE TYPE sys.ku$_Status1020 IS OBJECT
(
    mask          NUMBER,          -- Status types present
    wip           ku$_LogEntry1010, -- Work in progress
    job_description ku$_JobDesc1020, -- Complete job description

```

```

        job_status      ku$_JobStatus1020,-- Detailed job status
        error           ku$_LogEntry1010 -- Multi-level context errors
    )

CREATE OR REPLACE PUBLIC SYNONYM ku$_Status1020 FOR sys.ku$_Status1020;

CREATE TYPE sys.ku$_Status1120 IS OBJECT
(
    mask                NUMBER,          -- Status types present
    wip                 ku$_LogEntry1010, -- Work in progress
    job_description     ku$_JobDesc1020,  -- Complete job description
    job_status          ku$_JobStatus1120,-- Detailed job status
    error               ku$_LogEntry1010  -- Multi-level context errors
)

CREATE OR REPLACE PUBLIC SYNONYM ku$_Status1120 FOR sys.ku$_Status1120;

CREATE TYPE sys.ku$_Status1210 IS OBJECT
(
    mask                NUMBER,          -- Status types present
    wip                 ku$_LogEntry1010, -- Work in progress
    job_description     ku$_JobDesc1210,  -- Complete job description
    job_status          ku$_JobStatus1210,-- Detailed job status
    error               ku$_LogEntry1010  -- Multi-level context errors
)

CREATE OR REPLACE PUBLIC SYNONYM ku$_Status1210 FOR sys.ku$_Status1210;

CREATE TYPE sys.ku$_Status1220 IS OBJECT
(
    mask                NUMBER,          -- Status types present
    wip                 ku$_LogEntry1010, -- Work in progress
    job_description     ku$_JobDesc1220,  -- Complete job description
    job_status          ku$_JobStatus1220,-- Detailed job status
    error               ku$_LogEntry1010  -- Multi-level context errors
)

CREATE OR REPLACE PUBLIC SYNONYM ku$_Status1220 FOR sys.ku$_Status1220;

CREATE OR REPLACE PUBLIC SYNONYM ku$_Status FOR ku$_Status1220;

```

55.5 Summary of DBMS_DATAPUMP Subprograms

This table lists the DBMS_DATAPUMP subprograms in alphabetical order and briefly describes them.

Table 55-1 DBMS_DATAPUMP Package Subprograms

Subprogram	Description
ADD_FILE Procedure	Adds dump files to the dump file set for an Export, Import, or SQL_FILE operation. In addition to dump files, other types of files can also be added by using the FILETYPE parameter provided with this procedure.
ATTACH Function	Used to gain access to a Data Pump job that is in the Defining, Executing, Idling, or Stopped state
DATA_FILTER Procedures	Specifies restrictions on the rows that are to be retrieved

Table 55-1 (Cont.) DBMS_DATAPUMP Package Subprograms

Subprogram	Description
DATA_REMAP Procedure	Specifies transformations to be applied to column data as it is exported from, or imported into, a database.
DETACH Procedure	Specifies that the user has no further interest in using the handle
GET_DUMPFILE_INFO Procedure	Retrieves information about a specified dump file
GET_STATUS Procedure	Monitors the status of a job or waits for the completion of a job or for more details on API errors
LOG_ENTRY Procedure	Inserts a message into the log file
METADATA_FILTER Procedure	Provides filters that allow you to restrict the items that are included in a job
METADATA_REMAP Procedure	Specifies a remapping to be applied to objects as they are processed in the specified job
METADATA_TRANSFORM Procedure	Specifies transformations to be applied to objects as they are processed in the specified job
OPEN Function	Declares a new job using the Data Pump API, the handle returned being used as a parameter for calls to all other procedures (but not to the <code>ATTACH</code> function)
SET_PARALLEL Procedure	Adjusts the degree of parallelism within a job
SET_PARAMETER Procedures	Specifies job-processing options
START_JOB Procedure	Begins or resumes execution of a job
STOP_JOB Procedure	Terminates a job, but optionally, preserves the state of the job
WAIT_FOR_JOB Procedure	Runs a job until it either completes normally or stops for some other reason

55.5.1 ADD_FILE Procedure

This procedure adds files to the dump file set for an Export, Import, or `SQL_FILE` operation, or specifies the log file or the output file for a `SQL_FILE` operation.

Syntax

```
DBMS_DATAPUMP.ADD_FILE (
  handle      IN NUMBER,
  filename    IN VARCHAR2,
  directory   IN VARCHAR2,
  filesize    IN VARCHAR2 DEFAULT NULL,
  filetype    IN NUMBER DEFAULT DBMS_DATAPUMP.KU$_FILE_TYPE_DUMP_FILE,
  reusefile   IN NUMBER DEFAULT NULL);
```

Parameters

Table 55-2 ADD_FILE Procedure Parameters

Parameter	Description
handle	The handle of a job. The current session must have previously attached to the handle through a call to either the <code>OPEN</code> or <code>ATTACH</code> function.
filename	<p>The name of the file that is being added. The <code>filename</code> parameter must be a simple filename without any directory path information. For dump files, the <code>filename</code> can include a substitution variable. For a description of available substitution variables, see the following table.</p> <p>The file can be written to or read from either the local file system or the Oracle Object Store. If you are interfacing with the local file system, the <code>filename</code> parameter must contain a filename without directory path information. If you are interfacing with the Oracle Object Store, the <code>filename</code> parameter must contain a valid URI to the location of a bucket within your compartment in the Oracle Object Store. You must also specify a valid <code>CREDENTIAL</code> in the directory parameter to access the bucket and the <code>DBMS_DATAPUMP.KU\$_FILE_TYPE_URIDUMP_FILE</code> file type in the <code>filetype</code> parameter. For examples, see <i>Using the Oracle Data Pump API</i> in <i>Oracle Database Utilities Guide</i>.</p>
directory	<p>If you are interfacing with the local file system, then the <code>directory</code> parameter specifies the name of a directory object within the database that is used to locate the filename. If you are interfacing with the Oracle Object Store, then the <code>directory</code> parameter must specify a valid <code>CREDENTIAL</code> to access the bucket where filename resides.</p> <p>Ensure that you specify a valid <code>directory</code> parameter.</p>
filesize	<p>The size of the dump file that is being added.</p> <p>It can be specified as follows:</p> <ul style="list-style-type: none"> • The number of bytes • The number of kilobytes (if followed by <code>K</code>) • The number of megabytes (if followed by <code>M</code>) • The number of gigabytes (if followed by <code>G</code>) • The number of terabytes (if followed by <code>T</code>) <p>An Export operation will write no more than the specified number of bytes to the file. When the file is full, it will be closed. If there is insufficient space on the device to write the specified number of bytes, then the Export operation will fail, but it can be restarted. If not specified, then <code>filesize</code> defaults to an unlimited size. For Import and <code>SQL_FILE</code> operations, <code>filesize</code> is ignored. The minimum value for <code>filesize</code> is ten times the default Data Pump block size, which is 4 kilobytes. A <code>filesize</code> can only be specified for dump files.</p>
filetype	<p>The type of the file that you want to add. The supported values are as follows:</p> <ul style="list-style-type: none"> • <code>DBMS_DATAPUMP.KU\$_FILE_TYPE_DUMP_FILE</code>—Dump file for a job • <code>DBMS_DATAPUMP.KU\$_FILE_TYPE_LOG_FILE</code>—Log file for a job • <code>DBMS_DATAPUMP.KU\$_FILE_TYPE_SQL_FILE</code>—Output for <code>SQL_FILE</code> job • <code>DBMS_DATAPUMP.KU\$_FILE_TYPE_URIDUMP_FILE</code>—Specifies a filename in the Oracle Object Store. For more information, see the <code>filename</code> and <code>directory</code> parameters described above.

Table 55-2 (Cont.) ADD_FILE Procedure Parameters

Parameter	Description
reusefile	If the value is 0, then a preexisting file will cause an error. If the value is 1, then a preexisting file will be overwritten. If the value is NULL, then the default action for the file type will be applied (that is, dump files will not be overwritten). This parameter should only be non-NULL for dump files. The reusefile parameter is restricted to export jobs.

Substitution Variables

Table 55-3 Substitution Variables Available for the Filename Parameter on DBMS_DATAPUMP.ADD_FILE

Substitution Variable	Description
%U	<p>The %U is expanded in the resulting file names into a two-character, fixed-width, incrementing integer starting at 01, and ending at 99. For example, the dump filename of export%U would cause export01, export02, export03, and so on, to be created depending on how many files are needed to perform the export up to export99. For filenames containing the % character, the % must be represented as %% to avoid ambiguity.</p> <p>Note: If you have more than 100 files, then Oracle recommends that you use the %L substitution variable.</p>
%l, %L	<p>Specifies a system-generated unique file name. The file names can contain a substitution variable (%L), which implies that multiple files may be generated. The substitution variable is expanded in the resulting file names into a 2-digit, fixed-width, incrementing integer starting at 01 and ending at 99 which is the same as (%U). In addition, the substitution variable is expanded in the resulting file names into a 3-digit to 10-digit, variable-width, incrementing integers starting at 100 and ending at 2147483646. The width field is determined by the number of digits in the integer.</p> <p>For example if the current integer was 1, exp%Laa%L.dmp would resolve to</p> <pre>exp01aa01.dmp exp02aa02.dmp</pre> <p>and so forth up until 99. Then, the next file name would have 3 digits substituted:</p> <pre>exp100aa100.dmp exp101aa101.dmp</pre> <p>and so forth up until 999 where the next file would have 4 digits substituted. The substitution will continue up to the largest number substitution allowed, which is 2147483646.</p>
%d, %D	<p>Specifies the current day of the month from the Gregorian calendar in format DD.</p> <p>Note: This substitution variable cannot be used in an import file name.</p>
%m, %M	<p>Specifies the month in the Gregorian calendar in format MM.</p> <p>Note: This substitution variable cannot be used in an import file name.</p>

Table 55-3 (Cont.) Substitution Variables Available for the Filename Parameter on DBMS_DATAPUMP.ADD_FILE

Substitution Variable	Description
%t, %T	Specifies the year, month, and day in the Gregorian calendar in this format: YYYYMMDD. Note: This substitution variable cannot be used in an import file name.
%y, %Y	Specifies the year in this format: YYYY. Note: This substitution variable cannot be used in an import file name.

Exceptions

- `INVALID_HANDLE`. The specified handle is not attached to an Oracle Data Pump job.
- `INVALID_ARGVAL`. An invalid value was supplied for an input parameter.
- `INVALID_STATE`. The job is completing, or the job is past the defining state for an import or `SQL_FILE` job, or is past the defining state for `LOG` and `SQL` files.
- `INVALID_OPERATION`. A dump file was specified for a Network Import or `ESTIMATE_ONLY` export operation.
- `SUCCESS_WITH_INFO`. The procedure succeeded, but further information is available through the `GET_STATUS` procedure.
- `NO_SUCH_JOB`. The specified job does not exist.

Usage Notes

- This procedure adds files to an Oracle Data Pump job. You can add the following types of files to a job:
 - Log files—To record the messages associated with an operation. The Log file overwrites the previously existing files.
 - SQL files—To record the output of a `SQL_FILE` operation. The SQL file overwrites the previously existing files.
 - Dump files—To contain the data that is being moved. The Dump files do not overwrite the existing files. However, an error is generated.
- Import and `SQL_FILE` operations require that that you specify all dump files during the definition phase of the job. For Export operations, dump files can be added at any time. For example, if the user ascertains that the file space is running low during an Export, additional dump files can be added through this API. If the specified dump file already exists for an Export operation and `reusefile` is not set to 1, an error will be returned.
- For Export operations, the parallelism setting should be less than or equal to the number of dump files in the dump file set. If there are not enough dump files, then the job will not be able to maximize parallelism to the degree specified by the `SET_PARALLEL` procedure.
- For Import operations, the parallelism setting should also be less than or equal to the number of dump files in the dump file set. If there are not enough dump files,

the performance will not be optimal, as multiple threads of execution try to access the same dump file.

- If the substitution variable (%U) is included in a filename, then multiple dump files can be specified through a single call to `ADD_FILE`. For Export operations, the new dump files will be created as they are needed. Enough dump files will be created to allow all of the processes specified by the current `SET_PARALLEL` value to be active. If one of the dump files is full, then it is closed, and a new dump file (with a new generated name) is created to take its place. If multiple `ADD_FILES` with substitution variables have been specified for dump files in a job, then they will be used to generate dump files in a round-robin fashion. For example, if `expa%U`, `expb%U` and `expc%U` were all specified for a job having a parallelism of 6, then the initial dump files created would appear as follows: `expa01`, `expb01`, `expc01`, `expa02`, `expb02`, and `expc02`.
- If presented with dump file specifications, `expa%U`, `expb%U` and `expc%U`, then an Import or `SQL_FILE` operation will begin by attempting to open the dump files, `expa01`, `expb01`, and `expc01`. If the dump file containing the master table is not found in this set, then the operation will expand its search for dump files by incrementing the substitution variable and looking up the new filenames (for example, `expa02`, `expb02`, and `expc02`). The Oracle Data Pump API will keep expanding the search until it locates the dump file containing the master table. If the Oracle Data Pump API determines that the dump file does not exist, or that it is not part of the current dump set at any iteration, then the Oracle Data Pump API stops incrementing the substitution variable for the dump file specification that was in error. After the master table is found, the master table is used to ascertain when all of dump files in the dump file set have been located.

Examples



Note:

The examples in this section assume that the credentials, network ACLs, database account, and object-store information are already set up.

Example 1

The following example performs a table mode export to the Oracle Object Store.

```
CONNECT user;
Enter password: password

SET SERVEROUTPUT ON
SET ECHO ON
SET FEEDBACK 1
SET NUMWIDTH 10
SET LINESIZE 80
SET TRIMSPOOL ON
SET TAB OFF
SET PAGESIZE 100

DECLARE
    hdl          NUMBER;          -- Datapump handle
    ind          NUMBER;          -- Loop index
    le           ku$_LogEntry;    -- For WIP and error messages
    js           ku$_JobStatus;   -- The job status from get_status
```

```

jd          ku$_JobDesc;    -- The job description from get_status
sts         ku$_Status;    -- The status object returned by
get_status
  jobState  VARCHAR2(30);   -- To keep track of job state
  dumpFile  VARCHAR2(1024) := 'https://example.oraclecloud.com/
test/den02ten_foo3b_split_%u.dat';
  dumpType  NUMBER        :=
dbms_datapump.ku$_file_type_uridump_file;
  credName  VARCHAR2(1024) := 'BMCTEST';
  logFile   VARCHAR2(1024) := 'tkopc_export3b_cdb2.log';
  logDir    VARCHAR2(9)    := 'WORK';
  logType   NUMBER        := dbms_datapump.ku$_file_type_log_file;

BEGIN

  --
  -- Open a schema-based export job and perform defining-phase
  initialization.
  --
  hdl := dbms_datapump.open('EXPORT', 'TABLE');
  dbms_datapump.set_parameter(hdl, 'COMPRESSION', 'ALL');
  dbms_datapump.set_parameter(hdl, 'CHECKSUM', 1);
  dbms_datapump.add_file(hdl, logfile, logdir, null, logType);
  dbms_datapump.add_file(hdl, dumpFile, credName, '3MB', dumpType, 1);
  dbms_datapump.data_filter(hdl, 'INCLUDE_ROWS', 1);
  dbms_datapump.metadata_filter(hdl, 'TABLE_FILTER', 'FOO', '');
  --
  -- Start the job.
  --
  dbms_datapump.start_job(hdl);

  --
  -- Now grab output from the job and write to standard out.
  --
  jobState := 'UNDEFINED';
  WHILE (jobState != 'COMPLETED') AND (jobState != 'STOPPED')
  LOOP
    dbms_datapump.get_status(hdl,
      dbms_datapump.ku$_status_job_error +
      dbms_datapump.ku$_status_job_status +
      dbms_datapump.ku$_status_wip, -1, jobState, sts);
    js := sts.job_status;

    --
    -- If we received any WIP or Error messages for the job, display
    them.
    --
    IF (BITAND(sts.mask, dbms_datapump.ku$_status_wip) != 0) THEN
      le := sts.wip;
    ELSE
      IF (bitand(sts.mask, dbms_datapump.ku$_status_job_error) != 0)
      THEN
        le := sts.error;
      ELSE
        le := NULL;

```

```

        END IF;
    END IF;

    IF le IS NOT NULL THEN
        ind := le.FIRST;
        WHILE ind IS NOT NULL LOOP
            dbms_output.put_line(le(ind).LogText);
            ind := le.NEXT(ind);
        END LOOP;
    END IF;
END LOOP;

--
-- Detach from job.
--
dbms_datapump.detach(hdl);

--
-- Any exceptions that propagated to this point will be captured.
-- The details are retrieved from get_status and displayed.
--
EXCEPTION
    WHEN OTHERS THEN
        BEGIN
            dbms_datapump.get_status(hdl, dbms_datapump.ku$_status_job_error, 0,
                                    jobState, sts);
            IF (BITAND(sts.mask,dbms_datapump.ku$_status_job_error) != 0) THEN
                le := sts.error;
                IF le IS NOT NULL THEN
                    ind := le.FIRST;
                    WHILE ind IS NOT NULL LOOP
                        dbms_output.put_line(le(ind).LogText);
                        ind := le.NEXT(ind);
                    END LOOP;
                END IF;
            END IF;
        END IF;

        BEGIN
            dbms_datapump.stop_job (hdl, 1, 0, 0);
        EXCEPTION
            WHEN OTHERS THEN NULL;
        END;

    EXCEPTION
    WHEN OTHERS THEN
        dbms_output.put_line('Unexpected exception while in exception ' ||
                            'handler. sqlcode = ' || TO_CHAR(SQLCODE));

    END;
END;
/
EXIT;

```

Example 2

The following example performs a table mode import from the Oracle Object Store.

```
CONNECT user;
Enter password: password

SET SERVEROUTPUT ON
SET ECHO ON
SET FEEDBACK 1
SET NUMWIDTH 10
SET LINESIZE 80
SET TRIMSPOOL ON
SET TAB OFF
SET PAGESIZE 100

DECLARE
    hdl          NUMBER;          -- Datapump handle
    ind          NUMBER;          -- Loop index
    le           ku$_LogEntry;    -- For WIP and error messages
    js           ku$_JobStatus;   -- The job status from get_status
    jd           ku$_JobDesc;     -- The job description from get_status
    sts         ku$_Status;      -- The status object returned by
get_status
    jobState     VARCHAR2(30);    -- To keep track of job state
    dumpFile     VARCHAR2(1024)  := 'https://example.oraclecloud.com/
test/den02ten_foo3b_split_%u.dat';
    dumpType     NUMBER          :=
dbms_datapump.ku$_file_type_uridump_file;
    credName     VARCHAR2(1024)  := 'BMCTEST';
    logFile      VARCHAR2(1024)  := 'tkopc_import3b_cdb2.log';
    logDir       VARCHAR2(9)     := 'WORK';
    logType      NUMBER          := dbms_datapump.ku$_file_type_log_file;

BEGIN

    --
    -- Open a schema-based export job and perform defining-phase
    initialization.
    --
    hdl := dbms_datapump.open('IMPORT', 'TABLE', NULL, 'OSI');
    dbms_datapump.add_file(hdl, logfile, logdir, null, logType);
    dbms_datapump.add_file(hdl, dumpFile, credName, null, dumpType);
    dbms_datapump.metadata_filter(hdl, 'TABLE_FILTER', 'FOO', '');
    dbms_datapump.set_parameter(hdl, 'TABLE_EXISTS_ACTION', 'REPLACE');
    dbms_datapump.set_parameter(hdl, 'VERIFY_CHECKSUM', 1);

    --
    -- Start the job.
    --
    dbms_datapump.start_job(hdl);

    --
    -- Now grab output from the job and write to standard out.
    --
    jobState := 'UNDEFINED';
    WHILE (jobState != 'COMPLETED') AND (jobState != 'STOPPED')
```

```
LOOP
    dbms_datapump.get_status(hdl,
        dbms_datapump.ku$_status_job_error +
        dbms_datapump.ku$_status_job_status +
        dbms_datapump.ku$_status_wip, -1, jobState, sts);
    js := sts.job_status;

    --
    -- If we received any WIP or Error messages for the job, display them.
    --
    IF (BITAND(sts.mask,dbms_datapump.ku$_status_wip) != 0) THEN
        le := sts.wip;
    ELSE
        IF (bitand(sts.mask,dbms_datapump.ku$_status_job_error) != 0) THEN
            le := sts.error;
        ELSE
            le := NULL;
        END IF;
    END IF;

    IF le IS NOT NULL THEN
        ind := le.FIRST;
        WHILE ind IS NOT NULL LOOP
            dbms_output.put_line(le(ind).LogText);
            ind := le.NEXT(ind);
        END LOOP;
    END IF;
END LOOP;

--
-- Detach from job.
--
dbms_datapump.detach(hdl);

--
-- Any exceptions that propagated to this point will be captured.
-- The details are retrieved from get_status and displayed.
--
EXCEPTION
    WHEN OTHERS THEN
        BEGIN
            dbms_datapump.get_status(hdl, dbms_datapump.ku$_status_job_error, 0,
                jobState, sts);
            IF (BITAND(sts.mask,dbms_datapump.ku$_status_job_error) != 0) THEN
                le := sts.error;
                IF le IS NOT NULL THEN
                    ind := le.FIRST;
                    WHILE ind IS NOT NULL LOOP
                        dbms_output.put_line(le(ind).LogText);
                        ind := le.NEXT(ind);
                    END LOOP;
                END IF;
            END IF;
        END IF;

    BEGIN
```

```

        dbms_datapump.stop_job (hdl, 1, 0, 0);
    EXCEPTION
        WHEN OTHERS THEN NULL;
    END;

    EXCEPTION
    WHEN OTHERS THEN
        dbms_output.put_line('Unexpected exception while in exception
' ||
                                'handler. sqlcode = ' ||
TO_CHAR(SQLCODE));
    END;
END;
/
EXIT;

```

55.5.2 ATTACH Function

This function provides access to a previously created job.

Syntax

```

DBMS_DATAPUMP.ATTACH (
    job_name      IN VARCHAR2 DEFAULT NULL,
    job_owner     IN VARCHAR2 DEFAULT NULL)
RETURN NUMBER;

```

Parameters

Table 55-4 ATTACH Function Parameters

Parameter	Description
job_name	The name of the job. The default is the job name owned by the user who is specified in the job_owner parameter (assuming that user has only one job in the Defining, Executing, or Idling states).
job_owner	The user who originally started the job. If NULL, then the value defaults to the owner of the current session. To specify a job owner other than yourself, you must have either the DATAPUMP_EXP_FULL_DATABASE role (for export operations) or the DATAPUMP_IMP_FULL_DATABASE role (for import and SQL_FILE operations). Being a privileged user allows you to monitor another user's job, but you cannot restart another user's job.

Return Values

An opaque handle for the job. This handle is used as input to the following procedures: ADD_FILE, DATA_FILTER, DETACH, GET_STATUS, LOG_ENTRY, METADATA_FILTER, METADATA_REMAP, METADATA_TRANSFORM, SET_PARALLEL, SET_PARAMETER, START_JOB, STOP_JOB, and WAIT_FOR_JOB.

Exceptions

- INVALID_ARGVAL. An invalid value was supplied for an input parameter.

- **OBJECT_NOT_FOUND.** The specified job no longer exists or the user specified a job owned by another schema, but the user did not have the `DATAPUMP_EXP_FULL_DATABASE` or `DATAPUMP_IMP_FULL_DATABASE` role.
- **SUCCESS_WITH_INFO.** The function succeeded, but further information is available through the `GET_STATUS` procedure.
- **NO_SUCH_JOB.** The specified job does not exist.

Usage Notes

- If the job was in the `Stopped` state, then the job is placed into the `Idling` state. After the `ATTACH` succeeds, you can monitor the progress of the job or control the job. The stream of `KU$ STATUS_WIP` and `KU$ STATUS_JOB_ERROR` messages returned through the `GET_STATUS` procedure will be returned to the newly attached job starting at the approximate time of the client's attachment. There will be no repeating of status and error messages that were processed before the client attached to a job.
- If you want to perform a second attach to a job, then you must do so from a different session.
- If the `ATTACH` fails, then use a null handle in a subsequent call to `GET_STATUS` for more information about the failure.

55.5.3 DATA_FILTER Procedures

This procedure specifies restrictions on the rows that are to be retrieved.

Syntax

```
DBMS_DATAPUMP.DATA_FILTER (
    handle      IN NUMBER,
    name        IN VARCHAR2,
    value       IN NUMBER,
    table_name  IN VARCHAR2 DEFAULT NULL,
    schema_name IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_DATAPUMP.DATA_FILTER (
    handle      IN NUMBER,
    name        IN VARCHAR2,
    value       IN VARCHAR2,
    table_name  IN VARCHAR2 DEFAULT NULL,
    schema_name IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_DATAPUMP.DATA_FILTER (
    handle      IN NUMBER,
    name        IN VARCHAR2,
    value       IN CLOB,
    table_name  IN VARCHAR2 DEFAULT NULL,
    schema_name IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 55-5 DATA_FILTER Procedure Parameters

Parameter	Description
handle	The handle that is returned from the <code>OPEN</code> function

Table 55-5 (Cont.) DATA_FILTER Procedure Parameters

Parameter	Description
name	The name of the filter
value	The value of the filter
table_name	The name of the table on which the data filter is applied. If no table name is supplied, the filter applies to all tables in the job.
schema_name	The name of the schema that owns the table on which the filter is applied. If no schema name is specified, the filter applies to all schemas in the job. If you supply a schema name you must also supply a table name.

Exceptions

- **INVALID_ARGVAL.** There can be several reasons for this message:
 - A bad filter name is specified
 - The mode is `TRANSPORTABLE`, which does not support data filters
 - The specified table does not exist
 - The filter has already been set for the specified values of `schema_name` and `table_name`
- **INVALID_STATE.** The user called `DATA_FILTER` when the job was not in the Defining state.
- **INCONSISTENT_ARGS.** The `value` parameter is missing or its datatype does not match the filter name. Or a schema name was supplied, but not a table name.
- **PRIVILEGE_ERROR.** A schema name was supplied, but the user did not have the `DATAPUMP_EXP_FULL_DATABASE` or `DATAPUMP_IMP_FULL_DATABASE` role.
- **SUCCESS_WITH_INFO.** The procedure succeeded, but further information is available through the `GET_STATUS` procedure.
- **NO_SUCH_JOB.** The specified job does not exist.

Usage Notes

- Each data filter can only appear once in each table (for example, you cannot supply multiple `SUBQUERY` filters to a table) or once in each job. If different filters using the same name are applied to both a particular table and to the whole job, the filter parameter supplied for the specific table will take precedence.

With the exception of the `INCLUDE_ROWS` filter, data filters are not supported on tables having nested tables or domain indexes defined upon them. Data filters are not supported in jobs performed in Transportable Tablespace mode.

The available data filters are described in [Table 55-6](#).

Table 55-6 Data Filters

Name	Datatype	Operations that Support Filter	Description
INCLUDE_ROWS	NUMBER	EXPORT, IMPORT	If nonzero, this filter specifies that user data for the specified table should be included in the job. The default is 1.
PARTITION_EXPR	TEXT	EXPORT, IMPORT	<p>Note:</p> <p>In this description, the information about partitions also applies to subpartitions.</p>
PARTITION_LIST	TEXT		
SAMPLE	NUMBER	EXPORT, IMPORT	<p>For Export jobs, these filters specify which partitions are unloaded from the database. For Import jobs, they specify which table partitions are loaded into the database. Partition names are included in the job if their names satisfy the specified expression (for <code>PARTITION_EXPR</code>) or are included in the list (for <code>PARTITION_LIST</code>). Whereas the expression version of the filter offers more flexibility, the list version provides for full validation of the partition names.</p> <p>Double quotation marks around partition names are required only if the partition names contain special characters.</p> <p><code>PARTITION_EXPR</code> is not supported on jobs across a network link.</p> <p>Default=All partitions are processed</p> <p>For Export jobs, specifies a percentage for sampling the data blocks to be moved. This filter allows subsets of large tables to be extracted for testing purposes.</p>
SUBQUERY	TEXT	EXPORT, IMPORT	Specifies a subquery that is added to the end of the <code>SELECT</code> statement for the table. If you specify a <code>WHERE</code> clause in the subquery, you can restrict the rows that are selected. Specifying an <code>ORDER BY</code> clause orders the rows dumped in the export which improves performance when migrating from heap-organized tables to index-organized tables.

55.5.4 DATA_REMAP Procedure

This procedure specifies transformations to be applied to column data as it is exported from, or imported into, a database.

Syntax

```
DBMS_DATAPUMP.DATA_REMAP (
    handle          IN NUMBER,
    name            IN VARCHAR2,
    table_name      IN VARCHAR2,
    column          IN VARCHAR2,
    remap_function  IN VARCHAR2,
    schema          IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 55-7 DATA_REMAP Procedure Parameters

Parameter	Description
handle	The handle of the current job. The current session must have previously attached to the handle through a call to an <code>OPEN</code> function.
name	The name of the remap
table_name	The table containing the column to be remapped
column	The name of the column to be remapped
remap_function	The meaning of <code>remap_function</code> is dependent upon the value of <code>name</code> . See Table 55-8 for a list of possible names.
schema	The schema containing the column to be remapped. If <code>NULL</code> , the remapping applies to all schemas moved in the job that contain the specified table.

Exceptions

- `INVALID_ARGVAL`. The mode is transportable (which does not support data modifications) or it has specified that no data to be included in the job. An invalid remap name was supplied.
- `INVALID_OPERATION`. Data remaps are only supported for Export and Import operations.
- `INVALID_STATE`. The `DATA_REMAP` procedure was called after the job started (that is, it was not in the defining state).
- `NO_SUCH_JOB`. The job handle is no longer valid.

Usage Notes

- The `DATA_REMAP` procedure is only supported for Export and Import operations. It allows you to manipulate user data being exported or imported. The `name` of the remap determines the remap operation to be performed.
- For export operations, you might wish to define a data remap to obscure sensitive data such as credit card numbers from a dump file, but leave the remainder of the

data so that it can be read. To accomplish this, the remapping should convert each unique source number into a distinct generated number. So that the mapping is consistent across the dump file set, the same function should be called for every column that contains the credit card number.

- For import operations, you might wish to define a data remap to reset the primary key when data is being merged into an existing table that contains colliding primary keys. A single remapping function should be provided for all columns defining or referencing the primary key to ensure that remapping is consistent.

 **Note:**

If the called function uses package state variables, then to ensure that remapping is performed consistently across all tables, the job should be run with a SET_PARALLEL value of 1 and no restart operations should be performed.

The Data Remap functions are listed in [Table 55-8](#).

Table 55-8 Names of Data Remap Functions

Name	Meaning of remap_function	Meaning
COLUMN_FUNCTION	String having the format: [schema.]package.function	The name parameter references a PL/SQL package function which is called to modify the data for the specified column. The function accepts a single parameter, which has the same datatype as the remapped column, and returns a value having the same datatype as the remapped column. Note that the default for the schema is the schema of the user performing the export.

55.5.5 DETACH Procedure

This procedure specifies that the user has no further interest in using the handle.

Syntax

```
DBMS_DATAPUMP.DETACH (
    handle IN NUMBER);
```

Parameters

Table 55-9 DETACH Procedure Parameters

Parameter	Description
handle	The handle of the job. The current session must have previously attached to the handle through a call to either an OPEN or ATTACH function.

Exceptions

- `INVALID_HANDLE`. The specified handle is not attached to a Data Pump job.
- `SUCCESS_WITH_INFO`. The procedure succeeded, but further information is available through the `GET_STATUS` procedure.
- `NO_SUCH_JOB`. The specified job does not exist.

Usage Notes

- Through this call, you specify that you have no further interest in using the handle. Resources associated with a completed job cannot be reclaimed until all users are detached from the job. An implicit detach from a handle is performed when the user's session is exited or aborted. An implicit detach from a handle is also performed upon the expiration of the timeout associated with a `STOP_JOB` that was applied to the job referenced by the handle. All previously allocated `DBMS_DATAPUMP` handles are released when an instance is restarted.

55.5.6 GET_DUMPFILE_INFO Procedure

This procedure retrieves information about a specified dump file.

Syntax

```
DBMS_DATAPUMP.GET_DUMPFILE_INFO(
  filename      IN VARCHAR2,
  directory     IN VARCHAR2,
  info_table    OUT ku$_dumpfile_info,
  filetype      OUT NUMBER);
```

Parameters

Table 55-10 GET_DUMPFILE_INFO Procedure Parameters

Parameter	Description
<code>filename</code>	A simple filename with no directory path information
<code>directory</code>	A directory object that specifies where the file can be found
<code>info_table</code>	A PL/SQL table for storing information about the dump file
<code>filetype</code>	The type of file (Data Pump dump file, original Export dump file, external tables dump file, or unknown)

Exceptions

The `GET_DUMPFILE_INFO` procedure is a utility routine that operates outside the context of any Data Pump job. Exceptions are handled differently for this procedure than for procedures associated in some way with a Data Pump job. A full exception stack should be available directly, without the need to call the `GET_STATUS` procedure to retrieve the detailed information. The exception for this procedure is as follows:

- `NO_DUMPFILE_INFO`. Unable to retrieve dump file information as specified.

Usage Notes

You can use the `GET_DUMPFILE_INFO` procedure to request information about a specific file. If the file is not recognized as any type of dump file, then a filetype of 0 (zero) is returned and the dump file `info_table` remains empty.

A filetype value of 1 indicates a Data Pump dump file. A filetype value of 2 indicates an original Export dump file. A filetype value of 3 indicates an external tables dump file. In all cases, the dump file `info_table` will be populated with information retrieved from the dump file header. Rows of this table consist of item code and value pairs, where the item code indicates the type of information and the value column is a `VARCHAR2` containing the actual data (converted to a string in some cases). The table is defined as follows:

```
CREATE TYPE sys.ku$_dumpfile_item IS OBJECT (
    item_code    NUMBER,           -- Identifies header item
    value        VARCHAR2(2048)   -- Text string value)/

GRANT EXECUTE ON sys.ku$_dumpfile_item TO PUBLIC;
CREATE OR REPLACE PUBLIC SYNONYM ku$_dumpfile_item FOR sys.ku$_dumpfile_item;

CREATE TYPE sys.ku$_dumpfile_info AS TABLE OF sys.ku$_dumpfile_item/

GRANT EXECUTE ON sys.ku$_dumpfile_info TO PUBLIC;
CREATE OR REPLACE PUBLIC SYNONYM ku$_dumpfile_info FOR sys.ku$_dumpfile_info;
```

The item codes, which can easily be extended to provide more information as needed, are currently defined as shown in [Table 55-11](#) (prepended with the package name, `DBMS_DATAPUMP`). Assume the following with regard to these item codes:

- Unless otherwise stated, all item codes may be returned only for Oracle Data Pump and external tables dump files (filetypes 1 and 3).
- Unless otherwise stated, all item codes have been available since Oracle Database 10g Release 2 (10.2).

Table 55-11 Item Codes For the DBMS_DATAPUMP.GET_DUMPFILE_INFO Procedure

Item Code	Description
<code>KU\$_DFHDR_FILE_VERSION</code>	The internal file version of the dump file.
<code>KU\$_DFHDR_MASTER_PRESENT</code>	If the Data Pump master table is present in the dump file, then the value for this item code is 1; otherwise the value is 0. Returned only for filetype 1.
<code>KU\$_DFHDR_GUID</code>	A unique identifier assigned to the Data Pump export job or the external tables unload job that produced the dump file. For a multifile dump set, each file in the set has the same value for this item code.
<code>KU\$_DFHDR_FILE_NUMBER</code>	A numeric identifier assigned to the dump file. Each dump file in a multifile dump set has its own identifier, unique only within the dump set.
<code>KU\$_DFHDR_CHARSET_ID</code>	A numeric code that represents the character set in use at the source system when the dump file was created. Returned for all filetypes.
<code>KU\$_DFHDR_CREATION_DATE</code>	The date and time that the dump file was created.
<code>KU\$_DFHDR_FLAGS</code>	Internal flag values.

Table 55-11 (Cont.) Item Codes For the DBMS_DATAPUMP.GET_DUMPFILE_INFO Procedure

Item Code	Description
KU\$_DFHDR_JOB_NAME	The name assigned to the export job that created the dump file. Returned only for filetype 1.
KU\$_DFHDR_PLATFORM	The operating system name of the source system on which the dump file was created.
KU\$_DFHDR_INSTANCE	The instance name of the source system on which the dump file was created.
KU\$_DFHDR_LANGUAGE	The language name that corresponds to the character set of the source system where the export dump file was created.
KU\$_DFHDR_BLOCKSIZE	The blocksize, in bytes, of the dump file.
KU\$_DFHDR_DIRPATH	If direct path mode was used when the dump file was created, then the value for this item code is 1, otherwise the value is 0. Returned only for filetype 2.
KU\$_DFHDR_METADATA_COMPRESSED	If the system metadata is stored in the dump file in compressed format, then the value for this item code is 1, otherwise the value is 0. Returned only for filetype 1.
KU\$_DFHDR_DB_VERSION	The database job version used to create the dump file. Returned for all filetypes.
KU\$_DFHDR_MASTER_PIECE_COUNT	The Data Pump master table may be split into multiple pieces and written to multiple dump files in the set, one piece per file. The value returned for this item code indicates the number of dump files that contain pieces of the master table. The value for this item code is only meaningful if the Data Pump master table is present in the dump file, as indicated by the item code KU\$_DFHDR_MASTER_PRESENT. Returned only for filetype 1. Only available since Oracle Database 11g Release 1 (11.1).
KU\$_DFHDR_MASTER_PIECE_NUMBER	The Data Pump master table may be split into multiple pieces and written to multiple dump files in the set, one piece per file. The value returned for this item code indicates which master table piece is contained in the dump file. The value for this item code is only meaningful if the Data Pump master table is present in the dump file, as indicated by the item code KU\$_DFHDR_MASTER_PRESENT. Returned only for filetype 1. Only available since Oracle Database 11g Release 1 (11.1).
KU\$_DFHDR_DATA_COMPRESSED	If the table data is stored in the dump file in compressed format, then the value for this item code is 1, otherwise the value is 0. Only available since Oracle Database 11g Release 1 (11.1).
KU\$_DFHDR_METADATA_ENCRYPTED	If the system metadata is stored in the dump file in encrypted format, then the value for this item code is 1, otherwise the value is 0. Returned only for filetype 1. Only available since Oracle Database 11g Release 1 (11.1).
KU\$_DFHDR_DATA_ENCRYPTED	If the table data is stored in the dump file in encrypted format, then the value for this item code is 1, otherwise the value is 0. Only available since Oracle Database 11g Release 1 (11.1).

Table 55-11 (Cont.) Item Codes For the DBMS_DATAPUMP.GET_DUMPFILE_INFO Procedure

Item Code	Description
KU\$_DFHDR_COLUMNS_ENCRYPTED	<p>If encrypted column data is stored in the dump file in encrypted format, then the value for this item code is 1, otherwise the value is 0.</p> <p>Returned only for filetype 1.</p> <p>Only available since Oracle Database 11g Release 1 (11.1).</p>
KU\$_DFHDR_ENCRYPTION_MODE	<p>The encryption mode indicates whether a user-provided password or the Oracle Encryption Wallet was used to encrypt data written to the dump file. The possible values returned for this item code are:</p> <ul style="list-style-type: none"> • KU\$_DFHDR_ENCMODE_NONE No data was written to the dump file in encrypted format. • KU\$_DFHDR_ENCMODE_PASSWORD Data was written to the dump file in encrypted format using a provided password. • KU\$_DFHDR_ENCMODE_DUAL Data was written to the dump file in encrypted format using both a provided password as well as an Oracle Encryption Wallet. • KU\$_DFHDR_ENCMODE_TRANS Data was written to the dump file in encrypted format transparently using an Oracle Encryption Wallet. <p>Only available since Oracle Database 11g Release 1 (11.1).</p>
KU\$_DFHDR_COMPRESSION_ALG	<p>The compression algorithm used when writing system metadata and/or table data to the dump file in compressed format. The possible values returned for this item code are:</p> <ul style="list-style-type: none"> • KU\$_DFHDR_CMPALG_NONE No data was written to the dump file in compressed format. • KU\$_DFHDR_CMPALG_BASIC Data was written to the dump file in compressed format using an internal algorithm. This is the default algorithm used since Oracle Database 10g Release 2 (10.2). • KU\$_DFHDR_CMPALG_LOW Data was written to the dump file in compressed format using the LOW algorithm. • KU\$_DFHDR_CMPALG_MEDIUM Data was written to the dump file in compressed format using the MEDIUM algorithm. • KU\$_DFHDR_CMPALG_HIGH Data was written to the dump file in compressed format using the HIGH algorithm. <p>Only available since Oracle Database 12c Release 1 (12.1).</p>

55.5.7 GET_STATUS Procedure

This procedure monitors the status of a job or waits for the completion of a job.

Syntax

```
DBMS_DATAPUMP.GET_STATUS (
    handle      IN NUMBER,
    mask       IN BINARY_INTEGER,
```



```

timeout  IN NUMBER DEFAULT NULL,
job_state OUT VARCHAR2,
status   OUT ku$_Status);

```

Parameters

Table 55-12 GET_STATUS Procedure Parameters

Parameter	Description
handle	The handle of a job. The current session must have previously attached to the handle through a call to either the <code>OPEN</code> or <code>ATTACH</code> function. A null handle can be used to retrieve error information after <code>OPEN</code> and <code>ATTACH</code> failures.
mask	A bit mask that indicates which of four types of information to return: <ul style="list-style-type: none"> • <code>KU\$_STATUS_WIP</code> • <code>KU\$_STATUS_JOB_DESC</code> • <code>KU\$_STATUS_JOB_STATUS</code> • <code>KU\$_STATUS_JOB_ERROR</code> Each status has a numerical value. You can request multiple types of information by adding together different combinations of values.
timeout	Maximum number of seconds to wait before returning to the user. A value of 0 requests an immediate return. A value of -1 requests an infinite wait. If <code>KU\$_STATUS_WIP</code> or <code>KU\$_STATUS_JOB_ERROR</code> information is requested and becomes available during the timeout period, then the procedure returns before the timeout period is over.
job_state	Current state of the job. If only the job state is needed, it is much more efficient to use this parameter than to retrieve the full <code>ku\$_Status</code> structure.
status	A <code>ku\$_Status</code> is returned. The <code>ku\$_Status</code> mask indicates what kind of information is included. This could be none if only <code>KU\$_STATUS_WIP</code> or <code>KU\$_STATUS_JOB_ERROR</code> information is requested and the timeout period expires.

Exceptions

- `INVALID_HANDLE`. The specified handle is not attached to a Data Pump job.
- `INVALID_VALUE`. The mask or timeout contains an illegal value.
- `SUCCESS_WITH_INFO`. The procedure succeeded, but further information is available through the `GET_STATUS` procedure.
- `NO_SUCH_JOB`. The specified job does not exist.

Usage Notes

The `GET_STATUS` procedure is used to monitor the progress of an ongoing job and to receive error notification. You can request various type of information using the mask parameter. The `KU$_STATUS_JOB_DESC` and `KU$_STATUS_JOB_STATUS` values are classified as synchronous information because the information resides in the master table. The `KU$_STATUS_WIP` and `KU$_STATUS_JOB_ERROR` values are classified as asynchronous because the messages that embody these types of information can be generated at any time by various layers in the Data Pump architecture.

- If synchronous information *only* is requested, the interface will ignore the timeout parameter and simply return the requested information.

- If asynchronous information is requested, the interface will wait a *maximum* of timeout seconds before returning to the client. If a message of the requested asynchronous information type is received, the call will complete prior to timeout seconds. If synchronous information was also requested, it will be returned whenever the procedure returns.
- If the `job_state` returned by `GET_STATUS` does not indicate a terminating job, it is possible that the job could still terminate before the next call to `GET_STATUS`. This would result in an `INVALID_HANDLE` exception. Alternatively, the job could terminate during the call to `GET_STATUS`, which would result in a `NO_SUCH_JOB` exception. Callers should be prepared to handle these cases.

Error Handling

There are two types of error scenarios that need to be handled using the `GET_STATUS` procedure:

- Errors resulting from other procedure calls: For example, the `SET_PARAMETER` procedure may produce an `INCONSISTENT_ARGS` exception. The client should immediately call `GET_STATUS` with `mask=8` (errors) and `timeout=0`. The returned `ku$_Status.error` will contain a `ku$_LogEntry` that describes the inconsistency in more detail.
- Errors resulting from events asynchronous to the client(s): An example might be `Table already exists` when trying to create a table. The `ku$_Status.error` will contain a `ku$_LogEntry` with all error lines (from all processing layers that added context about the error) properly ordered.

After a job has begun, a client's main processing loop will typically consist of a call to `GET_STATUS` with an infinite timeout (-1) "listening" for `KU$_STATUS_WIP` and `KU$_STATUS_JOB_ERROR` messages. If status was requested, then `JOB_STATUS` information will also be in the request.

When the `ku$_Status` is interpreted, the following guidelines should be used:

- `ku$_Status.ku$_JobStatus.percent_done` refers only to the amount of data that has been processed in a job. Metadata is not considered in the calculation. It is determined using the following formulas:
 - `EXPORT` or `network IMPORT`-- $(\text{bytes_processed} / \text{estimated_bytes}) * 100$
 - `IMPORT`-- $(\text{bytes_processed} / \text{total_expected_bytes}) * 100$
 - `SQL_FILE` or `estimate-only EXPORT`-- 0.00 if not done or 100.00 if done

The effects of the `QUERY` and `PARTITION_EXPR` data filters are not considered in computing `percent_done`.

It is expected that the status returned will be transformed by the caller into more user-friendly status. For example, when `percent done` is not zero, an estimate of completion time could be produced using the following formula:

$$((\text{SYSDATE} - \text{start time}) / \text{ku$_Status.ku$_JobStatus.percent_done}) * 100$$

- The caller should not use `ku$_Status.ku$_JobStatus.percent_done` for determining whether the job has completed. Instead, the caller should only rely on the state of the job as found in `job_state`.

55.5.8 LOG_ENTRY Procedure

This procedure inserts a message into the log file.

Syntax

```
DBMS_DATAPUMP.LOG_ENTRY (
    handle          IN NUMBER,
    message         IN VARCHAR2
    log_file_only  IN NUMBER DEFAULT 0);
```

Parameters

Table 55-13 LOG_ENTRY Procedure Parameters

Parameter	Description
handle	The handle of a job. The current session must have previously attached to the handle through a call to either the <code>OPEN</code> or <code>ATTACH</code> function.
message	A text line to be added to the log file
log_file_only	Specified text should be written only to the log file. It should not be returned in <code>GET_STATUS</code> work-in-progress (<code>KU\$_STATUS_WIP</code>) messages.

Exceptions

- `INVALID_HANDLE`. The specified handle is not attached to a Data Pump job.
- `SUCCESS_WITH_INFO`. The procedure succeeded, but further information is available through the `GET_STATUS` procedure.
- `NO_SUCH_JOB`. The specified job does not exist.

Usage Notes

The message is added to the log file. If `log_file_only` is zero (the default), the message is also broadcast as a `KU$_STATUS_WIP` message through the `GET_STATUS` procedure to all users attached to the job.

The `LOG_ENTRY` procedure allows applications to tailor the log stream to match the abstractions provided by the application. For example, the command-line interface supports `INCLUDE` and `EXCLUDE` parameters defined by the user. Identifying these values as calls to the underlying `METADATA_FILTER` procedure would be confusing to users. Instead, the command-line interface can enter text into the log describing the settings for the `INCLUDE` and `EXCLUDE` parameters.

Lines entered in the log stream from `LOG_ENTRY` are prefixed by the string, ";;; "

55.5.9 METADATA_FILTER Procedure

This procedure provides filters that allow you to restrict the items that are included in a job.

Syntax

```
DBMS_DATAPUMP.METADATA_FILTER(
    handle      IN NUMBER,
    name       IN VARCHAR2,
    value      IN VARCHAR2,
    object_path IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_DATAPUMP.METADATA_FILTER(
    handle      IN NUMBER,
    name       IN VARCHAR2,
    value      IN CLOB,
    object_path IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 55-14 METADATA_FILTER Procedure Parameters

Parameter	Description
handle	The handle returned from the OPEN function
name	The name of the filter. See Table 55-15 for descriptions of the available filters.
value	The value of the filter
object_path	The object path to which the filter applies. If the default is used, the filter applies to all applicable objects. Lists of the object paths supported for each mode are contained in the catalog views for DATABASE_EXPORT_OBJECTS, SCHEMA_EXPORT_OBJECTS, and TABLE_EXPORT_OBJECTS. (Note that the TABLE_EXPORT_OBJECTS view is applicable to both Table and Tablespace mode because their object paths are the same.) For an import operation, object paths reference the mode used to create the dump file rather than the mode being used for the import.

[Table 55-15](#) describes the name, the object type, and the meaning of the filters available with the METADATA_FILTER procedure. The datatype for all the filters is a text expression. All operations support all filters.

Table 55-15 Filters Provided by METADATA_FILTER Procedure

Name	Object Type	Meaning
NAME_EXPR NAME_LIST	Named objects	Defines which object names are included in the job. You use the object type parameter to limit the filter to a particular object type. For Table mode, identifies which tables are to be processed.
SCHEMA_EXPR SCHEMA_LIST	Schema objects	Restricts the job to objects whose owning schema name is satisfied by the expression. For Table mode, only a single SCHEMA_EXPR filter is supported. If specified, it must only specify a single schema (for example, 'IN ('SCOTT')'). For Schema mode, identifies which users are to be processed.

Table 55-15 (Cont.) Filters Provided by METADATA_FILTER Procedure

Name	Object Type	Meaning
TABSPACE_EX PR	TABLE, CLUSTER,	Restricts the job to objects stored in a tablespace whose name is satisfied by the expression.
TABSPACE_LI ST	INDEX, ROLLBACK_SEGM ENT	For Tablespace mode, identifies which tablespaces are to be processed. If a partition of an object is stored in the tablespace, the entire object is added to the job. For Transportable mode, identifies which tablespaces are to be processed. If a table has a single partition in the tablespace set, all partitions must be in the tablespace set. An index is not included within the tablespace set unless all of its partitions are in the tablespace set. A domain index is not included in the tablespace set unless all of its secondary objects are included in the tablespace set.
INCLUDE_PATH_ EXPR	All	Defines which object paths are included in, or excluded from, the job. You use these filters to select only certain object types from the database or dump file set. Objects of paths satisfying the condition are included (INCLUDE_PATH_*) or excluded (EXCLUDE_PATH_*) from the operation. The object_path parameter is not supported for these filters.
INCLUDE_PATH_ LIST		
EXCLUDE_PATH_ EXPR		
EXCLUDE_PATH_ LIST		
EXCLUDE_TABLE S	TABLE_EXPORT	Specifies that no tables are to be exported.
VIEWS_AS_TABL ES	TABLE_EXPORT	A comma-separated list of views to be exported as tables: [schema_name.]view_name[:table_name] The filter can be called multiple times with multiple values and all values get added to a list. All views on the list are exported as tables.

Exceptions

- INVALID_HANDLE. The specified handle is not attached to a Data Pump job.
- INVALID_ARGVAL. This exception can indicate any of the following conditions:
 - An object_path was specified for an INCLUDE_PATH_EXPR or EXCLUDE_PATH_EXPR filter.
 - The specified object_path is not supported for the current mode.
 - The SCHEMA_EXPR filter specified multiple schemas for a Table mode job.
- INVALID_STATE. The user called the METADATA_FILTER procedure after the job left the defining state.
- INCONSISTENT_ARGS. The filter value is of the wrong datatype or is missing.
- SUCCESS_WITH_INFO. The procedure succeeded but further information is available through the GET_STATUS procedure.
- NO_SUCH_JOB. The specified job does not exist.

Usage Notes

- Metadata filters identify a set of objects to be included or excluded from a Data Pump operation. Except for `EXCLUDE_PATH_EXPR` and `INCLUDE_PATH_EXPR`, dependent objects of an identified object will be processed along with the identified object. For example, if an index is identified for inclusion by a filter, grants upon that index will also be included by the filter. Likewise, if a table is excluded by a filter, then indexes, constraints, grants and triggers upon the table will also be excluded by the filter.
- Two versions of each filter are supported: SQL expression and List. The SQL expression version of the filters offer maximum flexibility for identifying objects (for example the use of LIKE to support use of wild cards). The names of the expression filters are as follows:

- `NAME_EXPR`
- `SCHEMA_EXPR`
- `TABLESPACE_EXPR`
- `INCLUDE_PATH_EXPR`
- `EXCLUDE_PATH_EXPR`

The list version of the filters allow maximum validation of the filter. An error will be reported if one of the elements in the filter is not found within the source database (for Export and network-based jobs) or is not found within the dump file (for file-based Import and SQLFILE jobs). The names of the list filters are as follows:

- `NAME_LIST`
- `SCHEMA_LIST`
- `TABLESPACE_LIST`
- `INCLUDE_PATH_LIST`
- `EXCLUDE_PATH_LIST`

- Filters allow a user to restrict the items that are included in a job. For example, a user could request a full export, but without Package Specifications or Package Bodies.
- If multiple filters are specified for a object type, they are implicitly 'ANDed' together (that is, objects participating in the job must pass all of the filters applied to their object types).
- The same filter name can be specified multiple times within a job. For example, specifying `NAME_EXPR` as `'!='EMP''` and `NAME_EXPR` as `'!='DEPT''` on a Table mode export would produce a file set containing all of the tables except for `EMP` and `DEPT`.

55.5.10 METADATA_REMAP Procedure

This procedure specifies a remapping to be applied to objects as they are processed in the specified job.

Syntax

```
DBMS_DATAPUMP.METADATA_REMAP (
  handle      IN NUMBER,
  name        IN VARCHAR2,
  old_value   IN VARCHAR2,
  value       IN VARCHAR2,
  object_type IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 55-16 METADATA_REMAP Procedure Parameters

Parameter	Description
handle	The handle for the current job. The current session must have previously attached to the handle through a call to the <code>OPEN</code> function.
name	The name of the remap. See Table 55-17 for descriptions of the available remaps.
old_value	Specifies which value in the dump file set should be reset to <code>value</code>
value	The value of the parameter for the remap. This signifies the new value that <code>old_value</code> should be translated into.
object_type	<p>Designates the object type to which the remap applies. The list of object types supported for each mode are contained in the <code>DATABASE_EXPORT_OBJECTS</code>, <code>SCHEMA_EXPORT_OBJECTS</code>, <code>TABLE_EXPORT_OBJECTS</code>, and <code>TABLESPACE_EXPORT_OBJECTS</code> catalog views.</p> <p>By default, the remap applies to all applicable objects within the job. The <code>object_type</code> parameter allows a caller to specify different parameters for different object types within a job. Remaps that explicitly specify an object type override remaps that apply to all object types.</p>

[Table 55-17](#) describes the remaps provided by the `METADATA_REMAP` procedure.

Table 55-17 Remaps Provided by the METADATA_REMAP Procedure

Name	Datatype	Object Type	Meaning
REMAP_SCHEMA	TEXT	Schema objects	<p>Any schema object in the job that matches the <code>object_type</code> parameter and was located in the <code>old_value</code> schema will be moved to the <code>value</code> schema.</p> <p>Privileged users can perform unrestricted schema remaps.</p> <p>Nonprivileged users can perform schema remaps only if their schema is the target schema of the remap.</p> <p>For example, SCOTT can remap his BLAKE's objects to SCOTT, but SCOTT cannot remap SCOTT's objects to BLAKE.</p>
REMAP_TABLESPACE	TEXT	TABLE, INDEX, ROLLBACK_SEGMENT, MATERIALIZED_VIEW, , MATERIALIZED_VIEW_LOG, TABLE_SPACE	<p>Any storage segment in the job that matches the <code>object_type</code> parameter and was located in the <code>old_value</code> tablespace will be relocated to the <code>value</code> tablespace.</p>

Table 55-17 (Cont.) Remaps Provided by the METADATA_REMAP Procedure

Name	Datatype	Object Type	Meaning
REMAP_DATAFILE	TEXT	LIBRARY, TABLESPACE, DIRECTORY	If <code>old_value</code> and <code>value</code> are both full file specifications, then any data file reference in the job that matches the <code>object_type</code> parameter and that referenced the <code>old_value</code> data file will be redefined to use the <code>value</code> data file. If <code>old_value</code> and <code>value</code> are both directory paths, then any data file reference whose object path matches <code>old_value</code> will have its path substituted with <code>value</code> .
REMAP_TABLE	TEXT	TABLE	Any reference to a table in the job that matches the <code>old_value</code> table name will be replaced with the <code>value</code> table name. The <code>old_value</code> parameter may refer to a partition such as <code>employees.low</code> . This allows names for tables constructed the by <code>PARTITION_OPTIONS=DEPART</code> <code>ITION</code> parameter to be specified by the user.

Exceptions

- `INVALID_HANDLE`. The specified handle is not attached to a Data Pump job.
- `INVALID_ARGVAL`. This message can indicate any of the following:
 - The job's mode does not include the specified `object_type`.
 - The remap has already been specified for the specified `old_value` and `object_type`.
- `INVALID_OPERATION`. Remaps are only supported for `SQL_FILE` and Import operations. The job's operation was Export, which does not support the use of metadata remaps.
- `INVALID_STATE`. The user called `METADATA_REMAP` after the job had started (that is, the job was not in the defining state).
- `INCONSISTENT_ARGS`. There was no `value` supplied or it was of the wrong datatype for the remap.
- `PRIVILEGE_ERROR`. A nonprivileged user attempted to do a `REMAP_SCHEMA` to a different user's schema or a `REMAP_DATAFILE`.
- `SUCCESS_WITH_INFO`. The procedure succeeded, but further information is available through the `GET_STATUS` procedure.
- `NO_SUCH_JOB`. The specified job does not exist.

Usage Notes

- The `METADATA_REMAP` procedure is only supported for Import and `SQL_FILE` operations. It enables you to apply commonly desired, predefined remappings to the definition of objects as part of the transfer. If you need remaps that are not supported within this procedure, you should do a preliminary `SQL_FILE` operation to produce a SQL script corresponding to the dump file set. By editing the DDL directly and then executing it, you can produce any remappings that you need.
- Transforms for the DataPump API are a subset of the remaps implemented by the `DBMS_METADATA.SET_TRANSFORM_PARAMETER` API. Multiple remaps can be defined for a single job. However, each remap defined must be unique according to its parameters. That is, two remaps cannot specify conflicting or redundant remaps.

55.5.11 METADATA_TRANSFORM Procedure

This procedure specifies transformations to be applied to objects as they are processed in the specified job.

Syntax

```
DBMS_DATAPUMP.METADATA_TRANSFORM (
    handle      IN NUMBER,
    name        IN VARCHAR2,
    value       IN VARCHAR2,
    object_type IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_DATAPUMP.METADATA_TRANSFORM (
    handle      IN NUMBER,
    name        IN VARCHAR2,
    value       IN NUMBER,
    object_type IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 55-18 METADATA_TRANSFORM Procedure Parameters

Parameter	Description
handle	The handle for the current job. The current session must have previously attached to the handle through a call to the <code>OPEN</code> function.
name	The name of the transformation.
value	The value of the parameter for the transform
object_type	Designates the object type to which the transform applies. The list of object types supported for each mode are contained in the <code>DATABASE_EXPORT_OBJECTS</code> , <code>SCHEMA_EXPORT_OBJECTS</code> , <code>TABLE_EXPORT_OBJECTS</code> , and <code>TABLESPACE_EXPORT_OBJECTS</code> catalog views. By default, the transform applies to all applicable objects within the job. The <code>object_type</code> parameter allows a caller to specify different transform parameters for different object types within a job. Transforms that explicitly specify an object type override transforms that apply to all object types.

The following table describes the transforms provided by the `METADATA_TRANSFORM` procedure.

Table 55-19 Transforms Provided by the METADATA_TRANSFORM Procedure

Name	Datatype	Object Type	Meaning
DISABLE_ARCHIVE_LOGGING	NUMBER	TABLE INDEX	<p>Specifies whether to disable archive logging for specified object types during import.</p> <p>A value of zero (<code>FALSE</code>) is the default. It specifies that archive logging will take place. This is the default behavior if this transform parameter is not specified.</p> <p>A non-zero (<code>TRUE</code>) value disables archive logging for the specified object types before data is loaded during import. If no object type is specified, then archive logging is disabled for both <code>TABLE</code> and <code>INDEX</code> object types. All other object types processed during data pump import are logged.</p> <p>Note: If the database is in <code>FORCE LOGGING</code> mode, then the <code>DISABLE_ARCHIVE_LOGGING</code> transform does not disable logging when indexes and tables are created.</p>
INMEMORY	NUMBER	TABLE TABLESPACE MATERIALIZED VIEWS	<p>The <code>INMEMORY</code> transform is related to the In-Memory Column Store (IM column store), an optional area in the SGA that stores whole tables, table partitions, and individual columns in a compressed columnar format.</p> <p>If a non-zero value (<code>TRUE</code>) is specified on import, then Data Pump generates an <code>IM</code> clause that preserves the IM setting those objects had at export time. This is the default.</p> <p>If a value of zero (<code>FALSE</code>) is specified on import, then Data Pump does not include an <code>IM</code> clause for any objects.</p> <p>Note: The <code>INMEMORY</code> transform is available only in Oracle Database 12c Release 1 (12.1.0.2) or higher.</p>
INMEMORY_CLAUSE	TEXT	TABLE TABLESPACE MATERIALIZED VIEWS	<p>The <code>INMEMORY_CLAUSE</code> transform is related to the In-Memory Column Store (IM column store), an optional area in the SGA that stores whole tables, table partitions, and individual columns in a compressed columnar format.</p> <p>When you specify this transform, Data Pump uses the contents of the string as the <code>IM</code> clause for all objects being imported that have an <code>IM</code> clause in their DDL. This transform is useful when you want to override the <code>IM</code> clause for an object in the dump file.</p> <p>Note: The <code>INMEMORY_CLAUSE</code> transform is available only in Oracle Database 12c Release (12.1.0.2) or higher.</p>

Table 55-19 (Cont.) Transforms Provided by the METADATA_TRANSFORM Procedure

Name	Datatype	Object Type	Meaning
LOB_STORAGE	TEXT	TABLE	<p>Specifies the storage type to use for LOB segments. The options are as follows:</p> <ul style="list-style-type: none"> • SECUREFILE - LOB storage is returned as SECUREFILE • BASICFILE - LOB storage is returned as BASICFILE • DEFAULT - The keyword (SECUREFILE or BASICFILE) is omitted in the LOB STORE AS clause. • NO_CHANGE - LOB segments are created with the same storage they had in the source database. This is the default. <p>Specifying this transform changes the LOB storage for all tables in the job, including tables that provide storage for materialized views.</p>
OID	NUMBER	TYPE TABLE	<p>If zero, inhibits the assignment of the exported OID during type or table creation. Instead, a new OID will be assigned.</p> <p>Use of this transform on Object Tables will cause breakage in REF columns that point to the table.</p> <p>Defaults to 1.</p>
OMIT_ACDR_METADATA	NUMBER	TABLE	<p>Used with Oracle GoldenGate. When set to 1 (true), excludes invisible columns from importing replicated tables, deletes tombstone tables, and deletes all the automatic conflict detection and resolution (ACDR) instance procedural actions.</p>
PCTSPACE	NUMBER	TABLE INDEX TABLESPACE	<p>Specifies a percentage multiplier used to alter extent allocations and data file sizes. Used to shrink large tablespaces for testing purposes.</p> <p>Defaults to 100.</p>
SEGMENT_ATTRIBUTES	NUMBER	TABLE, INDEX	<p>If nonzero (TRUE), emit storage segment parameters.</p> <p>Defaults to 1.</p>
SEGMENT_CREATION	NUMBER	TABLE	<p>If nonzero (TRUE), the SQL SEGMENT CREATION clause is added to the CREATE TABLE statement. That is, the CREATE TABLE statement will explicitly say either SEGMENT CREATION DEFERRED or SEGMENT CREATION IMMEDIATE.</p> <p>If the value is FALSE, then the SEGMENT CREATION clause is omitted from the CREATE TABLE statement. Set this parameter to FALSE to use the default segment creation attributes for the table(s) being loaded.</p> <p>Defaults to nonzero (TRUE).</p>

Table 55-19 (Cont.) Transforms Provided by the METADATA_TRANSFORM Procedure

Name	Datatype	Object Type	Meaning
STORAGE	NUMBER	TABLE	If <code>nonzero</code> (TRUE), emit storage clause. (Ignored if <code>SEGMENT_ATTRIBUTES</code> is zero.) Defaults to <code>nonzero</code> (TRUE).
TABLE_COMPRESSION_CLAUSE	TEXT	TABLE	Specifies a table compression clause (for example, <code>COMPRESS BASIC</code>) to use when the table is created. Specify <code>NONE</code> to omit the table compression clause. The table will have the default compression for the tablespace. Specifying this transform changes the compression type for all tables in the job, including tables that provide storage for materialized views.

Exceptions

- `INVALID_HANDLE`. The specified handle is not attached to a Data Pump job.
- `INVALID_ARGVAL`. This message can indicate any of the following:
 - The mode is transportable, which doesn't support transforms.
 - The job's mode does not include the specified `object_type`.
 - The transform has already been specified for the specified `value` and `object_type`.
- `INVALID_OPERATION`. Transforms are only supported for `SQL_FILE` and Import operations. The job's operation was Export which does not support the use of metadata transforms.
- `INVALID_STATE`. The user called `METADATA_TRANSFORM` after the job had started (that is, the job was not in the defining state).
- `INCONSISTENT_ARGS`. There was no `value` supplied or it was of the wrong datatype for the transform.
- `PRIVILEGE_ERROR`. A nonprivileged user attempted to do a `REMAP_SCHEMA` to a different user's schema or a `REMAP_DATAFILE`.
- `SUCCESS_WITH_INFO`. The procedure succeeded, but further information is available through the `GET_STATUS` procedure.
- `NO_SUCH_JOB`. The specified job does not exist.

Usage Notes

- The `METADATA_TRANSFORM` procedure is only supported for Import and `SQL_FILE` operations. It enables you to apply commonly desired, predefined transformations to the definition of objects as part of the transfer. If you need transforms that are not supported within this procedure, you should do a preliminary `SQL_FILE` operation to produce a SQL script corresponding to the dump file set. By editing the DDL directly and then executing it, you can produce any transformations that you need.
- Transforms for the Oracle Data Pump API are a subset of the transforms implemented by the `DBMS_METADATA.SET_TRANSFORM_PARAMETER` API. Multiple transforms can be defined for a single job. However, each transform defined must be unique according its

parameters. That is, two transforms cannot specify conflicting or redundant transformations.

55.5.12 OPEN Function

This function is used to declare a new job using the Data Pump API.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

The handle that is returned is used as a parameter for calls to all other procedures (but not to the `ATTACH` function).

Syntax

```
DBMS_DATAPUMP.OPEN (
  operation      IN VARCHAR2,
  job_mode       IN VARCHAR2,
  remote_link    IN VARCHAR2 DEFAULT NULL,
  job_name       IN VARCHAR2 DEFAULT NULL,
  version        IN VARCHAR2 DEFAULT 'COMPATIBLE')
RETURN NUMBER;
```

Parameters

Table 55-20 OPEN Function Parameters

Parameter	Meaning
<code>operation</code>	The type of operation to be performed. Table 55-21 contains descriptions of valid operation types.
<code>job_mode</code>	The scope of the operation to be performed. Table 55-22 contains descriptions of valid modes. Specifying NULL generates an error.
<code>remote_link</code>	If the value of this parameter is non-null, it provides the name of a database link to the remote database that will be the source of data and metadata for the current job.

Table 55-20 (Cont.) OPEN Function Parameters

Parameter	Meaning
job_name	<p>The name of the job. The name is limited to 128 characters; it will be truncated if more than 128 characters are used. It may consist of printable characters and spaces. It is implicitly qualified by the schema of the user executing the OPEN function and must be unique to that schema (that is, there cannot be other Data Pump jobs using the same name).</p> <p>The name is used to identify the job both within the API and with other database components such as identifying the job in the DBA_RESUMABLE view if the job becomes suspended through lack of resources. If no name is supplied, a system generated name will be provided for the job in the following format: "SYS_<OPERATION>_<MODE>_%N".</p> <p>The default job name is formed where %N expands to a two-digit incrementing integer starting at '01' (for example, "SYS_IMPORT_FULL_03"). The name supplied for the job will also be used to name the master table and other resources associated with the job.</p>
version	<p>The version of database objects to be extracted. This option is only valid for Export, network Import, and SQL_FILE operations. Database objects or attributes that are incompatible with the version will not be extracted. Legal values for this parameter are as follows:</p> <ul style="list-style-type: none"> COMPATIBLE - (default) the version of the metadata corresponds to the database compatibility level and the compatibility release level for feature (as given in the V\$COMPATIBILITY view). Database compatibility must be set to 9.2 or higher. LATEST - the version of the metadata corresponds to the database version. A specific database version, for example, '11.0.0'. <p>Specify a value of 12 to allow all existing database features, components, and options to be exported from Oracle Database 11g release 2 (11.2.0.3) or later into an Oracle Database 12 c Release 1 (12.1) (either a multitenant container database (CDB) or a non-CDB).</p>

Table 55-21 describes the valid operation types for the OPEN function.

Table 55-21 Valid Operation Types for the OPEN Function

Operation	Description
EXPORT	Saves data and metadata to a dump file set or obtains an estimate of the size of the data for an operation.
IMPORT	Restores data and metadata from a dump file set or across a database link.
SQL_FILE	Displays the metadata within a dump file set, or from across a network link, as a SQL script. The location of the SQL script is specified through the ADD_FILE procedure.

Table 55-22 describes the valid modes for the OPEN function.

Table 55-22 Valid Modes for the OPEN Function

Mode	Description
FULL	Operates on the full database or full dump file set except for Oracle Database internal schemas. (Some tables from Oracle Database internal schemas may be registered to be exported and imported in full operations in order to provide consistent metadata during import.) The TRANSPORTABLE parameter can be set to ALWAYS during a full database export in order to move data via transportable tablespaces rather than in the Data Pump dump file.
SCHEMA	Operates on a set of selected schemas. Defaults to the schema of the current user. All objects in the selected schemas are processed. In SCHEMA mode, you cannot specify Oracle-internal schemas (for example, SYS, XDB, ORDSYS, MDSYS, CTXSYS, ORDPLUGINS, or LBACSYS).
TABLE	Operates on a set of selected tables. Defaults to all of the tables in the current user's schema. Only tables and their dependent objects are processed.
TABLESPACE	Operates on a set of selected tablespaces. No defaulting is performed. Tables that have storage in the specified tablespaces are processed in the same manner as in Table mode.
TRANSPORTABLE	Operates on metadata for tables (and their dependent objects) within a set of selected tablespaces to perform a transportable tablespace export/import.

Return Values

- An opaque handle for the job. This handle is used as input to the following procedures: ADD_FILE, CREATE_JOB_VIEW, DATA_FILTER, DETACH, GET_STATUS, LOG_ENTRY, LOG_ERROR, METADATA_FILTER, METADATA_REMAP, METADATA_TRANSFORM, SET_PARALLEL, SET_PARAMETER, START_JOB, STOP_JOB, and WAIT_FOR_JOB

Exceptions

- INVALID_ARGVAL. An invalid operation or mode was specified. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- JOB_EXISTS. A table already exists with the specified job name.
- PRIVILEGE_ERROR. The user does not have the necessary privileges or roles to use the specified mode.
- INTERNAL_ERROR. The job was created under the wrong schema or the master table was of the wrong format.
- SUCCESS_WITH_INFO. The function succeeded, but further information is available through the GET_STATUS procedure.
- NO_SUCH_JOB. The specified job does not exist.

Usage Notes

- When the job is created, a master table is created for the job under the caller's schema within the caller's default tablespace. A handle referencing the job is

returned that attaches the current session to the job. Once attached, the handle remains valid until either an explicit or implicit detach occurs. The handle is only valid in the caller's session. Other handles can be attached to the same job from a different session by using the `ATTACH` function.

- If the call to the `OPEN` function fails, call the `GET_STATUS` procedure with a null handle to retrieve additional information about the failure.

55.5.13 SET_PARALLEL Procedure

This procedure adjusts the degree of parallelism within a job.

Syntax

```
DBMS_DATAPUMP.SET_PARALLEL (
    handle      IN NUMBER,
    degree     IN NUMBER);
```

Parameters

Table 55-23 SET_PARALLEL Procedure Parameters

Parameter	Description
handle	The handle of a job. The current session must have previously attached to the handle through a call to either the <code>OPEN</code> or <code>ATTACH</code> function.
degree	The maximum number of worker processes that can be used for the job. You use this parameter to adjust the amount of resources used for a job.

Exceptions

- `INVALID_HANDLE`. The specified handle is not attached to a Data Pump job.
- `INVALID_OPERATION`. The `SET_PARALLEL` procedure is only valid for export and import operations.
- `INVALID_ARGVAL`. An invalid value was supplied for an input parameter.
- `SUCCESS_WITH_INFO`. The procedure succeeded, but further information is available through the `GET_STATUS` procedure.
- `NO_SUCH_JOB`. The specified job does not exist.

Usage Notes

- The `SET_PARALLEL` procedure is only available in the Enterprise Edition of the Oracle database.
- The `SET_PARALLEL` procedure can be executed by any session attached to a job. The job must be in one of the following states: Defining, Idling, or Executing.
- The effect of decreasing the degree of parallelism may be delayed because ongoing work needs to find an orderly completion point before `SET_PARALLEL` can take effect.
- Decreasing the parallelism will not result in fewer worker processes associated with the job. It will only decrease the number of worker processes that will be executing at any given time.

- Increasing the parallelism will take effect immediately if there is work that can be performed in parallel.
- The degree of parallelism requested by a user may be decreased based upon settings in the resource manager or through limitations introduced by the PROCESSES or SESSIONS initialization parameters in the `init.ora` file.
- To parallelize an Export job to a degree of n , the user should supply n files in the dump file set or specify a substitution variable in a file specification. Otherwise, some of the worker processes will be idle while waiting for files.
- SQL_FILE operations always operate with a degree of 1. Jobs running in the Transportable mode always operate with a degree of 1.

55.5.14 SET_PARAMETER Procedures

The DBMS_DATAPUMP procedure SET_PARAMETER is used to specify job-processing options.

Syntax

```
DBMS_DATAPUMP.SET_PARAMETER (
    handle      IN NUMBER,
    name        IN VARCHAR2,
    value       IN VARCHAR2);
```

```
DBMS_DATAPUMP.SET_PARAMETER (
    handle      IN NUMBER,
    name        IN VARCHAR2,
    value       IN NUMBER);
```

Parameters

Table 55-24 SET_PARAMETER Procedure Parameters

Parameter	Description
handle	The handle of a job. The current session must have previously attached to the handle through a call to the OPEN function.
name	The name of the parameter.
value	The value for the specified parameter

The following table describes the valid options for the name parameter of the SET_PARAMETER procedure.

Table 55-25 Valid Options for the name Parameter in the SET_PARAMETER Procedure

Parameter Name	Datatype	Supported Operations	Meaning
CLIENT_COMMAND	TEXT	All	An opaque string used to describe the current operation from the client's perspective. The command-line procedures will use this string to store the original command used to invoke the job.

Table 55-25 (Cont.) Valid Options for the name Parameter in the SET_PARAMETER Procedure

Parameter Name	Datatype	Supported Operations	Meaning
COMPRESSION	TEXT	Export	<p>Allows you to trade off the size of the dump file set versus the time it takes to perform export and import operations.</p> <p>The <code>DATA_ONLY</code> option compresses only user data in the dump file set.</p> <p>The <code>METADATA_ONLY</code> option compresses only metadata in the dump file set.</p> <p>The <code>ALL</code> option compresses both user data and metadata.</p> <p>The <code>NONE</code> option stores the dump file set in an uncompressed format.</p> <p>The <code>METADATA_ONLY</code> and <code>NONE</code> options require a job version of 10.2 or later. All other options require a job version of 11.1 or later.</p> <p>Default=<code>METADATA_ONLY</code></p>
COMPRESSION_ALGORITHM	TEXT	Export	<p>Indicates the compression algorithm is to be used when compressing dump file data. The choices are as follows:</p> <ul style="list-style-type: none"> <code>BASIC</code>--Offers a good combination of compression ratios and speed; the algorithm used is the same as in previous versions of Oracle Data Pump. <code>LOW</code>---Least impact on backup throughput and suited for environments where CPU resources are the limiting factor. <code>MEDIUM</code>---Recommended for most environments. This option, like the <code>BASIC</code> option, provides a good combination of compression ratios and speed, but it uses a different algorithm than <code>BASIC</code>. <code>HIGH</code>--Best suited for exports over slower networks where the limiting factor is network speed. <p>To use this feature, the <code>COMPATIBLE</code> initialization parameter must be set to at least 12.0.0.</p> <p>This feature requires that the Oracle Advanced Compression option be enabled.</p>
DATA_ACCESS_METHOD	TEXT	Export and Import	<p>Allows you to specify an alternative method to unload data if the default method does not work for some reason. The choices are <code>AUTOMATIC</code>, <code>DIRECT_PATH</code>, or <code>EXTERNAL_TABLE</code>. Oracle recommends that you use the default option (<code>AUTOMATIC</code>) whenever possible because it allows Oracle Data Pump to automatically select the most efficient method.</p> <p>If you are importing directly over a database link, then you can also specify <code>INSERT_AS_SELECT</code>. However, this is only an option when you import directly over a database link.</p>

Table 55-25 (Cont.) Valid Options for the name Parameter in the SET_PARAMETER Procedure

Parameter Name	Datatype	Supported Operations	Meaning
DATA_OPTIONS	Number	Export and Import	<p>A bitmask to supply special options for processing the job. The possible values are as follows:</p> <ul style="list-style-type: none"> • KU\$_DATAOPT_SKIP_CONST_ERR • KU\$_DATAOPT_XMLTYPE_CLOB • KU\$_DATAOPT_DISABL_APPEND_HINT • KU\$_DATAOPT_GRP_PART_TAB • KU\$_DATAOPT_TRUST_EXIST_TB_PAR • KU\$_DATAOPT_CONT_LOAD_ON_FMT_ERR <p>Export supports the value KU\$_DATAOPT_XMLTYPE_CLOB. This option stores compressed XMLType columns in the dump file in CLOB format rather than as XML documents.</p> <p>Note: XMLType stored as CLOB is deprecated as of Oracle Database 12c Release 1 (12.1).</p> <p>Import supports the value KU\$_DATAOPT_SKIP_CONST_ERR. This option specifies that if constraint violations occur while data is being imported into user tables, the rows that cause the violations will be rejected and the load will continue. If this option is not set, a constraint error will abort the loading of the entire partition (or table for unpartitioned tables). Setting this option may affect performance, especially for pre-existing tables with unique indexes or constraints.</p> <p>Import also supports the value KU\$_DATAOPT_DISABL_APPEND_HINT. This option prevents the append hint from being applied to the data load. Disabling the APPEND hint can be useful if there is a small set of data objects to load that already exist in the database and some other application may be concurrently accessing one or more of the data objects.</p> <p>Data Pump Export supports the value KU\$_DATAOPT_GRP_PART_TAB. This option tells Data Pump to unload all table data in one operation rather than unload each table partition as a separate operation. As a result, the definition of the table will not matter at import time because Import will see one partition of data that will be loaded into the entire table.</p> <p>Data Pump Import supports the value KU\$_DATAOPT_TRUST_EXIST_TB_PAR. This option tells Data Pump to load partition data in parallel into existing tables.</p> <p>Use of the DATA_OPTIONS parameter requires that the version on the OPEN function be set to 11.1 or later.</p> <p>Default=0</p> <p>Data Pump Import supports the value KU\$_DATAOPT_CONT_LOAD_ON_FMT_ERR. This option tells Data Pump to skip forward to the start of the next granule if a stream format error is encountered while loading table data. Most stream format errors are caused by corrupt dump files. This value can be used if Data Pump encounters a stream format error and the original export database is not available to export the table data again. If Data Pump skips over data, not all data</p>

Table 55-25 (Cont.) Valid Options for the name Parameter in the SET_PARAMETER Procedure

Parameter Name	Datatype	Supported Operations	Meaning
ENCRYPTION	TEXT	Export	<p>from the source database is imported potentially skipping hundreds or thousands of rows.</p> <p>Specifies what to encrypt in the dump file set, as follows: ALL enables encryption for all data and metadata in the export operation. DATA_ONLY specifies that only data is written to the dump file set in encrypted format. ENCRYPTED_COLUMNS_ONLY specifies that only encrypted columns are written to the dump file set in encrypted format. METADATA_ONLY specifies that only metadata is written to the dump file set in encrypted format. NONE specifies that no data is written to the dump file set in encrypted format.</p> <p>This parameter requires a job version of 11.1 or later.</p> <p>The default value depends upon the combination of encryption-related parameters that are used. To enable encryption, either ENCRYPTION or ENCRYPTION_PASSWORD or both, must be specified. If only ENCRYPTION_PASSWORD is specified, then ENCRYPTION defaults to ALL. If neither ENCRYPTION nor ENCRYPTION_PASSWORD is specified, then ENCRYPTION defaults to NONE.</p> <p>To specify ALL, DATA_ONLY, or METADATA_ONLY, the COMPATIBLE initialization parameter must be set to at least 11.1.</p> <p>NOTE: If the data being exported includes SecureFiles that you want to be encrypted, then you must specify ENCRYPTION=ALL to encrypt the entire dump file set. Encryption of the entire dump file set is the only way to achieve encryption security for SecureFiles during a Data Pump export operation.</p>
ENCRYPTION_ALGORITHM	TEXT	Export	<p>Identifies which cryptographic algorithm should be used to perform encryption. Possible values are AES128, AES192, and AES256.</p> <p>The ENCRYPTION_ALGORITHM parameter requires that you also specify either ENCRYPTION or ENCRYPTION_PASSWORD; otherwise an error is returned. See <i>Oracle Database Advanced Security Guide</i> for information about encryption algorithms.</p> <p>This parameter requires a job version of 1.1 or later. Default=AES128</p>

Table 55-25 (Cont.) Valid Options for the name Parameter in the SET_PARAMETER Procedure

Parameter Name	Datatype	Supported Operations	Meaning
ENCRYPTION_MODE	TEXT	Export	<p>Identifies the types of security used for encryption and decryption. The values are as follows:</p> <p>PASSWORD requires that you provide a password when creating encrypted dump file sets. You will need to provide the same password when you import the dump file set. PASSWORD mode requires that you also specify the ENCRYPTION_PASSWORD parameter. The PASSWORD mode is best suited for cases in which the dump file set will be imported into a different or remote database, but which must remain secure in transit.</p> <p>TRANSPARENT allows an encrypted dump file set to be created without any intervention from a database administrator (DBA), provided the required Oracle Encryption Wallet is available. Therefore, the ENCRYPTION_PASSWORD parameter is not required, and will in fact, cause an error if it is used in TRANSPARENT mode. This encryption mode is best suited for cases in which the dump file set will be imported into the same database from which it was exported.</p> <p>DUAL creates a dump file set that can later be imported using either the Oracle Encryption Wallet or the password that was specified with the ENCRYPTION_PASSWORD parameter. DUAL mode is best suited for cases in which the dump file set will be imported on-site using the Oracle Encryption Wallet, but which may also need to be imported offsite where the Oracle Encryption Wallet is not available.</p> <p>When you use the ENCRYPTION_MODE parameter, you must also use either the ENCRYPTION or ENCRYPTION_PASSWORD parameter. Otherwise, an error is returned.</p> <p>To use DUAL or TRANSPARENT mode, the COMPATIBLE initialization parameter must be set to at least 11.1.</p> <p>The default mode depends on which other encryption-related parameters are used. If only ENCRYPTION is specified, then the default mode is TRANSPARENT. If ENCRYPTION_PASSWORD is specified and the Oracle Encryption Wallet is open, then the default is DUAL. If ENCRYPTION_PASSWORD is specified and the Oracle Encryption Wallet is closed, then the default is PASSWORD.</p>
ENCRYPTION_PASSWORD	TEXT	Export and Import	<p>For export operations, this parameter is required if ENCRYPTION_MODE is set to either PASSWORD or DUAL. It is also required for transportable export/import operations (job mode=FULL and TRANSPORTABLE=ALWAYS) when the database includes either encrypted tablespaces or tables with encrypted columns.</p>

Table 55-25 (Cont.) Valid Options for the name Parameter in the SET_PARAMETER Procedure

Parameter Name	Datatype	Supported Operations	Meaning
ESTIMATE	TEXT	Export and Import	<p>Specifies that the estimate method for the size of the tables should be performed before starting the job.</p> <p>If BLOCKS, a size estimate for the user tables is calculated using the count of blocks allocated to the user tables.</p> <p>If STATISTICS, a size estimate for the user tables is calculated using the statistics associated with each table. If no statistics are available for a table, the size of the table is estimated using BLOCKS.</p> <p>The ESTIMATE parameter cannot be used in Transportable Tablespace mode.</p> <p>Default=STATISTICS</p>
ESTIMATE_ONLY	NUMBER	Export	<p>Specifies that only the estimation portion of an export job should be performed. This option is useful for estimating the size of dump files when the size of the export is unknown.</p>
FLASHBACK_SCN	NUMBER	Export and network Import	<p>System change number (SCN) to serve as transactionally consistent point for reading user data. If neither FLASHBACK_SCN nor FLASHBACK_TIME is specified, there will be no transactional consistency between partitions, except for logical standby databases and Streams targets. FLASHBACK_SCN is not supported in Transportable mode.</p> <p>For FLASHBACK_SCN, Data Pump supports the new 8–byte big SCNs used in Oracle Database 12c release 2 (12.2).</p>
FLASHBACK_TIME	TEXT	Export and network Import	<p>Either the date and time used to determine a consistent point for reading user data or a string of the form TO_TIMESTAMP (...).</p> <p>If neither FLASHBACK_SCN nor FLASHBACK_TIME is specified, there will be no transactional consistency between partitions. FLASHBACK_SCN and FLASHBACK_TIME cannot both be specified for the same job. FLASHBACK_TIME is not supported in Transportable mode.</p>
INCLUDE_METADATA	NUMBER	Export and Import	<p>If nonzero, metadata for objects will be moved in addition to user table data.</p> <p>If zero, metadata for objects will not be moved. This parameter converts an Export operation into an unload of user data and an Import operation into a load of user data.</p> <p>INCLUDE_METADATA is not supported in Transportable mode.</p> <p>Default=1</p>
KEEP_MASTER	NUMBER	Export and Import	<p>Specifies whether the master table should be deleted or retained at the end of a Data Pump job that completes successfully. The master table is automatically retained for jobs that do not complete successfully.</p> <p>Default=0.</p>

Table 55-25 (Cont.) Valid Options for the name Parameter in the SET_PARAMETER Procedure

Parameter Name	Datatype	Supported Operations	Meaning
LOGTIME	TEXT	Export and Import	<p>Specifies that messages displayed during export and import operations be timestamped. Valid options are as follows:</p> <ul style="list-style-type: none"> NONE--No timestamps on status or log file messages (this is the default) STATUS--Timestamps on status messages only LOGFILE--Timestamps on log file messages only ALL--Timestamps on both status and log file messages
MASTER_ONLY	NUMBER	Import	<p>Indicates whether to import just the master table and then stop the job so that the contents of the master table can be examined.</p> <p>Default=0.</p>
METRICS	NUMBER	Export and Import	<p>Indicates whether additional information about the job should be reported to the Data Pump log file.</p> <p>Default=0.</p>
PARTITION_OPTIONS	TEXT	Import	<p>Specifies how partitioned tables should be handled during an import operation. The options are as follows:</p> <p>NONE means that partitioning is reproduced on the target database as it existed in the source database.</p> <p>DEPARTITION means that each partition or subpartition that contains storage in the job is reproduced as a separate unpartitioned table. Intermediate partitions that are subpartitioned are not re-created (although their subpartitions are converted into tables). The names of the resulting tables are system-generated from the original table names and partition names unless the name is overridden by the REMAP_TABLE metadata transform.</p> <p>MERGE means that each partitioned table is re-created in the target database as an unpartitioned table. The data from all of the source partitions is merged into a single storage segment. This option is not supported for transportable jobs or when the TRANSPORTABLE parameter is set to ALWAYS.</p> <p>This parameter requires a job version of 11.1 or later.</p> <p>Default=NONE</p>
REUSE_DATAFILES	NUMBER	Import	<p>Specifies whether the import job should reuse existing data files for tablespace creation.</p> <p>Default=0.</p>
SKIP_UNUSABLE_INDEXES	NUMBER	Import	<p>If nonzero, rows will be inserted into tables having unusable indexes. SKIP_UNUSABLE_INDEXES is not supported in Transportable mode.</p> <p>Default=1</p>
SOURCE_EDITION	TEXT	Export and network Import	<p>The application edition that will be used for determining the objects that will be unloaded for export and for network import.</p>
STREAMS_CONFIGURATION	NUMBER	Import	<p>Specifies whether to import any Streams metadata that may be present in the export dump file.</p> <p>Default=1.</p>

Table 55-25 (Cont.) Valid Options for the name Parameter in the SET_PARAMETER Procedure

Parameter Name	Datatype	Supported Operations	Meaning
TABLE_EXISTS_ACTION	TEXT	Import	<p>Specifies the action to be performed when data is loaded into a preexisting table. The possible actions are: TRUNCATE, REPLACE, APPEND, and SKIP.</p> <p>If INCLUDE_METADATA=0, only TRUNCATE and APPEND are supported.</p> <p>If TRUNCATE, rows are removed from a preexisting table before inserting rows from the Import.</p> <p>Note that if TRUNCATE is specified on tables referenced by foreign key constraints, the TRUNCATE will be modified into a REPLACE.</p> <p>If REPLACE, preexisting tables are replaced with new definitions. Before creating the new table, the old table is dropped.</p> <p>If APPEND, new rows are added to the existing rows in the table.</p> <p>If SKIP, the preexisting table is left unchanged.</p> <p>TABLE_EXISTS_ACTION is not supported in Transportable mode.</p> <p>The default is SKIP if metadata is included in the import. The default is APPEND if INCLUDE_METADATA is set to 0.</p>
TABSPACE_DATA_FILE	TEXT	Import	<p>Specifies the full file specification for a data file in the transportable tablespace set. TABSPACE_DATAFILE is only valid for transportable mode imports.</p> <p>TABSPACE_DATAFILE can be specified multiple times, but the value specified for each occurrence must be different.</p>
TARGET_EDITION	TEXT	Import	<p>The application edition that will be used for determining where the objects will be loaded for import and for network import.</p>

Table 55-25 (Cont.) Valid Options for the name Parameter in the SET_PARAMETER Procedure

Parameter Name	Datatype	Supported Operations	Meaning
TRANSPORTABLE	TEXT	Export (and network import or full-mode import)	<p>This option is for export operations done in table mode, and also for full-mode imports and network imports. It allows the data to be moved using transportable tablespaces.</p> <p>In table-mode storage segments in the moved tablespaces that are not associated with the parent schemas (tables) will be reclaimed at import time. If individual partitions are selected in a table-mode job, only the tablespaces referenced by those partitions will be moved. During import, the moved partitions can only be reconstituted as tables by using the <code>PARTITION_OPTIONS=DEPARTITION</code> parameter.</p> <p>Use of the <code>TRANSPORTABLE</code> parameter prohibits the subsequent import of the dump file into a database at a lower version or using different character sets. Additionally, the data files may need to be converted if the target database is on a different platform.</p> <p>In table-mode, the <code>TRANSPORTABLE</code> parameter is not allowed if a network link is supplied on the <code>OPEN</code> call.</p> <p>The possible values for this parameter are as follows: <code>ALWAYS</code> - data is always moved by moving data files. This option is valid only for table mode and full mode. <code>NEVER</code> - data files are never used for copying user data</p> <p>This parameter requires a job version of 11.1 or later This parameter requires a job version of 12.1 or later when the job mode is <code>FULL</code>. Default=<code>NEVER</code></p>
TTS_FULL_CHECK	NUMBER	Export	<p>If nonzero, verifies that a transportable tablespace set has no dependencies (specifically, IN pointers) on objects outside the set, and vice versa. Only valid for Transportable mode Exports. Default=0</p>
USER_METADATA	NUMBER	Export and network Import	<p>For schema-mode operations, specifies that the metadata to re-create the users' schemas (for example, privilege grants to the exported schemas) should also be part of the operation if set to nonzero. Users must be privileged to explicitly set this parameter.</p> <p>The <code>USER_METADATA</code> parameter cannot be used in Table, Tablespace, or Transportable Tablespace mode. Default=1 if user has <code>DATAPUMP_EXP_FULL_DATABASE</code> role; 0 otherwise.</p>

Exceptions

- `INVALID_HANDLE`. The specified handle is not attached to a Data Pump job.
- `INVALID_ARGVAL`. This exception could be due to any of the following causes:
 - An invalid name was supplied for an input parameter
 - The wrong datatype was used for `value`
 - A `value` was not supplied

- The supplied `value` was not allowed for the specified parameter name
- A flashback parameter had been established after a different flashback parameter had already been established
- A parameter was specified that did not support duplicate definitions
- `INVALID_OPERATION`. The operation specified is invalid in this context.
- `INVALID_STATE`. The specified job is not in the Defining state.
- `INCONSISTENT_ARGS`. Either the specified parameter is not supported for the current operation type or it is not supported for the current mode.
- `PRIVILEGE_ERROR`. The user does not have the `DATAPUMP_EXP_FULL_DATABASE` or `DATAPUMP_IMP_FULL_DATABASE` role required for the specified parameter.
- `SUCCESS_WITH_INFO`. The procedure succeeded, but further information is available through the `GET_STATUS` procedure.
- `NO_SUCH_JOB`. The specified job does not exist.

Usage Notes

- The `SET_PARAMETER` procedure is used to specify optional features for the current job. For a list of supported options, see the preceding table, "Valid Options for the name Parameter in the `SET_PARAMETER` Procedure".

55.5.15 START_JOB Procedure

This procedure begins or resumes job execution.

Syntax

```
DBMS_DATAPUMP.START_JOB (
    handle          IN NUMBER,
    skip_current    IN NUMBER DEFAULT 0,
    abort_step      IN NUMBER DEFAULT 0,
    cluster_ok      IN NUMBER DEFAULT 1,
    service_name    IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 55-26 START_JOB Procedure Parameters

Parameter	Description
<code>handle</code>	The handle of a job. The current session must have previously attached to the handle through a call to either the <code>OPEN</code> or <code>ATTACH</code> function.
<code>skip_current</code>	If nonzero, causes actions that were 'in progress' on a previous execution of the job to be skipped when the job restarts. The skip will only be honored for Import jobs. This mechanism allows the user to skip actions that trigger fatal bugs and cause the premature termination of a job. Multiple actions can be skipped on a restart. The log file will identify which actions are skipped. If a domain index was being processed, all pieces of the domain index are skipped even if the error occurred in only a subcomponent of the domain index. A description of the actions skipped is entered into the log file. <code>skip_current</code> is ignored for the initial <code>START_JOB</code> in a job. If zero, no data or metadata is lost upon a restart.

Table 55-26 (Cont.) START_JOB Procedure Parameters

Parameter	Description
<code>abort_step</code>	Value must be 0. Inserting values other than 0 into this argument will have unintended consequences.
<code>cluster_ok</code>	If = 0, all workers are started on the current instance. Otherwise, workers are started on instances usable by the job.
<code>service_name</code>	If specified, indicates a service name used to constrain the job to specific instances or to a specific resource group.

Exceptions

- `INVALID_HANDLE`. The specified handle is not attached to a Data Pump job.
- `INVALID_STATE`. The causes of this exception can be any of the following:
 - No files have been defined for an Export, non-network Import, or `SQL_FILE` job
 - An `ADD_FILE` procedure has not been called to define the output for a `SQL_FILE` job
 - A `TABLESPACE_DATAFILE` parameter has not been defined for a Transportable Import job
 - A `TABLESPACE_EXPR` metadata filter has not been defined for a Transportable or Tablespace mode Export or Network job
 - The dump file set on an Import or `SQL_FILE` job was either incomplete or missing a master table specification
- `INVALID_OPERATION`. Unable to restore master table from a dump file set.
- `INTERNAL_ERROR`. An inconsistency was detected when the job was started. Additional information may be available through the `GET_STATUS` procedure.
- `SUCCESS_WITH_INFO`. The procedure succeeded, but further information is available through the `GET_STATUS` procedure.
- `NO_SUCH_JOB`. The specified job does not exist.

Usage Notes

- When this procedure is called to request that the corresponding job be started or restarted, the state of the job is changed from either the Defining or Idling state to the Executing state.
- If the `SET_PARALLEL` procedure was not called prior to the `START_JOB` procedure, the initial level of parallelism used in the job will be 1. If `SET_PARALLEL` was called prior to the job starting, the `degree` specified by the last `SET_PARALLEL` call determines the parallelism for the job. On restarts, the parallelism is determined by the previous parallel setting for the job, unless it is overridden by another `SET_PARALLEL` call.
- To restart a stopped job, an `ATTACH` function must be performed prior to executing the `START_JOB` procedure.

55.5.16 STOP_JOB Procedure

This procedure terminates a job, but optionally, preserves the state of the job.

Syntax

```
DBMS_DATAPUMP.STOP_JOB (
    handle      IN NUMBER,
    immediate   IN NUMBER DEFAULT 0,
    keep_master IN NUMBER DEFAULT NULL,
    delay       IN NUMBER DEFAULT 60);
```

Parameters

Table 55-27 STOP_JOB Procedure Parameters

Parameter	Description
handle	The handle of a job. The current session must have previously attached to the handle through a call to either the <code>OPEN</code> or <code>ATTACH</code> function. At the end of the procedure, the user is detached from the handle.
immediate	If nonzero, the worker processes are aborted immediately. This halts the job quickly, but parts of the job will have to be rerun if the job is ever restarted. If zero, the worker processes are allowed to complete their current work item (either metadata or table data) before they are terminated. The job is placed in a Stop Pending state while the workers finish their current work.
keep_master	If nonzero, the master table is retained when the job is stopped. If zero, the master table is dropped when the job is stopped. If the master table is dropped, the job will not be restartable. If the master table is dropped during an export job, the created dump files are deleted.
delay	The number of seconds to wait until other attached sessions are forcibly detached. The delay allows other sessions attached to the job to be notified that a stop has been performed. The job keeps running until either all clients have detached or the delay has been satisfied. If no delay is specified, then the default delay is 60 seconds. If a shorter delay is used, clients might not be able to retrieve the final messages for the job through the <code>GET_STATUS</code> procedure.

Exceptions

- `INVALID_HANDLE`. The specified handle is not attached to a Data Pump job.
- `INVALID_STATE`. The job is already in the process of being stopped or completed.
- `SUCCESS_WITH_INFO`. The procedure succeeded, but further information is available through the `GET_STATUS` procedure.
- `NO_SUCH_JOB`. The specified job does not exist.

Usage Notes

- This procedure is used to request that the corresponding job stop executing.
- The termination of a job that is in an Executing state may take several minutes to complete in an orderly fashion.
- For jobs in the Defining, Idling, or Completing states, this procedure is functionally equivalent to the `DETACH` procedure.

- Once a job is stopped, it can be restarted using the `ATTACH` function and `START_JOB` procedures, provided the master table and the dump file set are left intact.
- If the `KEEP_MASTER` parameter is not specified, and the job is in the Defining state or has a mode of Transportable, the master table is dropped. Otherwise, the master table is retained.

55.5.17 WAIT_FOR_JOB Procedure

This procedure runs a job until it either completes normally or stops for some other reason.

Syntax

```
DBMS_DATAPUMP.WAIT_FOR_JOB (
    handle      IN  NUMBER,
    job_state   OUT VARCHAR2);
```

Parameters

Table 55-28 WAIT_FOR_JOB Procedure Parameters

Parameter	Description
handle	The handle of the job. The current session must have previously attached to the handle through a call to either the <code>OPEN</code> or <code>ATTACH</code> function. At the end of the procedure, the user is detached from the handle.
job_state	The state of the job when it has stopped executing; either <code>STOPPED</code> or <code>COMPLETED</code> .

Exceptions

- `SUCCESS_WITH_INFO`. The procedure succeeded, but further information is available through the `GET_STATUS` API.
- `INVALID_HANDLE`. The job handle is no longer valid.

Usage Notes

This procedure provides the simplest mechanism for waiting for the completion of a Data Pump job. The job should be started before calling `WAIT_FOR_JOB`. When `WAIT_FOR_JOB` returns, the job will no longer be executing. If the job completed normally, the final status will be `COMPLETED`. If the job stopped executing because of a `STOP_JOB` request or an internal error, the final status will be `STOPPED`.

DBMS_DB_VERSION

The `DBMS_DB_VERSION` package specifies the Oracle version numbers and other information useful for simple conditional compilation selections based on Oracle versions.



See Also:

Oracle Database PL/SQL Language Reference regarding conditional compilation

This package contains the following topics:

- [Overview](#)
- [Constants](#)
- [Examples](#)

56.1 DBMS_DB_VERSION Overview

The `DBMS_DB_VERSION` package specifies the Oracle version numbers and other information useful for simple conditional compilation selections based on Oracle versions.

The package for the Oracle Database 21c version is shown below.

```
PACKAGE DBMS_DB_VERSION IS
  VERSION CONSTANT PLS_INTEGER := 21; -- RDBMS version number
  RELEASE CONSTANT PLS_INTEGER := 0; -- RDBMS release number
  ver_le_9_1      CONSTANT BOOLEAN := FALSE;
  ver_le_9_2      CONSTANT BOOLEAN := FALSE;
  ver_le_9        CONSTANT BOOLEAN := FALSE;
  ver_le_10_1     CONSTANT BOOLEAN := FALSE;
  ver_le_10_2     CONSTANT BOOLEAN := FALSE;
  ver_le_10       CONSTANT BOOLEAN := FALSE;
  ver_le_11_1     CONSTANT BOOLEAN := FALSE;
  ver_le_11_2     CONSTANT BOOLEAN := FALSE;
  ver_le_11       CONSTANT BOOLEAN := FALSE;
  ver_le_12_1     CONSTANT BOOLEAN := FALSE;
  ver_le_12_2     CONSTANT BOOLEAN := FALSE;
  ver_le_12       CONSTANT BOOLEAN := FALSE;
  ver_le_18       CONSTANT BOOLEAN := FALSE;
  ver_le_19       CONSTANT BOOLEAN := FALSE;
  ver_le_20       CONSTANT BOOLEAN := FALSE;
  ver_le_21       CONSTANT BOOLEAN := TRUE;
END DBMS_DB_VERSION;
```

The boolean constants follow a naming convention. Each constant gives a name for a boolean expression. For example:

- `VER_LE_9_1` represents version ≤ 9 and release ≤ 1

- VER_LE_10_2 represents version <= 10 and release <= 2
- VER_LE_10 represents version <= 10

A typical usage of these boolean constants is:

```

$IF DBMS_DB_VERSION.VER_LE_10 $THEN
    version 10 and earlier code
$ELSIF DBMS_DB_VERSION.VER_LE_11 $THEN
    version 11 code
$ELSE
    version 12 and later code
$END

```

This code structure will protect any reference to the code for version 12. It also prevents the controlling package constant `DBMS_DB_VERSION.VER_LE_11` from being referenced when the program is compiled under version 10. A similar observation applies to version 11. This scheme works even though the static constant `VER_LE_11` is not defined in version 10 database because conditional compilation protects the `$ELSIF` from evaluation if `DBMS_DB_VERSION.VER_LE_10` is `TRUE`.

56.2 DBMS_DB_VERSION Constants

The `DBMS_DB_VERSION` package contains different constants for different Oracle Database releases.

The Oracle Database 21c version of the `DBMS_DB_VERSION` package uses the constants shown in the following table.

Table 56-1 DBMS_DB_VERSION Constants

Name	Type	Value	Description
VERSION	PLS_INTEGER	21	Current version
RELEASE	PLS_INTEGER	0	Current release
VER_LE_9	BOOLEAN	FALSE	Version <= 9
VER_LE_9_1	BOOLEAN	FALSE	Version <= 9 and release <= 1
VER_LE_9_2	BOOLEAN	FALSE	Version <= 9 and release <= 2
VER_LE_10	BOOLEAN	FALSE	Version <= 10
VER_LE_10_1	BOOLEAN	FALSE	Version <= 10 and release <= 1
VER_LE_10_2	BOOLEAN	FALSE	Version <=10 and release <= 2
VER_LE_11	BOOLEAN	FALSE	Version <= 11
VER_LE_11_1	BOOLEAN	FALSE	Version <=11 and release <= 1
VER_LE_11_2	BOOLEAN	FALSE	Version <=11 and release <= 2
VER_LE_12	BOOLEAN	FALSE	Version <=12
VER_LE_12_1	BOOLEAN	FALSE	Version <=12 and release <= 1
VER_LE_12_2	BOOLEAN	FALSE	Version <=12 and release <= 2
VER_LE_18	BOOLEAN	FALSE	Version <=18
VER_LE_19	BOOLEAN	FALSE	Version <=19
VER_LE_20	BOOLEAN	FALSE	Version <=20

Table 56-1 (Cont.) DBMS_DB_VERSION Constants

Name	Type	Value	Description
VER_LE_21	BOOLEAN	TRUE	Version <=21

56.3 DBMS_DB_VERSION Examples

This example uses conditional compilation to guard new features.

```

CREATE OR REPLACE PROCEDURE whetstone IS

  -- Notice that conditional compilation constructs
  -- can interrupt a regular PL/SQL statement.
  -- You can locate a conditional compilation directive anywhere
  -- there is whitespace in the regular statement.

  SUBTYPE my_real IS
    $IF DBMS_DB_VERSION.VER_LE_9 $THEN NUMBER
    $ELSE BINARY_DOUBLE
    $END;

  t CONSTANT my_real := $IF DBMS_DB_VERSION.VER_LE_9 $THEN 0.499975
    $ELSE 0.499975d
    $END;

  t2 CONSTANT my_real := $if DBMS_DB_VERSION.VER_LE_9 $THEN 2.0
    $ELSE 2.0d
    $END;

  x CONSTANT my_real := $IF DBMS_DB_VERSION.VER_LE_9 $THEN 1.0
    $ELSE 1.0d
    $END;

  y CONSTANT my_real := $IF DBMS_DB_VERSION.VER_LE_9 $THEN 1.0
    $ELSE 1.0d
    $END;

  z MY_REAL;

  PROCEDURE P(x IN my_real, y IN my_real, z OUT NOCOPY my_real) IS
    x1 my_real;
    y1 my_real;
  BEGIN
    x1 := x;
    y1 := y;
    x1 := t * (x1 + y1);
    y1 := t * (x1 + y1);
    z := (x1 + y1)/t2;
  END P;
BEGIN
  P(x, y, z);
  DBMS_OUTPUT.PUT_LINE ('z = ' || z);
END whetstone;
/

```


DBMS_DBCOMP

The `DBMS_DBCOMP` package performs block comparison to detect lost writes or database inconsistencies between a primary database and one or more physical standby databases. It contains one procedure, `DBCMP`, which can be executed at any time. (It does not require that the `DB_LOST_WRITE_PROTECT` initialization parameter be enabled.)

This chapter contains the following sections:

- [Using DBMS_DBCOMP](#)
- [DBMS_DBCOMP Security Model](#)
- [DBCMP Procedure](#)

Related Topics

- *Oracle Data Guard Concepts and Administration*

57.1 Using DBMS_DBCOMP

The `DBMS_DBCOMP.DBCMP` procedure assumes that there is one primary database and one or more physical standby databases. The databases should be at least mounted before block comparison.



Note:

Logical standby databases, far sync instances, and cascaded standbys cannot be the target database for the `DBMS_DBCOMP.DBCMP` procedure.

While this procedure is running, you can monitor progress of the compare operation by querying the `V$SESSION_LONGOPS` view. For example:

```
SQL> SELECT target_desc, sofar, totalwork FROM V$SESSION_LONGOPS WHERE
opname = 'BlockCompare';
```

The output might look as follows:

TARGET_DESC	SO FAR	TOTALWORK
-----	-----	-----
Compared Blocks	23914	340639
Lost Writes	0	0

The results can be interpreted as follows:

- The `Compared Blocks` value is the number of blocks that were scanned (including those that did not use compare callback functions). The number is the sum of all secondary processes (that is, each secondary process is responsible for a connection between

primary and standby). For example, if there are two secondary processes and each secondary process has compared 1000 blocks, then the value of `SO FAR` should be 2000.

- The `Lost Writes` value is the number of lost writes found at both the primary and the standby. Also, it is the sum of all secondary processes. For `Lost Writes`, the value of `SO FAR` should be always equal to the value of `TOTALWORK`.
- The value of `SO FAR` should be always less than or equal to the value of `TOTALWORK`.
- When the block compare secondary processes finish, the value of `SO FAR` should be equal to the value of `TOTALWORK`.

57.2 DBMS_DBCOMP Security Model

The `DBMS_DBCOMP` package runs with invoker's rights and requires the `SYSDBA` or `SYSDBG` or `SYSBACKUP` privilege.

57.3 Summary of the DBMS_DBCOMP Subprogram

The `DBMS_DBCOMP` package contains one procedure, `DBCMP`.

Subprogram	Description
<code>DBCMP</code> procedure	The <code>DBMS_DBCOMP.DBCMP</code> procedure performs block comparison to detect lost writes or database inconsistencies between a primary database and one or more physical standby databases. The <code>DBCMP</code> procedure can be executed on the primary or on the physical standby while the databases are mounted or open.

57.3.1 DBCOMP Procedure

Use `DBCMP` procedure to compare blocks on a primary database and one or more physical standby databases.

Syntax

```
DBMS_DBCOMP.DBCMP (
    datafile IN varchar2,
    outputfile IN varchar2,
    block_dump IN boolean);
```

Parameters

Parameter	Description
<code>datafile</code>	This can be a data file name or a data file number. Specify <code>'ALL'</code> to compare all data files.

Parameter	Description
outputfile	This value is used as a prefix in the name of the output file. By default, output files are placed in the dbs/ directory, but the output file argument can contain a relative directory path or an absolute directory path. See Usage Notes for descriptions of the information contained in the output file.
block_dump	This is a Boolean parameter to specify whether block content should be dumped into output files if a pair of blocks of primary and standby databases is not identical. This parameter does not guarantee that all different block pairs are dumped. The default value is FALSE.

Usage Notes

- The output file contains the following columns:
 - **ID**: The block type. For instance, type 02 is undo block type, and 06 is KTB-managed data block type.
 - **TOTAL**: The total number of blocks in the specific block type.
 - **CORR**: The number of corrupted blocks.
 - **SKIPPED**: The number of block pairs that are skipped (ignored) without comparison, such as direct loaded blocks, RMAN optimized blocks, and flashback optimized blocks
 - **DIFFV**: The number of blocks that have different version numbers between primary and standby.
 - **SAMEV**: The number of block pairs that have the same version number between primary and standby.
 - **SAMEV&C**: The number of block pairs that have the same version and the same checksum.
 - **ENCERR**: The number of block pairs that have encryption related errors (usually because the Wallet is not open).
 - **LWLOC**: The number of lost writes on the local database.
 - **LWRMT**: The number of lost writes on the remote databases.
 - **DIFFPAIR** : The number of block pairs that have the same version but different checksum, and which the block compare callback function has concluded are different.

Example 57-1 Example

The following is an example of using the `DBMS_DBCOMP.DBCOMP` procedure.

```
declare
  Datafile_Name_or_Number varchar2(1000);
  Output_File varchar2(1000);
begin
  dbms_output.enable(1000000);
```

```
Datafile_Name_or_Number:= 'all' ;  
Output_File:='BlockCompareAll_';  
sys.dbms_dbcomp.DBCOMP(Datafile_Name_or_Number, Output_File, true);  
end;
```

DBMS_DBFS_CONTENT

The `DBMS_DBFS_CONTENT` package provides an interface comprising a file system-like abstraction backed by one or more Store Providers.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Exceptions](#)
- [Operational Notes](#)
- [Data Structures](#)
- [Summary of DBMS_DBFS_CONTENT Subprograms](#)



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide

58.1 DBMS_DBFS_CONTENT Overview

The `DBMS_DBFS_CONTENT` package provides an interface that connects the Oracle database to the DBFS client-side.

In the server, the `DBMS_DBFS_CONTENT` package is backed by the `DBMS_DBFS_CONTENT_SPI` package, which includes descriptions but not actual implementations of DBFS stores.



See Also:

- Oracle Database SecureFiles and Large Objects Developer's Guide for a description of `DBMS_DBFS_CONTENT` and the DBFS architecture
- Oracle Database SecureFiles and Large Objects Developer's Guide for conceptual information about the `DBMS_DBFS_CONTENT` package

58.2 DBMS_DBFS_CONTENT Security Model

The `DBMS_DBFS_CONTENT` package runs under `AUTHID CURRENT_USER`.

58.3 DBMS_DBFS_CONTENT Constants

The `DBMS_DBFS_CONTENT` package uses various types of constants.

These are shown in the following tables:

- [Table 58-1](#)
- [Table 58-2](#)
- [Table 58-3](#)
- [Table 58-4](#)
- [Table 58-5](#)
- [Table 58-6](#)
- [Table 58-7](#)
- [Table 58-8](#)
- [Table 58-9](#)
- [Table 58-10](#)

Path Name Constants and Types

The following constants are useful for declaring paths and item names. Paths are limited to 1024 characters and item names are limited to 256 characters.

Table 58-1 DBMS_DBFS_CONTENT Constants - Path Names

Constant	Type	Value	Description
NAME_MAX	PLS_INTEGER	256	Maximum length of an absolute path name visible to clients
NAME_T	VARCHAR2 (256)	NAME_MAX	Portable alias for string that can represent component names
PATH_MAX	PLS_INTEGER	1024	Maximum length of any individual component of an absolute path name visible to clients
PATH_T	VARCHAR2 (1024)	PATH_MAX	Portable alias for string that can represent path names

ContentID Constants

Stores may expose to the user a unique identifier that represents a particular path item in the store. These identifiers are limited to 128 characters.

Table 58-2 DBMS_DBFS_CONTENT Constants - ContentID

Constant	Type	Value	Description
CONTENT_ID_MAX	PLS_INTEGER	128	Maximum length of a store-specific provider-generated contentID that identifies a file-type content item
CONTENT_ID_T	RAW(128)	CONTENT_ID_MAX	Portable alias for raw buffers that can represent contentID values

Path Properties Constants

Every path name in a store is associated with a set of properties. Each property is identified by a string "name", has a string "value" (which might be `NULL` if unset or undefined or unsupported by a specific store implementation) and a value "typecode" (a numeric discriminant for the actual type of value held in the "value" string.)

Table 58-3 DBMS_DBFS_CONTENT Constants - Properties

Constant	Type	Value	Description
PROPNAME_MAX	PLS_INTEGER	32	Maximum length of a property name
PROPNAME_T	VARCHAR2(32)	PROPNAME_MAX	Portable alias for string that can represent property names
PROPVAL_MAX	PLS_INTEGER	1024	Maximum length of the string value of a property
PROPVAL_T	VARCHAR2(1024)	PATH_MAX	Portable alias for string that can represent property values

Path Name Type Constants

Path items in a store have a item type associated with them. These types represent the kind of entry the item represents in the store.

Table 58-4 DBMS_DBFS_CONTENT Constants - Path Name Types

Constant	Type	Value	Description
TYPE_FILE	PLS_INTEGER	1	A regular file storing content (a logically linear sequence of bytes accessed as a BLOB)
TYPE_DIRECTORY	PLS_INTEGER	2	A container of other path name types, including file types

Table 58-4 (Cont.) DBMS_DBFS_CONTENT Constants - Path Name Types

Constant	Type	Value	Description
TYPE_LINK	PLS_INTEGER	3	A symbolic link (that is, an uninterpreted string value associated with a path name). Since symbolic links may represent path names that fall outside the scope of any given store (or even the entire aggregation of stores managed by the DBMS_DBFS_CONTENT interface), or may not even represent path names, clients must be careful in creating symbolic links, and stores must be careful in trying to resolve these links internally.
TYPE_REFERENCE	PLS_INTEGER	4	A hard link which is always a valid path name alias to content
TYPE_SOCKET	PLS_INTEGER	5	UNIX domain socket created using socket interface defined as in <code>socket.h</code> with domain defined as <code>AF_UNIX</code> or <code>AF_LOCAL</code> .

Store Feature Constants

The DBFS content API allows different store providers (and different stores) to describe themselves through a *feature set* (a bitmask indicating which features they support and which ones they do not).

Table 58-5 DBMS_DBFS_CONTENT Constants - Store Features

Constant	Type	Value	Description
FEATURE_FOLDERS	PLS_INTEGER	1	Set if the store supports folders (or directories) as part of hierarchical path names
FEATURE_FOIAI	PLS_INTEGER	2	Set if implicit folder operations within the store (performed as part of a client-requested operation) runs inside autonomous transactions. In general, the use of autonomous transactions is a compromise between (a) simplicity in the implementation and client-controlled transaction scope for all operations, at the cost of greatly reduced concurrency (FEATURE_FOIAI not set), versus (b) more complex implementation and smaller client-controlled transaction scope, at the benefit of greatly increased concurrency (FEATURE_FOIAI set).

Table 58-5 (Cont.) DBMS_DBFS_CONTENT Constants - Store Features

Constant	Type	Value	Description
FEATURE_NOWAIT	PLS_INTEGER	4	Set if the store allows <code>nowait</code> gets of path elements. The default behavior is to wait for row locks; if <code>nowait</code> gets are implemented, the <code>get</code> operation raises an ORA-54 exception if the path element is already locked by another transaction.
FEATURE_ACLS	PLS_INTEGER	8	Set if the store supports Access Control Lists (ACLs) and internal authorization or checking based on these ACLs. ACLs are standard properties but a store may do nothing more than store and retrieve the ACLs without interpreting them in any way.
FEATURE_LINKS	PLS_INTEGER	16	Set if the store supports symbolic links, and if certain types of symbolic links (specifically non-absolute path names) can be internally resolved by the store itself
FEATURE_LINK_DEREF	PLS_INTEGER	32	Set if the store supports symbolic links, and if certain types of symbolic links (specifically non-absolute path names) can be internally resolved by the store itself
FEATURE_REFERENCES	PLS_INTEGER	64	Set if the store supports hard links
FEATURE_LOCKING	PLS_INTEGER	128	Set if the store supports user-level locks (read-only, write-only, read-write) that can be applied on various items of the store, and if the store uses these lock settings to control various types of access to the locked items. User-level locks are orthogonal to transaction locks and persist beyond the scope of any specific transaction, session, or connection — this implies that the store itself may not be able to clean up after dangling locks, and client-applications need to perform any garbage collection.
FEATURE_LOCK_HIERARCHY	PLS_INTEGER	256	Set if the store allows a user-lock to control access to the entire sub-tree under the locked path name.
FEATURE_LOCK_CONVERT	PLS_INTEGER	512	Set if the store supports upgrade or downgrade of locks from one mode to another

Table 58-5 (Cont.) DBMS_DBFS_CONTENT Constants - Store Features

Constant	Type	Value	Description
FEATURE_VERSIONING	PLS_INTEGER	1024	Set if the store supports at least a linear versioning and version management. Different versions of the same path name are identified by monotonic version numbers, with a version-nonqualified path name representing the latest version.
FEATURE_VERSION_PATH	PLS_INTEGER	2048	Set if the store supports a hierarchical namespace for different versions of a path name
FEATURE_SOFT_DELETES	PLS_INTEGER	4096	Set if the store supports a "soft-delete", that is, the ability to delete a path name and make it invisible to normal operations, but retain the ability to restore the path name later (as long as it has not been overwritten by a new create operation). The store also supports purging soft-deleted path names (making them truly deleted), and navigation modes that show soft-deleted items.
FEATURE_HASHING	PLS_INTEGER	8192	Set if the store automatically computes and maintains some type of a secure hash of the contents of a path name (typically a TYPE_FILE path).
FEATURE_HASH_LOOKUP	PLS_INTEGER	16384	Set if the store allows "content-based addressing", that is, the ability to locate a content item based, not on its path name, but on its content hash.

Table 58-5 (Cont.) DBMS_DBFS_CONTENT Constants - Store Features

Constant	Type	Value	Description
FEATURE_FILTERING	PLS_INTEGER	32768	<p>Set if the store allows clients to pass a filter function (a PL/SQL function conforming to the signature below) that returns a logical boolean indicating if a given store item satisfies a selection predicate. Stores that support filtering may be able to more efficiently perform item listing, directory navigation, and deletions by embedding the filtering logic inside their implementation. If filtering is not supported, clients can retrieve more items than necessary and perform the filtering checks themselves, albeit less efficiently.</p> <p>A filter predicate is a function with the following signature:</p> <pre>function filterFunction(path IN VARCHAR2, store_name IN VARCHAR2, opcode IN INTEGER, item_type IN INTEGER, properties IN DBMS_DBFS_CONTENT_PROPERTIES_T, content IN BLOB) RETURN INTEGER;</pre> <p>Any PL/SQL function conforming to this signature can examine the contents and properties of a store item, and determine if the item satisfies the selection criterion for the current operation. Any nonzero return value results in the DBMS_DBFS_CONTENT interface processing the item as part of the current operation; a return value that is zero or NULL results in the item being skipped from processing.</p>
FEATURE_SEARCHING	PLS_INTEGER	65536	<p>Set if the store allows clients to pass a text-search filter query to locate <code>type_file</code> path names based on their content. Stores that support searching may use indexes to accelerate such searches; otherwise, clients need to build their own indexes, or else search a potentially larger set of items to locate the ones of interest for the current search.</p>
FEATURE_ASOF	PLS_INTEGER	131072	<p>Set if the store allows clients to use a flashback timestamp in query operations (non-mutating GETPATH Procedures and LIST Function).</p>

Table 58-5 (Cont.) DBMS_DBFS_CONTENT Constants - Store Features

Constant	Type	Value	Description
FEATURE_PROVIDER_PROPS	PLS_INTEGER	262144	Set if the store allows per-operation properties (that control the behavior of the store with regard to the current operation, as opposed to properties associated with individual items).
FEATURE_SNAPSHOTS	PLS_INTEGER	524288	Set if the store allows the use of named, read-only snapshots of its contents. It is up to the provider to implement snapshots using any suitable means (including creating immediate copies of the content, or using copy-on-write) and managing dependencies between snapshots and its parent content view.
FEATURE_CLONES	PLS_INTEGER	1048576	Set if the store allows the use of named, writable clones of its contents. It is up to the provider to implement clones using any suitable means (including creating immediate copies of the content, or using copy-on-write) and managing dependencies between clones and its parent content view.
FEATURE_LOCATOR	PLS_INTEGER	2097152	Set if the store allows direct access to file contents through a LOB locator. Stores that internally manipulate the file contents, perhaps by shredding or reassembling them in separate pieces, performing other transformations, and so on, cannot transparently give out a LOB locator to clients. The file contents of these stores should be accessed using the buffer-based interfaces.
FEATURE_CONTENT_ID	PLS_INTEGER	4194304	Set if the store allows a "pathless", contentID-based access to files (there is no notion of a directory, link, or reference in this model)
FEATURE_LAZY_PATH	PLS_INTEGER	8388608	Set if the store allows a lazy binding of a path name to file content elements that are otherwise identified by a contentID; this feature makes sense only in conjunction with FEATURE_CONTENT_ID

Lock Type Constants

Stores that support locking should implement 3 types of locks: `LOCK_READ_ONLY`, `LOCK_WRITE_ONLY`, and `LOCK_READ_WRITE`.

Table 58-6 DBMS_DBFS_CONTENT Constants - Lock Types

Constant	Type	Value	Description
LOCK_READ_ONLY	PLS_INTEGER	1	Locks as read-only
LOCK_WRITE_ONLY	PLS_INTEGER	2	Locks as write-only
LOCK_READ_WRITE	PLS_INTEGER	3	Locks as read-write

Standard Property Constants

Standard properties are well-defined, mandatory properties associated with all content path names that all stores should support (in the manner described by the content interface), with some exceptions. For example, a read-only store need not implement a `modification_time` or `creation_time`.

All standard properties informally use the `STD` namespace, which clients and stores should avoid using.

Table 58-7 DBMS_DBFS_CONTENT Constants - Standard Properties

Constant	Type	Value	Description
STD_ACCESS_TIME	VARCHAR2 (32)	'std:access_time'	TYPECODE_TIMESTAMP in UTC: The time of last access of a path name's contents
STD_ACL	VARCHAR2 (32)	'std:acl'	TYPECODE_VARCHAR2: The access control list (in standard ACL syntax) associated with the path name
STD_CANONICAL_PATH	VARCHAR2 (32)	'std:canonical_path'	TYPECODE_VARCHAR2: The canonical store-specific path name of an item.
STD_CHANGE_TIME	VARCHAR2 (32)	'std:change_time'	TYPECODE_TIMESTAMP in UTC: The time of last change to the metadata of a path name
STD_CHILDREN	VARCHAR2 (32)	'std:children'	TYPECODE_NUMBER: The number of child directories/folders a directory/folder path has (this property should be available in providers that support the FEATURE_FOLDERS feature)
STD_CONTENT_TYPE	VARCHAR2 (32)	'std:content_type'	TYPECODE_NUMBER: The client-supplied mime-type(s) (in standard RFC syntax) describing the (typically <code>type_file</code>) path name. The content type is not necessarily interpreted by the store.
STD_CREATION_TIME	VARCHAR2 (32)	'std:creation_time'	TYPECODE_TIMESTAMP in UTC: The time at which the item was created (once set, this value never changes for the lifetime of the path name)

Table 58-7 (Cont.) DBMS_DBFS_CONTENT Constants - Standard Properties

Constant	Type	Value	Description
STD_DELETED	VARCHAR2 (32)	'std:deleted'	TYPECODE_NUMBER as a BOOLEAN: Set to a nonzero number if the path name has been soft-deleted but not yet purged.
STD_GUID	VARCHAR2 (32)	'std:guid'	TYPECODE_NUMBER: A store-specific unique identifier for a path name. Clients must not depend on the GUID being unique across different stores, but a given (<i>store-name, store-specific-path name</i>) has a stable and unique GUID for its lifetime.
STD_LENGTH	VARCHAR2 (32)	'std:length'	TYPECODE_NUMBER: The length of the content (BLOB) of a TYPE_FILE/TYPE_REFERENCE path, or the length of the referent of a TYPE_LINK symbolic link. Directories do not have a well-defined length and stores are free to set this property to zero, NULL, or any other value.
STD_MODIFICATION_TIME	VARCHAR2 (32)	'std:modification_time'	TYPECODE_TIMESTAMP in UTC: The time of last change to the data associated with a path name. Change to the content of a TYPE_FILE/TYPE_REFERENCE path, the referent of the TYPE_LINK path, and addition or deletion of immediate children in a TYPE_DIRECTORY path, all constitute data changes.
STD_OWNER	VARCHAR2 (32)	'std:owner'	TYPECODE_VARCHAR2: A client-supplied (or implicit) owner name for the path name. The owner name may be used (along with the current "principal") for access checks by stores that support ACLs, locking, or both.
STD_PARENT_GUID	VARCHAR2 (32)	'std:parent_guid'	TYPECODE_NUMBER: A store-specific unique identifier for the parent of a path name. Clients must not depend on the GUID being unique across different stores, but a given (<i>store-name, store-specific-path name</i>) has a stable and unique GUID for its lifetime. STD_PARENT_GUID(path name) == STD_GUID(parent(path name))

Table 58-7 (Cont.) DBMS_DBFS_CONTENT Constants - Standard Properties

Constant	Type	Value	Description
STD_REFERENT	VARCHAR2 (32)	'std:refere nt'	TYPECODE_VARCHAR2: The content of the symbolic link of a TYPE_LINK path; NULL otherwise. As mentioned, the STD_REFERENT can be an arbitrary string and must not necessarily be interpreted as path name by clients (or such interpretation should be done with great care).

Optional Property Constants

Optional properties are well-defined properties (not mandatory) associated with all content path names that all stores are free to support (but only in the manner described by the DBFS content API).

All optional properties informally use the `opt:` namespace, which clients and stores should avoid using.

Table 58-8 DBMS_DBFS_CONTENT Constants - Optional Properties

Constant	Type	Value	Description
OPT_HASH_TYPE	VARCHAR2 (32)	'opt:hash_ type'	TYPECODE_NUMBER: The type of hash provided in the <code>opt_hash_value</code> property; see DBMS_CRYPTO for possible options.
OPT_HASH_VALUE	VARCHAR2 (32)	'opt:hash_ value'	TYPECODE_NUMBER: The hash value of type <code>OPT_HASH_TYPE</code> describing the content of the path name.
OPT_LOCK_COUNT	VARCHAR2 (32)	'opt:lock_ count'	TYPECODE_NUMBER: The number of (compatible) locks placed on a path name. If different principals are allowed to place compatible (read) locks on a path, the <code>opt_locker</code> must specify all lockers (with repeats so that lock counts can be correctly maintained).
OPT_LOCK_DATA	VARCHAR2 (32)	'opt:lock_ data'	TYPECODE_NUMBER: The client-supplied user-data associated with a user-lock, uninterpreted by the store.
OPT_LOCKER	VARCHAR2 (32)	'opt:locke r'	TYPECODE_NUMBER: One or more implicit or client-specified principals that applied a user-lock on a path name.

Table 58-8 (Cont.) DBMS_DBFS_CONTENT Constants - Optional Properties

Constant	Type	Value	Description
OPT_LOCK_STATUS	VARCHAR2 (32)	'opt:lock_status'	TYPECODE_NUMBER: One of the LOCK_READ_ONLY, LOCK_WRITE_ONLY, LOCK_READ_WRITE values describing the type of lock currently applied on a path name.
OPT_VERSION	VARCHAR2 (32)	'opt:version'	TYPECODE_NUMBER: A sequence number for linear versioning of a path name.
OPT_VERSION_PATH	VARCHAR2 (32)	'opt:version_path'	TYPECODE_NUMBER: A version-path name for hierarchical versioning of a path name.
OPT_CONTENT_ID	VARCHAR2 (32)	'opt:content_id'	TYPECODE_NUMBER: A provider-generated store-specific unique contentID in the form of a string for a file content element (that may optionally not be associated with a path; see FEATURE_CONTENT_ID and FEATURE_LAZY_PATH).

Property Access Flag Constants

Content interface methods to get or set properties can use combinations of property access flags to fetch properties from different name spaces in a single interface call.

Table 58-9 DBMS_DBFS_CONTENT Constants - Property Access Flags

Constant	Type	Value	Description
PROP_NONE	PLS_INTEGER	0	None: used when the client is not interested in any properties, and is invoking the content access method for other reasons (path name existence or lockability validation, data access, and so on)
PROP_STD	PLS_INTEGER	1	Mandatory: used when the client is interested in the standard properties; all standard properties are retrieved if this flag is specified.
PROP_OPT	PLS_INTEGER	2	Optional: used when the client is interested in the optional properties; all optional properties are retrieved if this flag is specified.
PROP_USR	PLS_INTEGER	3	User-defined: used when the client is interested in the user-defined properties; all user-defined properties are retrieved if this flag is specified.

Table 58-9 (Cont.) DBMS_DBFS_CONTENT Constants - Property Access Flags

Constant	Type	Value	Description
PROP_ALL	PLS_INTEGER	PROP_STD + PROP_OPT + PROP_USR;	All: an alias for the combination of all standard, optional, and user-defined properties
PROP_DATA	PLS_INTEGER	8	Content: used when the client is interested only in data access, and does not care about properties
PROP_SPC	PLS_INTEGER	16	Specific: used when the client is interested in a mix-and-match of different subsets of various property name spaces; the names of the specific properties to fetch are passed into the content interface method call as arguments, and only these property values are fetched and returned to the client. This is useful in cases where there are a very large number of properties potentially accessible, but the client is interested in only a small number of them (and knows the names of these "interesting" properties beforehand). PROP_SPC is applicable only to the various GETPATH operations. Other operations that specify properties ignore PROP_SPC specifications.

Operation Code Constants

All of the operations in the DBFS content API are represented as abstract opcodes.

Clients can use these opcodes to directly and explicitly by invoking the [CHECKACCESS Function](#) to verify if a particular operation can be invoked by a given principal on a particular path name.

Table 58-10 DBMS_DBFS_CONTENT Constants - Operation Codes

Constant	Type	Value	Description
OP_CREATE	PLS_INTEGER	1	Create a path item
OP_CREATEFILE	PLS_INTEGER	OP_CREATE	Create a file
OP_CREATELINK	PLS_INTEGER	OP_CREATE	Create a soft link
OP_CREATEREERENCE	PLS_INTEGER	OP_CREATE	Create a reference (hard link)

Table 58-10 (Cont.) DBMS_DBFS_CONTENT Constants - Operation Codes

Constant	Type	Value	Description
OP_DELETE	PLS_INTEGER	2	Soft-deletion, purge, and restore operations are all represented by OP_DELETE
OP_DELETEFILE	PLS_INTEGER	OP_DELETE	Delete a file
OP_DELETEDIRECTORY	PLS_INTEGER	OP_DELETE	Delete a directory
OP_RESTORE	PLS_INTEGER	OP_DELETE	Restore a soft-deleted path item
OP_PURGE	PLS_INTEGER	OP_DELETE	Purge a soft-deleted path item
OP_READ	PLS_INTEGER	3	Read from a path item
OP_GET	PLS_INTEGER	OP_READ	Get a path item for either read or update operations
OP_WRITE	PLS_INTEGER	4	Write a path item
OP_PUT	PLS_INTEGER	OP_WRITE	Put (write) to a path item
OP_RENAME	PLS_INTEGER	5	Rename a path item
OP_RENAMEFROM	PLS_INTEGER	OP_RENAME	Operations performed on the source of a rename
OP_RENAMETO	PLS_INTEGER	OP_RENAME	Operations performed on the destination of a rename
OP_SETPATH	PLS_INTEGER	OP_RENAME	Set a path item name
OP_LIST	PLS_INTEGER	6	Perform a path listing
OP_SEARCH	PLS_INTEGER	7	Perform a search
OP_LOCK	PLS_INTEGER	8	Lock a path item
OP_UNLOCK	PLS_INTEGER	9	Unlock a path item
OP_ACL	PLS_INTEGER	10	An implicit operation invoked during an OP_CREATE or OP_PUT that specifies a STD_ACL property; the operation tests to see if the principal is allowed to set or change the ACL of a store item
OP_STORE	PLS_INTEGER	11	A catch-all category for miscellaneous store operations that do not fall under any of the other operational interfaces

58.4 Exceptions

DBFS content API operations can raise any one of these top-level exceptions.

Table 58-11 DBMS_DBFS_CONTENT Exceptions

Exception	Code	Description
PATH_EXISTS	64000	A specified path name already exists
INVALID_PARENT	64001	Parent of a specified path name does not exist
INVALID_PATH	64002	Specified path name does not exist, or is not valid
UNSUPPORTED_OPERATION	64003	An operation unsupported by a store was invoked
INVALID_ARGUMENTS	64004	An operation was invoked with invalid arguments
INVALID_ACCESS	64005	Access control checks failed for the current operation
LOCK_CONFLICT	64006	Current operation failed lock conflict check
INVALID_STORE	64007	An invalid store name was specified
INVALID_MOUNT	64008	An invalid mount point was specified
INVALID_PROVIDER	64009	An invalid provider-package was specified
READONLY_PATH	64010	A mutating operation was invoked on a read-only mount or store

58.5 DBMS_DBFS_CONTENT Operational Notes

This topic lists operational notes for DBMS_DBFS_CONTENT implementation, path names, and other operations.

- [Implementation](#)
- [Path Names](#)
- [Other DBMS_DBFS_CONTENT Operations](#)

Implementation

Since the interconnection of the [DBMS_DBFS_CONTENT](#) interface and the provider SPI is a 1-to-many pluggable architecture, the interface uses dynamic SQL to invoke methods in the provider SPI, this can lead to runtime errors.

There are no explicit `INIT` or `FINI` methods to indicate when the `DBMS_DBFS_CONTENT` interface plugs or unplugs a particular provider SPI. Provider SPIs must be willing to auto-initialize themselves at any SPI entry-point.

All operations performed by a store provider are "stateless" in that they are complete operations unto themselves. If state is necessary to be maintained for some reason, then the state must be maintained in data structures such as auxiliary tables that can be queried as needed.

Path Names

All path names used in the provider SPI are store-qualified in pair form (`store_name`, `pathname`) where the path name is rooted within the store namespace.

Stores and their providers that support contentID-based access (see `FEATURE_CONTENT_ID` in [Table 58-5](#)) also support a form of addressing that is not based on path names. Content items are identified by an explicit store name, a `NULL` path name, and possibly a contentID specified as a parameter or by way of the `OPT_CONTENT_ID` (see [Table 58-8](#)) property.

Not all operations are supported with contentID-based access, and applications should depend only on the simplest create or delete functionality being available.

This table lists other operations and provides links to related discussions.

Other DBMS_DBFS_CONTENT Operations

Table 58-12 Other DBMS_DBFS_CONTENT Operations

Other Operations	See ...
Creation	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on creation operations
Deletion	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on deletion operations
Get (Retrieve) and Put (Insert)	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on Get and Put operations
Rename and Move	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on Rename and Move operations
Directory Navigation and Search	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on Navigation and Search operations
Locking	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on Locking operations
Access Check	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on Access Check operations

58.6 DBMS_DBFS_CONTENT Data Structures

The `DBMS_DBFS_CONTENT` package defines `RECORD` types and `TABLE` types.

RECORD Types

- [FEATURE_T Record Type](#)
- [MOUNT_T Record Type](#)
- [PATH_ITEM_T Record Type](#)
- [PROP_ITEM_T Record Type](#)
- [PROPERTY_T Record Type](#)
- [STORE_T Record Type](#)

TABLE Types

- [FEATURES_T Table Type](#)
- [MOUNTS_T Table Type](#)
- [PATH_ITEMS_T Table Type](#)
- [PROP_ITEMS_T Table Type](#)
- [PROPERTIES_T Table Type](#)
- [STORES_T Table Type](#)

Usage Notes

There is an approximate correspondence between `DBMS_DBFS_CONTENT_PROPERTY_T` and `PROPERTY_T` — the former is a SQL object type that describes the full property tuple, while the latter is a PL/SQL record type that describes only the property value component.

Likewise, there is an approximate correspondence between `DBMS_DBFS_CONTENT_PROPERTIES_T` and `PROPERTIES_T` — the former is a SQL nested table type, while the latter is a PL/SQL hash table type.

Dynamic SQL calling conventions force the use of SQL types, but PL/SQL code may be implemented more conveniently in terms of the hash-table types.

The `DBMS_DBFS_CONTENT` interface provides convenient utility functions to convert between `DBMS_DBFS_CONTENT_PROPERTIES_T` and `PROPERTIES_T` (see `propertiesT2H` and `propertiesH2T`).

Clients can query the `DBMS_DBFS_CONTENT` interface for the list of available stores, determine which store is to handle access to a given path name, and determine the feature set for the store.

58.6.1 DBMS_DBFS_CONTENT FEATURE_T Record Type

This type describes a store mount point and its properties.

Syntax

```
TYPE feature_t IS RECORD (
    feature_name    VARCHAR2(32),
    feature_mask    INTEGER,
    feature_state   VARCHAR2(3));
```

Fields

Table 58-13 MOUNT_T Fields

Field	Description
<code>feature_name</code>	Name of feature
<code>feature_mask</code>	Value used to mask off all other bits other than this feature in the feature value
<code>feature_state</code>	'YES' or 'NO' depending on whether the feature is supported on this store

58.6.2 DBMS_DBFS_CONTENT MOUNT_T Record Type

This type describes a store mount point and its properties.

Syntax

```
TYPE mount_t IS RECORD (
    store_name      VARCHAR2(32),
    store_id        NUMBER,
    provider_name   VARCHAR2(32),
    provider_pkg    VARCHAR2(32),
```

```

provider_id      NUMBER,
provider_version VARCHAR2(32),
store_features   INTEGER,
store_guid       NUMBER,
store_mount      NAME_T,
mount_properties DBMS_DBFS_CONTENT_PROPERTIES_T);

```

Fields

Table 58-14 MOUNT_T Fields

Field	Description
store_name	Name of store
store_id	ID of store
provider_name	Name of the content store
provider_pkg	PL/SQL package name for the content store
provider_id	Unique identifier for the content store
provider_version	Version number for the content store
respos_features	Features supported by this content store
store_guid	Unique ID for this instance of the store
store_mount	Location at which this store instance is mounted
mount_properties	Properties for this mount point (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)

58.6.3 DBMS_DBFS_CONTENT PATH_ITEM_T Record Type

A `PATH_ITEM_T` is a tuple describing a (store, mount) qualified path in a store, with all standard and optional properties associated with it.

Syntax

```

TYPE path_item_t IS RECORD (
  store          NAME_T,
  mount          NAME_T,
  pathname       PATH_T,
  pathtype       VARCHAR2(32),
  filedata       BLOB,
  std_access_time  TIMESTAMP,
  std_acl        VARCHAR2(1024),
  std_change_time  TIMESTAMP,
  std_children    NUMBER,
  std_content_type VARCHAR2(1024),
  std_creation_time  TIMESTAMP,
  std_deleted     INTEGER,
  std_guid        INTEGER,
  std_modification_time  TIMESTAMP,
  std_owner       VARCHAR2(32),
  std_parent_guid  INTEGER,
  std_referent    VARCHAR2(1024),
  opt_hash_type   VARCHAR2(32),
  opt_hash_value  VARCHAR2(128),
  opt_lock_count  INTEGER,
  opt_lock_data   VARCHAR2(128),

```

```

opt_locker          VARCHAR2(128),
opt_lock_status     INTEGER,
opt_version         INTEGER,
opt_version_path    PATH_T,
opt_content_id      CONTENT_ID_T);

```

Fields

Table 58-15 PATH_ITEM_T Fields

Field	Description
store	Name of store
mount	Location at which instance of store is mounted
pathname	Name of path to item
pathtype	Type of object path (see Table 58-4)
filedata	BLOB locator that can be used to access data in the path item
std_access_time	Time of last access of a pathname's contents
std_acl	Access Control List (in standard ACL syntax)
std_change_time	Time of last change to the metadata of a path name
std_children	Number of child directories or folders a directory or folder path (this property should be available in providers that support the <code>feature_folders</code> feature).
std_content_type	One or more client-supplied mime-types (in standard RFC syntax) describing the path name which is typically of <code>type_file</code> . The content type s not necessarily interpreted by the store.
std_creation_time	Time at which the item was created. Once set, this value remains the same for the lifetime of the path name.
std_deleted	Set to a nonzero number if the path name has been soft-deleted but not yet purged (see Table 58-5)
std_guid	Store-specific unique identifier for a path name. Clients must not depend on the GUID being unique across different stores, but a given <i>store-name</i> , <i>store-specific-pathname</i> has a stable and unique GUID for its lifetime.
std_modification_time	Time of last change to the data associated with a path name. Changes to the content of a <code>type_file</code> or <code>type_reference</code> path, the referent of the <code>type_link</code> path, and addition or deletion of immediate children in a <code>type_directory</code> path, all constitute data changes.
std_owner	Client-supplied (or implicit) owner name for the path name
std_parent_guid	Store-specific unique identifier for the parent of a path name. Clients must not depend on the GUID being unique across different stores, but a given <i>store-name</i> , <i>store-specific-pathname</i> has a stable and unique GUID for its lifetime. <code>std_parent_guid(pathname) == std_guid(parent(pathname))</code>
std_referent	Content of the symbolic link of a <code>type_link</code> path, otherwise NULL. As mentioned before, the <code>std_referent</code> can be an arbitrary string and must not necessarily be interpreted as pathname by clients (or such interpretation should be done with great care).

Table 58-15 (Cont.) PATH_ITEM_T Fields

Field	Description
opt_hash_type	Type of hash provided in the opt_hash_value property (see DBMS_CRYPTO for possible options)
opt_hash_value	Hash value of type opt_hash_type describing the content of the path name
opt_lock_count	Number of compatible locks placed on a path name. If different principals are allowed to place compatible (read) locks on a path, the opt_locker must specify all lockers with repeats so that lock counts can be correctly maintained.
opt_lock_data	Client-supplied user-data associated with a user-lock, uninterpreted by the store
opt_locker	One or more implicit or client-specified principals that applied a user-lock on a path name
opt_lock_status	One of the lock_read_only, lock_write_only, lock_read_write values describing the type of lock currently applied on a path name
opt_version	Sequence number for linear versioning of a path name
opt_version_path	Version path name for hierarchical versioning of a path name
opt_content_id	Stringified provider-generated store-specific unique contentID for a file element (that may optionally not be associated with a path (see FEATURE_CONTENT_ID and FEATURE_LAZY_PATH in Table 58-5))

58.6.4 DBMS_DBFS_CONTENT PROP_ITEM_T Record Type

A PROP_ITEM_T is a tuple describing a (store, mount) qualified path in a store, with all user-defined properties associated with it, expanded out into individual (name, value, type) tuples.

Syntax

```
TYPE prop_item_t IS RECORD (
  store          NAME_T,
  mount         NAME_T,
  pathname      PATH_T,
  property_name PROPNAME_T,
  property_value PROPVAL_T,
  property_type INTEGER);
```

Fields

Table 58-16 PROP_ITEM_T Fields

Field	Description
store	Name of store
mount	Location at which instance of store is mounted
pathname	Name of path to item
property_name	Name of the property

Table 58-16 (Cont.) PROP_ITEM_T Fields

Field	Description
property_value	Value of the property
property_type	PL/SQL typecode for the property value

58.6.5 PROPERTY_T Record Type

This type describes a single (value, typecode) property value tuple; the property name is implied.

See [PROPERTIES_T Table Type](#) for more information.

Syntax

```
TYPE property_t IS RECORD (
  propvalue    PROPVAL_T,
  typecode     INTEGER);
```

Fields

Table 58-17 PROPERTY_T Fields

Field	Description
propvalue	Value of property
typecode	Typecode

58.6.6 DBMS_DBFS_CONTENT STORE_T Record Type

This type describes a store registered with and managed by the DBMS_DBFS_CONTENT interface.

Syntax

```
TYPE store_t IS RECORD (
  store_name    VARCHAR2(32),
  store_id      NUMBER,
  provider_name VARCHAR2(32),
  provider_pkg  VARCHAR2(32),
  provider_id   NUMBER,
  provider_version VARCHAR2(32),
  store_features INTEGER,
  store_guid    NUMBER);
```

Fields

Table 58-18 STORET_T Fields

Field	Description
store_name	Name of store

Table 58-18 (Cont.) STORET_T Fields

Field	Description
store_name	ID of store
provider_name	Name of the content store
provider_pkg	PL/SQL package name for the content store
provider_id	Unique identifier for the content store
provider_version	Version number for the content store
respos_features	Features supported by this content store
store_guid	Unique ID for this instance of the store

58.6.7 DBMS_DBFS_CONTENT FEATURES_T Table Type

A table type of FEATURE_T Record Type.

Syntax

```
TYPE features_t IS TABLE OF feature_t;
```

Related Topics

- [DBMS_DBFS_CONTENT FEATURE_T Record Type](#)
This type describes a store mount point and its properties.

58.6.8 MOUNTS_T Table Type

A table type of MOUNT_T Record Type.

Syntax

```
TYPE mounts_t IS TABLE OF mount_t;
```

Related Topics

- [DBMS_DBFS_CONTENT MOUNT_T Record Type](#)
This type describes a store mount point and its properties.

58.6.9 DBMS_DBFS_CONTENT PATH_ITEMS_T Table Type

A table type of PATH_ITEM_T Record Type

Syntax

```
TYPE path_items_t IS TABLE OF path_item_t;
```

Related Topics

- [DBMS_DBFS_CONTENT PATH_ITEM_T Record Type](#)
A PATH_ITEM_T is a tuple describing a (store, mount) qualified path in a store, with all standard and optional properties associated with it.

58.6.10 DBMS_DBFS_CONTENT PROP_ITEMS_T Table Type

A table type of PATH_ITEM_T Record Type.

Syntax

```
TYPE prop_items_t IS TABLE OF prop_item_t;
```

Related Topics

- [DBMS_DBFS_CONTENT PATH_ITEM_T Record Type](#)
A PATH_ITEM_T is a tuple describing a (store, mount) qualified path in a store, with all standard and optional properties associated with it.

58.6.11 DBMS_DBFS_CONTENT PROPERTIES_T Table Type

This is a name-indexed hash table of property tuples. The implicit hash-table association between the index and the value allows the client to build up the full DBMS_DBFS_CONTENT_PROPERTY_T tuples for a PROPERTIES_T.

Syntax

```
TYPE properties_t IS TABLE OF property_t INDEX BY propname_t;
```

58.6.12 STORES_T Table Type

This type describes a store registered with and managed by the DBMS_DBFS_CONTENT interface.

Syntax

```
TYPE stores_t IS TABLE OF store_t;
```

58.7 Summary of DBMS_DBFS_CONTENT Subprograms

This table lists and describes the subprograms used in the DBMS_DBFS_CONTENT Package.

Table 58-19 DBMS_DBFS_CONTENT Package Subprograms

Subprogram	Description
CHECKACCESS Function	Reports if the user (principal) can perform the specified operation on the given path
CHECKSPI Functions and Procedures	Checks if a user-provided package implements all of the DBMS_DBFS_CONTENT_SPI subprograms with the proper signatures, and reports on the conformance.
CREATEDIRECTORY Procedures	Creates a directory
CREATEFILE Procedures	Creates a file
CREATELINK Procedures	Creates a new reference to the source file system element
CREATEREFERENCE Procedures	Creates a physical link to an already existing file system element

Table 58-19 (Cont.) DBMS_DBFS_CONTENT Package Subprograms

Subprogram	Description
DECODEFEATURES Function	Given a feature bit set integer value, returns a <code>FEATURES_T</code> table of the feature bits as <code>FEATURE_T</code> records
DELETECONTENT Procedure	Deletes the file specified by the given <code>contentID</code>
DELETEDIRECTORY Procedure	Deletes a directory
DELETEFILE Procedure	Deletes a file
FEATURENAME Function	Given a feature bit, returns a <code>VARCHAR2</code> of that feature's name
FLUSHSTATS Function	Flushes <code>DBMS_DBFS_CONTENT</code> statistics to disk
GETDEFAULTACL Procedure	Returns the <code>ACL</code> parameter of the default context
GETDEFAULTASOF Procedure	Returns the <code>asof</code> parameter of the default context
GETDEFAULTCONTEXT Procedure	Returns the default context
GETDEFAULTOWNER Procedure	Returns the <code>owner</code> parameter of the default context
GETDEFAULTPRINCIPAL Procedure	Returns the <code>principal</code> parameter of the default context
GETFEATURESBYMOUNT Function	Returns features of a store by mount point
GETFEATURESBYNAME Function	Returns features of a store by store name
GETFEATURESBYPATH Function	Returns features of a store by path
GETPATHBYMOUNTID Function	Returns the full absolute path name
GETPATH Procedures	Returns existing path items (such as files and directories)
GETPATHBYSTOREID Function	If the underlying <code>GUID</code> is found in the underlying store, returns the store-qualified path name
GETPATHNOWAIT Procedures	Implies that the operation is for an update, and, if implemented, allows providers to return an exception (<code>ORA-00054</code>) rather than wait for row locks.
GETSTOREBYMOUNT Function	Returns a store by way of its mount point
GETSTOREBYNAME Function	Returns a store by way of its name
GETSTOREBYPATH Function	Returns a store by way of its path
GETSTATS Procedure	Returns information about <code>DBMS_DBFS_CONTENT</code> statistics collection
GETTRACE Function	Returns whether or not <code>DBMS_DBFS_CONTENT</code> tracing is turned on
GETVERSION Function	Returns the version of the <code>DBMS_DBFS_CONTENT</code> interface in a standardized format associated with a store
LIST Function	Lists the path items in the specified path meeting the specified filter and other criteria
LISTALLCONTENT Function	Lists all path items in all mounts
LISTALLPROPERTIES Function	Returns a table of all properties for all path items in all mounts
LISTMOUNTS Function	Lists all available mount points, their backing stores, and the store features
LISTSTORES Function	Lists all available stores and their features

Table 58-19 (Cont.) DBMS_DBFS_CONTENT Package Subprograms

Subprogram	Description
LOCKPATH Procedure	Applies user-level locks to the given valid path name
MOUNTSTORE Procedure	Mounts a previously registered store and binds it to the mount point
NORMALIZEPATH Functions	Converts a store-specific or full-absolute path name into normalized form
PROPANY Functions	Provides constructors that take one of a variety of types and return a <code>PROPERTY_T</code>
PROPERTIESH2T Function	Converts a <code>PROPERTY_T</code> hash to a <code>DBMS_DBFS_CONTENT_PROPERTIES_T</code> table
PROPERTIEST2H Function	Converts a <code>DBMS_DBFS_CONTENT_PROPERTIES_T</code> table to a <code>PROPERTY_T</code> hash
PROPNUMBER Function	Is a constructor that takes a <code>NUMBER</code> and returns a <code>PROPERTY_T</code>
PROPRAW Function	Is a constructor that takes a <code>RAW</code> and returns a <code>PROPERTY_T</code>
PROPTIMESTAMP Function	Is a constructor that takes a <code>TIMESTAMP</code> and returns a <code>PROPERTY_T</code>
PROPVARCHAR2 Function	Is a constructor that takes a <code>VARCAHR2</code> and returns a <code>PROPERTY_T</code>
PURGEALL Procedure	Purges all soft-deleted entries matching the path and optional filter criteria
PURGEPATH Procedure	Purges any soft-deleted versions of the given path item
PUTPATH Procedures	Creates a new path item
REGISTERSTORE Procedure	Registers a new store
RENAMEPATH Procedures	Renames or moves a path
RESTOREALL Procedure	Restores all soft-deleted path items meeting the path and filter criteria
RESTOREPATH Procedure	Restores all soft-deleted path items that match the given path and filter criteria
SETDEFAULTACL Procedure	Sets the ACL parameter of the default context
SETDEFAULTASOF Procedure	Sets the "as of" parameter of the default context
SETDEFAULTCONTEXT Procedure	Sets the default context
SETDEFAULTOWNER Procedure	Sets the "owner" parameter of the default context
SETDEFAULTPRINCIPAL Procedure	Sets the "principal" parameter of the default context
SETPATH Procedures	Assigns a path name to a path item represented by contentID
SETSTATS Procedure	Enables and disables statistics collection
SETTRACE Procedure	Sets <code>DBMS_DBFS_CONTENT</code> tracing on or off
SPACEUSAGE Procedure	Queries file system space usage statistics
TRACE Procedure	Returns a <code>CLOB</code> that contains the evaluation results
TRACEENABLED Function	Determines if the current trace "severity" set by the SETTRACE Procedure is at least as high as the given trace level
UNLOCKPATH Procedure	Unlocks path items that were previously locked with the LOCKPATH Procedure

Table 58-19 (Cont.) DBMS_DBFS_CONTENT Package Subprograms

Subprogram	Description
UNMOUNTSTORE Procedure	Unmounts a registered store
UNREGISTERSTORE Procedure	Unregisters a store

58.7.1 CHECKACCESS Function

This function reports if the user (*principal*) can perform the specified operation on the given path. This enables verifying the validity of an operation without attempting to perform the operation. If `CHECKACCESS` returns 0, then the subprogram invoked to implement that operation should fail with an error.

Syntax

```
DBMS_DBFS_CONTENT.CHECKACCESS (
  path          IN      VARCHAR2,
  pathtype     IN      INTEGER,
  operation     IN      VARCHAR2,
  principal    IN      VARCHAR2,
  store_name   IN      VARCHAR2 DEFAULT NULL)
RETURN BOOLEAN;
```

Parameters

Table 58-20 CHECKACCESS Procedure Parameters

Parameter	Description
<code>path</code>	Name of path to check for access
<code>pathtype</code>	Type of object <code>path</code> represents (see Table 58-4)
<code>operation</code>	Operation to be checked (see Table 58-8)
<code>principal</code>	File system user for whom the access check is made
<code>store_name</code>	Name of store

Usage Notes

Whether or not the user invokes this function, a store that supports access control internally performs these checks to guarantee security.

58.7.2 CHECKSPI Functions and Procedures

Given the name of a putative `DBMS_DBFS_CONTENT_SPI` conforming package, this function or procedure checks whether the package implements all of the provider subprograms with the proper signatures, and reports on the conformance.

Syntax

```
DBMS_DBFS_CONTENT.CHECKSPI (
  package_name IN      VARCHAR2)
RETURN CLOB;
```

```
DBMS_DBFS_CONTENT.CHECKSPI (
  schema_name      IN          VARCHAR2,
  package_name     IN          VARCHAR2)
return clob;
```

```
DBMS_DBFS_CONTENT.CHECKSPI (
  package_name     IN          VARCHAR2,
  chk              IN OUT NOCOPY CLOB);
```

```
DBMS_DBFS_CONTENT.CHECKSPI (
  schema_name     in          VARCHAR2,
  package_name    in          VARCHAR2,
  chk             in out nocopy CLOB);
```

Parameters

Table 58-21 CHECKSPI Procedure Parameters

Parameter	Description
package_name	Name of package
schema_name	Name of schema
chk	CLOB that contains the evaluation results

Usage Notes

- The functional form returns a cached temporary LOB of session duration with the results of the analysis. The caller is expected to manage the lifetime of this LOB, as needed.
- The procedural form generates the results of the analysis into the `chk` LOB parameter; if the value passed in is `NULL`, the results are written to the foreground trace file provided that `DBMS_DBFS_CONTENT` interface tracing is enabled. If neither tracing is enabled nor a valid LOB passed in, the checker does not provide any useful indication of the analysis (other than raise exceptions if it encounters a serious error).
- If `schema_name` is `NULL`, standard name resolution rules (current schema, private synonym, public synonym) are used to try and locate a suitable package to analyze.

58.7.3 CREATEDIRECTORY Procedures

This procedure creates a directory.

Syntax

```
DBMS_DBFS_CONTENT.CREATEDIRECTORY (
  path           IN          VARCHAR2,
  properties     IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  prop_flags     IN          INTEGER      DEFAULT PROP_STD,
  recurse       IN          BOOLEAN      DEFAULT FALSE,
  store_name     IN          VARCHAR2    DEFAULT NULL,
  principal      IN          VARCHAR2    DEFAULT NULL);
```

```
DBMS_DBFS_CONTENT.CREATEDIRECTORY (
  path           IN          VARCHAR2,
  properties     IN OUT NOCOPY PROPERTIES_T,
  prop_flags     IN          INTEGER      DEFAULT PROP_STD,
  recurse       IN          BOOLEAN      DEFAULT FALSE,
```

```

store_name IN          VARCHAR2  DEFAULT NULL,
principal  IN          VARCHAR2  DEFAULT NULL);

```

Parameters

Table 58-22 CREATEDIRECTORY Procedure Parameters

Parameter	Description
path	Name of path to the directory
properties	One or more properties and their values to be set, returned, or both, depending on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
prop_flags	Determines which properties are set, returned, or both. Default is <code>PROP_STD</code> . Specify properties to be returned by setting <code>PROP_SPC</code> (see Table 58-9), and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
recurse	If 0, do not execute recursively; otherwise, recursively create the directories above the given directory
store_name	Name of store
principal	File system user for whom the access check is made

58.7.4 CREATEFILE Procedures

This procedure creates a file.

Syntax

```

DBMS_DBFS_CONTENT.CREATEFILE (
  path          IN          VARCHAR2,
  properties    IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  content       IN OUT NOCOPY BLOB,
  prop_flags    IN          INTEGER      DEFAULT (PROP_STD + PROP_DATA),
  store_name    IN          VARCHAR2    DEFAULT NULL,
  principal     IN          VARCHAR2    DEFAULT NULL);

```

```

DBMS_DBFS_CONTENT.CREATEFILE (
  path          IN          VARCHAR2,
  properties    IN OUT NOCOPY PROPERTIES_T,
  content       IN OUT NOCOPY BLOB,
  prop_flags    IN          INTEGER      DEFAULT (PROP_STD + PROP_DATA),
  store_name    IN          VARCHAR2    DEFAULT NULL,
  principal     IN          VARCHAR2    DEFAULT NULL);

```

Parameters

Table 58-23 CREATEFILE Procedure Parameters

Parameter	Description
path	Name of path to the file
properties	One or more properties and their values to be set, returned, or both, depending on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)

Table 58-23 (Cont.) CREATEFILE Procedure Parameters

Parameter	Description
content	BLOB holding data with which to populate the file (optional)
prop_flags	Determines which properties are set, returned, or both. Default is PROP_STD. Specify properties to be returned by setting prop_spec, and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
store_name	Name of store
principal	File system user for whom the access check is made

58.7.5 CREATELINK Procedures

This procedure creates a new link element `srcPath` with the value of `dstPath`. The value of `dstPath` is not validated or interpreted in any way by this procedure. This is analogous to a UNIX file system symbolic link.

Syntax

```
DBMS_DBFS_CONTENT.CREATELINK (
  srcPath      IN          VARCHAR2,
  dstPath      IN          VARCHAR2,
  properties    IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  prop_flags   IN          INTEGER      DEFAULT PROP_STD,
  store_name   IN          VARCHAR2    DEFAULT NULL,
  principal    IN          VARCHAR2    DEFAULT NULL);
```

```
DBMS_DBFS_CONTENT.CREATELINK (
  srcPath      IN          VARCHAR2,
  dstPath      IN          VARCHAR2,
  properties    IN OUT NOCOPY PROPERTIES_T,
  prop_flags   IN          INTEGER      DEFAULT PROP_STD,
  store_name   IN          VARCHAR2    DEFAULT NULL,
  principal    IN          VARCHAR2    DEFAULT NULL);
```

Parameters

Table 58-24 CREATELINK Procedure Parameters

Parameter	Description
srcPath	File system entry to create.
dstPath	Value to associate with <code>srcPath</code> .
properties	One or more properties and their values to be set, returned depending, or both, on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
prop_flags	Determines which properties are set, returned, or both. Default is PROP_STD. Specify properties to be returned by setting <code>prop_spec</code> , and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.

Table 58-24 (Cont.) CREATELINK Procedure Parameters

Parameter	Description
store_name	Name of store
principal	File system user for whom the access check is made

58.7.6 CREATEREERENCE Procedures

This procedure creates a physical link, `srcPath`, to an already existing file system element, `dstPath` (such as file or directory). The resulting entry shares the same metadata structures as the value of the `dstPath` parameter, and so is similar to incrementing a reference count on the file system element. This is analogous to a UNIX file system hard link.

Syntax

```
DBMS_DBFS_CONTENT.CREATEREFERENCE (
    srcPath      IN          VARCHAR2,
    dstPath      IN          VARCHAR2,
    properties   IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
    prop_flags   IN          INTEGER      DEFAULT PROP_STD,
    store_name   IN          VARCHAR2    DEFAULT NULL,
    principal    IN          VARCHAR2    DEFAULT NULL);
```

```
DBMS_DBFS_CONTENT.CREATEREFERENCE (
    srcPath      IN          VARCHAR2,
    dstPath      IN          VARCHAR2,
    properties   IN OUT NOCOPY PROPERTIES_T,
    prop_flags   IN          INTEGER      DEFAULT PROP_STD,
    store_name   IN          VARCHAR2    DEFAULT NULL,
    principal    IN          VARCHAR2    DEFAULT NULL);
```

Parameters

Table 58-25 CREATEREERENCE Procedure Parameters

Parameter	Description
srcPath	File system entry to create.
dstPath	Path that is the reference to <code>srcPath</code> .
properties	One or more properties and their values to be set, returned, or both, depending on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
prop_flags	Determines which properties are set, returned. Default is <code>PROP_STD</code> . Specify properties to be returned by setting <code>prop_spec</code> , and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
store_name	Name of store
principal	File system user for whom the access check is made

58.7.7 DECODEFEATURES Function

Given a feature bit set integer value, this function returns a `FEATURES_T` table of the feature bits as `FEATURE_T` records.

Syntax

```
DBMS_DBFS_CONTENT.DECODEFEATURES (
    featureSet      IN      INTEGER)
    RETURN FEATURES_T DETERMINISTIC PIPELINED;
```

Parameters

Table 58-26 DECODEFEATURES Function Parameters

Parameter	Description
featureSet	Feature set

Return Values

[FEATURES_T Table Type](#)

58.7.8 DELETECONTENT Procedure

This procedure deletes the file specified by the given contentID.

Syntax

```
DBMS_DBFS_CONTENT.DELETECONTENT (
    store_name      IN      VARCHAR2      DEFAULT NULL,
    contentID       IN      RAW,
    filter          IN      VARCHAR2      DEFAULT NULL,
    soft_delete     IN      BOOLEAN       DEFAULT NULL,
    principal       IN      VARCHAR2      DEFAULT NULL);
```

Parameters

Table 58-27 DELETECONTENT Procedure Parameters

Parameter	Description
store_name	Name of store
contentID	Unique identifier for the file to be deleted
filter	A filter, if any, to be applied
soft_delete	If 0, execute a hard (permanent) delete. For any value other than 0, perform a soft delete (see <i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> , Deletion Operations).
principal	File system user for whom the access check is made

58.7.9 DELETEDIRECTORY Procedure

This procedure deletes a directory.

If `recurse` is nonzero, it recursively deletes all elements of the directory. A filter, if supplied, determines which elements of the directory are deleted.

Syntax

```
DBMS_DBFS_CONTENT.DELETEDIRECTORY (
  path          IN      VARCHAR2,
  filter        IN      VARCHAR2   DEFAULT NULL,
  soft_delete   IN      BOOLEAN    DEFAULT NULL,
  recurse       IN      BOOLEAN    DEFAULT FALSE,
  store_name    IN      VARCHAR2   DEFAULT NULL,
  principal     IN      VARCHAR2   DEFAULT NULL);
```

Parameters

Table 58-28 DELETEDIRECTORY Procedure Parameters

Parameter	Description
<code>path</code>	Name of path to the directory
<code>filter</code>	A filter, if any, to be applied
<code>soft_delete</code>	If 0, execute a hard (permanent) delete. For any value other than 0, perform a soft delete see <i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> , Deletion Operations.
<code>recurse</code>	If 0, do not execute recursively. Otherwise, recursively delete the directories and files below the given directory.
<code>store_name</code>	Name of store
<code>principal</code>	File system user for whom the access check is made

58.7.10 DELETEFILE Procedure

This procedure deletes the specified file.

Syntax

```
DBMS_DBFS_CONTENT.DELETEFILE (
  path          IN      VARCHAR2,
  filter        IN      VARCHAR2   DEFAULT NULL,
  soft_delete   IN      BOOLEAN    DEFAULT NULL,
  store_name    IN      VARCHAR2   DEFAULT NULL,
  principal     IN      VARCHAR2   DEFAULT NULL);
```

Parameters

Table 58-29 DELETEFILE Procedure Parameters

Parameter	Description
<code>path</code>	Name of path to the file

Table 58-29 (Cont.) DELETEFILE Procedure Parameters

Parameter	Description
filter	A filter, if any, to be applied
soft_delete	If 0, execute a hard (permanent) delete. For any value other than 0, perform a soft delete (see <i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> , Deletion Operations).
store_name	Name of store
principal	File system user for whom the access check is made

58.7.11 FEATURENAME Function

Given a feature bit, this function returns a VARCHAR2 of that feature's name.

Syntax

```
DBMS_DBFS_CONTENT.FEATURENAME (
    featureBit          IN          INTEGER)
RETURN VARCHAR2 DETERMINISTIC;
```

Parameters

Table 58-30 FEATURENAME Function Parameters

Parameter	Description
featureBit	Bit representation of the feature (see Table 58-5)

Return Values

Name of the feature

58.7.12 FLUSHSTATS Function

This procedure flushes DBMS_DBFS_CONTENT statistics to disk.

Syntax

```
DBMS_DBFS_CONTENT.FLUSHSTATS;
```

58.7.13 GETDEFAULTACL Procedure

This procedure returns the ACL parameter of the default context. This information can be inserted explicitly by way of argument into other method calls, allowing for a more fine-grained control.

Syntax

```
DBMS_DBFS_CONTENT.GETDEFAULTACL (
    acl          OUT NOCOPY          VARCHAR2);
```

Parameters

Table 58-31 GETDEFAULTACL Procedure Parameters

Parameter	Description
acl	ACL for all new elements created (implicitly or explicitly) by the current operation

58.7.14 GETDEFAULTASOF Procedure

This procedure returns the "as of" parameter of the default context. This information can be inserted explicitly by way of argument into other method calls, allowing for a more fine-grained control.

Syntax

```
DBMS_DBFS_CONTENT.GETDEFAULTASOF (
  asof      OUT NOCOPY      TIMESTAMP);
```

Parameters

Table 58-32 GETDEFAULTASOF Procedure Parameters

Parameter	Description
asof	The "as of" timestamp at which the underlying read-only operation (or its read-only sub-components) executes

58.7.15 GETDEFAULTCONTEXT Procedure

This procedure returns the default context. The information contained in the context can be inserted explicitly by way of arguments to the various method calls, allowing for fine-grained control over individual operations.

Syntax

```
DBMS_DBFS_CONTENT.GETDEFAULTCONTEXT (
  principal  OUT NOCOPY  VARCHAR2,
  owner      OUT NOCOPY  VARCHAR2,
  acl        OUT NOCOPY  VARCHAR2,
  asof       OUT NOCOPY  TIMESTAMP);
```

Parameters

Table 58-33 GETDEFAULTCONTEXT Procedure Parameters

Parameter	Description
principal	Agent (principal) invoking the current operation
owner	Owner for new elements created (implicitly or explicitly) by the current operation

Table 58-33 (Cont.) GETDEFAULTCONTEXT Procedure Parameters

Parameter	Description
acl	ACL for all new elements created (implicitly or explicitly) by the current operation
asof	The "as of" timestamp at which the underlying read-only operation (or its read-only sub-components) executes

58.7.16 GETDEFAULTOWNER Procedure

This procedure returns the "owner" parameter of the default context. This information can be inserted explicitly by way of argument into other method calls, allowing for a more fine-grained control.

Syntax

```
DBMS_DBFS_CONTENT.GETDEFAULTOWNER (
    principal IN VARCHAR2);
```

Parameters

Table 58-34 GETDEFAULTOWNER Procedure Parameters

Parameter	Description
owner	Owner for new elements created (implicitly or explicitly) by the current operation

58.7.17 GETDEFAULTPRINCIPAL Procedure

This procedure returns the "principal" parameter of the default context. This information contained can be inserted explicitly by way of argument into other method calls, allowing for a more fine-grained control.

Syntax

```
DBMS_DBFS_CONTENT.GETDEFAULTPRINCIPAL (
    principal OUT NOCOPY VARCHAR2);
```

Parameters

Table 58-35 GETDEFAULTPRINCIPAL Procedure Parameters

Parameter	Description
principal	Agent (principal) invoking the current operation

58.7.18 GETFEATURESBYMOUNT Function

This function returns features of a store by mount point.

Syntax

```
DBMS_DBFS_CONTENT.GETFEATURESBYMOUNT (  
    store_mount    IN    VARCHAR2)  
    RETURN INTEGER;
```

Parameters

Table 58-36 GETFEATURESBYMOUNT Function Parameters

Parameter	Description
store_mount	Mount point

Return Values

A bit mask of supported features (see [FEATURES_T Table Type](#))

58.7.19 GETFEATURESBYNAME Function

This function returns features of a store by store name.

Syntax

```
DBMS_DBFS_CONTENT.GETFEATURESBYNAME (  
    store_name    IN    VARCHAR2)  
    RETURN INTEGER;
```

Parameters

Table 58-37 GETFEATURESBYNAME Function Parameters

Parameter	Description
store_name	Name of store

Return Values

A bit mask of supported features (see [FEATURES_T Table Type](#))

58.7.20 GETFEATURESBYPATH Function

This function returns features of a store by path.

Syntax

```
DBMS_DBFS_CONTENT.GETFEATURESBYPATH (  
    path    IN    PATH_T)  
    RETURN INTEGER;
```


Parameters

Table 58-38 GETFEATURESBYPATH Function Parameters

Parameter	Description
path	PATH_T

Return Values

A bit mask of supported features (see [FEATURES_T Table Type](#))

58.7.21 GETPATH Procedures

This procedure returns existing path items (such as files and directories). This includes both data and metadata (properties).

The client can request (using `prop_flags`) that specific properties be returned. File path names can be read either by specifying a BLOB locator using the `prop_data` bitmask in `prop_flags` (see [Table 58-9](#)) or by passing one or more RAW buffers.

When `forUpdate` is 0, this procedure also accepts a valid `asof` timestamp parameter as part of `ctx` that can be used by stores to implement "as of" style flashback queries. Mutating versions of the GETPATH Procedures do not support these modes of operation.

Syntax

```
DBMS_DBFS_CONTENT.GETPATH (
    path          IN          VARCHAR2,
    properties    IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
    content       OUT NOCOPY  BLOB,
    item_type     OUT          INTEGER,
    prop_flags    IN          INTEGER          DEFAULT (PROP_STD +
                                                PROP_OPT +
                                                PROP_DATA),

    asof          IN          TIMESTAMP      DEFAULT NULL,
    forUpdate     IN          BOOLEAN        DEFAULT FALSE,
    deref         IN          BOOLEAN        DEFAULT FALSE,
    store_name    IN          VARCHAR2      DEFAULT NULL,
    principal     IN          VARCHAR2      DEFAULT NULL);
```

```
DBMS_DBFS_CONTENT.GETPATH (
    path          IN          VARCHAR2,
    properties    IN OUT NOCOPY PROPERTIES_T,
    content       OUT NOCOPY  BLOB,
    item_type     OUT          INTEGER,
    prop_flags    IN          INTEGER          DEFAULT (PROP_STD +
                                                PROP_OPT +
                                                PROP_DATA),

    asof          IN          TIMESTAMP      DEFAULT NULL,
    forUpdate     IN          BOOLEAN        DEFAULT FALSE,
    deref         IN          BOOLEAN        DEFAULT FALSE,
    store_name    IN          VARCHAR2      DEFAULT NULL,
    principal     IN          VARCHAR2      DEFAULT NULL);
```

```
DBMS_DBFS_CONTENT.GETPATH (
    path          IN          VARCHAR2,
```

```

properties IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
amount     IN OUT      NUMBER,
offset     IN          NUMBER,
buffers    OUT NOCOPY RAW,
prop_flags IN          INTEGER      DEFAULT (PROP_STD +
                                           PROP_OPT +
                                           PROP_DATA),

asof       IN          TIMESTAMP    DEFAULT NULL,
store_name IN          VARCHAR2     DEFAULT NULL,
principal  IN          VARCHAR2     DEFAULT NULL);

DBMS_DBFS_CONTENT.GETPATH (
  path       IN          VARCHAR2,
  properties IN OUT NOCOPY PROPERTIES_T,
  amount     IN OUT      NUMBER,
  offset     IN          NUMBER,
  buffers    OUT NOCOPY RAW,
  prop_flags IN          INTEGER      DEFAULT (PROP_STD +
                                           PROP_OPT +
                                           PROP_DATA),

  asof       IN          TIMESTAMP    DEFAULT NULL,
  store_name IN          VARCHAR2     DEFAULT NULL,
  principal  IN          VARCHAR2     DEFAULT NULL);

DBMS_DBFS_CONTENT.GETPATH (
  path       IN          VARCHAR2,
  properties IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  amount     IN OUT      NUMBER,
  offset     IN          NUMBER,
  buffers    OUT NOCOPY DBMS_DBFS_CONTENT_RAW_T,
  prop_flags IN          INTEGER      DEFAULT (PROP_STD +
                                           PROP_OPT +
                                           PROP_DATA),

  asof       IN          TIMESTAMP    DEFAULT NULL,
  store_name IN          VARCHAR2     DEFAULT NULL,
  principal  IN          VARCHAR2     DEFAULT NULL);

DBMS_DBFS_CONTENT.GETPATH (
  path       IN          VARCHAR2,
  properties IN OUT NOCOPY PROPERTIES_T,
  amount     IN OUT      NUMBER,
  offset     IN          NUMBER,
  buffers    OUT NOCOPY DBMS_DBFS_CONTENT_RAW_T,
  prop_flags IN          INTEGER      DEFAULT (PROP_STD +
                                           PROP_OPT +
                                           PROP_DATA),

  asof       IN          TIMESTAMP    DEFAULT NULL,
  store_name IN          VARCHAR2     DEFAULT NULL,
  principal  IN          VARCHAR2     DEFAULT NULL);

```

Parameters

Table 58-39 GETPATH Procedure Parameters

Parameter	Description
path	Name of path to path items

Table 58-39 (Cont.) GETPATH Procedure Parameters

Parameter	Description
properties	One or more properties and their values to be returned depending on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
content	BLOB holding data which populates the file (optional)
item_type	Type of the path item specified (see Table 58-4)
amount	On input, number of bytes to be read. On output, number of bytes read
offset	Byte offset from which to begin reading
buffer	Buffer to which to write
buffers	Buffers to which to write
prop_flags	Determines which properties are set, returned, or both. Default is <code>PROP_STD</code> . Specify properties to be returned by setting <code>prop_spec</code> , and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
asof	The "as of" timestamp at which the underlying read-only operation (or its read-only sub-components) executes
forUpdate	Specifies that a lock should be taken to signify exclusive write access to the path item
deref	If nonzero, attempts to resolve the given path item to actual data provided it is a reference
store_name	Name of store
principal	Agent (principal) invoking the current operation

58.7.22 GETPATHBYMOUNTID Function

If the underlying GUID is found in the underlying store, this function returns the full absolute path name.

Syntax

```
DBMS_DBFS_CONTENT.GETPATHBYMOUNTID (
  store_mount      IN      VARCHAR2,
  guid             IN      INTEGER)
RETURN VARCHAR2;
```

Parameters

Table 58-40 GETPATHBYMOUNTID Function Parameters

Parameter	Description
store_mount	Mount point in which the path item with <code>guid</code> resides
guid	Unique ID for the path item

Usage Notes

If the GUID is unknown, a `NULL` value is returned. Clients are expected to handle this as appropriate.

Return Values

Path of the path item represented by GUID in `store_mount`

58.7.23 GETPATHBYSTOREID Function

If the underlying GUID is found in the underlying store, this function returns the store-qualified path name.

Syntax

```
DBMS_DBFS_CONTENT.GETPATHBYSTOREID (
  store_name      IN      VARCHAR2,
  guid            IN      INTEGER)
RETURN VARCHAR2;
```

Parameters

Table 58-41 GETPATHBYSTOREID Function Parameters

Parameter	Description
<code>store_name</code>	Name of store
<code>guid</code>	Unique ID representing the desired path item

Usage Notes

If the GUID is unknown, a `NULL` value is returned. Clients are expected to handle this as appropriate.

Return Values

Store-qualified path name represented by the GUID

58.7.24 GETPATHNOWAIT Procedures

This procedure implies that the operation is for an update, and, if implemented, allows providers to return an exception (ORA-00054) rather than wait for row locks.

See `FEATURE_NOWAIT` in [Table 58-5](#) for more information.

Syntax

```
DBMS_DBFS_CONTENT.GETPATHNOWAIT (
  path           IN          VARCHAR2,
  properties     IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  content        OUT NOCOPY  BLOB,
  item_type      OUT          INTEGER,
  prop_flags     IN          INTEGER      DEFAULT (PROP_STD +
                                     PROP_OPT +
                                     PROP_DATA),
```

```

deref          IN          BOOLEAN          DEFAULT FALSE,
store_name     IN          VARCHAR2        DEFAULT NULL,
principal      IN          VARCHAR2        DEFAULT NULL);

DBMS_DBFS_CONTENT.GETPATHNOWAIT (
  path          IN          VARCHAR2,
  properties    IN OUT NOCOPY PROPERTIES_T,
  content       OUT NOCOPY BLOB,
  item_type     OUT          INTEGER,
  prop_flags    IN          INTEGER          DEFAULT (PROP_STD +
                                           PROP_OPT +
                                           PROP_DATA),
  deref         IN          BOOLEAN          DEFAULT FALSE,
  store_name    IN          VARCHAR2        DEFAULT NULL,
  principal     IN          VARCHAR2        DEFAULT NULL);

```

Parameters

Table 58-42 GETPATHNOWAIT Procedure Parameters

Parameter	Description
path	Name of path to path items
properties	One or more properties and their values to be returned depending on prop_flags (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
content	BLOB holding data which populates the file (optional)
item_type	Type of the path item specified (see Table 58-4)
prop_flags	Determines which properties are returned. Default is PROP_STD. Specify properties to be returned by setting prop_spec, and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
asof	The "as of" timestamp at which the underlying read-only operation (or its read-only sub-components) executes
deref	If nonzero, attempts to resolve the given path item to actual data provided it is a reference
store_name	Name of store
principal	Agent (principal) invoking the current operation

58.7.25 GETSTOREBYMOUNT Function

This function returns a store by way of its name.

Syntax

```

DBMS_DBFS_CONTENT.GETSTOREBYMOUNT (
  store_mount   IN          VARCHAR2)
RETURN STORE_T;

```

Parameters

Table 58-43 GETSTOREBYMOUNT Function Parameters

Parameter	Description
store_mount	Location at which the store instance is mounted

Return Values

[STORE_T Record Type](#)

58.7.26 GETSTOREBYNAME Function

This function returns a store by way of its name.

Syntax

```
DBMS_DBFS_CONTENT.GETSTOREBYNAME (
    store_name    IN    VARCHAR2)
RETURN STORE_T;
```

Parameters

Table 58-44 GETSTOREBYNAME Function Parameters

Parameter	Description
store_name	Name of store

Return Values

[STORE_T Record Type](#)

58.7.27 GETSTOREBYPATH Function

This function returns a store by way of its path.

Syntax

```
DBMS_DBFS_CONTENT.GETSTOREBYPATH (
    path    IN    PATH_T)
RETURN STORE_T;
```

Parameters

Table 58-45 GETSTOREBYPATH Function Parameters

Parameter	Description
path	PATH_T s

Return Values[STORE_T Record Type](#)

58.7.28 GETSTATS Procedure

This procedure returns information about DBMS_DBFS_CONTENT statistics collection.

Syntax

```
DBMS_DBFS_CONTENT.GETSTATS (  
    enabled          OUT   BOOLEAN,  
    flush_time      OUT   INTEGER,  
    flush_count     OUT   INTEGER);
```

Parameters**Table 58-46 GETSTATS Procedure Parameters**

Parameter	Description
enabled	Whether statistics collection is enabled
flush_time	How often to flush the statistics to disk in centiseconds
flush_count	Number of operations to allow between statistics flushes

58.7.29 GETTRACE Function

This function returns whether DBMS_DBFS_CONTENT tracing is turned on or not.

Syntax

```
DBMS_DBFS_CONTENT.GETTRACE  
    RETURN INTEGER.
```

Return Values

Returns zero if tracing is off, non-zero if tracing is on.

58.7.30 GETVERSION Function

This function marks each version of the DBMS_DBFS_CONTENT interface.

Syntax

```
DBMS_DBFS_CONTENT.GETVERSION (  
    RETURN VARCHAR2;
```

Return Values

A string enumerating the version of the DBMS_DBFS_CONTENT interface in standard naming convention: string: *a.b.c* corresponding to *major*, *minor*, and *patch* components.

58.7.31 ISPATHLOCKED Procedure

This procedure checks if any user-level locks are applied on a given path.

Syntax

```
DBMS_DBFS_CONTENT.ISPATHLOCKED (
  path          IN      VARCHAR2,
  who           IN      VARCHAR2,
  lock_type     IN OUT  INTEGER,
  store_name    IN      VARCHAR2   DEFAULT NULL,
  principal     IN      VARCHAR2   DEFAULT NULL);
```

Parameters

Table 58-47 ISPATHLOCKED Procedure Parameters

Parameter	Description
path	Name of path to file items
who	Transaction identifier that has locked the path
lock_type	One of the available lock types (see Table 58-6)
store_name	Name of store
principal	Agent (principal) invoking the current operation

58.7.32 LIST Function

This function lists the path items in the specified path meeting the specified filter and other criteria.

Syntax

```
DBMS_DBFS_CONTENT.LIST (
  path          IN      VARCHAR2,
  filter        IN      VARCHAR2   DEFAULT NULL,
  recurse       IN      INTEGER     DEFAULT 0,
  asof          IN      TIMESTAMP   DEFAULT NULL,
  store_name    IN      VARCHAR2   DEFAULT NULL,
  principal     IN      VARCHAR2   DEFAULT NULL)
RETURN DBMS_DBFS_CONTENT_LIST_ITEMS_T PIPELINED;
```

Parameters

Table 58-48 LIST Function Parameters

Parameter	Description
path	Name of path to directories
filter	A filter, if any, to be applied
recurse	If 0, do not execute recursively. Otherwise, recursively list the contents of directories and files below the given directory.

Table 58-48 (Cont.) LIST Function Parameters

Parameter	Description
asof	The "as of" timestamp at which the underlying read-only operation (or its read-only sub-components) executes
store_name	Name of repository
principal	Agent (principal) invoking the current operation

Return Values

[DBMS_DBFS_CONTENT_LIST_ITEMS_T Table Type](#)

58.7.33 LISTALLPROPERTIES Function

This function returns a table of all properties for all path items in all mounts.

Syntax

```
DBMS_DBFS_CONTENT.LISTALLPROPERTIES  
RETURN PROP_ITEMS_T PIPELINED;
```

Return Values

[PROP_ITEMS_T Table Type](#)

58.7.34 LISTALLCONTENT Function

This function lists all path items in all mounts.

Syntax

```
DBMS_DBFS_CONTENT.LISTALLCONTENT  
RETURN PATH_ITEMS_T PIPELINED;
```

Return Values

[PATH_ITEMS_T Table Type](#)

58.7.35 LISTMOUNTS Function

This function lists all available mount points, their backing stores, and the store features.

Syntax

```
DBMS_DBFS_CONTENT.LISTMOUNTS  
RETURN MOUNTS_T PIPELINED;
```

Return Values

[MOUNTS_T Table Type](#)

Usage Notes

A single mount results in a single returned row, with its `store_mount` field of the returned records set to `NULL`.

58.7.36 LISTSTORES Function

This function lists all available stores and their features.

Syntax

```
DBMS_DBFS_CONTENT.LISTSTORES
  RETURN STORES_T PIPELINED;
```

Return Values

[STORES_T Table Type](#)

Usage Notes

The `store_mount` field of the returned records is set to `NULL` (since mount-points are separate from stores themselves).

58.7.37 LOCKPATH Procedure

This procedure applies user-level locks to the given valid path name (subject to store feature support), and optionally associates user-data with the lock.

Syntax

```
DBMS_DBFS_CONTENT.LOCKPATH (
  path          IN      VARCHAR2,
  who           IN      VARCHAR2,
  lock_type     IN      INTEGER,
  waitForRowLock IN    INTEGER    DEFAULT 1,
  store_name    IN      VARCHAR2  DEFAULT NULL,
  principal     IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 58-49 LOCKPATH Procedure Parameters

Parameter	Description
<code>path</code>	Name of path to file items
<code>who</code>	Transaction identifier that has locked the path
<code>lock_type</code>	One of the available lock types (see Table 58-6)
<code>waitForRowLock</code>	Determines if a row is locked by a transaction or not
<code>store_name</code>	Name of store
<code>principal</code>	Agent (principal) invoking the current operation

58.7.38 MOUNTSTORE Procedure

This procedure mounts a previously registered store and binds it to the mount point.

Syntax

```
DBMS_DBFS_CONTENT.MOUNTSTORE (
  store_mount  in    VARCHAR2  DEFAULT NULL,
  singleton    in    BOOLEAN    DEFAULT FALSE,
  principal    in    VARCHAR2  DEFAULT NULL,
  owner        in    VARCHAR2  DEFAULT NULL,
  acl          in    VARCHAR2  DEFAULT NULL,
  asof         in    TIMESTAMP  DEFAULT NULL,
  read_only    in    BOOLEAN    DEFAULT FALSE);
```

Parameters

Table 58-50 MOUNTSTORE Procedure Parameters

Parameter	Description
store_mount	Path name to use to mount this store
singleton	Whether the mount is a single backend store on the system
principal	Agent (principal) invoking the current operation
owner	Owner for new elements created (implicitly or explicitly) by the current operation
acl	ACL for all new elements created (implicitly or explicitly) by the current operation
asof	The "as of" timestamp at which the underlying read-only operation (or its read-only sub-components) executes
read_only	Whether the mount is read-only

Usage Notes



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for information on mounting a registered store

58.7.39 NORMALIZEPATH Functions

This function converts a store-specific or full-absolute path name into normalized form.

It does the following:

- verifies that the path name is absolute, and so starts with "/"
- collapses multiple consecutive "/" into a single "/"
- strips trailing "/"

- breaks up a store-specific normalized path name into 2 components - parent pathname, trailing component name
- breaks up a full-absolute normalized path name into 3 components - store name, parent pathname, trailing component name

Syntax

```
DBMS_DBFS_CONTENT.NORMALIZEPATH (
  path      IN          VARCHAR2,
  parent    OUT NOCOPY  VARCHAR2,
  tpath     OUT NOCOPY  VARCHAR2)
RETURN VARCHAR2;
```

```
DBMS_DBFS_CONTENT.NORMALIZEPATH (
  path      IN          VARCHAR2,
  store_name OUT NOCOPY  VARCHAR2,
  parent    OUT NOCOPY  VARCHAR2,
  tpath     OUT NOCOPY  VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 58-51 NORMALIZEPATH Function Parameters

Parameter	Description
path	Name of path to file items
store_name	Name of store
parent	Parent path name
tpath	Name of trailing path item

Return Values

The completely normalized store-specific or full-absolute path name

58.7.40 PROPANY Functions

This function provides constructors that take one of a variety of types and return a PROPERTY_T.

Syntax

```
DBMS_DBFS_CONTENT.PROPANY (
  val      IN          NUMBER)
RETURN PROPERTY_T;
```

```
DBMS_DBFS_CONTENT.PROPANY (
  val      IN          VARCHAR2)
RETURN PROPERTY_T;
```

```
DBMS_DBFS_CONTENT.PROPANY (
  val      IN          TIMESTAMP)
RETURN PROPERTY_T;
```

```
DBMS_DBFS_CONTENT.PROPANY (
```

```

    val      IN      RAW)
RETURN PROPERTY_T;

```

Parameters

Table 58-52 PROPANY Function Parameters

Parameter	Description
val	Value

Return Values

[PROPERTY_T Record Type](#)

58.7.41 PROPERTIESH2T Function

This function converts a `PROPERTY_T` hash to a `DBMS_DBFS_CONTENT_PROPERTIES_T` table.

Syntax

```

DBMS_DBFS_CONTENT.PROPERTIESH2T (
    pprops      IN      PROPERTIES_T)
RETURN DBMS_DBFS_CONTENT_PROPERTIES_T;

```

Parameters

Table 58-53 PROPERTIESH2T Function Parameters

Parameter	Description
sprops	A <code>PROPERTIES_T</code> hash

Return Values

[DBMS_DBFS_CONTENT_PROPERTIES_T Table Type](#)

58.7.42 PROPERTIEST2H Function

This function converts a `DBMS_DBFS_CONTENT_PROPERTIES_T` table to a `PROPERTY_T` hash.

Syntax

```

DBMS_DBFS_CONTENT.PROPERTIEST2H (
    sprops      IN      DBMS_DBFS_CONTENT_PROPERTIES_T)
RETURN properties_t;

```

Parameters

Table 58-54 PROPERTIEST2H Function Parameters

Parameter	Description
sprops	A <code>DBMS_DBFS_CONTENT_PROPERTIES_T</code> table

Return Values

[PROPERTIES_T Table Type](#)

58.7.43 PROPNUMBER Function

This function is a constructor that takes a number and returns a `PROPERTY_T`.

Syntax

```
DBMS_DBFS_CONTENT.PROPNUMBER (
    val      IN      NUMBER)
RETURN PROPERTY_T;
```

Parameters

Table 58-55 PROPNUMBER Function Parameters

Parameter	Description
val	Value

Return Values

[PROPERTY_T Record Type](#)

58.7.44 PROPRAW Function

This function is a constructor that takes a `RAW` and returns a `PROPERTY_T`.

Syntax

```
DBMS_DBFS_CONTENT.PROPRAW (
    val      IN      RAW)
RETURN PROPERTY_T;
```

Parameters

Table 58-56 PROPRAW Function Parameters

Parameter	Description
val	Value

Return Values

[PROPERTY_T Record Type](#)

58.7.45 PROPTIMESTAMP Function

This function is a constructor that takes a `TIMESTAMP` and returns a `PROPERTY_T`.

Syntax

```
DBMS_DBFS_CONTENT.PROPTIMESTAMP (
    val      IN      TIMESTAMP)
RETURN PROPERTY_T;
```

Parameters

Table 58-57 PROPTIMESTAMP Function Parameters

Parameter	Description
val	Value

Return Values

[PROPERTY_T Record Type](#)

58.7.46 PROPVARCHAR2 Function

This function is a constructor that takes a `VARCHAR2` and returns a `PROPERTY_T`.

Syntax

```
DBMS_DBFS_CONTENT.PROPVARCHAR2 (
    val      IN      VARCHAR2)
RETURN PROPERTY_T;
```

Parameters

Table 58-58 PROPNUMBER Function Parameters

Parameter	Description
val	Value

Return Values

[PROPERTY_T Record Type](#)

58.7.47 PURGEALL Procedure

This procedure purges all soft-deleted entries matching the path and optional filter criteria.

Syntax

```
DBMS_DBFS_CONTENT.PURGEALL (
    path      IN      VARCHAR2,
    filter     IN      VARCHAR2    DEFAULT NULL,
    store_name IN      VARCHAR2    DEFAULT NULL,
    principal  IN      VARCHAR2    DEFAULT NULL);
```

Parameters

Table 58-59 PURGEALL Procedure Parameters

Parameter	Description
path	Name of path to file items
filter	A filter, if any, to be applied based on specified criteria
store_name	Name of store
principal	Agent (principal) invoking the current operation

58.7.48 PURGEPATH Procedure

This procedure purges any soft-deleted versions of the given path item.

Syntax

```
DBMS_DBFS_CONTENT.PURGEPATH (
    path          IN          VARCHAR2,
    filter        IN          VARCHAR2    DEFAULT NULL,
    store_name    IN          VARCHAR2    DEFAULT NULL,
    principal     IN          VARCHAR2    DEFAULT NULL);
```

Parameters

Table 58-60 PURGEPATH Procedure Parameters

Parameter	Description
path	Name of path to file items
filter	A filter, if any, to be applied
store_name	Name of store
principal	Agent (principal) invoking the current operation

58.7.49 PUTPATH Procedures

This procedure creates a new path item.

Syntax

```
DBMS_DBFS_CONTENT.PUTPATH (
    path          IN          VARCHAR2,
    properties    IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
    content       IN OUT NOCOPY BLOB,
    item_type     OUT          INTEGER,
    prop_flags    IN          INTEGER    DEFAULT (PROP_STD +
                                                PROP_OPT +
                                                PROP_DATA),
    store_name    IN          VARCHAR2    DEFAULT NULL,
    principal     IN          VARCHAR2    DEFAULT NULL);

DBMS_DBFS_CONTENT.PUTPATH (
    path          IN          VARCHAR2,
```



```

properties IN OUT NOCOPY PROPERTIES_T,
content    IN OUT NOCOPY BLOB,
item_type  OUT           INTEGER,
prop_flags IN           INTEGER    DEFAULT (PROP_STD +
                                PROP_OPT +
                                PROP_DATA),

store_name IN           VARCHAR2   DEFAULT NULL,
principal  IN           VARCHAR2   DEFAULT NULL);

DBMS_DBFS_CONTENT.PUTPATH (
  path      IN           VARCHAR2,
  properties IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  amount    IN           NUMBER,
  offset    IN           NUMBER,
  buffer    IN           RAW,
  prop_flags IN           INTEGER    DEFAULT (PROP_STD +
                                PROP_OPT),

  store_name IN           VARCHAR2   DEFAULT NULL,
  principal  IN           VARCHAR2   DEFAULT NULL);

DBMS_DBFS_CONTENT.PUTPATH (
  path      IN           VARCHAR2,
  properties IN OUT NOCOPY PROPERTIES_T,
  amount    IN           NUMBER,
  offset    IN           NUMBER,
  buffer    IN           RAW,
  prop_flags IN           INTEGER    DEFAULT (PROP_STD +
                                PROP_OPT),

  store_name IN           VARCHAR2   DEFAULT NULL,
  principal  IN           VARCHAR2   DEFAULT NULL);

DBMS_DBFS_CONTENT.PUTPATH (
  path      IN           VARCHAR2,
  properties IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  written   OUT          NUMBER,
  offset    IN           NUMBER,
  buffers   IN           DBMS_DBFS_CONTENT_RAW_T,
  prop_flags IN           INTEGER    DEFAULT (PROP_STD +
                                PROP_OPT),

  store_name IN           VARCHAR2   DEFAULT NULL,
  principal  IN           VARCHAR2   DEFAULT NULL);

DBMS_DBFS_CONTENT.PUTPATH (
  path      IN           VARCHAR2,
  properties IN OUT NOCOPY PROPERTIES_T,
  written   OUT          NUMBER,
  offset    IN           NUMBER,
  buffers   IN           DBMS_DBFS_CONTENT_RAW_T,
  prop_flags IN           INTEGER    DEFAULT (PROP_STD +
                                PROP_OPT),

  store_name IN           VARCHAR2   DEFAULT NULL,
  principal  IN           VARCHAR2   DEFAULT NULL);

```

Parameters

Table 58-61 PUTPATH Procedure Parameters

Parameter	Description
path	Name of path to file items

Table 58-61 (Cont.) PUTPATH Procedure Parameters

Parameter	Description
properties	One or more properties and their values to be set depending on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
content	BLOB holding data which populates the file (optional)
item_type	Type of the path item specified (see Table 58-4)
amount	Number of bytes to be read
offset	Byte offset from which to begin reading
buffer	Buffer to which to write
buffers	Buffers to which to write
prop_flags	Determines which properties are set. Default is <code>PROP_STD</code> . Specify properties to be returned by setting <code>prop_spec</code> , and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
store_name	Name of store
principal	Agent (principal) invoking the current operation

58.7.50 REGISTERSTORE Procedure

This procedure registers a new store backed by a provider that uses a store provider (conforming to the `DBMS_DBFS_CONTENT_SPI` package signature).

This method is to be used primarily by store providers after they have created a new store.

Syntax

```
DBMS_DBFS_CONTENT.REGISTERSTORE (
  store_name      IN      VARCHAR2,
  provider_name   IN      VARCHAR2,
  provider_package IN      VARCHAR2);
```

Parameters

Table 58-62 REGISTERSTORE Procedure Parameters

Parameter	Description
store_name	Name of store, must be unique
provider_name	Name of provider
provider_package	Store provider

58.7.51 RENAMEPATH Procedures

This procedure renames or moves a path. This operation can be performed across directory hierarchies and mount-points as long as it is within the same store.



Note:

See *Oracle Database SecureFiles and Large Objects Developer's Guide for Rename and Move operations*

Syntax

```
DBMS_DBFS_CONTENT.RENAMEPATH (
    oldPath      IN          VARCHAR2,
    newPath      IN          VARCHAR2,
    properties   IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
    store_name   IN          VARCHAR2   DEFAULT NULL,
    principal    IN          VARCHAR2   DEFAULT NULL);
```

```
DBMS_DBFS_CONTENT.RENAMEPATH (
    oldPath      IN          VARCHAR2,
    newPath      IN          VARCHAR2,
    properties   IN OUT NOCOPY PROPERTIES_T,
    store_name   IN          VARCHAR2   DEFAULT NULL,
    principal    IN          VARCHAR2   DEFAULT NULL);
```

Parameters

Table 58-63 RENAMEPATH Procedure Parameters

Parameter	Description
oldPath	Name of path prior to renaming
newPath	Name of path after renaming
properties	One or more properties and their values to be set depending on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
store_name	Name of store, must be unique
principal	Agent (principal) invoking the current operation

58.7.52 RESTOREALL Procedure

This procedure restores all soft-deleted path items meeting the path and optional filter criteria.

Syntax

```
DBMS_DBFS_CONTENT.RESTOREALL (
    path      IN          VARCHAR2,
    filter    IN          VARCHAR2   DEFAULT NULL,
```

```

store_name    IN      VARCHAR2    DEFAULT NULL,
principal     IN      VARCHAR2    DEFAULT NULL);

```

Parameters

Table 58-64 RESTOREALL Procedure Parameters

Parameter	Description
path	Name of path to file items
filter	A filter, if any, to be applied
store_name	Name of store
principal	Agent (principal) invoking the current operation

58.7.53 RESTOREPATH Procedure

This procedure restores all soft-deleted path items that match the given path and optional filter criteria.

Syntax

```

DBMS_DBFS_CONTENT.RESTOREPATH (
  path          IN      VARCHAR2,
  filter        IN      VARCHAR2    DEFAULT NULL,
  store_name    IN      VARCHAR2    DEFAULT NULL,
  principal     IN      VARCHAR2    DEFAULT NULL);

```

Parameters

Table 58-65 RESTOREPATH Procedure Parameters

Parameter	Description
path	Name of path to file items
filter	A filter, if any, to be applied
store_name	Name of store
principal	Agent (principal) invoking the current operation

58.7.54 SETDEFAULTACL Procedure

This procedure sets the ACL parameter of the default context.

This information can be inserted explicitly by way of argument into other method calls, allowing for a more fine-grained control.

Syntax

```

DBMS_DBFS_CONTENT.SETDEFAULTACL (
  acl          IN      VARCHAR2);

```

Parameters

Table 58-66 SETDEFAULTACL Procedure Parameters

Parameter	Description
acl	ACL for all new elements created (implicitly or explicitly) by the current operation

Usage Notes

- NULL by default, this parameter be can be cleared by setting it to NULL.
- The parameters, once set, remain as a default for the duration of the session, and is inherited by all operations for which the default is not explicitly overridden.

58.7.55 SETDEFAULTASOF Procedure

This procedure sets the "as of" parameter of the default context. This information can be inserted explicitly by way of argument into other method calls, allowing for a more fine-grained control.

Syntax

```
DBMS_DBFS_CONTENT.SETDEFAULTASOF (
  asof    IN    TIMESTAMP);
```

Parameters

Table 58-67 SETDEFAULTASOF Procedure Parameters

Parameter	Description
asof	The "as of" timestamp at which the underlying read-only operation (or its read-only sub-components) executes

Usage Notes

- NULL by default, this parameter be can be cleared by setting it to NULL.
- The parameters, once set, remain as a default for the duration of the session, and is inherited by all operations for which the default is not explicitly overridden.

58.7.56 SETDEFAULTCONTEXT Procedure

This procedure sets the default context. The information contained in the context can be inserted explicitly by way of arguments to the various method calls, allowing for fine-grained control over individual operations.

Syntax

```
DBMS_DBFS_CONTENT.SETDEFAULTCONTEXT (
  principal  IN    VARCHAR2,
  owner      IN    VARCHAR2,
  acl        IN    VARCHAR2,
  asof       IN    TIMESTAMP);
```

Parameters

Table 58-68 SETDEFAULTCONTEXT Procedure Parameters

Parameter	Description
principal	Agent (principal) invoking the current operation
owner	Owner for new elements created (implicitly or explicitly) by the current operation
acl	ACL for all new elements created (implicitly or explicitly) by the current operation
asof	The "as of" timestamp at which the underlying read-only operation (or its read-only sub-components) executes

Usage Notes

- All of the context parameters are `NULL` by default, and be can be cleared by setting them to `NULL`.
- The context parameters, once set, remain as defaults for the duration of the session, and are inherited by all operations for which the defaults are not explicitly overridden.

58.7.57 SETDEFAULTOWNER Procedure

This procedure sets the "owner" parameter of the default context. This information can be inserted explicitly by way of argument into other method calls, allowing for a more fine-grained control.

Syntax

```
DBMS_DBFS_CONTENT.SETDEFAULTOWNER (
    principal IN VARCHAR2);
```

Parameters

Table 58-69 SETDEFAULTOWNER Procedure Parameters

Parameter	Description
owner	Owner for new elements created (implicitly or explicitly) by the current operation

Usage Notes

- `NULL` by default, this parameter be can be cleared by setting it to `NULL`.
- The parameters, once set, remain as a default for the duration of the session, and is inherited by all operations for which the default is not explicitly overridden.

58.7.58 SETDEFAULTPRINCIPAL Procedure

This procedure sets the "principal" parameter of the default context. This information contained can be inserted explicitly by way of argument into other method calls, allowing for a more fine-grained control.

Syntax

```
DBMS_DBFS_CONTENT.SETDEFAULTPRINCIPAL (
    principal IN VARCHAR2);
```

Parameters

Table 58-70 SETDEFAULTPRINCIPAL Procedure Parameters

Parameter	Description
principal	Agent (principal) invoking the current operation

Usage Notes

- NULL by default, this parameter be can be cleared by setting it to NULL.
- The parameters, once set, remain as a default for the duration of the session, and is inherited by all operations for which the default is not explicitly overridden.

58.7.59 SETPATH Procedures

This procedure assigns a path name to a path item represented by contentID.

Stores and their providers that support contentID-based access and lazy path name binding also support the SETPATH Procedure that associates an existing contentID with a new path.



Note:

See *Oracle Database SecureFiles and Large Objects Developer's Guide* for Rename and Move operations

Syntax

```
DBMS_DBFS_CONTENT.SETPATH (
    store_name IN VARCHAR2,
    contentID IN RAW,
    path IN VARCHAR2,
    properties IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
    principal IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_DBFS_CONTENT.SETPATH (
    store_name IN VARCHAR2,
    contentID IN RAW,
    path IN VARCHAR2,
    properties IN OUT NOCOPY PROPERTIES_T,
    principal IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 58-71 SETPATH Procedure Parameters

Parameter	Description
store_name	Name of the store
contentID	Unique identifier for the item to be associated
path	Name of path to path item
properties	One or more properties and their values to be set depending on prop_flags (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
principal	Agent (principal) invoking the current operation

58.7.60 SETSTATS Procedure

This procedure enables and disables statistics collection.

The client can optionally control the flush settings by specifying non-NULL values for the time, count or both parameters.

Syntax

```
DBMS_DBFS_CONTENT.SETSTATS (
    enable          IN    BOOLEAN,
    flush_time     IN    INTEGER,
    flush_count    IN    INTEGER);
```

Parameters

Table 58-72 SETSTATS Procedure Parameters

Parameter	Description
enable	If TRUE, enable statistics collection. If FALSE, disable statistics collection.
flush_time	How often to flush the statistics to disk in centiseconds
flush_count	Number of operations to allow between statistics flushes

Usage Notes

The SETSTATS Procedure buffers statistics in-memory for a maximum of flush_time centiseconds or a maximum of flush_count operations (whichever limit is reached first), or both, at which time the buffers are implicitly flushed to disk.

58.7.61 SETTRACE Procedure

This procedure sets the DBMS_DBFS_CONTENT tracing severity to the given level, 0 being "off".

Syntax

```
DBMS_DBFS_CONTENT.SETTRACE
    trclvl      IN      INTEGER);
```

Parameters

Table 58-73 SETTRACE Procedure Parameters

Parameter	Description
trclvl	Level of the tracing, higher values implying more tracing

58.7.62 SPACEUSAGE Procedure

This procedure queries file system space usage statistics.

Providers are expected to support this subprogram for their stores (and to make a best effort determination of space usage, especially if the store consists of multiple tables, indexes, LOBs, and so on).

Syntax

```
DBMS_DBFS_CONTENT.SPACEUSAGE (
    path          IN      VARCHAR2,
    blksize       OUT     INTEGER,
    tbytes        OUT     INTEGER,
    fbytes        OUT     INTEGER,
    nfile         OUT     INTEGER,
    ndir          OUT     INTEGER,
    nlink         OUT     INTEGER,
    nref          OUT     INTEGER,
    store_name    IN      VARCHAR2 DEFAULT NULL);
```

Parameters

Table 58-74 SPACEUSAGE Procedure Parameters

Parameter	Description
path	Name of path to file items
blksize	Natural tablespace blocksize that holds the store. If multiple tablespaces with different blocksizes are used, any valid blocksize is acceptable.
tbytes	Total size of the store in bytes computed over all segments that comprise the store
fbytes	Free or unused size of the store in bytes computed over all segments that comprise the store
nfile	Number of currently available files in the store

Table 58-74 (Cont.) SPACEUSAGE Procedure Parameters

Parameter	Description
ndir	Number of currently available directories in the store
nlink	Number of currently available links in the store
nref	Number of currently available references in the store
store_name	Name of store

Usage Notes

- A space usage query on the top-level root directory returns a combined summary of the space usage of all available distinct stores under it (if the same store is mounted multiple times, is still counted only once).
- Since database objects are dynamically expandable, it is not easy to estimate the division between "free" space and "used" space.

58.7.63 TRACE Procedure

This procedure outputs tracing to the current foreground trace file.

Syntax

```
DBMS_DBFS_CONTENT.TRACE
    sev          IN          INTEGER,
    msg0         IN          VARCHAR2,
    msg1         IN          VARCHAR   DEFAULT '',
    msg2         IN          VARCHAR   DEFAULT '',
    msg3         IN          VARCHAR   DEFAULT '',
    msg4         IN          VARCHAR   DEFAULT '',
    msg5         IN          VARCHAR   DEFAULT '',
    msg6         IN          VARCHAR   DEFAULT '',
    msg7         IN          VARCHAR   DEFAULT '',
    msg8         IN          VARCHAR   DEFAULT '',
    msg9         IN          VARCHAR   DEFAULT '',
    msg10        IN          VARCHAR   DEFAULT '' );
```

Parameters

Table 58-75 TRACE Procedure Parameters

Parameter	Description
sev	Severity at which trace message is output
msg*	One or more message strings to be output. If more than one message is specified, all are output.

Usage Notes

- Trace information is written to the foreground trace file, with varying levels of detail as specified by the trace level arguments.
- The global trace level consists of 2 components: "severity" and "detail". These can be thought of as additive bitmasks.

The "severity" allows the separation of top level as compared to low-level tracing of different components, and allows the amount of tracing to be increased as needed. There are no semantics associated with different levels, and users are free to set trace at any severity they choose, although a good rule of thumb would use severity "1" for top level API entry and exit traces, "2" for internal operations, and "3" or greater for very low-level traces.

The "detail" controls how much additional information: timestamps, short-stack, etc. is dumped along with each trace record.

58.7.64 TRACEENABLED Function

This function determines if the current trace "severity" set by the SETTRACE Procedure is at least as high as the given trace level.

Syntax

```
DBMS_DBFS_CONTENT.TRACEENABLED (
    sev          IN          INTEGER)
RETURN INTEGER;
```

Parameters

Table 58-76 TRACEENABLED Procedure Parameters

Parameter	Description
sev	Severity at which trace message is output

Return Values

Returns 0 if the requested severity level is lower than the currently set trace severity level; 1 otherwise.

Related Topics

- [SETTRACE Procedure](#)
This procedure sets the DBMS_DBFS_CONTENT tracing severity to the given level, 0 being "off".

58.7.65 UNLOCKPATH Procedure

This procedure unlocks path items that were previously locked with the LOCKPATH Procedure.

Syntax

```
DBMS_DBFS_CONTENT.UNLOCKPATH (
    path          IN          VARCHAR2,
    who           IN          VARCHAR2,
    waitForRowLock IN        INTEGER    DEFAULT 1,
    store_name    IN          VARCHAR2    DEFAULT NULL,
    principal     IN          VARCHAR2    DEFAULT NULL);
```

Parameters

Table 58-77 UNLOCKPATH Procedure Parameters

Parameter	Description
path	Name of path to file items
who	Transaction identifier that has locked the path
waitForRowLock	Determines if a row is locked by a transaction or not
store_name	Name of store
principal	Agent (principal) invoking the current operation

Related Topics

- [LOCKPATH Procedure](#)
This procedure applies user-level locks to the given valid path name (subject to store feature support), and optionally associates user-data with the lock.

58.7.66 UNMOUNTSTORE Procedure

This procedure unmounts a registered store, either by name or by mount point.

Syntax

```
DBMS_DBFS_CONTENT.UNMOUNTSTORE (
    store_name      IN      VARCHAR2  DEFAULT NULL,
    store_mount     IN      VARCHAR2  DEFAULT NULL,
    ignore_unknown  IN      BOOLEAN   DEFAULT FALSE);
```

Parameters

Table 58-78 UNMOUNTSTORE Procedure Parameters

Parameter	Description
store_name	Name of store
store_mount	Location at which the store instance is mounted
ignore_unknown	If TRUE, attempts to unregister unknown stores will not raise an exception.

Usage Notes



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for further information on unmounting a previously unmounted store

58.7.67 UNREGISTERSTORE Procedure

This procedure unregisters a previously registered store (invalidating all mount points associated with it).

Syntax

```
DBMS_DBFS_CONTENT.UNREGISTERSTORE (  
    store_name          IN      VARCHAR2,  
    ignore_unknown     IN      BOOLEAN DEFAULT FALSE);
```

Parameters

Table 58-79 UNREGISTERSTORE Procedure Parameters

Parameter	Description
store_name	Name of store
ignore_unknown	If TRUE, attempts to unregister unknown stores will not raise an exception.

Usage Notes

- Once unregistered all access to the store (and its mount points) are not guaranteed to work
- If the `ignore_unknown` argument is TRUE, attempts to unregister unknown stores do not raise an exception.

DBMS_DBFS_CONTENT_SPI

The `DBMS_DBFS_CONTENT_SPI` package is a specification for `DBMS_DBFS_CONTENT` store providers, which must be implemented. Application designers can create PL/SQL packages conforming to this specification to extend `DBMS_DBFS_CONTENT` to use custom store providers.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Operational Notes](#)
- [Summary of DBMS_DBFS_CONTENT_SPI Subprograms](#)

Related Topics

- [DBMS_DBFS_CONTENT](#)
The `DBMS_DBFS_CONTENT` package provides an interface comprising a file system-like abstraction backed by one or more Store Providers.

See Also:

- *Oracle Database SecureFiles and Large Objects Developer's Guide*

59.1 ODBMS_DBFS_CONTENT_SPI Overview

The `DBMS_DBFS_CONTENT_SPI` package describes an internal contract between the implementation of the `DBMS_DBFS_CONTENT` interface and individual store providers, and whichever package contains their code.

Since PL/SQL does not allow a compile-time, declarative type-conformation between package signatures, store providers should informally conform to the SPI, which is to say, they should implement the SPI by means of a package that contains all of the methods specified in package `DBMS_DBFS_CONTENT_SPI`, with the same method signatures and semantics.

Obviously, these provider packages can implement other methods and expose other interfaces, however, these interfaces are not to be used by the `DBMS_DBFS_CONTENT` interface itself.

Since the provider SPI is merely a contract specification, there is no package body for `DBMS_DBFS_CONTENT_SPI`, and it is not possible to actually invoke any methods using this package.

The SPI references various elements (constants, types, exceptions) defined by the `DBMS_DBFS_CONTENT` interface.

Additionally, there is an almost one-to-one correspondence between the client API exported by the `DBMS_DBFS_CONTENT` interface and the provider interface that the `DBMS_DBFS_CONTENT` interface itself expects to work against.

The main distinction in the method naming conventions is that all path name references are always store-qualified. That is, the notion of mount-points and full-absolute path names have been normalized and converted to store-qualified path names by the `DBMS_DBFS_CONTENT` interface before it invokes any of the provider SPI methods.

Since the interconnection of the `DBMS_DBFS_CONTENT` interface and the provider SPI is a 1-to-many pluggable architecture, and the interface uses dynamic SQL to invoke methods in the provider SPI, this can lead to runtime errors.

Related Topics

- [DBMS_DBFS_CONTENT](#)
The `DBMS_DBFS_CONTENT` package provides an interface comprising a file system-like abstraction backed by one or more Store Providers.

59.2 DBMS_DBFS_CONTENT_SPI Security Model

Implementations of the `DBMS_DBFS_CONTENT_SPI` package should be created as `AUTHID CURRENT_USER`.

59.3 DBMS_DBFS_CONTENT_SPI Operational Notes

This topic lists operational notes for `DBMS_DBFS_CONTENT_SPI` implementation, path names, and other operations.

- [Implementation](#)
- [Path Names](#)
- [Other DBMS_DBFS_CONTENT Operations](#)

Implementation

Since the interconnection of the `DBMS_DBFS_CONTENT` interface and the provider SPI is a 1-to-many pluggable architecture, the interface uses dynamic SQL to invoke methods in the provider SPI, this can lead to runtime errors.

There are no explicit `INIT` or `FINI` methods to indicate when the `DBMS_DBFS_CONTENT` interface plugs or unplugs a particular provider SPI. Provider SPIs must be willing to auto-initialize themselves at any SPI entry-point.

All operations performed by a store provider are "stateless" in that they are complete operations unto themselves. If state is necessary to be maintained for some reason, then the state must be maintained in data structures such as auxiliary tables that can be queried as needed.

Path Names

All path names used in the provider SPI are store-qualified in pair form (`store_name`, `pathname`) where the path name is rooted within the store namespace.

Stores and their providers that support contentID-based access (see `FEATURE_CONTENT_ID` in [Table 58-5](#)) also support a form of addressing that is not based on path names. Content items are identified by an explicit store name, a `NULL` path name, and possibly a contentID specified as a parameter or by way of the `OPT_CONTENT_ID` (see [Table 58-8](#)) property.

Not all operations are supported with contentID-based access, and applications should depend only on the simplest create or delete functionality being available.

Other DBMS_DBFS_CONTENT Operations

This table lists other operations and provides links to related discussions.

Table 59-1 Other DBMS_DBFS_CONTENT Operations

Other Operations	See ...
Creation	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on creation operations
Deletion	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on deletion operations
Get (Retrieve) and Put (Insert)	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on Get and Put operations
Rename and Move	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on Rename and Move operations
Directory Navigation and Search	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on Navigation and Search operations
Locking	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on Locking operations
Access Check	<i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> for further information on Access Check operations

59.4 Summary of DBMS_DBFS_CONTENT_SPI Subprograms

This table lists and describes the subprograms used in the `DBMS_DBFS_CONTENT_SPI` Package.

Table 59-2 DBMS_DBFS_CONTENT_SPI Package Subprograms

Subprogram	Description
CHECKACCESS Function	Reports if the user (principal) can perform the specified operation on the given path
CREATEDIRECTORY Procedure	Creates a directory
CREATEFILE Procedure	Creates a file
CREATELINK Procedure	Creates a physical link to an already existing file system element
CREATEREFERENCE Procedure	Creates a new reference to the source file system element
DELETECONTENT Procedure	Deletes the file specified by the given contentID
DELETEDIRECTORY Procedure	Deletes a directory
DELETEFILE Procedure	Deletes a file
GETFEATURES Function	Returns the features of a store
GETPATH Procedures	Returns existing path items (such as files and directories)

Table 59-2 (Cont.) DBMS_DBFS_CONTENT_SPI Package Subprograms

Subprogram	Description
GETPATHBYSTOREID Function	If the underlying GUID is found in the underlying store, returns the store-qualified path name
GETPATHNOWAIT Procedure	Implies that the operation is for an update, and, if implemented, allows providers to return an exception (ORA-00054) rather than wait for row locks.
GETSTOREID Function	Returns the ID of a store
GETVERSION Function	Returns the version associated with a store
LIST Function	Lists the contents of a directory path name
LOCKPATH Procedure	Applies user-level locks to the given valid path name
PURGEALL Procedure	Purges all soft-deleted entries matching the path and optional filter criteria
PURGEPATH Procedure	Purges any soft-deleted versions of the given path item
PUTPATH Procedures	Creates a new path item
RENAMEPATH Procedure	Renames or moves a path
RESTOREALL Procedure	Restores all soft-deleted path items meeting the path and filter criteria
RESTOREPATH Procedure	Restores all soft-deleted path items that match the given path and filter criteria
SEARCH Function	Searches for path items matching the given path and filter criteria
SETPATH Procedure	Assigns a path name to a path item represented by contentID
SPACEUSAGE Procedure	Queries file system space usage statistics
UNLOCKPATH Procedure	Unlocks path items that were previously locked with the LOCKPATH Procedure

59.4.1 CHECKACCESS Function

This function reports if the user (*principal*) can perform the specified operation on the given path. This enables verifying the validity of an operation without attempting to perform the operation. If `CHECKACCESS` returns 0, then the subprogram invoked to implement that operation should fail with an error.

Syntax

```
DBMS_DBFS_CONTENT_SPI.CHECKACCESS (
  store_name      IN      VARCHAR2  DEFAULT NULL,
  path            IN      VARCHAR2,
  pathtype       IN      INTEGER,
  operation       IN      VARCHAR2,
  principal       IN      VARCHAR2)
RETURN INTEGER;
```

Parameters

Table 59-3 CHECKACCESS Procedure Parameters

Parameter	Description
store_name	Name of store
path	Name of path to check for access
pathtype	Type of object path represents (see Table 58-4)
operation	Operation to be checked (see Table 58-8)
principal	File system user for whom the access check is made

Usage Notes

Whether or not the user invokes this function, a store that supports access control internally performs these checks to guarantee security.

59.4.2 CREATEDIRECTORY Procedure

This procedure creates a directory.

Syntax

```
DBMS_DBFS_CONTENT_SPI.CREATEDIRECTORY (
  store_name IN          VARCHAR2,
  path       IN          VARCHAR2,
  properties IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  prop_flags IN          INTEGER,
  recurse    IN          INTEGER,
  ctx        IN          DBMS_DBFS_CONTENT_CONTEXT_T);
```

Parameters

Table 59-4 CREATEDIRECTORY Procedure Parameters

Parameter	Description
store_name	Name of store
path	Name of path to the directory
properties	One or more properties and their values to be set, returned, or both, depending on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
prop_flags	Determines which properties are set, returned, or both. Default is <code>PROP_STD</code> . Specify properties to be returned by setting <code>PROP_SPC</code> (see Table 58-9), and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
recurse	If 0, do not execute recursively; otherwise, recursively create the directories above the given directory
ctx	Context with which to create the directory (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.3 CREATEFILE Procedure

This procedure creates a file.

Syntax

```
DBMS_DBFS_CONTENT_SPI.CREATEFILE (
  store_name  IN          VARCHAR2,
  path        IN          VARCHAR2,
  properties  IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  content     IN OUT NOCOPY BLOB,
  prop_flags  IN          INTEGER,
  ctx         IN          DBMS_DBFS_CONTENT_CONTEXT_T);
```

Parameters

Table 59-5 CREATEFILE Procedure Parameters

Parameter	Description
store_name	Name of store
path	Name of path to the file
properties	One or more properties and their values to be set, returned or both depending, or both on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
content	BLOB holding data with which to populate the file (optional)
prop_flags	Determines which properties are set, returned, or both. Default is <code>PROP_STD</code> . Specify properties to be returned by setting <code>prop_spec</code> , and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
ctx	Context with which to create the file (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.4 CREATELINK Procedure

This procedure creates a physical link to an already existing file system element (such as file or directory). The resulting entry shares the same metadata structures as the value of the `srcPath` parameter, and so is similar to incrementing a reference count on the file system element. This is analogous to a UNIX file system hard link.

Syntax

```
DBMS_DBFS_CONTENT_SPI.CREATELINK (
  store_name  IN          VARCHAR2,
  srcPath     IN          VARCHAR2,
  dstPath     IN          VARCHAR2,
  properties  IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  prop_flags  IN          INTEGER,
  ctx         IN          DBMS_DBFS_CONTENT_CONTEXT_T);
```

Parameters

Table 59-6 CREATELINK Procedure Parameters

Parameter	Description
store_name	Name of store
srcPath	File system entry with which to link
dstPath	Path of the new link element to be created
properties	One or more properties and their values to be set, returned, or both, depending on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
prop_flags	Determines which properties are set, returned, or both. Default is <code>PROP_STD</code> . Specify properties to be returned by setting <code>prop_spec</code> , and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
ctx	Context with which to create the link (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.5 CREATEREERENCE Procedure

This procedure creates a new reference to the source file system element (such as a file, or directory). The resulting reference points to the source element but does not directly share metadata with the source element. This is analogous to a UNIX file system symbolic link.

Syntax

```
DBMS_DBFS_CONTENT_SPI.CREATEREERENCE (
  srcPath      IN          VARCHAR2,
  dstPath      IN          VARCHAR2,
  properties   IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  prop_flags   IN          INTEGER,
  store_name   IN          VARCHAR2,
  ctx          IN          DBMS_DBFS_CONTENT_CONTEXT_T);
```

Parameters

Table 59-7 CREATEREERENCE Procedure Parameters

Parameter	Description
store_name	Name of store
srcPath	File system entry with which to link
dstPath	Path of the new link element to be created
properties	One or more properties and their values to be set, returned, or both, depending on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)

Table 59-7 (Cont.) CREATEREference Procedure Parameters

Parameter	Description
prop_flags	Determines which properties are set, returned, or both. Default is PROP_STD. Specify properties to be returned by setting prop_spec, and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
ctx	Context with which to create the reference (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.6 DELETECONTENT Procedure

This procedure deletes the file specified by the given contentID.

Syntax

```
DBMS_DBFS_CONTENT_SPI.DELETECONTENT (
  store_name      IN      VARCHAR2,
  contentID      IN      RAW,
  filter          IN      VARCHAR2,
  soft_delete    IN      INTEGER,
  ctx            IN      DBMS_DBFS_CONTENT_CONTEXT_T);
```

Parameters

Table 59-8 DELETECONTENT Procedure Parameters

Parameter	Description
store_name	Name of store
contentID	Unique identifier for the file to be deleted
filter	A filter, if any, to be applied
soft_delete	If 0, execute a hard (permanent) delete. For any value other than 0, perform a soft delete see <i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> , Deletion Operations).
ctx	Context with which to delete the file (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.7 DELETEDIRECTORY Procedure

This procedure deletes a directory.

If `recurse` is nonzero, it recursively deletes all elements of the directory. A filter, if supplied, determines which elements of the directory are deleted.

Syntax

```
DBMS_DBFS_CONTENT_SPI.DELETEDIRECTORY (
  store_name      IN      VARCHAR2,
  path           IN      VARCHAR2,
  filter         IN      VARCHAR2,
  soft_delete    IN      INTEGER,
```

```

recurse      IN      INTEGER,
ctx          IN      DBMS_DBFS_CONTENT_CONTEXT_T);

```

Parameters

Table 59-9 DELETEDIRECTORY Procedure Parameters

Parameter	Description
store_name	Name of store
path	Name of path to the directory
filter	A filter, if any, to be applied
soft_delete	If 0, execute a hard (permanent) delete. For any value other than 0, perform a soft delete see <i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> , Deletion Operations).
recurse	If 0, do not execute recursively. Otherwise, recursively delete the directories and files below the given directory.
ctx	Context with which to delete the directory (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.8 DELETEFILE Procedure

This procedure deletes the specified file.

Syntax

```

DBMS_DBFS_CONTENT_SPI.DELETEFILE (
  store_name  IN      VARCHAR2,
  path        IN      VARCHAR2,
  filter      IN      VARCHAR2,
  soft_delete IN      BOOLEAN,
  ctx         IN      DBMS_DBFS_CONTENT_CONTEXT_T);

```

Parameters

Table 59-10 DELETEFILE Procedure Parameters

Parameter	Description
store_name	Name of store
path	Name of path to the file
filter	A filter, if any, to be applied
soft_delete	If 0, execute a hard (permanent) delete. For any value other than 0, perform a soft delete see <i>Oracle Database SecureFiles and Large Objects Developer's Guide</i> , Deletion Operations).
ctx	Context with which to delete the file (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.9 GETFEATURES Function

This function returns the features of a store.

Syntax

```
DBMS_DBFS_CONTENT_SPI.GETFEATURES (
    store_name      IN      VARCHAR2)
RETURN INTEGER;
```

Parameters

Table 59-11 GETFEATURES Function Parameters

Parameter	Description
store_name	Name of store

Return Values

DBMS_DBFS_CONTENT.FEATURE_* features supported by the Store Provider

59.4.10 GETPATH Procedures

This procedure returns existing path items (such as files and directories). This includes both data and metadata (properties).

The client can request (using `prop_flags`) that specific properties be returned. File path names can be read either by specifying a BLOB locator using the `prop_data` bitmask in `prop_flags` (see [Table 58-9](#)) or by passing one or more RAW buffers.

When `forUpdate` is 0, this procedure also accepts a valid "as of" timestamp parameter as part of `ctx` that can be used by stores to implement "as of" style flashback queries. Mutating versions of the GETPATH Procedures do not support these modes of operation.

Syntax

```
DBMS_DBFS_CONTENT_SPI.GETPATH (
    store_name  IN          VARCHAR2,
    path        IN          VARCHAR2,
    properties  IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
    content     OUT NOCOPY  BLOB,
    item_type   OUT         INTEGER,
    prop_flags  IN          INTEGER,
    forUpdate   IN          INTEGER,
    deref       IN          INTEGER,
    ctx         IN          DBMS_DBFS_CONTENT_CONTEXT_T);
```

```
DBMS_DBFS_CONTENT_SPI.GETPATH (
    store_name  IN          VARCHAR2,
    path        IN          VARCHAR2,
    properties  IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
    amount     IN OUT      NUMBER,
    offset      IN          NUMBER,
    buffer      OUT NOCOPY  RAW,
```

```

prop_flags IN          INTEGER,
ctx        IN          DBMS_DBFS_CONTENT_CONTEXT_T);

DBMS_DBFS_CONTENT_SPI.GETPATH (
  store_name IN          VARCHAR2,
  path       IN          VARCHAR2,
  properties IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  amount    IN OUT      NUMBER,
  offset    IN          NUMBER,
  buffers   OUT NOCOPY  DBMS_DBFS_CONTENT_RAW_T,
  prop_flags IN          INTEGER,
  ctx       IN          DBMS_DBFS_CONTENT_CONTEXT_T);

```

Parameters

Table 59-12 GETPATH Procedure Parameters

Parameter	Description
store_name	Name of store
path	Name of path to path items
properties	One or more properties and their values to be returned depending on prop_flags (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
content	BLOB holding data which populates the file (optional)
item_type	Type of the path item specified (see Table 58-4)
amount	On input, number of bytes to be read. On output, number of bytes read
offset	Byte offset from which to begin reading
buffer	Buffer to which to write
buffers	Buffers to which to write
prop_flags	Determines which properties are set, returned, or both. Default is PROP_STD. Specify properties to be returned by setting prop_spec, and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
forUpdate	Specifies that a lock should be taken to signify exclusive write access to the path item
deref	If nonzero, attempts to resolve the given path item to actual data provided it is a reference (symbolic link)
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.11 GETPATHBYSTOREID Function

If the underlying GUID is found in the underlying store, this function returns the store-qualified path name.

Syntax

```

DBMS_DBFS_CONTENT_SPI.GETPATHBYSTOREID (
  store_name IN          VARCHAR2,
  guid       IN          INTEGER)
RETURN VARCHAR2;

```


Parameters

Table 59-13 GETPATHBYSTOREID Function Parameters

Parameter	Description
store_name	Name of store
guid	Unique ID representing the desired path item

Return Values

Store-qualified path name represented by the GUID

Usage Notes

If the `STD_GUID` is unknown, a `NULL` value is returned. Clients are expected to handle this as appropriate.

59.4.12 GETPATHNOWAIT Procedure

This procedure implies that the operation is for an update, and, if implemented, allows providers to return an exception (ORA-00054) rather than wait for row locks.

See `FEATURE_NOWAIT` in [Table 58-5](#) for more information.

Syntax

```
DBMS_DBFS_CONTENT_SPI.GETPATHNOWAIT (
  store_name IN          VARCHAR2,
  path       IN          VARCHAR2,
  properties IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  content    OUT NOCOPY  BLOB,
  item_type  OUT         INTEGER,
  prop_flags IN          INTEGER,
  deref      IN          INTEGER,
  ctx        IN          DBMS_DBFS_CONTENT_CONTEXT_T);
```

Parameters

Table 59-14 GETPATHNOWAIT Procedure Parameters

Parameter	Description
store_name	Name of store
path	Name of path to path items
properties	One or more properties and their values to be returned depending on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
content	BLOB holding data which populates the file (optional)
item_type	Type of the path item specified (see Table 58-4)

Table 59-14 (Cont.) GETPATHNOWAIT Procedure Parameters

Parameter	Description
prop_flags	Determines which properties are returned. Default is PROP_STD. Specify properties to be returned by setting prop_spec, and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
deref	If nonzero, attempts to resolve the given path item to actual data provided it is a reference (symbolic link)
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.13 GETSTOREID Function

This function returns the ID of a store.

Syntax

```
DBMS_DBFS_CONTENT_SPI.GETSTOREID (
    store_name          IN          VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 59-15 GETSTOREID Function Parameters

Parameter	Description
store_name	Name of store

Return Values

ID of the Store

Usage Notes

A store ID identifies a provider-specific store, across registrations and mounts, but independent of changes to the store contents. For this reason, changes to the store table or tables should be reflected in the store ID, but re-initialization of the same store table or tables should preserve the store ID.

59.4.14 GETVERSION Function

This function returns the version associated with a store.

Syntax

```
DBMS_DBFS_CONTENT_SPI.GETVERSION (
    store_name          IN          VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 59-16 GETVERSION Function Parameters

Parameter	Description
store_name	Name of store

Return Values

A "version" (either specific to a provider package, or to an individual store) based on a standard *a.b.c* naming convention (for *major*, *minor*, and *patch* components)

59.4.15 ISPATHLOCKED Procedure

This procedure checks if any user-level locks are applied on a given path.

Syntax

```
DBMS_DBFS_CONTENT.ISPATHLOCKED (
  store_name  IN   VARCHAR2,
  path        IN   VARCHAR2,
  who         IN   VARCHAR2,
  lock_type   IN OUT INTEGER,
  ctx         IN   DBMS_DBFS_CONTENT_CONTEXT_T);
```

Parameters

Table 59-17 ISPATHLOCKED Procedure Parameters

Parameter	Description
store_name	Name of store
path	Path name of items to be locked
who	Transaction identifier that has locked the path
lock_type	One of the available lock types (see Table 58-6)
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.16 LIST Function

This function lists the contents of a directory path name.

The invoker of the subprogram has the option to investigate recursively into sub-directories, to make soft-deleted items visible, to use a flashback "as of" a specified timestamp, and to filter items within the store based on list predicates.

Syntax

```
DBMS_DBFS_CONTENT_SPI.LIST (
  store_name  IN   VARCHAR2,
  path        IN   VARCHAR2,
  filter      IN   VARCHAR2,
  recurse     IN   INTEGER,
```

```

    ctx          IN      DBMS_DBFS_CONTENT_CONTEXT_T)
RETURN  DBMS_DBFS_CONTENT_LIST_ITEMS_T PIPELINED;

```

Parameters

Table 59-18 LIST Function Parameters

Parameter	Description
store_name	Name of repository
path	Name of path to directories
filter	A filter, if any, to be applied
recurse	If 0, do not execute recursively. Otherwise, recursively list the contents of directories and files below the given directory.
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

Return Values

Path items found that match the path, filter and criteria for executing recursively (see [DBMS_DBFS_CONTENT_LIST_ITEMS_T Table Type](#))

Usage Notes

This function returns only list items; the client is expected to explicitly use one of the [GETPATH Procedures](#) to access the properties or content associated with an item.

59.4.17 LOCKPATH Procedure

This procedure applies user-level locks to the given valid path name (subject to store feature support), and optionally associates user-data with the lock.

Syntax

```

DBMS_DBFS_CONTENT_SPI.LOCKPATH (
    store_name    IN      VARCHAR2,
    path          IN      VARCHAR2,
    who           IN      VARCHAR2,
    lock_type     IN      INTEGER,
    waitForRowLock IN    INTEGER,
    ctx           IN      DBMS_DBFS_CONTENT_CONTEXT_T);

```

Parameters

Table 59-19 LOCKPATH Procedure Parameters

Parameter	Description
store_name	Name of store
path	Path name of items to be locked
who	Transaction identifier that has locked the path
lock_type	One of the available lock types (see Table 58-6)
waitForRowLock	Determines if a row is locked by a transaction or not

Table 59-19 (Cont.) LOCKPATH Procedure Parameters

Parameter	Description
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

Usage Notes

- It is the responsibility of the store and its providers (assuming it supports user-defined lock checking) to ensure that lock and unlock operations are performed in a consistent manner.
- The status of locked items is available by means of various optional properties (see `OPT_LOCK*` in [Table 58-8](#)).

59.4.18 PURGEALL Procedure

This procedure purges all soft-deleted entries matching the path and optional filter criteria.

Syntax

```
DBMS_DBFS_CONTENT_SPI.PURGEALL (
  store_name    IN    VARCHAR2,
  path          IN    VARCHAR2,
  filter        IN    VARCHAR2,
  ctx           IN    DBMS_DBFS_CONTENT_CONTEXT_T);
```

Parameters**Table 59-20 PURGEALL Procedure Parameters**

Parameter	Description
store_name	Name of store
path	Name of path to file items
filter	A filter, if any, to be applied based on specified criteria
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.19 PURGEPATH Procedure

This procedure purges any soft-deleted versions of the given path item.

Syntax

```
DBMS_DBFS_CONTENT_SPI.PURGEPATH (
  path          IN    VARCHAR2,
  filter        IN    VARCHAR2,
  store_name    IN    VARCHAR2,
  ctx           IN    DBMS_DBFS_CONTENT_CONTEXT_T);
```

Parameters

Table 59-21 PURGEPATH Procedure Parameters

Parameter	Description
store_name	Name of store
path	Name of path to file items
filter	A filter, if any, to be applied
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.20 PUTPATH Procedures

This procedure creates a new path item.

Syntax

```

DBMS_DBFS_CONTENT_SPI.PUTPATH (
  store_name  IN          VARCHAR2,
  path        IN          VARCHAR2,
  properties  IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  content     IN OUT NOCOPY BLOB,
  item_type   OUT         INTEGER,
  prop_flags  IN          INTEGER,
  ctx         IN          DBMS_DBFS_CONTENT_CONTEXT_T);

DBMS_DBFS_CONTENT_SPI.PUTPATH (
  store_name  IN          VARCHAR2,
  path        IN          VARCHAR2,
  properties  IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  amount     IN          NUMBER,
  offset     IN          NUMBER,
  buffer     IN          RAW,
  prop_flags  IN          INTEGER,
  ctx         IN          DBMS_DBFS_CONTENT_CONTEXT_T);

DBMS_DBFS_CONTENT_SPI.PUTPATH (
  store_name  IN          VARCHAR2,
  path        IN          VARCHAR2,
  properties  IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  written     OUT         NUMBER,
  offset     IN          NUMBER,
  buffers     IN          DBMS_DBFS_CONTENT_RAW_T,
  prop_flags  IN          INTEGER,
  ctx         IN          DBMS_DBFS_CONTENT_CONTEXT_T);

```

Parameters

Table 59-22 PUTPATH Procedure Parameters

Parameter	Description
store_name	Name of store
path	Path name of item to be put

Table 59-22 (Cont.) PUTPATH Procedure Parameters

Parameter	Description
properties	One or more properties and their values to be set depending on <code>prop_flags</code> (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
content	BLOB holding data which populates the file (optional)
item_type	Type of the path item specified (see Table 58-4)
amount	Number of bytes to be read
written	Number of bytes written
offset	Byte offset from which to begin reading
buffer	Buffer to which to write
buffers	Buffers to which to write
prop_flags	Determines which properties are set. Default is <code>PROP_STD</code> . Specify properties to be returned by setting <code>prop_spec</code> , and providing an instance of the DBMS_DBFS_CONTENT_PROPERTIES_T Table Type with properties whose values are of interest.
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

Usage Notes

- All path names allow their metadata (properties) to be read and modified. On completion of the call, the client can access specific properties using `prop_flags` (see [Table 58-9](#)).
- On completion of the call, the client can request a new BLOB locator that can be used to continue data access using the `prop_data` bitmask in `prop_flags` (see [Table 58-9](#)).
- Files can also be written without using BLOB locators, by explicitly specifying logical offsets or buffer-amounts, and a suitably sized buffer.

59.4.21 RENAMEPATH Procedure

This procedure renames or moves a path. This operation can be performed across directory hierarchies and mount-points as long as it is within the same store.



Note:

See *Oracle Database SecureFiles and Large Objects Developer's Guide* for further information on Rename and Move operations

Syntax

```
DBMS_DBFS_CONTENT_SPI.RENAMEPATH (
    store_name    IN          VARCHAR2,
    oldPath       IN          VARCHAR2,
    newPath       IN          VARCHAR2,
```

```

properties  IN OUT NOCOPY  DBMS_DBFS_CONTENT_PROPERTIES_T,
ctx         IN          DBMS_DBFS_CONTENT_CONTEXT_T);

```

Parameters

Table 59-23 RENAMEPATH Procedure Parameters

Parameter	Description
store_name	Name of store, must be unique
oldPath	Name of path prior to renaming
newPath	Name of path after renaming
properties	One or more properties and their values to be set depending on prop_flags (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.22 RESTOREALL Procedure

This procedure restores all soft-deleted path items meeting the path and optional filter criteria.

Syntax

```

DBMS_DBFS_CONTENT_SPI.RESTOREALL (
  store_name  IN      VARCHAR2,
  path        IN      VARCHAR2,
  filter      IN      VARCHAR2,
  ctx         IN      DBMS_DBFS_CONTENT_CONTEXT_T);

```

Parameters

Table 59-24 RESTOREALL Procedure Parameters

Parameter	Description
store_name	Name of store
path	Name of path to path items
filter	A filter, if any, to be applied
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.23 RESTOREPATH Procedure

This procedure restores all soft-deleted path items that match the given path and optional filter criteria.

Syntax

```

DBMS_DBFS_CONTENT_SPI.RESTOREPATH (
  store_name  IN      VARCHAR2,
  path        IN      VARCHAR2,

```



```

filter      IN      VARCHAR2,
ctx         IN      DBMS_DBFS_CONTENT_CONTEXT_T);

```

Parameters

Table 59-25 RESTOREPATH Procedure Parameters

Parameter	Description
store_name	Name of store
path	Name of path to path items
filter	A filter, if any, to be applied
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.24 SEARCH Function

This function searches for path items matching the given path and filter criteria.

Syntax

```

DBMS_DBFS_CONTENT_SPI.SEARCH (
  store_name  IN      VARCHAR2,
  path        IN      VARCHAR2,
  filter      IN      VARCHAR2,
  recurse     IN      INTEGER,
  ctx         IN      DBMS_DBFS_CONTENT_CONTEXT_T)
RETURN DBMS_DBFS_CONTENT_LIST_ITEMS_T PIPELINED;

```

Parameters

Table 59-26 LIST Function Parameters

Parameter	Description
store_name	Name of store
path	Name of path to the path items
filter	A filter, if any, to be applied
recurse	If 0, do not execute recursively. Otherwise, recursively search the contents of directories and files below the given directory.
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

Return Values

Path items matching the given path and filter criteria (see [DBMS_DBFS_CONTENT_LIST_ITEMS_T Table Type](#))

59.4.25 SETPATH Procedure

This procedure assigns a path name to a path item represented by contentID.

Stores and their providers that support contentID-based access and lazy path name binding also support the SETPATH Procedure that associates an existing contentID with a new path.



Note:

See *Oracle Database SecureFiles and Large Objects Developer's Guide* for further information on Rename and Move operations

Syntax

```
DBMS_DBFS_CONTENT_SPI.SETPATH (
  store_name      IN          VARCHAR2,
  contentID       IN          RAW,
  path            IN          VARCHAR2,
  properties      IN OUT NOCOPY DBMS_DBFS_CONTENT_PROPERTIES_T,
  ctx             IN          DBMS_DBFS_CONTENT_CONTEXT_T);
```

Parameters

Table 59-27 SETPATH Procedure Parameters

Parameter	Description
store_name	Name of the store
contentID	Unique identifier for the item to be associated
path	Name of path to path item
properties	One or more properties and their values to be set depending on prop_flags (see DBMS_DBFS_CONTENT_PROPERTIES_T Table Type)
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

59.4.26 SPACEUSAGE Procedure

This procedure queries file system space usage statistics.

Providers are expected to support this subprogram for their stores and to make a best effort determination of space usage, especially if the store consists of multiple tables, indexes, LOBs, and so on.

Syntax

```
DBMS_DBFS_CONTENT_SPI.SPACEUSAGE (
  store_name      IN          VARCHAR2,
  blksize        OUT         INTEGER,
  tbytes         OUT         INTEGER,
  fbytes         OUT         INTEGER,
```

```
nfile      OUT      INTEGER,
ndir       OUT      INTEGER,
nlink     OUT      INTEGER,
nref      OUT      INTEGER);
```

Parameters

Table 59-28 SPACEUSAGE Procedure Parameters

Parameter	Description
store_name	Name of store
blksize	Natural tablespace blocksize that holds the store. If multiple tablespaces with different blocksizes are used, any valid blocksize is acceptable.
tbytes	Total size of the store in bytes computed over all segments that comprise the store
fbytes	Free or unused size of the store in bytes computed over all segments that comprise the store
nfile	Number of currently available files in the store
ndir	Number of currently available directories in the store
nlink	Number of currently available links in the store
nref	Number of currently available references in the store

Usage Notes

- A space usage query on the top-level root directory returns a combined summary of the space usage of all available distinct stores under it (if the same store is mounted multiple times, it is still counted only once).
- Since database objects are dynamically expandable, it is not easy to estimate the division between "free" space and "used" space.

59.4.27 UNLOCKPATH Procedure

This procedure unlocks path items that were previously locked with the LOCKPATH Procedure.

Syntax

```
DBMS_DBFS_CONTENT_SPI.UNLOCKPATH (
  store_name  IN    VARCHAR2,
  path        IN    VARCHAR2,
  who         IN    VARCHAR2,
  waitForRowLock IN  INTEGER,
  ctx         IN    DBMS_DBFS_CONTENT_CONTEXT_T);
```

Parameters

Table 59-29 UNLOCKPATH Procedure Parameters

Parameter	Description
store_name	Name of store

Table 59-29 (Cont.) UNLOCKPATH Procedure Parameters

Parameter	Description
path	Name of path to the path items
who	Transaction identifier that has locked the path
waitForRowLock	Determines if a row is locked by a transaction or not
ctx	Context with which to access the path items (see DBMS_DBFS_CONTENT_CONTEXT_T Object Type)

Related Topics

- [LOCKPATH Procedure](#)
This procedure applies user-level locks to the given valid path name (subject to store feature support), and optionally associates user-data with the lock.

DBMS_DBFS_HS

The Oracle Database File System Hierarchical Store is implemented in the `DBMS_DBFS_HS` package. This package provides users the ability to use tape or Amazon S3 Web service as a storage tier when doing Information Lifecycle Management for their database tables.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Operational Notes](#)
- [Summary of DBMS_DBFS_HS Subprograms](#)



See Also:

- *Oracle Database SecureFiles and Large Objects Developer's Guide*

60.1 DBMS_DBFS_HS Overview

The `DBMS_DBFS_HS` package is a service provider underneath the `DBMS_DBFS_CONTENT` package that enables use of tape or Amazon S3 Web service as storage for data.

The data on tape or Amazon S3 Web service is part of the Oracle Database and can be accessed through all standard interfaces, but only through the database. The package allows users to use tape or Amazon S3 Web service as a storage tier when doing Information Lifecycle Management of their content.

The package initially stores all content files in level-1 cache. As the level-1 cache fills up, content files are moved to level-2 cache and then to an external storage device using bulk writes.

60.2 DBMS_DBFS_HS Security Model

The `DBMS_DBFS_HS` package runs with invoker's rights.

60.3 DBMS_DBFS_HS Constants

The `DBMS_DBFS_HS` package uses the constants shown in the tables in this topic.

Table 60-1 DBMS_DBFS_HS Constants - Used by the CREATESTORE Procedure

Constant	Type	Value	Description
STORETYPE_TAPE	VARCHAR2(50)	'HS_TAPE'	Use tape as a storage tier
STORETYPE_AMAZONS3	VARCHAR2(50)	'HS_S3'	Use Amazon S3 Web service as a storage tier

Table 60-2 DBMS_DBFS_HS Constants - Used by the SETSTOREPROPERTY Procedure and the GETSTOREPROPERTY Function

Constant	Type	Value	Description
PROPNAME_BUCKET	VARCHAR2(50)	'BUCKET'	Specifies the AWS bucket to be used as a storage tier by the Hierarchical Store. Restrictions on bucket name are: 1) Bucket names can only contain lowercase letters, numbers, periods (.) and dashes(-). Note that underscores (_) are invalid. 2) Bucket names must start with a number or letter. 3) Bucket names cannot be in an IP address style (192.168.5.4). 4) Bucket names must be between 3 and 63 characters long. 5) Bucket names should not end with a dash. 6) Dashes cannot appear next to periods. For example, my-.bucket.com is invalid.
PROPNAME_CACHESIZE	VARCHAR2(50)	'CACHE_SIZE'	Specifies the cumulative cache size used for the Hierarchical Store. This property is set by the CREATESTORE Procedure and can be modified by the RECONFIGCACHE Procedure . It cannot be modified by the SETSTOREPROPERTY Procedure , though its value can be queried by the GETSTOREPROPERTY Function .
PROPNAME_COMPRESSIONLEVEL	VARCHAR2(50)	'COMPRESSION_LEVEL'	Use to enable compression of files stored in the DBFS hierarchical store. It specifies the compression level to be used for compressing the files

Table 60-2 (Cont.) DBMS_DBFS_HS Constants - Used by the SETSTOREPROPERTY Procedure and the GETSTOREPROPERTY Function

Constant	Type	Value	Description
PROPNAME_ENABLE CLEANUPONDELETE	VARCHAR2 (50)	'ENABLE_CLEAN UP_ON_DELETE'	If this property is set to 'TRUE', whenever the user invokes the DELETEFILE Procedure in the DBMS_DBFS_CONTENT interface on a file residing in the DBMS_DBFS_HS store, the DBMS_DBFS_HS removes the file on the external storage that contains this user file, provided that the file has no other useful data. By default, the property is set to 'TRUE' for STORETYPE_AMAZONS3 and 'FALSE' for STORETYPE_TAPE .
PROPNAME_HTTPPR OXY	VARCHAR2 (50)	'HTTP_PROXY'	Specifies the DNS name of the HTTP proxy, if any, that is needed to access the Amazon S3 storage service
PROPNAME_LICENS EID	VARCHAR2 (50)	'LICENSE_ID'	Specifies the license ID associated with the library <code>libosbws11.so</code> .
PROPNAME_LOBCAC HE_QUOTA	VARCHAR2 (50)	'LOBCACHE_QUO TA'	Specifies fraction of the <code>cache_size</code> which is allocated for level 1 cache. The default value of this parameter is <code>NULL</code> which means that 0.8 (= 80%) of the <code>cache_size</code> is used for level 1 cache. This property cannot be modified by the SETSTOREPROPERTY Procedure though its value can be queried by the GETSTOREPROPERTY Function . Its value is set by CREATESTORE Procedure and can be modified by the RECONFIGCACHE Procedure .
PROPNAME_MEDIAP OOL	VARCHAR2 (50)	'MEDIA_POOL'	Specifies the media pool number to use for storing the content
PROPVAL_COMPLVL _NONE	VARCHAR2 (50)	'NONE'	Indicates no compression
PROPVAL_COMPLVL _LOW	VARCHAR2 (50)	'LOW'	Use to set the compression level to <code>LOW</code> . This is expected to have the best performance while still providing a good compression ratio.
PROPVAL_COMPLVL _MEDIUM	VARCHAR2 (50)	'MEDIUM'	Use to set the compression level to <code>MEDIUM</code> . This compression level is expected to provide better compression ratio than <code>LOW</code> but the time required for compression will be higher than compression level <code>LOW</code> .

Table 60-2 (Cont.) DBMS_DBFS_HS Constants - Used by the SETSTOREPROPERTY Procedure and the GETSTOREPROPERTY Function

Constant	Type	Value	Description
PROPVAL_COMPLVL_HIGH	VARCHAR2(50)	'HIGH'	Use to set the compression level to HIGH. This compression level is expected to provide the best compression ratio but compression time will in general be highest among the 3 compression levels.
PROPNAME_OPTTARBALLSIZE	VARCHAR2(50)	'OPTIMAL_TARBALL_SIZE'	Specifies <code>optimal_tarball_size</code> as the maximum possible size of an archive file. Multiple content files are bundled together into one archive file and then the archive file is transferred to tape or Amazon S3. This is because creating one file on tape or Amazon S3 for every content file in the store is a prohibitively expensive operation. This property cannot be modified by the SETSTOREPROPERTY Procedure though its value can be queried by the GETSTOREPROPERTY Function . Its value is set by CREATESTORE Procedure and can be modified by the RECONFIGCACHE Procedure .
PROPNAME_READCHUNKSIZE	VARCHAR2(50)	'READ_CHUNK_SIZE'	Specifies the size used by the SBT protocol to transfer data from tape or S3. This chunk is allocated in memory per transaction for retrieval of content files from an archive store, so the value of this property should be conservative. The default size of 1MB is typically good for most users.
PROPNAME_S3HOST	VARCHAR2(50)	'S3_HOST'	Specifies the <code>HOST</code> name of the Amazon S3 storage service. It must be <code>s3.amazonaws.com</code> .
PROPNAME_SBT_LIBRARY	VARCHAR2(50)	'SBT_LIBRARY'	Specifies the path of the shared library used by RMAN to communicate with Amazon S3. It is named <code>libosbws11.so</code> and is available in <code>rdbms/lib</code> directory.
PROPNAME_STREAMABLE	VARCHAR2(50)	'STREAMABLE'	Indicates whether buffer-based <code>PUT</code> or <code>GET</code> should be done on this store. Valid values for are <code>TRUE</code> and <code>FALSE</code> . The default value of this property is <code>TRUE</code> .

Table 60-2 (Cont.) DBMS_DBFS_HS Constants - Used by the SETSTOREPROPERTY Procedure and the GETSTOREPROPERTY Function

Constant	Type	Value	Description
PROPNAME_WALLET	VARCHAR2(50)	'WALLET'	<p>The value of this property should be of the form:</p> <pre>LOCATION=file:filename CREDENTIAL_ALIAS=access/secret_alias PROXY_AUTH_ALIAS=proxyusername/password alias</pre> <p>Defines the Oracle Wallet which contains the credentials of the Amazon S3 account associated with the store under consideration.</p> <p>LOCATION: The directory path that contains the Oracle wallet. The format is <code>file:directory-path</code></p> <p>The format of <code>wallet_path</code> in Windows is, for example:</p> <pre>file:c:\WINNT\Profiles\username\WALLETS</pre> <p>In UNIX or Linux it is, for example:</p> <pre>file:/home/username/wallets</pre> <p>When the package is executed in the Oracle database server, the wallet is accessed from the database server.</p> <p>PASSWORD: Defines the wallet password. If auto-login is enabled in wallet, this parameter does not have to be specified. By default, the <code>mkstore</code> utility enables auto-login.</p> <p>CREDENTIAL_ALIAS: Defines the credential alias for <code>ACCESS_KEY</code> and <code>SECRET_KEY</code></p>
PROPNAME_WRITEC HUNKSIZ	VARCHAR2(50)	'WRITE_CHUNK_SIZE'	<p>Specifies the size used by the SBT protocol to transfer data to tape or S3.</p> <p>This chunk is allocated in memory per transaction for <code>PUT</code> of Content Files to an archive store so the value should be conservative.</p> <p>The default size of 1MB is typically good for most users.</p>

Table 60-3 DBMS_DBFS_HS Constants - Used by the REGISTERSTORECOMMAND Function

Constant	Type	Value	Description
BEFORE_PUT	NUMBER	'1'	Specified operation must be performed before writing a <code>SECUREFILE</code> to the remote store
BEFORE_GET	NUMBER	'2'	Specified operation must be performed before a retrieval operation such as reading a <code>SECUREFILE</code> from the remote device

Table 60-4 DBMS_DBFS_HS Constants - Failure/Success/Error

Constant	Type	Value	Description
FAIL	NUMBER	'0'	Procedure or function did not execute successfully
SUCCESS	NUMBER	'1'	Procedure or function completed successfully
ERROR	NUMBER	'2'	Procedure or function returned an error

60.4 DBMS_DBFS_HS Operational Notes

When the `DBMS_DBFS_HS` package is executed in the Oracle database server, the wallet is accessed from the database server.

60.5 Summary of DBMS_DBFS_HS Subprograms

This table lists and describes the subprograms in the `DBMS_DBFS_HS` package.

Table 60-5 DBMS_DBFS_HS Package Subprograms

Subprogram	Description
CLEANUPUNUSEDBACKUPFILES Procedure	Removes files created on the external storage device that hold no currently used data
CREATEBUCKET Procedure	Creates an AWS bucket, associated with a store of type <code>STORETYPE_AMAZONS3</code> into which the Hierarchical Store can then move data
CREATESTORE Procedure	Creates a new hierarchical store
DEREGSTORECOMMAND Function	Removes a command that had been previously associated with a store through the RECONFIGCACHE Procedure
DROPSTORE Procedure	Deletes a previously created hierarchical store
FLUSHCACHE Procedure	Flushes (writes out) dirty contents from the level-1 cache.
GETSTOREPROPERTY Function	Retrieves the values of a property of a store

Table 60-5 (Cont.) DBMS_DBFS_HS Package Subprograms

Subprogram	Description
RECONFIGCACHE Procedure	Reconfigures the parameters of the database cache used by the store
REGISTERSTORECOMMAND Procedure	Registers commands for a store with the Hierarchical Store to be sent to the Media Manager for the external storage device associated with the store
SENDCOMMAND Procedures	Sends a command to be executed on the external storage device's Media Manager
SETSTOREPROPERTY Procedure	Stores properties of a store in the database
STOREPUSH Procedure	Pushes locally staged data to the remote storage

60.5.1 CLEANUPUNUSEDBACKUPFILES Procedure

This procedure removes files created on the external storage device that hold no currently used data in them.

Syntax

```
DBMS_DBFS_HS.CLEANUPUNUSEDBACKUPFILES (
    store_name    IN    VARCHAR2);
```

Parameters

Table 60-6 CLEANUPUNUSEDBACKUPFILES Procedure Parameters

Parameter	Description
store_name	Name of store

Usage Notes

- The action of removing files from external storage device can not be rolled back.
- This method can be executed periodically to clear space on the external storage device. Asynchronously deleting content from the external storage device is useful because it has minimal impact on the OLTP performance. The periodic scheduling can be accomplished using the DBMS_SCHEDULER package.

60.5.2 CREATEBUCKET Procedure

This procedure creates an AWS bucket, associated with a store of type STORETYPE_AMAZONS3 into which the Hierarchical Store can then move data.

Syntax

```
DBMS_DBFS_HS.CREATEBUCKET (
    store_name    IN    VARCHAR2);
```

Parameters

Table 60-7 CREATEBUCKET Procedure Parameters

Parameter	Description
store_name	Name of store

Usage Notes

- The PROPNAME_BUCKET property of the store should be set before this subprogram is called.
- Once this procedure has successfully created a bucket in Amazon S3, the bucket can only be deleted using out-of-band methods, such as logging-in to S3 and deleting data (directories, files, and other items) for the bucket.

60.5.3 CREATESTORE Procedure

This procedure creates a new hierarchical store `store_name` of type `STORE_TYPE` (`STORETYPE_TAPE` or `STORETYPE_AMAZONS3`) in schema `schema_name` (defaulting to the current schema) under the ownership of the invoking session user.

Syntax

```
DBMS_DBFS_HS.CREATESTORE (
    store_name      IN      VARCHAR2,
    store_type     IN      VARCHAR2,
    tbl_name       IN      VARCHAR2,
    tbs_name       IN      VARCHAR2,
    cache_size     IN      NUMBER,
    lob_cache_quota IN      NUMBER DEFAULT NULL,
    optimal_tarball_size IN  NUMBER DEFAULT NULL,
    schema_name    IN      VARCHAR2 DEFAULT NULL);
```

Parameters

Table 60-8 CREATESTORE Procedure Parameters

Parameter	Description
store_name	Name of store
store_type	STORETYPE_TAPE or STORETYPE_AMAZONS3
tbl_name	Table for store entries
tbs_name	Tablespace for the store
cache_size	Amount of space used by the store to cache content in given tablespace
lob_cache_quota	Fraction of the cache_size which is allocated for level 1 cache. The default value of this parameter is NULL which means that 0.8 (= 80%) of the cache_size is used for level 1 cache.

Table 60-8 (Cont.) CREATESTORE Procedure Parameters

Parameter	Description
<code>optimal_tarball_size</code>	Maximum possible size of the archive file. Multiple content files are bundled together into one archive file, and then the archive file is transferred to tape or Amazon S3. This is because creating one file on tape or Amazon S3 for every content file in the store is a prohibitively expensive operation. The value of is set by default to 10GB for tape and to 100MB for Amazon S3.
<code>schema_name</code>	Schema for the store

Usage Notes

`CREATESTORE ()` sets certain properties of the store to default values. The user can use the methods `SETSTOREPROPERTY ()` and `RECONFIGCACHE ()` to appropriately change the property values and to set other properties of the store.

- Store names must be unique for an owner. The same store names can be used for different stores owned by different owners.
- Once a table space has been specified to store the store's content in a database, it cannot be changed later.
- This subprogram will execute like a DDL statement, performing an automatic `COMMIT` before and after execution.
- Stores using `DBMS_DBFS_HS` must not use singleton mount. This means that the singleton parameter should be `FALSE` and the `store_mount` parameter should have a non-NULL value in a call to the `DBMS_DBFS_CONTENT.MOUNTSTORE` procedure.

60.5.4 DEREGSTORECOMMAND Function

This procedure removes a command that had been previously associated with a store through the `REGISTERSTORECOMMAND` Procedure.

Syntax

```
DBMS_DBFS_HS.DEREGSTORECOMMAND (
    store_name      IN   VARCHAR2,
    message         IN   VARCHAR2);
```

Parameters

Table 60-9 DEREGSTORECOMMAND Procedure Parameters

Parameter	Description
<code>store_name</code>	Name of store
<code>message</code>	Message to be deregistered

Usage Notes

If this subprogram successfully executes, its actions cannot be rolled back by the user. If the user wants to restore the previous state, the user must call the [REGISTERSTORECOMMAND Procedure](#).

Related Topics

- [REGISTERSTORECOMMAND Procedure](#)
This procedure registers commands for a store with the Hierarchical Store. These commands are sent to the Media Manager for the external storage device associated with the store.

60.5.5 DROPSTORE Procedure

This procedure deletes a previously created hierarchical store specified by name and owned by the invoking session user.

Syntax

```
DBMS_DBFS_HS.DROPSTORE (
    store_name  IN    VARCHAR2,
    opt_flags   IN    INTEGER DEFAULT 0);
```

Parameters

Table 60-10 DROPSTORE Procedure Parameters

Parameter	Description
store_name	Name of store owned by the invoking session user
opt_flags	User can specify optional flags. If <code>DISABLE_CLEANUPBACKUPFILES</code> is specified as one of the optional flags, the call to the CLEANUPUNUSEDBACKUPFILES Procedure is not issued. By default, when this flag is not set, the procedure implicitly cleans-up all unused backup files.

Usage Notes

- The procedure executes like a DDL in that it auto-commits before and after its execution.
- If `CLEANUPBACKUPFILES` is disabled during the procedure, the user must resort to out-of-band techniques to cleanup unused backup files. No further invocations of `CLEANUPBACKFILES` for a dropped store are possible through hierarchical store.
- This subprogram will un-register the store from `DBMS_DBFS_CONTENT` package. All files in the given store are deleted from the store (Tape or Amazon S3 Web service). The database table holding the store's entries in the database, is also dropped by this subprogram.

60.5.6 FLUSHCACHE Procedure

This procedure flushes out dirty contents from level-1 cache, which can be locked, to level-2 cache, thereby freeing-up space in level 1 cache.

Syntax

```
DBMS_DBFS_HS.FLUSHCACHE (
    store_name    IN    VARCHAR2);
```

Parameters

Table 60-11 FLUSHCACHE Procedure Parameters

Parameter	Description
store_name	Name of store

60.5.7 GETSTOREPROPERTY Function

This function retrieves the values of a property.

Syntax

```
DBMS_DBFS_HS.GETSTOREPROPERTY (
    store_name    IN    VARCHAR2,
    property_name IN    VARCHAR2,
    noexcp       IN    BOOLEAN DEFAULT FALSE) RETURN VARCHAR2;
```

Parameters

Table 60-12 GETSTOREPROPERTY Function Parameters

Parameter	Description
store_name	Name of store
property_name	Name of property
noexcp	If set to <code>FALSE</code> , raises an exception if the property does not exist in the database. If <code>noexcp</code> is set to <code>TRUE</code> , returns <code>NULL</code> if the property does not exist.

Return Values

The values of a property.

Usage Notes

The specified store must already have been created.

60.5.8 RECONFIGCACHE Procedure

This procedure reconfigures the parameters of the database cache being used by the store.

Syntax

```
DBMS_DBFS_HS.RECONFIGCACHE (
  store_name          IN    VARCHAR2,
  cache_size          IN    NUMBER DEFAULT NULL,
  lobcache_quota      IN    NUMBER DEFAULT NULL,
  optimal_tarball_size IN    NUMBER DEFAULT NULL);
```

Parameters

Table 60-13 RECONFIGCACHE Procedure Parameters

Parameter	Description
store_name	Name of store
cache_size	Cumulative cache size used for the Hierarchical Store
lobcache_quota	Fraction of the cache size that are assigned to level 1 cache
optimal_tarball_size	Maximum possible size of an archive file. Since creating one file for every content file in the store is a prohibitively expensive operation, multiple content files are bundled together into one archive file for transfer to tape or Amazon S3.

Usage Notes

- The specified store must already have been created before reconfiguration.
- The Hierarchical Store uses a level 1 cache and a level 2 cache. The level 1 cache subsumes most of the working set and the level 2 cache is used to perform bulk writes to the backend device.
- If any of the last 3 parameters is `NULL`, its value specified during store creation is used. If the parameter was `NULL` when the call to the [CREATESTORE Procedure](#) was issued, the `DBMS_DBFS_HS` package assigns a default value.

The `DBMS_DBFS_HS` package optimistically tries to allocate more than 1 tarball's worth of size for level 2 cache to facilitate concurrency, though a minimum of 1 tarball size is necessary for level 2 cache.

The values for cumulative cache size and LOB cache quota decide allocation of space for the two caches. If values are not provided, a user might see an `INSUFFICIENT_CACHE` exception. In that case, it is better to revise the cache parameters in order to have a working store.

- If this subprogram successfully executes, its actions cannot be rolled back by the user. In that case, the user should call `RECONFIGCACHE` again with new or modified parameters.

60.5.9 REGISTERSTORECOMMAND Procedure

This procedure registers commands for a store with the Hierarchical Store. These commands are sent to the Media Manager for the external storage device associated with the store.

Syntax

```
DBMS_DBFS_HS.REGISTERSTORECOMMAND (
  store_name      IN      VARCHAR2,
  message         IN      VARCHAR2,
  flags           IN      NUMBER);
```

Parameters

Table 60-14 REGISTERSTORECOMMAND Procedure Parameters

Parameter	Description
store_name	Name of store
message	Message to be sent to the Media Manager of the external store
flags	Valid values: <ul style="list-style-type: none"> • BEFORE_PUT CONSTANT NUMBER := 1; • BEFORE_GET CONSTANT NUMBER := 2;

Usage Notes

- These commands are sent before the next read or write of content. When the Hierarchical Store wants to push (or get) data to (or from) the storage device, it begins a session (to communicate with the device). After beginning the session, it sends all registered commands for the to the relevant device before writing (or getting) any data.
- If this method successfully executes, its actions cannot be rolled back by the user. To restore the previous state the user must call the [DEREGSTORECOMMAND Function](#).

60.5.10 SENDCOMMAND Procedure

This procedure sends a command to be executed on the external storage device's Media Manager.

Syntax

```
DBMS_DBFS_HS.SENDCOMMAND (
  store_name      IN      VARCHAR2,
  message         IN      VARCHAR2);
```

Parameters

Table 60-15 SENDCOMMAND Procedure Parameters

Parameter	Description
store_name	Name of store
message	Message string to be executed

60.5.11 SETSTOREPROPERTY Procedure

This procedure stores properties of a store in the database as name-value pairs.

Syntax

```
DBMS_DBFS_HS.SETSTOREPROPERTY (
    store_name      IN      VARCHAR2,
    property_name   IN      VARCHAR2,
    property_value  IN      VARCHAR2);
```

Parameters

Table 60-16 SETSTOREPROPERTY Procedure Parameters

Parameter	Description
store_name	Name of store
property_name	For a store using Tape device, there are three properties whose values must be set by the user, and four properties that have default values. Stores of type STORETYPE_AMAZONS3 have properties with default values. The various options for both types of stores are detailed under property_value.
property_value	<p>Stores using a Tape Device</p> <p>The values for the following properties must be set by the user:</p> <ul style="list-style-type: none"> PROPNAME_SBTLIBRARY - This should point to the shared library used by RMAN to communicate with the external tape device. It is usually named libobk.so. PROPNAME_MEDIAPPOOL - Media pool number for storing content PROPNAME_CACHE_SIZE - Amount of space, in bytes, used for the cache of this store <p>The following properties, which have default values assigned to them when a store is created, benefit from tuning:</p> <ul style="list-style-type: none"> PROPNAME_READCHUNKSIZE and PROPNAME_WRITECHUNKSIZE - These are the sizes used by the SBT protocol to transfer data to and from the tapes. These chunks are allocated in memory per transaction, so the values should be conservative. The default size is 1MB. PROPNAME_STREAMABLE - Indicates whether DBFS_LINKS can perform read operations (for example SELECT or DBMS_LOB.READ) directly from the store, or if the data must be copied back into the database before it can be read PROPNAME_ENABLECLEANUPONDELETE - Indicates if DBMS_DBFS_HS should delete unused files on the external storage. Valid values for this property are 'FALSE' for STORETYPE_TAPE. PROPNAME_COMPRESSLEVEL - Describes how files written to Tape should be compressed. It can be set to PROPVAL_COMPLVL_NONE, PROPVAL_COMPLVL_LOW, PROPVAL_COMPLVL_MEDIUM or PROPVAL_COMPLVL_HIGH. By default it is set to PROPVAL_COMPLVL_NONE.

Table 60-16 (Cont.) SETSTOREPROPERTY Procedure Parameters

Parameter	Description
(cont) <code>property_value</code>	<p>Stores of type STORETYPE_AMAZONS3</p> <p>It is mandatory that the following properties have assigned values, and default values are provided:</p> <ul style="list-style-type: none"> • <code>PROPNAME_SBTLIBRARY</code> - Specifies the path of the shared library used by RMAN to communicate with Amazon S3. It is named <code>libosbws11.so</code> and is available in <code>rdbms/lib</code> directory. • <code>PROPNAME_S3HOST</code> - Defines the HOST name of the Amazon S3 storage service. It must be <code>s3.amazonaws.com</code>. • <code>PROPNAME_BUCKET</code> - Defines the AWS bucket used as a storage tier by the Hierarchical Store. Restrictions on bucket names are: <ul style="list-style-type: none"> -- Bucket names can only contain lowercase letters, numbers, periods (.) and dashes (-). Use of an underscore () is invalid. -- Bucket names must start with a number or letter -- Bucket names cannot be in an IP address style ("192.168.5.4") -- Bucket names must be between 3 and 63 characters in length -- Bucket names should not end with a dash -- Dashes cannot appear next to periods. For example, "my-.bucket.com" is invalid. • <code>PROPNAME_LICENSEID</code> - Specifies the license ID associated with the library <code>libosbws11.so</code>. • <code>PROPNAME_WALLET</code> - Has the form: <pre>'LOCATION=file:<filename> CREDENTIAL_ALIAS=<access/secret_alias> PROXY_AUTH_ALIAS=<proxyusername/password alias>'</pre> <ul style="list-style-type: none"> -- <code>LOCATION</code> - Directory path that contains the Oracle wallet. The format is <code>file:directory-path</code>. See Examples for variations in format. -- <code>PASSWORD</code> - Defines the wallet password. If <code>auto-login</code> is enabled in the wallet (this can be changed using the user's own utility), and does not have to be specified. By default, the <code>mkstore</code> utility enables <code>auto-login</code>. -- <code>CREDENTIAL_ALIAS</code> - Defines the credential alias for <code>ACCESS_KEY</code> and <code>SECRET_KEY</code> -- <code>PROXY_AUTH_ALIAS</code> - Defines authentication credentials for the proxy server, if applicable.

Table 60-16 (Cont.) SETSTOREPROPERTY Procedure Parameters

Parameter	Description
(property_value (contd.))	<p>The following properties are optional:</p> <ul style="list-style-type: none"> PROPNAME_HTTPPROXY - Defines the DNS name of the HTTP proxy, if any, that is needed to access the Amazon S3 storage service. PROPNAME_STREAMABLE – Indicates whether buffer-based PUT or GET operation should be done on this store. Valid values for this property are TRUE (default) and FALSE. PROPNAME_ENABLECLEANUPONDELETE - Indicates if DBMS_DBFS_HS should delete unused files on the external storage device. Default values for this property are FALSE for STORETYPE_TAPE and TRUE for STORETYPE_AMAZONS3. PROPNAME_COMPRESSLEVEL - Describes how files written to tape should be compressed. It can be set to PROPVAL_COMPLVL_NONE, PROPVAL_COMPLVL_LOW, PROPVAL_COMPLVL_MEDIUM or PROPVAL_COMPLVL_HIGH. By default it is set to PROPVAL_COMPLVL_NONE.

Usage Notes

- The specified store must already have been created.
- If this subprogram successfully executes, its actions cannot be rolled back by the user.
- The same property can be set multiple times to the same or different values using this subprogram
- Regarding PROPNAME_ENABLECLEANUPONDELETE behavior, a job is created for each store by the DBMS_DBFS_HS to remove the unused files from the external storage. By default, the job is enabled for STORETYPE_AMAZONS3 and is disabled for STORETYPE_TAPE. If the ENABLECLEANUPONDELETE property is set to TRUE, the job is enabled; if the property is set to FALSE, the job is disabled. If enabled, the job runs at an interval of one hour by default. The DBMS_SCHEDULER package can be used to modify the schedule. The name of the job can be obtained by querying USER_DBFS_HS_FIXED_PROPERTIES for prop_name = 'DELJOB_NAME'.

Examples

Format

The format of wallet_path in Windows is, for example:

```
file:c:\WINNT\Profiles\\WALLETS
```

The format of wallet_path in UNIX or Linux is, for example:

```
file:/home/username/wallets
```

60.5.12 STOREPUSH Procedure

This procedure pushes locally staged data to the remote storage.

Syntax

```
DBMS_DBFS_HS.STOREPUSH (  
    store_name  IN      VARCHAR2,  
    path        IN      VARCHAR2 DEFAULT NULL);
```

Parameters

Table 60-17 STOREPUSH Procedure Parameters

Parameter	Description
store_name	Name of store whose content the client writes from local cache to the external store
path	A non-mount qualified (without mount point) path within the store. By default, its value is <code>NULL</code> which corresponds to the root path of the store.

Usage Notes

- The Hierarchical Store caches the content files locally in database tables. When enough content is amassed in the cache to make it efficient to write to the external storage device (or the cache is completely filled), the Hierarchical Store creates a tarball out of the local content and writes these tarballs as files on the external device. The size of the tarball created by the Hierarchical Store is controlled by the store property `PROPNAME_OPTTARBALLSIZE`.
- When the amount of free space in the cache is such that the caching of a content file will push the space used above `cache_size`, the Hierarchical Store will internally call `STOREPUSH`. The `STOREPUSH` Procedure creates tarball(s) out of the existing dirty or modified content files in the cache and writes them out to the external device. A `STOREPUSH` call is not guaranteed to write all the dirty content from local cache to the external storage, since some files may be locked by other sessions.
- `STOREPUSH` has a built-in ability feature allowing it to automatically resume operation. If a `STOREPUSH` call is interrupted (say by a network outage) after it has transferred some tarballs to the external device, it can be restarted after the outage and will then resume transferring data from the point it was interrupted. In other words, work done before the outage is not lost. `STOREPUSH` can safely be restarted and the effect is such as if the outage never occurred.
- If this method successfully executes, its actions cannot be rolled back by the user.
- By default, when `path` is `NULL`, all files in the store are candidates for `STOREPUSH`. If `path` has a valid input value, all files which are under the namespace of given path are written from the local cache to the external store. If a given path is an existing file, it is pushed out again to the remote store.

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DBMS_DBFS_SFS

The `DBMS_DBFS_SFS` package provides an interface to operate a SecureFile-based store (SFS) for the content interface described in the `DBMS_DBFS_CONTENT` package.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Summary of DBMS_DBFS_SFS Subprograms](#)



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide

61.1 DBMS_DBFS_SFS Overview

The `DBMS_DBFS_SFS` package is a sample implementation of a package that implements and extends the `DBMS_DBFS_CONTENT_SFI` interface. It provides a POSIX-compliant file system stored in the RDBMS.

61.2 DBMS_DBFS_SFS Security Model

The `DBMS_DBFS_SFS` package runs with `AUTHID CURRENT_USER`.

61.3 DBMS_DBFS_SFS Constants

The `DBMS_DBFS_SFS` package uses the constants shown in the following tables.



Note:

Oracle has deprecated the older encryptions and hashing algorithms. The deprecated algorithms for `DBMS_CRYPTO` and native network encryption include MD4, MD5, DES, 3DES, and RC4-related algorithms as well as 3DES for Transparent Data Encryption (TDE). Removing older, less secure cryptography algorithms prevents accidental use of these algorithms. To meet your security requirements, Oracle recommends that you use more modern cryptography algorithms, such as the Advanced Encryption Standard (AES).

- [Table 61-1](#)

- [Table 61-2](#)
- [Table 61-3](#)
- [Table 61-4](#)

Table 61-1 DBMS_DBFS_SFS Constants - Compression Levels

Constant	Type	Value	Description
COMPRESSION_DEFAULT	VARCHAR2 (32)	' '	Use the default SecureFile compression level
COMPRESSION_LOW	VARCHAR2 (32)	'LOW'	Use compression level 'LOW'
COMPRESSION_MEDIUM	VARCHAR2 (32)	'MEDIUM'	Use compression level 'MEDIUM'
COMPRESSION_HIGH	VARCHAR2 (32)	'HIGH'	Use compression level 'HIGH'

Table 61-2 DBMS_DBFS_SFS Constants - Used by the encryption Parameter

Constant	Type	Value	Description
ENCRYPTION_DEFAULT	VARCHAR2 (32)	' '	Use the default SecureFile encryption algorithm
ENCRYPTION_AES128	VARCHAR2 (32)	'AES128'	Use encryption AES 128 bit
ENCRYPTION_AES192	VARCHAR2 (32)	'AES192'	Use encryption AES 192 bit
ENCRYPTION_AES256	VARCHAR2 (32)	'AES256'	Use encryption AES 256 bit

Table 61-3 DBMS_DBFS_SFS Constants - Used by the npartitions Parameter

Constant	Type	Value	Description
DEFAULT_PARTITIONS	INTEGER	16	Default to 16 partitions

Table 61-4 DBMS_DBFS_SFS Constants - Used by the partition_key Parameter

Constant	Type	Value	Description
PARTITION_BY_ITEM	INTEGER	1	Use a hash of the item name for the partition key
PARTITION_BY_PATH	INTEGER	2	Use a hash of the path name for the partition key
PARTITION_BY_GUID	INTEGER	3	Use a hash of the GUID as the partition key

61.4 Summary of DBMS_DBFS_SFS Subprograms

This table lists and describes the DBMS_DBFS_SFS Package subprograms.

Table 61-5 DBMS_DBFS_SFS Package Subprograms

Subprogram	Description
CREATEFILESYSTEM Procedure	Creates a file system store
CREATESTORE Procedure	Creates a new DBFS SFS store
DROPFILERYSTEM Procedures	Drops the DBFS SFS store
INITFS Procedure	Initializes a POSIX file system store

61.4.1 CREATEFILESYSTEM Procedure

This procedure creates a file system store.

Syntax

```
DBMS_DBFS_SFS.CREATEFILESYSTEM (
  store_name          IN      VARCHAR2,
  schema_name        IN      VARCHAR2  DEFAULT NULL,
  tbl_name           IN      VARCHAR2  DEFAULT NULL,
  tbl_tbs            IN      VARCHAR2  DEFAULT NULL,
  lob_tbs            IN      VARCHAR2  DEFAULT NULL,
  use_bf             IN      BOOLEAN   DEFAULT FALSE,
  properties         IN      DBMS_DBFS_CONTENT_PROPERTIES_T DEFAULT NULL,
  create_only        IN      BOOLEAN   FALSE,
  use_objects        IN      BOOLEAN   DEFAULT FALSE,
  with_grants        IN      BOOLEAN   DEFAULT FALSE,
  do_dedup           IN      BOOLEAN   DEFAULT FALSE,
  do_compress        IN      BOOLEAN   DEFAULT FALSE,
  compression        IN      VARCHAR2  DEFAULT COMPRESSION_DEFAULT,
  do_encrypt         IN      BOOLEAN   DEFAULT FALSE,
  encryption         IN      VARCHAR2  DEFAULT ENCRYPTION_DEFAULT,
  do_partition       IN      BOOLEAN   DEFAULT FALSE,
  npartitions        IN      NUMBER     DEFAULTDEFAULT_PARTITIONS,
  partition_key      IN      NUMBER     DEFAULT PARTITION_BY_ITEM,
  partition_guidi    IN      BOOLEAN   DEFAULT FALSE,
  partition_pathi    IN      BOOLEAN   DEFAULT FALSE,
  partition_prop     IN      BOOLEAN   DEFAULT TRUE);
```

Parameters

Table 61-6 CREATEFILESYSTEM Procedure Parameters

Parameter	Description
store_name	Name of store
schema_name	Schema for the store, defaulting to the current schema
tbl_name	Table for store entries. If not specified, an internally generated name is used.
tbl_tb	Tablespace for the store, defaulting to the schema's default tablespace
lob_tbs	Tablespace in which to create the LOB segment. It defaults to the user's default tablespace.
use_bf	If TRUE, a BasicFile LOB is used; otherwise a SecureFile LOB is used.

Table 61-6 (Cont.) CREATEFILESYSTEM Procedure Parameters

Parameter	Description
properties	Table of (name, value, typecode) tuples used to configure the store properties. Currently no such properties are defined or used.
create_only	If TRUE, the file system is created, but not registered with the current user
use_objects	If TRUE, a single base-table with an object-type column (using a nested table) is created to backup the new file system. Otherwise, a pair of (parent, child) tables is used to backup the file system. In both cases, the object type nested table or the child table is used only for user-defined properties.
with_grants	If TRUE, DML and query access permissions are granted to the DBFS_ROLE as part of creating the file system. Otherwise, explicit grants (or existing permissions) are required to access the file system.
do_dedup	If TRUE, do deduplication the underlying SecureFile column
do_compress	If TRUE, do compression the underlying SecureFile column
compression	Compression algorithm to use (see Table 61-1)
do_encrypt	If TRUE, encrypt the underlying SecureFile column
encryption	encryption algorithm to use (see Table 61-2)
do_partition	If TRUE, partition the table used for storage
npartitions	Number of partitions to create for the table (see Table 61-3).
partition_key	How to partition the table: by item name, by path name, or by GUID (see Table 61-4).
partition_guidi	If TRUE, build an index on GUID
partition_pathi	If TRUE, build an index on path name
partition_prop	If TRUE, partition the properties table

Usage Notes

The procedure executes like a DDL in that it auto-commits before and after its execution.

61.4.2 CREATESTORE Procedure

This procedure creates a new DBFS SFS store owned by the invoking session user.

Syntax

```
DBMS_DBFS_SFS.CREATESTORE (
  store_name      IN      VARCHAR2,
  tbl_name       IN      VARCHAR2  DEFAULT NULL,
  tbs_name       in      VARCHAR2  DEFAULT NULL,
  use_bf         in      BOOLEAN   DEFAULT FALSE,
  stgopts       in      VARCHAR2  DEFAULT '');
```

Parameters

Table 61-7 CREATESTORE Procedure Parameters

Parameter	Description
store_name	Name of store
store_type	STORETYPE_TAPE or STORETYPE_AMAZONS3
tbl_name	Placeholder for the store content cached in database
tbs_name	Named tablespace
use_bf	If TRUE, a BasicFile LOB is used; otherwise a SecureFile LOB is used.
stgopts	Currently non-operational, reserved for future use

61.4.3 DROPFILESYSTEM Procedures

This procedure drops the DBFS SFS store, purging all dictionary information associated with the store, and dropping the underlying file system table.

Syntax

```
DBMS_DBFS_SFS.DROPFILESYSTEM (
  schema_name  IN      VARCHAR2 DEFAULT NULL,
  tbl_name     IN      INTEGER);
```

```
DBMS_DBFS_SFS.DROPFILESYSTEM (
  store_name   IN      VARCHAR2);
```

Parameters

Table 61-8 DROPFILESYSTEM Procedure Parameters

Parameter	Description
schema_name	Name of schema
tbl_name	Name of tablespace
store_name	Name of store path

Usage Notes

- If the specified store table is registered by the current user, it will be unregistered from the content interface described in the `DBMS_DBFS_CONTENT` package and the POSIX metadata tables.
- Subsequent to unregistration, an attempt will be made to store table(s). This operation may fail if other users are currently using this store table.
- The user attempting a drop of the tables underlying the store must actually have the privileges to complete the drop operation (either as the owner of the tables, or as a sufficiently privileged user for cross-schema operations).
- The procedure executes like a DDL in that it auto-commits before and after its execution.

61.4.4 INITFS Procedure

This procedure initialize a POSIX file system store. The table associated with the POSIX file system store `store_name` is truncated and reinitialized with a single "root" directory entry.

Syntax

```
DBMS_DBFS_SFS.INITFS (  
    store_name      IN      VARCHAR2);
```

Parameters

Table 61-9 INITFS Procedure Parameters

Parameter	Description
<code>store_name</code>	Name of store

Usage Notes

The procedure executes like a DDL in that it auto-commits before and after its execution.

DBMS_DDL

This package provides access to some SQL data definition language (DDL) statements from stored procedures. It also provides special administration operations that are not available as Data Definition Language statements (DDLs).

This chapter contains the following topics:

- [Deprecated Subprograms](#)
- [Security Model](#)
- [Operational Notes](#)
- [Summary of DBMS_DDL Subprograms](#)

62.1 DBMS_DDL Deprecated Subprograms

Oracle recommends that you do not use deprecated subprograms in new applications. Support for deprecated features is for backward compatibility only.

The following subprograms are deprecated with release Oracle Database 10g:

- [ALTER_COMPILE Procedure](#)

62.2 DBMS_DDL Security Model

This package runs with the privileges of the calling user, rather than the package owner `SYS`.

62.3 DBMS_DDL Operational Notes

The `ALTER_COMPILE` procedure commits the current transaction, performs the operation, and then commits again.

62.4 Summary of DBMS_DDL Subprograms

This table lists the `DBMS_DDL` subprograms in alphabetical order and briefly describes them.

Table 62-1 *DBMS_DDL Package Subprograms*

Subprogram	Description
ALTER_COMPILE Procedure	Compiles the PL/SQL object
ALTER_TABLE_NOT_REFERENCEABLE Procedure	Reorganizes object tables
ALTER_TABLE_REFERENCEABLE Procedure	Reorganizes object tables

Table 62-1 (Cont.) DBMS_DDL Package Subprograms

Subprogram	Description
CREATE_WRAPPED Procedures	Takes as input a single CREATE OR REPLACE statement that specifies creation of a PL/SQL package specification, package body, function, procedure, type specification or type body, generates a CREATE OR REPLACE statement with the PL/SQL source text obfuscated and executes the generated statement
IS_TRIGGER_FIRE_ONCE Function	Returns TRUE if the specified DML or DDL trigger is set to fire once. Otherwise, returns FALSE
SET_TRIGGER_FIRING_PROPERTY Procedures	Sets the specified DML or DDL trigger's firing property
WRAP Functions	Takes as input a CREATE OR REPLACE statement that specifies creation of a PL/SQL package specification, package body, function, procedure, type specification or type body and returns a CREATE OR REPLACE statement where the text of the PL/SQL unit has been obfuscated

62.4.1 ALTER_COMPILE Procedure

This procedure is equivalent to the SQL statement: ALTER PROCEDURE|FUNCTION|PACKAGE [<schema>.] <name> COMPILE [BODY]



Note:

This procedure is deprecated in Oracle Database 10g Release 2 (10.2). While the procedure remains available in the package for reasons of backward compatibility, Oracle recommends using the DDL equivalent in a dynamic SQL statement.

Syntax

```
DBMS_DDL.ALTER_COMPILE (
    type          VARCHAR2,
    schema        VARCHAR2,
    name          VARCHAR2
    reuse_settings BOOLEAN := FALSE);
```

Parameters

Table 62-2 ALTER_COMPILE Procedure Parameters

Parameter	Description
type	Must be either PROCEDURE, FUNCTION, PACKAGE, PACKAGE BODY or TRIGGER
schema	Schema name If NULL, then use current schema (case-sensitive)

Table 62-2 (Cont.) ALTER_COMPILE Procedure Parameters

Parameter	Description
name	Name of the object (case-sensitive)
reuse_settings	Indicates whether the session settings in the objects should be reused, or whether the current session settings should be adopted instead

Exceptions**Table 62-3 ALTER_COMPILE Procedure Exceptions**

Exception	Description
ORA-20000:	Insufficient privileges or object does not exist
ORA-20001:	Remote object, cannot compile
ORA-20002:	Bad value for object type: should be either PACKAGE, PACKAGE BODY, PROCEDURE, FUNCTION, or TRIGGER

62.4.2 ALTER_TABLE_NOT_REFERENCEABLE Procedure

This procedure alters the given object table `table_schema.table_name` so it becomes not the default referenceable table for the schema `affected_schema`.

This is equivalent to SQL:

```
ALTER TABLE [<table_schema>.<table_name>] NOT REFERENCEABLE FOR <affected_schema>
```

which is currently not supported or available as a DDL statement.

Syntax

```
DBMS_DDL.ALTER_TABLE_NOT_REFERENCEABLE (
    table_name      IN          VARCHAR2,
    table_schema    IN DEFAULT  NULL,
    affected_schema IN DEFAULT  NULL);
```

Parameters**Table 62-4 ALTER_TABLE_NOT_REFERENCEABLE Procedure Parameters**

Parameter	Description
table_name	Name of the table to be altered. Cannot be a synonym. Must not be NULL. Case sensitive.
table_schema	Name of the schema owning the table to be altered. If NULL then the current schema is used. Case sensitive.
affected_schema	Name of the schema affected by this alteration. If NULL then the current schema is used. Case sensitive.

Usage Notes

This procedure simply reverts for the affected schema to the default table referenceable for PUBLIC; that is., it simply undoes the previous ALTER_TABLE_REFERENCEABLE call for this specific schema. The affected schema must be a particular schema (cannot be PUBLIC).

The user that executes this procedure must own the table (that is, the schema is the same as the user), and the affected schema must be the same as the user.

If the user executing this procedure has ALTER ANY TABLE and SELECT ANY TABLE and DROP ANY TABLE privileges, the user doesn't have to own the table and the affected schema can be any valid schema.

62.4.3 ALTER_TABLE_REFERENCEABLE Procedure

This procedure alters the given object table `table_schema.table_name` so it becomes the referenceable table for the given schema `affected_schema`.

This is equivalent to SQL:

```
ALTER TABLE [<table_schema>.<table_name>] REFERENCEABLE FOR <affected_schema>
```

which is currently not supported or available as a DDL statement.

Syntax

```
DBMS_DDL.ALTER_TABLE_REFERENCEABLE
  table_name      IN VARCHAR2,
  table_schema    IN DEFAULT NULL,
  affected_schema IN DEFAULT NULL);
```

Parameters

Table 62-5 ALTER_TABLE_REFERENCEABLE Procedure Parameters

Parameter	Description
<code>table_name</code>	Name of the table to be altered. Cannot be a synonym. Must not be NULL. Case sensitive.
<code>table_schema</code>	Name of the schema owning the table to be altered. If NULL then the current schema is used. Case sensitive.
<code>affected_schema</code>	Name of the schema affected by this alteration. If NULL then the current schema is used. Case sensitive.

Usage Notes

When you create an object table, it automatically becomes referenceable, unless you use the `OID AS` clause when creating the table. The `OID AS` clause makes it possible for you to create an object table and to assign to the new table the same EOID as another object table of the same type. After you create a new table using the `OID AS` clause, you end up with two object table with the same EOID; the new table is not referenceable, the original one is. All references that used to point to the objects in the original table still reference the same objects in the same original table.

If you execute this procedure on the new table, it makes the new table the referenceable table replacing the original one; thus, those references now point to the objects in the new table instead of the original table.

62.4.4 CREATE_WRAPPED Procedures

The procedure takes as input a single `CREATE OR REPLACE` statement that specifies creation of a PL/SQL package specification, package body, function, procedure, type specification or type body. It then generates a `CREATE OR REPLACE` statement with the PL/SQL source text obfuscated and executes the generated statement. In effect, this procedure bundles together the operations of wrapping the text and creating the PL/SQL unit.



See Also:

[WRAP Functions](#)

This procedure has 3 overloads. Each of the three functions provides better performance than using a combination of individual [WRAP Functions](#) and `DBMS_SQL.PARSE` (or `EXECUTE IMMEDIATE`) calls. The different functionality of each form of syntax is presented with the definition.

Syntax

Is a shortcut for `EXECUTE IMMEDIATE SYS.DBMS_DDL.WRAP(ddl)`:

```
DBMS_DDL.CREATE_WRAPPED (
    ddl    VARCHAR2);
```

Is a shortcut for `DBMS_SQL.PARSE(cursor, SYS.DBMS_DDL.WRAP (input, lb, ub))`:

```
DBMS_DDL.CREATE_WRAPPED (
    ddl    DBMS_SQL.VARCHAR2A,
    lb     PLS_INTEGER,
    ub     PLS_INTEGER);
```

Is a shortcut for `DBMS_SQL.PARSE(cursor, SYS.DBMS_DDL.WRAP (input, lb, ub))`:

```
DBMS_DDL.CREATE_WRAPPED (
    ddl    DBMS_SQL.VARCHAR2S,
    lb     PLS_INTEGER,
    ub     PLS_INTEGER);
```

Parameters

Table 62-6 CREATE_WRAPPED Procedure Parameters

Parameter	Description
ddl	A <code>CREATE OR REPLACE</code> statement that specifies creation of a PL/SQL package specification, package body, function, procedure, type specification or type body
lb	Lower bound for indices in the string table that specify the <code>CREATE OR REPLACE</code> statement

Table 62-6 (Cont.) CREATE_WRAPPED Procedure Parameters

Parameter	Description
ub	Upper bound for indices in the string table that specify the CREATE OR REPLACE statement.

Usage Notes

- The CREATE OR REPLACE statement is executed with the privileges of the user invoking DBMS_DDL.CREATE_WRAPPED.
- Any PL/SQL code that attempts to call these interfaces should use the fully qualified package name SYS.DBMS_DDL to avoid the possibility that the name DBMS_DDL is captured by a locally-defined unit or by redefining the DBMS_DDL public synonym.
- Each invocation of any accepts only a single PL/SQL unit. By contrast, the PL/SQL wrap utility accepts a entire SQL*Plus file and obfuscates the PL/SQL units within the file leaving all other text as-is. These interfaces are intended to be used in conjunction with or as a replacement for PL/SQL's dynamic SQL interfaces (EXECUTE IMMEDIATE and DBMS_SQL.PARSE). Since these dynamic SQL interfaces only accept a single unit at a time (and do not understand the SQL*Plus "/" termination character), both the CREATE_WRAPPED Procedures and the WRAP Functions require input to be a single unit.

Exceptions

ORA-24230: If the input is not a CREATE OR REPLACE statement specifying a PL/SQL unit, exception DBMS_DDL.MALFORMED_WRAP_INPUT is raised.

Examples

```
DECLARE
    ddl VARCHAR2(32767);
BEGIN
    ddl := GENERATE_PACKAGE(...);
    SYS.DBMS_DDL.CREATE_WRAPPED(ddl); -- Instead of EXECUTE IMMEDIATE ddl
END;
```

62.4.5 IS_TRIGGER_FIRE_ONCE Function

This function returns TRUE if the specified DML or DDL trigger is set to fire once. Otherwise, it returns FALSE.

A fire once trigger fires in a user session but does not fire in the following cases:

- For changes made by a Streams apply process
- For changes made by executing one or more Streams apply errors using the EXECUTE_ERROR or EXECUTE_ALL_ERRORS procedure in the DBMS_APPLY_ADM package
- For changes made by a Logical Standby apply process



Note:

Only DML and DDL triggers can be fire once. All other types of triggers always fire.



See Also:

"SET_TRIGGER_FIRING_PROPERTY Procedures"

Syntax

```
DBMS_DDL.IS_TRIGGER_FIRE_ONCE
    trig_owner      IN VARCHAR2,
    trig_name       IN VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 62-7 IS_TRIGGER_FIRE_ONCE Function Parameters

Parameter	Description
trig_owner	Schema of trigger
trig_name	Name of trigger

62.4.6 SET_TRIGGER_FIRING_PROPERTY Procedures

This procedure sets the specified DML or DDL trigger's firing property whether or not the property is set for the trigger.

Use this procedure to control a DML or DDL trigger's firing property for changes:

- Applied by a Streams apply process
- Made by executing one or more Streams apply errors using the EXECUTE_ERROR or EXECUTE_ALL_ERRORS procedure in the DBMS_APPLY_ADM package.
- Applied by a Logical Standby apply process

Syntax

```
DBMS_DDL.SET_TRIGGER_FIRING_PROPERTY (
    trig_owner      IN VARCHAR2,
    trig_name       IN VARCHAR2,
    fire_once       IN BOOLEAN);
```

```
DBMS_DDL.SET_TRIGGER_FIRING_PROPERTY (
    trig_owner      IN VARCHAR2,
    trig_name       IN VARCHAR2,
    property        IN INTEGER,
    setting         IN BOOLEAN);
```

Parameters

Table 62-8 SET_TRIGGER_FIRING_PROPERTY Procedure Parameters

Parameter	Description
trig_owner	Schema of the trigger to set
trig_name	Name of the trigger to set
fire_once	<ul style="list-style-type: none"> If <code>TRUE</code>, the trigger is set to fire once. By default, the <code>fire_once</code> parameter is set to <code>TRUE</code> for DML and DDL triggers. If <code>FALSE</code>, the trigger is set to always fire unless <code>apply_server_only</code> property is set to <code>TRUE</code>, which overrides <code>fire_once</code> property setting.
property	<ul style="list-style-type: none"> <code>DBMS_DDL.fire_once</code> to set the <code>fire_once</code> property of the trigger <code>DBMS_DDL.apply_server_only</code> to indicate whether trigger fires only in the context of SQL apply processes maintaining a logical standby database or Streams apply processes
setting	Value of property being set

Usage Notes

DML triggers created on a table have their fire-once property set to `TRUE`. In this case, the triggers only fire when the table is modified by an user process, and they are automatically disabled inside Oracle processes maintaining either a logical standby database (SQL Apply) or Oracle processes doing replication (Streams Apply) processes, and thus do not fire when a SQL Apply or a Streams Apply process modifies the table. There are two ways for a user to fire a trigger as a result of SQL Apply or a Streams Apply process making a change to a maintained table: (a) setting the fire-once property of a trigger to `FALSE`, which allows it fire both in the context of a user process or a SQL or Streams Apply process, or (b) by setting the apply-server-only property to `TRUE` and thus making the trigger fire only in the context of a SQL Apply or a Streams Apply process and not in the context of a user process.

- `FIRE_ONCE=TRUE, APPLY_SERVER_ONLY=FALSE`

This is the default property setting for a DML trigger. The trigger only fires when user process modifies the base table.

- `FIRE_ONCE=TRUE or FALSE, APPLY_SERVER_ONLY=TRUE`

The trigger only fires when SQL Apply or Streams Apply process modifies the base table. The trigger does not fire when a user process modifies the base table. Thus the apply-server-only property overrides the fire-once property of a trigger.

 **Note:**

- If you dequeue an error transaction from the error queue and execute it without using the `DBMS_APPLY_ADM` package, then relevant changes resulting from this execution cause a trigger to fire, regardless of the trigger firing property.
- Only DML and DDL triggers can be fire once. All other types of triggers always fire.

62.4.7 WRAP Functions

This function takes as input a single `CREATE OR REPLACE` statement that specifies creation of a PL/SQL package specification, package body, function, procedure, type specification or type body and returns a `CREATE OR REPLACE` statement where the text of the PL/SQL unit has been obfuscated.

The function has 3 overloads to allow for the different ways in which DDL statements can be generated dynamically and presented to `DBMS_SQL` or `EXECUTE IMMEDIATE`. The different functionality of each form of syntax is presented with the definition.

 **See Also:**

[CREATE_WRAPPED Procedures](#)

Syntax

Provides basic functionality:

```
DBMS_DDL.WRAP (
    ddl      VARCHAR2)
RETURN VARCHAR2;
```

Provides the same functionality as the first form, but allows for larger inputs. This function is intended to be used with the [PARSE Procedures](#) in the `DBMS_SQL` package and its argument list follows the convention of `DBMS_SQL.PARSE`:

```
DBMS_DDL.WRAP (
    ddl      DBMS_SQL.VARCHAR2S,
    lb       PLS_INTEGER,
    ub       PLS_INTEGER)
RETURN DBMS_SQL.VARCHAR2S;
```

Provides the same functionality as the second form and is provided for compatibility with multiple forms of the [PARSE Procedures](#) in the `DBMS_SQL` package:

```
DBMS_DDL.WRAP (
    ddl      DBMS_SQL.VARCHAR2A,
    lb       PLS_INTEGER,
    ub       PLS_INTEGER)
RETURN DBMS_SQL.VARCHAR2A;
```

Parameters

Table 62-9 WRAP Function Parameters

Parameter	Description
ddl	A CREATE OR REPLACE statement that specifies creation of a PL/SQL package specification, package body, function, procedure, type specification or type body
lb	Lower bound for indices in the string table that specify the CREATE OR REPLACE statement
ub	Upper bound for indices in the string table that specify the CREATE OR REPLACE statement.

Return Values

A CREATE OR REPLACE statement with the text obfuscated. In the case of the second and third form, the return value is a table of strings that need to be concatenated in order to construct the CREATE OR REPLACE string containing obfuscated source text.

Usage Notes

- Any PL/SQL code that attempts to call these interfaces should use the fully qualified package name `SYS.DBMS_DDL` to avoid the possibility that the name `DBMS_DDL` is captured by a locally-defined unit or by redefining the `DBMS_DDL` public synonym.
- Each invocation of any accepts only a single PL/SQL unit. By contrast, the PL/SQL `wrap` utility accepts a full SQL file and obfuscates the PL/SQL units within the file leaving all other text as-is. These interfaces are intended to be used in conjunction with or as a replacement for PL/SQL's dynamic SQL interfaces (`EXECUTE IMMEDIATE` and `DBMS_SQL.PARSE`). Since these dynamic SQL interfaces only accept a single unit at a time (and do not understand the SQL*Plus "/" termination character), both the [CREATE_WRAPPED Procedures](#) and the [WRAP Functions](#) require input to be a single unit.

Exceptions

ORA-24230: If the input is not a CREATE OR REPLACE statement specifying a PL/SQL unit, exception `DBMS_DDL.MALFORMED_WRAP_INPUT` is raised.

Examples

```
DECLARE
    ddl VARCHAR2(32767);
BEGIN
    ddl := GENERATE_PACKAGE(...);
EXECUTE IMMEDIATE SYS.DBMS_DDL.WRAP(ddl); -- Instead of EXECUTE IMMEDIATE ddl
END;
```

DBMS_DEBUG

`DBMS_DEBUG` is deprecated. Use `DBMS_DEBUG_JDWP` instead.

See [DBMS_DEBUG_JDWP](#) for more information.

`DBMS_DEBUG` is a PL/SQL interface to the PL/SQL debugger layer, Probe, in the Oracle server.

This package is primarily intended to implement server-side debuggers and it provides a way to debug server-side PL/SQL program units.

Note:

The term *program unit* refers to a PL/SQL program of any type (procedure, function, package, package body, trigger, anonymous block, object type, or object type body).

This chapter contains the following topics:

- [Overview](#)
- [Constants](#)
- [Variables](#)
- [Exceptions](#)
- [Operational Notes](#)
- [Data Structures](#)
- [Summary of DBMS_DEBUG Subprograms](#)

63.1 DBMS_DEBUG Overview

To debug server-side code, you must have two database sessions: one session to run the code in debug mode (the target session), and a second session to supervise the target session (the debug session).

The target session becomes available for debugging by making initializing calls with `DBMS_DEBUG`. This marks the session so that the PL/SQL interpreter runs in debug mode and generates debug events. As debug events are generated, they are posted from the session. In most cases, debug events require return notification: the interpreter pauses awaiting a reply.

Meanwhile, the debug session must also initialize itself using `DBMS_DEBUG`: This tells it which target session to supervise. The debug session may then call entry points in `DBMS_DEBUG` to read events that were posted from the target session and to communicate with the target session.

The following subprograms are run in the target session (the session that is to be debugged):

- [SYNCHRONIZE Function](#)
- [DEBUG_ON Procedure](#)
- [DEBUG_OFF Procedure](#)

DBMS_DEBUG does not provide an interface to the PL/SQL compiler, but it does depend on debug information optionally generated by the compiler. Without debug information, it is not possible to examine or modify the values of parameters or variables.

63.2 DBMS_DEBUG Constants

A breakpoint status may have the following value: `breakpoint_status_unused`—breakpoint is not in use.

Otherwise, the status is a mask of the following values:

- `breakpoint_status_active`—a line breakpoint
- `breakpoint_status_disabled`—breakpoint is currently disabled
- `breakpoint_status_remote`—a shadow breakpoint (a local representation of a remote breakpoint)

63.3 DBMS_DEBUG Variables

The DBMS_DEBUG uses the variables shown in the following table.

Table 63-1 DBMS_DEBUG Variables

Variable	Description
<code>default_timeout</code>	The timeout value (used by both sessions). The smallest possible timeout is 1 second. If this value is set to 0, then a large value (3600) is used.

63.4 DBMS_DEBUG Exceptions

These values are returned by the various functions called in the debug session (`SYNCHRONIZE`, `CONTINUE`, `SET_BREAKPOINT`, and so on). If PL/SQL exceptions worked across client/server and server/server boundaries, then these would all be exceptions rather than error codes.

Table 63-2 DBMS_DEBUG Exceptions

Status	Description
<code>success</code>	Normal termination

Statuses returned by `GET_VALUE` and `SET_VALUE`:

Table 63-3 DBMS_DEBUG Exceptions Returned by GET_VALUE and SET_VALUE

Status	Description
error_bogus_frame	No such entrypoint on the stack
error_no_debug_info	Program was compiled without debug symbols
error_no_such_object	No such variable or parameter
error_unknown_type	Debug information is unreadable
error_indexed_table	Returned by GET_VALUE if the object is a table, but no index was provided
error_illegal_index	No such element exists in the collection
error_nullcollection	Table is atomically NULL
error_nullvalue	Value is NULL

Statuses returned by SET_VALUE:

Table 63-4 DBMS_DEBUG Exceptions Returned by SET_VALUE

Status	Description
error_illegal_value	Constraint violation
error_illegal_null	Constraint violation
error_value_malformed	Unable to decipher the given value
error_other	Some other error
error_name_incomplete	Name did not resolve to a scalar

Statuses returned by the breakpoint functions:

Table 63-5 Statuses Returned by the Breakpoint Functions

Status	Description
error_no_such_breakpt	No such breakpoint
error_idle_breakpt	Cannot enable or disable an unused breakpoint
error_bad_handle	Unable to set breakpoint in given program (nonexistent or security violation)

General error codes (returned by many of the DBMS_DEBUG subprograms):

Table 63-6 DBMS_DEBUG Subprograms Error Codes

Status	Description
error_unimplemented	Functionality is not yet implemented
error_deferred	No program running; operation deferred
error_exception	An exception was raised in the DBMS_DEBUG or Probe packages on the server

Table 63-6 (Cont.) DBMS_DEBUG Subprograms Error Codes

Status	Description
error_communication	Some error other than a timeout occurred
error_timeout	Timeout occurred

Table 63-7 illegal_init Exceptions

Exception	Description
illegal_init	DEBUG_ON was called prior to INITIALIZE

The following exceptions are raised by procedure `SELF_CHECK`:

Table 63-8 SELF_CHECK Procedure Exceptions

Exception	Description
pipe_creation_failure	Could not create a pipe
pipe_send_failure	Could not write data to the pipe
pipe_receive_failure	Could not read data from the pipe
pipe_datatype_mismatch	Datatype in the pipe was wrong
pipe_data_error	Data got garbled in the pipe

63.5 DBMS_DEBUG Operational Notes

There are two ways to ensure that debug information is generated: through a session switch, or through individual recompilation.

To set the session switch, enter the following statement:

```
ALTER SESSION SET PLSQL_DEBUG = true;
```

This instructs the compiler to generate debug information for the remainder of the session. It does not recompile any existing PL/SQL.

To generate debug information for existing PL/SQL code, use one of the following statements (the second recompiles a package or type body):

```
ALTER [PROCEDURE | FUNCTION | PACKAGE | TRIGGER | TYPE] <name> COMPILE DEBUG;
ALTER [PACKAGE | TYPE] <name> COMPILE DEBUG BODY;
```

[Figure 63-1](#) and [Figure 63-2](#) illustrate the flow of operations in the session to be debugged and in the debugging session.

Figure 63-1 Target Session

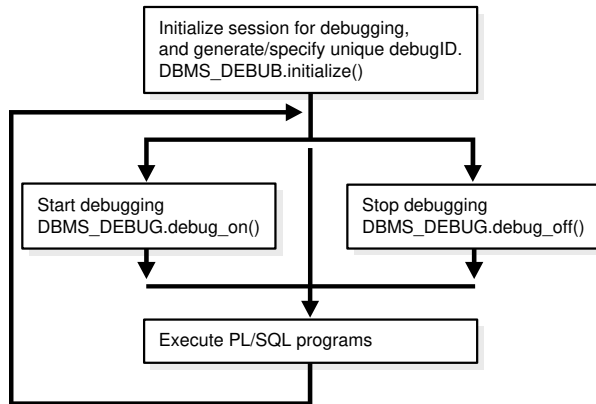


illustration: arpls001
release: 9
caption: Target Session
date: 1/29/01
platform: pc

Figure 63-2 Debug Session

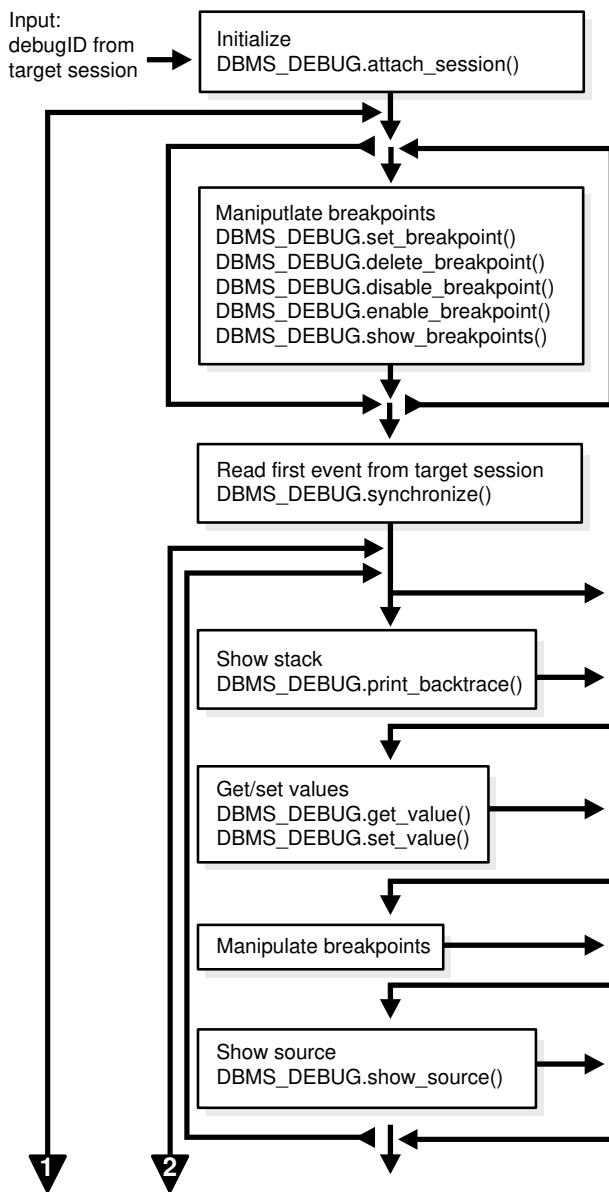
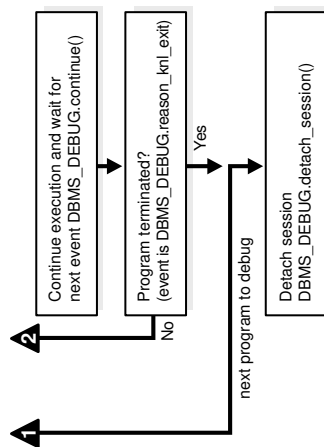


illustration: arpls003
release: 9
caption: Target Session
 see arpls004
date: 1/30/01
platform: pc

Figure 63-3 Debug Session (Cont.)



Control of the Interpreter

The interpreter pauses execution at the following times:

1. At startup of the interpreter so any deferred breakpoints may be installed prior to execution.
2. At any line containing an enabled breakpoint.
3. At any line where an *interesting* event occurs. The set of interesting events is specified by the flags passed to `DBMS_DEBUG.CONTINUE` in the `breakflags` parameter.

illustration: arpls004
release: 9
caption: Target Session
see arpls003
date: 1/30/01
platform: pc

Session Termination

There is no event for session termination. Therefore, it is the responsibility of the debug session to check and make sure that the target session has not ended. A call to `DBMS_DEBUG.SYNCHRONIZE` after the target session has ended causes the debug session to hang until it times out.

Deferred Operations

The diagram suggests that it is possible to set breakpoints prior to having a target session. This is true. In this case, Probe caches the breakpoint request and transmits it to the target session at first synchronization. However, if a breakpoint request is deferred in this fashion, then:

- `SET_BREAKPOINT` does not set the breakpoint number (it can be obtained later from `SHOW_BREAKPOINTS` if necessary).
- `SET_BREAKPOINT` does not validate the breakpoint request. If the requested source line does not exist, then an error silently occurs at synchronization, and no breakpoint is set.

Diagnostic Output

To debug Probe, there are *diagnostics* parameters to some of the calls in `DBMS_DEBUG`. These parameters specify whether to place diagnostic output in the RDBMS tracefile. If output to the RDBMS tracefile is disabled, these parameters have no effect.

Common Debug Session Sections

- Common Section
- Target Session
- Debug Session Section

Common Section

The following subprograms may be called in either the target or the debug session:

- [PROBE_VERSION Procedure](#)
- [SELF_CHECK Procedure](#)
- [SET_TIMEOUT Function](#)

Target Session

The following subprograms may be called only in the target session:

- [INITIALIZE Function](#)
- [DEBUG_ON Procedure](#)
- [SET_TIMEOUT_BEHAVIOUR Procedure](#)
- [GET_TIMEOUT_BEHAVIOUR Function](#)

Debug Session Section

The following subprograms should be run in the debug session only:

- [ATTACH_SESSION Procedure](#)

- SYNCHRONIZE Function
- SHOW_FRAME_SOURCE Procedure
- SHOW_SOURCE Procedures
- GET_MORE_SOURCE Procedure
- PRINT_BACKTRACE Procedure
- CONTINUE Function
- SET_BREAKPOINT Function
- DELETE_BREAKPOINT Function
- SET_OER_BREAKPOINT Function
- DELETE_OER_BREAKPOINT Function
- ENABLE_BREAKPOINT Function
- DISABLE_BREAKPOINT Function
- SHOW_BREAKPOINTS Procedures
- SET_VALUE Functionn
- GET_VALUE Function
- TARGET_PROGRAM_RUNNING Procedure
- DETACH_SESSION Procedure
- GET_RUNTIME_INFO Function
- PRINT_INSTANTIATIONS Procedure
- PING Procedure
- GET_LINE_MAP Function
- GET_RUNTIME_INFO Function
- GET_INDEXES Function
- EXECUTE Procedure

OER Breakpoints

Exceptions that are declared in PL/SQL programs are known as user-defined exceptions. In addition, there are Oracle Errors (OERs) that are returned from the Oracle kernel. To tie the two mechanisms together, PL/SQL provides the `exception_init` pragma that turns a user-defined exception into an OER, so that a PL/SQL handler may be used for it, and so that the PL/SQL engine can return OERs to the Oracle kernel. As of the current release, the only information available about an OER is its number. If two user-defined exceptions are `exception_init`'d to the same OER, they are indistinguishable.

Namespaces

Program units on the server reside in different namespaces. When setting a breakpoint, specify the desired namespace.

1. `Namespace_cursor` contains cursors (anonymous blocks).
2. `Namespace_pgkspec_or_toplevel` contains:
 - Package specifications.

- Procedures and functions that are not nested inside other packages, procedures, or functions.
 - Object types.
3. `Namespace_pkg_body` contains package bodies and type bodies.
 4. `Namespace_trigger` contains triggers.

Libunit Types

These values are used to disambiguate among objects in a given namespace. These constants are used in `PROGRAM_INFO` when Probe is giving a stack backtrace.

- `LibunitType_cursor`
- `LibunitType_procedure`
- `LibunitType_function`
- `LibunitType_package`
- `LibunitType_package_body`
- `LibunitType_trigger`
- `LibunitType_Unknown`

Breakflags

These are values to use for the `breakflags` parameter to `CONTINUE`, in order to tell Probe what events are of interest to the client. These flags may be combined.

Value	Description
<code>break_next_line</code>	Break at next source line (step over calls)
<code>break_any_call</code>	Break at next source line (step into calls)
<code>break_any_return</code>	Break after returning from current entrypoint (skip over any entrypoints called from the current routine)
<code>break_return</code>	Break the next time an entrypoint gets ready to return. (This includes entrypoints called from the current one. If interpreter is running <code>Proc1</code> , which calls <code>Proc2</code> , then <code>break_return</code> stops at the end of <code>Proc2</code> .)
<code>break_exception</code>	Break when an exception is raised
<code>break_handler</code>	Break when an exception handler is executed
<code>abort_execution</code>	Stop execution and force an 'exit' event as soon as <code>DBMS_DEBUG.CONTINUE</code> is called.

Information Flags

These are flags which may be passed as the `info_requested` parameter to `SYNCHRONIZE`, `CONTINUE`, and `GET_RUNTIME_INFO`.

Flag	Description
<code>info_getStackDepth</code>	Get the current depth of the stack
<code>info_getBreakpoint</code>	Get the breakpoint number

Flag	Description
info_getLineinfo	Get program unit information

Reasons for Suspension

After `CONTINUE` is run, the program either runs to completion or breaks on some line.

Reason	Description
reason_none	-
reason_interpreter_starting	Interpreter is starting
reason_breakpoint	Hit a breakpoint
reason_enter	Procedure entry
reason_return	Procedure is about to return
reason_finish	Procedure is finished
reason_line	Reached a new line
reason_interrupt	An interrupt occurred
reason_exception	An exception was raised
reason_exit	Interpreter is exiting (old form)
reason_knl_exit	Kernel is exiting
reason_handler	Start exception-handler
reason_timeout	A timeout occurred
reason_instantiate	Instantiation block
reason_abort	Interpreter is aborting

63.6 DBMS_DEBUG Data Structures

The `DBMS_DEBUG` package defines `RECORD` types and `TABLE` types.

RECORD Types

- [BREAKPOINT_INFO Record Type](#)
- [PROGRAM_INFO Record Type](#)
- [RUNTIME_INFO Record Type](#)

TABLE Types

- [BACKTRACE_TABLE Table Type](#)
- [BREAKPOINT_TABLE Table Type](#)
- [INDEX_TABLE Table Type](#)
- [VC2_TABLE Table Type](#)

63.6.1 BREAKPOINT_INFO Record Type

This type gives information about a breakpoint, such as its current status and the program unit in which it was placed.

Syntax

```
TYPE breakpoint_info IS RECORD (
  name          VARCHAR2(30),
  owner         VARCHAR2(30),
  dblink        VARCHAR2(30),
  line#         BINARY_INTEGER,
  libunittype   BINARY_INTEGER,
  status        BINARY_INTEGER);
```

Fields

Table 63-9 BREAKPOINT_INFO Fields

Field	Description
name	Name of the program unit
owner	Owner of the program unit
dblink	Database link, if remote
line#	Line number
libunittype	NULL, unless this is a nested procedure or function
status	See Constants for values of breakpoint_status_*

63.6.2 PROGRAM_INFO Record Type

The PROGRAM_INFO record type of the DBMS_DEBUG package specifies a program location. It is a line number in a program unit.

This is used for stack backtraces and for setting and examining breakpoints. The read-only fields are currently ignored by Probe for breakpoint operations. They are set by Probe only for stack backtraces.

Syntax

```
TYPE program_info IS RECORD(
  -- The following fields are used when setting a breakpoint
  namespace     BINARY_INTEGER,
  name          VARCHAR2(30),
  owner         VARCHAR2(30),
  dblink        VARCHAR2(30),
  line#         BINARY_INTEGER,
  -- Read-only fields (set by Probe when doing a stack backtrace)
  libunittype   BINARY_INTEGER,
  entrypointname VARCHAR2(30));
```

Fields

Table 63-10 PROGRAM_INFO Fields

Field	Description
namespace	See DBMS_DEBUG Operational Notes for more information about namespaces.
name	Name of the program unit
owner	Owner of the program unit
dblink	Database link, if remote
line#	Line number
libunittype	A read-only field, NULL, unless this is a nested procedure or function
entrypointname	A read-only field, to disambiguate among objects that share the same namespace (for example, procedure and package specifications). See DBMS_DEBUG Operational Notes for more information about the libunit types.

63.6.3 RUNTIME_INFO Record Type

This type gives context information about the running program.

Syntax

```
TYPE runtime_info IS RECORD(
  line#           BINARY_INTEGER,
  terminated      binary_integer,
  breakpoint      binary_integer,
  stackdepth      BINARY_INTEGER,
  interpreterdepth BINARY_INTEGER,
  reason          BINARY_INTEGER,
  program         program_info);
```

Fields

Table 63-11 RUNTIME_INFO Fields

Field	Description
line#	Duplicate of <code>program.line#</code>
terminated	Whether the program has terminated
breakpoint	Breakpoint number
stackdepth	Number of frames on the stack
interpreterdepth	[A reserved field]
reason	Reason for suspension
program	Source location

63.6.4 BACKTRACE_TABLE Table Type

This type is used by `PRINT_BACKTRACE`.

Syntax

```
TYPE backtrace_table IS TABLE OF program_info INDEX BY BINARY_INTEGER;
```

63.6.5 BREAKPOINT_TABLE Table Type

This type is used by `SHOW_BREAKPOINTS`.

Syntax

```
TYPE breakpoint_table IS TABLE OF breakpoint_info INDEX BY BINARY_INTEGER;
```

63.6.6 INDEX_TABLE Table Type

This type is used by `GET_INDEXES` to return the available indexes for an indexed table.

Syntax

```
TYPE index_table IS table of BINARY_INTEGER INDEX BY BINARY_INTEGER;
```

63.6.7 VC2_TABLE Table Type

This type is used by `SHOW_SOURCE`.

Syntax

```
TYPE vc2_table IS TABLE OF VARCHAR2(90) INDEX BY BINARY_INTEGER;
```

63.7 Summary of DBMS_DEBUG Subprograms

This table lists the `DBMS_DEBUG` subprograms in alphabetical order and briefly describes them.

Table 63-12 DBMS_DEBUG Package Subprograms

Subprogram	Description
ATTACH_SESSION Procedure	Notifies the debug session about the target debugID
CONTINUE Function	Continues execution of the target program
DEBUG_OFF Procedure	Turns debug-mode off
DEBUG_ON Procedure	Turns debug-mode on
DELETE_BREAKPOINT Function	Deletes a breakpoint
DELETE_OER_BREAKPOINT Function	Deletes an OER breakpoint

Table 63-12 (Cont.) DBMS_DEBUG Package Subprograms

Subprogram	Description
DETACH_SESSION Procedure	Stops debugging the target program
DISABLE_BREAKPOINT Function	Disables a breakpoint
ENABLE_BREAKPOINT Function	Activates an existing breakpoint
EXECUTE Procedure	Executes SQL or PL/SQL in the target session
GET_INDEXES Function	Returns the set of indexes for an indexed table
GET_MORE_SOURCE Procedure	Provides additional source in the event of buffer overflow when using SHOW_SOURCE
GET_LINE_MAP Function	Returns information about line numbers in a program unit
GET_RUNTIME_INFO Function	Returns information about the current program
GET_TIMEOUT_BEHAVIOUR Function	Returns the current timeout behavior
GET_VALUE Function	Gets a value from the currently-running program
INITIALIZE Function	Sets debugID in target session
PING Procedure	Pings the target session to prevent it from timing out
PRINT_BACKTRACE Procedure	Prints a stack backtrace
PRINT_INSTANTIATIONS Procedure	Prints a stack backtrace
PROBE_VERSION Procedure	Returns the version number of DBMS_DEBUG on the server
SELF_CHECK Procedure	Performs an internal consistency check
SET_BREAKPOINT Function	Sets a breakpoint in a program unit
SET_OER_BREAKPOINT Function	Sets an OER breakpoint
SET_TIMEOUT Function	Sets the timeout value
SET_TIMEOUT_BEHAVIOUR Procedure	Tells Probe what to do with the target session when a timeout occurs
SET_VALUE Function	Sets a value in the currently-running program
SHOW_BREAKPOINTS Procedures	Returns a listing of the current breakpoints
SHOW_FRAME_SOURCE Procedure	Fetches the frame source
SHOW_SOURCE Procedures	Fetches program source
SYNCHRONIZE Function	Waits for program to start running
TARGET_PROGRAM_RUNNING Procedure	Returns TRUE if the target session is currently executing a stored procedure, or FALSE if it is not

63.7.1 ATTACH_SESSION Procedure

This procedure notifies the debug session about the target program.

Syntax

```
DBMS_DEBUG.ATTACH_SESSION (
    debug_session_id IN VARCHAR2,
    diagnostics      IN BINARY_INTEGER := 0);
```

Parameters

Table 63-13 ATTACH_SESSION Procedure Parameters

Parameter	Description
debug_session_id	Debug ID from a call to INITIALIZE in target session
diagnostics	Generate diagnostic output if nonzero

63.7.2 CONTINUE Function

This function passes the given breakflags (a mask of the events that are of interest) to Probe in the target process. It tells Probe to continue execution of the target process, and it waits until the target process runs to completion or signals an event.

If `info_requested` is not NULL, then calls `GET_RUNTIME_INFO`.

Syntax

```
DBMS_DEBUG.CONTINUE (
    run_info      IN OUT runtime_info,
    breakflags    IN      BINARY_INTEGER,
    info_requested IN      BINARY_INTEGER := NULL)
RETURN BINARY_INTEGER;
```

Parameters

Table 63-14 CONTINUE Function Parameters

Parameter	Description
run_info	Information about the state of the program
breakflags	Mask of events that are of interest (see the discussion about break flags under DBMS_DEBUG Operational Notes)
info_requested	Which information should be returned in <code>run_info</code> when the program stops (see the discussion of information flags under DBMS_DEBUG Operational Notes)

Return Values

Table 63-15 CONTINUE Function Return Values

Return	Description
success	
error_timeout	Timed out before the program started running
error_communication	Other communication error

63.7.3 DEBUG_OFF Procedure

This procedure notifies the target session that debugging should no longer take place in that session. It is not necessary to call this function before ending the session.

⚠ WARNING:

There must be a debug session waiting if immediate is `TRUE`.

Syntax

```
DBMS_DEBUG.DEBUG_OFF;
```

Usage Notes

The server does not handle this entrypoint specially. Therefore, it attempts to debug this entrypoint.

63.7.4 DEBUG_ON Procedure

This procedure marks the target session so that all PL/SQL is run in debug mode. This must be done before any debugging can take place.

Syntax

```
DBMS_DEBUG.DEBUG_ON (
    no_client_side_plsql_engine BOOLEAN := TRUE,
    immediate                   BOOLEAN := FALSE);
```

Parameters

Table 63-16 DEBUG_ON Procedure Parameters

Parameter	Description
no_client_side_plsql_engine	Should be left to its default value unless the debugging session is taking place from a client-side PL/SQL engine
immediate	If this is <code>TRUE</code> , then the interpreter immediately switches itself into debug-mode, instead of continuing in regular mode for the duration of the call.

63.7.5 DELETE_BREAKPOINT Function

This function deletes a breakpoint.

Syntax

```
DBMS_DEBUG.DELETE_BREAKPOINT (
    breakpoint IN BINARY_INTEGER)
RETURN BINARY_INTEGER;
```

Parameters

Table 63-17 DELETE_BREAKPOINT Function Parameters

Parameter	Description
breakpoint	Breakpoint number from a previous call to SET_BREAKPOINT

Return Values

Table 63-18 DELETE_BREAKPOINT Function Return Values

Return	Description
success	
error_no_such_breakpoint	No such breakpoint exists
error_idle_breakpoint	Cannot delete an unused breakpoint
error_stale_breakpoint	The program unit was redefined since the breakpoint was set

63.7.6 DELETE_OER_BREAKPOINT Function

This function deletes an OER breakpoint.

Syntax

```
DBMS_DEBUG.DELETE_OER_BREAKPOINT (
    oer IN PLS_INTEGER)
RETURN PLS_INTEGER;
```

Parameters

Table 63-19 DELETE_OER_BREAKPOINT Function Parameters

Parameter	Description
oer	The OER (positive 4-byte number) to delete

63.7.7 DETACH_SESSION Procedure

This procedure stops debugging the target program.

This procedure may be called at any time, but it does not notify the target session that the debug session is detaching itself, and it does not terminate execution of the target session. Therefore, care should be taken to ensure that the target session does not hang itself.

Syntax

```
DBMS_DEBUG.DETACH_SESSION;
```

63.7.8 DISABLE_BREAKPOINT Function

This function makes an existing breakpoint inactive but leaves it in place.

Syntax

```
DBMS_DEBUG.DISABLE_BREAKPOINT (
    breakpoint IN BINARY_INTEGER)
RETURN BINARY_INTEGER;
```

Parameters

Table 63-20 DISABLE_BREAKPOINT Function Parameters

Parameter	Description
breakpoint	Breakpoint number from a previous call to SET_BREAKPOINT

Return Values

Table 63-21 DISABLE_BREAKPOINT Function Return Values

Returns	Description
success	
error_no_such_breakpt	No such breakpoint exists
error_idle_breakpt	Cannot disable an unused breakpoint

63.7.9 ENABLE_BREAKPOINT Function

This function is the reverse of disabling. This enables a previously disabled breakpoint.

Syntax

```
DBMS_DEBUG.ENABLE_BREAKPOINT (
    breakpoint IN BINARY_INTEGER)
RETURN BINARY_INTEGER;
```


Parameters

Table 63-22 ENABLE_BREAKPOINT Function Parameters

Parameter	Description
breakpoint	Breakpoint number from a previous call to SET_BREAKPOINT

Return Values

Table 63-23 ENABLE_BREAKPOINT Function Return Values

Return	Description
success	Success
error_no_such_breakpt	No such breakpoint exists
error_idle_breakpt	Cannot enable an unused breakpoint

63.7.10 EXECUTE Procedure

This procedure executes SQL or PL/SQL code in the target session. The target session is assumed to be waiting at a breakpoint (or other event). The call to DBMS_DEBUG.EXECUTE occurs in the debug session, which then asks the target session to execute the code.

Syntax

```
DBMS_DEBUG.EXECUTE (
  what          IN VARCHAR2,
  frame#        IN BINARY_INTEGER,
  bind_results  IN BINARY_INTEGER,
  results       IN OUT NOCOPY dbms_debug_vc2coll,
  errm          IN OUT NOCOPY VARCHAR2);
```

Parameters

Table 63-24 EXECUTE Procedure Parameters

Parameter	Description
what	SQL or PL/SQL source to execute
frame#	The context in which to execute the code. Only -1 (global context) is supported at this time.
bind_results	Whether the source wants to bind to results in order to return values from the target session: 0 = No 1 = Yes
results	Collection in which to place results, if bind_results is not 0
errm	Error message, if an error occurred; otherwise, NULL

Examples

Example 1

This example executes a SQL statement. It returns no results.

```

DECLARE
    coll sys.dbms_debug_vc2coll; -- results (unused)
    errm VARCHAR2(100);
BEGIN
    dbms_debug.execute('insert into emp(ename,empno,deptno) ' ||
                      'values(''LJE'', 1, 1)',
                      -1, 0, coll, errm);
END;

```

Example 2

This example executes a PL/SQL block, and it returns no results. The block is an autonomous transaction, which means that the value inserted into the table becomes visible in the debug session.

```

DECLARE
    coll sys.dbms_debug_vc2coll;
    errm VARCHAR2(100);
BEGIN
    dbms_debug.execute(
        'DECLARE PRAGMA autonomous_transaction; ' ||
        'BEGIN ' ||
        '  insert into emp(ename, empno, deptno) ' ||
        '  values(''LJE'', 1, 1); ' ||
        ' COMMIT; ' ||
        'END;',
        -1, 0, coll, errm);
END;

```

Example 3

This example executes a PL/SQL block, and it returns some results.

```

DECLARE
    coll sys.dbms_debug_vc2coll;
    errm VARCHAR2(100);
BEGIN
    dbms_debug.execute(
        'DECLARE ' ||
        '  pp SYS.dbms_debug_vc2coll := SYS.dbms_debug_vc2coll(); ' ||
        '  x PLS_INTEGER; ' ||
        '  i PLS_INTEGER := 1; ' ||
        'BEGIN ' ||
        '  SELECT COUNT(*) INTO x FROM emp; ' ||
        '  pp.EXTEND(x * 6); ' ||
        '  FOR c IN (SELECT * FROM emp) LOOP ' ||
        '    pp(i) := ''Ename: '' || c.ename; i := i+1; ' ||
        '    pp(i) := ''Empno: '' || c.empno; i := i+1; ' ||
        '    pp(i) := ''Job:    '' || c.job;   i := i+1; ' ||
        '    pp(i) := ''Mgr:    '' || c.mgr;   i := i+1; ' ||
        '    pp(i) := ''Sal:    '' || c.sal;   i := i+1; ' ||
        '    pp(i) := null;      i := i+1; ' ||
        '  END LOOP; ' ||
        '  :1 := pp; ' ||
        'END;',

```

```

        -1, 1, coll, errm);
    each := coll.FIRST;
    WHILE (each IS NOT NULL) LOOP
        dosomething(coll(each));
        each := coll.NEXT(each);
    END LOOP;
END;
```

63.7.11 GET_INDEXES Function

Given a name of a variable or parameter, this function returns the set of its indexes, if it is an indexed table. An error is returned if it is not an indexed table.

Syntax

```

DBMS_DEBUG.GET_INDEXES (
    varname   IN  VARCHAR2,
    frame#    IN  BINARY_INTEGER,
    handle    IN  program_info,
    entries   OUT index_table)
RETURN BINARY_INTEGER;
```

Parameters

Table 63-25 GET_INDEXES Function Parameters

Parameter	Description
varname	Name of the variable to get index information about
frame#	Number of frame in which the variable or parameter resides; NULL for a package variable
handle	Package description, if object is a package variable
entries	1-based table of the indexes: if non-NULL, then entries(1) contains the first index of the table, entries(2) contains the second index, and so on.

Return Values

Table 63-26 GET_INDEXES Function Return Values

Return	Description
error_no_such_object	One of the following: <ul style="list-style-type: none"> - The package does not exist - The package is not instantiated - The user does not have privileges to debug the package - The object does not exist in the package

63.7.12 GET_MORE_SOURCE Procedure

When the source does not fit in the buffer provided by the SHOW_SOURCE Procedure version which produced a formatted buffer, this procedure provides additional source.

Syntax

```
DBMS_DEBUG.GET_MORE_SOURCE (  
    buffer          IN OUT VARCHAR2,  
    buflen         IN BINARY_INTEGER,  
    piece#         IN BINARY_INTEGER);
```

Parameters

Table 63-27 GET_MORE_SOURCE Procedure Parameters

Parameter	Description
buffer	The buffer
buflen	The length of the buffer
piece#	A value between 2 and the value returned in the parameter pieces from the call to the relevant version of the SHOW_SOURCE Procedures

Usage Notes

This procedure should be called only after the version of SHOW_SOURCE that returns a formatted buffer.

Related Topics

- [SHOW_SOURCE Procedures](#)
The procedure gets the source code. There are two overloaded SHOW_SOURCE procedures.

63.7.13 GET_LINE_MAP Function

This function finds line and entypoint information about a program so that a debugger can determine the source lines at which it is possible to place breakpoints.

Syntax

```
DBMS_DEBUG.GET_LINE_MAP (  
    program          IN  program_info,  
    maxline         OUT BINARY_INTEGER,  
    number_of_entry_points OUT BINARY_INTEGER,  
    linemap         OUT RAW)  
RETURN BINARY_INTEGER;
```

Parameters

Table 63-28 GET_LINE_MAP Function Parameters

Parameter	Description
program	A top-level program unit (procedure / package / function / package body, and so on). Its <code>Namespace</code> , <code>Name</code> , and <code>Owner</code> fields must be initialized, the remaining fields are ignored.
maxline	The largest source code line number in 'program'
number_of_entry_points	The number of subprograms in 'program'
linemap	A bitmap representing the executable lines of 'program'. If line number <code>N</code> is executable, bit number <code>N MOD 8</code> will be set to 1 at <code>linemap</code> position <code>N / 8</code> . The length of returned <code>linemap</code> is either <code>maxline</code> divided by 8 (plus one if <code>maxline MOD 8</code> is not zero) or 32767 in the unlikely case of <code>maxline</code> being larger than <code>32767 * 8</code> .

Return Values

Table 63-29 GET_LINE_MAP Function Return Values

Return	Description
success	A successful completion
error_no_debug_info	The program unit exists, but has no debug info
error_bad_handle	No such program unit exists

63.7.14 GET_RUNTIME_INFO Function

This function returns information about the current program. It is only needed if the `info_requested` parameter to `SYNCHRONIZE` or `CONTINUE` was set to 0.

**Note:**

This is currently only used by client-side PL/SQL.

Syntax

```
DBMS_DEBUG.GET_RUNTIME_INFO (
    info_requested IN BINARY_INTEGER,
    run_info      OUT runtime_info)
RETURN BINARY_INTEGER;
```

Parameters

Table 63-30 GET_RUNTIME_INFO Function Parameters

Parameter	Description
<code>info_requested</code>	Which information should be returned in <code>run_info</code> when the program stops (see DBMS_DEBUG Operational Notes for information about information flags)
<code>run_info</code>	Information about the state of the program

63.7.15 GET_TIMEOUT_BEHAVIOUR Function

This procedure returns the current timeout behavior. This call is made in the target session.

Syntax

```
DBMS_DEBUG.GET_TIMEOUT_BEHAVIOUR
RETURN BINARY_INTEGER;
```

Parameters

Table 63-31 GET_TIMEOUT_BEHAVIOUR Function Parameters

Parameter	Description
<code>oer</code>	The OER (a 4-byte positive number)

Return Values

Table 63-32 GET_TIMEOUT_BEHAVIOUR Function Return Values

Return	Description
<code>success</code>	A successful completion

Information Flags

```
info_getOerInfo CONSTANT PLS_INTEGER:= 32;
```

Usage Notes

Less functionality is supported on OER breakpoints than on code breakpoints. In particular, note that:

- No "breakpoint number" is returned - the number of the OER is used instead. Thus it is impossible to set duplicate breakpoints on a given OER (it is a no-op).
- It is not possible to disable an OER breakpoint (although clients are free to simulate this by deleting it).
- OER breakpoints are deleted using `delete_oer_breakpoint`.

63.7.16 GET_VALUE Function

This function gets a value from the currently-running program. There are two overloaded `GET_VALUE` functions.

Syntax

```
DBMS_DEBUG.GET_VALUE (
  variable_name IN VARCHAR2,
  frame#       IN BINARY_INTEGER,
  scalar_value OUT VARCHAR2,
  format      IN VARCHAR2 := NULL)
RETURN BINARY_INTEGER;
```

Parameters

Table 63-33 GET_VALUE Function Parameters

Parameter	Description
<code>variable_name</code>	Name of the variable or parameter
<code>frame#</code>	Frame in which it lives; 0 means the current procedure
<code>scalar_value</code>	Value
<code>format</code>	Optional date format to use, if meaningful

Return Values

Table 63-34 GET_VALUE Function Return Values

Return	Description
<code>success</code>	A successful completion
<code>error_bogus_frame</code>	Frame does not exist
<code>error_no_debug_info</code>	Entrypoint has no debug information
<code>error_no_such_object</code>	<code>variable_name</code> does not exist in <code>frame#</code>
<code>error_unknown_type</code>	The type information in the debug information is illegible
<code>error_nullvalue</code>	Value is NULL
<code>error_indexed_table</code>	The object is a table, but no index was provided

This form of `GET_VALUE` is for fetching package variables. Instead of a `frame#`, it takes a handle, which describes the package containing the variable.

Syntax

```
DBMS_DEBUG.GET_VALUE (
  variable_name IN VARCHAR2,
  handle       IN program_info,
  scalar_value OUT VARCHAR2,
  format      IN VARCHAR2 := NULL)
RETURN BINARY_INTEGER;
```

Parameters

Table 63-35 GET_VALUE Function Parameters

Parameter	Description
variable_name	Name of the variable or parameter
handle	Description of the package containing the variable
scalar_value	Value
format	Optional date format to use, if meaningful

Return Values

Table 63-36 GET_VALUE Function Return Values

Return	Description
error_no_such_object	One of the following: <ul style="list-style-type: none"> - Package does not exist - Package is not instantiated - User does not have privileges to debug the package - Object does not exist in the package
error_indexed_table	The object is a table, but no index was provided

Examples

This example illustrates how to get the value with a given package `PACK` in schema `SCOTT`, containing variable `VAR`:

```
DECLARE
    handle    dbms_debug.program_info;
    resultbuf VARCHAR2(500);
    retval    BINARY_INTEGER;
BEGIN
    handle.Owner      := 'SCOTT';
    handle.Name       := 'PACK';
    handle.namespace := dbms_debug.namespace_pkgspec_or_toplevel;
    retval           := dbms_debug.get_value('VAR', handle, resultbuf, NULL);
END;
```

63.7.17 INITIALIZE Function

This function initializes the target session for debugging.

Syntax

```
DBMS_DEBUG.INITIALIZE (
    debug_session_id IN VARCHAR2      := NULL,
    diagnostics      IN BINARY_INTEGER := 0)
RETURN VARCHAR2;
```


Parameters

Table 63-37 INITIALIZE Function Parameters

Parameter	Description
<code>debug_session_id</code>	Name of session ID. If <code>NULL</code> , then a unique ID is generated.
<code>diagnostics</code>	Indicates whether to dump diagnostic output to the tracefile: 0 = (default) no diagnostics 1 = print diagnostics

Return Values

The newly-registered debug session ID (`debugID`)

Usage Notes

You cannot use `DBMS_DEBUG` and the JDWP-based debugging interface simultaneously. This call will either fail with an `ORA-30677` error if the session is currently being debugged with the JDWP-based debugging interface or, if the call succeeds, any further use of the JDWP-based interface to debug this session will be disallowed.

Calls to `DBMS_DEBUG` will succeed only if either the caller or the specified debug role carries the `DEBUG CONNECT SESSION` privilege. Failing that, an `ORA-1031` error will be raised. Other exceptions are also possible if a debug role is specified but the password does not match, or if the calling user has not been granted the role, or the role is application-enabled and this call does not originate from within the role-enabling package.

The `CREATE ANY PROCEDURE` privilege does not affect the visibility of routines through the debugger. A privilege `DEBUG` for each object has been introduced with a corresponding `DEBUG ANY PROCEDURE` variant. These are required in order to see routines owned by users other than the session's login user.

Authentication of the debug role and the check for `DEBUG CONNECT SESSION` privilege will be done in the context of the caller to this routine. If the caller is a definer's rights routine or has been called from one, only privileges granted to the defining user, the debug role, or `PUBLIC` will be used to check for `DEBUG CONNECT SESSION`. If this call is from within a definer's rights routine, the debug role, if specified, must be one that has been granted to that definer, but it need not also have been granted to the session login user or be enabled in the calling session at the time the call is made.

The checks made by the debugger after this call is made looking for the `DEBUG` privilege on individual procedures will be done in the context of the session's login user, the roles that were enabled at session level at the moment this call was made (even if those roles were not available within a definer's rights environment of the call), and the debug role.

63.7.18 PING Procedure

This procedure pings the target session to prevent it from timing out. Use this procedure when execution is suspended in the target session, for example at a breakpoint.

If the `timeout_behaviour` is set to `retry_on_timeout` then this procedure is not necessary.

Syntax

```
DBMS_DEBUG.PING;
```

Exceptions

Oracle will display the `no_target_program` exception if there is no target program or if the target session is not currently waiting for input from the debug session.

Usage Notes

Timeout options for the target session are registered with the target session by calling `set_timeout_behaviour`:

- `retry_on_timeout` - Retry. Timeout has no effect. This is like setting the timeout to an infinitely large value.
- `continue_on_timeout` - Continue execution, using same event flags.
- `nodebug_on_timeout` - Turn debug-mode OFF (in other words, call `debug_off`) and then continue execution. No more events will be generated by this target session unless it is re-initialized by calling `debug_on`.
- `abort_on_timeout` - Continue execution, using the `abort_execution` flag, which should cause the program to terminate immediately. The session remains in debug-mode.

```
retry_on_timeout CONSTANT BINARY_INTEGER:= 0;
```

```
continue_on_timeout CONSTANT BINARY_INTEGER:= 1;
```

```
nodebug_on_timeout CONSTANT BINARY_INTEGER:= 2;
```

```
abort_on_timeout CONSTANT BINARY_INTEGER:= 3;
```

63.7.19 PRINT_BACKTRACE Procedure

This procedure prints a backtrace listing of the current execution stack. This should only be called if a program is currently running.

There are two overloaded `PRINT_BACKTRACE` procedures.

Syntax

```
DBMS_DEBUG.PRINT_BACKTRACE (  
    listing IN OUT VARCHAR2);
```

```
DBMS_DEBUG.PRINT_BACKTRACE (  
    backtrace OUT backtrace_table);
```

Parameters

Table 63-38 PRINT_BACKTRACE Procedure Parameters

Parameter	Description
listing	A formatted character buffer with embedded newlines
backtrace	1-based indexed table of backtrace entries. The currently-running procedure is the last entry in the table (that is, the frame numbering is the same as that used by GET_VALUE). Entry 1 is the oldest procedure on the stack.

63.7.20 PRINT_INSTANTIATIONS Procedure

This procedure returns a list of the packages that have been instantiated in the current session.

Syntax

```
DBMS_DEBUG.PRINT_INSTANTIATIONS (
    pkgs   IN OUT NOCOPY backtrace_table,
    flags  IN BINARY_INTEGER);
```

Parameters

Table 63-39 PRINT_INSTANTIATIONS Procedure Parameters

Parameter	Description
pkgs	The instantiated packages
flags	Bitmask of options: <ul style="list-style-type: none"> • 1 - show specs • 2 - show bodies • 4 - show local instantiations • 8 - show remote instantiations (NYI) • 16 - do a fast job. The routine does not test whether debug information exists or whether the libunit is shrink-wrapped.

Exceptions

no_target_program - target session is not currently executing

Usage Notes

On return, pkgs contains a program_info for each instantiation. The valid fields are: Namespace, Name, Owner, and LibunitType.

In addition, Line# contains a bitmask of:

- 1 - the libunit contains debug info
- 2 - the libunit is shrink-wrapped

63.7.21 PROBE_VERSION Procedure

This procedure returns the version number of DBMS_DEBUG on the server.

Syntax

```
DBMS_DEBUG.PROBE_VERSION (
    major out BINARY_INTEGER,
    minor out BINARY_INTEGER);
```

Parameters

Table 63-40 PROBE_VERSION Procedure Parameters

Parameter	Description
major	Major version number
minor	Minor version number: increments as functionality is added

63.7.22 SELF_CHECK Procedure

This procedure performs an internal consistency check. SELF_CHECK also runs a communications test to ensure that the Probe processes are able to communicate.

If SELF_CHECK does not return successfully, then an incorrect version of DBMS_DEBUG was probably installed on this server. The solution is to install the correct version (pblog.sql loads DBMS_DEBUG and the other relevant packages).

Syntax

```
DBMS_DEBUG.SELF_CHECK (
    timeout IN binary_integer := 60);
```

Parameters

Table 63-41 SELF_CHECK Procedure Parameters

Parameter	Description
timeout	The timeout to use for the communication test. Default is 60 seconds.

Exceptions

Table 63-42 SELF_CHECK Procedure Exceptions

Exception	Description
OER-6516	Probe version is inconsistent
pipe_creation_failure	Could not create a pipe
pipe_send_failure	Could not write data to the pipe
pipe_receive_failure	Could not read data from the pipe

Table 63-42 (Cont.) SELF_CHECK Procedure Exceptions

Exception	Description
pipe_datatype_mismatch	Datatype in the pipe was wrong
pipe_data_error	Data got garbled in the pipe

All of these exceptions are fatal. They indicate a serious problem with Probe that prevents it from working correctly.

63.7.23 SET_BREAKPOINT Function

This function sets a breakpoint in a program unit, which persists for the current session.

Execution pauses if the target program reaches the breakpoint.

Syntax

```
DBMS_DEBUG.SET_BREAKPOINT (
  program      IN  program_info,
  line#        IN  BINARY_INTEGER,
  breakpoint#  OUT BINARY_INTEGER,
  fuzzy        IN  BINARY_INTEGER := 0,
  iterations   IN  BINARY_INTEGER := 0)
RETURN BINARY_INTEGER;
```

Parameters

Table 63-43 SET_BREAKPOINT Function Parameters

Parameter	Description
program	Information about the program unit in which the breakpoint is to be set. (In version 2.1 and later, the namespace, name, owner, and dblink may be set to NULL, in which case the breakpoint is placed in the currently-running program unit.)
line#	Line at which the breakpoint is to be set
breakpoint#	On successful completion, contains the unique breakpoint number by which to refer to the breakpoint
fuzzy	Only applicable if there is no executable code at the specified line: 0 means return <code>error_illegal_line</code> 1 means search forward for an adjacent line at which to place the breakpoint -1 means search backward for an adjacent line at which to place the breakpoint
iterations	Number of times to wait before signalling this breakpoint

Return Values



Note:

The `fuzzy` and `iterations` parameters are not yet implemented

Table 63-44 SET_BREAKPOINT Function Return Values

Return	Description
success	A successful completion
error_illegal_line	Cannot set a breakpoint at that line
error_bad_handle	No such program unit exists

63.7.24 SET_OER_BREAKPOINT Function

This function sets an OER breakpoint.

Syntax

```
DBMS_DEBUG.SET_OER_BREAKPOINT (
    oer IN PLS_INTEGER)
RETURN PLS_INTEGER;
```

Parameters

Table 63-45 SET_OER_BREAKPOINT Function Parameters

Parameter	Description
oer	The OER (positive 4-byte number) to set

Return Values

Table 63-46 SET_OER_BREAKPOINT Function Return Values

Return	Description
success	A successful completion
error_no_such_breakpt	No such OER breakpoint exists

63.7.25 SET_TIMEOUT Function

This function sets the timeout value and returns the new timeout value.

Syntax

```
DBMS_DEBUG.SET_TIMEOUT (
    timeout BINARY_INTEGER)
RETURN BINARY_INTEGER;
```

Parameters

Table 63-47 SET_TIMEOUT Function Parameters

Parameter	Description
timeout	The timeout to use for communication between the target and debug sessions

63.7.26 SET_TIMEOUT_BEHAVIOUR Procedure

This procedure tells Probe what to do with the target session when a timeout occurs. This call is made in the target session.

Syntax

```
DBMS_DEBUG.SET_TIMEOUT_BEHAVIOUR (
    behaviour IN PLS_INTEGER);
```

Parameters

Table 63-48 SET_TIMEOUT_BEHAVIOUR Procedure Parameters

Parameter	Description
behaviour - One of the following:	
retry_on_timeout	Retry. Timeout has no effect. This is like setting the timeout to an infinitely large value.
continue_on_timeout	Continue execution, using same event flags
nodebug_on_timeout	Turn debug-mode OFF (in other words, call <code>debug_off</code>) and continue execution. No more events will be generated by this target session unless it is re-initialized by calling <code>debug_on</code> .
abort_on_timeout	Continue execution, using the <code>abort_execution</code> flag, which should cause the program to terminate immediately. The session remains in debug-mode.

Exceptions

unimplemented - the requested behavior is not recognized

Usage Notes

The default behavior (if this procedure is not called) is `continue_on_timeout`, since it allows a debugger client to reestablish control (at the next event) but does not cause the target session to hang indefinitely.

63.7.27 SET_VALUE Function

This function sets a value in the currently-running program. There are two overloaded SET_VALUE functions.

Syntax

```
DBMS_DEBUG.SET_VALUE (
    frame#           IN binary_integer,
    assignment_statement IN varchar2)
RETURN BINARY_INTEGER;
```

```
DBMS_DEBUG.SET_VALUE (
    handle           IN program_info,
    assignment_statement IN VARCHAR2)
RETURN BINARY_INTEGER;
```

Parameters

Table 63-49 SET_VALUE Function Parameters

Parameter	Description
frame#	Frame in which the value is to be set; 0 means the currently executing frame.
handle	Description of the package containing the variable
assignment_statement	An assignment statement (which must be legal PL/SQL) to run in order to set the value. For example, 'x := 3'; Only scalar values are supported in this release. The right side of the assignment statement must be a scalar.

Return Values

Table 63-50 SET_VALUE Function Return Values

Return	Description
success	-
error_illegal_value	Not possible to set it to that value
error_illegal_null	Cannot set to NULL because object type specifies it as 'not NULL'
error_value_malformed	Value is not a scalar
error_name_incomplete	The assignment statement does not resolve to a scalar. For example, 'x := 3;', if x is a record.
error_no_such_object	One of the following: <ul style="list-style-type: none"> - Package does not exist - Package is not instantiated - User does not have privileges to debug the package - Object does not exist in the package

Usage Notes

In some cases, the PL/SQL compiler uses temporaries to access package variables, and does not guarantee to update such temporaries. It is possible, although unlikely, that modification to a package variable using `SET_VALUE` might not take effect for a line or two.

Examples

To set the value of `SCOTT.PACK.var` to 6:

```
DECLARE
    handle dbms_debug.program_info;
    retval BINARY_INTEGER;
BEGIN
    handle.Owner      := 'SCOTT';
    handle.Name       := 'PACK';
    handle.namespace := dbms_debug.namespace_pkgspec_or_toplevel;
    retval            := dbms_debug.set_value(handle, 'var := 6;');
END;
```

63.7.28 SHOW_BREAKPOINTS Procedures

There are two overloaded procedures that return a listing of the current breakpoints. There are three overloaded `SHOW_BREAKPOINTS` procedures.

Syntax

```
DBMS_DEBUG.SHOW_BREAKPOINTS (
    listing    IN OUT VARCHAR2);

DBMS_DEBUG.SHOW_BREAKPOINTS (
    listing    OUT breakpoint_table);

DBMS_DEBUG.SHOW_BREAKPOINTS (
    code_breakpoints OUT breakpoint_table,
    oer_breakpoints  OUT oer_table);
```

Parameters

Table 63-51 SHOW_BREAKPOINTS Procedure Parameters

Parameter	Description
<code>listing</code>	A formatted buffer (including newlines) of the breakpoints.
<code>code_breakpoints</code>	Indexed table of breakpoint entries. The breakpoint number is indicated by the index into the table. Breakpoint numbers start at 1 and are reused when deleted.
<code>oer_breakpoints</code>	The indexed table of OER breakpoints, indexed by OER

63.7.29 SHOW_FRAME_SOURCE Procedure

The procedure gets the source code. There are two overloaded SHOW_SOURCE procedures.

Syntax

```
DBMS_DEBUG.SHOW_FRAME_SOURCE (
    first_line IN          BINARY_INTEGER,
    last_line  IN          BINARY_INTEGER,
    source     IN OUT NOCOPY vc2_table,
    frame_num IN          BINARY_INTEGER);
```

Parameters

Table 63-52 SHOW_FRAME_SOURCE Procedure Parameters

Parameter	Description
first_line	Line number of first line to fetch (PL/SQL programs always start at line 1 and have no holes)
last_line	Line number of last line to fetch. No lines are fetched past the end of the program.
source	The resulting table, which may be indexed by line#
frame_num	1-based frame number

Usage Notes

- You use this function only when backtrace shows an anonymous unit is executing at a given frame position and you need to view the source in order to set a breakpoint.
- If frame number is top of the stack and it's an anonymous block then SHOW_SOURCE can also be used.
- If it's a stored PL/SQL package/function/procedure then use SQL as described in the [Usage Notes](#) to [SHOW_SOURCE Procedures](#).

63.7.30 SHOW_SOURCE Procedures

The procedure gets the source code. There are two overloaded SHOW_SOURCE procedures.

Syntax

```
DBMS_DEBUG.SHOW_SOURCE (
    first_line IN  BINARY_INTEGER,
    last_line  IN  BINARY_INTEGER,
    source     OUT vc2_table);

DBMS_DEBUG.SHOW_SOURCE (
    first_line IN  BINARY_INTEGER,
    last_line  IN  BINARY_INTEGER,
    window     IN  BINARY_INTEGER,
    print_arrow IN  BINARY_INTEGER,
    buffer     IN OUT VARCHAR2,
    buflen     IN  BINARY_INTEGER,
    pieces     OUT  BINARY_INTEGER);
```

Parameters

Table 63-53 SHOW_SOURCE Procedure Parameters

Parameter	Description
<code>first_line</code>	Line number of first line to fetch (PL/SQL programs always start at line 1 and have no holes)
<code>last_line</code>	Line number of last line to fetch. No lines are fetched past the end of the program.
<code>source</code>	The resulting table, which may be indexed by line#
<code>window</code>	'Window' of lines (the number of lines around the current source line)
<code>print_arrow</code>	Nonzero means to print an arrow before the current line
<code>buffer</code>	Buffer in which to place the source listing
<code>buflen</code>	Length of buffer
<code>pieces</code>	Set to nonzero if not all the source could be placed into the given buffer

Return Values

An indexed table of source-lines. The source lines are stored starting at `first_line`. If any error occurs, then the table is empty.

Usage Notes

The best way to get the source code (for a program that is being run) is to use SQL. For example:

```
DECLARE
    info DBMS_DEBUG.runtime_info;
BEGIN
    -- call DBMS_DEBUG.SYNCHRONIZE, CONTINUE,
    -- or GET_RUNTIME_INFO to fill in 'info'
    SELECT text INTO <buffer> FROM all_source
    WHERE owner = info.Program.Owner
    AND name = info.Program.Name
    AND line = info.Line#;
END;
```

However, this does not work for nonpersistent programs (for example, anonymous blocks and trigger invocation blocks). For nonpersistent programs, call `SHOW_SOURCE`. There are two flavors: one returns an indexed table of source lines, and the other returns a packed (and formatted) buffer.

The second overloading of `SHOW_SOURCE` returns the source in a formatted buffer, complete with line-numbers. It is faster than the indexed table version, but it does not guarantee to fetch all the source.

If the source does not fit in `bufferlength` (`buflen`), then additional pieces can be retrieved using the `GET_MORE_SOURCE` procedure (`pieces` returns the number of additional pieces that need to be retrieved).

63.7.31 SYNCHRONIZE Function

This function waits until the target program signals an event. If `info_requested` is not `NULL`, then it calls `GET_RUNTIME_INFO`.

Syntax

```
DBMS_DEBUG.SYNCHRONIZE (
    run_info      OUT runtime_info,
    info_requested IN  BINARY_INTEGER := NULL)
RETURN BINARY_INTEGER;
```

Parameters

Table 63-54 SYNCHRONIZE Function Parameters

Parameter	Description
<code>run_info</code>	Structure in which to write information about the program. By default, this includes information about what program is running and at which line execution has paused.
<code>info_requested</code>	Optional bit-field in which to request information other than the default (which is <code>info_getStackDepth + info_getLineInfo</code>). 0 means that no information is requested at all (see DBMS_DEBUG Operational Notes for more about information flags).

Return Values

Table 63-55 SYNCHRONIZE Function Return Values

Return	Description
<code>success</code>	A successful completion
<code>error_timeout</code>	Timed out before the program started execution
<code>error_communication</code>	Other communication error

63.7.32 TARGET_PROGRAM_RUNNING Procedure

This procedure returns `TRUE` if the target session is currently executing a stored procedure, or `FALSE` if it is not.

Syntax

```
DBMS_DEBUG.TARGET_PROGRAM_RUNNING
RETURN BOOLEAN;
```

64

DBMS_DEBUG_JDWP

The `DBMS_DEBUG_JDWP` provides the interface to initiate and control the debugging of PL/SQL stored procedures and Java stored procedures over Java Debug Wire Protocol (JDWP).

This chapter contains the following topics:

- [DBMS_DEBUG_JDWP Overview](#)
- [DBMS_DEBUG_JDWP Security Model](#)
- [Summary of DBMS_DEBUG_JDWP Subprograms](#)

64.1 DBMS_DEBUG_JDWP Overview

Oracle supports the debugging of PL/SQL stored procedures and Java stored procedures over JDWP. Using the `DBMS_DEBUG_JDWP` package, you can:

- Retrieve the session ID of the current session and serial number
- Connect a database session to a debugger over JDWP
- Set the NLS parameters to change the formats in which PL/SQL program values are represented over JDWP

64.2 DBMS_DEBUG_JDWP Security Model

The debugging user invoking a `DBMS_DEBUG_JDWP` subprogram requires a privilege to connect the target database session to the debugger.

Table 64-1 System Privileges

System Privilege	Description
DEBUG CONNECT SESSION	Allows a user to connect his current session to a debugger
DEBUG CONNECT ANY	Allows a user to connect a session by any logon user to a debugger

In addition, the user can also be granted the following user privilege to debug another user's session.

Table 64-2 User Privileges

User Privilege	Description
DEBUG CONNECT ON USER <user>	Allows a user to connect any of the specified user's logon sessions to a debugger to debug another user's session or his own

64.3 Summary DBMS_DEBUG_JDWP Subprograms

This table lists the DBMS_DEBUG_JDWP subprograms and briefly describes them.

Table 64-3 DBMS_DEBUG_JDWP Package Subprograms

Subprogram	Description
CONNECT_TCP Procedure	Connects the specified session to the debugger waiting at <code>host:port</code>
CURRENT_SESSION_ID Function	Gets the current session's session ID
CURRENT_SESSION_SERIAL Function	Gets the current session's session serial number
DISCONNECT Procedure	Disconnects the specified session from any debugger with which it is connected
GET-NLS_PARAMETER Function	Gets the value of the specified NLS parameter affecting the format in which NUMBER, DATE, TIME (WITH TIME ZONE) and TIMESTAMP (WITH TIME ZONE) runtime values of PL/SQL programs are converted to strings as they are presented through JDWP
PROCESS_CONNECT_STRING Procedure	Connects a session to a debugger without having to directly modify an application's code
SET-NLS_PARAMETER Procedure	Sets the value of the specified NLS parameter affecting the format in which NUMBER, DATE, TIME (WITH TIME ZONE) and TIMESTAMP (WITH TIME ZONE) runtime values of PL/SQL programs are converted to strings as they are presented through JDWP

64.3.1 CONNECT_TCP Procedure

This procedure connects the specified session to the debugger waiting at `host:port`.

Syntax

```
DBMS_DEBUG_JDWP.CONNECT_TCP (
  host           IN VARCHAR2,
  port           IN VARCHAR2,
  session_id     IN PLS_INTEGER := NULL,
  session_serial IN PLS_INTEGER := NULL,
  debug_role     IN VARCHAR2 := NULL,
  debug_role_pwd IN VARCHAR2 := NULL,
  option_flags   IN PLS_INTEGER := 0,
  extensions_cmd_set IN PLS_INTEGER := 128);
```

Parameters

Table 64-4 CONNECT_TCP Parameters

Parameter	Description
host	The host name the debugger is waiting at
port	The port number the debugger is waiting at
session_id	Session ID
session_serial	Session number
debug_role	Debug role
debug_role_pwd	Debug password
option_flags	Values: <ul style="list-style-type: none"> • 1 : Does not suspend the program until the next client/server request begins. This can be used to hide the startup sequence from end users, who may only want to see their own code • 2 : Forces the connection even if the session appears to be connected to a debugger. This should best only be specified after some human-interaction confirmation step has occurred; i.e., if an attempt without this option raised ORA-30677, then if the user confirms, retry with this bit set. These may be added together to select multiple option choices.
extensions_cmd_set	The ID of the Oracle JDWP extension command set

Exceptions

Table 64-5 CONNECT_TCP Exceptions

Exception	Description
ORA-00022	Invalid session ID
ORA-01031	Insufficient privilege
ORA-30677	Session is already connected to a debugger
ORA-30681	Improper value for argument EXTENSIONS_CMD_SET
ORA-30682	Improper value for argument OPTION_FLAGS
ORA-30683	Failure establishing connection to debugger

Usage Notes

- To connect the current session to a debugger, you can pass NULL to both the session_id and session_serial parameters.

- To connect a different session, you need to find out its ID and serial. These are available in the `v$sql_debuggable_sessions` view. The Instance Manager option of Oracle Enterprise Manager is one example of a user interface that displays these values to users. You can also find the values of these for your own session using the [CURRENT_SESSION_ID Function](#) and [CURRENT_SESSION_SERIAL Function](#).
- The `debug_role` and `debug_role_pwd` arguments allow the user to name any role as the "debug role", which will be available to privilege checking when checking for permissions to connect the session and when checking permissions available on objects within the debugged session. Both the role and its password are passed here as strings and not as identifiers, so double quotes should not be used but case matters. If the original role name wasn't double-quoted, it should be specified here in upper case.
- An `ORA-30677` indicates that the requested session is already being debugged. It is suggested in this case that the user be asked to confirm that (s)he desires to steal the session from the existing connection, and then either an explicit disconnect call or the use of the `connect_force_connect` option bit can be used to allow the connection to succeed on a second attempt. Note that using the `connect_force_connect` bit will avoid the session being allowed to run freely if it is currently suspended through the debugger - in other words, this bit lets you steal a session from one debugger to another without actually disturbing the state of the session.

64.3.2 CURRENT_SESSION_ID Function

This function gets the current session's session ID

Syntax

```
DBMS_DEBUG_JDWP.CURRENT_SESSION_ID  
RETURN PLS_INTEGER;
```

64.3.3 CURRENT_SESSION_SERIAL Function

This function gets the current session's session number.

Syntax

```
DBMS_DEBUG_JDWP.CURRENT_SESSION_SERIAL  
RETURN PLS_INTEGER;
```

64.3.4 DISCONNECT Procedure

This procedure disconnects the specified session from any debugger with which it is connected.

Syntax

```
DBMS_DEBUG_JDWP.DISCONNECT(  
    session_id      IN PLS_INTEGER := NULL,  
    session_serial  IN PLS_INTEGER := NULL);
```


Parameters

Table 64-6 DISCONNECT Procedure Parameters

Parameter	Description
<code>session_id</code>	Session ID
<code>session_serial</code>	Session number

Usage Notes

- If the session to disconnect is the current session, the session will be allowed to run freely after disconnecting the debugger. Otherwise, the session will be terminated.
- The same rights are required for this call as for connect, except when disconnecting the current session and the effective user at the time of the call is the same as the login user of the session where no privilege is required.

64.3.5 GET_NLS_PARAMETER Function

This function gets the value of the specified NLS parameter affecting the format in which the NUMBER, DATE, TIME (WITH TIME ZONE) and TIMESTAMP (WITH TIME ZONE) runtime values of PL/SQL programs are converted to strings, as they are presented through JDWP.

These values are private to the current session, but further are private to the debugger mechanisms, separate from the values used to convert values within the debugged program itself.

Syntax

```
DBMS_DEBUG_JDWP.GET_NLS_PARAMETER(
    name    IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 64-7 GET_NLS_PARAMETER Function Parameters

Parameter	Description
<code>name</code>	Specified NLS parameter

Usage Notes

- When any variable value is read or assigned through JDWP, or when either GET_NLS_PARAMETER Function or SET_NLS_PARAMETER Procedure is first invoked in a session, the debugger mechanisms make a private copy of the then-current NLS_LANGUAGE, NLS_TERRITORY, NLS_CALENDAR, NLS_DATE_LANGUAGE, NLS_NUMERIC_CHARACTERS, NLS_TIMESTAMP_FORMAT, NLS_TIMESTAMP_TZ_FORMAT, NLS_TIME_FOMAT and NLS_TIME_TZ_FORMAT values. These private copies may be read using this GET_NLS_PARAMETER Functioncall and changed using the following call to the [SET_NLS_PARAMETER Procedure](#).
- Once the debugger's private copy of the NLS parameters is established, changes made to the NLS parameters in the current session using the ALTER SESSION statement will

have no effect on the formatting of values as seen through JDWP. To modify the NLS parameters used for JDWP, one must use the `SET_NLS_PARAMETER Procedure`. By the same token, changes made to the debugger's private copy of the NLS parameters using `SET_NLS_PARAMETER Procedure` will have no effect on the debugged program itself.

- Date values are always formatted for JDWP use using the `NLS_TIMESTAMP_FORMAT`. The default format for `DATE (NLS_DATE_FORMAT)` used in a session most often does not show the time information that is in fact present in the value, and for debugging purposes it seems beneficial to always display that information.

64.3.6 PROCESS_CONNECT_STRING Procedure

This procedure connects a session to a debugger in two ways, so that you do not have to directly modify the application code.

The two ways are:

- Using the `ORA_DEBUG_JDWP` environment variable, when running an OCI program
- Setting a web browser cookie called `OWA_DEBUG_<dad>`, when running an application through the PL/SQL Web Gateway

Syntax

```
DBMS_DEBUG_JDWP.PROCESS_CONNECT_STRING (
    connect_string          IN VARCHAR2,
    connect_string_type    IN PLS_INTEGER);
```

Parameters

Table 64-8 PROCESS_CONNECT_STRING Procedure Parameters

Parameter	Description
<code>connect_string</code>	The <code>ORA_DEBUG_JDWP</code> environment variable or <code>OWA_DEBUG_<dad></code> cookie value that contains the JDWP connection information such as the host and port number of the debugger to connect to
<code>connect_string_type</code>	Can have the following two values: <ul style="list-style-type: none"> • 1 if the connect string value is retrieved from the <code>ORA_DEBUG_JDWP</code> environment • 2 if the value is from the <code>OWA_DEBUG_<dad></code> cookie

Exceptions

Table 64-9 PROCESS_CONNECT_STRING Procedure Exceptions

Exception	Description
ORA-00022	Invalid session ID
ORA-01031	Insufficient privilege
ORA-30677	Session is already connected to a debugger

Table 64-9 (Cont.) PROCESS_CONNECT_STRING Procedure Exceptions

Exception	Description
ORA-30681	Improper value for argument EXTENSIONS_CMD_SET
ORA-30682	Improper value for argument OPTION_FLAGS
ORA-30683	Failure establishing connection to debugger
ORA-30689	Improper value for environment variable ORA_DEBUG_JDWP

64.3.7 SET_NLS_PARAMETER Procedure

This function sets the value of the specified NLS parameter affecting the format in which NUMBER, DATE, TIME (WITH TIME ZONE) and TIMESTAMP (WITH TIME ZONE) runtime values of PL/SQL programs are converted to strings as they are presented through JDWP.

These values are private to the current session, but further are private to the debugger mechanisms, separate from the values used to convert values within the debugged program itself.

Syntax

```
DBMS_DEBUG_JDWP.SET_NLS_PARAMETER(
    name      IN  VARCHAR2,
    value     IN  VARCHAR2);
```

Parameters

Table 64-10 SET_NLS_PARAMETER Procedure Parameters

Parameter	Description
name	Specified NLS parameter
value	Value of specified NLS parameter

Usage Notes

- When any variable value is read or assigned through JDWP, or when either [GET_NLS_PARAMETER Function](#) or [SET_NLS_PARAMETER Procedure](#) is first invoked in a session, the debugger mechanisms make a private copy of the then-current NLS_LANGUAGE, NLS_TERRITORY, NLS_CALENDAR, NLS_DATE_LANGUAGE, NLS_NUMERIC_CHARACTERS, NLS_TIMESTAMP_FORMAT, NLS_TIMESTAMP_TZ_FORMAT, NLS_TIME_FOMAT and NLS_TIME_TZ_FORMAT values. These private copies may be read by calling the [GET_NLS_PARAMETER Function](#) and changed using the following call to the [SET_NLS_PARAMETER Procedure](#).
- Once the debugger's private copy of the NLS parameters is established, changes made to the NLS parameters in the current session using the ALTER SESSION statement will have no effect on the formatting of values as seen through JDWP. To modify the NLS parameters used for JDWP, one must use the [SET_NLS_PARAMETER Procedure](#). By the same token, changes made to the debugger's private copy of the NLS parameters using [SET_NLS_PARAMETER Procedure](#) will have no effect on the debugged program itself.

- Date values are always formatted for JDWP use using the `NLS_TIMESTAMP_FORMAT`. The default format for `DATE` (`NLS_DATE_FORMAT`) used in a session most often does not show the time information that is in fact present in the value, and for debugging purposes it seems beneficial to always display that information.

DBMS_DEBUG_JDWP_CUSTOM

The `DBMS_DEBUG_JDWP_CUSTOM` package provides database users a means to perform custom handling of a debug connection request of a database session to a debugger using the Java Debug Wire Protocol (JDWP).

This chapter contains the following topics:

- [DBMS_DEBUG_JDWP_CUSTOM Overview](#)
- [DBMS_DEBUG_JDWP_CUSTOM Security Model](#)
- [Summary of DBMS_DEBUG_JDWP_CUSTOM Subprograms](#)

65.1 DBMS_DEBUG_JDWP_CUSTOM Overview

The `DBMS_DEBUG_JDWP_CUSTOM` package is invoked when you attempt to connect your database session to a debugger, using the Java Debug Wire Protocol (JDWP). Before connecting to the database, you must set the `ORA_DEBUG_JDWP` environment variable in your client-side OCI application. Defining this package in your schema enables you to perform custom actions before connecting your database session to the debugger.

65.2 DBMS_DEBUG_JDWP_CUSTOM Security Model

This default implementation of the `DBMS_DEBUG_JDWP_CUSTOM` package does not perform any additional security checks and only invokes the `DBMS_DEBUG_JDWP` package for making the debug connection. When the `DBMS_DEBUG_JDWP` package is invoked, it checks for the necessary `DEBUG CONNECT` system or user privilege before making the connection.

A database user who wants to perform additional custom security checks, must perform the following steps to override this default implementation:

- Define the `DBMS_DEBUG_JDWP_CUSTOM` package in the user's own schema.
- Implement the check before invoking the `DBMS_DEBUG_JDWP` package in the user's local copy of the package.

65.3 Summary DBMS_DEBUG_JDWP_CUSTOM Subprograms

This table summarizes the `DBMS_DEBUG_JDWP_CUSTOM` subprograms.

Table 65-1 DBMS_DEBUG_JDWP_CUSTOM Subprograms

Subprogram	Description
CONNECT_DEBUGGER Procedure	This procedure is invoked to handle the debug connection request of the current database session to the debugger.

65.3.1 CONNECT_DEBUGGER Procedure

This procedure is invoked to handle the debug connection request of the current database session to the debugger.

Syntax

```
PROCEDURE CONNECT_DEBUGGER
(
    HOST            VARCHAR2,
    PORT            VARCHAR2,
    DEBUG_ROLE      VARCHAR2 := NULL,
    DEBUG_ROLE_PWD  VARCHAR2 := NULL,
    OPTION_FLAGS    PLS_INTEGER := 0,
    EXTENSIONS_CMD_SET PLS_INTEGER := 128
)
```

Parameters

The preceding parameters are for the default implementation of the procedure for handling the debug connection request. A user, who wants to customize the handling of the request, must override this default implementation of the `DBMS_DEBUG_JDWP_CUSTOM` package procedure by defining the package (specification and body) with a procedure of the same name in the user's own schema. The user may customize the number and names of the arguments, but must have the same name for the package and the procedure, namely, `DBMS_DEBUG_JDWP_CUSTOM` and `CONNECT_DEBUGGER` respectively. The user's customized version of the package may contain overloaded versions of the `CONNECT_DEBUGGER` procedure with different arguments. All of the arguments to the custom package procedure must either be of `VARCHAR2` type or of types that PL/SQL can implicitly convert from `VARCHAR2`.

For example, if a user wants to disallow debugging outside business hours, while applying optional NLS settings to the program values displayed during debugging, then the user can define a custom implementation of the package in the user's schema in the following way:

```
CREATE OR REPLACE PACKAGE DBMS_DEBUG_JDWP_CUSTOM AUTHID CURRENT_USER IS
    PROCEDURE CONNECT_DEBUGGER(HOST VARCHAR2,
                               PORT VARCHAR2,
                               NLS_LANGUAGE VARCHAR2 DEFAULT NULL,
                               NLS_TERRITORY VARCHAR2 DEFAULT NULL);
END;
/

CREATE OR REPLACE PACKAGE BODY DBMS_DEBUG_JDWP_CUSTOM IS

    PROCEDURE CONNECT_DEBUGGER(HOST VARCHAR2,
                               PORT VARCHAR2,
                               NLS_LANGUAGE VARCHAR2 DEFAULT NULL,
                               NLS_TERRITORY VARCHAR2 DEFAULT NULL) IS
    BEGIN
        SELECT EXTRACT(HOUR FROM LOCALTIMESTAMP) INTO HOUR FROM DUAL;
```

```
IF (HOUR < 9 OR HOUR > 5) THEN
  RAISE_APPLICATION_ERROR(-20000,
    'Debug connection disallowed outside business hours');
ELSE
  IF (NLS_LANGUAGE IS NOT NULL) THEN
    DBMS_DEBUG_JDWP.SET-NLS_PARAMETER('NLS_LANGUAGE', NLS_LANGUAGE);
  END IF;
  IF (NLS_TERRITORY IS NOT NULL) THEN
    DBMS_DEBUG_JDWP.SET-NLS_PARAMETER('NLS_TERRITORY', NLS_TERRITORY);
  END IF;
  DBMS_DEBUG_JDWP.CONNECT_TCP(HOST, PORT);
END IF;
END;

END;
/
```

Before executing the client application for passing arguments to the procedure parameters, the user must set the `ORA_DEBUG_JDWP` environment variable as follows :

```
> setenv ORA_DEBUG_JDWP "host=123.45.67.89;port=4000;nls_language=american"
> myapp -user HR/<password>
...
```

DBMS_DESCRIBE

You can use the `DBMS_DESCRIBE` package to get information about a PL/SQL object. When you specify an object name, `DBMS_DESCRIBE` returns a set of indexed tables with the results. Full name translation is performed and security checking is also checked on the final object.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Types](#)
- [Exceptions](#)
- [Examples](#)
- [Summary of DBMS_DESCRIBE Subprograms](#)

66.1 DBMS_DESCRIBE Overview

This package provides the same functionality as the Oracle Call Interface `OCIDescribeAny` call.



See Also:

Oracle Call Interface Developer's Guide

66.2 DBMS_DESCRIBE Security Model

This package is available to `PUBLIC` and performs its own security checking based on the schema object being described.

66.3 DBMS_DESCRIBE Types

The `DBMS_DESCRIBE` package declares two PL/SQL table types, which are used to hold data returned by `DESCRIBE_PROCEDURE` in its `OUT` parameters.

The types are:

```
TYPE VARCHAR2_TABLE IS TABLE OF VARCHAR2(30)
INDEX BY BINARY_INTEGER;
```

```
TYPE NUMBER_TABLE IS TABLE OF NUMBER
INDEX BY BINARY_INTEGER;
```


66.4 DBMS_DESCRIBE Exceptions

DBMS_DESCRIBE can raise application errors in the range -20000 to -20004.

Table 66-1 DBMS_DESCRIBE Errors

Error	Description
ORA-20000	ORU 10035: cannot describe a package ('X') only a procedure within a package.
ORA-20001	ORU-10032: procedure 'X' within package 'Y' does not exist.
ORA-20002	ORU-10033: object 'X' is remote, cannot describe; expanded name 'Y'.
ORA-20003	ORU-10036: object 'X' is invalid and cannot be described.
ORA-20004	Syntax error attempting to parse 'X'.

66.5 DBMS_DESCRIBE Examples

One use of the DESCRIBE_PROCEDURE procedure is as an external service interface.

For example, consider a client that provides an OBJECT_NAME of SCOTT.ACCOUNT_UPDATE, where ACCOUNT_UPDATE is an overloaded function with specification:

```
TABLE account (acct_no NUMBER, person_id NUMBER,
               balance NUMBER(7,2))
TABLE person (person_id number(4), person_nm varchar2(10))

CREATE OR REPLACE PACKAGE ACCOUNT_PKG IS
  FUNCTION ACCOUNT_UPDATE (acct_no
    NUMBER,
                           person
                           person%rowtype,
                           amounts
                           DBMS_DESCRIBE.NUMBER_TABLE,
                           trans_date
                           DATE)
    return
    account.balance%type;

  FUNCTION ACCOUNT_UPDATE (acct_no
    NUMBER,
                           person
                           person%rowtype,
                           amounts
                           DBMS_DESCRIBE.NUMBER_TABLE,
                           trans_no
                           NUMBER)
    return
    account.balance%type;
END;
```

This procedure might look similar to the following output:

```
overload position argument level datatype length prec scale rad
-----
1          0          0          2      22      7      2  10
1          1  ACCNT_NO  0          2       0      0      0  0
1          2  PERSON    0        250       0      0      0  0
1          1  PERSON_ID  1          2      22      4      0  10
1          2  PERSON_NM  1          1      10      0      0  0
1          3  AMOUNTS   0        251       0      0      0  0
1          1          1          2      22      0      0  0
1          4  TRANS_DATE 0         12       0      0      0  0
2          0          0          2      22      7      2  10
```

2	1	ACCNT_NO	0	2	22	0	0	0
2	2	PERSON	0	2	22	4	0	10
2	3	AMOUNTS	0	251	22	4	0	10
2	1		1	2	0	0	0	0
2	4	TRANS_NO	0	2	0	0	0	0

The following PL/SQL procedure has as its parameters all of the PL/SQL datatypes:

```
CREATE OR REPLACE PROCEDURE p1 (
  pvc2   IN   VARCHAR2,
  pvc    OUT  VARCHAR,
  pstr   IN OUT STRING,
  plong  IN   LONG,
  prowid IN   ROWID,
  pchara IN   CHARACTER,
  pchar  IN   CHAR,
  praw  IN   RAW,
  plraw  IN   LONG RAW,
  pbinint IN BINARY_INTEGER,
  pplsint IN PLS_INTEGER,
  pbool  IN   BOOLEAN,
  pnat   IN   NATURAL,
  ppos   IN   POSITIVE,
  pposn  IN   POSITIVEN,
  pnatn  IN   NATURALN,
  pnum   IN   NUMBER,
  pintgr IN   INTEGER,
  pint   IN   INT,
  psmall IN   SMALLINT,
  pdec   IN   DECIMAL,
  preal  IN   REAL,
  pfloat IN   FLOAT,
  pnumer IN   NUMERIC,
  pdp    IN   DOUBLE PRECISION,
  pdate  IN   DATE,
  pmls   IN   MLSLABEL) AS

BEGIN
  NULL;
END;
```

If you describe this procedure using the following:

```
CREATE OR REPLACE PACKAGE describe_it AS

  PROCEDURE desc_proc (name VARCHAR2);

END describe_it;

CREATE OR REPLACE PACKAGE BODY describe_it AS

  PROCEDURE prt_value(val VARCHAR2, isize INTEGER) IS
    n INTEGER;
  BEGIN
    n := isize - LENGTHB(val);
    IF n < 0 THEN
      n := 0;
    END IF;
    DBMS_OUTPUT.PUT(val);
    FOR i in 1..n LOOP
      DBMS_OUTPUT.PUT(' ');
    END LOOP;
  END;
```

```

        END LOOP;
    END prt_value;

    PROCEDURE desc_proc (name VARCHAR2) IS

        overload      DBMS_DESCRIBE.NUMBER_TABLE;
        position       DBMS_DESCRIBE.NUMBER_TABLE;
        c_level        DBMS_DESCRIBE.NUMBER_TABLE;
        arg_name       DBMS_DESCRIBE.VARCHAR2_TABLE;
        dtypes         DBMS_DESCRIBE.NUMBER_TABLE;
        def_val        DBMS_DESCRIBE.NUMBER_TABLE;
        p_mode         DBMS_DESCRIBE.NUMBER_TABLE;
        length         DBMS_DESCRIBE.NUMBER_TABLE;
        precision      DBMS_DESCRIBE.NUMBER_TABLE;
        scale          DBMS_DESCRIBE.NUMBER_TABLE;
        radix          DBMS_DESCRIBE.NUMBER_TABLE;
        spare          DBMS_DESCRIBE.NUMBER_TABLE;
        idx            INTEGER := 0;

    BEGIN
        DBMS_DESCRIBE.DESCRIBE_PROCEDURE(
            name,
            null,
            null,
            overload,
            position,
            c_level,
            arg_name,
            dtypes,
            def_val,
            p_mode,
            length,
            precision,
            scale,
            radix,
            spare);

        DBMS_OUTPUT.PUT_LINE('Position      Name          DTY  Mode');
        LOOP
            idx := idx + 1;
            prt_value(TO_CHAR(position(idx)), 12);
            prt_value(arg_name(idx), 12);
            prt_value(TO_CHAR(dtypes(idx)), 5);
            prt_value(TO_CHAR(p_mode(idx)), 5);
            DBMS_OUTPUT.NEW_LINE;
        END LOOP;
    EXCEPTION
        WHEN NO_DATA_FOUND THEN
            DBMS_OUTPUT.NEW_LINE;
            DBMS_OUTPUT.NEW_LINE;

    END desc_proc;
END describe_it;

```

Then the results list all the numeric codes for the PL/SQL datatypes:

Position	Name	Datatype_Code	Mode
1	PVC2	1	0
2	PVC	1	1
3	PSTR	1	2
4	PLONG	8	0

5	PROWID	11	0
6	PCHARA	96	0
7	PCHAR	96	0
8	PRAW	23	0
9	PLRAW	24	0
10	PBININT	3	0
11	PPLSINT	3	0
12	PBOOL	252	0
13	PNAT	3	0
14	PPOS	3	0
15	PPOSN	3	0
16	PNATN	3	0
17	PNUM	2	0
18	PINTGR	2	0
19	PINT	2	0
20	PSMALL	2	0
21	PDEC	2	0
22	PREAL	2	0
23	PFLOAT	2	0
24	PNUMBER	2	0
25	PDP	2	0
26	PDATE	12	0
27	PMLS	106	0

66.6 Summary of DBMS_DESCRIBE Subprograms

The DBMS_DESCRIBE package includes the DESCRIBE_PROCEDURE procedure.

Table 66-2 DBMS_DESCRIBE Package Subprograms

Subprogram	Description
DESCRIBE_PROCEDURE Procedure	Provides a brief description of a PL/SQL stored procedure

66.6.1 DESCRIBE_PROCEDURE Procedure

The procedure DESCRIBE_PROCEDURE provides a brief description of a PL/SQL stored procedure.

It takes the name of a stored procedure and returns information about each parameter of that procedure.

Syntax

```
DBMS_DESCRIBE.DESCRIBE_PROCEDURE (
    object_name          IN  VARCHAR2,
    reserved1            IN  VARCHAR2,
    reserved2            IN  VARCHAR2,
    overload             OUT NUMBER_TABLE,
    position             OUT NUMBER_TABLE,
    level                OUT NUMBER_TABLE,
    argument_name        OUT VARCHAR2_TABLE,
    datatype             OUT NUMBER_TABLE,
    default_value        OUT NUMBER_TABLE,
    in_out               OUT NUMBER_TABLE,
    length               OUT NUMBER_TABLE,
    precision            OUT NUMBER_TABLE,
```

```

scale                OUT NUMBER_TABLE,
radix                OUT NUMBER_TABLE,
spare                OUT NUMBER_TABLE
include_string_constraints  OUT BOOLEAN DEFAULT FALSE);

```

Parameters

Table 66-3 DBMS_DESCRIBE.DESCRIBE_PROCEDURE Parameters

Parameter	Description
object_name	<p>Name of the procedure being described.</p> <p>The syntax for this parameter follows the rules used for identifiers in SQL. The name can be a synonym. This parameter is required and may not be null. The total length of the name cannot exceed 197 bytes. An incorrectly specified OBJECT_NAME can result in one of the following exceptions:</p> <p>ORA-20000 - A package was specified. You can only specify a stored procedure, stored function, packaged procedure, or packaged function.</p> <p>ORA-20001 - The procedure or function that you specified does not exist within the given package.</p> <p>ORA-20002 - The object that you specified is a remote object. This procedure cannot currently describe remote objects.</p> <p>ORA-20003 - The object that you specified is invalid and cannot be described.</p> <p>ORA-20004 - The object was specified with a syntax error.</p>
reserved1 reserved2	Reserved for future use -- must be set to NULL or the empty string.
overload	<p>A unique number assigned to the procedure's signature.</p> <p>If a procedure is overloaded, then this field holds a different value for each version of the procedure.</p>
position	<p>Position of the argument in the parameter list.</p> <p>Position 0 returns the values for the return type of a function.</p>
level	If the argument is a composite type, such as record, then this parameter returns the level of the datatype. See the <i>Oracle Call Interface Developer's Guide</i> for a description of the ODESSP call for an example.
argument_name	Name of the argument associated with the procedure that you are describing.

Table 66-3 (Cont.) DBMS_DESCRIBE.DESCRIBE_PROCEDURE Parameters

Parameter	Description
datatype	<p>Oracle datatype of the argument being described. The datatypes and their numeric type codes are:</p> <ul style="list-style-type: none"> 0 placeholder for procedures with no arguments 1 VARCHAR, VARCHAR, STRING 2 NUMBER, INTEGER, SMALLINT, REAL, FLOAT, DECIMAL 3 BINARY_INTEGER, PLS_INTEGER, POSITIVE, NATURAL 8 LONG 11 ROWID 12 DATE 23 RAW 24 LONG RAW 58 OPAQUE TYPE 96 CHAR (ANSI FIXED CHAR), CHARACTER 106 MLSLABEL 121 OBJECT 122 NESTED TABLE 123 VARRAY 178 TIME 179 TIME WITH TIME ZONE 180 TIMESTAMP 181 TIMESTAMP WITH TIME ZONE 231 TIMESTAMP WITH LOCAL TIME ZONE 250 PL/SQL RECORD 251 PL/SQL TABLE 252 PL/SQL BOOLEAN
default_value	1 if the argument being described has a default value; otherwise, the value is 0.
in_out	<p>Describes the mode of the parameter:</p> <ul style="list-style-type: none"> 0 IN 1 OUT 2 IN OUT
length	For %rowtype formal arguments, the length constraint is returned, otherwise 0 is returned. If the include_string_constraints parameter is set to TRUE, the argument's formal length constraint is passed back if it is of the appropriate type. Those are the string types: 1;8;23;24;96
precision	If the argument being described is of datatype 2 (NUMBER), then this parameter is the precision of that number.
scale	If the argument being described is of datatype 2 (NUMBER), then this parameter is the scale of that number.
radix	If the argument being described is of datatype 2 (NUMBER), then this parameter is the radix of that number.
spare	Reserved for future functionality.
include_string_constraints	The default is FALSE. If the parameter is set to TRUE, the arguments' formal type constraints is passed back if it is of the appropriate type. Those are the string types: 1;8;23;24;96

Return Values

All values from `DESCRIBE_PROCEDURE` are returned in its `OUT` parameters. The datatypes for these are PL/SQL tables, to accommodate a variable number of parameters.

DBMS_DG

The `DBMS_DG` package allows applications to notify the primary database or the fast-start failover target database in an Oracle Data Guard broker environment to initiate a fast-start failover when the application encounters a condition that warrants a failover.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

This chapter contains the following topics:

- [Using DBMS_DG](#)
- [Security Model](#)
- [Summary of the DBMS_DG Subprogram](#)

See Also:

Oracle Data Guard Broker

67.1 Using DBMS_DG

There are conditions detectable by applications running outside of the Oracle database that may warrant the Oracle Data Guard broker to perform a fast-start failover. Because the range of possible conditions is virtually unlimited, it is left to the applications to determine which conditions warrant a fast-start failover.

When such conditions occur, the application calls the `DBMS_DG.INITIATE_FS_FAILOVER` procedure to alert either the primary or fast-start failover target standby database that the application wants a fast-start failover to occur immediately. The database on which the procedure was called then notifies the observer, which immediately initiates a fast-start failover as long as the standby database is in a valid fast-start failover state ("observed" and either "synchronized" or "within lag") to accept a failover. If the configuration is not in a valid fast-start failover state, the `INITIATE_FS_FAILOVER` subprogram returns an ORA error message (it will not signal an exception) to inform the calling application that a fast-start failover could not be performed.

 **Note:**

If you are working in a multitenant container database (CDB), then functions within `DBMS_DG` are only executed at the root level. Ensure you are connected at the root level, not at the individual pluggable database (PDB) level.

67.2 DBMS_DG Security Model

The `DBMS_DG` package runs with invoker's rights and requires the `SYSDBA` privilege.

67.3 Summary of the DBMS_DG Subprogram

The `DBMS_DG` package contains one subprogram, the `INITIATE_FS_FAILOVER` procedure.

Table 67-1 DBMS_DG Package Subprogram

Subprogram	Description
INITIATE_FS_FAILOVER Procedure	Enables an application to notify either the primary or fast-start failover target standby database that a fast-start failover is necessary when the application encounters conditions that warrant a failover. This procedure can only be called while connected to a primary database or a fast-start failover standby database.

67.3.1 INITIATE_FS_FAILOVER Procedure

Use this procedure to specify a condition string that, when encountered by an application, allows the application to request that a fast-start failover be invoked.

Syntax

```
DBMS_DG.INITIATE_FS_FAILOVER (
    condstr          IN VARCHAR2)
RETURN BINARY_INTEGER;
```

Parameters

Table 67-2 INITIATE_FS_FAILOVER Procedure Parameters

Parameter	Description
condstr	Specifies the condition string for which a fast-start failover should be requested. If no condition string argument is supplied, the default string of "Application Failover Requested" will be logged in the broker log file and in the database alert log of the database on which the procedure was called.

Usage Notes

- This procedure returns a binary integer.

- Query the `V$FS_FAILOVER_STATS` view to see the time of the last fast-start failover and the reason it was performed.
- This procedure can only be called while connected to a primary database or a fast-start failover standby database.

Errors

Table 67-3 INITIATE_FS_FAILOVER Procedure Errors

Error	Description
ORA-00000: normal, successful completion	The request to initiate a fast-start failover has been posted to the observer.
ORA-16646: fast-start failover is disabled	Either a broker configuration does not exist or fast-start failover has not been enabled.
ORA-16666: unable to initiate fast-start failover on a bystander standby database	DBMS_DG.INITIATE_FS_FAILOVER was invoked on a bystander standby database. That is, it was not invoked on the primary or on the fast-start failover target standby database.
ORA-16817: unsynchronized fast-start failover configuration	DBMS_DG.INITIATE_FS_FAILOVER was invoked in a maximum available fast-start failover configuration when the configuration was not synchronized.
ORA-16819: fast-start failover observer not started	DBMS_DG.INITIATE_FS_FAILOVER was invoked but an observer had not yet been started.
ORA-16820: fast-start failover observer is no longer observing this database	DBMS_DG.INITIATE_FS_FAILOVER was invoked but the configuration detects that the observer may not be running.
ORA-16829: lagging fast-start failover configuration	DBMS_DG.INITIATE_FS_FAILOVER was invoked in a maximum performance fast-start failover configuration when the configuration was not in the user-specified redo lag limit.

Example

In this example, the program attempts to initiate a fast-start failover when fast-start failover is disabled. To use this example, connect as user `SYS` with `SYDDBA` privileges.

```
set serveroutput on

declare
status integer;

begin
status := dbms_dg.initiate_fs_failover('Failover Requested');

dbms_output.put_line('Fast-Start Failover is disabled: Expected status = ORA-16646');
dbms_output.put_line('                Actual Status = ORA-' || status);

end;
/
exit;
```

DBMS_DICTIONARY_CHECK

`DBMS_DICTIONARY_CHECK` is a read-only and lightweight PL/SQL package procedure that helps you identify Oracle Database dictionary inconsistencies.

68.1 Overview of Oracle Database Dictionary Check

`DBMS_DICTIONARY_CHECK` is a read-only and lightweight PL/SQL package procedure that helps you identify Oracle Database dictionary inconsistencies that are manifested in unexpected entries in the Oracle Database dictionary tables or invalid references between dictionary tables. Oracle Database dictionary inconsistencies can cause process failures and, in some cases, instance crash. Such inconsistencies may be exposed to internal `ORA-00600` errors. `DBMS_DICTIONARY_CHECK` assists you in identifying such inconsistencies and in some cases provides guided remediation to resolve the problem and avoid such database failures.

Unexpected entries in the dictionary tables or invalid references between dictionary tables, for example, include the following:

- A lob segment not in `OBJ$`
- An entry in `SOURCE$` not in `OBJ$`
- Invalid data between `OBJ$-PARTOBJ$` and `TABPART$`
- A segment with no owner
- A materialized segment with no entry in `seg$`
- A segment with no object entry
- A recycle bin object not in the `recyclebin$`
- Check if `Control Seq` is near the limit

68.2 Using `DBMS_DICTIONARY_CHECK`

To run all the checks or only the critical checks defined by `DBMS_DICTIONARY_CHECK`, connect to the `SYS` schema, and then run the following commands as `SYS` user:

Full check

```
SQL> set serveroutput on size unlimited
SQL> execute dbms_dictionary_check.full
```

```
SQL> set serveroutput on size unlimited
SQL> EXECUTE dbms_dictionary_check.full(repair=>TRUE)
```

While running a full check, optionally, you can use the `repair` option to resolve inconsistencies. Valid values: `TRUE|FALSE`. Default: `FALSE`.

Critical check

```
SQL> set serveroutput on size unlimited
SQL> execute dbms_dictionary_check.critical
```

Optionally, turn on the spool to redirect the output to a server-side flat file. By default, when you query the `SYS` schema, the `DBMS_DICTIONARY_CHECK` package creates a trace file named, `DICTCHECK.trc`.

For example: `/<path>/diag/rdbms/<db_name>/<oracle_sid>/trace/<oracle_sid>_<ora>_<pid>_DICTCHECK.trc`.

The execution reports the result as:

- **CRITICAL:** Requires an immediate fix.
- **FAIL:** Requires resolution on priority.
- **WARN:** Good to resolve.
- **PASS:** No issues.

Note:

In all cases, any output reporting "problems" must be triaged by Oracle Support to confirm if any action is required.

Example 68-1 Full check run

```
SQL> set serveroutput on size unlimited
SQL> execute dbms_dictionary_check.full
dbms_dictionary_check on 07-MAR-2023
03:17:48
```

```
-----
Catalog Version 21.0.0.0.0
(2300000000)
```

```
db_name:
ORCL
```

```
Is CDB?:
NO
```

```
Trace File: /oracle/log/diag/rdbms/orcl/orcl/trace/
orcl_ora_2574906_DICTCHECK.trc
```

Fixed	Procedure Name	Catalog	Version	Vs Release
-------	----------------	---------	---------	------------

```

Timestamp      Result
-----
.- OIDOnObjCol      ... 2300000000 <= *All Rel* 03/07 03:17:48
PASS
.- LobNotInObj      ... 2300000000 <= *All Rel* 03/07 03:17:48
PASS
.- SourceNotInObj   ... 2300000000 <= *All Rel* 03/07 03:17:48
PASS
.- OversizedFiles   ... 2300000000 <= *All Rel* 03/07 03:17:48
PASS
.- PoorDefaultStorage ... 2300000000 <= *All Rel* 03/07 03:17:48
PASS
.- PoorStorage       ... 2300000000 <= *All Rel* 03/07 03:17:48
PASS
.- TabPartCountMismatch ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- TabComPartObj     ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- Mview             ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- ValidDir          ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- DuplicateDataobj  ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- ObjSyn            ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- ObjSeq            ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- UndoSeg           ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- IndexSeg          ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- IndexPartitionSeg ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- IndexSubPartitionSeg ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- TableSeg          ... 2300000000 <= *All Rel* 03/07 03:17:49
FAIL

```

```

HCKE-0019: Orphaned TAB$ (no SEG$) (Doc ID
1360889.1)
ORPHAN TAB$: OBJ#=83241 DOBJ#=83241 TS=5 RFILE/BLOCK=5/11
TABLE=SYS.ORPHANSEG BOBJ#=

```

```

.- TablePartitionSeg ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- TableSubPartitionSeg ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- PartCol           ... 2300000000 <= *All Rel* 03/07 03:17:49
PASS
.- ValidSeg          ... 2300000000 <= *All Rel* 03/07 03:17:49
FAIL

```

```

HCKE-0023: Orphaned SEG$ Entry (Doc ID

```

```

1360934.1)
ORPHAN SEG$: SegType=LOB TS=5 RFILE/
BLOCK=5/26

.- IndPartObj                ... 2300000000 <= *All Rel* 03/07
03:17:49 PASS
.- DuplicateBlockUse         ... 2300000000 <= *All Rel* 03/07
03:17:49 PASS
.- FetUet                    ... 2300000000 <= *All Rel* 03/07
03:17:49 PASS
.- Uet0Check                 ... 2300000000 <= *All Rel* 03/07
03:17:49 PASS
.- SeglessUET                ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- ValidInd                  ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- ValidTab                  ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- IcolDepCnt                ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- ObjIndDobj                ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- TrgAfterUpgrade           ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- ObjType0                  ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- ValidOwner                ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- StmtAuditOnCommit         ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- PublicObjects             ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- SegFreelist               ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- ValidDepends              ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- CheckDual                 ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- ObjectNames               ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- ChkIotTs                  ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- NoSegmentIndex            ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- NextObject                ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- DroppedROTS               ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- FilBlkZero                ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- DbmsSchemaCopy            ... 2300000000 <= *All Rel* 03/07
03:17:50 PASS
.- IdnseqObj                 ... 2300000000 > 1201000000 03/07
03:17:50 PASS
.- IdnseqSeq                 ... 2300000000 > 1201000000 03/07

```

```
03:17:50 PASS
.- ObjError ... 2300000000 > 1102000000 03/07 03:17:50
PASS
.- ObjNotLob ... 2300000000 <= *All Rel* 03/07 03:17:50
FAIL
```

```
HCKE-0049: OBJ$ LOB entry has no LOB$ or LOBFRAG$ entry (Doc ID
2125104.1)
OBJ$ LOB has no LOB$ entry: Obj=83243 Owner: SYS LOB Name:
LOBCl
```

```
.- MaxControlfSeq ... 2300000000 <= *All Rel* 03/07 03:17:50
PASS
.- SegNotInDeferredStg ... 2300000000 > 1102000000 03/07 03:17:50
PASS
.- SystemNotRfile1 ... 2300000000 <= *All Rel* 03/07 03:17:50
PASS
.- DictOwnNonDefaultSYSTEM ... 2300000000 <= *All Rel* 03/07 03:17:50
PASS
.- ValidateTrigger ... 2300000000 <= *All Rel* 03/07 03:17:50
PASS
.- ObjNotTrigger ... 2300000000 <= *All Rel* 03/07 03:17:50
PASS
.- InvalidTSMMaxSCN ... 2300000000 > 1202000000 03/07 03:17:50
CRITICAL
```

```
HCKE-0054: TS$ has Tablespace with invalid Maximum SCN (Doc ID
1360208.1)
TS$ has Tablespace with invalid Maximum SCN: TS#=5 Tablespace=HCHECK
Online$=1
```

```
.- OBJRecycleBin ... 2300000000 <= *All Rel* 03/07 03:17:50
PASS
```

```
-----
07-MAR-2023 03:17:50 Elapsed: 2
secs
-----
```

```
Found 4 potential problem(s) and 0
warning(s)
Found 1 CRITICAL problem(s) needing
attention
Contact Oracle Support with the output and trace
file
to check if the above needs attention or
not
BEGIN dbms_dictionary_check.full; END;
```

```
*
ERROR at line 1:
ORA-20000: dbms_dictionary_check found 1 critical issue(s). Trace file:
/oracle/log/diag/rdbms/orcl/orcl/trace/orcl_ora_2574906_DICTCHECK.trc
```

```
SQL>
```

Example 68-2 Full check run with repair option

```

SQL> set serveroutput on size unlimited
SQL> EXECUTE dbms_dictionary_check.full(repair=>TRUE)
dbms_dictionary_check on 04-OCT-2023 01:35:37
-----
Catalog Version 23.0.0.0.0 (2300000000)
db_name: orcl
Is CDB?: NO
Trace File: /oracle/log/diag/rdbms/orcl/orcl/trace/
orcl_ora_3831454_DICTCHECK.trc

Procedure Name          Catalog      Fixed
Timestamp              Version     Vs Release
Result
-----
... -----
-----

.- OIDOnObjCol          ... 2300000000 <= *All Rel* 10/04
01:35:37 PASS
.- LobNotInObj          ... 2300000000 <= *All Rel* 10/04
01:35:37 PASS
.- SourceNotInObj      ... 2300000000 <= *All Rel* 10/04
01:35:38 FAIL

HCKE-0003: SOURCE$ for OBJ# not in OBJ$ (Doc ID 1360233.1)
SOURCE$ has 10 rows for 1 OBJ# values not in OBJ$

INCONSISTENCY REPAIRED - Check the trace file for repair details:
SourceNotInObj_Repair: DELETED 10 objects from SOURCE$ not found in
OBJ$

.- OversizedFiles      ... 2300000000 <= *All Rel* 10/04
01:35:38 PASS
.- PoorDefaultStorage  ... 2300000000 <= *All Rel* 10/04
01:35:38 PASS
.- PoorStorage         ... 2300000000 <= *All Rel* 10/04
01:35:38 PASS
.- TabPartCountMismatch ... 2300000000 <= *All Rel* 10/04
01:35:38 PASS
.- TabComPartObj       ... 2300000000 <= *All Rel* 10/04
01:35:38 PASS
.- Mview               ... 2300000000 <= *All Rel* 10/04
01:35:38 PASS
.- ValidDir            ... 2300000000 <= *All Rel* 10/04
01:35:38 PASS
.- DuplicateDataobj    ... 2300000000 <= *All Rel* 10/04
01:35:38 PASS
.- ObjSyn              ... 2300000000 <= *All Rel* 10/04
01:35:39 PASS
.- ObjSeq              ... 2300000000 <= *All Rel* 10/04
01:35:39 PASS
.- ValidateSeg         ... 2300000000 <= *All Rel* 10/04
01:35:39 FAIL

HCKE-0023: Orphaned SEG$ Entry (Doc ID 1360934.1)

```



```

ORPHAN SEG$: SegType=DATA TS=5 RFILE/BLOCK=5/11 HWMINCR(DOBJ#)=73271

.- TableSeg                ... 2300000000 <= *All Rel* 10/04 01:35:39
PASS
.- TablePartitionSeg       ... 2300000000 <= *All Rel* 10/04 01:35:39
PASS
.- TableSubPartitionSeg    ... 2300000000 <= *All Rel* 10/04 01:35:39
PASS
ORPHAN SEG$: SegType=DATA TS=5 RFILE/BLOCK=5/11
^ Segment entry repaired - Converted to TEMPORARY
INCONSISTENCY REPAIRED - Check the trace file for repair details:
ValidateSeg repaired 1 Orphan Seg$ entries

.- UndoSeg                 ... 2300000000 <= *All Rel* 10/04 01:35:39
PASS
...
-----
04-OCT-2023 01:35:40 Elapsed: 3 secs
-----
Found 3 potential problem(s) and 0 warning(s)
Repaired 11 item(s)
Contact Oracle Support with the output and trace file
to check if the above needs attention or not
BEGIN dbms_dictionary_check.full(repair=>TRUE); END;

*
ERROR at line 1:
ORA-20001: dbms_dictionary_check found 3 problem(s) and repaired 11
item(s). Trace file:
/oracle/log/diag/rdbms/orcl/orcl/trace/orcl_ora_3831454_DICTCHECK.trc

```

Example 68-3 Critical check run

```

SQL> set serveroutput on size unlimited
SQL> execute dbms_dictionary_check.critical
dbms_dictionary_check on 07-MAR-2023
03:12:23
-----

Catalog Version 21.0.0.0.0
(2100000000)
db_name:
ORCL

Is CDB?:
NO

Trace File: /oracle/log/diag/rdbms/orcl/orcl/trace/
orcl_ora_2574058_DICTCHECK.trc

Fixed
Procedure Name          Catalog
Result                  Version   Vs Release   Timestamp

```

```

-----
-----
.- UndoSeg                ... 2300000000 <= *All Rel* 03/07
03:12:23 PASS
.- MaxControlfSeq        ... 2300000000 <= *All Rel* 03/07
03:12:23 PASS
.- InvalidTSMMaxSCN      ... 2300000000 > 1202000000 03/07
03:12:23 CRITICAL

HCKE-0054: TS$ has Tablespace with invalid Maximum SCN (Doc ID
1360208.1)
TS$ has Tablespace with invalid Maximum SCN: TS#=5 Tablespace=HCHECK
Online$=1

-----

07-MAR-2023 03:12:23 Elapsed: 0
secs
-----

Found 1 potential problem(s) and 0
warning(s)
Found 1 CRITICAL problem(s) needing
attention
Contact Oracle Support with the output and trace
file
to check if the above needs attention or
not
BEGIN dbms_dictionary_check.critical; END;

*
ERROR at line 1:
ORA-20000: dbms_dictionary_check found 1 critical issue(s). Trace
file:
/oracle/log/diag/rdbms/orcl/orcl/trace/orcl_ora_2574058_DICTCHECK.trc

SQL>

```

68.3 Summary of DBMS_DICTIONARY_CHECK Subprograms

DBMS_DICTIONARY_CHECK package includes the following procedures:

- **LobNotInObj:** Checks if a LOB segment is not in OBJ\$ (My Oracle Support Note [1360208.1](#))
- **OIDOnObjCol:** Checks if an object type column is not in OID\$ (My Oracle Support Note [1360268.1](#))
- **SourceNotInObj:** Checks if an entry in SOURCE\$ is not in OBJ\$ (My Oracle Support Note [1360233.1](#))

While running the SourceNotInObj procedure, optionally, you can use the repair option to resolve inconsistencies. Valid values: TRUE|FALSE. Default: FALSE.

- **IndIndparMismatch**: Checks for index name mismatch between partitions (My Oracle Support Note [1360285.1](#))
 - **InvCorrAudit**: Checks for invalid `AUDIT$` entries (My Oracle Support Note [1360489.1](#))
 - **OversizedFiles**: Checks for oversized database files (My Oracle Support Note [1360490.1](#))
 - **PoorDefaultStorage**: Checks tablespace default storage clauses (My Oracle Support Note [1360493.1](#))
 - **PoorStorage**: Checks objects storage clause (My Oracle Support Note [1360496.1](#))
 - **PartSubPartMismatch**: Checks valid partition methods (My Oracle Support Note [1360504.1](#))
 - **TabPartCountMismatch**: Checks invalid data between `OBJ$-PARTOBJ$` and `TABPART$` (My Oracle Support Note [1360514.1](#))
 - **TabComPartObj**: Checks that the composite partition has a valid entry in `OBJ$` (My Oracle Support Note [1360515.1](#))
 - **Mview**: Check invalid entries for materialized view (My Oracle Support Note [1360517.1](#))
 - **ValidDir**: Checks that the directory object has valid entries (My Oracle Support Note [1360518.1](#))
 - **DuplicateDataobj**: Checks for duplicate segment `data_object_id` (My Oracle Support Note [1360519.1](#))
 - **ObjSyn**: Checks that a synonym has a valid entry in `OBJ$` (My Oracle Support Note [1360520.1](#))
 - **ObjSeq**: Checks that a sequence has a valid entry in `OBJ$` (My Oracle Support Note [1360524.1](#))
 - **UndoSeg**: Checks that undo segment has a valid entry in `SEG$` (My Oracle Support Note [1360527.1](#))
 - **IndexSeg**: Checks that an index segment has a valid entry in `SEG$` (My Oracle Support Note [1360531.1](#))
 - **IndexPartitionSeg**: Checks that an index partition has a valid entry in `SEG$` (My Oracle Support Note [1360535.1](#))
 - **IndexSubPartitionSeg**: Checks that an index sub-partition has a valid entry in `SEG$` (My Oracle Support Note [1360536.1](#))
 - **TableSeg**: Checks that a table has a valid entry in `SEG$` (My Oracle Support Note [1360889.1](#))
 - **TablePartitionSeg**: Checks that a table partition has a valid entry in `SEG$` (My Oracle Support Note [1360890.1](#))
 - **TableSubPartitionSeg**: Checks that a table sub-partition has a valid entry in `SEG$` (My Oracle Support Note [1360891.1](#))
 - **PartCol**: Checks for valid entry of column partition (My Oracle Support Note [1360892.1](#))
 - **ValidateSeg**: Checks that a segment in `SEG$` has an entry in its parent (My Oracle Support Note [1360934.1](#))
- While running the `ValidateSeg` procedure, optionally, you can use the `repair` option to resolve inconsistencies. Valid values: `TRUE|FALSE`. Default: `FALSE`.

- **IndPartObj**: Checks that an index partition has an entry in OBJ\$ (My Oracle Support Note [1360935.1](#))
- **DuplicateBlockUse**: Checks for a segment header block is used by only one segment (My Oracle Support Note [1360880.1](#))
- **FetUet**: Checks valid free/used space in a dictionary-managed tablespace (My Oracle Support Note [1360882.1](#))
- **Uet0Check**: Checks valid first extent in a dictionary-managed tablespace (My Oracle Support Note [1360883.1](#))
- **ExtentlessSeg**: Checks SEG\$/UET\$ mismatch in a dictionary-managed tablespace (My Oracle Support Note [1360944.1](#))
- **SeglessUET**: Checks UET\$/SEG\$ mismatch in a dictionary-managed tablespace (My Oracle Support Note [1360944.1](#))
- **ValidInd**: Checks that an index in OBJ\$ has a corresponding entry in the index dictionary (My Oracle Support Note [1360528.1](#))
- **ValidTab**: Checks that a table in OBJ\$ has a corresponding entry in TAB\$ (My Oracle Support Note [1360538.1](#))
- **IcolDepCnt**: Checks valid entries in ICOLDEP\$ (My Oracle Support Note [1360938.1](#))
- **WarnIcolDep**: Checks that an index does not have an ADT (object column) (My Oracle Support Note [1360939.1](#))
- **ObjIndDobj**: Checks index data_object_id mismatch between OBJ\$ and IND\$ (My Oracle Support Note [1360968.1](#))
- **TrgAfterUpgrade**: Checks valid entries in triggers (My Oracle Support Note [1361014.1](#))
- **ObjType0**: Checks that OBJ\$ has a valid type greater than 0 (My Oracle Support Note [1361015.1](#))
- **ValidOwner**: Checks that an entry in OBJ\$ has a valid user ID (My Oracle Support Note [1361020.1](#))
- **StmtAuditOnCommit**: Checks valid entries for STMT_AUDIT_OPTION_MAP (My Oracle Support Note [1361021.1](#))
- **PublicObjects**: Checks that objects are not owned by PUBLIC (My Oracle Support Note [1361022.1](#))
- **SegFreelist**: Checks that a LOB segment has a valid free list group (My Oracle Support Note [1361023.1](#))
- **ValidDepends**: Checks for valid dependency timestamps (My Oracle Support Note [1361045.1](#))
- **CheckDual**: Checks valid entries in DUAL (My Oracle Support Note [1361046.1](#))
- **ObjectNames**: Checks if an object has the same name as its schema owner (My Oracle Support Note [2363142.1](#))
- **CboHiLo**: Checks for valid entries in histograms (My Oracle Support Note [1361047.1](#))
- **ChkIotTs**: Checks that an IOT object does not have a segment (My Oracle Support Note [1361048.1](#))

- **NoSegmentIndex:** Checks for NOSEGMENT indexes (My Oracle Support Note [1361049.1](#))
- **NextObject:** Checks for valid data_object_id (My Oracle Support Note [2124772.1](#))
- **DroppedROTS:** Checks for valid entries in a read-only tablespace (My Oracle Support Note [2124774.1](#))
- **FilBlkZero:** Checks for zero data block address (My Oracle Support Note [2124783.1](#))
- **DbmsSchemaCopy:** Checks for invalid execution of DBMS_SCHEMA_COPY (My Oracle Support Note [2124795.1](#))
- **IdnseqObj:** Checks that Identity column has a valid object (My Oracle Support Note [2124805.1](#))
- **IdnseqSeq:** Checks that a sequence has a valid object (My Oracle Support Note [2124787.1](#))
- **ObjError:** Checks that an object error is valid (My Oracle Support Note [2124788.1](#))
- **ObjNotLob:** Checks that a LOB object has an entry in LOB\$ (My Oracle Support Note [2125104.1](#))
- **MaxControlfSeq:** Checks if Control Seq is near the limit (My Oracle Support Note [2128446.1](#))
- **SegNotInDeferredStg:** Checks for an invalid deferred segment (My Oracle Support Note [2298947.1](#))
- **SystemNotRfile1:** Checks that the system tablespace has a relative file number 1 (My Oracle Support Note [2364065.1](#))
- **DictOwnNonDefaultSYSTEM:** Checks that the users SYS and SYSTEM have default tablespace SYSTEM (My Oracle Support Note [2377270.1](#))
- **ValidateTrigger:** Checks that triggers have valid entries in their parents (My Oracle Support Note [2384373.1](#))
- **ObjNotTrigger:** Checks if an object trigger is not in TRIGGER\$ (My Oracle Support Note [2384392.1](#))
- **WarningTSMMaxSCN:** Checks exposed SCN entries in tablespaces
- **InvalidTSMMaxSCN:** Checks for invalid SCN entries in tablespaces (My Oracle Support Note [1360208.1](#))
- **OBJRecycleBin:** Checks that recycle bin objects in OBJ\$ exist in RECYCLEBIN\$ (My Oracle Support Note [2902943.1](#))
- **LobSeg:** Checks that a LOB segment has a valid entry in SEG\$ (My Oracle Support Note [2948392.1](#) and [2948408.1](#))
- **ObjLogicalConstraints:** Checks logical constraints in OBJ\$ (My Oracle Support Note [2977609.1](#) and Note [2977591.1](#))
- **SysSequences:** Checks inconsistencies with critical sequences owned by SYS (My Oracle Support Note [2992123.1](#), Note [2992124.1](#) and Note [2992107.1](#))
- **Critical:** Executes only critical checks
- **Full:** Executes all checks

Example 68-4 ValidateSeg with repair option

```
SQL> EXECUTE dbms_dictionary_check.ValidateSeg(repair=>TRUE)
.- ValidateSeg                ... 2300000000 <= *All Rel* 10/04 01:30:21
```

FAIL

HCKE-0023: Orphaned SEG\$ Entry (Doc ID 1360934.1)
ORPHAN SEG\$: SegType=DATA TS=5 RFILE/BLOCK=5/11 HWMINCR(DOBJ#)=73270

```

.- TableSeg                ... 2300000000 <= *All Rel* 10/04
01:30:21 PASS
.- TablePartitionSeg       ... 2300000000 <= *All Rel* 10/04
01:30:21 PASS
.- TableSubPartitionSeg    ... 2300000000 <= *All Rel* 10/04
01:30:21 PASS

```

ORPHAN SEG\$: SegType=DATA TS=5 RFILE/BLOCK=5/11
^ Segment entry repaired - Converted to TEMPORARY
INCONSISTENCY REPAIRED - Check the trace file for repair details:
ValidateSeg repaired 1 Orphan Seg\$ entries

PL/SQL procedure successfully completed.

Example 68-5 SourceNotInObj with repair option

```

SQL> EXECUTE dbms_dictionary_check.SourceNotInObj(repair=>TRUE)
dbms_dictionary_check on 04-OCT-2023 01:30:20

```

```

-----
Catalog Version 23.0.0.0.0 (2300000000)
db_name: orcl
Is CDB?: NO
Trace File: /oracle/log/diag/rdbms/orcl/orcl/trace/
orcl_ora_3831239_DICTCHECK.trc

```

Procedure Name	Timestamp	Result	Catalog Version	Fixed Vs Release
.- SourceNotInObj	01:30:20	FAIL	... 2300000000 <=	*All Rel* 10/04

HCKE-0003: SOURCE\$ for OBJ# not in OBJ\$ (Doc ID 1360233.1)
SOURCE\$ has 10 rows for 1 OBJ# values not in OBJ\$

INCONSISTENCY REPAIRED - Check the trace file for repair details:
SourceNotInObj_Repair: DELETED 10 objects from SOURCE\$ not found in
OBJ\$

PL/SQL procedure successfully completed.

DBMS_DIMENSION

DBMS_DIMENSION enables you to verify dimension relationships and provides an alternative to the Enterprise Manager Dimension Wizard for displaying a dimension definition.



See Also:

Oracle Database Data Warehousing Guide for detailed conceptual and usage information about the DBMS_DIMENSION package

This chapter contains the following topics:

- [Security Model](#)
- [Summary of DBMS_DIMENSION Subprograms](#)

69.1 DBMS_DIMENSION Security Model

Security on this package can be controlled by granting EXECUTE to selected users or roles.

A user can validate or describe all the dimensions in his own schema. To validate or describe a dimension in another schema, you must have either an object privilege on the dimension or one of the following system privileges: CREATE ANY DIMENSION, ALTER ANY DIMENSION, and DROP ANY DIMENSION.

69.2 Summary of DBMS_DIMENSION Subprograms

This table lists the DBMS_DIMENSION subprograms and briefly describes them.

Table 69-1 DBMS_DIMENSION Package Subprograms

Subprogram	Description
DESCRIBE_DIMENSION Procedure	Prints out the definition of the input dimension, including dimension owner and name, levels, hierarchies, and attributes
VALIDATE_DIMENSION Procedure	Verifies that the relationships specified in a dimension are correct

69.2.1 DESCRIBE_DIMENSION Procedure

This procedure displays the definition of the dimension, including dimension name, levels, hierarchies, and attributes. It displays the output using the `DBMS_OUTPUT` package.

Syntax

```
DBMS_DIMENSION.DESCRIBE_DIMENSION (
    dimension IN VARCHAR2);
```

Parameters

Table 69-2 DESCRIBE_DIMENSION Procedure Parameter

Parameter	Description
<code>dimension</code>	The owner and name of the dimension in the format of <code>owner.name</code> .

69.2.2 VALIDATE_DIMENSION Procedure

This procedure verifies that the relationships specified in a dimension are valid. The `rowid` for any row that is found to be invalid will be stored in the table `DIMENSION_EXCEPTIONS` in the user's schema.

Syntax

```
DBMS_DIMENSION.VALIDATE_DIMENSION (
    dimension          IN VARCHAR2,
    incremental        IN BOOLEAN := TRUE,
    check_nulls        IN BOOLEAN := FALSE,
    statement_id        IN VARCHAR2 := NULL );
```

Parameters

Table 69-3 VALIDATE_DIMENSION Procedure Parameters

Parameter	Description
<code>dimension</code>	The owner and name of the dimension in the format of <code>owner.name</code> .
<code>incremental</code>	If <code>TRUE</code> , check only the new rows for tables of this dimension. If <code>FALSE</code> , check all the rows.
<code>check_nulls</code>	If <code>TRUE</code> , then all level columns are verified to be non-null. If <code>FALSE</code> , this check is omitted. Specify <code>FALSE</code> when non-NULLness is guaranteed by other means, such as <code>NOT NULL</code> constraints.
<code>statement_id</code>	A client-supplied unique identifier to associate output rows with specific invocations of the procedure.

DBMS_DISTRIBUTED_TRUST_ADMIN

DBMS_DISTRIBUTED_TRUST_ADMIN procedures maintain the Trusted Servers List. Use these procedures to define whether a server is trusted. If a database is not trusted, Oracle refuses current user database links from the database.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Examples](#)
- [Summary of DBMS_DISTRIBUTED_TRUST_ADMIN Subprograms](#)

70.1 DBMS_DISTRIBUTED_TRUST_ADMIN Overview

Oracle uses local Trusted Servers Lists, along with enterprise domain membership lists stored in the enterprise LDAP directory service, to determine if another database is trusted. The LDAP directory service entries are managed with the Enterprise Security Manager Tool in Oracle Enterprise Manager.

Oracle considers another database to be "trusted" if it meets the following criteria:

1. It is in the same enterprise domain in the directory service as the local database.
2. The enterprise domain is marked as trusted in the directory service.
3. It is not listed as untrusted in the local Trusted Servers List. Current user database links will only be accepted from another database if both databases involved trust each other.

You can list a database server locally in the Trusted Servers List regardless of what is listed in the directory service. However, if you list a database that is not in the same domain as the local database, or if that domain is untrusted, the entry will have no effect.

This functionality is part of the Enterprise User Security feature of the Oracle Advanced Security Option.

70.2 DBMS_DISTRIBUTED_TRUST_ADMIN Security Model

To execute DBMS_DISTRIBUTED_TRUST_ADMIN, the EXECUTE_CATALOG_ROLE role must be granted to the DBA. To select from the view TRUSTED_SERVERS, the SELECT_CATALOG_ROLE role must be granted to the DBA.

It is important to know whether all servers are trusted or not trusted. Trusting a particular server with the ALLOW_SERVER procedure does not have any effect if the database already trusts all databases, or if that database is already trusted. Similarly, denying a particular server with the DENY_SERVER procedure does not have any effect if the database already does not trust any database or if that database is already untrusted.

The procedures `DENY_ALL` and `ALLOW_ALL` delete all entries (in other words, server names) that are explicitly allowed or denied using the `ALLOW_SERVER` procedure or `DENY_SERVER` procedure respectively.

70.3 DBMS_DISTRIBUTED_TRUST_ADMIN Examples

If you have not yet used the package `DBMS_DISTRIBUTED_TRUST_ADMIN` to change the trust listing, by default you trust all databases in the same enterprise domain if that domain is listed as trusted in the directory service:

```
SELECT * FROM TRUSTED_SERVERS;
TRUST
NAME
-----
Trusted
All
```

Because all servers are currently trusted, you can execute the [DENY_SERVER Procedure](#) and specify that a particular server is not trusted:

```
EXECUTE DBMS_DISTRIBUTED_TRUST_ADMIN.DENY_SERVER
        ('SALES.US.AMERICAS.ACME_AUTO.COM');
PL/SQL procedure successfully completed.
```

```
SELECT * FROM TRUSTED_SERVERS;
TRUST
NAME
-----
Untrusted SALES.US.AMERICAS.ACME_AUTO.COM
```

By executing the [DENY_ALL Procedure](#), you can choose to not trust any database server:

```
EXECUTE DBMS_DISTRIBUTED_TRUST_ADMIN.DENY_ALL;
```

```
PL/SQL procedure successfully completed.
```

```
SELECT * FROM TRUSTED_SERVERS;

TRUST
NAME
-----
Untrusted
All
```

The [ALLOW_SERVER Procedure](#) can be used to specify that one particular database is to be trusted:

```
EXECUTE DBMS_DISTRIBUTED_TRUST_ADMIN.ALLOW_SERVER
        ('SALES.US.AMERICAS.ACME_AUTO.COM');
PL/SQL procedure successfully completed.
```

```
SELECT * FROM TRUSTED_SERVERS;
TRUST
NAME
-----
Trusted  SALES.US.AMERICAS.ACME_AUTO.COM
```

70.4 Summary of DBMS_DISTRIBUTED_TRUST_ADMIN Subprograms

This table lists and briefly describes the DBMS_DISTRIBUTED_TRUST_ADMIN subprograms.

Table 70-1 DBMS_DISTRIBUTED_TRUST_ADMIN Package Subprograms

Subprogram	Description
ALLOW_ALL Procedure	Empties the list and inserts a row indicating that all servers should be trusted
ALLOW_SERVER Procedure	Enables a specific server to be allowed access even though deny all is indicated in the list
DENY_ALL Procedure	Empties the list and inserts a row indicating that all servers should be untrusted
DENY_SERVER Procedure	Enables a specific server to be denied access even though allow all is indicated in the list

70.4.1 ALLOW_ALL Procedure

This procedure empties the Trusted Servers List and specifies that all servers that are members of a trusted domain in an enterprise directory service and that are in the same domain are allowed access.

The view TRUSTED_SERVERS will show "TRUSTED ALL" indicating that the database trusts all servers that are currently trusted by the enterprise directory service.

Syntax

```
DBMS_DISTRIBUTED_TRUST_ADMIN.ALLOW_ALL;
```

Usage Notes

ALLOW_ALL only applies to servers listed as trusted in the enterprise directory service and in the same enterprise domain.

70.4.2 ALLOW_SERVER Procedure

This procedure ensures that the specified server is considered trusted (even if you have previously specified "deny all").

Syntax

```
DBMS_DISTRIBUTED_TRUST_ADMIN.ALLOW_SERVER (
  server IN VARCHAR2);
```

Parameters

Table 70-2 ALLOW_SERVER Procedure Parameters

Parameter	Description
server	Unique, fully-qualified name of the server to be trusted.

Usage Notes

If the Trusted Servers List contains the entry "deny all", then this procedure adds a specification indicating that a specific database (for example, DBx) is to be trusted.

If the Trusted Servers List contains the entry "allow all", and if there is no "deny DBx" entry in the list, then executing this procedure causes no change.

If the Trusted Servers List contains the entry "allow all", and if there is a "deny DBx" entry in the list, then that entry is deleted.

70.4.3 DENY_ALL Procedure

This procedure empties the Trusted Servers List and specifies that all servers are denied access.

The view TRUSTED_SERVERS will show "UNTRUSTED ALL" indicating that no servers are currently trusted.

Syntax

```
DBMS_DISTRIBUTED_TRUST_ADMIN.DENY_ALL;
```

70.4.4 DENY_SERVER Procedure

This procedure ensures that the specified server is considered untrusted (even if you have previously specified allow all).

Syntax

```
DBMS_DISTRIBUTED_TRUST_ADMIN.DENY_SERVER (
    server IN VARCHAR2);
```

Parameters

Table 70-3 DENY_SERVER Procedure Parameters

Parameter	Description
server	Unique, fully-qualified name of the server to be untrusted.

Usage Notes

If the Trusted Servers List contains the entry allow all, then this procedure adds an entry indicating that the specified database (for example, DBx) is not to be trusted.

If the Trusted Servers List contains the entry "deny all", and if there is no "allow DBx" entry in the list, then this procedure causes no change.

If the Trusted Servers List contains the entry "deny all", and if there is an "allow DBx" entry, then this procedure causes that entry to be deleted.

71

DBMS_DNFS

The `DBMS_DNFS` package provides an interface to assists in creating a database using files in the backup set.

This chapter contains the following topics:

- [Security Model](#)
- [Summary of DBMS_DNFS Subprograms](#)



See Also:

Oracle Database Administrator's Guide

71.1 DBMS_DNFS Security Model

This package has to be executed by users with `SYSDBA` privileges.

71.2 Summary of DBMS_DNFS Subprograms

The `DBMS_DNFS` package includes the `CLONEDB_RENAMEFILE`, `RESTORE_DATAFILE_PERMISSIONS`, and `UNMOUNTVOLUME` procedures.

Table 71-1 DBMS_DNFS Package Subprograms

Subprogram	Description
CLONEDB_RENAMEFILE Procedure	Renames datafiles that were pointing to the backup set to the actual file name in cloned database.
RESTORE_DATAFILE_PERMISSIONS Procedure	This procedure will restore the file permissions for the data files belonging to the PDB to read write. PDB data files are converted to read only when one or more clones are created using this source PDB.
UNMOUNTVOLUME Procedure	This procedure cleans up the cached Direct NFS file handles in SGA.

71.2.1 CLONEDB_RENAMEFILE Procedure

This procedure is used to rename datafiles that were pointing to the backup set to the actual file name in cloned database.

The `srcfile` is the file name that represents the data file in the backup image copy or a read-only storage snapshot. The `destfile` destination file path must point to a NFS volume where clonedDB datafiles will be created. When the procedure is run successfully, the control file record is updated with the new datafile name.

Syntax

```
DBMS_DNFS.CLONEDB_RENAMEFILE (
    srcfile      IN      VARCHAR2,
    destfile     IN      VARCHAR2);
```

Parameters**Table 71-2** *CLONEDB_RENAMEFILE Procedure Parameters*

Parameter	Description
srcfile	Source datafile name in the control file
destfile	New datafile name

71.2.2 RESTORE_DATAFILE_PERMISSIONS Procedure

This procedure restores the file permissions for the data files belonging to the PDB to `read write`. PDB data files are converted to `read only` when one or more clones are created using this source PDB. This procedure must be invoked after the last clone is dropped to restore the data file permissions for the source PDB files.

Syntax

```
DBMS_DNFS.RESTORE_DATAFILE_PERMISSIONS (
    pdb_name     IN      VARCHAR2 DEFAULT NULL);
```

Parameters**Table 71-3** *RESTORE_DATAFILE_PERMISSIONS Procedure Parameters*

Parameter	Description
pdb_name	Name of pluggable database whose file permissions need to be restored.

71.2.3 UNMOUNTVOLUME Procedure

This procedure cleans up the cached Direct NFS file handles in SGA. This procedure must be used when any NFS mount changes are being made via the operating system and the OS unmount and mount commands are invoked.

The server is the host name or IP address of the NFS server. The volume is the exported path from the NFS server. This procedure will fail if the database has any open files in the volume that is being unmounted.

Syntax

```
DBMS_DNFS.UNMOUNTVOLUME (
    server      IN      VARCHAR2,
    volume     IN      VARCHAR2);
```

Parameters

Table 71-4 *UNMOUNTVOLUME Procedure Parameters*

Parameter	Description
server	NFS server host name or IP address.
volume	Exported path from the NFS server.

DBMS_DST

The DBMS_DST package provides an interface to apply the Daylight Saving Time (DST) patch to the Timestamp with Time Zone datatype.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Views](#)
- [Summary of DBMS_DST Subprograms](#)

See Also:

- *Oracle Database Globalization Support Guide*
- *Oracle Database Reference*

72.1 DBMS_DST Overview

The transition period during which Daylight Saving Time comes into effect, or stops being in effect, has the potential for problems, such as data loss, when handling timestamps with time zone data. The DBMS_DST package enables working with these transitions in the context of a set of rules.

72.2 DBMS_DST Security Model

The DBMS_DST package is an invoker's rights package.

See Also:

Oracle Database PL/SQL Language Reference for more information about using Invoker Rights or Definer Rights

The execute privilege on the package is granted to the EXECUTE_CATALOG_ROLE role. This role is normally granted to selected users to allow EXECUTE privileges for packages and procedures in the data dictionary.

The user that invokes the package must have the following privileges:

- CREATE ANY TABLE
- ALTER ANY TABLE

- DROP ANY TABLE
- SELECT ANY TABLE
- LOCK ANY TABLE
- ALTER ANY INDEX
- ALTER ANY TRIGGER
- UPDATE ANY TABLE
- EXECUTE ANY TYPE

72.3 DBMS_DST Views

The `DBMS_DST` package uses views to display table information.

These views are shown in the following table. They are further described in the *Oracle Database Reference*:

Table 72-1 Views used by DBMS_DST

View	Description
<code>DBA_TSTZ_TABLES</code>	Displays information about all tables in the database, which have columns defined on <code>TIMESTAMP WITH TIME ZONE</code> datatypes or object types containing attributes of <code>TIMESTAMP WITH TIME ZONE</code> datatypes. Its columns are the same as those in <code>ALL_TSTZ_TABLES</code> .
<code>USER_TSTZ_TABLES</code>	Displays information about the tables owned by the current user, which have columns defined on <code>TIMESTAMP WITH TIME ZONE</code> datatypes or object types containing attributes of <code>TIMESTAMP WITH TIME ZONE</code> datatypes. Its columns (except for <code>OWNER</code>) are the same as those in <code>ALL_TSTZ_TABLES</code> .
<code>ALL_TSTZ_TABLES</code>	Displays information about the tables accessible to the current user, which have columns defined on <code>TIMESTAMP WITH TIME ZONE</code> datatypes or object types containing attributes of <code>TIMESTAMP WITH TIME ZONE</code> datatypes.

72.4 Summary of DBMS_DST Subprograms

This table lists and describes the `DBMS_DST` package subprograms.

Table 72-2 DBMS_DST Package Subprograms

Subprogram	Description
BEGIN_PREPARE Procedure	Starts a prepare window
BEGIN_UPGRADE Procedure	Starts an upgrade window
CREATE_AFFECTED_TABLE Procedure	Creates a table that has the schema shown in the comments for the FIND_AFFECTED_TABLES Procedure

Table 72-2 (Cont.) DBMS_DST Package Subprograms

Subprogram	Description
CREATE_ERROR_TABLE Procedure	Creates a log error table
CREATE_TRIGGER_TABLE Procedure	Creates a table that is used to record active triggers disabled before performing upgrade on the table, having not been enabled due to fatal failure during the upgrading process
END_PREPARE Procedure	Ends a prepare window
END_UPGRADE Procedure	Ends an upgrade window
FIND_AFFECTED_TABLES Procedure	Finds all the tables that have affected TSTZ data due to the new timezone version
UPGRADE_DATABASE Procedure	Upgrades all tables in the database that have one or more columns defined on the TSTZ type, or an ADT containing the TSTZ type
UPGRADE_SCHEMA Procedure	Upgrades tables in a specified list of schemas that has one or more columns defined on the TSTZ type, or an ADT containing the TSTZ type
UPGRADE_TABLE Procedure	Upgrades a specified list of tables that has one or more columns defined on the TSTZ type or an ADT containing the TSTZ type

72.4.1 BEGIN_PREPARE Procedure

This procedure starts a prepare window. Once a prepare window is started successfully, the database property 'DST_UPGRADE_STATE' is set to 'PREPARE', and the database property 'SECONDARY_TT_VERSION' is set to a new timezone version.

The prepare window lets a DBA investigate data affected by the upgrade, and so judge when it is optimal to perform the upgrade. The prepare window can overlap normal database operation.

Syntax

```
DBMS_DST.BEGIN_PREPARE (
    new_version          IN BINARY_INTEGER);
```

Parameters

Table 72-3 BEGIN_PREPARE Procedure Parameters

Parameter	Description
new_version	New timezone version to which the database is to be prepared to upgrade

72.4.2 BEGIN_UPGRADE Procedure

This procedure starts an upgrade window.

Syntax

```
DBMS_DST.BEGIN_UPGRADE (
    new_version          IN BINARY_INTEGER,
    error_on_overlap_time IN BOOLEAN := FALSE,
    error_on_nonexisting_time IN BOOLEAN := FALSE);
```

Parameters

Table 72-4 BEGIN_UPGRADE Procedure Parameters

Parameter	Description
new_version	New timezone version to which the database is to be upgraded
error_on_overlap_time	Boolean flag indicating whether to report errors on the 'overlap' time semantic conversion error. The default is <code>FALSE</code> . For more information about boundary cases, see <i>Oracle Database SQL Language Reference</i> .
error_on_nonexisting_time	Boolean flag indicating whether to report errors on the 'non-existing' time semantic conversion error. The default value is <code>FALSE</code> .

72.4.3 CREATE_AFFECTED_TABLE Procedure

This procedure creates a table that has the schema shown in the comments for the `FIND_AFFECTED_TABLES` Procedure.

Syntax

```
DBMS_DST.CREATE_AFFECTED_TABLE (
    table_name          IN VARCHAR2);
```

Parameters

Table 72-5 CREATE_AFFECTED_TABLE Procedure Parameters

Parameter	Description
table_name	Name of the table created

Usage Notes

This procedure takes a `table_name` without schema qualification, creating a table within the current user schema.

Related Topics

- [FIND_AFFECTED_TABLES Procedure](#)
This procedure finds all the tables which have affected TSTZ data due to the new timezone version.

72.4.4 CREATE_ERROR_TABLE Procedure

This procedure creates a log error table.

The table has the following schema:

```
CREATE TABLE dst$error_table(  
  table_owner  VARCHAR2(30),  
  table_name   VARCHAR2(30),  
  column_name  VARCHAR2(4000),  
  rid          ROWID,  
  error_number NUMBER)
```

Syntax

```
DBMS_DST.CREATE_ERROR_TABLE (  
  table_name      IN  VARCHAR2);
```

Parameters

Table 72-6 CREATE_ERROR_TABLE Procedure Parameters

Parameter	Description
table_name	Name of the table created

Usage Notes

- This procedure takes a `table_name` without schema qualification, creating a table within the current user schema.
- The error number is found when upgrading time zone file and timestamp with time zone data. For more information about error handling when upgrading time zone file and timestamp with time zone data, see Oracle Database Globalization Support Guide

72.4.5 CREATE_TRIGGER_TABLE Procedure

This procedure creates a table to record active triggers that are disabled before performing upgrade on the table, having not been enabled due to fatal failure during the upgrading process.

The table that has the following schema.

```
CREATE TABLE dst_trigger_table (  
  trigger_owner VARCHAR2(30),  
  trigger_name  VARCHAR2(30));
```

Syntax

```
DBMS_DST.CREATE_TRIGGER_TABLE (  
  table_name      IN  VARCHAR2);
```

Parameters

Table 72-7 CREATE_TRIGGER_TABLE Procedure Parameters

Parameter	Description
table_name	Name of table to be created

Usage Notes

This procedure takes a `table_name` without schema qualification, creating a table within the current user schema.

72.4.6 END_PREPARE Procedure

This procedure ends a prepare window.

Syntax

```
DBMS_DST.BEGIN_PREPARE;
```

72.4.7 END_UPGRADE Procedure

This procedure ends an upgrade window. An upgraded window is ended if all the affected user tables have been upgraded. Otherwise, the `OUT` parameter `num_of_failures` indicates how many tables have not been converted.

Syntax

```
DBMS_DST.END_UPGRADE (
  num_of_failures OUT BINARY_INTEGER);
```

Parameters

Table 72-8 END_UPGRADE Procedure Parameters

Parameter	Description
num_of_failures	Number of tables that fail to complete

72.4.8 FIND_AFFECTED_TABLES Procedure

This procedure finds all the tables which have affected TSTZ data due to the new timezone version.

This procedure can only be invoked during a prepare window. The tables which have affected TSTZ data are recorded into a table indicated by parameter `affected_tables`. If semantic errors must be logged, they are recorded into a table indicated by parameter `log_errors_table`.

Syntax

```
DBMS_DST.FIND_AFFECTED_TABLES (
  affected_tables          IN VARCHAR2 =: 'sys.dst$affected_tables',
```

```

log_errors          IN  BOOLEAN := FALSE,
log_errors_table    IN  VARCHAR2 := 'sys.dst$error_table',
parallel            IN  BOOLEAN := FALSE);

```

Parameters

Table 72-9 FIND_AFFECTED_TABLES Procedure Parameters

Parameter	Description
affected_tables	<p>Name of table with the following schema:</p> <pre> CREATE TABLE dst\$affected_tables (table_owner VARCHAR2(30), table_name VARCHAR2(30), column_name VARCHAR2(4000), row_count NUMBER, error_count NUMBER) </pre> <p>The table can be created with the CREATE_AFFECTED_TABLE Procedure.</p>
log_errors	<p>Boolean flag indicating whether to log errors during upgrade. If FALSE, no error is logged into the log_errors_table after aborting conversion of the current table. If TRUE, the error is logged to the log_errors_table.</p> <p>The default is FALSE.</p>
log_errors_table	<p>Table name with the following schema:</p> <pre> CREATE TABLE dst\$error_table (table_owner VARCHAR2(30), table_name VARCHAR2(30), column_name VARCHAR2(4000), rid ROWID, error_number NUMBER) </pre> <p>The table can be created with the CREATE_ERROR_TABLE Procedure. The rid column records the rowids of the offending rows, and the error_number column records the corresponding error number.</p>
parallel	<p>Boolean flag indicating whether to find the affected tables using parallel queries or serial queries. The default is FALSE.</p>

72.4.9 UPGRADE_DATABASE Procedure

This procedure upgrades all tables in the database, which have one or more columns defined on the TSTZ type or an ADT containing the TSTZ type.

This procedure can only be invoked after an upgrade window has been started. Each table is upgraded in an atomic transaction. Note that, a base table and its materialized view log table are upgraded in an atomic transaction.

Syntax

```

DBMS_DST.UPGRADE_DATABASE (
  num_of_failures OUT BINARY_INTEGER,
  upgrade_data    IN  BOOLEAN := TRUE,
  parallel        IN  BOOLEAN := FALSE,

```

```

continue_after_errors      IN  BOOLEAN := TRUE,
log_errors                 IN  BOOLEAN := FALSE,
log_errors_table          IN  VARCHAR2 := 'sys.dst$error_table' ,
error_on_overlap_time     IN  BOOLEAN := FALSE,
error_on_nonexisting_time  IN  BOOLEAN := FALSE,
log_triggers_table        IN  VARCHAR2 := 'sys.dst$trigger_table';

```

Parameters

Table 72-10 UPGRADE_DATABASE Procedure Parameters

Parameter	Description
num_of_failures	Number of tables that fail to complete
upgrade_data	Boolean flag indicating whether to convert TSTZ data using the new Time Zone patch File (TRUE), or to leave it unconverted (FALSE).The default is TRUE.
parallel	Boolean flag indicating whether to convert tables using PDML (Parallel DML) or Serial DML.The default is FALSE.
continue_after_errors	Boolean flag indicating whether to continue after upgrade fails on the current table. The default is TRUE.
log_errors	Boolean flag indicating whether to log errors during upgrade. If FALSE, no error is logged into the log_errors_table after aborting conversion of the current table. If TRUE, errors are logged to the log_errors_table. The default is FALSE.
log_errors_table	Table name with the following schema: <pre> CREATE TABLE dst\$error_table (table_owner VARCHAR2(30), table_name VARCHAR2(30), column_name VARCHAR2(4000), rid ROWID, error_number NUMBER) </pre> The table can be created with the CREATE_ERROR_TABLE Procedure . The rid column records the rowids of the offending rows, and the error_number column records the corresponding error number.
error_on_overlap_time	Boolean flag indicating whether to report errors on the 'overlap' time semantic conversion error. The default is TRUE.
error_on_nonexisting_time	Boolean flag indicating whether to report errors on the 'non-existing' time semantic conversion error. The default is TRUE.
log_triggers_table	Table to log triggers which are disabled before upgrade, having not been enabled due to a fatal failure when performing an upgrade

72.4.10 UPGRADE_SCHEMA Procedure

This procedure upgrades tables in a specified list of schemas that have one or more columns defined on the TSTZ type, or an ADT containing the TSTZ type.

This procedure can be invoked only after an upgrade window has been started. Each table is upgraded in an atomic transaction. Note that a base table and its materialized view log table are upgraded in an atomic transaction.

Syntax

```
DBMS_DST.UPGRADE_SCHEMA (
    num_of_failures          OUT BINARY_INTEGER,
    schema_list              IN  VARCHAR2,
    upgrade_data             IN  BOOLEAN := TRUE,
    parallel                 IN  BOOLEAN := FALSE,
    continue_after_errors   IN  BOOLEAN := TRUE,
    log_errors               IN  BOOLEAN := FALSE,
    log_errors_table        IN  VARCHAR2 =: 'sys.dst$error_table' ,
    error_on_overlap_time   IN  BOOLEAN := FALSE,
    error_on_nonexisting_time IN  BOOLEAN := FALSE,
    log_triggers_table      IN  VARCHAR2 :=: 'sys.dst$trigger_table');
```

Parameters

Table 72-11 UPGRADE_SCHEMA Procedure Parameters

Parameter	Description
num_of_failures	Number of tables that fail to complete
schema_list	Schema name list (comma separated strings)
upgrade_data	Boolean flag indicating whether to convert TSTZ data using the new Time Zone patch File (TRUE) or to leave unconverted (FALSE).The default is TRUE.
parallel	Boolean flag indicating whether to convert tables using PDML (Parallel DML) or Serial DML.The default is FALSE.
continue_after_errors	Boolean flag indicating whether to continue after upgrade fails on the current table.The default is TRUE.
log_errors	Boolean flag indicating whether to log errors during upgrade. If FALSE, no error is logged into the log_errors_table after aborting conversion of the current table. If TRUE, the error is logged to the log_errors_table. The default is FALSE.

Table 72-11 (Cont.) UPGRADE_SCHEMA Procedure Parameters

Parameter	Description
log_errors_table	<p>Table name with the following schema:</p> <pre>CREATE TABLE dst\$error_table (table_owner VARCHAR2(30), table_name VARCHAR2(30), column_name VARCHAR2(4000), rid ROWID, error_number NUMBER)</pre> <p>The table can be created with the CREATE_ERROR_TABLE Procedure. The <code>rid</code> column records the rowids of the offending rows, and the <code>error_number</code> column records the corresponding error number.</p>
error_on_overlap_time	<p>Boolean flag indicating whether to report errors on the 'overlap' time semantic conversion error.</p> <p>The default is TRUE.</p>
error_on_nonexisting_time	<p>Boolean flag indicating whether to report errors on the 'non-existing' time semantic conversion error.</p> <p>The default is TRUE.</p>
log_triggers_table	<p>Table to log triggers that are disabled before upgrade, having not been enabled due to a fatal failure when performing an upgrade</p>

72.4.11 UPGRADE_TABLE Procedure

This procedure upgrades a specified list of tables that have one or more columns defined on the TSTZ type, or an ADT containing the TSTZ type.

Syntax

```
DBMS_DST.UPGRADE_TABLE (
  num_of_failures      OUT BINARY_INTEGER,
  table_list           IN  VARCHAR2,
  upgrade_data         IN  BOOLEAN := TRUE,
  parallel             IN  BOOLEAN := FALSE,
  continue_after_errors IN  BOOLEAN := TRUE,
  log_errors           IN  BOOLEAN := FALSE,
  log_errors_table     IN  VARCHAR2 := 'sys.dst$error_table' ,
  error_on_overlap_time IN  BOOLEAN := FALSE,
  error_on_nonexisting_time IN  BOOLEAN := FALSE,
  log_triggers_table   IN  VARCHAR2 := 'sys.dst$trigger_table',
  atomic_upgrade       IN  BOOLEAN := FALSE);
```

Parameters

Table 72-12 UPGRADE_TABLE Procedure Parameters

Parameter	Description
num_of_failures	Number of tables that fail to complete
table_list	Table name list (comma separated strings)

Table 72-12 (Cont.) UPGRADE_TABLE Procedure Parameters

Parameter	Description
upgrade_data	Boolean flag indicating whether to convert TSTZ data using the new Time Zone patch File (<code>TRUE</code>), or to leave unconverted (<code>FALSE</code>). The default is <code>TRUE</code> .
parallel	Boolean flag indicating whether to convert tables using PDML (Parallel DML), or Serial DML. The default is <code>FALSE</code> .
continue_after_errors	Boolean flag indicating whether to continue after upgrade fails on the current table. The default is <code>TRUE</code> .
log_errors	Boolean flag indicating whether to log errors during upgrade. If <code>FALSE</code> , no error is logged into the <code>log_errors_table</code> after aborting conversion of the current table. If <code>TRUE</code> , the error is logged to the <code>log_errors_table</code> . The default is <code>FALSE</code> .
log_errors_table	Table name with the following schema: <pre>CREATE TABLE dst\$error_table (table_owner VARCHAR2(30), table_name VARCHAR2(30), column_name VARCHAR2(4000), rid ROWID, error_number NUMBER)</pre> The table can be created with the CREATE_ERROR_TABLE Procedure . The <code>rid</code> parameter records the rowids of the offending rows and the corresponding error number.
error_on_overlap_time	Boolean flag indicating whether to report errors on the 'overlap' time semantic conversion error. The default is <code>TRUE</code> .
error_on_nonexisting_time	Boolean flag indicating whether to report errors on the 'non-existing' time semantic conversion error. The default is <code>TRUE</code> .
log_triggers_table	Table to log triggers that are disabled before upgrade, having not been enabled due to a fatal failure when performing an upgrade
atomic_upgrade	Boolean flag indicating whether to convert the listed tables atomically (in a single transaction). If <code>FALSE</code> , each table is converted in its own transaction. The default is <code>FALSE</code> .

Usage Notes

This procedure can only be invoked after an upgrade window has been started. The table list has to satisfy the following partial ordering:

1. If a base table has a materialized view log table, the log table must be the next item in the list.

2. If the container table for a materialized view appears in the list, the materialized view's 'non-upgraded' base tables and log tables must appear in the table list and before the container table.

A base table and its materialized view log table need to be upgraded in an atomic transaction by specifying `atomic_upgrade` to `TRUE`.

73

DBMS_EDITIONS_UTILITIES

The `DBMS_EDITIONS_UTILITIES` package provides helper functions for edition-related operations.

The chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Exceptions](#)
- [Summary of DBMS_EDITIONS_UTILITIES Subprograms](#)

73.1 DBMS_EDITIONS_UTILITIES Overview

The `DBMS_EDITIONS_UTILITIES` package implements an interface which provides helper functions for edition-related operations.

73.2 DBMS_EDITIONS_UTILITIES Security Model

This package is owned by `SYS` with `execute` access granted to `PUBLIC`. It runs with invoker's rights, that is, with the security profile of the caller.

73.3 DBMS_EDITIONS_UTILITIES Exceptions

The table in this topic lists exception messages created by `DBMS_EDITIONS_UTILITIES`.

Table 73-1 DBMS_EDITIONS_UTILITIES Error Messages

Error	Description
ORA-38817	Insufficient privileges
ORA-942	Missing table

73.4 Summary of DBMS_EDITIONS_UTILITIES Subprograms

This table lists and describes the `DBMS_EDITIONS_UTILITIES` package subprograms.

Table 73-2 DBMS_EDITIONS_UTILITIES Package Subprograms

Subprogram	Description
CLEAN_UNUSABLE_EDITIONS Procedure	Drops covered objects in unusable editions, and drops empty unusable editions if possible.

Table 73-2 (Cont.) DBMS_EDITIONS_UTILITIES Package Subprograms

Subprogram	Description
SET_EDITIONING_VIEWS_READ_ONLY Procedure	Given the schema name and table name, this procedure sets the corresponding editioning views in all editions to READ ONLY or READ/WRITE
SET_NULL_COLUMN_VALUES_TO_EXPR Procedure	For use only during an edition-based redefinition (EBR) exercise

73.4.1 CLEAN_UNUSABLE_EDITIONS Procedure

Drops all covered objects in any unusable editions and drops empty unusable editions.

The `CLEAN_UNUSABLE_EDITIONS` procedure executes immediately and in its entirety.

Syntax

```
DBMS_EDITIONS_UTILITIES.CLEAN_UNUSABLE_EDITIONS ( );
```

Usage Notes

The `COMPATIBLE` parameter must be set to 12.2.0 or higher for this procedure to execute.



See Also:

- *Oracle Database SQL Language Reference* for information about `DROP EDITION`
- *Oracle Database Development Guide* for more information about using edition-based redefinition

73.4.2 SET_EDITIONING_VIEWS_READ_ONLY Procedure

Given the schema name and table name, this procedure sets the corresponding editioning views in all editions to `READ ONLY` or `READ/WRITE`.

Syntax

```
DBMS_EDITIONS_UTILITIES.SET_EDITIONING_VIEWS_READ_ONLY (
    table_name IN VARCHAR2,
    owner      IN VARCHAR2 DEFAULT NULL,
    read_only  IN BOOLEAN  DEFAULT TRUE);
```

Parameters

Table 73-3 SET_EDITIONING_VIEWS_READ_ONLY Procedure Parameters

Parameter	Description
table_name	Base table of the editioning views
owner	Base table schema. The default (or NULL) is the current schema.
read_only	TRUE to set the views to read-only; FALSE (or NULL) sets the views to READ/WRITE. Default is TRUE.

Usage Notes

The user must have the following privileges:

- Owner of the table, or have the ALTER ANY TABLE system privileges
- USE object privilege on all the editions for which the views are defined

73.4.3 SET_NULL_COLUMN_VALUES_TO_EXPR Procedure

This procedure replaces NULL values in a replacement column with the value of an expression.

The expression evaluation cost is deferred to future updates and queries. The procedure is intended for use only during an edition-based redefinition (EBR) exercise.

See Also:

- *Oracle Database Development Guide* regarding transforming pre- to post-upgrade representation

Syntax

```
DBMS_EDITIONS_UTILITIES.SET_NULL_COLUMN_VALUES_TO_EXPR(
  table_name    IN VARCHAR2,
  column_name   IN VARCHAR2,
  expression    IN VARCHAR2);
```

Parameters

Table 73-4 SET_NULL_COLUMN_VALUES_TO_EXPR Procedure Parameters

Parameter	Description
table_name	A potentially schema-qualified table name
column_name	Name of the column to be updated
expression	An expression composed of columns in the same table, constants, and SQL functions

DBMS_EPG

The `DBMS_EPG` package implements the embedded PL/SQL gateway that enables a Web browser to invoke a PL/SQL stored procedure through an HTTP listener.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Exceptions](#)
- [Data Structures](#)
 - [VARCHAR2_TABLE Table Type](#)
- [Subprogram Groups](#)
- [Summary of DBMS_EPG Subprograms](#)

74.1 DBMS_EPG Overview

The `DBMS_EPG` package is a platform on which PL/SQL users develop and deploy PL/SQL Web applications. The embedded PL/SQL gateway is an embedded version of the gateway that runs in the XML database HTTP server in the Oracle database. It provides the core features of `mod_plsql` in the database but does not require the Oracle HTTP server powered by Apache.

In order to make a PL/SQL application accessible from a browser by way of HTTP, a Database Access Descriptor (DAD) must be created and mapped to a virtual path. A DAD is a set of configuration values used for database access and the virtual path mapping makes the application accessible under a virtual path of the XML DB HTTP Server. A DAD is represented as a servlet in XML DB HTTP Server.

74.2 DBMS_EPG Security Model

The `XDBADMIN` role is required to invoke the configuration interface. It may be invoked by the database user "XDB".

The authorization interface can be invoked by any user.

74.3 DBMS_EPG Exceptions

The table in this topic lists the exceptions raised by the `DBMS_EPG` package.

Table 74-1 DBMS_EPG Exceptions

Exception	Error Code	Description
DAD_NOT_FOUND	20000	Database Access Descriptor (DAD) %s not found. Ensure that the name of the DAD is correct and that it exists.

74.4 DBMS_EPG Data Structures

The DBMS_EPG package defines a TABLE type.

VARCHAR2_TABLE Table Type

This type is used by the procedures GET_ALL_GLOBAL_ATTRIBUTES, GET_ALL_DAD_ATTRIBUTES, GET_ALL_DAD_MAPPINGS, and GET_DAD_LIST to return lists of attribute names, attribute values, virtual paths, and database access descriptors (DAD).

```
TYPE VARCHAR2_TABLE IS TABLE OF VARCHAR2(4000) INDEX BY BINARY_INTEGER;
```

74.5 DBMS_EPG Subprogram Groups

The DBMS_EPG consists of two interfaces: configuration subprograms and authorization subprograms.

- [Configuration Subprograms](#)
- [Authorization Subprograms](#)

74.5.1 DBMS_EPG Configuration Subprograms

The Configuration subprogram group contain the subprogram interfaces to examine and modify the global and database access descriptor (DAD) specific settings of the embedded PL/SQL gateway.

Table 74-2 Configuration Subprogram Group

Subprogram	Description
CREATE_DAD Procedure	Creates a new DAD
DELETE_DAD_ATTRIBUTE Procedure	Deletes a DAD attribute
DELETE_GLOBAL_ATTRIBUTE Procedure	Deletes a global attribute
DROP_DAD Procedure	Drops a DAD
GET_ALL_DAD_ATTRIBUTES Procedure	Retrieves all the attributes of a DAD.
GET_ALL_DAD_MAPPINGS Procedure	Retrieves all virtual paths to which the specified DAD is mapped.
GET_ALL_GLOBAL_ATTRIBUTES Procedure	Retrieves all global attributes and values
GET_DAD_ATTRIBUTE Function	Retrieves the value of a DAD attribute

Table 74-2 (Cont.) Configuration Subprogram Group

Subprogram	Description
GET_DAD_LIST Procedure	Retrieves a list of all DADs for an Embedded Gateway instance.
GET_GLOBAL_ATTRIBUTE Function	Retrieves the value of a global attribute
MAP_DAD Procedure	Maps a DAD to the specified virtual path.
SET_DAD_ATTRIBUTE Procedure	Sets the value for a DAD
SET_GLOBAL_ATTRIBUTE Procedure	Sets the value of a global attribute
UNMAP_DAD Procedure	Unmaps a DAD from the specified virtual path

74.5.2 DBMS_EPG Authorization Subprograms

The Authorization subprogram group contains the subprogram interfaces to authorize and deauthorize the use of a database user's privileges by the embedded PL/SQL gateway through a specific database access descriptor (DAD)

Table 74-3 Authorization Subprogram Group

Subprogram	Description
AUTHORIZE_DAD Procedure	Authorizes a DAD to invoke procedures and access document tables with a database user's privileges
DEAUTHORIZE_DAD Procedure	Deauthorizes a DAD with regard to invoking procedures and accessing document tables with a database user's privileges

74.6 Summary of DBMS_EPG Subprograms

This table lists the DBMS_ALERT subprograms and briefly describes them.

Table 74-4 DBMS_EPG Package Subprograms

Subprogram	Description
AUTHORIZE_DAD Procedure	authorizes a DAD to invoke procedures and access document tables with a database user's privileges
CREATE_DAD Procedure	Creates a new DAD
DEAUTHORIZE_DAD Procedure	Deauthorizes a DAD with regard to invoking procedures and accessing document tables with a database user's privileges
DELETE_DAD_ATTRIBUTE Procedure	Deletes a DAD attribute
DELETE_GLOBAL_ATTRIBUTE Procedure	Deletes a global attribute
DROP_DAD Procedure	Drops a DAD
GET_ALL_DAD_ATTRIBUTES Procedure	Retrieves all the attributes of a DAD.
GET_ALL_DAD_MAPPINGS Procedure	Retrieves all virtual paths to which the specified DAD is mapped.

Table 74-4 (Cont.) DBMS_EPG Package Subprograms

Subprogram	Description
GET_ALL_GLOBAL_ATTRIBUTES Procedure	Retrieves all global attributes and values
GET_DAD_ATTRIBUTE Function	Retrieves the value of a DAD attribute
GET_DAD_LIST Procedure	Retrieves a list of all DADs for an Embedded Gateway instance.
GET_GLOBAL_ATTRIBUTE Function	Retrieves the value of a global attribute
MAP_DAD Procedure	Maps a DAD to the specified virtual path.
SET_DAD_ATTRIBUTE Procedure	Sets the value for a DAD
SET_GLOBAL_ATTRIBUTE Procedure	Sets the value of a global attribute
UNMAP_DAD Procedure	Unmaps a DAD from the specified virtual path

74.6.1 AUTHORIZE_DAD Procedure

This procedure authorizes a DAD to invoke procedures and access document tables with a database user's privileges. The invoker can always authorize the use of her/his own privileges.



See Also:

[Authorization Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.AUTHORIZE_DAD (
    dad_name IN VARCHAR2,
    path     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 74-5 AUTHORIZE_DAD Procedure Parameters

Parameter	Description
dad_name	The name of the DAD to create
user	The user whose privileges to deauthorize. If use, the invoker is assumed.

Usage Notes

- To authorize the use of another user's privileges, the invoker must have the `ALTER USER` system privilege.
- The DAD must exist but its "database-username" DAD attribute does not have to be set to user to authorize.
- Multiple users can authorize the same DAD and it is up to the DAD's "database-username" setting to decide which user's privileges to use.

Exceptions

Raises an error if the DAD or user does not exist, or the invoker does not have the needed system privilege.

Examples

```
DBMS_EPG.AUTHORIZE_DAD('HR');
```

74.6.2 CREATE_DAD Procedure

This procedure creates a new DAD.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.CREATE_DAD (  
    dad_name IN VARCHAR2,  
    path     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 74-6 CREATE_DAD Procedure Parameters

Parameter	Description
dad_name	The name of the DAD to create
path	The virtual path to which to map the DAD

74.6.3 DEAUTHORIZE_DAD Procedure

This procedure deauthorizes a DAD with regard to invoking procedures and accessing document tables with a database user's privileges. The invoker can always deauthorize the use of his own privileges.



See Also:

[Authorization Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.DEAUTHORIZE_DAD (  
    dad_name IN VARCHAR2,  
    path     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 74-7 DEAUTHORIZE_DAD Procedure Parameters

Parameter	Description
dad_name	The name of the DAD for which to deauthorize use
user	The user whose privileges to deauthorize. If use, the invoker is assumed.

Usage Notes

To deauthorize the use of another user's privileges, the invoker must have the `ALTER USER` system privilege.

Exceptions

Raises an error if the DAD or user does not exist, or the invoker does not have the needed system privilege.

Examples

```
DBMS_EPG.DEAUTHORIZE_DAD('HR');
```

74.6.4 DELETE_DAD_ATTRIBUTE Procedure

This procedure deletes a DAD attribute.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.DELETE_DAD_ATTRIBUTE (
  dad_name      IN  VARCHAR2,
  attr_name     IN  VARCHAR2);
```

Parameters

Table 74-8 DELETE_DAD_ATTRIBUTE Procedure Parameters

Parameter	Description
dad_name	The name of the DAD for which to delete a DAD attribute
attr_name	The name of the DAD attribute to delete

Exceptions

Raises an error if DAD does not exist

74.6.5 DELETE_GLOBAL_ATTRIBUTE Procedure

This procedure deletes a global attribute.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.DELETE_GLOBAL_ATTRIBUTE (  
    attr_name    IN VARCHAR2);
```

Parameters

Table 74-9 DELETE_GLOBAL_ATTRIBUTE Procedure Parameters

Parameter	Description
attr_name	The global attribute to delete

74.6.6 DROP_DAD Procedure

This procedure drops a DAD. All the virtual-path mappings of the DAD will be dropped also.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.DROP_DAD (  
    dadname    IN VARCHAR2);
```

Parameters

Table 74-10 DROP_DAD Procedure Parameters

Parameter	Description
dad_name	The DAD to drop

Exceptions

Raises an error if the DAD does not exist.

74.6.7 GET_ALL_DAD_ATTRIBUTES Procedure

This procedure retrieves all the attributes of a DAD. The outputs are 2 correlated index-by tables of the name/value pairs.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.GET_ALL_DAD_ATTRIBUTES (
  dad_name      IN          VARCHAR2,
  attr_names    OUT NOCOPY  VARCHAR2_TABLE,
  attr_values   OUT NOCOPY  VARCHAR2_TABLE);
```

Parameters

Table 74-11 GET_ALL_DAD_ATTRIBUTES Procedure Parameters

Parameter	Description
dad_names	The name of the DAD
attr_names	The attribute names
attr_values	The attribute values

Exceptions

Raises an error if DAD does not exist.

Usage Notes

If the DAD has no attributes set, then `attr_names` and `attr_values` will be set to empty arrays.

74.6.8 GET_ALL_DAD_MAPPINGS Procedure

This procedure retrieves all the virtual paths to which the specified DAD is mapped.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.GET_ALL_DAD_MAPPINGS (
  dad_name      IN          VARCHAR2,
  paths        OUT NOCOPY  VARCHAR2_TABLE);
```

Parameters

Table 74-12 GET_ALL_DAD_MAPPINGS Procedure Parameters

Parameter	Description
dad_names	The name of the DAD
paths	The virtual paths to which h the DAD is mapped

Exceptions

Raises an error if DAD does not exist.

Usage Notes

If the DAD is not mapped to any virtual path, `paths` will be set to empty arrays.

74.6.9 GET_ALL_GLOBAL_ATTRIBUTES Procedure

This procedure retrieves all global attributes and values. The outputs are 2 correlated index-by tables of the name/value pairs.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.GET_ALL_GLOBAL_ATTRIBUTES (
  attr_names      OUT  NOCOPY  VARCHAR2_TABLE,
  attr_values     OUT  NOCOPY  VARCHAR2_TABLE);
```

Parameters

Table 74-13 GET_ALL_GLOBAL_ATTRIBUTES Procedure Parameters

Parameter	Description
attr_names	The global attribute names
attr_values	The values of the global attributes

Usage Notes

If the gateway instance has no global attributes set, then `attr_names` and `attr_values` will be set to empty arrays.

74.6.10 GET_DAD_ATTRIBUTE Function

This procedure retrieves the value of a DAD attribute.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.GET_DAD_ATTRIBUTE (  
    dad_name     IN  VARCHAR2,  
    attr_name    IN  VARCHAR2)  
RETURN VARCHAR2;
```

Parameters

Table 74-14 GET_DAD_ATTRIBUTE Function Parameters

Parameter	Description
dad_name	The name of the DAD for which to delete an attribute
attr_name	The name of the attribute to delete

Return values

Returns the DAD attribute value. Returns `NULL` if attribute is unknown or has not been set.

Exceptions

Raises an error if DAD does not exist.

74.6.11 GET_DAD_LIST Procedure

This procedure retrieves a list of all DADs for an Embedded Gateway instance.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.GET_DAD_LIST (  
    dad_names    OUT NOCOPY  VARCHAR2_TABLE);
```

Parameters

Table 74-15 GET_DAD_LIST Procedure Parameters

Parameter	Description
dad_names	The list of all DADs

Usage Notes

If no DADs exist then `dad_names` will be set to an empty array.

74.6.12 GET_GLOBAL_ATTRIBUTE Function

This function retrieves the value of a global attribute.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.GET_GLOBAL_ATTRIBUTE (
    attr_name IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 74-16 GET_GLOBAL_ATTRIBUTE Procedure Parameters

Parameter	Description
attr_name	The global attribute to retrieve

Return Values

Returns the global attribute value. Returns `NULL` if attribute has not been set or is not a valid attribute.

74.6.13 MAP_DAD Procedure

This procedure maps a DAD to the specified virtual path. If the virtual path exists already, the old virtual-path mapping will be overridden.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.MAP_DAD (
  dad_name IN VARCHAR2,
  path     IN VARCHAR2);
```

Parameters**Table 74-17 MAP_DAD Procedure Parameters**

Parameter	Description
dad_name	The name of the DAD to map
path	The virtual path to map

Exceptions

Raises an error if the DAD does not exist.

74.6.14 SET_DAD_ATTRIBUTE Procedure

This procedure sets the value for a DAD.

**See Also:**

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.SET_DAD_ATTRIBUTE (
  dad_name IN VARCHAR2,
  attr_name IN VARCHAR2, attr_value IN VARCHAR2);
```

Parameters**Table 74-18 SET_DAD_ATTRIBUTE Procedure Parameters**

Parameter	Description
dad_name	The name of the DAD for which to set the attribute
attr_name	The name of the attribute to set
attr_value	The attribute value to set

Table 74-19 Mapping Between mod_plsql and Embedded PL/SQL Gateway DAD Attributes

mod_plsql DAD Attribute	Embedded PL/SQL Gateway DAD Attribute	Allows Multiple Occurrences	Legal Values
PlsqlAfterProcedure	after-procedure	No	String
PlsqlAlwaysDescribeProcedure	always-describe-procedure	No	Enumeration of On, Off
PlsqlAuthenticationMode	authentication-mode	No	Enumeration of Basic, SingleSignOn, GlobalOwa, CustomOwa, PerPackageOwa
PlsqlBeforeProcedure	before-procedure	No	String
PlsqlBindBucketLengths	bind-bucket-lengths	Yes	Unsigned integer
PlsqlBindBucketWidths	bind-bucket-widths	Yes	Unsigned integer
PlsqlCGIEnvironmentList	cgi-environment-list	Yes	String
PlsqlCompatibilityMode	compatibility-mode	No	Unsigned integer
PlsqlDatabaseUsername	database-username	No	String
PlsqlDefaultPage	default-page	No	String
PlsqlDocumentPath	document-path	No	String
PlsqlDocumentProcedure	document-procedure	No	String
PlsqlDocumentTableName	document-table-name	No	String
PlsqlErrorStyle	error-style	No	Enumeration of ApacheStyle, ModplsqlStyle, DebugStyle
PlsqlExclusionList	exclusion-list	Yes	String
PlsqlFetchBufferSize	fetch-buffer-size	No	Unsigned integer
PlsqlInfoLogging	info-logging	No	Enumeration of InfoDebug
PlsqlOWADebugEnable	owa-debug-enable	No	Enumeration of On, Off
PlsqlMaxRequestsPerSession	max-requests-per-session	No	Unsigned integer
PlsqlNLSLanguage	nls-language	No	String
PlsqlPathAlias	path-alias	No	String
PlsqlPathAliasProcedure	path-alias-procedure	No	String

Table 74-19 (Cont.) Mapping Between mod_plsql and Embedded PL/SQL Gateway DAD Attributes

mod_plsql DAD Attribute	Embedded PL/SQL Gateway DAD Attribute	Allows Multiple Occurrences	Legal Values
PlsqlRequestValidationFunction	request-validation-function	No	String
PlsqlSessionCookieName	session-cookie-name	No	String
PlsqlSessionStateManagement	session-state-management	No	Enumeration of StatelessWithResetPackageState, StatelessWithFastRestPackageState, StatelessWithPreservePackageState
PlsqlTransferMode	transfer-mode	No	Enumeration of Char, Raw
PlsqlUploadAsLongRaw	upload-as-long-raw	No	String

Exceptions

Raises an error if DAD does not exist or the attribute is unknown.

Usage Notes

- If `attr_name` attribute has been set before, then the old value will be overwritten with the new `attr_value` argument.
- The embedded gateway assumes default values when the attributes are not set. The default values of the DAD attributes should be sufficient for most users of the embedded gateway. `mod_plsql` users should note the following
 - The `PlsqlDatabasePassword` attribute is not needed.
 - The `PlsqlDatabaseConnectionString` attribute is not needed because the embedded gateway does not support logon to external databases.

Examples

```
DBMS_EPG.SET_DAD_ATTRIBUTE('HR', 'default-page', 'HRApp.home');
```

74.6.15 SET_GLOBAL_ATTRIBUTE Procedure

This procedure sets the value of a global attribute.



See Also:

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.SET_GLOBAL_ATTRIBUTE (
    attr_name    IN VARCHAR2,
    attr_value   IN VARCHAR2);
```

Parameters**Table 74-20 SET_GLOBAL_ATTRIBUTE Procedure Parameters**

Parameter	Description
attr_name	The global attribute to set
attr_value	The attribute value to set

Table 74-21 Mapping Between mod_plsql and Embedded PL/SQL Gateway Global Attributes

mod_plsql Global Attribute	Embedded PL/SQL Gateway Global Attribute	Allows Multiple Occurrences	Legal Values
PlsqlLogLevel	log-level	No	Unsigned integer
PlsqlMaxParameters	max-parameters	No	Unsigned integer

Usage Notes

- The attribute name is case sensitive. The value may or may not be case-sensitive depending on the attribute.
- If `attr_name` attribute has been set before, then the old value will be overwritten with the new `attr_value` argument.

Exceptions

Raises an error if the attribute is unknown.

Examples

```
dbms_epg.set_global_attribute('max-parameters', '100');
```

74.6.16 UNMAP_DAD Procedure

This procedure unmaps a DAD from the specified virtual path. If path is `NULL`, the procedure removes all virtual-path mappings for the DAD but keeps the DAD.

**See Also:**

[Configuration Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_EPG.UNMAP_DAD (  
    dad_name IN VARCHAR2,  
    path      IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 74-22 UNMAP_DAD Procedure Parameters

Parameter	Description
dad_name	The name of the DAD to unmap
path	The virtual path to unmap

Usage Notes

Raises an error if the DAD does not exist.

DBMS_ERRLOG

The `DBMS_ERRLOG` package provides a procedure that enables you to create an error logging table so that DML operations can continue after encountering errors rather than abort and roll back. This enables you to save time and system resources.

This chapter contains the following topics:

- [Security Model](#)
- [Summary of DBMS_ERRLOG Subprograms](#)



See Also:

Oracle Database Data Warehousing Guide for more information regarding how to use `DBMS_ERRLOG` and *Oracle Database SQL Language Reference* for `error_logging_clause` syntax

75.1 DBMS_ERRLOG Security Model

Security on this package can be controlled by granting `EXECUTE` on this package to selected users or roles. The `EXECUTE` privilege is granted publicly. However, to create an error logging table, you need `SELECT` access on the base table or view, the `CREATE TABLE` privilege, as well as tablespace quota for the target tablespace.

75.2 Summary of DBMS_ERRLOG Subprograms

The `DBMS_ERRLOG` package includes the `CREATE_ERROR_LOG` procedure subprogram.

Table 75-1 DBMS_ERRLOG Package Subprograms

Subprogram	Description
CREATE_ERROR_LOG Procedure	Creates the error logging table used in DML error logging

75.2.1 CREATE_ERROR_LOG Procedure

This procedure creates the error logging table needed to use the DML error logging capability.

`LONG`, `CLOB`, `BLOB`, `BFILE`, and `ADT` datatypes are not supported in the columns.

Syntax

```
DBMS_ERRLOG.CREATE_ERROR_LOG (
    dml_table_name      IN VARCHAR2,
    err_log_table_name  IN VARCHAR2 := NULL,
    err_log_table_owner IN VARCHAR2 := NULL,
    err_log_table_space IN VARCHAR2 := NULL,
    skip_unsupported    IN BOOLEAN := FALSE);
```

Parameters

Table 75-2 CREATE_ERROR_LOG Procedure Parameters

Parameter	Description
dml_table_name	The name of the DML table to base the error logging table on. The name can be fully qualified (for example, emp, scott.emp, "EMP", "SCOTT"."EMP"). If a name component is enclosed in double quotes, it will not be upper cased.
err_log_table_name	The name of the error logging table you will create. The default is the first 25 characters in the name of the DML table prefixed with 'ERR\$'. Examples are the following: dml_table_name: 'EMP', err_log_table_name: 'ERR\$_EMP' dml_table_name: '"Emp2"', err_log_table_name: 'ERR\$_Emp2'
err_log_table_owner	The name of the owner of the error logging table. You can specify the owner in dml_table_name. Otherwise, the schema of the current connected user is used.
err_log_table_space	The tablespace the error logging table will be created in. If not specified, the default tablespace for the user owning the DML error logging table will be used.
skip_unsupported	When set to TRUE, column types that are not supported by error logging will be skipped over and not added to the error logging table. When set to FALSE, an unsupported column type will cause the procedure to terminate. The default is FALSE.

Examples

First, create an error log table for the channels table in the SH schema, using the default name generation.

Then, see all columns of the table channels:

```
SQL> DESC channels
Name                                Null?      Type
-----
CHANNEL_ID                          NOT NULL   CHAR(1)
CHANNEL_DESC                         NOT NULL   VARCHAR2(20)
CHANNEL_CLASS                        VARCHAR2(20)
```

Finally, see all columns of the generated error log table. Note the mandatory control columns that are created by the package:

```

SQL> DESC ERR$_CHANNELS
Name                               Null?      Type
-----
ORA_ERR_NUMBER$                    NUMBER
ORA_ERR_MESG$                      VARCHAR2(2000)
ORA_ERR_ROWID$                     ROWID
ORA_ERR_OPTYP$                    VARCHAR2(2)
ORA_ERR_TAG$                       VARCHAR2(2000)
CHANNEL_ID                         VARCHAR2(4000)
CHANNEL_DESC                       VARCHAR2(4000)
CHANNEL_CLASS                      VARCHAR2(4000)
  
```

See *Oracle Database Administrator's Guide* for more information regarding control columns.

76

DBMS_FGA

The `DBMS_FGA` package provides fine-grained security functions.

This chapter contains the following topics:

- [Security Model](#)
- [Operational Notes](#)
- [Summary of DBMS_FGA Subprograms](#)

76.1 DBMS_FGA Security Model

You must have the `AUDIT_ADMIN` role or the `EXECUTE` privilege on the `DBMS_FGA` package to create audit policies. `DBMS_FGA` is an invoker rights package.



Note:

Starting in Oracle Database 23ai, fine-grained audit policies that are created with the `DBMS_FGA` package will generate audit records in the unified audit trail, viewable with the `UNIFIED_AUDIT_TRAIL` data dictionary view.

To analyze and audit data, you must have the `AUDIT_VIEWER` role. Because the audit function can potentially capture all user environment and application context values, policy administration should be executable by privileged users only. The policy event handler module is executed with the module owner's privilege.

76.2 DBMS_FGA Operational Notes

This package is available for only cost-based optimization. The rule-based optimizer may generate unnecessary audit records since audit monitoring can occur before row filtering.

For both the rule-based optimizer and the cost-based optimizer, you can query the `SQL_TEXT` and `SQL_BINDS` columns of the `UNIFIED_AUDIT_TRAIL` view to analyze the SQL text and corresponding bind variables that are issued.

76.3 Summary of DBMS_FGA Subprograms

This table describes the `DBMS_FGA` subprograms.

Table 76-1 DBMS_FGA Package Subprograms

Subprogram	Description
ADD_POLICY Procedure	Creates an audit policy using the supplied predicate as the audit condition
DISABLE_POLICY Procedure	Disables an audit policy
DROP_POLICY Procedure	Drops an audit policy
ENABLE_POLICY Procedure	Enables an audit policy

76.3.1 ADD_POLICY Procedure

This procedure creates an audit policy using the supplied predicate as the audit condition.

Syntax

```
DBMS_FGA.ADD_POLICY(
    object_schema    IN VARCHAR2 DEFAULT NULL,
    object_name      IN VARCHAR2,
    policy_name      IN VARCHAR2,
    audit_condition  IN VARCHAR2 DEFAULT NULL,
    audit_column     IN VARCHAR2 DEFAULT NULL,
    handler_schema   IN VARCHAR2 DEFAULT NULL,
    handler_module   IN VARCHAR2 DEFAULT NULL,
    enable           IN BOOLEAN DEFAULT TRUE,
    statement_types  IN VARCHAR2 DEFAULT SELECT,
    audit_trail      IN BINARY_INTEGER DEFAULT NULL,
    audit_column_opts IN BINARY_INTEGER DEFAULT ANY_COLUMNS,
    policy_owner     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 76-2 ADD_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema of the object to be audited. If NULL, the current schema is assumed.
object_name	Name of the object to be audited
policy_name	Unique name of the policy. Do not enter special characters such as spaces or commas. If you want to use special characters for the policy name, then enclose the name in quotation marks.
audit_condition	A condition in a row that indicates a monitoring condition. NULL is allowed and acts as TRUE.
audit_column	Columns to be checked for access. These can include OLS hidden columns or object type columns. The default, NULL, causes audit if any column is accessed or affected.
handler_schema	Schema that contains the event handler. The default, NULL, causes the current schema to be used.

Table 76-2 (Cont.) ADD_POLICY Procedure Parameters

Parameter	Description
handler_module	Function name of the event handler; includes the package name if necessary. This function is invoked only after the first row that matches the audit condition in the query is processed. If the procedure fails with an exception, the user SQL statement will fail as well.
enable	Enables the policy if <code>TRUE</code> , which is the default
statement_types	SQL statement types to which this policy is applicable: <code>INSERT</code> , <code>UPDATE</code> , <code>DELETE</code> , or <code>SELECT</code> only
audit_trail	Do not set this parameter; it is desupported. All audit records are written to the unified audit trail, viewable by querying the <code>UNIFIED_AUDIT_TRAIL</code> data dictionary view.
audit_column_opts	Establishes whether a statement is audited when the query references <i>any</i> column specified in the <code>audit_column</code> parameter or only when <i>all</i> such columns are referenced
policy_owner	User who owns the fine-grained auditing policy. However, this setting is not a user-supplied argument. The Oracle Data Pump client uses this setting internally to recreate the fine-grained audit policies appropriately.

Usage Notes

- A table or view can have a maximum of 256 fine-grained audit policies applied to it.
- If `object_schema` is not specified, the current schema is assumed.
- An FGA policy should not be applied to out-of-line columns such as LOB columns.
- Each audit policy is applied to the query individually. However, at most one audit record may be generated for each policy, no matter how many rows being returned satisfy that policy's `audit_condition`. In other words, whenever any number of rows being returned satisfy an audit condition defined on the table, a single audit record will be generated for each such policy.
- If a table with an FGA policy defined on it receives a Fast Path insert or a vectored update, the hint is automatically disabled before any such operations. Disabling the hint allows auditing to occur according to the policy's terms. (One example of a Fast Path insert is the statement `INSERT-WITH-APPEND-hint`.)
- The `audit_condition` must be a boolean expression that can be evaluated using the values in the row being inserted, updated, or deleted. The expression can also use functions, such as the `USER` or `SYS_CONTEXT` functions.

The expression must not combine conditions using operators such as `AND` and `OR`. `audit_condition` can be `NULL` (or omitted), which is interpreted as `TRUE`, but it cannot contain the following elements:

- Subqueries or sequences
- The following attributes of the `USERENV` namespace when accessed using the `SYS_CONTEXT` function:
 - * `CURRENT_SQL`
 - * `CURRENT_SQL_LENGTH`

* CURRENT_BIND

- Any use of the pseudo columns LEVEL, PRIOR, or ROWNUM.

Specifying an audit condition of 1=1 to force auditing of all specified statements ("statement_types") affecting the specified column ("audit_column") is no longer needed to achieve this purpose. A NULL value for audit_condition causes audit to happen even if no rows are processed, so that all actions on a table with this policy are audited.

- The audit_condition is evaluated using the privileges of the user who creates the policy.
- For the audit_condition setting, do not include functions, which execute the auditable statement on the same base table, in the audit_condition setting. For example, suppose you create a function that executes an INSERT statement on the HR.EMPLOYEES table. The policy audit_condition contains this function and it is for INSERT statements (as set by the statement_types parameter). When the policy is used, the function executes recursively until the system has run out of memory. This can raise the error ORA-1000: maximum open cursors exceeded or ORA-00036: maximum number of recursive SQL levels (50) exceeded.
- Do not issue the DBMS_FGA.ENABLE_POLICY or DBMS_FGA.DISABLE_POLICY statement from a policy function in a condition.
- The audit function (handler_module) is an alerting mechanism for the administrator. The required interface for such a function is as follows:

```
PROCEDURE fname ( object_schema VARCHAR2, object_name VARCHAR2, policy_name
VARCHAR2 ) AS ...
```

where *fname* is the name of the procedure, *object_schema* is the name of the schema of the table audited, *object_name* is the name of the table to be audited, and *policy_name* is the name of the policy being enforced. The audit function will be executed with the function owner's privilege.

- Because traditional auditing is desupported, omit the audit_trail parameter because the audit records are written to the unified audit trail, viewable by querying the UNIFIED_AUDIT_TRAIL data dictionary view.
- Be aware that sensitive data, such as credit card information, can be recorded in clear text.
- You can change the operating system destination by using the following statement:

```
ALTER SYSTEM SET AUDIT_FILE_DEST = new_directory DEFERRED
```

Starting with Oracle Database 23ai, the AUDIT_FILE_DEST parameter is deprecated.

- The audit_column_opts parameter establishes whether a statement is audited
 - when the query references *any* column specified in the audit_column parameter (audit_column_opts = DBMS_FGA.ANY_COLUMNS), or
 - only when *all* such columns are referenced (audit_column_opts = DBMS_FGA.ALL_COLUMNS).

The default is DBMS_FGA.ANY_COLUMNS.

The ALL_AUDIT_POLICIES view also shows audit_column_opts.

- When `audit_column_opts` is set to `DBMS_FGA.ALL_COLUMNS`, a SQL statement is audited only when all the columns mentioned in `audit_column` have been explicitly referenced in the statement. And these columns must be referenced in the same SQL-statement or in the sub-select.
All these columns must refer to a single table/view or alias.
If a SQL statement selects the columns from different table aliases, the statement will not be audited.
- For `SQL_TEXT` and `SQL_BIND` element values (CLOB type columns), the dynamic view shows only the first 4000 characters. The underlying XML file may have more than 4000 characters for such `SQL_TEXT` and `SQL_BIND` values.
- Error handling is the same as when `AUDIT_TRAIL=OS`. If any error occurs in writing an audit record, the audited operation fails and an alert message is logged.
- The policy event handler module will be executed with the module owner's privilege.
- Do not create recursive fine-grained audit handlers. For example, suppose you create a handler that executes an `INSERT` statement on the `HR.EMPLOYEES` table. The policy that is associated with this handler is for `INSERT` statements (as set by the `statement_types` parameter). When the policy is used, the handler executes recursively until the system has run out of memory. This can raise the error `ORA-1000: maximum open cursors exceeded` or `ORA-00036: maximum number of recursive SQL levels (50) exceeded`. See also *Oracle Database Security Guide* with regard to creating a fine-grained audit policy.
- The fine-grained audit handler module should not have explicit `COMMIT`, `ROLLBACK`, and `DDL` statements mentioned in it.

See Also:

Oracle Database Security Guide for an example of creating an email alert handler for a fine-grained audit policy

Examples

```
DBMS_FGA.ADD_POLICY (
  object_schema   => 'scott',
  object_name     => 'emp',
  policy_name     => 'mypolicy1',
  audit_condition => 'sal < 100',
  audit_column    => 'comm,sal',
  handler_schema  => NULL,
  handler_module  => NULL,
  enable         => TRUE,
  statement_types => 'INSERT, UPDATE',
  audit_column_opts => DBMS_FGA.ANY_COLUMNS,
  policy_owner    => 'sec_admin');
```

76.3.2 DISABLE_POLICY Procedure

This procedure disables an audit policy.

Syntax

```
DBMS_FGA.DISABLE_POLICY (
  object_schema IN VARCHAR2,
  object_name   IN VARCHAR2,
  policy_name   IN VARCHAR2);
```

Parameters

Table 76-3 DISABLE_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema of the object to be audited. If <code>NULL</code> , the current schema is assumed.
object_name	Name of the object to be audited
policy_name	Unique name of the policy

The default value for `object_schema` is `NULL`. If `NULL`, the current schema is assumed.

Examples

```
DBMS_FGA.DISABLE_POLICY (
  object_schema => 'scott',
  object_name   => 'emp',
  policy_name   => 'mypolicy1');
```

76.3.3 DROP_POLICY Procedure

This procedure drops an audit policy.

Syntax

```
DBMS_FGA.DROP_POLICY (
  object_schema IN VARCHAR2,
  object_name   IN VARCHAR2,
  policy_name   IN VARCHAR2);
```

Parameters

Table 76-4 DROP_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema of the object to be audited. If <code>NULL</code> , the current schema is assumed.
object_name	Name of the object to be audited
policy_name	Unique name of the policy

Usage Notes

The `DBMS_FGA` procedures cause current DML transactions, if any, to commit before the operation unless they are inside a DDL event trigger. With DDL transactions, the `DBMS_FGA` procedures are part of the DDL transaction. The default value for `object_schema` is `NULL`. If `NULL`, the current schema is assumed.



Note:

Oracle Database automatically drops the audit policy if you remove the object specified in the `object_name` parameter of the `DBMS_FGA.ADD_POLICY` procedure, or if you drop the user who created the audit policy.

Examples

```
DBMS_FGA.DROP_POLICY (
  object_schema => 'scott',
  object_name   => 'emp',
  policy_name   => 'mypolicy1');
```

76.3.4 ENABLE_POLICY Procedure

This procedure enables an audit policy.

Syntax

```
DBMS_FGA.ENABLE_POLICY(
  object_schema IN VARCHAR2,
  object_name   IN VARCHAR2,
  policy_name   IN VARCHAR2,
  enable        IN BOOLEAN);
```

Parameters

Table 76-5 ENABLE_POLICY Procedure Parameters

Parameter	Description
<code>object_schema</code>	Schema of the object to be audited. If <code>NULL</code> , the current schema is assumed.
<code>object_name</code>	Name of the object to be audited
<code>policy_name</code>	Unique name of the policy
<code>enable</code>	Defaults to <code>TRUE</code> to enable the policy

Examples

```
DBMS_FGA.ENABLE_POLICY (
  object_schema => 'scott',
  object_name   => 'emp',
  policy_name   => 'mypolicy1',
  enable        => TRUE);
```

DBMS_FILE_TRANSFER

The `DBMS_FILE_TRANSFER` package provides procedures to copy a binary file within a database or to transfer a binary file between databases.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Operating Notes](#)
- [Summary of DBMS_FILE_TRANSFER Subprograms](#)



See Also:

Oracle Database Administrator's Guide for instructions about using file transfer

77.1 DBMS_FILE_TRANSFER Overview

The `DBMS_FILE_TRANSFER` package provides procedures to copy a binary file within a database or to transfer a binary file between databases.

The destination database converts each block when it receives a file from a platform with different endianness. Datafiles can be imported after they are moved to the destination database as part of a transportable operation without RMAN conversion. Both `GET` and `PUT` operations will converted the file across platform difference at the destination. However, `COPY` is a local operation and therefore no conversion is required.

77.2 DBMS_FILE_TRANSFER Security Model

The `DBMS_FILE_TRANSFER` package must be created under `SYS` (`CONNECT INTERNAL`). Operations provided by this package are performed under the current calling user, not the package owner (`SYS`).

To use this interface the following users must have the following privileges:

- The current user at the local database must have `READ` privilege on the directory object specified in the `source_directory_object` parameter.
- The connected user at the destination database must have `WRITE` privilege to the directory object specified in the `destination_directory_object` parameter.

77.3 DBMS_FILE_TRANSFER Operational Notes

`DBMS_FILE_TRANSFER` supports online backup. You should therefore be careful in copying or transferring a file that is being modified by the database because this can result in an

inconsistent file, and require recovery. To guarantee consistency, bring files offline when the database is in use.

If you want to use `DBMS_FILE_TRANSFER` for performing backups, note that you are implementing self-managed backups, and should therefore put the files in hot backup mode.

77.4 Summary of DBMS_FILE_TRANSFER Subprograms

This table lists the `DBMS_FILE_TRANSFER` subprograms and briefly describes them.

Table 77-1 DBMS_FILE_TRANSFER Package Subprograms

Subprogram	Description
COPY_FILE Procedure	Reads a file from a source directory and creates a copy of it in a destination directory. The source and destination directories can both be in a local file system, or both be in an Automatic Storage Management (ASM) disk group, or between local file system and ASM with copying in either direction.
GET_FILE Procedure	Contacts a remote database to read a remote file and then creates a copy of the file in the local file system or ASM
PUT_FILE Procedure	Reads a local file or ASM and contacts a remote database to create a copy of the file in the remote file system

77.4.1 COPY_FILE Procedure

This procedure reads a file from a source directory and creates a copy of it in a destination directory. The source and destination directories can both be in a local file system, or both be in an Automatic Storage Management (ASM) disk group, or between local file system and ASM with copying in either direction.

You can copy any type of file to and from a local file system. However, you can copy only database files (such as datafiles, tempfiles, controlfiles, and so on) to and from an ASM disk group.

The destination file is not closed until the procedure completes successfully.

Syntax

```
DBMS_FILE_TRANSFER.COPY_FILE(
    source_directory_object    IN  VARCHAR2,
    source_file_name          IN  VARCHAR2,
    destination_directory_object IN VARCHAR2,
    destination_file_name     IN  VARCHAR2);
```

Parameters

Table 77-2 COPY_FILE Procedure Parameters

Parameter	Description
<code>source_directory_object</code>	The directory object that designates the source directory. The directory object must already exist. (You create directory objects with the <code>CREATE DIRECTORY</code> command).
<code>source_file_name</code>	The name of the file to copy. This file must exist in the source directory.
<code>destination_directory_object</code>	The directory object that designates the destination directory. The directory object must already exist. If the destination is ASM, the directory object must designate either a disk group name (for example, <code>+diskgroup1</code>) or a directory created for alias names. In the case of a directory, the full path to the directory must be specified (for example: <code>+diskgroup1/dbs/control</code>).
<code>destination_file_name</code>	<p>The name to assign to the file in the destination directory. A file with the same name must not exist in the destination directory. If the destination is ASM:</p> <ul style="list-style-type: none"> The file is given a fully qualified ASM filename and created in the appropriate directory (depending on the database name and file type) The file type tag assigned to the file is <code>COPY_FILE</code> The value of the <code>destination_file_name</code> argument becomes the file's alias name in the designated destination directory <p>The file name can be followed by an ASM template name in parentheses. The file is then given the attributes specified by the template.</p>

Usage Notes

To run this procedure successfully, the current user must have the following privileges:

- `READ` privilege on the directory object specified in the `source_directory_object` parameter
- `WRITE` privilege on directory object specified in the `destination_directory_object` parameter

This procedure converts directory object parameters to uppercase unless they are surrounded by double quotation marks, but this procedure does not convert file names to uppercase.

Also, the copied file must meet the following requirements:

- The size of the copied file must be a multiple of 512 bytes.
- The size of the copied file must be less than or equal to two terabytes.

The `source_file_name` parameter must specify a file that is in the directory specified by the `source_directory_object` parameter before running the procedure, and the `destination_file_name` parameter must specify the new name of the file in the new location specified in the `destination_directory_object` parameter. Relative paths and symbolic

links are not allowed in the directory objects for the `source_directory_object` and `destination_directory_object` parameters.

Transferring the file is not transactional. To monitor the progress of a long file copy, query the `V$SESSION_LONGOPS` dynamic performance view.



See Also:

Oracle Automatic Storage Management Administrator's Guide for instructions about using file transfer

Examples

```
SQL> create directory DGROUP as '+diskgroup1/dbs/backup';
```

Directory created.

```
SQL> BEGIN
  2   DBMS_FILE_TRANSFER.COPY_FILE('SOURCEDIR','t_xdbtmp.f', 'DGROUP',
                                't_xdbtmp.f');
  3 END;
  4 /
```

PL/SQL procedure successfully completed.

```
SQL> EXIT
$ASMCMD
ASMCMD> ls
DISKGROUP1/
ASMCMD> cd diskgroup1/dbs/backup
ASMCMD> ls
t_xdbtmp.f => +DISKGROUP1/ORCL/TEMPFILE/COPY_FILE.267.546546525
```

77.4.2 GET_FILE Procedure

This procedure contacts a remote database to read a remote file and then creates a copy of the file in the local file system or ASM. The file that is copied is the source file, and the new file that results from the copy is the destination file. The destination file is not closed until the procedure completes successfully.

Syntax

```
DBMS_FILE_TRANSFER.GET_FILE
  source_directory_object  IN  VARCHAR2,
  source_file_name         IN  VARCHAR2,
  source_database          IN  VARCHAR2,
  destination_directory_object IN VARCHAR2,
  destination_file_name    IN  VARCHAR2);
```

Parameters

Table 77-3 GET_FILE Procedure Parameters

Parameter	Description
source_directory_object	The directory object from which the file is copied at the source site. This directory object must exist at the source site.
source_file_name	The name of the file that is copied in the remote file system. This file must exist in the remote file system in the directory associated with the source directory object.
source_database	The name of a database link to the remote database where the file is located.
destination_directory_object	The directory object into which the file is placed at the destination site. This directory object must exist in the local file system.
destination_file_name	The name of the file copied to the local file system. A file with the same name must not exist in the destination directory in the local file system.

Usage Notes

To run this procedure successfully, the following users must have the following privileges:

- The connected user at the source database must have read privilege on the directory object specified in the `source_directory_object` parameter.
- The current user at the local database must have write privilege on the directory object specified in the `destination_directory_object` parameter.

This procedure converts directory object parameters to uppercase unless they are surrounded by double quotation marks, but this procedure does not convert file names to uppercase.

Also, the copied file must meet the following requirements:

- The size of the copied file must be a multiple of 512 bytes.
- The size of the copied file must be less than or equal to two terabytes.

Transferring the file is not transactional. To monitor the progress of a long file transfer, query the `V$SESSION_LONGOPS` dynamic performance view.

Examples

```
CREATE OR REPLACE DIRECTORY df AS '+datafile' ;
GRANT WRITE ON DIRECTORY df TO "user";
CREATE DIRECTORY DSK_FILES AS '^t_work^';
GRANT WRITE ON DIRECTORY dsk_files TO "user";

-- assumes that dbs2 link has been created and we are connected to the instance.
-- dbs2 could be a loopback or point to another instance.

BEGIN
-- asm file to an os file
-- get an asm file from dbs1.asm/a1 to dbs2.^t_work^/oa5.dat
  DBMS_FILE_TRANSFER.GET_FILE ( 'df' , 'a1' , 'dbs1', 'dsk_files' , 'oa5.dat' );
```

```
-- os file to an os file
-- get an os file from dbs1.^t_work^/a2.dat to dbs2.^t_work^/a2back.dat
  DBMS_FILE_TRANSFER.GET_FILE ( 'dsk_files' , 'a2.dat' , 'dbs1', 'dsk_files' ,
    'a2back.dat' );

END ;
/
```

77.4.3 PUT_FILE Procedure

This procedure reads a local file or ASM and contacts a remote database to create a copy of the file in the remote file system.

The file that is copied is the source file, and the new file that results from the copy is the destination file. The destination file is not closed until the procedure completes successfully.

Syntax

```
DBMS_FILE_TRANSFER.PUT_FILE(
  source_directory_object      IN  VARCHAR2,
  source_file_name             IN  VARCHAR2,
  destination_directory_object IN  VARCHAR2,
  destination_file_name        IN  VARCHAR2,
  destination_database         IN  VARCHAR2);
```

Parameters

Table 77-4 PUT_FILE Procedure Parameters

Parameter	Description
source_directory_object	The directory object from which the file is copied at the local source site. This directory object must exist at the source site.
source_file_name	The name of the file that is copied from the local file system. This file must exist in the local file system in the directory associated with the source directory object.
destination_directory_object	The directory object into which the file is placed at the destination site. This directory object must exist in the remote file system.
destination_file_name	The name of the file placed in the remote file system. A file with the same name must not exist in the destination directory in the remote file system.
destination_database	The name of a database link to the remote database to which the file is copied.

Usage Notes

To run this procedure successfully, the following users must have the following privileges:

- The current user at the local database must have read privilege on the directory object specified in the `source_directory_object` parameter.

- The connected user at the destination database must have write privilege to the directory object specified in the `destination_directory_object` parameter.

This procedure converts directory object parameters to uppercase unless they are surrounded by double quotation marks, but this procedure does not convert file names to uppercase.

Also, the copied file must meet the following requirements:

- The size of the copied file must be a multiple of 512 bytes.
- The size of the copied file must be less than or equal to two terabytes.

Transferring the file is not transactional. To monitor the progress of a long file transfer, query the `V$SESSION_LONGOPS` dynamic performance view.

Examples

```
CREATE OR REPLACE DIRECTORY df AS '+datafile' ;
GRANT WRITE ON DIRECTORY df TO "user";
CREATE OR REPLACE DIRECTORY ft1 AS '+datafile/ft1' ;
GRANT READ,WRITE ON DIRECTORY ft1 TO "user";
CREATE OR REPLACE DIRECTORY ft1_1 AS '+datafile/ft1/ft1_1' ;

CONNECT user;
Enter password: password

-- - put a1.dat to a4.dat (using dbs2 dblink)
-- - level 2 sub dir to parent dir
-- - user has read privs on ft1_1 at dbs1 and write on df in dbs2
BEGIN
  DBMS_FILE_TRANSFER.PUT_FILE ( 'ft1_1' , 'a2.dat' , 'df' , 'a4.dat' ,
                                'dbs2' ) ;
END ;
```


DBMS_FLASHBACK

Using `DBMS_FLASHBACK`, you can flash back to a version of the database at a specified time or a specified system change number (SCN).

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Types](#)
- [Exceptions](#)
- [Operational Notes](#)
- [Examples](#)
- [Summary of DBMS_FLASHBACK Subprograms](#)



See Also:

For detailed information about `DBMS_FLASHBACK`:

- *Oracle Database Development Guide*
- *Oracle Database SQL Language Reference*.

78.1 DBMS_FLASHBACK Overview

`DBMS_FLASHBACK` provides an interface for the user to view the database at a particular time in the past, with the additional capacity provided by transaction back out features that allow for selective removal of the effects of individual transactions. This is different from a flashback database which moves the database back in time.

When `DBMS_FLASHBACK` is enabled, the user session uses the Flashback version of the database, and applications can execute against the Flashback version of the database.

You may want to use `DBMS_FLASHBACK` for the following reasons:

- **Self-service repair:** If you accidentally delete rows from a table, you can recover the deleted rows.
- **Packaged applications such as email and voicemail:** You can use Flashback to restore deleted email by re-inserting the deleted message into the current message box.
- **Decision support system (DSS) and online analytical processing (OLAP) applications:** You can perform data analysis or data modeling to track seasonal demand.

78.2 DBMS_FLASHBACK Security Model

To use the `DBMS_FLASHBACK` package, you must have the `EXECUTE` privilege on it.

78.3 DBMS_FLASHBACK Types

The following table describes the types used by `DBMS_FLASHBACK`.

Table 78-1 DBMS_FLASHBACK

Type	Description
<code>TXNAME_ARRAY</code>	Creates a <code>VARRAY</code> for holding Transaction Names or Identifiers (XIDs)

78.4 DBMS_FLASHBACK Exceptions

`DBMS_FLASHBACK` creates the following error messages.

Table 78-2 DBMS_FLASHBACK Error Messages

Error	Description
<code>ORA-08180</code>	Time specified is too old
<code>ORA-08181</code>	Invalid system change number specified
<code>ORA-08182</code>	User cannot begin read-only or serializable transactions in Flashback mode
<code>ORA-08183</code>	User cannot enable Flashback within an uncommitted transaction
<code>ORA-08184</code>	User cannot enable Flashback within another Flashback session
<code>ORA-08185</code>	<code>SYS</code> cannot enable Flashback mode

78.5 DBMS_FLASHBACK Operational Notes

`DBMS_FLASHBACK` is automatically turned off when the session ends, either by disconnection or by starting another connection.

PL/SQL cursors opened in Flashback mode return rows as of the flashback time or SCN. Different concurrent sessions (connections) in the database can perform Flashback to different wall-clock times or SCNs. DML and DDL operations and distributed operations are not allowed while a session is running in Flashback mode. You can use PL/SQL cursors opened before disabling Flashback to perform DML.

Under Automatic Undo Management (AUM) mode, you can use retention control to control how far back in time to go for the version of the database you need. If you need to perform a Flashback over a 24-hour period, the DBA must set the `undo_retention` parameter to 24 hours. This way, the system retains enough undo information to regenerate the older versions of the data.

You can set the `RETENTION GUARANTEE` clause for the undo tablespace to ensure that unexpired undo is not discarded. `UNDO_RETENTION` is not in itself a guarantee because, if the system is under space pressure, unexpired undo may be overwritten with freshly generated undo. In such cases, `RETENTION GUARANTEE` prevents this. For more information, see the *Oracle Database Administrator's Guide*.

In a Flashback-enabled session, `SYSDATE` is not affected; it continues to provide the current time.

`DBMS_FLASHBACK` can be used within logon triggers to enable Flashback without changing the application code.

See Also:

Oracle Database Administrator's Guide for information on setting the minimum undo retention period.

78.6 DBMS_FLASHBACK Examples

The following example illustrates how Flashback can be used when the deletion of a senior employee triggers the deletion of all the personnel reporting to him. Using the Flashback feature, you can recover and re-insert the missing employees.

```
DROP TABLE employee;
DROP TABLE keep_scn;

REM -- Keep_scn is a temporary table to store scns that we are interested in

CREATE TABLE keep_scn (scn number);
SET ECHO ON
CREATE TABLE employee (
  employee_no  number(5) PRIMARY KEY,
  employee_name varchar2(20),
  employee_mgr  number(5)
  CONSTRAINT mgr_fkey REFERENCES EMPLOYEE ON DELETE CASCADE,
  salary       number,
  hiredate     date
);

REM -- Populate the company with employees
INSERT INTO employee VALUES (1, 'John Doe', null, 1000000, '5-jul-81');
INSERT INTO employee VALUES (10, 'Joe Johnson', 1, 500000, '12-aug-84');
INSERT INTO employee VALUES (20, 'Susie Tiger', 10, 250000, '13-dec-90');
INSERT INTO employee VALUES (100, 'Scott Tiger', 20, 200000, '3-feb-86');
INSERT INTO employee VALUES (200, 'Charles Smith', 100, 150000, '22-mar-88');
INSERT INTO employee VALUES (210, 'Jane Johnson', 100, 100000, '11-apr-87');
INSERT INTO employee VALUES (220, 'Nancy Doe', 100, 100000, '18-sep-93');
INSERT INTO employee VALUES (300, 'Gary Smith', 210, 75000, '4-nov-96');
INSERT INTO employee VALUES (310, 'Bob Smith', 210, 65000, '3-may-95');
COMMIT;

REM -- Show the entire org
SELECT lpad(' ', 2*(level-1)) || employee_name Name
FROM employee
CONNECT BY PRIOR employee_no = employee_mgr
START WITH employee_no = 1
```

```
ORDER BY LEVEL;

REM -- Sleep for a short time (approximately 10 to 20 seconds) to avoid
REM -- querying close to table creation

EXECUTE DBMS_LOCK.SLEEP(10);

REM -- Store this snapshot for later access through Flashback
DECLARE
I NUMBER;
BEGIN
I := DBMS_FLASHBACK.GET_SYSTEM_CHANGE_NUMBER;
INSERT INTO keep_scn VALUES (I);
COMMIT;
END;
/

REM -- Scott decides to retire but the transaction is done incorrectly
DELETE FROM EMPLOYEE WHERE employee_name = 'Scott Tiger';
COMMIT;

REM -- notice that all of scott's employees are gone
SELECT lpad(' ', 2*(level-1)) || employee_name Name
FROM EMPLOYEE
CONNECT BY PRIOR employee_no = employee_mgr
START WITH employee_no = 1
ORDER BY LEVEL;

REM -- Flashback to see Scott's organization
DECLARE
restore_scn number;
BEGIN
SELECT scn INTO restore_scn FROM keep_scn;
DBMS_FLASHBACK.ENABLE_AT_SYSTEM_CHANGE_NUMBER (restore_scn);
END;
/

REM -- Show Scott's org.
SELECT lpad(' ', 2*(level-1)) || employee_name Name
FROM employee
CONNECT BY PRIOR employee_no = employee_mgr
START WITH employee_no =
(SELECT employee_no FROM employee WHERE employee_name = 'Scott Tiger')
ORDER BY LEVEL;

REM -- Restore scott's organization.
DECLARE
scotts_emp NUMBER;
scotts_mgr NUMBER;
CURSOR c1 IS
SELECT employee_no, employee_name, employee_mgr, salary, hiredate
FROM employee
CONNECT BY PRIOR employee_no = employee_mgr
START WITH employee_no =
(SELECT employee_no FROM employee WHERE employee_name = 'Scott Tiger');
c1_rec c1 % ROWTYPE;
BEGIN
SELECT employee_no, employee_mgr INTO scotts_emp, scotts_mgr FROM employee
WHERE employee_name = 'Scott Tiger';
/* Open c1 in flashback mode */
OPEN c1;
```

```

/* Disable Flashback */
DBMS_FLASHBACK.DISABLE;
LOOP
  FETCH c1 INTO c1_rec;
  EXIT WHEN c1%NOTFOUND;
/*
  Note that all the DML operations inside the loop are performed
  with Flashback disabled
*/
IF (c1_rec.employee_mgr = scotts_emp) then
  INSERT INTO employee VALUES (c1_rec.employee_no,
    c1_rec.employee_name,
    scotts_mgr,
    c1_rec.salary,
    c1_rec.hiredate);
ELSE
IF (c1_rec.employee_no != scotts_emp) THEN
INSERT INTO employee VALUES (c1_rec.employee_no,
  c1_rec.employee_name,
  c1_rec.employee_mgr,
  c1_rec.salary,
  c1_rec.hiredate);
  END IF;
END IF;
END LOOP;
END;
/

REM -- Show the restored organization.
select lpad(' ', 2*(level-1)) || employee_name Name
FROM employee
CONNECT BY PRIOR employee_no = employee_mgr
START WITH employee_no = 1
ORDER BY LEVEL;

```

78.7 Summary of DBMS_FLASHBACK Subprograms

This table lists the DBMS_FLASHBACK subprograms and briefly describes them.

Table 78-3 DBMS_FLASHBACK Package Subprograms

Subprogram	Description
DISABLE Procedure	Disables the Flashback mode for the entire session
ENABLE_AT_SYSTEM_CHANGE_NUMBER Procedure	Enables Flashback for the entire session. Takes an SCN as an Oracle number and sets the session snapshot to the specified number. Inside the Flashback mode, all queries return data consistent as of the specified wall-clock time or SCN
ENABLE_AT_TIME Procedure	Enables Flashback for the entire session. The snapshot time is set to the SCN that most closely matches the time specified in <code>query_time</code>
GET_SYSTEM_CHANGE_NUMBER Function	Returns the current SCN as an Oracle number. You can use the SCN to store specific snapshots
TRANSACTION_BACKOUT Procedures	Provides the mechanism to back out a transaction

78.7.1 DISABLE Procedure

This procedure disables the Flashback mode for the entire session.

Syntax

```
DBMS_FLASHBACK.DISABLE;
```

Examples

The following example queries the salary of an employee, Joe, on August 30, 2000:

```
EXECUTE dbms_flashback.enable_at_time('30-AUG-2000');
SELECT salary FROM emp where name = 'Joe'
EXECUTE dbms_flashback.disable;
```

78.7.2 ENABLE_AT_SYSTEM_CHANGE_NUMBER Procedure

This procedure takes an SCN as an input parameter and sets the session snapshot to the specified number.

In the Flashback mode, all queries return data consistent as of the specified wall-clock time or SCN. It enables Flashback for the entire session.

Syntax

```
DBMS_FLASHBACK.ENABLE_AT_SYSTEM_CHANGE_NUMBER (
    query_scn IN NUMBER);
```

Parameters

Table 78-4 ENABLE_AT_SYSTEM_CHANGE_NUMBER Procedure Parameters

Parameter	Description
query_scn	The system change number (SCN), a version number for the database that is incremented on every transaction commit.

78.7.3 ENABLE_AT_TIME Procedure

This procedure enables Flashback for the entire session.

The snapshot time is set to the SCN that most closely matches the time specified in query_time. It enables Flashback for the entire session.

Syntax

```
DBMS_FLASHBACK.ENABLE_AT_TIME (
    query_time IN TIMESTAMP);
```

Parameters

Table 78-5 ENABLE_AT_TIME Procedure Parameters

Parameter	Description
query_time	<p>This is an input parameter of type <code>TIMESTAMP</code>. A time stamp can be specified in the following ways:</p> <ul style="list-style-type: none"> Using the <code>TIMESTAMP</code> constructor <pre>EXECUTE DBMS_FLASHBACK.ENABLE_AT_TIME(TIMESTAMP '2001-01-09 12:31:00');</pre> <p>Use the Globalization Support (NLS) format and supply a string. The format depends on the Globalization Support settings.</p> Using the <code>TO_TIMESTAMP</code> function: <pre>EXECUTE DBMS_FLASHBACK.ENABLE_AT_TIME(TO_TIMESTAMP('12-02-2001 14:35:00', 'DD-MM-YYYY HH24:MI:SS'))</pre> <p>You provide the format you want to use. This example shows the <code>TO_TIMESTAMP</code> function for February 12, 2001, 2:35 PM.</p> <ul style="list-style-type: none"> If the time is omitted from query time, it defaults to the beginning of the day, that is, 12:00 A.M. Note that if the query time contains a time zone, the time zone information is truncated.

78.7.4 GET_SYSTEM_CHANGE_NUMBER Function

This function returns the current SCN as an Oracle number datatype. You can obtain the current change number and store it for later use. This helps you retain specific snapshots.

Syntax

```
DBMS_FLASHBACK.GET_SYSTEM_CHANGE_NUMBER
RETURN NUMBER;
```

78.7.5 TRANSACTION_BACKOUT Procedures

This procedure provides a mechanism to back out a set of transactions. The user can call these procedures with either transaction names or transaction identifiers (`XIDS`).

The procedure analyzes the transactional dependencies, perform DMLs and generates an extensive report on the operation performed by the subprogram. This procedure does not commit the DMLs performed as part of transaction back out. However it holds all the required locks on rows and tables in the right form, so that no other dependencies can enter the system. To make the changes permanent you must explicitly commit the transaction.

A report is generated in the system tables `DBA_FLASHBACK_TRANSACTION_STATE` and `DBA_FLASHBACK_TRANSACTION_REPORT`.

Syntax

```
DBMS_FLASHBACK.TRANSACTION_BACKOUT
numtxns          NUMBER,
```

```

xids          XID_ARRAY,
options       NUMBER default NOCASCADE,
timeHint     TIMESTAMP default MINTIME);

DBMS_FLASHBACK.TRANSACTION_BACKOUT
numtxns      NUMBER,
xids         XID_ARRAY,
options      NUMBER default NOCASCADE,
scnHint     TIMESTAMP default 0 );

DBMS_FLASHBACK.TRANSACTION_BACKOUT
numtxns      NUMBER,
txnnames     TXNAME_ARRAY,
options      NUMBER default NOCASCADE,
timehint     TIMESTAMP MINTIME );

DBMS_FLASHBACK.TRANSACTION_BACKOUT
numtxns      NUMBER,
txnNames     TXNAME_ARRAY,
options      NUMBER default NOCASCADE,
scnHint     NUMBER 0);

```

Parameters

Table 78-6 TRANSACTION_BACKOUT Procedure Parameters

Parameter	Description
numtxns	Number of transactions passed as input
xids	List of transaction IDs in the form of an array
txnnames	List of transaction names in the form of an array
options	Back out dependent transactions: <ul style="list-style-type: none"> • NOCASCADE - No dependency is expected. If a dependency is found, this raises an error, with the first dependent transaction provided in the report. • NOCASCADE_FORCE - The user forcibly backs out the given transactions without considering the dependent transactions. The RDBMS executes the UNDO SQL for the given transactions in reverse order of their commit times. If no constraints break, and the result is satisfactory, the user can either COMMIT the changes or else ROLL BACK. • NONCONFLICT_ONLY - This option lets the user back out the changes to the nonconflicting rows of the given transactions. Note that a transaction dependency can happen due to a row conflict through either WAW or primary/unique key constraints. If the user chooses to back out only the nonconflicting rows, this does not cause any problem with database consistency, although transaction atomicity is lost. As this is a recovery operation, the user can correct the data. • CASCADE - This completely removes the given transactions including their dependents in a post order fashion (reverse order of commit times).
timehint	Time hint on the start of the transaction
scnhint	SCN hint on the start of the transaction

Usage Notes



Note:

For information about restrictions in using `TRANSACTION_BACKOUT`, see "Using Flashback Transaction" in the *Oracle Database Development Guide*.

- If transaction name is used, a time hint must be provided. The time hint should be a time before the start of all the given transactions to back out.
- If the SCN hint is provided, it must be before the start of the earliest transaction in the specified input set, or this raises an error and terminates. If it is not provided and the transaction has committed within undo retention, the database system is able to determine the start time.

DBMS_FLASHBACK_ARCHIVE

The `DBMS_FLASHBACK_ARCHIVE` package contains procedures for performing various flashback archive tasks.

These include:

- Disassociation and reassociation of a Flashback Archive enabled table from/with its underlying Flashback Time Travel
- Tamper-proofing the tables of an application
- Importing of user history

 **Caution:**

Importing user-generated history can lead to inaccurate, or unreliable results. This procedure should only be used after consulting with Oracle Support.

- Enabling and disabling of session-level support for valid-time

 **See Also:**

Oracle Database Development Guide for more information about Using Flashback Time Travel

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Summary of DBMS_FLASHBACK_ARCHIVE Subprograms](#)

79.1 DBMS_FLASHBACK_ARCHIVE Overview

Flashback Time Travel provides strict protection on the internal history tables that it creates and maintains for users.

▲ Caution:

The `DBMS_FLASHBACK_ARCHIVE` package does not support migration between databases. It allows you to move Flashback Time Travel history within the same database only, and not outside it. This package does not allow you to move Flashback Time Travel table data. It allows you to import customer history only and not Flashback Time Travel history.

The read-only semantics prohibit users, including a DBA, from doing updates, deletes, and inserts on the Flashback Time Travel internal history tables. Users are also prevented from issuing any DDL statements on these tables. This strict security enforcement helps meet the requirements of applications in regulatory / compliance environments. Flashback Time Travel supports most common DDL statements, including those that alter the table definition or incur data movement. However, some DDL statements are not supported on Flashback Archive enabled tables. Since most application schemas are modified during application software upgrades, the ability to perform DDL operations on tracked tables is critical.

To support schema evolution during application upgrades and other table maintenance tasks that require use of DDL statements not supported by Flashback Time Travel, the `DBMS_FLASHBACK_ARCHIVE` package provides a set of simple-to-use PL/SQL procedures:

- To disassociate a Flashback Archive enabled base table from the underlying Flashback Time Travel
- To reassociate a temporarily disassociated base table with its underlying Flashback Time Travel

After a user has disassociated the base table from its Flashback Archive, it's possible to issue any DDL statements on the base table or the history tables in the Flashback Archive. Having finished with the schema changes, the user can then reassociate the base table with its Flashback Archive so that Flashback Time Travel protection is in operation and automatic tracking and archiving is resumed.

79.2 DBMS_FLASHBACK_ARCHIVE Security Model

Users need the `FLASHBACK_ARCHIVE_ADMINISTER` privilege to import user-generated history, to set context level, and to tamper-proof tables. After a table is disassociated, users can perform DDL and DML statements on the table if they have the necessary privileges. Enabling and disabling session-level Valid Time Temporal flashback needs no additional privileges.

79.3 DBMS_FLASHBACK_ARCHIVE Constants

The `DBMS_FLASHBACK_ARCHIVE` package uses the constants shown in the following table.

Table 79-1 DBMS_FLASHBACK_ARCHIVE Constants

Constant	Type	Value	Description
<code>NODROP</code>	<code>BINARY_INTEGER</code>	1	Do not drop temporary history table
<code>NOCOMMIT</code>	<code>BINARY_INTEGER</code>	2	Do not commit transaction
<code>NODELETE</code>	<code>BINARY_INTEGER</code>	4	Do not delete data in history table

79.4 Summary of DBMS_FLASHBACK_ARCHIVE Subprograms

This table lists the `DBMS_FLASHBACK_ARCHIVE` subprograms and briefly describes them.

Table 79-2 DBMS_FLASHBACK_ARCHIVE Package Subprograms

Subprogram	Description
ADD_TABLE_TO_APPLICATION Procedure	Takes an application name and adds a table to the application as a security table
CREATE_TEMP_HISTORY_TABLE Procedure	Creates a table called <code>TEMP_HISTORY</code> with the correct definition in schema
DISABLE_APPLICATION Procedure	Takes an application name and marks a table in it as a security table
DISABLE_ASOF_VALID_TIME Procedure	Disables session level valid-time flashback
DISASSOCIATE_FBA Procedure	Disassociates the given table from the Flashback Time Travel
DROP_APPLICATION Procedure	Takes an application name and removes it from the list of applications
ENABLE_APPLICATION Procedure	Takes an application name and enables Flashback Time Travel on all the security tables for this application
ENABLE_AT_VALID_TIME Procedure	Enables session level valid time flashback
EXTEND_MAPPINGS Procedure	Extends time mappings to times in the past
GET_CURRENT_LIFESPAN_DIGEST Function	Generates the current lifespan digest for the specified row in a user table
GET_SYS_CONTEXT Function	Gets the context previously selected by the SET_CONTEXT_LEVEL Procedure
IMPORT_HISTORY Procedure	Imports history from a table called <code>TEMP_HISTORY</code> in the given schema.
LOCK_DOWN_APPLICATION Procedure	Takes an application name and makes all the security tables read-only. The group called <code>SYSTEM</code> cannot be locked
PURGE_CONTEXT Procedure	Purges the context to be saved selected by the SET_CONTEXT_LEVEL Procedure

Table 79-2 (Cont.) DBMS_FLASHBACK_ARCHIVE Package Subprograms

Subprogram	Description
REASSOCIATE_FBA Procedure	Reassociates the given table with the Flashback Time Travel
REGISTER_APPLICATION Procedure	Takes an application name and optionally a Time Travel, and registers an application for database hardening
REMOVE_TABLE_FROM_APPLICATION Procedure	Takes an application name and marks a table in it as no longer being a security table
SET_CONTEXT_LEVEL Procedure	Defines how much of the user context is to be saved
VERIFY_BLOCKCHAIN_LIFESPAN Procedure	Verifies the content of the current, historical, or all lifespans of user table rows

79.4.1 ADD_TABLE_TO_APPLICATION Procedure

This procedure takes an application name and adds a table to the application as a security table. If the application is enabled for Flashback Time Travel, then this table will also be enabled for Flashback Time Travel.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.ADD_TABLE_TO_APPLICATION (
    application_name      IN   VARCHAR2,
    table_name            IN   VARCHAR2,
    schema_name           IN   VARCHAR2 := NULL);
```

Parameters

Table 79-3 ADD_TABLE_TO_APPLICATION Procedure Parameters

Parameter	Description
application_name	Name of the application for which a table has been added as a security table
table_name	Name of the table to add as a security table for the given application
schema_name	Name of the schema containing the desired table. If no schema name is specified, the current schema is used.

79.4.2 CREATE_TEMP_HISTORY_TABLE Procedure

This procedure creates a table called `TEMP_HISTORY` with the correct definition in schema.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.CREATE_TEMP_HISTORY_TABLE (
    owner_name1          IN   VARCHAR2,
    table_name1          IN   VARCHAR2);
```

Parameters

Table 79-4 CREATE_TEMP_HISTORY_TABLE Procedure Parameters

Parameter	Description
owner_name1	Schema of the Flashback Time Travel-enabled table
table_name1	Name of the Flashback Time Travel-enabled table

79.4.3 DISABLE_APPLICATION Procedure

This procedure takes an application name and disables Flashback Time Travel on all of its security tables.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.DISABLE_APPLICATION (
    application_name          IN  VARCHAR2);
```

Parameters

Table 79-5 DISABLE_APPLICATION Procedure Parameters

Parameter	Description
application_name	Name of the application whose security tables will be disabled for Flashback Time Travel

79.4.4 DISABLE_ASOF_VALID_TIME Procedure

This procedure disables session level valid-time flashback.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.DISABLE_ASOF_VALID_TIME;
```

79.4.5 DISASSOCIATE_FBA Procedure

This procedure disassociates the given table from the Flashback Time Travel.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.DISASSOCIATE_FBA (
    owner_name      IN  VARCHAR2,
    table_name      IN  VARCHAR2);
```

Parameters

Table 79-6 DISASSOCIATE_FBA Procedure Parameters

Parameter	Description
owner_name	Schema of the Flashback Time Travel enabled base table

Table 79-6 (Cont.) DISASSOCIATE_FBA Procedure Parameters

Parameter	Description
table_name	Name of the Flashback Time Travel enabled base table

Exceptions

Table 79-7 DISASSOCIATE_FBA Procedure Exceptions

Exception	Description
ORA-55602	User table is not enabled for Flashback Time Travel
ORA-55634	Cannot acquire the lock on the table for disassociation

79.4.6 DROP_APPLICATION Procedure

This procedure takes an application name and removes it from the list of applications. As part of this procedure, Flashback Time Travel will be disabled on all security-enabled tables and all history data will be lost. The group called `SYSTEM` cannot be dropped.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.DROP_APPLICATION (
    application_name          IN  VARCHAR2);
```

Parameters

Table 79-8 DROP_APPLICATION Procedure Parameters

Parameter	Description
application_name	Name of the application for which a table has been added as a security table

79.4.7 ENABLE_APPLICATION Procedure

This procedure takes an application name and enables Flashback Time Travel on all the security tables for this application. Once an application is enabled, every change to an Flashback Time Travel enabled table will be tracked.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.ENABLE_APPLICATION (
    application_name          IN  VARCHAR2);
```

Parameters

Table 79-9 ENABLE_APPLICATION Procedure Parameters

Parameter	Description
application_name	Name of the application for which to enable Flashback Time Travel on all its security tables

79.4.8 ENABLE_AT_VALID_TIME Procedure

This procedure enables session level valid time flashback.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.ENABLE_AT_VALID_TIME (
    level          IN    VARCHAR2,
    query_time     IN    TIMESTAMP DEFAULT SYSTIMESTAMP);
```

Parameters

Table 79-10 ENABLE_AT_VALID_TIME Procedure Parameters

Parameter	Description
level	Options: <ul style="list-style-type: none"> All - Sets the visibility of temporal data to the full table, which is the default temporal table visibility CURRENT - Sets the visibility of temporal data to currently valid data within the valid time period at the session level ASOF - Sets the visibility of temporal data to data valid as of the given time as defined by the timestamp
query_time	Used only if level is ASOF. Data which is valid at this query_time will only be shown.

79.4.9 EXTEND_MAPPINGS Procedure

This procedure extends time mappings to times in the past.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.EXTEND_MAPPINGS;
```

79.4.10 GET_CURRENT_LIFESPAN_DIGEST Function

This function generates the current lifespan digest for the specified row in a user table.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.GET_CURRENT_LIFESPAN_DIGEST (
    rid          IN    VARCHAR2,
    start_scn    IN    RAW,
    xid          IN    RAW,
```



```

        op          IN  VARCHAR2,
        objno       IN  NUMBER)
RETURN RAW;
```

Parameters

Table 79-11 GET_CURRENT_LIFESPAN_DIGEST Function Parameters

Parameter	Description
rid	The ROWID of the user table row.
start_scn	The latest start SCN of the row.
xid	The latest transaction ID of the row.
op	The latest operation that is performed on the row.
objno	The table's object number.

The cryptographic hash is generated over all column values in the ascending order of the column IDs. Each column value is prefixed by column metadata. For more information, refer to the Appendix B.1 Column Content in Blockchain Tables section of the *Database Administrator's Guide*.

- Each row of the user table transitions through a series of "lifespans" created by transactions that commit changes to the row. The most recent lifespan is referred to as the "current lifespan," and all other previous lifespans are referred to as "historical lifespans."
- The historical lifespans are recorded into a Flashback Archive (FBA) internal table: SYS_FBA_HIST_<objno>.
- The current lifespans are always present in the user table. However, the relevant metadata of current lifespans are recorded in another FBA internal table: SYS_FBA_TCRV_<objno>.
- This API can be used to compute the current lifespan digest of the specific row of a user table using its associated metadata from the FBA internal table: SYS_FBA_TCRV_<objno>. A user can record this digest for detecting corruptions, if any, in the row data.

79.4.11 GET_SYS_CONTEXT Function

This function gets the context previously selected by the SET_CONTEXT_LEVEL Procedure.

Syntax

```

DBMS_FLASHBACK_ARCHIVE.GET_SYS_CONTEXT (
    xid          IN  RAW,
    namespace    IN  VARCHAR2,
    parameter    IN  VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 79-12 GET_SYS_CONTEXT Function Parameters

Parameter	Description
xid	Transaction identifier is an opaque handle to a transaction obtained from the versions query
namespace	Namespace
parameter	If undefined, the subprogram returns NULL

Related Topics

- [SET_CONTEXT_LEVEL Procedure](#)
This procedure defines how much of the user context is to be saved.

79.4.12 IMPORT_HISTORY Procedure

This procedure is called after invoking the CREATE_TEMP_HISTORY_TABLE procedure, and after the TEMP_HISTORY table is populated with user-generated history data

Caution:

Importing user-generated history can lead to inaccurate, or unreliable results. This procedure should only be used after consulting with Oracle Support.

The DBMS_FLASHBACK_ARCHIVE package does not support migration between databases. It allows you to move Flashback Time Travel history within the same database only, and not outside it. This package does not allow you to move Flashback Time Travel table data. It allows you to import customer history only and not Flashback Time Travel history.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.IMPORT_HISTORY (
  owner_name1      IN   VARCHAR2,
  table_name1      IN   VARCHAR2
  temp_history_name IN   VARCHAR2 DEFAULT 'TEMP_HISTORY',
  options          IN   BINARY_INTEGER DEFAULT 0);
```

Parameters

Table 79-13 IMPORT_HISTORY Procedure Parameters

Parameter	Description
owner_name1	Schema of the Flashback Time Travel-enabled table
table_name1	Name of the Flashback Time Travel-enabled table
temp_history_name	Optional temporary history table from which we import history data

Table 79-13 (Cont.) IMPORT_HISTORY Procedure Parameters

Parameter	Description
options	One (or a combination) of constants (NODROP, NOCOMMIT, and NODELETE) to specify if we want to drop, commit changes of, or truncate the temporary history table

Usage Notes

The database function `TIMESTAMP_TO_SCN` can be used to convert times to SCN when populating the temporary history table.

Related Topics

- [CREATE_TEMP_HISTORY_TABLE Procedure](#)
This procedure creates a table called `TEMP_HISTORY` with the correct definition in schema.

79.4.13 LOCK_DOWN_APPLICATION Procedure

This procedure takes an application name and makes all the security tables read-only. The group called `SYSTEM` cannot be locked.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.LOCK_DOWN_APPLICATION (
    application_name          IN  VARCHAR2);
```

Parameters

Table 79-14 LOCK_DOWN_APPLICATION Procedure Parameters

Parameter	Description
application_name	Name of the application for which a table has been added as a security table

79.4.14 PURGE_CONTEXT Procedure

This procedure purges the context to be saved selected by the `SET_CONTEXT_LEVEL` Procedure.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.PURGE_CONTEXT;
```

Related Topics

- [SET_CONTEXT_LEVEL Procedure](#)
This procedure defines how much of the user context is to be saved.

79.4.15 REASSOCIATE_FBA Procedure

This procedure reassociates the given table with the Flashback Time Travel.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.REASSOCIATE_FBA (
    owner_name      VARCHAR2,
    table_name      VARCHAR2);
```

Parameters

Table 79-15 REASSOCIATE_FBA Procedure Parameters

Parameter	Description
owner_name	Schema of the Flashback Time Travel enabled base table
table_name	Name of the Flashback Time Travel enabled base table

Exceptions

Table 79-16 REASSOCIATE_FBA Procedure Exceptions

Parameter	Description
ORA-55602	User table is not enabled for Flashback Time Travel
ORA-55636	Table definition validation failed

Usage Notes

- The procedure will signal an error if the base table and the history table do not have identical data definitions. For example, when columns are added or table is split, the resulting base table and history table need to have the same schema.
- The Flashback Time Travel internal history table schema has some row versions metadata columns. The procedure will signal an error if any metadata column is dropped by users.

79.4.16 REGISTER_APPLICATION Procedure

This procedure takes an application name and optionally a Flashback Archive, and registers an application for database hardening.

When database hardening is enabled, then all the security tables for that application are enabled for Flashback Archive using the given Flashback Archive. If no Flashback Archive is specified, the default Flashback Archive is used.

See Also:

Using Flashback Time Travel in *Oracle Database Development Guide* regarding database hardening

Syntax

```
DBMS_FLASHBACK_ARCHIVE.REGISTER_APPLICATION (
    application_name      IN   VARCHAR2,
    flashback_archive_name IN   VARCHAR2 := NULL);
```

Parameters

Table 79-17 REGISTER_APPLICATION Procedure Parameters

Parameter	Description
application_name	Name of the application which is being registered. The application SYSTEM is already registered when the package is created and is populated with list of tables needed for database hardening.
flashback_archive_name	Name of the Flashback Archive in which the historical data for the security tables for given application is stored. If no Flashback Archive is specified, the default Flashback Archive is used.

79.4.17 REMOVE_TABLE_FROM_APPLICATION Procedure

This procedure takes an application name and marks a table in it as no longer being a security table.

If the application is already enabled for Flashback Archive, Flashback Archive will be disabled for this table.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.REMOVE_TABLE_TO_APPLICATION (
    application_name      IN   VARCHAR2,
    table_name           IN   VARCHAR2,
    schema_name          IN   VARCHAR2 := NULL);
```

Parameters

Table 79-18 REMOVE_TABLE_FROM_APPLICATION Procedure Parameters

Parameter	Description
application_name	Name of the application for which a table is being removed from the list of security tables
table_name	Name of the table to mark as being no longer a security table for the given application
schema_name	Name of the schema containing the desired table. If no schema name is specified, the current schema is used.

79.4.18 SET_CONTEXT_LEVEL Procedure

This procedure defines how much of the user context is to be saved.

Syntax

```
DBMS_FLASHBACK_ARCHIVE.SET_CONTEXT_LEVEL (
    level          VARCHAR2);
```

Parameters

Table 79-19 SET_CONTEXT_LEVEL Procedure Parameters

Parameter	Description
level	Depending on how much of the user context needs to be saved: <ul style="list-style-type: none"> • ALL - the entire SYS_CONTEXT • TYPICAL - the user ID, global user ID and the hostname • NONE - nothing

79.4.19 VERIFY_BLOCKCHAIN_LIFESPAN Procedure

This procedure verifies the contents of the current lifespans, historical lifespans, or all lifespans of the user table rows that are protected using blockchain Flashback Archive (FBA). The verification is done by comparing the row's cryptographic hash with the ORAFBA_CURRENT_LIFESPAN_DIGEST\$ column value recorded in its previous historical lifespan.

Syntax

```
PROCEDURE verify_blockchain_lifespan(
    schema_name          IN  VARCHAR2,
    table_name           IN  VARCHAR2,
    number_of_lifespan_verified OUT NUMBER,
    type_of_lifespan     IN  NUMBER DEFAULT LIFESPAN_ALL);
```

Parameters

Table 79-20 VERIFY_BLOCKCHAIN_LIFESPAN Procedure Parameters

Parameter	Description
schema_name	The user schema name.
table_name	The user table name.
number_of_lifespan_verified	The number of lifespan rows verified.
type_of_lifespan	The type of lifespan to be verified. The following are the constants for the type_of_lifespan parameter. <ul style="list-style-type: none"> • LIFESPAN_CURRENT CONSTANT NUMBER := 1; • LIFESPAN_HISTORICAL CONSTANT NUMBER := 2; • LIFESPAN_ALL CONSTANT NUMBER := 3;

DBMS_FLASHBACK_ARCHIVE_MIGRATE

Using the `DBMS_FLASHBACK_ARCHIVE_MIGRATE` package, you can export and import the Flashback Archive base tables along with their history to another database using the Transportable Tablespaces.

Restrictions

You can use this migration package only on a non-CDB environment.

This chapter contains the following topics:

- [DBMS_FLASHBACK_ARCHIVE_MIGRATE Overview](#)
- [DBMS_FLASHBACK_ARCHIVE_MIGRATE Security Model](#)
- [DBMS_FLASHBACK_ARCHIVE_MIGRATE Operational Notes](#)
- [DBMS_FLASHBACK_ARCHIVE_MIGRATE Examples](#)
- [Summary of DBMS_FLASHBACK Subprograms](#)



See Also:

For detailed information about `DBMS_FLASHBACK_ARCHIVE_MIGRATE`:

- *Oracle Database Development Guide*
- *Oracle Database SQL Language Reference*.

80.1 DBMS_FLASHBACK_ARCHIVE_MIGRATE Overview

Using this package one can export and import the Flashback Archive base tables along with their history to another database using the Transportable Tablespaces.

80.2 DBMS_FLASHBACK_ARCHIVE_MIGRATE Security Model

The `DBMS_FLASHBACK_ARCHIVE_MIGRATE` package must be compiled on both the source and target databases as `SYS`. The source file is located at `?/rdbms/admin/crefbamig.sql`, using which the package can be created or compiled.

The export and import procedures must be executed as `SYS`. Since the package uses `DBMS_DATAPUMP`, `DBMS_LOCK`, `DBMS_SYSTEM`, `DBMS_SQL`, and `DBMS_SCHEDULER` PL/SQL packages, their Security Models are also applicable. Along with the user's FDA tables that are being exported the export function also exports the following `SYS` tables' data:

- `SMON_SCN_TIME`
- `SYS_FBA_FA`
- `SYS_FBA_TSFA`

- SYS_FBA_TRACKEDTABLES
- SYS_FBA_PARTITIONS
- SYS_FBA_USERS

80.3 DBMS_FLASHBACK_ARCHIVE_MIGRATE Operational Notes

This section describes how to use the `DBMS_FLASHBACK_ARCHIVE_MIGRATE` package.

Prerequisites

Database version \geq 11.2

If database version is 11.2, following conditions should be met:

- `shared_pool_size` \geq 500M
- `streams_pool_size` \geq 40M

or

- `sga_target` \geq 2G

Constants

None

1. On the source database run `flashback_archive.export` to export the given Flashback Archive enabled tables, their history tables and other relevant metadata information using the transportable tablespaces.
2. Copy the transportable tablespace export dump and relevant datafiles from the source to the target database.
3. On the target database run `flashback_archive.import` to finish the import of the exported Flashback Archive enabled table and their history.

Extraneous objects

The tablespaces which host the Flashback Archive enabled tables and Flashback archive itself may have totally unrelated objects. During the export all those objects are also exported as the process uses the transportable tablespaces feature. Such extraneous objects are listed in the table `SYS_FBA_EXTRANEUSOBS`.

Upon successful import, the extraneous objects are left as is. DBA should drop the extraneous objects.

Self Containment of Tablespaces

Since transportable tablespaces feature is used for export and import, all the objects in those tablespaces must be self contained. Otherwise, the function aborts.

Reduction in History Granularity

After the import, it is possible to see the reduction in the granularity of the history.

For example, The multiple history generated on the source database in a small duration of time may be coalesced into one history.

Logs

Export and import logs are available in the OS directory given as the input `data_pump_dir` argument.

The format of export logs is `fda_mig_exdpd_YYYY_MMDD_HH24MI.log`

The format of import logs is `fda_mig_impdp_YYYY_MMDD_HH24MI.log`

Operational Notes

- After export, involved tablespaces are kept in `READONLY` mode so that the DBA can copy the involved datafiles.
- Keeping the involved tablespaces in `READONLY` mode also ensures the exported tables are in immutable state during exporting and copying of the datafiles.
- The procedures provided cannot be used for exporting and importing to change the table block sizes. Because, internally these procedures use transportable tablespace export and import functionalities.
- After successful import, the tablespaces are again kept in `READONLY` mode. After the DBA verify the imported data, tablespaces can be made `READ-WRITE`.
- After successful import, the small tablespace that was given as input to the export operation can be dropped.

80.4 DBMS_FLASHBACK_ARCHIVE_MIGRATE Examples

This section illustrates exporting and importing Flashback Archive tables along with their history.

Step 1: Export the Flashback Archive enabled tables along with their history

In the example, three Flashback Archive enabled tables `USR1_TAB1`, `USR1_TAB2`, and `USR1_TAB3` are exported. These tables are spread across the `FA1_TBSP`, `FA1_TBSP_1`, `USR1_TBSP`, and `USR1_TBSP_1` tablespaces.

The `TTS_TBSP` is a small tablespace that holds export related metadata.

`/some/dir/with/enough/disk/space` is the OS directory where data pump files and logs are created.

```
set serveroutput on;
declare
  l_fda_tabs dbms_sql.varchar2_table;
begin
  l_fda_tabs(1) := upper('usr1_tab1');
  l_fda_tabs(2) := upper('usr1_tab2');
  l_fda_tabs(3) := upper('usr1_tab3');
  flashback_archive_migrate.export
  ( schema_owner => 'USR1'
  , fda_tables   => l_fda_tabs
  , tts         => 'TTS_TBSP'
  , data_pump_dir => '/some/dir/with/enough/disk/space'
  );
```

```
end;
/
```

On completion, the export output lists the datapump dump file and the datafiles that are to be copied to the target database to complete the import.

Step 2: Copy the datapump dump file and datafiles listed in the Step 1 to the target database.

Step 3: Import the Flashback Archive tables along with their history

In the example, three Flashback Archive enabled tables `USR1_TAB1`, `USR1_TAB2`, and `USR1_TAB3` are imported from `FA1_TBSP`, `FA1_TBSP_1`, `USR1_TBSP`, and `USR1_TBSP_1` tablespaces spread over the data files.

For the example given, following are the data files captured in the export (Step 1) log file:

- `/u01/app/oracle/oradata/TGT_DB/tts_tbsp.dbf`
- `/u01/app/oracle/oradata/TGT_DB/usr1_tbsp.dbf`
- `/u01/app/oracle/oradata/TGT_DB/usr1_tbsp1.dbf`
- `/u01/app/oracle/oradata/TGT_DB/FA1_tbsp.dbf`
- `/u01/app/oracle/oradata/TGT_DB/FA1_tbsp_1.dbf`

The `TTS_TBSP` is a small tablespace that holds the export related metadata whose datafile is `/ade/nkedlaya_fda2/rdbms/dbs/tts_tbsp.dbf`.

`/some/dir/with/enough/disk/space` is the OS directory where data pump files are created.

```
set serveroutput on;
declare
  l_data_files dbms_sql.varchar2_table;
begin
  l_data_files(1) := '/u01/app/oracle/oradata/TGT_DB/tts_tbsp.dbf';
  l_data_files(2) := '/u01/app/oracle/oradata/TGT_DB/usr1_tbsp.dbf';
  l_data_files(3) := '/u01/app/oracle/oradata/TGT_DB/usr1_tbsp1.dbf';
  l_data_files(4) := '/u01/app/oracle/oradata/TGT_DB/FA1_tbsp.dbf';
  l_data_files(5) := '/u01/app/oracle/oradata/TGT_DB/FA1_tbsp_1.dbf';

  flashback_archive_migrate.import
  ( schema_owner => 'USR1'
    , tts         => 'TTS_TBSP'
    , data_pump_dir => '/data/pump/dir/where/export/dump/file/resides'
    , tts_data_files => l_data_files
  );
end;
/
```

Upon successful completion of the import, Flashback Archive is enabled on the imported tables and the prior history is available along with the new history that will be generated.

80.5 Summary of DBMS_FLASHBACK Subprograms

This table lists the DBMS_FLASHBACK_ARCHIVE_MIGRATE subprograms and briefly describes them.

Table 80-1 DBMS_FLASHBACK_ARCHIVE_MIGRATE Package Subprograms

Subprogram	Description
EXPORT Procedure	This procedure exports the given Flashback Archive enabled base tables, their history, and related tablespaces.
EXPORT_ANALYZE Procedure	This procedure analyzes the given Flashback Archive enabled base tables, their history, and related tablespaces for self containment using transportable tablespace checks.
IMPORT Procedure	This procedure imports the Flashback Archive enabled base tables that were exported, their history, and related tablespaces.

80.5.1 EXPORT Procedure

This procedure exports the given Flashback Archive enabled base tables, their history, and related tablespaces.

Syntax

```
DBMS_FLASHBACK_ARCHIVE_MIGRATE.EXPORT (
  schema_owner      IN  VARCHAR2,
  fda_tables        IN  DBMS_SQL.VARCHAR2,
  tts               IN  VARCHAR2,
  data_pump_dir     IN  VARCHAR2,
  ignore_errors     IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 80-2 EXPORT Procedure Parameters

Parameter	Description
schema_owner	Flashback Archive enabled tables' owner
fda_tables	Array of Flashback Archive enabled tables
tts	A small tablespace that can be used to hold the export related metadata
data_pump_dir	The directory path in the operating system where the export dump is placed
ignore_errors	Ignore any transportable tablespaces errors. The default value is FALSE.

80.5.2 EXPORT_ANALYZE Procedure

This procedure analyzes the given Flashback Archive enabled base tables, their history, and related tablespaces for self containment using Transportable tablespace checks.

Syntax

```
DBMS_FLASHBACK_ARCHIVE_MIGRATE.EXPORT_ANALYZE (
  schema_owner      IN  VARCHAR2,
  fda_tables        IN  DBMS_SQL.VARCHAR2,
  tts               IN  VARCHAR2);
```

Parameters

Table 80-3 EXPORT_ANALYZE Procedure Parameters

Parameter	Description
schema_owner	Flashback Archive enabled tables' owner
fda_tables	Array of Flashback Archive enabled tables
tts	A small tablespace that can be used to hold the export related metadata

80.5.3 IMPORT Procedure

This procedure Imports the Flashback Archive enabled base tables that were exported, their history, and related tablespaces.

Syntax

```
DBMS_FLASHBACK_ARCHIVE_MIGRATE.IMPORT (
  schema_owner      IN  VARCHAR2,
  tts               IN  VARCHAR2,
  data_pump_dir     IN  VARCHAR2,
  tts_data_files    IN  DBMS_SQL.VARCHAR2_TABLE);
```

Parameters

Table 80-4 IMPORT Procedure Parameters

Parameter	Description
schema_owner	Flashback Archive enabled tables' owner
tts	A small tablespace that can be used to hold the export related metadata
data_pump_dir	The directory path in the operating system where the export dump is placed
tts_data_files	The data files list of TTS exported tablespaces.

81

DBMS_FREQUENT_ITEMSET

The DBMS_FREQUENT_ITEMSET package enables frequent itemset counting. The two functions are identical except in the input cursor format difference.

This chapter contains the following topics:

- [Summary of DBMS_FREQUENT_ITEMSET Subprograms](#)

81.1 Summary of DBMS_FREQUENT_ITEMSET Subprograms

The DBMS_FREQUENT_ITEMSET package includes the FI_HORIZONTAL function and FI_TRANSACTIONAL function subprograms.

Table 81-1 DBMS_FREQUENT_ITEMSET Package Subprograms

Subprogram	Description
FI_HORIZONTAL Function	Counts all frequent itemsets given a cursor for input data which is in 'HORIZONTAL' row format, support threshold, minimum itemset length, maximum itemset length, items to be included, items to be excluded
FI_TRANSACTIONAL Function	Counts all frequent itemsets given a cursor for input data which is in 'TRANSACTIONAL' row format, support threshold, minimum itemset length, maximum itemset length, items to be included, items to be excluded

81.1.1 FI_HORIZONTAL Function

The purpose of this table function is to count all frequent itemsets given a cursor for input data which is in 'HORIZONTAL' row format, support threshold, minimum itemset length, maximum itemset length, items to be included, items to be excluded. The result will be a table of rows in form of itemset, support, length, total transactions counted.

In 'HORIZONTAL' row format, each row contains all of the item ids for a single transaction. Since all of the items come together, no transaction id is necessary.

The benefit of this table function is that if an application already has data in horizontal format, the database can skip the step of transforming rows that are in transactional format into horizontal format.

Syntax

```
DBMS_FREQUENT_ITEMSET.FI_HORIZONTAL(  
    tranx_cursor      IN    SYSREFCURSOR,  
    support_threshold IN    NUMBER,  
    itemset_length_min IN    NUMBER,  
    itemset_length_max IN    NUMBER,  
    including_items   IN    SYS_REFCURSOR DEFAULT NULL,  
    excluding_items   IN    SYS_REFCURSOR DEFAULT NULL)
```

```

RETURN TABLE OF ROW (
    itemset [Nested Table of Item Type DERIVED FROM tranx_cursor],
    support      NUMBER,
    length       NUMBER,
    total_tranx  NUMBER);

```

Parameters

Table 81-2 FI_HORIZONTAL Function Parameters

Parameter	Description
tranx_cursor	The cursor parameter that the user will supply when calling the function. There is no limits on the number of returning columns. Each column of cursor represents an item. All columns of the cursor must be of the same datatype. The item id must be number or character type (for example, VARCHAR2(n)).
support_threshold	A fraction number of total transaction count. An itemset is termed "frequent" if [the number of transactions it occurs in] divided by [the total number of transactions] exceed the fraction. The parameter must be a NUMBER.
itemset_length_min	The minimum length for interested frequent itemset. The parameter must be a NUMBER between 1 and 20, inclusive.
itemset_length_max	The maximum length for interested frequent itemset. This parameter must be a NUMBER between 1 and 20, inclusive, and must not be less than itemset_length_min.
including_items	A cursor from which a list of items can be fetched. At least one item from the list must appear in frequent itemsets that are returned. The default is NULL.
excluding_items	A cursor from which a list of items can be fetched. No item from the list can appear in frequent itemsets that are returned. The default is NULL.

Return Values

Table 81-3 FI_HORIZONTAL Return Values

Parameter	Description
support	The number of transactions in which a frequent itemset occurs. This will be returned as a NUMBER.
itemset	A collection of items which is computed as frequent itemset. This will be returned as a nested table of item type which is the item column type of the input cursor.
length	Number of items in a frequent itemset. This will be returned as a NUMBER.
total_tranx	The total transaction count. This will be returned as a NUMBER.

Example

Suppose you have a table `horiz_table_in`.

```
horiz_table_in(iid1 VARCHAR2(30), iid2 VARCHAR2(30), iid3 VARCHAR2(30), iid4
VARCHAR2(30), iid5 VARCHAR2(30));
```

and the data in `horiz_table_in` looks as follows:

```
('apple', 'banana', NULL, NULL, NULL)
('apple', 'milk', 'banana', NULL, NULL)
('orange', NULL, NULL, NULL, NULL)
```

Suppose you want to find out what combinations of items is frequent with a given support threshold of 30%, requiring itemset containing at least one of ('apple','banana','orange'), but excluding any of ('milk') in any itemset. You use the following query:

```
CREATE TYPE fi_varchar_nt AS TABLE OF VARCHAR2(30);
SELECT CAST(itemset as FI_VARCHAR_NT)itemset, support, length, total_tranx
  FROM table(DBMS_FREQUENT_ITEMSET.FI_HORIZONTAL(
    CURSOR(SELECT iid1, iid2, iid3, iid4, iid5
           FROM horiz_table_in),
    0.3,
    2,
    5,
    CURSOR(SELECT * FROM table(FI_VARCHAR_NT
                              ('apple','banana','orange'))),
    CURSOR(SELECT * FROM table(FI_VARCHAR_NT('milk'))));
```

81.1.2 FI_TRANSACTIONAL Function

This procedure counts all frequent itemsets given a cursor for input data which is in 'TRANSACTIONAL' row format, support threshold, minimum itemset length, maximum itemset length, items to be included, items to be excluded. The result will be a table of rows in form of itemset, support, length, total number of transactions.

In 'TRANSACTIONAL' row format, each transaction is spread across multiple rows. All the rows of a given transaction have the same transaction id, and each row has a different item id. Combining all of the item ids which share a given transaction id results in a single transaction.

Syntax

```
DBMS_FREQUENT_ITEMSET.FI_TRANSACTIONAL (
  tranx_cursor      IN      SYSREFCURSOR,
  support_threshold IN      NUMBER,
  itemset_length_min IN     NUMBER,
  itemset_length_max IN     NUMBER,
  including_items   IN      SYS_REFCURSOR DEFAULT NULL,
  excluding_items   IN      SYS_REFCURSOR DEFAULT NULL)
RETURN TABLE OF ROW (
  itemset [Nested Table of Item Type DERIVED FROM tranx_cursor],
  support      NUMBER,
  length       NUMBER,
  total_tranx  NUMBER);
```

Parameters

Table 81-4 *FI_TRANSACTIONAL Function Parameters*

Parameter	Description
<code>tranx_cursor</code>	The cursor parameter that the user will supply when calling the function. It should return two columns in its returning row, the first column being the transaction id, the second column being the item id. The item id must be number or character type (for example, <code>VARCHAR2(n)</code>).
<code>support_threshold</code>	A fraction number of total transaction count. An itemset is termed "frequent" if [the number of transactions it occurs in] divided by [the total number of transactions] exceed the fraction. The parameter must be a <code>NUMBER</code> .
<code>itemset_length_min</code>	The minimum length for interested frequent itemset. The parameter must be a <code>NUMBER</code> between 1 and 20, inclusive.
<code>itemset_length_max</code>	The maximum length for interested frequent itemset. This parameter must be a <code>NUMBER</code> between 1 and 20, inclusive, and must not be less than <code>itemset_length_min</code> .
<code>including_items</code>	A cursor from which a list of items can be fetched. At least one item from the list must appear in frequent itemsets that will be returned. The default is <code>NULL</code> .
<code>excluding_items</code>	A cursor from which a list of items can be fetched. No item from the list can appear in frequent itemsets that will returned. The default is <code>NULL</code> .

Return Values

Table 81-5 *FI_TRANSACTIONAL Return Values*

Parameter	Description
<code>support</code>	The number of transactions in which a frequent itemset occurs. This will be returned as a <code>NUMBER</code> .
<code>itemset</code>	A collection of items which is computed as frequent itemset. This will be returned as a nested table of item type which is the item column type of the input cursor.
<code>length</code>	Number of items in a frequent itemset. This will be returned as a <code>NUMBER</code> .
<code>total_tranx</code>	The total transaction count. This will be returned as a <code>NUMBER</code> , and will be the same for all returned rows, similar to a reporting aggregate.

Usage Notes

Applications must predefine a nested table type of the input item type and cast the output itemset into this predefined nested table type before further processing, such as loading into a table.

Examples

Suppose that the input table `tranx_table_in` looks as follows:


```
(1, 'apple')
(1, 'banana')
(2, 'apple')
(2, 'milk')
(2, 'banana')
(3, 'orange')
```

and the user is trying to find itemsets that satisfy a support-threshold of 60% and have the itemset-length greater than 1 (namely, (apple, banana)).

The output of this function would contain the following output row:

```
itemset=('apple','banana'), support=2, length=2, total_tranx=3
```

You need to create a nested table of item type before you submit a query to perform the frequent itemset counting. In this example, since item is of VARCHAR2(30), you must create a nested table of VARCHAR2(30):

```
CREATE TYPE fi_varchar_nt AS TABLE OF VARCHAR2(30);
SELECT CAST(itemset as FI_VARCHAR_NT) itemset, support, length, total_tranx
FROM table(DBMS_FREQUENT_ITEMSET.FI_TRANSACTIONAL(
    cursor(SELECT tid, iid FROM tranx_table_in),
    0.6,
    2,
    5,
    NULL,
    NULL));
```

Here is another example to illustrate how to include certain items and exclude certain items in the counting.

```
SELECT CAST(itemset as FI_VARCHAR_NT) itemset, support, length, total_tranx
FROM table(DBMS_FREQUENT_ITEMSET.FI_TRANSACTIONAL(
    CURSOR(SELECT tid, iid FROM tranx_table_in),
    0.6,
    2,
    5,
    CURSOR(SELECT * FROM table(FI_VARCHAR_NT
        ('apple','banana','orange'))),
    CURSOR(SELECT * FROM table(FI_VARCHAR_NT('milk'))));
```

Using the including/excluding items parameter, you are able to further optimize the execution by ignoring itemsets that are not expected by application.

You can also use transactional output through collection unnesting:

```
SELECT
    bt.setid, nt.*
FROM
    (SELECT cast(Itemset as FI_VARCHAR_NT) itemset, rownum setid
    FROM table(
        DBMS_FREQUENT_ITEMSET.FI_TRANSACTIONAL(
            CURSOR(SELECT tid, iid FROM tranx_table_in), 0.6, 2, 5,
            NULL, NULL)) bt,
    table(bt.itemset) nt;
```

If you want to use an insert statement to load frequent itemsets into a nested table, it is better to use the NESTED_TABLE_FAST_INSERT hint for performance:

```

CREATE TABLE fq_nt (coll FI_VARCHAR_NT) NESTED TABLE coll STORE AS
  coll_nest;
INSERT /*+ NESTED_TABLE_FAST_INSERT */ INTO fq_nt
  SELECT cast(itemset as FI_VARCHAR_NT)
  FROM table(DBMS_FREQUENT_ITEMSET.FI_TRANSACTIONAL(
    cursor(SELECT tid, iid FROM tranx_table_in), 0.6, 2, 5,
    NULL, NULL));

```

Note that if you want to use the package inside a PL/SQL cursor, you must cast the return type of the table function:

```

CREATE TYPE fi_res AS OBJECT (
  itemset      FI_VARCHAR_NT,
  support      NUMBER,
  length       NUMBER,
  total_tranx  NUMBER
);
/
CREATE TYPE fi_coll AS TABLE OF fi_res;
/

DECLARE
  cursor freqC is
    SELECT Itemset
    FROM table(
      CAST(DBMS_FREQUENT_ITEMSET.FI_TRANSACTIONAL(
        cursor(SELECT tid, iid FROM tranx_table_in), 0.6, 2, 5,
        NULL, NULL) AS fi_coll));
  coll_nt  FI_VARCHAR_NT;
  num_rows int;
  num_itms int;
BEGIN
  num_rows := 0;
  num_itms := 0;
  OPEN freqC;
  LOOP
    FETCH freqC INTO coll_nt;
    EXIT WHEN freqC%NOTFOUND;
    num_rows := num_rows + 1;
    num_itms := num_itms + coll_nt.count;
  END LOOP;
  CLOSE freqC;
  DBMS_OUTPUT.PUT_LINE('Totally ' || num_rows || ' rows ' || num_itms || '
items were produced.');
```

DBMS_FS

The `DBMS_FS` package for performing operations on an Oracle file system (make, mount, unmount and destroy operations) in an Oracle database.

This chapter contains the following topics:

- [DBMS_FS Overview](#)
- [DBMS_FS Security Model](#)
- [Summary of DBMS_FS Subprograms](#)

82.1 DBMS_FS Overview

The `DBMS_FS` package contains Oracle file system (OFS) procedures that you can use to create, mount, unmount, and destroy an Oracle file system.

Starting 19c release, the file systems are supported by PDB. Oracle Database supports maximum 5 file systems per PDB and 1000 file systems in total.

The `DBMS_FS` package enables applications to access database objects from a universal client such as an NFS server. This feature interfaces with Oracle SecureFiles to provide the file system access.



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for a detailed description of managing an NFS server in Oracle Database

82.2 DBMS_FS Security Model

You must have the `SYSDBA` administrative privilege to use the `DBMS_FS` package.

The operations that you perform using the `DBMS_FS` package are equivalent to the file system operations that are performed in an operating system by the root user. Access to the individual file system that is created and mounted by this package is enforced using Access Control Lists (ACLs) and the permissions on the mounted directories to the operating system user.

82.3 Summary of DBMS_FS Subprograms

The following table lists the `DBMS_FS` subprograms and briefly describes them.

Table 82-1 DBMS_FS Subprograms

Subprogram	Description
DESTROY_ORACLE_FS Procedure	Destroys an Oracle file system, using the <code>fstype</code> and of name <code>fsname</code> .
FS_EXISTS Procedure	Validates if the specified file system exists. Run this procedure before executing any mount, unmount or destroy operation.
LIST_FILES Procedure	Lists all the files within a specified directory in a file system.
MAKE_ORACLE_FS Procedure	Creates a file system of type specified by <code>fstype</code> and of name <code>fsname</code> .
MOUNT_ORACLE_FS Procedure	Mounts an Oracle file system on the specified mount point.
UNMOUNT_ORACLE_FS Procedure	Unmounts an Oracle file system on the specified mount point.

82.3.1 DESTROY_ORACLE_FS Procedure

This procedure destroys an Oracle file system and then frees the resources that were associated with it. Run the `dbms_fs.destroy_oracle_fs()` procedure to destroy file systems that are no longer in use.

Syntax

```
DBMS_FS.DESTROY_ORACLE_FS (
    fstype      IN VARCHAR2,
    fsname      IN VARCHAR2);
```

Parameters

Table 82-2 DBMS_FS Parameters

Parameter	Description
<code>fstype</code>	File system type. Oracle File System (OFS) and Database File System (DBFS) are supported.
<code>fsname</code>	Name of the file system

Usage Notes

- You can find information about the currently mounted file systems by querying the `V$OFSMOUNT` dynamic view.
- For more information about the file system types, see the `fstype` description in [MAKE_ORACLE_FS Procedure](#).
- Before you run the `DBMS_FS.DESTROY_ORACLE_FS` procedure, you must unmount the file system by using the `DBMS_FS.UNMOUNT_ORACLE_FS` procedure. If you run this procedure on a file system that is still in use, it results in an error.
- After you run `DBMS_FS.DESTROY_ORACLE_FS`, Oracle Database destroys the file system and frees the associated resources.

Example

The following sample code shows how to destroy a DBFS file system, `dbfs_fs1`.

```
BEGIN
  DBMS_FS.DESTROY_ORACLE_FS (
    fstype      => 'dbfs',
    fsname      => 'dbfs_fs1');
END;
/
```

82.3.2 FS_EXISTS Procedure

Use the `dbms_fs.fs_exists()` procedure to validate if the given file system exists before executing any mount, unmount or destroy operation.

Syntax

```
DBMS_FS.FS_EXISTS (
  fsname      IN VARCHAR2);
```

Parameters

Table 82-3 DBMS_FS Parameters

Parameter	Description
<code>fsname</code>	Name of the file system.

Example

The following sample code shows how to check if a file system exists with the specified file system name, `data`.

```
SQL> declare
  fsname varchar2(64) := 'data';
  fsexists integer;

  begin
    fs_exists := dbms_fs.fs_exists(fsname);
    dbms_output.put_line('fs exists: ' || fsexists);
  end;
/
SQL> select dbms_fs.fs_exists('data') from dual;
```

82.3.3 LIST_FILES Procedure

Run the `dbms_fs.list_files()` procedure to list all the files within a specified directory in a file system.

Syntax

```
DBMS_FS.LIST_FILES (
    fsname      IN VARCHAR2,
    dirpath     IN VARCHAR2);
```

Parameters

Table 82-4 DBMS_FS Parameters

Parameter	Description
fsname	Name of the file system.
dirpath	Path to an existing directory in the file system. Enter a path that is relative to the mount path. For example, if you enter '/' as the directory path, it is relative to the mount path.

Example

The following sample code shows how to list all the files within a specified directory in a file system.

```
SQL> select * from DBMS_FS.LIST_FILES ('data', '/') from dual;
```

Where, the path to the directory ('/') is relative to the mount path.

82.3.4 MAKE_ORACLE_FS Procedure

This procedure creates a new file system of type `DBFS` or `OFS`, on top of an existing Oracle tablespace or other database object.

Syntax

```
DBMS_FS.MAKE_ORACLE_FS (
    fstype      IN VARCHAR2,
    fsname      IN VARCHAR2,
    fsoptions   IN VARCHAR2);
```

Parameters

Table 82-5 DBMS_FS Parameters

Parameter	Description
fstype	File system type. Enter one of the following values: <ul style="list-style-type: none"> <code>ofs</code>—to create an Oracle File System <code>dbfs</code>—to create a Database File System
fsname	Name of the file system. Enter a string no longer than 256 characters, using alphanumeric characters.
fsoptions	Specify an existing tablespace to use for the Oracle file system, using the following format: <p>"tablespace=tablespace_name"</p>

Usage Notes

- If you want to create a database file system (DBFS), then you must run the `dbfs_create_filesystem.sql` script, which in turn calls the `dbfs_create_filesystem_advanced.sql` script. By default, this script is in the `$ORACLE_HOME/rdbms/admin` directory. When you run this script, provide the name of an existing tablespace and a name for the file system that will be stored in the database. The size of the file system will be the same as the table size. For example, to create a file system in the `dbfs_ts` tablespace, in the file system `dbfs_tab`:

```
@/$ORACLE_HOME/rdbms/admin/dbfs_create_filesystem.sql dbfs_ts dbfs_tab
```

After you run this script, you can use the other procedures in the `DBMS_FS` package to mount, unmount, and destroy the file system.

Note:

Starting Oracle Database 19.3.1.0 release, the `DBMS_FS.MAKE_ORACLE_FS` is used to create a DBFS filesystem; hence no auxiliary SQL script is needed to create a DBFS filesystem.

- Running the `DBMS_FS.MAKE_ORACLE_FS` procedure on the database instance is equivalent to running the `mkfs` command by root in an operating system.
- The tablespace that you specified in the `fsoptions` parameter must already exist before you execute the `DBMS_FS.MAKE_ORACLE_FS` procedure. To find existing tablespaces, query the `DBA_TABLESPACES` data dictionary view.
- The size of the file system is the same size as this tablespace.

Example

The following example shows how to create a DBFS file system named `dbfs_fs1` in the tablespace `dbfs_fs1_tbsp`.

```
BEGIN
  DBMS_FS.MAKE_ORACLE_FS (
    fstype      => 'dbfs',
    fsname     => 'dbfs_fs1',
    fsoptions  => 'TABLESPACE=dbfs_fs1_tbsp');
END;
/
```

82.3.5 MOUNT_ORACLE_FS Procedure

Use the `dbms_fs.mount_oracle_fs()` procedure to mount an Oracle file system or OFS managed file system on the specified mount point.

Before you begin, complete the following checks to ensure that:

- You have created the file system using the `dbms_fs.make_oracle_fs()` procedure.
- The mount point that you specify exists in the local node.
- The Oracle user has access permissions.

- The mount path is empty, which means that the directory specified by the mount point does not have any files.

Oracle supports an extensive list of mount options that you can use to have better control on resources and achieve good performance. When you use the `persist` mount option, file systems are automatically remounted every time instance restarts. Since OFSD is a non-fatal background process, it gets automatically restarted after the death of a process. File systems that are mounted at the time of the death of the OFSD process are automatically remounted after starting a new OFSD process. This ensures continuous availability of the mounted file systems even in the case of an error.

To improve the throughput, OFSD has its own local cache for writes and reads. The write cache uses 8 (1 MB) buffers per file connection, and it can use up to 256 MB per file system. You can modify this value through the mount option, `wcache_size`. A read-ahead algorithm is implemented for read operation and it uses 2 (1 MB) per file connection and it can use up to 256 MB per file system. Use the mount option, `rcache_size`, to modify this value.

The read-write cache is maintained per node, so this provides local cache consistency. In an RAC environment, consistency is guaranteed only after the `flush()` or `close()` operation is performed on the file. When two different processes on two different RAC nodes modify a single file and write to the same offset, then the first process that performs the `close()` operation on the file will have its data written into the file.

Syntax

```
DBMS_FS.MOUNT_ORACLE_FS (
  fstype           IN VARCHAR2,
  fsname          IN VARCHAR2,
  mount_point     IN VARCHAR2,
  mount_options   IN VARCHAR2);
```

Parameters

Table 82-6 MOUNT_ORACLE_FS Procedure Parameters

Parameter	Description
<code>fstype</code>	File system type. Oracle File System (OFS) and Database File System (DBFS) are supported.
<code>fsname</code>	Name of the file system. Enter a string no longer than 256 characters, using alpha numeric characters.
<code>mount_point</code>	Local directory where the file system should be mounted. This directory must already exist. Enter an absolute path. The maximum number of mount points that you can create is 5 mount points per PDB and 1000 mount points per instance.
<code>mount_options</code>	Comma-separated mount options, listed in Table 82-7 .

Usage Notes

Table 82-7 Supported Mount Options for the MOUNT_ORACLE_FS procedure

Mount Option	Usage Description
db_access	Optimizes the read and write operations performed by database process when you access files managed through OFS or DBFS.
default_permissions	Enables permission check and restrict access based on file mode. This option is useful with the <code>allow_other</code> mount option.
allow_other	Allows other users apart from the operating system user that did the mount can access the files. This will be used in conjunction with permission checks in determining the file access. This option requires setting the <code>user_allow_other</code> parameter in the <code>/etc/fuse.conf</code> configuration file on Linux.
max_read	Maximum size of the read operation. No maximum size is set by default.
max_write	Maximum write size in a single request. The default is 128K.
direct_io	Indicates to the operating system kernel not use file system cache.
nopersist	Does not store the mount options for use in next instance start up.
persist	Stores the mount entry persistently so that on subsequent instance start up it will be automatically mounted again. This option is supported for both <code>ofs</code> and <code>dbfs</code> .
ro	Mounts the file system in read-only mode. Files cannot be modified.
rw	Mounts the file system as read-write. This is the default.
nosuid	Specifies that the file system cannot contain set userid files.
suid	Specifies that the file system can contain set userid files. This is the default.
ofs_cache_attr_time	Specifies the OFS cache attribute timeout in seconds. Default value is 5 seconds. The permissible range is 0 to <code>UB4MAXVAL</code> . Oracle recommends that you specify low values when you use RAC. If you specify a larger value, such as 1000, the attributes from the files may not match if the same file system is mounted in another path. This is due to the aggressive caching that is done in the OFS layer.
exec	Allows executing a file under the mount path. This option is enabled by default.
noexec	Prohibits executing a file under the mount path. Use this option to disallow any file to be executed in the file system.
atime	Maintains information about the time when the file was accessed. This option is enabled by default.
noatime	Does not maintain information about the time when the was file accessed. When you enable this option, it increases throughput as the access time is not updated for every read operation.
max_readahead	Sets the maximum size, in bytes, for the read-ahead operations. The default value depends on the versions of the kernel and FUSE in your operating system.
sync_read	Permits only synchronous reads. If you use this option, it disables read-ahead caching for OFS.

Table 82-7 (Cont.) Supported Mount Options for the MOUNT_ORACLE_FS procedure

Mount Option	Usage Description
<code>async_read</code>	Permits asynchronous reads. All read and write operations in the file system as performed asynchronously. This is the default option for FUSE versions 7.6 or later.
<code>dirsync</code>	Makes all directory operations synchronous. FUSE utilizes this option.
<code>big_writes</code>	Permits writes larger than 4KB. This is the default option for FUSE versions 7.6 or later.
<code>no_big_writes</code>	Does not allow writes larger than 4KB. This is not a recommended option for OFS.
<code>xattr_enabled</code>	Enables the use of extended attributes. Specify this option only if you want to use extended attributes.
<code>kernel_cache_mode=writeback</code>	Makes the Linux kernel cache behave like a writeback cache when you enter <code>writeback</code> as the value for this option. A writeback cache provides better performance when there are many small input-output requirements. FUSE utilizes this option. Permitted values are: <code>writeback</code> and <code>write-through</code> . The default value is <code>write-through</code> .
<code>kernel_cache_attr_time=N</code>	Sets the Linux kernel attribute cache timeout to N seconds. The default value is infinity. Oracle recommends that you set low values for RAC setup.
<code>wcache_size=N</code>	Sets the OFS write cache size to N bytes. The default value is 256 MB.
<code>rcache_size</code>	Sets the OFS read cache size to N bytes. The default value is 256 MB.
<code>statfs_ctime</code>	Sets the time, in seconds, for which <code>statfs()</code> gets cached in OFS. The default value is 300 seconds or 5 minutes. Oracle recommends that you use the default value to avoid repeated <code>statfs()</code> calls from FUSE.
<code>no_rbt_cache</code>	Disallows the use of a red-black tree for caching directory entries. By default, a red-black tree is used to ensure accuracy when there are concurrent updates while listing directories.
<code>posix_locks</code>	Implements the POSIX file locks in OFS. This is not supported by OFS. If you want to use the file-locking mechanism, use the <code>noposix_locks</code> option.
<code>noposix_locks</code>	Implements POSIX file locks in Linux kernel. This is the default option.

 **Note:**

The following options are exclusive options and cannot be used together:

- `nopersist/persist`
- `ro/rw`
- `nosuid/suid`
- `exec/noexec`
- `atime/noatime`
- `big_writes/no_big_writes`
- `sync_read/async_read`
- `posix_locks/noposix_locks`

Usage Notes

- This procedure makes the file system visible in the local database instance.
- For more information about the file system types, see the `fstype` description in [MAKE_ORACLE_FS Procedure](#).
- You can find information about currently mounted file systems by querying the `V$OFSMOUNT` dynamic view.
- Run the `DBMS_FS.MOUNT_ORACLE_FS` procedure on a file system that has already been created with `DBMS_FS.MAKE_ORACLE_FS` in the local computer node where the Oracle database instance is running. You cannot run this procedure on file systems that were created outside of Oracle Database.
- You cannot update the mount options after mounting the file system. If you want to change the mount options later, you'll have to unmount the file system, and then remount it.

Example 1: Mounts a DBFS file system

Mounts a DBFS file system at `/oracle/dbfs/testfs`.

```
BEGIN
  DBMS_FS.MOUNT_ORACLE_FS (
    fstype          => 'dbfs',
    fsname          => 'dbfs_fs1',
    mount_point     => '/oracle/dbfs/testfs',
    mount_options   => 'default_permissions, allow_other, db_access');
END;
```

Example 2: Persist mount a DBFS file system

Persist mounts a DBFS file system at `/oracle/dbfs/testfs`.

```
BEGIN
  DBMS_FS.MOUNT_ORACLE_FS (
    fstype          => 'dbfs',
    fsname          => 'dbfs_fs1',
    mount_point     => '/oracle/dbfs/testfs',
```

```
mount_options => 'default_permissions, allow_other, persist, db_access');
END;
```

82.3.6 UNMOUNT_ORACLE_FS Procedure

This procedure unmounts an Oracle file system on the specified mount point.

File systems that are mounted in a PDB are automatically unmounted when the PDB is closed. You can also use `dbms_fs.unmount_oracle_fs()` to explicitly unmount an Oracle file system that you have mounted through OFS.

Syntax

```
DBMS_FS.UNMOUNT_ORACLE_FS (
  fsname           IN VARCHAR2,
  mount_point      IN VARCHAR2,
  unmount_options  IN VARCHAR2);
```

Table 82-8 UNMOUNT_ORACLE_FS Procedure Parameters

Parameter	Description
<code>fsname</code>	Name of the file system.
<code>mount_point</code>	Local directory where the file system had been mounted. Enter an absolute path.
<code>unmount_options</code>	Optionally, enter <code>force</code> or <code>clean</code> . Enter <code>force</code> to unmount the file system forcibly. This setting prevents new requests from being sent to the file system. All pending requests on the file system are either completed or canceled. If you omit this setting, then attempts to unmount a busy file system cause an <code>EBUSY</code> error. Enter <code>clean</code> if you don't want the file system to be remounted when the OFSD restarts.

Usage Notes

- Before you unmount the file system, ensure that all applications that use this file system are shut down. Also ensure that no processes reference the mounting file system.
- You can find information about the currently mounted file systems by querying the `V$OFSMOUNT` dynamic view.
- For more information about the file system types, see the `fstype` description in [MAKE_ORACLE_FS Procedure](#).
- After unmounting the file system, the write permissions are removed from the mount point to prevent applications from writing to the underlying file system instead of the OFS supported file systems.
- When an Oracle instance is shut down in normal immediate mode, then all the mounted file systems are automatically unmounted.
- If a file system is mounted with the `MOUNT_ORACLE_FS` procedure with the `persist` option, it will be automatically mounted again when the database instance starts or the PDB is plugged. If this file system is unmounted by executing

DBMS_FS.UNMOUNT_ORACLE_FS, it will remain unmounted even if the `persist` option was used to mount it.

- If you perform a `SHUTDOWN ABORT`, then the file system may still show as mounted but it may not be accessible. In this case, you can unmount the system manually by calling the `umount` command at the operating system level or the `fusermount` procedure on Linux systems.
- Do not use `fusermount -u` to unmount a running file system as it causes inconsistency in Oracle views, such as `v$ofsmount`.
- You can export the local mount point of an Oracle file system to point to the remote system, and then NFS mount the file system from the remote system by using the operating system `mount` command. The `DBMS_FS.MOUNT_ORACLE_FS` procedure is similar to `mount` commands that are used for other local file systems.
- For better security, Oracle recommends that you use access control lists (ACLs) and Kerberos to control access to sensitive data.
- Do not attempt to unmount the file system from the operating system level. Doing so can leave the Oracle Database-created file system internal tables in an inconsistent state.

Example

The following sample code unmounts a DBFS mounted file system at `/oracle/dbfs/testfs`.

```
BEGIN
  DBMS_FS.UNMOUNT_ORACLE_FS (
    fsname          => 'dbfs_fs1',
    mount_point     => '/oracle/dbfs/testfs',
    mount_options   => 'force');
END;
```

DBMS_GOLDENGATE_ADM

The `DBMS_GOLDENGATE_ADM` package provides subprograms to configure and manage Oracle GoldenGate conflict detection and resolution.

This chapter contains the following topics:

- [Using DBMS_GOLDENGATE_ADM](#)
- [Summary of DBMS_GOLDENGATE_ADM Subprograms](#)

83.1 Using DBMS_GOLDENGATE_ADM

This section contains topics which relate to using the `DBMS_GOLDENGATE_ADM` package.

- [DBMS_GOLDENGATE_ADM Overview](#)
- [DBMS_GOLDENGATE_ADM Security Model](#)

83.1.1 DBMS_GOLDENGATE_ADM Overview

The `DBMS_GOLDENGATE_ADM` package provides interfaces to configure automatic conflict detection and resolution in an Oracle GoldenGate configuration that replicates tables between Oracle databases.

When more than one replica of a table allows changes to the table, a conflict can occur when a change is made to the same row in two different databases at nearly the same time. Oracle GoldenGate replicates changes using row logical change records (LCRs). It detects a conflict by comparing the old values in the row LCR with the current values of the corresponding table row identified by the key columns. If any column value does not match, then there is a conflict. After a conflict is detected, Oracle GoldenGate can resolve the conflict by overwriting values in the row with some values from the row LCR, ignoring the values in the row LCR, or computing a delta to update the row values.

XStream inbound servers and outbound servers can be used in an XStream configuration in a multitenant container database (CDB). A CDB is an Oracle database that includes zero, one, or many user-created pluggable databases (PDBs).

**Note:**

Using XStream requires purchasing a license for the Oracle GoldenGate product.

 **See Also:**

- *Oracle Database XStream Guide*
- *Oracle Database Concepts* for more information about CDBs and PDBs

83.1.2 DBMS_GOLDENGATE_ADM Security Model

Security on this package can be controlled either by granting `EXECUTE` on this package to selected users or roles or by granting `EXECUTE_CATALOG_ROLE` to selected users or roles.

If subprograms in the package are run from within a stored procedure, then the user who runs the subprograms must be granted `EXECUTE` privilege on the package directly. It cannot be granted through a role.

An Oracle GoldenGate administrator must be configured at each Oracle database in the table's replication environment, and Oracle GoldenGate must be configured to replicate the table at each Oracle database. You can configure an Oracle GoldenGate administrator using the `GRANT_ADMIN_PRIVILEGE` procedure in the `DBMS_GOLDENGATE_ADM` package.

 **See Also:**

The Oracle GoldenGate documentation for more information about Oracle GoldenGate replication and configuring an Oracle GoldenGate administrator

83.2 Summary of DBMS_GOLDENGATE_ADM Subprograms

Table 83-1 DBMS_GOLDENGATE_ADM Package Subprograms

Subprogram	Description
ADD_AUTO_CDR Procedure	Configures Oracle GoldenGate automatic conflict detection and resolution for a table
ADD_AUTO_CDR_COLUMN_GROUP Procedure	Adds a column group and configures Oracle GoldenGate automatic conflict detection and resolution for the column group
ADD_AUTO_CDR_DELTA_RES Procedure	Configures Oracle GoldenGate automatic conflict detection and delta resolution for the column
ALTER_AUTO_CDR Procedure	Alters the Oracle GoldenGate automatic conflict detection and resolution for a table
ALTER_AUTO_CDR_COLUMN_GROUP Procedure	Alters a column group for Oracle GoldenGate automatic conflict detection and resolution

Table 83-1 (Cont.) DBMS_GOLDENGATE_ADM Package Subprograms

Subprogram	Description
DELETE_PROCREP_EXCLUSION_OBJ Procedure	Deletes a database object from the exclusion list for Oracle GoldenGate procedural replication
GG_PROCEDURE_REPLICATION_ON Function	Returns 1 if Oracle GoldenGate procedural replication is enabled and returns 0 if it is disabled
INSERT_PROCREP_EXCLUSION_OBJ Procedure	Inserts a database object into the exclusion list for Oracle GoldenGate procedural replication
PURGE_TOMBSTONES Procedure	Purges rows that were deleted before the specified timestamp from the tombstone table
REMOVE_AUTO_CDR Procedure	Removes Oracle GoldenGate automatic conflict detection and resolution for a table
REMOVE_AUTO_CDR_COLUMN_GROUP Procedure	Removes a column group that was configured for Oracle GoldenGate automatic conflict detection and resolution
REMOVE_AUTO_CDR_DELTA_RES Procedure	Removes Oracle GoldenGate automatic conflict detection and delta resolution for the column

**Note:**

All procedures commit unless specified otherwise.

83.2.1 ADD_AUTO_CDR Procedure

This procedure configures Oracle GoldenGate automatic conflict detection and resolution for a table.

The conflict detection and resolution configured by this procedure is based on the timestamp of the changes. The procedure adds one or more hidden columns of `TIMESTAMP` type to the table, and each hidden column is counted against the limit of 1,000 columns for each table.

The procedure automatically places the columns in the table into a default column group and into an unconditional supplemental log group, excluding nonscalar columns. To create column groups that include a subset of the columns in the table, use the `ADD_AUTO_CDR_COLUMN_GROUP` procedure in this package.

This procedure is overloaded. One version of this procedure contains the `additional_options` parameter, and the other does not.

Syntax

```
DBMS_GOLDENGATE_ADM.ADD_AUTO_CDR(
  schema_name          IN VARCHAR2,
  table_name           IN VARCHAR2,
  resolution_granularity IN VARCHAR2 DEFAULT 'ROW',
  existing_data_timestamp IN TIMESTAMP WITH TIME ZONE DEFAULT
'SYSTIMESTAMP',
  tombstone_deletes    IN BOOLEAN DEFAULT TRUE,
```



```

fetchcols           IN BOOLEAN DEFAULT TRUE,
record_conflicts    IN BOOLEAN DEFAULT TRUE,
use_custom_handlers IN BINARY_INTEGER DEFAULT 0);

```

```

DBMS_GOLDENGATE_ADM.ADD_AUTO_CDR(
  schema_name      IN VARCHAR2,
  table_name       IN VARCHAR2,
  resolution_granularity IN VARCHAR2 DEFAULT 'ROW',
  existing_data_timestamp IN TIMESTAMP WITH TIME ZONE DEFAULT
'SYSTIMESTAMP',
  tombstone_deletes IN BOOLEAN DEFAULT TRUE,
  fetchcols        IN BOOLEAN DEFAULT TRUE,
  record_conflicts  IN BOOLEAN DEFAULT TRUE,
  use_custom_handlers IN BINARY_INTEGER DEFAULT 0,
  additional_options IN BINARY_INTEGER);

```

Parameters

Table 83-2 ADD_AUTO_CDR Procedure Parameters

Parameter	Description
schema_name	The name of the table's schema.
table_name	The name of the table.
resolution_granularity	ROW, the default, adds one hidden <code>TIMESTAMP</code> column for the row and one hidden <code>TIMESTAMP</code> column for each LOB column. COLUMN adds one hidden <code>TIMESTAMP</code> column for each column in the table.
existing_data_timestamp	Timestamp to assign to existing rows. If <code>NULL</code> , then the current system timestamp is used. If a time is specified, and the operating system time zone is not a valid Oracle time zone, then Oracle uses UTC as the default value.
tombstone_deletes	<code>TRUE</code> , the default, tracks deleted rows in a tombstone table. Tracking deleted rows might be required to detect and resolve some conflicts, but tracking deleted rows requires additional database resources. <code>FALSE</code> does not track deleted rows in a tombstone table.
fetchcols	<code>TRUE</code> , the default, fetches the value of LOBs during conflict detection and resolution. Fetching LOBs can be an expensive operation. <code>FALSE</code> does not fetch the value of LOBs during conflict detection and resolution.
record_conflicts	<code>TRUE</code> , the default, records the conflict in the <code>DBA_APPLY_ERROR</code> and <code>DBA_APPLY_ERROR_MESSAGES</code> views. <code>FALSE</code> does not record the conflict.

Table 83-2 (Cont.) ADD_AUTO_CDR Procedure Parameters

Parameter	Description
use_custom_handlers	0, the default, indicates that automatic conflict handlers are used. 1 indicates that automatic conflict handlers are not used and that a custom error handler must be specified using the SET_DML_HANDLER procedure in the DBMS_APPLY_ADM package.
additional_options	0 indicates NONE. You can also use the DBMS_GOLDENGATE_ADM.DBMS_GOLDENGATE_ADM.ADDITIONAL_OPTIONS_NONE constant. 1 indicates EARLIEST_TIMESTAMP_RESOLUTION. In earliest timestamp resolution, the earliest timestamp is used for conflict resolution instead of the latest timestamp. You can also use the DBMS_GOLDENGATE_ADM.ADDITIONAL_OPTIONS_EARLIEST_TIMESTAMP constant. 2 indicates DELETE_ALWAYS_WINS. In delete always wins, when there is a conflict between a delete operation and another operation, the delete operation succeeds and the other operation is discarded. You can also use the DBMS_GOLDENGATE_ADM.ADDITIONAL_OPTIONS_DELETE_ALWAYS_WINS constant. 4 indicates IGNORE_GLOBAL_SITE_PRIORITY. In ignore global site priority, the locally defined resolution is used for the table even if global site priority is set in the Oracle GoldenGate replicat file. You can also use the DBMS_GOLDENGATE_ADM.ADDITIONAL_OPTIONS_IGNORE_GLOBAL_SITE_PRIORITY constant. 8 indicates ADD_KEY_VERSION. Use this option to add a version number with TIMESTAMP data type to handle delete conflicts. You can also use the DBMS_GOLDENGATE_ADM.ADDITIONAL_OPTIONS_ADD_KEY_VERSION constant. Add the options together to use more than one option. For example, to use earliest timestamp resolution and delete always wins, use 3.

Example

The following example illustrates how to use bitmask:

```
SQL> EXECUTE dbms_goldengate_adm.add_auto_cdr('scott','table1',
additional_options =>
dbms_goldengate_adm.additional_options_delete_always_wins +
dbms_goldengate_adm.additional_options_add_key_version,
record_conflicts => TRUE);
```

83.2.2 ADD_AUTO_CDR_COLUMN_GROUP Procedure

This procedure adds a column group to a table that is configured for Oracle GoldenGate automatic conflict detection and resolution.

For a table that has been configured for timestamp conflict detection and resolution, this procedure adds a column group that includes a specified subset of columns in the table. Any columns in the table that are not part of a column group remain in the default column group for the table.

When you add a column group to a table, conflict detection and resolution is performed on the columns in the column group separately from the other columns in the table. Column groups enable different databases to update different columns in the same row at nearly the same time without causing a conflict.

For example, a replicated table that contains employee information might have a salary column and a bonus column as well as other columns that identify the employee and a location column for the employees office number. Assume that one department in the company updates its database to change the employee's salary while another department updates its database to change the employee's location. If the salary and bonus columns are in a column group, these changes are applied to the replicated table in each database without requiring conflict resolution.

The procedure automatically places the columns in the column group into an unconditional supplemental log group, excluding nonscalar columns.

Before this procedure can be run on a table, the `DBMS_GOLDENGATE_ADM.ADD_AUTO_CDR` procedure must be run in the table with `ROW` specified for the `resolution_granularity` parameter.

Syntax

```
DBMS_GOLDENGATE_ADM.ADD_AUTO_CDR_COLUMN_GROUP (
  schema_name          IN VARCHAR2,
  table_name           IN VARCHAR2,
  column_list          IN VARCHAR2,
  column_group_name    IN VARCHAR2 DEFAULT NULL,
  existing_data_timestamp IN TIMESTAMP WITH TIME ZONE DEFAULT NULL);
```

Parameters

Table 83-3 ADD_AUTO_CDR_COLUMN_GROUP Procedure Parameters

Parameter	Description
<code>schema_name</code>	The name of the table's schema.
<code>table_name</code>	The name of the table.
<code>column_list</code>	Group of columns for which the conflict detection and resolution is configured. Specify the columns in a comma-separated list. The same column cannot be in more than one column group. Also, the same column cannot be in a column group and specified in a delta resolution.

Table 83-3 (Cont.) ADD_AUTO_CDR_COLUMN_GROUP Procedure Parameters

Parameter	Description
column_group_name	The name of the column group. If NULL, the column group name is system generated.
existing_data_timestamp	The time value for the added <code>TIMESTAMP</code> columns for existing table data.

83.2.3 ADD_AUTO_CDR_DELTA_RES Procedure

This procedure configures Oracle GoldenGate automatic conflict detection and delta resolution for the column.

The resolution method does not depend on a timestamp or an extra resolution column. With delta conflict resolution, the conflict is resolved by adding the difference between the new and old values in the LCR to the value in the table. For example, if a bank balance is updated at two sites concurrently, then the converged value accounts for all debits and credits. This resolution method is generally used for financial data such as an account balance.

The procedure automatically places the column into an unconditional supplemental log group.

Before this procedure can be run on a table, the `DBMS_GOLDENGATE_ADM.ADD_AUTO_CDR` procedure must be run in the table with `ROW` specified for the `resolution_granularity` parameter.

Syntax

```
DBMS_GOLDENGATE_ADM.ADD_AUTO_CDR_DELTA_RES (
    schema_name IN VARCHAR2,
    table_name  IN VARCHAR2,
    column_name IN VARCHAR2);
```

Parameters

Table 83-4 ADD_AUTO_CDR_DELTA_RES Procedure Parameters

Parameter	Description
schema_name	The name of the table's schema.
table_name	The name of the table.
column_name	The name of the column. The specified column must be a <code>NUMBER</code> or <code>FLOAT</code> data type column. The same column cannot be in a column group.

83.2.4 ALTER_AUTO_CDR Procedure

This procedure alters the Oracle GoldenGate automatic conflict detection and resolution for a table.

This procedure is overloaded. One version of this procedure contains the `additional_options` parameter, and the other does not.

Syntax

```
DBMS_GOLDENGATE_ADM.ALTER_AUTO_CDR(
  schema_name          IN VARCHAR2,
  table_name           IN VARCHAR2,
  tombstone_deletes    IN BOOLEAN DEFAULT TRUE,
  fetchcols            IN BOOLEAN DEFAULT TRUE,
  record_conflicts     IN BOOLEAN DEFAULT TRUE,
  use_custom_handlers  IN BINARY_INTEGER DEFAULT 0);
```

```
DBMS_GOLDENGATE_ADM.ALTER_AUTO_CDR(
  schema_name          IN VARCHAR2,
  table_name           IN VARCHAR2,
  tombstone_deletes    IN BOOLEAN DEFAULT TRUE,
  fetchcols            IN BOOLEAN DEFAULT TRUE,
  record_conflicts     IN BOOLEAN DEFAULT TRUE,
  use_custom_handlers  IN BINARY_INTEGER DEFAULT 0,
  additional_options   IN BINARY_INTEGER);
```

Parameters

Table 83-5 ALTER_AUTO_CDR Procedure Parameters

Parameter	Description
schema_name	The name of the table's schema.
table_name	The name of the table.
tombstone_deletes	TRUE tracks deleted rows in a tombstone table. Tracking deleted rows might be required to detect and resolve some conflicts, but tracking deleted rows requires additional database resources. FALSE does not track deleted rows in a tombstone table. NULL retains the current setting for the parameter.
fetchcols	TRUE fetches the value of nonscalar columns during conflict detection and resolution. FALSE does not fetch the value of nonscalar columns during conflict detection and resolution. NULL retains the current setting for the parameter.
record_conflicts	TRUE records the conflict. FALSE does not record the conflict. NULL retains the current setting for the parameter.
use_custom_handlers	0, default, indicates that automatic conflict handlers are used. 1 indicates that automatic conflict handlers are not used and that a custom error handler must be specified using the SET_DML_HANDLER procedure in the DBMS_APPLY_ADM package. NULL, the default, retains the current setting for the parameter.

Table 83-5 (Cont.) ALTER_AUTO_CDR Procedure Parameters

Parameter	Description
<code>additional_options</code>	<p>A bit mask that indicates which of six types of actions to follow:</p> <ul style="list-style-type: none"> • 0 - no changes are made from any previous settings. You can also use the <code>DBMS_GOLDENGATE_ADM.ADDITIONAL_OPTIONS_NONE</code> constant. • 1 - sets earliest timestamp, but clears all other options/bits. You can also use the <code>DBMS_GOLDENGATE_ADM.EARLIEST_TIMESTAMP_RESOLUTION</code> constant. • 2 - sets delete always wins, but clears all other options/bits. You can also use the <code>DBMS_GOLDENGATE_ADM.ADDITIONAL_OPTIONS_DELETE_ALWAYS_WINS</code> constant. • 4 - indicates <code>IGNORE_GLOBAL_SITE_PRIORITY</code>. When you specify this option, then use local site resolution configuration for the table, even if the global site priority is set in the Oracle GoldenGate replicat file. You can also use the <code>DBMS_GOLDENGATE_ADM.ADDITIONAL_OPTIONS_IGNORE_GLOBAL_SITE_PRIORITY</code> constant. • 8 - indicates <code>ADD_KEY_VERSION</code>. Use this option to add a version number with <code>TIMESTAMP</code> data type to handle delete conflicts. You can also use the <code>DBMS_GOLDENGATE_ADM.ADDITIONAL_OPTIONS_ADD_KEY_VERSION</code> constant. • 16 - clears all. You can also use the <code>DBMS_GOLDENGATE_ADM.ADDITIONAL_OPTIONS_CLEAR_OPTIONS</code> constant.

 **Note:**

- Any combination of 1,2, 4, and 8 are possible.
- Any combination that include 1 or 2 will implicitly set 8.

You can add the options together to use more than one option.

For example:

If the previously used option was `DELETE_ALWAYS_WINS`, then when you specify a value of 1 for `additional_options`, `EARLIEST_TIMESTAMP_RESOLUTION` and 16 means clear all options. As a result, there are no additional options set.

83.2.5 ALTER_AUTO_CDR_COLUMN_GROUP Procedure

This procedure alters a column group for Oracle GoldenGate automatic conflict detection and resolution.

Syntax

```
DBMS_GOLDENGATE_ADM.ALTER_AUTO_CDR_COLUMN_GROUP (
  schema_name      IN VARCHAR2,
  table_name       IN VARCHAR2,
  column_group_name IN VARCHAR2,
  add_column_list  IN VARCHAR2,
  remove_column_list IN VARCHAR2);
```

Parameters

Table 83-6 ALTER_AUTO_CDR_COLUMN_GROUP Procedure Parameters

Parameter	Description
schema_name	The name of the table's schema.
table_name	The name of the table.
column_group_name	The name of the column group.
add_column_list	A comma-separated list of columns to add to the column group.
remove_column_list	A comma-separated list of columns to remove from the column group.

83.2.6 DELETE_PROCREP_EXCLUSION_OBJ Procedure

This procedure deletes a database object from the exclusion list for Oracle GoldenGate procedural replication.

When a database object is on the exclusion list for Oracle GoldenGate procedural replication, execution of subprogram in the package is not replicated if the subprogram operates on the excluded object. For example, if `hr.employees` is an excluded database object for the `DBMS_REDEFINITION` package, then an execution of the `DBMS_REDEFINITION.START_REDEF_TABLE` procedure on the `hr.employees` table is not replicated.

▲ Caution:

Run the `DELETE_PROCREP_EXCLUSION_OBJ` procedure only under the direction of Oracle Support.

Syntax

```
DBMS_GOLDENGATE_ADM.DELETE_PROCREP_EXCLUSION_OBJ (
  package_owner IN VARCHAR2 DEFAULT NULL,
  package_name  IN VARCHAR2 DEFAULT NULL,
```

```
object_owner      IN VARCHAR2 DEFAULT NULL,
object_name       IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 83-7 DELETE_PROCREP_EXCLUSION_OBJ Procedure Parameters

Parameter	Description
package_owner	The owner of the package.
package_name	The name of the package.
object_owner	The owner of the object.
object_name	The name of the object.

83.2.7 GG_PROCEDURE_REPLICATION_ON Function

This function returns 1 if Oracle GoldenGate procedural replication is enabled and returns 0 if it is disabled.

Syntax

```
DBMS_GOLDENGATE_ADM.GG_PROCEDURE_REPLICATION_ON
RETURN NUMBER;
```

83.2.8 INSERT_PROCREP_EXCLUSION_OBJ Procedure

This procedure inserts a database object into the exclusion list for Oracle GoldenGate procedural replication.

When a database object is on the exclusion list for Oracle GoldenGate procedural replication, execution of subprogram in the package is not replicated if the subprogram operates on the excluded object. For example, if `hr.employees` is an excluded database object for the `DBMS_REDEFINITION` package, then an execution of the `DBMS_REDEFINITION.START_REDEF_TABLE` procedure on the `hr.employees` table is not replicated.

Caution:

Run the `INSERT_PROCREP_EXCLUSION_OBJ` procedure only under the direction of Oracle Support.

Syntax

```
DBMS_GOLDENGATE_ADM.INSERT_PROCREP_EXCLUSION_OBJ(
package_owner      IN VARCHAR2 DEFAULT NULL,
package_name       IN VARCHAR2 DEFAULT NULL,
object_owner       IN VARCHAR2 DEFAULT NULL,
object_name        IN VARCHAR2 DEFAULT NULL);
```


Parameters**Table 83-8 INSERT_PROCREP_EXCLUSION_OBJ Procedure Parameters**

Parameter	Description
package_owner	The owner of the package.
package_name	The name of the package.
object_owner	The owner of the object.
object_name	The name of the object.

83.2.9 PURGE_TOMBSTONES Procedure

This procedure purges rows that were deleted before the specified timestamp from the tombstone table.

Syntax

```
DBMS_GOLDENGATE_ADM.PURGE_TOMBSTONES(
    purge_timestamp IN TIMESTAMP WITH TIME ZONE);
```

Parameters**Table 83-9 PURGE_TOMBSTONES Procedure Parameters**

Parameter	Description
purge_timestamp	The timestamp before which records are purged.

83.2.10 REMOVE_AUTO_CDR Procedure

This procedure removes Oracle GoldenGate automatic conflict detection and resolution for a table.

Syntax

```
DBMS_GOLDENGATE_ADM.REMOVE_AUTO_CDR(
    schema_name      IN VARCHAR2,
    table_name       IN VARCHAR2);
```

Parameters**Table 83-10 REMOVE_AUTO_CDR Procedure Parameters**

Parameter	Description
schema_name	The name of the table's schema.
table_name	The name of the table.

83.2.11 REMOVE_AUTO_CDR_COLUMN_GROUP Procedure

This procedure removes a column group that was configured for Oracle GoldenGate automatic conflict detection and resolution.

Syntax

```
DBMS_GOLDENGATE_ADM.REMOVE_AUTO_CDR_COLUMN_GROUP(  
    schema_name          IN VARCHAR2,  
    table_name           IN VARCHAR2,  
    column_group_name    IN VARCHAR2);
```

Parameters

Table 83-11 REMOVE_AUTO_CDR_COLUMN_GROUP Procedure Parameters

Parameter	Description
schema_name	The name of the table's schema.
table_name	The name of the table.
column_group_name	The name of the column group.

83.2.12 REMOVE_AUTO_CDR_DELTA_RES Procedure

This procedure removes Oracle GoldenGate automatic conflict detection and delta resolution for the column.

Syntax

```
DBMS_GOLDENGATE_ADM.REMOVE_AUTO_CDR_DELTA_RES(  
    schema_name IN VARCHAR2,  
    table_name  IN VARCHAR2,  
    column_name IN VARCHAR2);
```

Parameters

Table 83-12 REMOVE_AUTO_CDR_DELTA_RES Procedure Parameters

Parameter	Description
schema_name	The name of the table's schema.
table_name	The name of the table.
column_name	The name of the column.

DBMS_GOLDENGATE_AUTH

The `DBMS_GOLDENGATE_AUTH` package provides subprograms for granting privileges to and revoking privileges from GoldenGate administrators.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_GOLDENGATE_AUTH Subprograms](#)



See Also:

[GRANT_ADMIN_PRIVILEGE Procedure](#) in the `DBMS_XSTREAM_AUTH` package

84.1 DBMS_GOLDENGATE_AUTH Overview

This package provides subprograms for granting privileges to GoldenGate administrators and revoking privileges from GoldenGate administrators. A GoldenGate administrator manages an integrated GoldenGate and XStream Out configuration.

GoldenGate administrators can be used in a multitenant container database (CDB). A CDB is an Oracle database that includes zero, one, or many user-created pluggable databases (PDBs).



See Also:

- [GRANT_ADMIN_PRIVILEGE Procedure](#) in the `DBMS_XSTREAM_AUTH` package
- *Oracle Database XStream Guide*
- *Oracle Database Concepts* for more information about CDBs and PDBs

84.2 DBMS_GOLDENGATE_AUTH Security Model

Security on this package can be controlled by granting `EXECUTE` on this package to selected users or roles, or by granting `EXECUTE_CATALOG_ROLE` to selected users or roles.

The user executing the subprograms in the `DBMS_GOLDENGATE_AUTH` package must have `SYSDBA` administrative privilege, and the user must exercise the privilege using `AS SYSDBA` at connect time.

If subprograms in the package are run from within a stored procedure, then the user who runs the subprograms must be granted `EXECUTE` privilege on the package directly. It cannot be granted through a role.

To ensure that the user who runs the subprograms in this package has the necessary privileges, connect as an administrative user who can create users, grant privileges, and create tablespaces when using this package.

84.3 Summary of DBMS_GOLDENGATE_AUTH Subprograms

The `DBMS_XSTREAM_AUTH` package includes the `GRANT_ADMIN_PRIVILEGE` procedure and `REVOKE_ADMIN_PRIVILEGE` procedure subprograms.

Table 84-1 DBMS_GOLDENGATE_AUTH Package Subprograms

Subprogram	Description
GRANT_ADMIN_PRIVILEGE Procedure	Either grants the privileges needed by a user to be a GoldenGate administrator directly, or generates a script that grants these privileges
REVOKE_ADMIN_PRIVILEGE Procedure	Either revokes GoldenGate administrator privileges from a user directly, or generates a script that revokes these privileges



Note:

All subprograms commit unless specified otherwise.

84.3.1 GRANT_ADMIN_PRIVILEGE Procedure

This procedure grants the privileges needed by a user to be a GoldenGate administrator.



See Also:

[GRANT_ADMIN_PRIVILEGE Procedure](#) in the `DBMS_XSTREAM_AUTH` package

Syntax

```
DBMS_GOLDENGATE_AUTH.GRANT_ADMIN_PRIVILEGE (
  grantee           IN VARCHAR2,
  privilege_type    IN VARCHAR2 DEFAULT '*',
  grant_select_privileges IN BOOLEAN DEFAULT TRUE,
  do_grants         IN BOOLEAN DEFAULT TRUE,
  file_name         IN VARCHAR2 DEFAULT NULL,
  directory_name    IN VARCHAR2 DEFAULT NULL)
```

```
grant_optional_privileges IN VARCHAR2 DEFAULT NULL,
container                 IN VARCHAR2 DEFAULT 'CURRENT');
```

Parameters

Table 84-2 GRANT_ADMIN_PRIVILEGE Procedure Parameters

Parameter	Description
grantee	The user to whom privileges are granted
privilege_type	Specify one of the following values: <ul style="list-style-type: none"> CAPTURE Specifying CAPTURE grants the minimum privileges required by the user to administer Oracle GoldenGate integrated extract. APPLY Specifying APPLY grants the minimum privileges required by the user to administer Oracle GoldenGate integrated replicat. * Specifying * grants the minimum privileges required by the user to administer Oracle GoldenGate integrated extract and Oracle GoldenGate integrated replicat.
grant_select_privileges	If TRUE, then the procedure grants a set of privileges, including SELECT_CATALOG_ROLE, to the user. This setting is recommended for GoldenGate administrators. If FALSE, then the procedure does not grant the set of privileges to the user. SELECT_CATALOG_ROLE enables the user to select from the data dictionary.
do_grants	If TRUE, then the procedure grants the privileges to the specified grantee directly, and adds the grantee to the DBA_GOLDENGATE_PRIVILEGES data dictionary view. If the user already has an entry in this data dictionary view, then the procedure does not make another entry, and no error is raised. If TRUE and any of the grant statements fails, then the procedure raises an error. If FALSE, then the procedure does not grant the privileges to the specified grantee directly, and does not add the grantee to the DBA_GOLDENGATE_PRIVILEGES data dictionary view. You specify FALSE when the procedure is generating a file that you will run later. If you specify FALSE and either the file_name or directory_name parameter is NULL, then the procedure raises an error. Note: It is recommended that do_grants be set to TRUE because many APIs check for the presence of a user in the DBA_GOLDENGATE_PRIVILEGES view, which will not be populated if do_grants is set to FALSE.
file_name	The name of the file generated by the procedure. The file contains all of the statements that grant the privileges. If a file with the specified file name exists in the specified directory name, then the grant statements are appended to the existing file. If NULL, then the procedure does not generate a file.

Table 84-2 (Cont.) GRANT_ADMIN_PRIVILEGE Procedure Parameters

Parameter	Description
directory_name	<p>The directory into which the generated file is placed. The specified directory must be a directory object created using the SQL statement <code>CREATE DIRECTORY</code>. If you specify a directory, then the user who invokes the procedure must have the <code>WRITE</code> privilege on the directory object.</p> <p>If the <code>file_name</code> parameter is <code>NULL</code>, then this parameter is ignored, and the procedure does not generate a file.</p> <p>If <code>NULL</code> and the <code>file_name</code> parameter is non-<code>NULL</code>, then the procedure raises an error.</p>
grant_optional_privileges	<p>A comma-separated list of optional privileges to grant to the grantee. You can specify the following roles and privileges:</p> <ul style="list-style-type: none"> • <code>XDBADMIN</code> • <code>DV_XSTREAM_ADMIN</code> • <code>DV_GOLDENGATE_ADMIN</code> • <code>EXEMPT_ACCESS_POLICY</code> • <code>EXEMPT_REDACTION_POLICY</code>
container	<p>If <code>CURRENT</code>, then grants privileges to the grantee only in the container where the procedure is invoked. <code>CURRENT</code> can be specified while connected to the root or to a PDB.</p> <p>If <code>ALL</code>, then grants privileges to the grantee in all containers in the CDB and all PDBs created after the procedure is invoked. To specify <code>ALL</code>, the procedure must be invoked in the root by a common user.</p> <p>If a container name, then grants privileges to the grantee only in the specified container. To specify root, use <code>CDB\$ROOT</code> while connected to the root. To specify a PDB, the procedure must be invoked in the root.</p> <p>Note: This parameter only applies to CDBs.</p>

Usage Notes

The user who runs the procedure must be an administrative user who can grant privileges to other users.

Specifically, the procedure grants the following privileges to the specified user:

- The `RESTRICTED SESSION` system privilege
- `EXECUTE` on the following packages:
 - `DBMS_APPLY_ADM`
 - `DBMS_AQ`
 - `DBMS_AQADM`
 - `DBMS_AQIN`
 - `DBMS_AQELM`
 - `DBMS_CAPTURE_ADM`
 - `DBMS_FLASHBACK`
 - `DBMS_LOCK`
 - `DBMS_PROPAGATION_ADM`

- DBMS_RULE_ADM
- DBMS_TRANSFORM
- DBMS_XSTREAM_ADM
- Privileges to enqueue messages into and dequeue messages from any queue
- Privileges to manage any queue
- Privileges to create, alter, and execute any of the following types of objects in the user's own schema and in other schemas:
 - Evaluation contexts
 - Rule sets
 - Rules

In addition, the grantee can grant these privileges to other users.

- SELECT_CATALOG_ROLE
- SELECT or READ privilege on data dictionary views related to GoldenGate and Oracle Replication
- The ability to allow a remote GoldenGate administrator to perform administrative actions through a database link by connecting to the grantee

This ability is enabled by running the GRANT_REMOTE_ADMIN_ACCESS procedure in this package.

Note:

This procedure grants only the privileges necessary to configure and administer a GoldenGate environment. You can grant additional privileges to the grantee if necessary.

See Also:

[GRANT_ADMIN_PRIVILEGE Procedure](#) in the [DBMS_XSTREAM_AUTH](#) package

84.3.2 REVOKE_ADMIN_PRIVILEGE Procedure

This procedure revokes GoldenGate administrator privileges from a user.

Syntax

```
DBMS_GOLDENGATE_AUTH.REVOKE_ADMIN_PRIVILEGE (
  grantee                IN  VARCHAR2,
  privilege_type         IN  VARCHAR2  DEFAULT '*',
  revoke_select_privileges IN  BOOLEAN  DEFAULT FALSE,
  do_revokes            IN  BOOLEAN  DEFAULT TRUE,
  file_name             IN  VARCHAR2  DEFAULT NULL,
  directory_name        IN  VARCHAR2  DEFAULT NULL
```

```

revoke_optional_privileges IN VARCHAR2 DEFAULT NULL,
container                   IN VARCHAR2 DEFAULT 'CURRENT');

```

Parameters

Table 84-3 REVOKE_ADMIN_PRIVILEGE Procedure Parameters

Parameter	Description
grantee	The user from whom privileges are revoked
privilege_type	Specify one of the following values: <ul style="list-style-type: none"> • CAPTURE Specifying CAPTURE revokes the minimum privileges required by the user to administer Oracle GoldenGate integrated extract. • APPLY Specifying APPLY revokes the minimum privileges required by the user to administer Oracle GoldenGate integrated replicat. • * Specifying * revokes the minimum privileges required by the user to administer Oracle GoldenGate integrated extract and Oracle GoldenGate integrated replicat.
revoke_select_privileges	If TRUE, then the procedure revokes SELECT_CATALOG_ROLE from the user. If FALSE, then the procedure does not revoke SELECT_CATALOG_ROLE to the user. SELECT_CATALOG_ROLE enables the user to select from the data dictionary.
do_revokes	If TRUE, then the procedure revokes the privileges from the specified user directly, and removes the user from the DBA_XSTREAM_ADMINISTRATOR data dictionary view. If the user does not have a record in this data dictionary view, then the procedure does not remove a record from the view, and no error is raised. If TRUE and any of the revoke statements fails, then the procedure raises an error. A revoke statement fails if the user is not granted the privilege that is being revoked. If FALSE, then the procedure does not revoke the privileges from the specified user directly, and does not remove the user from the DBA_XSTREAM_ADMINISTRATOR data dictionary view. You specify FALSE when the procedure is generating a file that you will run later. If you specify FALSE and either the file_name or directory_name parameter is NULL, then the procedure does not raise an error.
file_name	The name of the file generated by this procedure. The file contains all of the statements that revoke the privileges. If a file with the specified file name exists in the specified directory name, then the revoke statements are appended to the existing file. If NULL, then the procedure does not generate a file.

Table 84-3 (Cont.) REVOKE_ADMIN_PRIVILEGE Procedure Parameters

Parameter	Description
directory_name	<p>The directory into which the generated file is placed. The specified directory must be a directory object created using the SQL statement <code>CREATE DIRECTORY</code>. If you specify a directory, then the user who invokes the procedure must have the <code>WRITE</code> privilege on the directory object.</p> <p>If the <code>file_name</code> parameter is <code>NULL</code>, then this parameter is ignored, and the procedure does not generate a file.</p> <p>If <code>NULL</code> and the <code>file_name</code> parameter is non-<code>NULL</code>, then the procedure raises an error.</p>
revoke_optional_privileges	<p>A comma-separated list of optional privileges to revoke from the grantee, such as the <code>DV_XSTREAM_ADMIN</code> and <code>DV_GOLDENGATE_ADMIN</code> privileges</p>
container	<p>If <code>CURRENT</code>, then revokes privileges from the grantee only in the container where the procedure is invoked. <code>CURRENT</code> can be specified while connected to the root or to a PDB.</p> <p>If <code>ALL</code>, then revokes privileges from the grantee in all containers in the CDB. To specify <code>ALL</code>, the procedure must be invoked in the root.</p> <p>If a container name, then revokes privileges from the grantee only in the specified container. To specify root, use <code>CDB\$ROOT</code> while connected to the root. To specify a PDB, the procedure must be invoked in the root.</p> <p>Note: This parameter only applies to CDBs.</p>

Usage Notes

The user who runs this procedure must be an administrative user who can revoke privileges from other users. Specifically, this procedure revokes the privileges granted by running the `GRANT_ADMIN_PRIVILEGE` procedure in this package.



See Also:

"[GRANT_ADMIN_PRIVILEGE Procedure](#)"

DBMS_HADOOP

The `DBMS_HADOOP` package provides a PL/SQL procedure called `CREATE_EXTDDL_FOR_HIVE()`, that creates an Oracle external table for a given hive table.

Big Data SQL needs to be correctly set up for `DBMS_HADOOP` to work.

This chapter contains the following topics:

- [DBMS_HADOOP Overview](#)
- [DBMS_HADOOP Security Model](#)
- [Summary of DBMS_HADOOP Subprograms](#)

85.1 DBMS_HADOOP Overview

The `DBMS_HADOOP` package provides two procedures for creating an Oracle external table and for synchronizing the Oracle external table partitions.

These procedures are:

- `CREATE_EXTDDL_FOR_HIVE()` — creates an Oracle external table for a given hive table
- `SYNCHRONIZE_PARTITIONS_FOR_HIVE()` — helps to synchronize the Oracle external table partitions with those in the corresponding hive table

85.2 DBMS_HADOOP Security Model

Users must have `ALTER` privileges on the table for modifying external table parameters. In addition the `ALTER` privileges, users must have `READ` privileges for the directory object that contains the external data source and `WRITE` privileges for the directory objects containing bad, log, and discard files.

Similar privileges are applicable to the partitioned external tables.

85.3 Summary of DBMS_HADOOP Subprograms

`DBMS_HADOOP` includes the `CREATE_EXTDDL_FOR_HIVE` procedure and `SYNC_PARTITIONS_FOR_HIVE` procedure subprograms.

Table 85-1 DBMS_HADOOP Subprograms

Subprogram	Description
CREATE_EXTDDL_FOR_HIVE Procedure	Given a hive table name, creates a text of DDL that can be executed to create an external table corresponding to the hive table

Table 85-1 (Cont.) DBMS_HADOOP Subprograms

Subprogram	Description
CREATE_HYBRID_PARTNED_TABLE Procedure	Merges a given partitioned Hive table with an Oracle partitioned table, and replaces it with the merged table.
SYNCHRONIZE_PARTITIONS_FOR_HIVE Procedure	Synchronizes the existing partitioning definition of a hive table in Oracle catalog

85.3.1 CREATE_EXTDDL_FOR_HIVE Procedure

This procedure creates an Oracle external table for a given hive table.

Syntax

```
DBMS_HADOOP.CREATE_EXTDDL_FOR_HIVE (
  cluster_id      IN  VARCHAR2,
  db_name         IN  VARCHAR2 := NULL,
  hive_table_name IN  VARCHAR2,
  hive_partition  IN  BOOLEAN,
  table_name      IN  VARCHAR2 := NULL,
  perform_DDL     IN  BOOLEAN := FALSE,
  text_of_DDL     OUT CLOB);
```

Parameters

Table 85-2 CREATE_EXTDDL_FOR_HIVE Procedure Parameters

Parameter	Description
cluster_id	Hadoop cluster ID
hive_db_name	Database where the hive table is located
hive_table_name	Name of the hive table
hive_partition	If this argument is <code>TRUE</code> and if the original hive table is partitioned, the corresponding Oracle external table will also be partitioned using the same partition key(s). If the original hive table is not partitioned, <code>hive_partition=TRUE</code> has no effect. If <code>hive_partition=FALSE</code> , the corresponding Oracle external table will not be partitioned even if the original hive table is partitioned.
table_name	Name of the Oracle external table
perform_DDL	If this argument is <code>TRUE</code> , the external table will be automatically created. Otherwise, only the textual representation of the DDL statement will be generated and returned in <code>text_of_DDL</code> .
text_of_DDL	If the argument <code>perform_DDL</code> is <code>FALSE</code> , only the textual representation of the DDL statement will be generated and returned in <code>text_of_DDL</code> .

85.3.2 CREATE_HYBRID_PARTNED_TABLE Procedure

This procedure merges the partitioned Hive table with an Oracle partitioned table, and replace it with the merged table.

Syntax

```
DBMS_HADOOP.CREATE_HYBRID_PARTNED_TABLE (
    cluster_id          IN      VARCHAR2,
    db_name             IN      VARCHAR2,
    hive_table_name     IN      VARCHAR2,
    table_name          IN      VARCHAR2,
    table_owner         IN      VARCHAR2,
    perform_ddl         IN      BOOLEAN := TRUE,
    text_of_ddl        OUT     CLOB);
```

Parameters

Table 85-3 CREATE_HYBRID_PARTNED_TABLE Procedure Parameters

Parameter	Description
cluster_id	Hadoop cluster ID
db_name	Database where the partitioned Hive table is located
hive_table_name	Name of the partitioned Hive table
table_name	Name of the partitioned Oracle table
table_owner	The owner of the partitioned Oracle table
perform_DDL	If the value of this parameter is <code>TRUE</code> , the external table is automatically created. If the value of this parameter is <code>FALSE</code> , only the textual representation of the DDL statement is generated and returned in <code>text_of_DDL</code> .
text_of_DDL	If the argument <code>perform_DDL</code> is <code>FALSE</code> , only the textual representation of the DDL statement is generated and returned in <code>text_of_DDL</code> .

85.3.3 SYNCHRONIZE_PARTITIONS_FOR_HIVE Procedure

This procedure synchronizes the Oracle external table partitions with those in the corresponding hive table.

Syntax

```
DBMS_HADOOP.SYNCHRONIZE_PARTITIONS_FOR_HIVE (
    table_name      IN  VARCHAR2,
    table_owner     IN  VARCHAR2);
```

Parameters

Table 85-4 SYNCHRONIZE_PARTITIONS_FOR_HIVE Procedure Parameters

Parameter	Description
table_name	Oracle external table
table_owner	Schema name

DBMS_HEAT_MAP

The `DBMS_HEAT_MAP` package provides an interface to externalize heatmaps at various levels of storage including block, extent, segment, object and tablespace. A second set of subprograms externalize the heatmaps materialized by the background for top N tablespaces.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_HEAT_MAP Subprograms](#)



See Also:

- [Heat Map in Oracle Database VLDB and Partitioning Guide](#)
- [DBMS_ILM](#)
- [DBMS_ILM_ADMIN](#)

86.1 DBMS_HEAT_MAP Overview

To implement your ILM strategy, you can use Heat Map in Oracle Database to track data access and modification. You can also use Automatic Data Optimization (ADO) to automate the compression and movement of data between different tiers of storage within the database.

The Heat Map tracks modification times at the block level, and multiple access statistics at the segment level. Objects in the `SYSTEM` and `SYSAUX` tablespaces are not tracked.

`DBMS_HEAT_MAP` gives you access to the Heat Map statistics at various levels - block, extent, segment, object, and tablespace.

86.2 DBMS_HEAT_MAP Security Model

The execution privilege is granted to `PUBLIC`. Procedures in this package run under the caller security. The user must have `ANALYZE` privilege on the object.

86.3 Summary of DBMS_HEAT_MAP Subprograms

This table lists and briefly describes the `DBMS_HEAT_MAP` package subprograms.

Table 86-1 DBMS_HEAT_MAP Package Subprograms

Subprogram	Description
BLOCK_HEAT_MAP Function	Returns last modification time for each block in a table segment
EXTENT_HEAT_MAP Function	Returns the extent level Heat Map statistics for a table segment
OBJECT_HEAT_MAP Function	Returns the minimum, maximum and average access times for all the segments belonging to the object
SEGMENT_HEAT_MAP Procedure	Returns the heatmap attributes for the given segment
TABLESPACE_HEAT_MAP Function	Returns the minimum, maximum and average access times for all the segments in the tablespace

86.3.1 BLOCK_HEAT_MAP Function

This table function returns the last modification time for each block in a table segment. It returns no information for segment types that are not data.

Syntax

```
DBMS_HEAT_MAP.BLOCK_HEAT_MAP (
    owner          IN VARCHAR2,
    segment_name   IN VARCHAR2,
    partition_name IN VARCHAR2 DEFAULT NULL,
    sort_columnid  IN NUMBER DEFAULT NULL,
    sort_order     IN VARCHAR2 DEFAULT NULL)
RETURN hm_bls_row PIPELINED;
```

Parameters

Table 86-2 BLOCK_HEAT_MAP Function Parameters

Parameter	Description
owner	Owner of the segment
segment_name	Table name of a non-partitioned table or (sub)partition of partitioned table. Returns no rows when table name is specified for a partitioned table.
partition_name	Defaults to NULL. For a partitioned table, specify the partition or subpartition segment name.
sort_columnid	ID of the column on which to sort the output. Valid values 1..9. Invalid values are ignored.
sort_order	Defaults to NULL. Possible values: ASC, DESC

Return Values

Table 86-3 *BLOCK_HEAT_MAP Function Return Values (Output Parameters)*

Parameter	Description
owner	Owner of the segment
segment_name	Segment name of the non-partitioned table
partition_name	Partition or subpartition name
tablespace_name	Tablespace containing the segment
file_id	Absolute file number of the block in the segment
relative_fno	Relative file number of the block in the segment
block_id	Block number of the block
write time	Last modification time of the block

86.3.2 EXTENT_HEAT_MAP Function

This table function returns the extent level Heat Map statistics for a table segment. It returns no information for segment types that are not data. Aggregates at extent level, including minimum modification time and maximum modification time, are included.

Syntax

```
DBMS_HEAT_MAP.EXTENT_HEAT_MAP (
  owner          IN VARCHAR2,
  segment_name   IN VARCHAR2,
  partition_name IN VARCHAR2 DEFAULT NULL,
  RETURN hm_els_row PIPELINED;
```

Parameters

Table 86-4 *EXTENT_HEAT_MAP Function Parameters*

Parameter	Description
owner	Owner of the segment
segment_name	Table name of a non-partitioned table or (sub)partition of partitioned table. Returns no rows when table name is specified for a partitioned table.
partition_name	Defaults to NULL. For a partitioned table, specify the partition or subpartition segment name.

Return Values

Table 86-5 *EXTENT_HEAT_MAP Function Return Values (Output Parameters)*

Parameter	Description
owner	Owner of the segment
segment_name	Segment name of the non-partitioned table

Table 86-5 (Cont.) EXTENT_HEAT_MAP Function Return Values (Output Parameters)

Parameter	Description
partition_name	Partition or subpartition name
tablespace_name	Tablespace containing the segment
file_id	Absolute file number of the block in the segment
relative_fno	Relative file number of the block in the segment
block_id	Block number of the block
blocks	Number of blocks in the extent
bytes	Number of bytes in the extent
min_writetime	Minimum of last modification time of the block
max_writetime	Maximum of last modification time of the block
avg_writetime	Average of last modification time of the block

86.3.3 OBJECT_HEAT_MAP Function

This table function returns the minimum, maximum and average access times for all the segments belonging to the object.

The object must be a table. The table function raises an error if called on object tables other than table.

Syntax

```
DBMS_HEAT_MAP.OBJECT_HEAT_MAP (
    object_owner      IN VARCHAR2,
    object_name       IN VARCHAR2)
RETURN hm_object_table PIPELINED;
```

Parameters

Table 86-6 OBJECT_HEAT_MAP Function Parameters

Parameter	Description
object_owner	Tablespace containing the segment
object_name	Segment header relative file number

Return Values

Table 86-7 OBJECT_HEAT_MAP Function Return Values (Output Parameters)

Parameter	Description
segment_name	Name of the top level segment
partition_name	Name of the partition
tablespace_name	Name of the tablespace
segment_type	Type of segment as in DBA_SEGMENTS.SEGMENT_TYPE

Table 86-7 (Cont.) OBJECT_HEAT_MAP Function Return Values (Output Parameters)

Parameter	Description
segment_size	Segment size in bytes
min_writetime	Oldest write time for the segment
max_writetime	Latest write time for the segment
avg_writetime	Average write time for the segment
min_readtime	Oldest read time for the segment
max_readtime	Latest read time for the segment
avg_writetime	Average write time for the segment
min_lookuptime	Oldest index lookup time for the segment
max_lookuptime	Latest index lookup time for the segment
avg_lookuptime	Average index lookup time for the segment
min_ftstime	Oldest full table scan time for the segment
max_ftstime	Latest full table scan time for the segment
avg_ftstime	Average full table scan time for the segment

86.3.4 SEGMENT_HEAT_MAP Procedure

This procedure returns the heatmap attributes for the given segment.

Syntax

```
DBMS_HEAT_MAP.SEGMENT_HEAT_MAP (
    tablespace_id      IN NUMBER,
    header_file        IN NUMBER,
    header_block       IN NUMBER,
    segment_objd       IN NUMBER,
    min_writetime      OUT DATE,
    max_writetime      OUT DATE,
    avg_writetime      OUT DATE,
    min_readtime       OUT DATE,
    max_readtime       OUT DATE,
    avg_readtime       OUT DATE,
    min_lookuptime     OUT DATE,
    max_lookuptime     OUT DATE,
    avg_lookuptime     OUT DATE,
    min_ftstime        OUT DATE,
    max_ftstime        OUT DATE,
    avg_ftstime        OUT DATE);
```

Parameters

Table 86-8 SEGMENT_HEAT_MAP Procedure Parameters

Parameter	Description
tablespace_id	Tablespace containing the segment

Table 86-8 (Cont.) SEGMENT_HEAT_MAP Procedure Parameters

Parameter	Description
header_file	Segment header relative file number
header_block	Segment header block number
segment_objd	DATAOBJ of the segment

Return Values

Table 86-9 SEGMENT_HEAT_MAP Procedure Return Values (Output Parameters)

Parameter	Description
min_writetime	Oldest write time for the segment
max_writetime	Latest write time for the segment
avg_writetime	Average write time for the segment
min_readtime	Oldest read time for the segment
max_readtime	Latest read time for the segment
avg_writetime	Average write time for the segment
min_lookuptime	Oldest index lookup time for the segment
max_lookuptime	Latest index lookup time for the segment
avg_lookuptime	Average index lookup time for the segment
min_ftstime	Oldest full table scan time for the segment
max_ftstime	Latest full table scan time for the segment
avg_ftstime	Average full table scan time for the segment

86.3.5 TABLESPACE_HEAT_MAP Function

This table function returns the minimum, maximum and average access times for all the segments in the tablespace.

Syntax

```
DBMS_HEAT_MAP.TABLESPACE_HEAT_MAP (
    tablespace_name    IN VARCHAR2)
RETURN hm_tablespace_table PIPELINED;
```

Parameters

Table 86-10 TABLESPACE_HEAT_MAP Procedure Parameters

Parameter	Description
tablespace_name	Name of the tablespace

Return Values

Table 86-11 *TABLESPACE_HEAT_MAP Procedure Return Values (Output Parameters)*

Parameter	Description
segment_count	Total number of segments in the tablespace
allocated_bytes	Space used by the segments in the tablespace
min_writetime	Oldest write time for the segment
max_writetime	Latest write time for the segment
avg_writetime	Average write time for the segment
min_readtime	Oldest read time for the segment
max_readtime	Latest read time for the segment
avg_writetime	Average write time for the segment
min_lookuptime	Oldest index lookup time for the segment
max_lookuptime	Latest index lookup time for the segment
avg_lookuptime	Average index lookup time for the segment
min_ftstime	Oldest full table scan time for the segment
max_ftstime	Latest full table scan time for the segment
avg_ftstime	Average full table scan time for the segment

DBMS_HIERARCHY

DBMS_HIERARCHY contains subprograms for validating the data in tables used by hierarchies and analytic views.

This chapter contains the following topics:

- [DBMS_HIERARCHY Overview](#)
- [DBMS_HIERARCHY Security Model](#)
- [Summary of DBMS_HIERARCHY Subprograms](#)

87.1 DBMS_HIERARCHY Overview

The DBMS_HIERARCHY package contains functions for validating that the contents of a database table are suitable for use by an analytic view or a hierarchy, a function for verifying the success of the validation, and a procedure for creating a table for logging validation operations.

**Note:**

Names specified by parameters of the DBMS_HIERARCHY subprograms are case-sensitive.

For information about using analytic views, see *Oracle Database Data Warehousing Guide*.

87.2 DBMS_HIERARCHY Security Model

Summarizes security considerations for the validation of analytic view and hierarchy objects.

All procedures in this package validate that the current user has the necessary privileges on the specified objects and return an error if those privileges are not found.

**Note:**

To ensure that the user has enough tablespace to log validation operations, do one of the following:

- GRANT UNLIMITED TABLESPACE TO *username* ;
- ALTER USERNAME *username* QUOTA *size* ON *tablespace_name* ;

The following system privileges are required to use this package:

To validate objects in the user's own schema:

- CREATE TABLE privilege for CREATE_VALIDATE_LOG_TABLE or to have VALIDATE_ANALYTIC_VIEW or VALIDATE_HIERARCHY automatically create a table
- SELECT privilege on the tables or views used by the analytic view or hierarchy
- INSERT privilege on the tables used by the attribute dimensions of the hierarchy or the fact table used by the analytic view

To validate objects in different schemas:

- CREATE ANY TABLE privilege for CREATE_VALIDATE_LOG_TABLE or to have the VALIDATE_ANALYTIC_VIEW or VALIDATE_HIERARCHY automatically create a table
- INSERT ANY TABLE privilege on the tables used by the attribute dimensions of the hierarchy or the fact table used by the analytic view

87.3 Summary of DBMS_HIERARCHY Subprograms

This table lists the DBMS_HIERARCHY subprograms and briefly describes them.

Subprogram	Description
CREATE_VALIDATE_LOG_TABLE Procedure	Creates a table that you can use for logging messages generated by the VALIDATE_HIERARCHY and VALIDATE_ANALYTIC_VIEW functions.
CREATE_VIEW_FOR_FACT_ROWS Procedure	This procedure creates a view for fact rows.
CREATE_VIEW_FOR_STAR_ROWS Procedure	This procedure creates a view for star rows.
GET_MV_SQL_FOR_AV_CACHE Function	This function either returns the SQL for a cache that is defined in the AV or the SQL for a given set of measures and levels. These measures and levels do not need to be part of a cache in the AV.
GET_MV_SQL_FOR_STAR_CACHE Function	This function returns the SQL in text form for the star cache.
UPGRADE_VALIDATE_LOG_TABLE Procedure	This procedure takes a log table and upgrades it to the newest format. Returns an error if the table cannot be upgraded due to other errors.
VALIDATE_ANALYTIC_VIEW Function	Validates that the data in a table is suitable for use by an analytic view.
VALIDATE_CHECK_SUCCESS Function	Indicates whether a prior call to VALIDATE_HIERARCHY or VALIDATE_ANALYTIC_VIEW was successful or produced validation errors.
VALIDATE_HIERARCHY Function	Validates that the data in a table is suitable for use by a hierarchy.

87.3.1 CREATE_VALIDATE_LOG_TABLE Procedure

This procedure creates a table that you can use for logging messages generated by the `VALIDATE_ANALYTIC_VIEW` or `VALIDATE_HIERARCHY` function, which validate data used by an analytic view or hierarchy.

The table that this procedure creates has the following structure.

NAME	NULL?	DATATYPE
LOG_NUMBER	NOT NULL	NUMBER
ACTION_ORDER	NOT NULL	NUMBER
OBJECT_OWNER	NOT NULL	VARCHAR2 (128 BYTE)
OBJECT_NAME	NOT NULL	VARCHAR2 (128 BYTE)
ACTION	NOT NULL	VARCHAR2 (10 BYTE)
TIME	NOT NULL	TIMESTAMP (6)
ERROR_NUMBER		NUMBER
ERROR_MESSAGE		VARCHAR2 (4000)

Syntax

```
DBMS_HIERARCHY.CREATE_VALIDATE_LOG_TABLE (
    table_name          IN  VARCHAR2,
    owner_name         IN  VARCHAR2          DEFAULT NULL,
    IGNORE_IF_EXISTS  IN  PL/SQL BOOLEAN   DEFAULT FALSE);
```

Parameters

Parameter	Description
<code>table_name</code>	The name of the table to create.
<code>owner_name</code>	The name of the schema in which to create the table. If <code>owner_name</code> is NULL, then the table is created in the current user's schema.
<code>IGNORE_IF_EXISTS</code>	A Boolean that indicates whether to create the table if a table by the same name exists. If you specify a table, it must have the same structure as the table that this procedure creates.

Examples

Example 87-1 Creating a Validation Log Table

```
BEGIN
    DBMS_HIERARCHY.CREATE_VALIDATE_LOG_TABLE (
        'VAL_AV_HIERARCHY_LOG',
        'AV_USER',
        FALSE
    );
END;
/
```

87.3.2 CREATE_VIEW_FOR_FACT_ROWS Procedure

This procedure creates a view over the analytic view that exposes only the rows of the fact table. This allows standard SQL group functions to be used to aggregate those rows. The advantage to querying such a view rather than the fact table directly is that the analytic view may be able to perform query optimizations otherwise unavailable. When `include_meas` is `TRUE`, the `AV_AGGREGATE` group function may be used to expose measure columns defined in the analytic view.

Syntax

```
DBMS_HIERARCHY.CREATE_VIEW_FOR_FACT_ROWS (
    analytic_view_name      IN VARCHAR2,
    view_name               IN VARCHAR2,
    dim_hier_seq            IN ID2_SEQUENCE  DEFAULT NULL,
    analytic_view_owner_name IN VARCHAR2    DEFAULT
SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA'),
    view_owner_name         IN VARCHAR2    DEFAULT
SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA'),
    dim_qual_sep            IN VARCHAR2    DEFAULT '_',
    all_join_keys           IN BOOLEAN     DEFAULT TRUE,
    include_meas            IN BOOLEAN     DEFAULT FALSE,
    include_hier_attr       IN BOOLEAN     DEFAULT FALSE);
```

Parameters

Parameter	Description
<code>analytic_view_name</code>	The name of the analytic view to be created.
<code>view_name</code>	The name of the view.
<code>dim_hier_seq</code>	A sequence of ID2 records. An ID2 record contains two VARCHAR2 (128) for the two parallel components, providing (dim, hier) name pairs. Default value is NULL which indicates that all hierarchies should be considered.
<code>analytic_view_owner_name</code>	The name of the analytic view owner. The default value is <code>SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA')</code> .
<code>view_owner_name</code>	The owner of the view to be created. The default value is <code>SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA')</code> .
<code>dim_qual_sep</code>	The separator to be used on the columns of the created view. For example, <ul style="list-style-type: none"> for fact columns - "FACT" <code>dim_qual_sep</code> {name of fact column alias} for measures - "MEASURE" <code>dim_qual_sep</code> {measure name alias} The default value is <code>_</code> .

Parameter	Description
all_join_keys	If TRUE, adds all of the join key columns in the AV to the view.
include_meas	If TRUE, include all of the base measures and calculated measures defined in the AV as columns in the created view.
include_hier_attr	If TRUE, include all of the hierarchical attributes defined in the AV as columns in the created view.

87.3.3 CREATE_VIEW_FOR_STAR_ROWS Procedure

This procedure creates a view over the analytic view that exposes only rows for a particular dimension star table. Such a view is intended to be used in conjunction with a corresponding fact rows view created using CREATE_VIEW_FOR_FACT_ROWS, joined using their corresponding keys as defined in the analytic view.

Syntax

```
DBMS_HIERARCHY.CREATE_VIEW_FOR_STAR_ROWS (
    analytic_view_name      IN VARCHAR2,
    dimension_alias        IN VARCHAR2,
    view_name              IN VARCHAR2,
    analytic_view_owner_name  IN VARCHAR2      DEFAULT
SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA'),
    view_owner_name        IN VARCHAR2      DEFAULT
SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA'),
    hier_qual_sep          IN VARCHAR2      DEFAULT '_',
    include_hier_attr      IN BOOLEAN      DEFAULT FALSE);
```

Parameters

Parameter	Description
analytic_view_name	The name of the analytic view to be created.
dimension_alias	The alias of the attribute dimension that you wish to create a star rows view for.
view_name	The name of the view.
analytic_view_owner_name	The name of the analytic view owner. The default value is SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA').
view_owner_name	The owner of the view to be created. The default value is SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA').
hier_qual_sep	The separator to be used. The separator is between the attribute dimension name and the built-in hierarchical attributes, such as MEMBER_NAME, LEVEL_NAME, DEPTH, and so on. The default value is _.
include_hier_attr	If TRUE, include all of the hierarchical attributes defined in the AV as columns in the created view.

87.3.4 GET_MV_SQL_FOR_AV_CACHE Function

This function has two signatures. The first version of this method returns the SQL for a cache that is defined in the AV. The second version of this method returns SQL for a given set of measures and levels. These measures and levels do not need to be part of a cache in the AV.

Syntax

```
DBMS_HIERARCHY.GET_MV_SQL_FOR_AV_CACHE (
    analytic_view_name      IN
    VARCHAR2,
    cache_idx               IN    NUMBER,
    analytic_view_owner_name IN    VARCHAR2 DEFAULT
    SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA'))
    RETURN CLOB;
```

```
DBMS_HIERARCHY.GET_MV_SQL_FOR_AV_CACHE (
    analytic_view_name      IN
    VARCHAR2,
    lvl_seq                 IN    ID3_SEQUENCE DEFAULT NULL,
    meas_seq                IN    ID_SEQUENCE  DEFAULT NULL,
    analytic_view_owner_name IN    VARCHAR2 DEFAULT
    SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA'))
    RETURN CLOB;
```

Parameters

Table 87-1 GET_MV_SQL_FOR_AV_CACHE Function Parameters

Parameter	Description
analytic_view_name	The name of the analytic view to be created.
cache_idx	Zero-based index for the caches defined on the AV.
analytic_view_owner_name	The name of the analytic view owner. The default value is SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA').
lvl_seq	The list of levels that the cache should be based on.
meas_seq	The list of measures that the cache should be based on.

87.3.5 GET_MV_SQL_FOR_STAR_CACHE Function

This function returns the SQL in text form for the star cache.

Syntax

```
DBMS_HIERARCHY.GET_MV_SQL_FOR_STAR_CACHE (
    attr_dim_name          IN    VARCHAR2,
    attr_dim_owner_name    IN    VARCHAR2 DEFAULT SYS_CONTEXT('USERENV',
    'CURRENT_SCHEMA'))
    RETURN CLOB;
```

Parameters

Table 87-2 GET_MV_SQL_FOR_STAR_CACHE Function Parameters

Parameter	Description
attr_dim_name	The name of the attribute dimension on which to create a cache.
attr_dim_owner_name	The schema that owns the attribute dimension. The default value is <code>SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA')</code> .

87.3.6 UPGRADE_VALIDATE_LOG_TABLE Procedure

This procedure takes a log table and upgrades it to the newest format. Returns an error if the table cannot be upgraded due to other errors.

Syntax

```
DBMS_HIERARCHY.UPGRADE_VALIDATE_LOG_TABLE (
    table_name      IN VARCHAR2,
    owner_name      IN VARCHAR2          DEFAULT NULL);
```

Parameters

Parameter	Description
table_name	The name of the table to upgrade.
owner_name	The name of the schema in which to find the table. If <code>owner_name</code> is <code>NULL</code> , then the table is created in the current user's schema.

87.3.7 VALIDATE_ANALYTIC_VIEW Function

This function validates that the data in a table or view conforms to the logical constraints inherent in the definition of an analytic view.

Syntax

```
DBMS_HIERARCHY.VALIDATE_ANALYTIC_VIEW (
    analytic_view_name      IN VARCHAR2          DEFAULT NULL,
    analytic_view_owner_name IN VARCHAR2          DEFAULT NULL,
    log_table_name          IN VARCHAR2          DEFAULT NULL,
    log_table_owner_name    IN VARCHAR2          DEFAULT NULL)
RETURN NUMBER;
```

Parameters

Parameter	Description
analytic_view_name	The name of the analytic view to validate.
analytic_view_owner_name	The name of the owner of the schema that contains the analytic view.

Parameter	Description
log_table_name	The name of the validation log table in which to put the results of the validation operation.
log_table_owner_name	The name of the owner of the schema in which the validation log table exists or in which to create the table.

Returns

The number of the entry in the validation log table for the validation results.

Usage Notes

If the `log_table_name` parameter is `NULL`, then the `VALIDATE_ANALYTIC_VIEW` function creates a validation log table. The name of the table it creates is `DBMS_HIERARCHY_LOG`.

When the validation operation begins, a row is inserted into the log table with the action of `START`. When the operation completes, a row is inserted into the log table with the action of `END`. When an error is detected, a row is inserted into the log table with the action of `ERROR`, and the associated `error_number` and `error_message` columns are populated. All rows inserted into the validation log table include a log number and the time of the insert.

The `VALIDATE_ANALYTIC_VIEW` function verifies that the following conditions are true for each attribute dimension the analytic view is dimensioned by:

- The key values found in the fact table for the attribute dimension must exist in the star schema dimension table for that attribute dimension.
- The referenced attribute values for the attribute dimension must be unique across all rows of the star schema dimension table for that dimension.

Also, for every hierarchy in the analytic view, the function verifies that the following conditions are true:

- The primary key of a level determines a unique value for each attribute of the level.
- For each row of the table or view used by the attribute dimension of the hierarchy, the value for every level key column (including alternate keys) of a `NOT NULL` level is non-`NULL`.
- For each row of the table or view, either all level key columns and alternate key columns of a `SKIP WHEN NULL` level must be `NULL` or they must all be non-`NULL`. This verifies that the alternate level key is determined by the level key.
- For each group of rows that have the same alternate key column values for a level, the key column values must have the same column values. This verifies that the level key is determined by the alternate level key, which is required for an alternate key.

Examples

Example 87-2 Validating an Analytic View

```

DECLARE
  log_num NUMBER;
  obj_name VARCHAR2(8) := 'SALES_AV';
BEGIN
  log_num := DBMS_HIERARCHY.VALIDATE_ANALYTIC_VIEW(obj_name);
END;
/

```

87.3.8 VALIDATE_CHECK_SUCCESS Function

This function indicates whether a prior call to `VALIDATE_HIERARCHY` or `VALIDATE_ANALYTIC_VIEW` was successful or produced validation errors.

Syntax

```

DBMS_HIERARCHY.VALIDATE_CHECK_SUCCESS (
  TOPOBJ_NAME          IN VARCHAR2,
  TOPOBJ_OWNER        IN VARCHAR2,
  LOG_NUMBER           IN VARCHAR2,
  LOG_TABLE_NAME       IN VARCHAR2,
  LOG_TABLE_OWNER_NAME IN VARCHAR2 )
RETURN VARCHAR2;

```

Parameters

Parameter	Description
TOPOBJ_NAME	The name of the hierarchy or analytic view.
TOPOBJ_OWNDER	The owner of the hierarchy or analytic view.
LOG_NUMBER	The number of the log entry.
LOG_TABLE_NAME	The name of the log table.
LOG_TABLE_OWNER_NAME	The name of the schema in which the table exists.

Returns

A `VARCHAR2` that is `SUCCESS` if no errors occurred or `ERROR` if errors did occur.

Examples

Example 87-3 Using VALIDATE_CHECK_SUCCESS

This example finds out whether the prior call to `VALIDATE_ANALYTIC_VIEW` encountered errors.

```

DECLARE
  log_num NUMBER;
  succ VARCHAR2(7);
  obj_name VARCHAR2(8) := 'SALES_AV';
BEGIN

```

```

log_num := dbms_hierarchy.validate_analytic_view(obj_name);
succ := dbms_hierarchy.validate_check_success(
    topobj_name => obj_name, log_number => log_num);
IF (succ != 'SUCCESS') THEN
    RAISE_APPLICATION_ERROR(
        num => -20000,
        msg => 'Validate failed!');
END IF;
END;
/

```

87.3.9 VALIDATE_HIERARCHY Function

This function validates that the data in a table or view conforms to the logical constraints inherent in the definitions of an attribute dimension that uses the table or view and a hierarchy that uses the attribute dimension.

Syntax

```

DBMS_HIERARCHY.VALIDATE_HIERARCHY (
    hier_name           IN VARCHAR2,
    hier_owner_name     IN VARCHAR2   DEFAULT NULL,
    log_table_name      IN VARCHAR2   DEFAULT NULL,
    log_table_owner_name IN VARCHAR2   DEFAULT NULL)
RETURN NUMBER;

```

Parameters

Parameter	Description
hier_name	The name of the hierarchy to validate.
hier_owner_name	The name of the owner of the schema that contains the hierarchy.
log_table_name	The name of the validation log table in which to put the results of the validation operation.
log_table_owner_name	The name of the owner of the schema in which the validation log table exists or in which to create the table.

Returns

The number of the entry in the validation log table for the validation results.

Usage Notes

If the `log_table_name` parameter is NULL, then the `VALIDATE_HIERARCHY` function creates a validation log table. The name of the table it creates is `DBMS_HIERARCHY_LOG`.

When the validation operation begins, a row is inserted into the log table with the action of `START`. When the operation completes, a row is inserted into the log table with the action of `END`. When an error is detected, a row is inserted into the log table with the action of `ERROR`, and the associated `error_number` and `error_message` columns are populated. All rows inserted into the validation log table include a log number and the time of the insert.

The `VALIDATE_HIERARCHY` function verifies that the following conditions are true for the hierarchy:

- The primary key of a level determines a unique value for each attribute of the level.
- For each row of the table or view used by the attribute dimension of the hierarchy, the value for every level key column (including alternate keys) of a `NOT NULL` level is non-NULL.
- For each row of the table or view, either all level key columns and alternate key columns of a `SKIP WHEN NULL` level must be `NULL` or they must all be non-NULL. This verifies that the alternate level key is determined by the level key.
- For each group of rows that have the same alternate key column values for a level, the key column values must have the same column values. This verifies that the level key is determined by the alternate level key, which is required for an alternate key.

Examples

Example 87-4 Validating a Hierarchy and Specifying a Table Name

This example validates the `PRODUCT_HIER` hierarchy and specifies that the results be inserted in the table named `VAL_AV_HIERARCHY_LOG`. The owner of the hierarchy and of the schema that contains the table is `AV_USER`.

```
-- Create a log table.
BEGIN
  DBMS_HIERARCHY.CREATE_VALIDATE_LOG_TABLE (
    'VAL_AV_HIERARCHY_LOG',
    'AV_USER',
    FALSE
  );
END;
/

-- Validate the hierarchy.
DECLARE
  log_num NUMBER;
  obj_name VARCHAR2(12) := 'PRODUCT_HIER';
  table_name VARCHAR2(28) := 'VAL_AV_HIERARCHY_LOG';
BEGIN
  log_num := DBMS_HIERARCHY.VALIDATE_HIERARCHY(obj_name, 'AV_USER',
table_name);
END;
/
```

Query the log table.

```
SELECT LOG_NUMBER, ACTION, OBJECT_NAME, ERROR_NUMBER, ERROR_MESSAGE
FROM AV_USER.VAL_AV_HIERARCHY_LOG;
WHERE OBJECT_NAME = 'PRODUCT_HIER';
```

LOG_NUMBER	ACTION	OBJECT_NAME	ERROR_NUMBER	ERROR_MESSAGE
1	START	PRODUCT_HIER		
1	END	PRODUCT_HIER		

Example 87-5 Validating a Hierarchy Without Specifying a Table Name

This example shows that if you do not specify a validation log table, then the `VALIDATE_HIERARCHY` function creates one named `DBMS_HIERARCHY_LOG`.

```
DECLARE
  log_num NUMBER;
  obj_name VARCHAR2(12) := 'PRODUCT_HIER';
BEGIN
  log_num := DBMS_HIERARCHY.VALIDATE_HIERARCHY(obj_name);
END;
```

Query the log table.

```
SELECT LOG_NUMBER, ACTION, OBJECT_NAME, ERROR_NUMBER, ERROR_MESSAGE
       FROM DBMS_HIERARCHY_LOG
       WHERE OBJECT_NAME = 'PRODUCT_HIER';
```

LOG_NUMBER	ACTION	OBJECT_NAME	ERROR_NUMBER	ERROR_MESSAGE
1	START	PRODUCT_HIER		
1	END	PRODUCT_HIER		

DBMS_HM

This package contains constants and procedure declarations for health check management. Health Monitor provides facilities to run a check store and retrieve the reports through DBMS_HM package

This chapter contains the following topics:

- [Security Model](#)
- [Summary of DBMS_HM Subprograms](#)



See Also:

Oracle Database Administrator's Guide for more information about "Health Monitor"

88.1 DBMS_HM Security Model

Users must have EXECUTE privilege to run the procedures of DBMS_HM package.

88.2 Summary of DBMS_HM Subprograms

This table lists the DBMS_CONNECTION_POOL subprograms and briefly describes them.

Table 88-1 DBMS_HM Package Subprograms

Subprogram	Description
GET_RUN_REPORT Function	Returns the report for the specified checker run
RUN_CHECK Procedure	Runs the specified checker with the given arguments

88.2.1 GET_RUN_REPORT Function

This function returns the report for the specified checker run.

Syntax

```
DBMS_HM.GET_RUN_REPORT (
  run_name      IN VARCHAR2,
  type          IN VARCHAR2 := 'TEXT',
  level         IN VARCHAR2 := 'BASIC',)
RETURN CLOB;
```

Parameters

Table 88-2 GET_RUN_REPORT Function Parameters

Parameter	Description
run_name	Name of the check's run
type	Report format type. Possible values are 'HTML', 'XML' and 'TEXT'. Default report type is 'TEXT'.
level	Details of report, possible value are 'BASIC' and 'DETAIL'. Caution: Currently only 'BASIC' level is supported.

88.2.2 RUN_CHECK Procedure

This procedure runs the specified checker with the specified arguments.

You can specify a name for the run, the inputs needed and maximum time-out for the run. The run report will be maintained persistently in the database.

Syntax

```
DBMS_HM.RUN_CHECK (
    check_name      IN  VARCHAR2,
    run_name        IN  VARCHAR2 := NULL,
    timeout         IN  NUMBER := NULL,
    input_params    IN  VARCHAR2 := NULL);
```

Parameters

Table 88-3 RUN_CHECK Procedure Parameters

Parameter	Description
check_name	Name of the check to be invoked. Check names and their parameters can be accessed from the V\$HM_CHECK and V\$HM_CHECK_PARAM views. Users can run all checks which are not internal in nature: SELECT name FROM V\$HM_CHECK WHERE INTERNAL_CHECK = 'N' retrieves the list of checks that can be run manually by users.
run_name	Name with which external users can uniquely identify this check's run. If NULL value is passed, then HM creates a unique name and associates with this check's run.
timeout	Maximum amount of time (in units of seconds), this checker run is allowed to run. HM will interrupt the run, if it the specified time elapses for the run. If NULL value is passed, HM doesn't impose any timeout limits on the run.

Table 88-3 (Cont.) RUN_CHECK Procedure Parameters

Parameter	Description
input_params	<p>Input string: which consists of name, value pairs de-limited by a special character ';'. Example ('Data Block Integrity Check' invocation may take following type of input parameters. <code>'BLC_DF_NUM=1;BLC_BL_NUM=23456'</code></p> <p>Input parameters BLC_DF_NUM and BLC_BL_NUM have values '1' and '23456' respectively. Every check will have well defined set of inputs associated with it. These Input parameters, their types, default values and descriptions can be obtained using V\$HM_CHECK_PARAM view. Example: The following query gets the list of parameters, their default values and descriptions for a 'Data Block Integrity Check'</p> <pre>SELECT a.* FROM v\$hm_check_param a, v\$hm_check b WHERE a.check_id = b.id AND b.name = 'Data Block Integrity Check';</pre>

DBMS_HPROF

The `DBMS_HPROF` package provides an interface for profiling the execution of PL/SQL applications. It provides services for collecting the hierarchical profiler data, analyzing the raw profiler output and profiling information generation.

This chapter contains the following topic:

- [Summary of DBMS_HPROF Subprograms](#)



See Also:

Oracle Database Development Guide for more information about the "PL/SQL Hierarchical Profiler"

89.1 DBMS_HPROF Security Model

You must have the following privileges to use the `DBMS_HPROF` package:

- An `EXECUTE` privilege on the `DBMS_HPROF` package.
- A `WRITE` privilege on the directory that you specify when you call the `DBMS_HPROF.START_PROFILING` procedure.

89.2 Summary of DBMS_HPROF Subprograms

This table lists and briefly describes the `DBMS_HPROF` package subprograms.

Table 89-1 DBMS_HPROF Package Subprograms

Subprogram	Description
ANALYZE Function	Analyzes the raw profiler output and produces hierarchical profiler information in database tables.
CREATE_TABLES Procedure	Creates the hierarchical profiler database tables and data structures in the user's session.
START_PROFILING Procedure	Starts hierarchical profiler data collection in the user's session.
STOP_PROFILING Procedure	Stops profiler data collection in the user's session.

89.2.1 ANALYZE Function

This function analyzes the raw profiler output and produces hierarchical profiler information in database tables or generates out-of-the-box HTML reports.

Syntax

```
DBMS_HPROF.ANALYZE (
    trace_id          IN NUMBER,
    summary_mode      IN BOOLEAN DEFAULT FALSE,
    trace             IN VARCHAR2 DEFAULT NULL,
    skip              IN PLS_INTEGER DEFAULT 0,
    collect           IN PLS_INTEGER DEFAULT NULL,
    run_comment       IN VARCHAR2 DEFAULT NULL)
RETURN NUMBER;
```

```
DBMS_HPROF.ANALYZE (
    trace_id          IN NUMBER,
    report_clob       OUT CLOB,
    trace             IN VARCHAR2 DEFAULT NULL,
    skip              IN PLS_INTEGER DEFAULT 0,
    collect           IN PLS_INTEGER DEFAULT NULL);
```

Parameters

Table 89-2 ANALYZE Function Parameters

Parameter	Description
trace_id	The trace_id of the raw profiler data entry in the raw profiler data table (dbmshp_trace_data).
summary_mode	By default (that is, when summary_mode is FALSE), a detailed analysis is done. When summary_mode is TRUE, only top-level summary information is generated into the database table.
report_clob	The analyzed HTML report.
trace	Analyzes only the subtrees rooted at the specified trace entry. By default (when trace is NULL), the analysis/reporting is generated for the entire run. The trace entry must be specified in a special quoted qualified format. For example, "HR"."PKG"."FOO" or "'.'"__plsqli_vm". If multiple overloads exist for the specified name, all of them will be analyzed.
skip	Used only when trace is specified. Analyze only the subtrees rooted at the specified trace, but ignore the first skip invocations to trace. The default value for skip is 0.
collect	Used only when trace is specified. Analyze collect number of invocations of traces (starting from skip+1'th invocation). By default, only 1 invocation is collected.
run_comment	User-provided comment for this run.

Return Values

A unique run identifier for this run of the analyzer. This can then be used to look up the results corresponding to this run from the hierarchical profiler tables.

Usage Notes

- Use the `DBMS_HPROF.CREATE_TABLES` subprogram to create the hierarchical profiler database tables and other data structures required for persistently storing the results of analyzing the raw profiler data.
- Calling the `DBMS_HPROF.CREATE_TABLES` with default value (`FALSE`) will raise error if table already exists.
- Use `DBMS_HPROF.CREATE_TABLES(TRUE)` to drop any previously created hierarchical profiler tables.
- Use the `DBMS_HPROF.CREATE_TABLES` to drop any previously created hierarchical profiler tables. By default, `force_it` is `FALSE`; therefore, to drop any previously created hierarchical profiler tables you must set the value of `force_it` to `TRUE`.
- If `trace_id` entry is `NULL`, error is raised.
- If `trace_id` entry in the raw profiler data table does not exist, error is raised.
- If raw data of the `trace_id` entry in the raw profiler data table is `NULL` or is zero size, error is raised.

Examples

The following snippet installs the hierarchical profiler tables in HR schema.

```
connect HR/<password>;
```

The following example analyzes and generates HTML CLOB report from a raw profiler data table.

```
DECLARE
    reportclob clob;
    trace_id number;
BEGIN
    -- create raw profiler data and analysis tables
    -- force_it =>TRUE will dropped the tables if table exists
    DBMS_HPROF.CREATE_TABLES(force_it =>TRUE);

    -- Start profiling
    -- Write raw profiler data in raw profiler data table
    trace_id := DBMS_HPROF.START_PROFILING;

    -- Run procedure to be profiled
    test;

    -- Stop profiling
    DBMS_HPROF.STOP_PROFILING;

    -- analyzes trace_id entry in raw profiler data table and produce
    -- analyzed HTML report in reportclob
    DBMS_HPROF.ANALYZE(trace_id , reportclob);
END;
/
```

89.2.2 CREATE_TABLES Procedure

Creates the hierarchical profiler database tables and data structures in the user's session.

Syntax

```
DBMS_HPROF.CREATE_TABLES (  
    force_it          IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 89-3 CREATE_TABLES Procedure Parameters

Parameter	Description
force_it	If FALSE and DBMS_HPROF tables are present, then an HPROF error is raised. If TRUE , then the procedure creates tables. If the tables already exist, then they are dropped and new tables are created.

Note:

Users need not use the `dbmshptab.sql` script located in the `rdbms/admin` directory to create the hierarchical profiler database tables and data structures anymore.

The `dbmshptab.sql` script is deprecated starting in Oracle Database 18c.

89.2.3 START_PROFILING Procedure

This procedure starts hierarchical profiler data collection in the user's session.

Syntax

```
DBMS_HPROF.START_PROFILING (  
    max_depth      IN PLS_INTEGER DEFAULT NULL,  
    sqlmonitor     IN BOOLEAN DEFAULT TRUE,  
    run_comment    IN VARCHAR2 DEFAULT NULL)  
RETURN NUMBER;
```

Parameters

Table 89-4 START_PROFILING Procedure Parameters

Parameter	Description
<code>max_depth</code>	By default (that is, when <code>max_depth</code> value is <code>NULL</code>) profile information is gathered for all functions irrespective of their call depth. When a non- <code>NULL</code> value is specified for <code>max_depth</code> , the profiler collects data only for functions up to a call depth level of <code>max_depth</code> .
<code>sqlmonitor</code>	Generates a real-time monitoring report for a profiler run when the profiler run ends. The default value is <code>TRUE</code> .
<code>run_comment</code>	User provided comment for the profiler data collection run.

Return Values

Unique run identifier for this profiler run. This can then be used to look up the results corresponding to this run from the hierarchical profiler tables.

Usage Notes

- Even though the profiler does not individually track functions at depth greater than `max_depth`, the time spent in such functions is charged to the ancestor function at depth `max_depth`.
- Raw profiler data is generated in the raw profiler data table with an unique `trace_id`.
- The unique `trace_id` is used to manage the raw profiler output stored in the raw profiler data table.

89.2.4 STOP_PROFILING Procedure

This procedure stops profiler data collection in the user's session. This subprogram also has the side effect of flushing data collected so far in the session, and it signals the end of a run. When the `STOP_PROFILING` procedure returns `CLOB`, it contains the Real-Time Monitoring report for the profiler run.

Syntax

```
DBMS_HPROF.STOP_PROFILING;
```

```
DBMS_HPROF.STOP_PROFILING
  RETURN CLOB;
```

Examples

Profiling with raw profiler data table

```
DECLARE
  analyze_runid number;
  trace_id number;
BEGIN
  -- create raw profiler data and analysis tables
```



```
-- call create_tables with force_it =>FALSE (default) when
-- raw profiler data and analysis tables do not exist already
DBMS_HPROF.CREATE_TABLES;
-- Start profiling
-- Write raw profiler data in raw profiler data table
trace_id := DBMS_HPROF.START_PROFILING;
-- Run the procedure to be profiled
test;
-- Stop profiling
DBMS_HPROF.STOP_PROFILING;
-- analyzes trace_id entry in raw profiler data table and writes
-- hierarchical profiler information in hprof's analysis tables
analyze_runid := DBMS_HPROF.ANALYZE(trace_id);
END;
/
```

DBMS_HS_PARALLEL

The `DBMS_HS_PARALLEL` PL/SQL package enables parallel processing for heterogeneous targets access. This package is designed to improve performance when retrieving data from a large foreign table.

This chapter discusses the following topics:

- [Using DBMS_HS_PARALLEL](#)
- [Summary of DBMS_HS_PARALLEL Subprograms](#)

90.1 Using the DBMS_HS_PARALLEL Subprogram

`DBMS_HS_PARALLEL` is compiled with the authorization ID of `CURRENT_USER`, which uses invoker's rights. In other words, all procedures in this package are executed with the privileges of the calling user.

90.2 Summary of DBMS_HS_PARALLEL Subprograms

This table lists the `DBMS_HS_PARALLEL` subprograms in alphabetic order and briefly describes them.

Table 90-1 DBMS_HS_PARALLEL Package Subprograms

Subprogram	Description
CREATE_OR_REPLACE_VIEW	Creates (or replaces) a read-only view to be referenced for retrieving the data from a remote table in parallel.
CREATE_TABLE_TEMPLATE	Writes out a <code>CREATE TABLE</code> template based on information gathered from the remote table. You can use the information to add any optimal Oracle <code>CREATE TABLE</code> clauses.
DROP_VIEW	Drops the view and internal objects created by the <code>CREATE_OR_REPLACE_VIEW</code> procedure. If the view has not already been created by the <code>CREATE_OR_REPLACE_VIEW</code> procedure, an error message is returned.
LOAD_TABLE	Loads the data from a remote table to a local Oracle table in parallel. If the local Oracle table does not already exist, it is created automatically.

90.2.1 CREATE_OR_REPLACE_VIEW Procedure

This procedure creates (or replaces) a read-only view to be referenced for retrieving the data from a remote table in parallel.

Syntax

```
CREATE_OR_REPLACE_VIEW (remote_table, database_link, oracle_view, parallel_degree)
```

Parameters

Table 90-2 CREATE_OR_REPLACE_VIEW Procedure Parameters

Parameters	Description
remote_table	The name of the remote database table. It is specified as [remote_schema_name.]remote_table_name.
database_link	The remote database link name. The call can only be applied to a heterogeneous services database link.
oracle_view	The name of the Oracle view. It is specified as [schema_name.]oracle_view_name. The default schema name is the current user. If the oracle_view parameter is not specified, the remote table name will be used as the view name.
parallel_degree	The number of parallel processes for the operation is computed based on the range-partition number if applicable, or the number of CPUs. The range of values is 2 to 16.

Usage Notes

- The specified Oracle view is created and future reference of this view utilizes internal database objects for parallel retrieval of remote non-Oracle table data. If the Oracle view already exists, the following Oracle error message is raised:
ORA-00955: name is already used by an existing object
- This view is created as a read-only view. If you attempt to insert and update the view, the following Oracle error message is raised:
ORA-01733: virtual column not allowed here
- If the remote table or the database link does not exist, one of the following Oracle error messages is raised:
ORA-00942: table or view does not exist
or
ORA-02019: connection description for remote database not found
- You need the CREATE VIEW, CREATE TABLE, CREATE TYPE, CREATE PACKAGE, and CREATE FUNCTION privileges to execute the CREATE_OR_REPLACE_VIEW procedure.
- If you encounter either of the following Oracle error messages, increase the PROCESSES and SESSIONS parameter in the Oracle initialization parameter file:
ORA-12801: error signaled in parallel query server P003
or
ORA-00018: maximum number of session exceeded
- Because the CREATE_OR_REPLACE_VIEW procedure creates some internal objects, use the DROP_VIEW procedure to drop the view and the internal objects. The SQL DROP VIEW statement only drops the view and not the internal objects.

90.2.2 CREATE_TABLE_TEMPLATE Procedure

This procedure writes out a `CREATE TABLE` template based on information gathered from the remote table. You can use the information to add any optimal Oracle `CREATE TABLE` clauses.

Syntax

```
CREATE_TABLE_TEMPLATE (remote_table, database_link, oracle_table,
create_table_template_string)
```

Parameters

Table 90-3 CREATE_TABLE_TEMPLATE Procedure Parameters

Parameter	Description
<code>remote_table</code>	The name of the remote database table. It is specified as <code>[remote_schema_name.]remote_table_name</code> .
<code>database_link</code>	The remote database link name. The call can only be applied to a heterogeneous services database link.
<code>oracle_table</code>	The name of the local Oracle table the data will be loaded into. It is specified as <code>[schema_name.]oracle_table_name</code> . The default schema name is the current user. If the <code>oracle_table</code> parameter is not specified, the remote table name will be used as the local Oracle name.
<code>create_table_template_string</code>	Contains the Oracle <code>CREATE TABLE</code> SQL template when the procedure is returned.

90.2.3 DROP_VIEW Procedure

This procedure drops the view and internal objects created by the `CREATE_OR_REPLACE_VIEW` procedure. If the view has not already been created by the `CREATE_OR_REPLACE_VIEW` procedure, an error message is returned.

Syntax

```
DROP_VIEW (oracle_view)
```

Parameters

Table 90-4 DROP_VIEW Procedure Parameter

Parameter	Description
<code>oracle_view</code>	The name of the Oracle view created by the <code>CREATE_OR_REPLACE_VIEW</code> procedure. If the view has not been created by the <code>CREATE_OR_REPLACE_VIEW</code> procedure, an error is returned.

90.2.4 LOAD_TABLE Procedure

This procedure loads the data from a remote table to a local Oracle table in parallel. If the local Oracle table does not already exist, it is created automatically.

Syntax

```
LOAD_TABLE (remote_table, database_link, oracle_table, truncate,
parallel_degree, row_count)
```

Parameters

Table 90-5 LOAD_TABLE Procedure Parameters

Parameter	Description
remote_table	The name of the remote database table. It is specified as [remote_schema_name.]remote_table_name
database_link	The remote database link name. The call can only be applied to a heterogeneous services database link.
oracle_table	The name of the local Oracle table the data will be loaded into. It is specified as [schema_name.]oracle_table_name. The default schema name is the current user. If the oracle_table parameter is not specified, the remote table name will be used as the local Oracle name.
truncate	Determines whether the Oracle table is truncated before the data is loaded. The value is either TRUE or FALSE. The default value is TRUE which means the Oracle table is truncated first. When set to FALSE, the Oracle table will not be truncated before the data is loaded.
parallel_degree	The number of parallel processes for the operation is computed based on the range-partition number if applicable, or the number of CPUs. The range of values is 2 to 16.
row_count	Contains the number of rows just added with the load table operation.

Usage Notes

- This procedure only loads the remote table data into Oracle local table. It does not create a key, index, constraints or any other dependencies such as triggers. It is recommended that you create these dependencies after the table data is loaded as performance will improve greatly. You will need to decide whether to create the dependencies before or after the data is loaded based on your knowledge of the remote table data and dependencies.
- If the local table does not exist, the `LOAD_TABLE` procedure creates a simple (non-partitioned) local table based on the exact column matching of the remote table after which the data is inserted into the local table.

- If the remote table or the database link does not exist, an error message is returned.
- If the local table is incompatible with the remote table, an error message is returned.
- You need the `CREATE TABLE`, `CREATE TYPE`, `CREATE PACKAGE`, and `CREATE FUNCTION` privileges to execute the `LOAD_TABLE` procedure.
- If you encounter either of the following Oracle error messages, increase the `PROCESSES` and `SESSIONS` parameter in Oracle initialization parameter file:

```
ORA-12801: error signaled in parallel query server P003  
or  
ORA-00018: maximum number of session exceeded
```

- One of the following is required for parallel processing:
 - The remote table is range partitioned.
 - Histogram information for a numeric column is available.
 - There is a numeric index or primary key.
- To drop the local table, use the `DROP TABLE` SQL statement.

DBMS_HS_PASSTHROUGH

The `DBMS_HS_PASSTHROUGH` PL/SQL package allows you to send a statement directly to a non-Oracle system without being interpreted by the Oracle server. This can be useful if the non-Oracle system allows operations in statements for which there is no equivalent in Oracle.

This chapter discusses the following topics:

- [DBMS_HS_PASSTHROUGH Overview](#)
- [DBMS_HS_PASSTHROUGH Operational Notes](#)
- [Summary of DBMS_HS_PASSTHROUGH Subprograms](#)

 **See Also:**

Oracle Database Heterogeneous Connectivity User's Guide for more information about this package

91.1 DBMS_HS_PASSTHROUGH Overview

You can execute passthrough SQL statements directly at the non-Oracle system using the PL/SQL package `DBMS_HS_PASSTHROUGH`. Any statement executed with this package is executed in the same transaction as standard SQL statements.

 **See Also:**

Oracle Database Heterogeneous Connectivity User's Guide for information about this package

91.2 DBMS_HS_PASSTHROUGH Operational Notes

The `DBMS_HS_PASSTHROUGH` package is a virtual package. It conceptually resides at the non-Oracle system. In reality, however, calls to this package are intercepted by Heterogeneous Services and mapped to one or more Heterogeneous Services calls. The driver, in turn, maps these Heterogeneous Services calls to the API of the non-Oracle system. The client application should invoke the procedures in the package through a database link in exactly the same way as it would invoke a non-Oracle system stored procedure. The special processing done by Heterogeneous Services is transparent to the user.

91.3 Summary of DBMS_HS_PASSTHROUGH Subprograms

This table lists the `DBMS_HS_PASSTHROUGH` subprograms and briefly describes them.

Table 91-1 DBMS_HS_PASSTHROUGH Package Subprograms

Subprogram	Description
BIND_INOUT_VARIABLE Procedure	Binds IN OUT bind variables
BIND_INOUT_VARIABLE_RAW Procedure	Binds IN OUT bind variables of datatype RAW
BIND_OUT_VARIABLE Procedure	Binds an OUT variable with a PL/SQL program variable
BIND_OUT_VARIABLE_RAW Procedure	Binds an OUT variable of datatype RAW with a PL/SQL program variable
BIND_VARIABLE Procedure	Binds an IN variable positionally with a PL/SQL program variable
BIND_VARIABLE_RAW Procedure	Binds IN variables of type RAW
CLOSE_CURSOR Procedure	Closes the cursor and releases associated memory after the SQL statement has been run at the non-Oracle system
EXECUTE_IMMEDIATE Procedure	Runs a (non-SELECT) SQL statement immediately, without bind variables
EXECUTE_NON_QUERY Function	Runs a (non-SELECT) SQL statement
FETCH_ROW Function	Fetches rows from a query
GET_VALUE Procedure	Retrieves column value from SELECT statement, or retrieves OUT bind parameters
GET_VALUE_RAW Procedure	Similar to GET_VALUE, but for datatype RAW
OPEN_CURSOR Function	Opens a cursor for running a passthrough SQL statement at the non-Oracle system
PARSE Procedure	Parses SQL statement at non-Oracle system

91.3.1 BIND_INOUT_VARIABLE Procedure

This procedure binds IN OUT bind variables.

Syntax

```
DBMS_HS_PASSTHROUGH.BIND_OUT_VARIABLE (
  c      IN BINARY_INTEGER NOT NULL,
  p      IN BINARY_INTEGER NULL,
  v      OUT <dt>,
  n      IN VARCHAR2);
```

<dt> is either DATE, NUMBER, or VARCHAR2.



See Also:

For binding OUT variables of datatype RAW, see [BIND_OUT_VARIABLE_RAW Procedure](#).

Pragmas

Purity level defined : WNDS, RNDS

Parameters

Table 91-2 BIND_INOUT_VARIABLE Procedure Parameters

Parameter	Description
c	Cursor associated with the passthrough SQL statement. Cursor must be opened and parsed, using the routines <code>OPEN_CURSOR</code> and <code>PARSE</code> respectively.
p	Position of the bind variable in the SQL statement: Starts at 1.
v	This value is used for two purposes: - To provide the IN value before the SQL statement is run. - To determine the size of the out value.
n	(Optional) Name of the bind variable. For example, in <code>SELECT * FROM emp WHERE ename=:ename</code> , the position of the bind variable <code>:ename</code> is 1, the name is <code>:ename</code> . This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 91-3 BIND_INOUT_VARIABLE Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

91.3.2 BIND_INOUT_VARIABLE_RAW Procedure

This procedure binds IN OUT bind variables of datatype RAW.

Syntax

```

DBMS_HS_PASSTHROUGH.BIND_INOUT_VARIABLE_RAW (
  c      IN      BINARY_INTEGER NOT NULL,
  p      IN      BINARY_INTEGER NOT NULL,
  v      IN OUT RAW,
  n      IN      VARCHAR2);

```

Pragmas

Purity level defined : WNDS, RNDS

Parameters

Table 91-4 BIND_INOUT_VARIABLE_RAW Procedure Parameters

Parameter	Description
c	Cursor associated with the passthrough SQL statement. Cursor must be opened and parsed using the routines <code>OPEN_CURSOR</code> and <code>PARSE</code> respectively.
p	Position of the bind variable in the SQL statement: Starts at 1.
v	This value is used for two purposes: - To provide the IN value before the SQL statement is run. - To determine the size of the out value.
n	(Optional) Name the bind variable. For example, in <code>SELECT * FROM emp WHERE ename=:ename</code> , the position of the bind variable <code>:ename</code> is 1, the name is <code>:ename</code> . This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 91-5 BIND_INOUT_VARIABLE_RAW Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

91.3.3 BIND_OUT_VARIABLE Procedure

This procedure binds an `OUT` variable with a PL/SQL program variable.

Syntax

```
DBMS_HS_PASSTHROUGH.BIND_OUT_VARIABLE (
  c      IN  BINARY_INTEGER NOT NULL,
  p      IN  BINARY_INTEGER NULL,
  v      OUT <dt>,
  n      IN  VARCHAR2);
```

<dt> is either `DATE`, `NUMBER`, or `VARCHAR2`.



See Also:

For binding `OUT` variables of datatype `RAW`, see [BIND_OUT_VARIABLE_RAW Procedure](#).

Pragmas

Purity level defined : WNDS, RNDS

Parameters

Table 91-6 BIND_OUT_VARIABLE Procedure Parameters

Parameter	Description
c	Cursor associated with the passthrough SQL statement. Cursor must be opened and parsed, using the routines <code>OPEN_CURSOR</code> and <code>PARSE</code> respectively.
p	Position of the bind variable in the SQL statement: Starts at 1.
v	Variable in which the <code>OUT</code> bind variable stores its value. The package remembers only the "size" of the variable. After the SQL statement is run, you can use <code>GET_VALUE</code> to retrieve the value of the <code>OUT</code> parameter. The size of the retrieved value should not exceed the size of the parameter that was passed using <code>BIND_OUT_VARIABLE</code> .
n	(Optional) Name of the bind variable. For example, in <code>SELECT * FROM emp WHERE ename=:ename</code> , the position of the bind variable <code>:ename</code> is 1, the name is <code>:ename</code> . This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 91-7 BIND_OUT_VARIABLE Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A <code>NULL</code> value was passed for a <code>NOT NULL</code> parameter.

91.3.4 BIND_OUT_VARIABLE_RAW Procedure

This procedure binds an `OUT` variable of datatype `RAW` with a PL/SQL program variable.

Syntax

```
DBMS_HS_PASSTHROUGH.BIND_OUT_VARIABLE_RAW (
    c      IN  BINARY_INTEGER NOT NULL,
    p      IN  BINARY_INTEGER NOT NULL,
```

```
v      OUT RAW,
n      IN  VARCHAR2);
```

Pragmas

Purity level defined : WNDS, RNDS

Parameters

Table 91-8 BIND_OUT_VARIABLE_RAW Procedure Parameters

Parameter	Description
c	Cursor associated with the passthrough SQL statement. Cursor must be opened and parsed, using the routines OPEN_CURSOR and PARSE respectively.
p	Position of the bind variable in the SQL statement: Starts at 1.
v	Variable in which the OUT bind variable stores its value. The package remembers only the "size" of the variable. After the SQL statement is run, you can use GET_VALUE to retrieve the value of the OUT parameter. The size of the retrieved value should not exceed the size of the parameter that was passed using BIND_OUT_VARIABLE_RAW.
n	(Optional) Name of the bind variable. For example, in SELECT * FROM emp WHERE ename=:ename, the position of the bind variable :ename is 1, the name is :ename. This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 91-9 BIND_OUT_VARIABLE_RAW Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

91.3.5 BIND_VARIABLE Procedure

This procedure binds an IN variable positionally with a PL/SQL program variable.

Syntax

```
DBMS_HS_PASSTHROUGH.BIND_VARIABLE (
  c      IN BINARY_INTEGER NOT NULL,
  p      IN BINARY_INTEGER NOT NULL,
  v      IN <dt>,
  n      IN VARCHAR2);
```

<dt> is either DATE, NUMBER, or VARCHAR2.



See Also:

To bind RAW variables use [BIND_VARIABLE_RAW Procedure](#).

Pragmas

Purity level defined: WNDS, RNDS

Parameters

Table 91-10 BIND_VARIABLE Procedure Parameters

Parameter	Description
c	Cursor associated with the passthrough SQL statement. Cursor must be opened and parsed using the routines OPEN_CURSOR and PARSE respectively.
p	Position of the bind variable in the SQL statement: Starts at 1.
v	Value that must be passed to the bind variable name.
n	(Optional) Name of the bind variable. For example, in SELECT * FROM emp WHERE ename=:ename, the position of the bind variable :ename is 1, the name is :ename. This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 91-11 BIND_VARIABLE Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

91.3.6 BIND_VARIABLE_RAW Procedure

This procedure binds IN variables of type RAW.

Syntax

```
DBMS_HS_PASSTHROUGH.BIND_VARIABLE_RAW (
  c   IN BINARY_INTEGER NOT NULL,
  p   IN BINARY_INTEGER NOT NULL,
  v   IN RAW,
  n   IN VARCHAR2);
```

Pragmas

Purity level defined : WNDS, RNDS

Parameters

Table 91-12 BIND_VARIABLE_RAW Procedure Parameters

Parameter	Description
c	Cursor associated with the passthrough SQL statement. Cursor must be opened and parsed, using the routines <code>OPEN_CURSOR</code> and <code>PARSE</code> respectively.
p	Position of the bind variable in the SQL statement: Starts at 1.
v	Value that must be passed to the bind variable.
n	(Optional) Name of the bind variable. For example, in <code>SELECT * FROM emp WHERE ename=:ename</code> , the position of the bind variable <code>:ename</code> is 1, the name is <code>:ename</code> . This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 91-13 BIND_VARIABLE_RAW Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

91.3.7 CLOSE_CURSOR Procedure

This function closes the cursor and releases associated memory after the SQL statement has been run at the non-Oracle system. If the cursor was not open, then the operation is a "no operation".

Syntax

```
DBMS_HS_PASSTHROUGH.CLOSE_CURSOR (
    c IN BINARY_INTEGER NOT NULL);
```

Pragmas

Purity level defined : WNDS, RNDS

Parameters

Table 91-14 CLOSE_CURSOR Procedure Parameters

Parameter	Description
c	Cursor to be released.

Exceptions

Table 91-15 CLOSE_CURSOR Procedure Exceptions

Exception	Description
ORA-28555	A NULL value was passed for a NOT NULL parameter.

91.3.8 EXECUTE_IMMEDIATE Procedure

This function runs a SQL statement immediately. Any valid SQL command except `SELECT` can be run immediately.

The statement must not contain any bind variables. The statement is passed in as a `VARCHAR2` in the argument. Internally the SQL statement is run using the `PASSTHROUGH SQL` protocol sequence of `OPEN_CURSOR`, `PARSE`, `EXECUTE_NON_QUERY`, `CLOSE_CURSOR`.

Syntax

```
DBMS_HS_PASSTHROUGH.EXECUTE_IMMEDIATE (
    s IN VARCHAR2 NOT NULL)
RETURN BINARY_INTEGER;
```

Parameters

Table 91-16 EXECUTE_IMMEDIATE Procedure Parameters

Parameter	Description
s	<code>VARCHAR2</code> variable with the statement to be executed immediately.

Return Values

The number of rows affected by the execution of the SQL statement.

Exceptions

Table 91-17 EXECUTE_IMMEDIATE Procedure Exceptions

Exception	Description
ORA-28551	SQL statement is invalid.
ORA-28554	Max open cursors.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

91.3.9 EXECUTE_NON_QUERY Function

This function runs a SQL statement. The SQL statement cannot be a `SELECT` statement. A cursor has to be open and the SQL statement has to be parsed before the SQL statement can be run.

Syntax

```
DBMS_HS_PASSTHROUGH.EXECUTE_NON_QUERY (
    c IN BINARY_INTEGER NOT NULL)
RETURN BINARY_INTEGER;
```

Parameters

Table 91-18 EXECUTE_NON_QUERY Function Parameters

Parameter	Description
c	Cursor associated with the passthrough SQL statement. Cursor must be opened and parsed, using the routines <code>OPEN_CURSOR</code> and <code>PARSE</code> respectively.

Return Values

The number of rows affected by the SQL statement in the non-Oracle system

Exceptions

Table 91-19 EXECUTE_NON_QUERY Function Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28555	A <code>NULL</code> value was passed for a <code>NOT NULL</code> parameter.

91.3.10 FETCH_ROW Function

This function fetches rows from a result set.

The result set is defined with a SQL `SELECT` statement. When there are no more rows to be fetched, the exception `NO_DATA_FOUND` is raised. Before the rows can be fetched, a cursor has to be opened, and the SQL statement has to be parsed.

Syntax

```
DBMS_HS_PASSTHROUGH.FETCH_ROW (
    c IN BINARY_INTEGER NOT NULL,
    f IN BOOLEAN)
RETURN BINARY_INTEGER;
```


Pragmas

Purity level defined : WNDS

Parameters

Table 91-20 FETCH_ROW Function Parameters

Parameter	Description
c	Cursor associated with the passthrough SQL statement. Cursor must be opened and parsed, using the routines <code>OPEN_CURSOR</code> and <code>PARSE</code> respectively.
first	(Optional) Reexecutes <code>SELECT</code> statement. Possible values: - <code>TRUE</code> : reexecute <code>SELECT</code> statement. - <code>FALSE</code> : fetch the next row, or if run for the first time, then execute and fetch rows (default).

Return Values

The returns the number of rows fetched. The function returns "0" if the last row was already fetched.

Exceptions

Table 91-21 FETCH_ROW Function Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28555	A <code>NULL</code> value was passed for a <code>NOT NULL</code> parameter.

91.3.11 GET_VALUE Procedure

This procedure has two purposes: it retrieves the select list items of `SELECT` statements after a row has been fetched, and it retrieves the `OUT` bind values, after the SQL statement has been run.

Syntax

```
DBMS_HS_PASSTHROUGH.GET_VALUE (
  c      IN BINARY_INTEGER NOT NULL,
  p      IN BINARY_INTEGER NOT NULL,
  v      OUT <dt>);
```

<dt> is either `DATE`, `NUMBER`, or `VARCHAR2`.



See Also:

For retrieving values of datatype RAW, see [GET_VALUE_RAW Procedure](#).

Pragmas

Purity level defined : WNDS

Parameters

Table 91-22 GET_VALUE Procedure Parameters

Parameter	Description
c	Cursor associated with the passthrough SQL statement. Cursor must be opened and parsed, using the routines OPEN_CURSOR and PARSE respectively.
p	Position of the bind variable or select list item in the SQL statement: Starts at 1.
v	Variable in which the OUT bind variable or select list item stores its value.

Exceptions

Table 91-23 GET_VALUE Procedure Exceptions

Exception	Description
ORA-1403	Returns NO_DATA_FOUND exception when running the GET_VALUE after the last row was fetched (that is, FETCH_ROW returned "0").
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

91.3.12 GET_VALUE_RAW Procedure

This procedure is similar to GET_VALUE, but for datatype RAW.

Syntax

```
DBMS_HS_PASSTHROUGH.GET_VALUE_RAW (
  c   IN  BINARY_INTEGER NOT NULL,
  p   IN  BINARY_INTEGER NOT NULL,
  v   OUT RAW);
```

Pragmas

Purity level defined : WNDS

Parameters

Table 91-24 GET_VALUE_RAW Procedure Parameters

Parameter	Description
c	Cursor associated with the passthrough SQL statement. Cursor must be opened and parsed, using the routines <code>OPEN_CURSOR</code> and <code>PARSE</code> respectively.
p	Position of the bind variable or select list item in the SQL statement: Starts at 1.
v	Variable in which the <code>OUT</code> bind variable or select list item stores its value.

Exceptions

Table 91-25 GET_VALUE_RAW Procedure Exceptions

Exception	Description
ORA-1403	Returns <code>NO_DATA_FOUND</code> exception when running the <code>GET_VALUE</code> after the last row was fetched (that is, <code>FETCH_ROW</code> returned "0").
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A <code>NULL</code> value was passed for a <code>NOT NULL</code> parameter.

91.3.13 OPEN_CURSOR Function

This function opens a cursor for running a passthrough SQL statement at the non-Oracle system. This function must be called for any type of SQL statement.

The function returns a cursor, which must be used in subsequent calls. This call allocates memory. To deallocate the associated memory, call the procedure `CLOSE_CURSOR`.

Syntax

```
DBMS_HS_PASSTHROUGH.OPEN_CURSOR
RETURN BINARY_INTEGER;
```

Pragmas

Purity level defined : WNDS, RNDS

Return Values

The cursor to be used on subsequent procedure and function calls.

Exceptions

Table 91-26 OPEN_CURSOR Function Exceptions

Exception	Description
ORA-28554	Maximum number of open cursor has been exceeded. Increase Heterogeneous Services' OPEN_CURSORS initialization parameter.

91.3.14 PARSE Procedure

This procedure parses an SQL statement at a non-Oracle system.

Syntax

```
DBMS_HS_PASSTHROUGH.PARSE (
  c      IN BINARY_INTEGER NOT NULL,
  stmt   IN VARCHAR2 NOT NULL);
```

Pragmas

Purity level defined : WNDS, RNDS

Parameters

Table 91-27 PARSE Procedure Parameters

Parameter	Description
c	Cursor associated with the passthrough SQL statement. Cursor must be opened using function OPEN_CURSOR.
stmt	Statement to be parsed.

Exceptions

Table 91-28 PARSE Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28551	SQL statement is illegal.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

DBMS_ILM

The `DBMS_ILM` package provides an interface for implementing Information Lifecycle Management (ILM) strategies using Automatic Data Optimization (ADO) policies.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Exceptions](#)
- [Summary of DBMS_ILM Subprograms](#)



See Also:

- *Oracle Database VLDB and Partitioning Guide* for information about managing Automatic Data Optimization (ADO) with this package
- [DBMS_ILM_ADMIN](#)
- [DBMS_HEAT_MAP](#)

92.1 DBMS_ILM Overview

To implement your ILM strategy, you can use Heat Map in Oracle Database to track data access and modification. You can also use Automatic Data Optimization (ADO) to automate the compression and movement of data between different tiers of storage within the database. The `DBMS_ILM` package supports immediate evaluation or execution of ADO related tasks. T

he package supports the following two ways for scheduling ADO actions.

- A database user schedules immediate ADO policy execution on a set of objects.
- A database user views the results of evaluation of ADO policies on a set of objects. The user then adds or deletes objects to this set and reviews the results of ADO policy evaluation again. The user repeats this step to determine the set of objects for ADO execution. The user can then schedule ADO actions for immediate execution on this set of objects.

The following procedures support the two usage modes. Before describing the procedures, we introduce the notion of an ADO task as an entity that helps to track a particular evaluation or (an evaluation and execution) of ADO policies. A particular ADO task could be in one of the following states.

- Inactive
- Active

- Completed

92.2 DBMS_ILM Security Model

The DBMS_ILM package runs under invoker's rights.

92.3 DBMS_ILM Constants

The table in this topic lists the constants used by the DBMS_ILM package.

Table 92-1 DBMS_ILM Constants

Constant	Value	Type	Description
ILM_ALL_POLICIES	'ALL POLICIES'	VARCHAR2 (20)	Selects all ADO policies on an object
ILM_EXECUTION_OF FLINE	1	NUMBER	Specifies that the object may be offline while ADO action is performed
ILM_EXECUTION_ON LINE	2	NUMBER	Specifies that the object should be online while ADO action is performed
SCOPE_DATABASE	1	NUMBER	Selects all ADO policies in the database
SCOPE_SCHEMA	2	NUMBER	Selects all ADO policies in the current schema
SCHEDULE_IMMEDIA TE	1	NUMBER	Schedules ADO task for immediate execution
ARCHIVE_STATE_AC TIVE	'0'	VARCHAR2 (1)	Represents the value of the ORA_ARCHIVE_STATE column of a row-archival enabled table that would make the row active
ARCHIVE_STATE_AR CHIVED	'1'	VARCHAR2 (1)	Represents the value of the ORA_ARCHIVE_STATE column of a row-archival enabled table that would make the row inactive

92.4 DBMS_ILM Exceptions

The table in this topic lists the exceptions raised by the DBMS_ILM package.

Table 92-2 DBMS_ILM Exceptions

Exception	Error Code	Description
INVALID_ARGUMENT_VALUE	38327	Invalid argument value
INVALID_ILM_DICTIONARY	38328	Inconsistent dictionary state
INTERNAL_ILM_ERROR	38329	Internal error
INSUFFICIENT_PRIVILEGES	38330	Insufficient privileges

92.5 Summary of DBMS_ILM Subprograms

This table lists and describes the DBMS_ILM package subprograms.

Table 92-3 DBMS_ILM Package Subprograms

Subprogram	Description
ADD_TO_ILM Procedure	Adds the object specified through the argument to a particular ADO task and evaluates the ADO policies on this object
ARCHIVESTATENAME Function	Returns the value of the ORA_ARCHIVE_STATE column of a row-archival enabled table
EXECUTE_ILM Procedure	Executes an ADO task.
EXECUTE_ILM_TASK Procedure	Executes an ADO task that has been evaluated previously
PREVIEW_ILM Procedure	Evaluates all ADO policies in the scope specified by means of an argument
REMOVE_FROM_ILM Procedure	Removes the object specified through the argument from a particular ADO task
STOP_ILM Procedure	Stops ADO-related jobs created for a particular ADO task

92.5.1 ADD_TO_ILM Procedure

This procedure adds the object specified through the argument to a particular ADO task and evaluates the ADO policies on this object.

The procedure can only be executed on an ADO task in an inactive state. The results of the ADO policy evaluation on this object can be viewed using the appropriate views depending on role and access (USER_ILMTASKS or DBA_ILMTASKS, USER_ILMEVALUATIONDETAILS or DBA_ILMEVALUATIONDETAILS, USER_ILMRESULTS or DBA_ILMRESULTS).

Syntax

```
DBMS_ILM.ADD_TO_ILM (
  task_id          IN   NUMBER,
  owner            IN   VARCHAR2,
  object_name      IN   VARCHAR2,
  subobject_name   IN   VARCHAR2 DEFAULT NULL);
```

Parameters

Table 92-4 ADD_TO_ILM Procedure Parameters

Parameter	Description
task_id	Identifies a particular ADO task
owner	Owner of the object
object_name	Name of the object
subobject_name	Name of the subobject (partition name in the case of partitioned tables)

92.5.2 ARCHIVESTATENAME Function

This function returns the value of the `ORA_ARCHIVE_STATE` column of a row-archival enabled table.

Syntax

```
DBMS_ILM.ARCHIVESTATENAME (
    value      IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 92-5 *ARCHIVESTATENAME Function Parameters*

Parameter	Description
value	Value for which the archive state name is to be returned

Usage Notes

Returns `ARCHIVE_STATE_ACTIVE` for 0, `ARCHIVE_STATE_ARCHIVED` for others



See Also:

"Using In-Database Archiving" in *Oracle Database VLDB and Partitioning Guide*

92.5.3 EXECUTE_ILM Procedure

This procedure executes an ADO task.

There are two overloads to this procedure. The first overload executes an ADO task for a set of objects without having evaluated them previously. The second overload executes ADO policies for a specific object.

Syntax

```
DBMS_ILM.EXECUTE_ILM (
    task_id          OUT    NUMBER,
    ilm_scope        IN     NUMBER DEFAULT SCOPE_SCHEMA,
    execution_mode   IN     NUMBER DEFAULT ILM_EXECUTION_ONLINE);
```

```
DBMS_ILM.EXECUTE_ILM (
    owner            IN     VARCHAR2,
    object_name      IN     VARCHAR2,
    task_id          OUT    NUMBER,
    subobject_name   IN     VARCHAR2 DEFAULT NULL,
    policy_name      IN     VARCHAR2 DEFAULT ILM_ALL_POLICIES,
    execution_mode   IN     NUMBER DEFAULT ILM_EXECUTION_ONLINE);
```


Parameters

Table 92-6 EXECUTE_ILM Procedure Parameters

Parameter	Description
task_id	Identifies a particular ADO task
ilm_scope	Determines the set of objects considered for ADO execution. The default is to consider only the objects in the schema.
execution_mode	Whether the ADO task be executed online (ILM_EXECUTION_ONLINE) or offline (ILM_EXECUTION_OFFLINE)
owner	Owner of the object
object_name	Name of the object
subobject_name	Name of the subobject (partition name in the case of partitioned tables)
policy_name	Name of the ADO policy to be evaluated on the object. The package constant ILM_ALL_POLICIES should be used if all ADO policies on an object should be evaluated.

Usage Notes

- The EXECUTE_ILM procedure can be used by users who want more control of when ADO is performed, and who do not want to wait until the next maintenance window.
- The procedure executes like a DDL in that it auto commits before and after the ADO task and related jobs are created.

92.5.4 EXECUTE_ILM_TASK Procedure

This procedure executes an ADO task that has been evaluated previously and moves it to an active state.

Syntax

```
DBMS_ILM.EXECUTE_ILM_TASK (
    task_id          IN      NUMBER,
    execution_mode   IN      NUMBER DEFAULT ILM_EXECUTION_ONLINE);
    execution_schedule IN    NUMBER DEFAULT SCHEDULE_IMMEDIATE);
```

Parameters

Table 92-7 EXECUTE_ILM_TASK Procedure Parameters

Parameter	Description
task_id	Identifies a particular ADO task
execution_mode	Whether the ADO task be executed online (ILM_EXECUTION_ONLINE) or offline (ILM_EXECUTION_OFFLINE)
execution_schedule	Identifies when the ADO task should be executed. Currently, the only choice available is immediate scheduling of ADO jobs

92.5.5 PREVIEW_ILM Procedure

This procedure evaluates the ADO policies on the objects specified using the `ILM_SCOPE` argument.

It returns a number as `task_id` which identifies a particular ADO task. This can be used to view the results of the policy evaluation in the appropriate views depending on role and access (`USER_ILMTASKS` or `DBA_ILMTASKS`, `USER_ILMEVALUATIONDETAILS` or `DBA_ILMEVALUATIONDETAILS`, `USER_ILMRESULTS` or `DBA_ILMRESULTS`).

The `PREVIEW_ILM` procedure leaves the ADO task in an inactive state. Once you have previewed the results, you can add or delete objects to this task.

Syntax

```
DBMS_ILM.PREVIEW_ILM (
    task_id          OUT    NUMBER,
    ilm_scope        IN     NUMBER DEFAULT SCOPE_SCHEMA);
```

Parameters

Table 92-8 *PREVIEW_ILM Procedure Parameters*

Parameter	Description
<code>task_id</code>	Identifies a particular ADO task
<code>ilm_scope</code>	Identifies the scope of execution. Should be either <code>SCOPE_DATABASE</code> or <code>SCOPE_SCHEMA</code> as described in Constants

92.5.6 REMOVE_FROM_ILM Procedure

This procedure removes the object specified through the argument from a particular ADO task.

The procedure can only be executed on an ADO task in an inactive state.

Syntax

```
DBMS_ILM.REMOVE_FROM_ILM (
    task_id          IN     NUMBER,
    owner            IN     VARCHAR2,
    object_name      IN     VARCHAR2,
    subobject_name   IN     VARCHAR2 DEFAULT NULL);
```

Parameters

Table 92-9 *REMOVE_FROM_ILM Procedure Parameters*

Parameter	Description
<code>task_id</code>	Identifies a particular ADO task
<code>owner</code>	Owner of the object
<code>object_name</code>	Name of the object

Table 92-9 (Cont.) REMOVE_FROM_ILM Procedure Parameters

Parameter	Description
subobject_name	Name of the subobject (partition name in the case of partitioned tables)

92.5.7 STOP_ILM Procedure

This procedure terminates ILM ADO jobs associated to a particular task Id or job name.

Syntax

```
DBMS_ILM.STOP_ILM (
    task_id          IN          NUMBER,
    p_drop_running_jobs IN      BOOLEAN DEFAULT FALSE),
    p_jobname       IN          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 92-10 STOP_ILM Procedure Parameters

Parameter	Description
task_id	Number that uniquely identifies a particular ADO task
p_drop_running_jobs	Determines whether running jobs are dropped
p_jobname	Name of job to be terminated

DBMS_ILM_ADMIN

The `DBMS_ILM_ADMIN` package provides an interface to customize Automatic Data Optimization (ADO) policy execution. In combination with partitioning and compression, ADO policies can be used to help implement an Information Lifecycle Management (ILM) strategy.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Summary of DBMS_ILM_ADMIN Subprograms](#)

See Also:

- *Oracle Database VLDB and Partitioning Guide* for information about managing Automatic Data Optimization (ADO) with this package
- [DBMS_ILM](#)
- [DBMS_HEAT_MAP](#)

93.1 DBMS_ILM_ADMIN Overview

To implement your ILM strategy, you can use Heat Map in Oracle Database to track data access and modification. You can also use Automatic Data Optimization (ADO) to automate the compression and movement of data between different tiers of storage within the database.

93.2 DBMS_ILM_ADMIN Security Model

This package runs under definer's rights. The user requires DBA privileges.

93.3 DBMS_ILM_ADMIN Constants

The table in this topic describes constants used by the `DBMS_ILM_ADMIN` package.

The value column refers to the numeric or character value that the constants resolve to.

Table 93-1 DBMS_ILM_ADMIN Constants

Constant	Value	Type	Description
ABS_JOBLIMIT	12	NUMBER	Specifies the absolute number of concurrent ILM ADO jobs.
DEG_PARALLEL	10	NUMBER	Decides the degree of parallelism to be used for ADO jobs
ENABLED	7	NUMBER	Provides a way to turn background ADO off or on
EXECUTION_INTERVAL	1	NUMBER	Determines the frequency with which ADO background evaluation occurs. Specified in minutes.
EXECUTION_MODE	4	NUMBER	Controls whether ADO execution is online, offline. The value for this parameter should either be DBMS_ILM_ADMIN.ILM_EXECUTION_OFFLINE or DBMS_ILM_ADMIN.ILM_EXECUTION_ONLINE.
HEAT_MAP_SEG_LOOKUP	8	NUMBER	Index scan done
HEAT_MAP_SEG_READ	1	NUMBER	Segment read done
HEAT_MAP_SEG_SCAN	4	NUMBER	Full table scan done
HEAT_MAP_SEG_WRITE	2	NUMBER	Segment write done
JOB_SIZELIMIT	13	NUMBER	Specifies the size (in megabytes) of the data that is processed by a single ILM ADO row level compression job.
JOBLIMIT	5	NUMBER	Controls the upper limit on number of ILM ADO jobs at any time. The maximum number of concurrent ADO jobs is JOBLIMIT*(number of instances)*(number of CPUs per instance).
POLICY_TIME	11	NUMBER	Decides if ADO policies are treated as though they are specified in seconds rather than days. Can take value ILM_POLICY_IN_SECONDS (treat policy time in seconds) or ILM_POLICY_IN_DAYS (treat policy time in days - default).
RETENTION_TIME	2	NUMBER	Controls the amount of time ADO history should be maintained. Specified in days.
TBS_PERCENT_FREE	9	NUMBER	Decides the targeted tablespace storage through ADO actions as a percentage of tablespace quota.
TBS_PERCENT_USED	8	NUMBER	Decides when a tablespace is considered full. Specified as a percentage of tablespace quota.

The DBMS_ILM_ADMIN package uses the constants as parameter values shown in [Table 93-2](#).

Table 93-2 DBMS_ILM_ADMIN Constants Used as Parameter Values

Constant	Value	Type	Description
AUTO_OPTIMIZE_ENABLED	15	NUMBER	Indicates whether automatic storage compression is enabled.
AUTO_OPTIMIZE_INACTIVITY_THRESHOLD	14	NUMBER	The period of inactivity that will determine that there are no modifications. This can be specified using <code>DBMS_ILM_ADMIN.CUSTOMIZE_ILM</code> . The default value is 1440 minutes, which is 1 day.
ILM_DISABLED	2	NUMBER	Indicates automatic ADO policy evaluation and execution is disabled
ILM_ENABLED	1	NUMBER	Indicates automatic ADO policy evaluation and execution is enabled
ILM_EXECUTION_OFFLINE	1	NUMBER	Specifies that the object may be offline while ADO action is performed.
ILM_EXECUTION_ONLINE	2	NUMBER	Specifies that the object should be online while ADO action is performed
ILM_POLICY_IN_DAYS	0	NUMBER	Indicates policy is specified in days. This is the default.

Table 93-2 (Cont.) DBMS_ILM_ADMIN Constants Used as Parameter Values

Constant	Value	Type	Description
ILM_POLICY_IN_SECONDS	1	NUMBER	Indicates policy unit is changed from days to seconds. This could be used to test ADO policy evaluation quickly instead of waiting for the policy duration.

 **Note:**

- Setting ILM_POLICY_IN_SECONDS does not compress the blocks within the specified seconds.
- Setting ILM_POLICY_IN_SECONDS is for test ADO and should not be set in the production environment.

93.4 Summary of DBMS_ILM_ADMIN Subprograms

This table lists and briefly describes the DBMS_ILM_ADMIN package subprograms.

Table 93-3 DBMS_ILM_ADMIN Package Subprograms

Subprogram	Description
CLEAR_HEAT_MAP_ALL Procedure	Deletes all rows except the dummy row
CLEAR_HEAT_MAP_TABLE Procedure	Clears all or some statistics for the heat map table, deleting rows for a given table or segment which match a given pattern, or all such rows
CUSTOMIZE_ILM Procedure	Customizes environment for ILM execution by specifying the values for ILM execution related parameters
DISABLE_ILM Procedure	Turns off all background ILM scheduling
ENABLE_AUTO_OPTIMIZE Procedure	Enables Auto Compression for all Hybrid Columnar Compression objects in the PDB.
ENABLE_ILM Procedure	Turns on all background ILM scheduling
IGNORE_AUTO_OPTIMIZE_CRITERIA Procedure	Ignores the inactivity threshold so that uncompressed loads will be eligible for background auto optimization immediately.
SET_HEAT_MAP_ALL Procedure	Updates or inserts heat map rows for all tables
SET_HEAT_MAP_START Procedure	Sets the start date for collecting heat map data
SET_HEAT_MAP_TABLE Procedure	Updates or inserts a row for the specified table or segment

93.4.1 CLEAR_HEAT_MAP_ALL Procedure

This procedure deletes all rows in HEAT_MAP_STAT\$ except the dummy row.

Syntax

```
DBMS_ILM_ADMIN.CLEAR_HEAT_MAP_ALL;
```

93.4.2 CLEAR_HEAT_MAP_TABLE Procedure

This procedure clears all or some statistics for the heat map table, deleting rows for a given table or segment which match a given pattern, or all such rows.

Syntax

```
DBMS_ILM_ADMIN.CLEAR_HEAT_MAP_TABLE (
  owner          IN VARCHAR2,
  tablename      IN VARCHAR2,
  partition      IN VARCHAR2 default '',
  access_date    IN DATE DEFAULT NULL,
  segment_access_summary IN NUMBER DEFAULT NULL);
```


Parameters

Table 93-4 *CLEAR_HEAT_MAP_TABLE Procedure Parameters*

Parameter	Description
owner	Table owner
tablename	Table name
partition	Name of the subobject, defaults to NULL
access_date	Date for the entry in HEAT_MAP_STAT\$ to be removed
segment_access_summary	Summary of segment access constants indicating access operations performed on the segment

93.4.3 CUSTOMIZE_ILM Procedure

This procedure customizes environment for ILM execution by specifying the values for ILM execution related parameters. These values take effect for the next background scheduling.

Syntax

```
DBMS_ILM_ADMIN.CUSTOMIZE_ILM (
    parameter      IN      NUMBER,
    value          IN      NUMBER);
```

Parameters

Table 93-5 *CUSTOMIZE_ILM Procedure Parameters*

Parameter	Description
parameter	One of the parameter constants defined in DBMS_ILM_ADMIN package
value	Value of parameter

93.4.4 DISABLE_AUTO_OPTIMIZE Procedure

Disables Auto Compression for all Hybrid Columnar Compression objects in the PDB.

Syntax

After you issue `enable_auto_optimize`, auto compression will be enabled. New direct loads will be in an uncompressed format and the data will be compressed gradually in the background. For example, after five direct loads the user issues `disable_auto_optimize`. If the background auto compression task was only able to compress three of them (because of autotask time constraints, data not yet cold, etc.), the remaining two will be in an uncompressed format. The data from these two uncompressed loads will be compressed in the background even after the user issues `disable_auto_optimize`, but new direct loads will now be compressed.

```
DBMS_ILM_ADMIN.DISABLE_AUTO_OPTIMIZE;
```

93.4.5 DISABLE_ILM Procedure

This procedure turns off all background ILM scheduling.

Syntax

```
DBMS_ILM_ADMIN.DISABLE_ILM;
```

93.4.6 ENABLE_AUTO_OPTIMIZE Procedure

Enables Auto Compression for all Hybrid Columnar Compression objects in the PDB.

When Auto Compression is enabled, direct loads into a Hybrid Columnar Compression (HCC) object would use the uncompressed format to achieve faster loads. The system will then wait until there are no modifications to the newly loaded data, for the duration of the specified inactivity threshold. At that point, the data from the uncompressed direct load will be gradually HCC compressed using a background Auto Compression task.

Syntax

```
DBMS_ILM_ADMIN.ENABLE_AUTO_OPTIMIZE;
```

93.4.7 ENABLE_ILM Procedure

This procedure turns on all background ILM scheduling.

Syntax

```
DBMS_ILM_ADMIN.ENABLE_ILM;
```

93.4.8 IGNORE_AUTO_OPTIMIZE_CRITERIA Procedure

Ignores the inactivity threshold so that uncompressed loads will be eligible for background auto optimization immediately.

Syntax

```
DBMS_ILM_ADMIN.IGNORE_AUTO_OPTIMIZE_CRITERIA;
```

93.4.9 SET_HEAT_MAP_ALL Procedure

This procedure sets an HTTP request header. The request header is sent to the Web server as soon as it is set.

Syntax

```
DBMS_ILM_ADMIN.SET_HEAT_MAP_ALL (
    access_date          IN DATE,
    segment_access_summary IN NUMBER);
```

Parameters

Table 93-6 *SET_HEAT_MAP_ALL Procedure Parameters*

Parameter	Description
access_date	Date for the entry in HEAT_MAP_STAT\$ to be added
segment_access_summary	Summary of segment access constants indicating access operations performed on the segment

93.4.10 SET_HEAT_MAP_START Procedure

This procedure sets the start date for collecting heat map data.

Syntax

```
DBMS_ILM_ADMIN.SET_HEAT_MAP_START (
    start_date IN DATE);
```

Parameters

Table 93-7 *SET_HEAT_MAP_START Procedure Parameters*

Parameter	Description
start_date	Indicates the new date from which all statistics are valid

93.4.11 SET_HEAT_MAP_TABLE Procedure

This procedure updates or inserts a row for the specified table or segment.

Syntax

```
DBMS_ILM_ADMIN.SET_HEAT_MAP_TABLE (
    owner          IN VARCHAR2,
    tablename      IN VARCHAR2,
    partition      IN VARCHAR2 DEFAULT '',
    access_date    IN DATE DEFAULT NULL,
    segment_access_summary IN NUMBER DEFAULT NULL);
```

Parameters

Table 93-8 *SET_HEAT_MAP_TABLE Procedure Parameters*

Parameter	Description
owner	Table owner
tablename	Table name
partition	Name of the subobject, defaults to NULL
access_date	Date for the entry in HEAT_MAP_STAT\$ to be added
segment_access_summary	Summary of segment access constants indicating access operations performed on the segment

DBMS_IMMUTABLE_TABLE

Immutable tables are read-only tables that protect data against unauthorized modification. They also prevent against accidental data modifications that may be caused by human errors. The `DBMS_IMMUTABLE_TABLE` package allows you to delete the expired rows in an immutable table and add interval partitioning.

This chapter contains the following topics:

- [DBMS_IMMUTABLE_TABLE Overview](#)
- [DBMS_IMMUTABLE_TABLE Security Model](#)
- [Summary of DBMS_IMMUTABLE_TABLE Subprograms](#)



See Also:

- *Oracle Database Administrator's Guide*
- *Oracle Database SQL Language Reference*
- *Oracle Database Reference*

94.1 DBMS_IMMUTABLE_TABLE Overview

Immutable tables are `read-only` tables that protect data against unauthorized modification. Immutable tables also prevent against accidental data modifications that may be caused by human errors. You must specify a retention period for the immutable table and for rows within the immutable table. An immutable table can be dropped if it contains no rows or if the specified retention period for the table has elapsed. Rows can be deleted from an immutable table only after the specified retention period for rows in the table has elapsed. Except for increasing the retention periods and adding interval partitioning, you cannot modify the definition of an immutable table with this package.

94.2 DBMS_IMMUTABLE_TABLE Security Model

The `DBMS_IMMUTABLE_TABLE` package is owned by `SYS` and is installed as part of database installation. The routines in the package are run with invoker's rights and hence run with the privileges of the current user.

94.3 Summary of DBMS_IMMUTABLE_TABLE Subprograms

This table lists the `DBMS_IMMUTABLE_TABLE` subprograms in alphabetical order and briefly describes them.

Table 94-1 DBMS_IMMUTABLE_TABLE Package Subprograms

Subprogram	Description
ADD_INTERVAL_PARTITIONING Procedure	This procedure adds interval partitioning to an existing, non-partitioned, V1 or V2 immutable table.
DELETE_EXPIRED_ROWS Procedure	This procedure deletes the expired rows.

94.3.1 ADD_INTERVAL_PARTITIONING Procedure

This procedure adds interval partitioning to an existing, non-partitioned, V1 or V2 immutable table.

Syntax

```
DBMS_IMMUTABLE_TABLE.ADD_INTERVAL_PARTITIONING (
    schema_name          IN    VARCHAR2,
    table_name           IN    VARCHAR2,
    interval_number      IN    NUMBER,
    interval_frequency   IN    VARCHAR2,
    first_high_timestamp IN    TIMESTAMP);
```

Parameters

Table 94-2 ADD_INTERVAL_PARTITIONING Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the immutable table.
interval_number	Sets how often the database creates partitions for the immutable table.
interval_frequency	Sets the frequency for the value that was set in the interval_number setting. Supported values are YEAR, MONTH, DAY, HOUR, and MINUTE.
first_high_timestamp	A timestamp that determines the upper boundary of the first partition in the immutable table.

Usage Notes

- Composite partitioning (that is, sub-partitioning) is not supported with the above interval partitioning.

94.3.2 DELETE_EXPIRED_ROWS Procedure

This procedure deletes some or all of the expired rows from the immutable table. This procedure commits before deleting any expired rows and commits after deleting any expired rows.

Syntax

```
DBMS_IMMUTABLE_TABLE.DELETE_EXPIRED_ROWS (
    schema_name          IN VARCHAR2,
```

```

table_name          IN VARCHAR2,
before_timestamp    IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
number_of_rows_deleted OUT NUMBER);

```

Parameters

Table 94-3 DELETE_EXPIRED_ROWS Procedure Parameters

Parameter	Description
schema_name	The name of the schema.
table_name	The name of the immutable table.
before_timestamp	If the parameter is NULL, all expired rows in the table are deleted. If the parameter is not NULL and older than the timestamp calculated based on current time and row retention time, rows with timestamps less than the parameter value are deleted. If the parameter is younger than the timestamp calculated based on the current time and row retention time, the calculated timestamp is used, and all expired rows are deleted. The default value is NULL.
number_of_rows_deleted	The number of rows deleted.

DBMS_INMEMORY

The `DBMS_INMEMORY` package provides an interface for In-Memory Column Store (IM column store) functionality.

This chapter contains the following topics:

- [DBMS_INMEMORY Overview](#)
- [DBMS_INMEMORY Security Model](#)
- [Summary of DBMS_INMEMORY Subprograms](#)

95.1 DBMS_INMEMORY Overview

This package contains procedures for populating and repopulating the IM column store, and for dropping IM expressions from a specified table.

IM Population and Repopulation

In-Memory population (population) occurs when the database reads existing row-format data from disk, transforms it into columnar format, and then stores it in the IM column store. Only objects with the `INMEMORY` attribute are eligible for population.

Population, which transforms existing data on disk into columnar format, is different from repopulation, which loads new data into the IM column store. Repopulation occurs automatically after their columnar data undergo significant DML activity.

When an object has the `INMEMORY` attribute and a priority other than `NONE`, the database gradually populates the object in the IM column store according to an internal priority queue. Objects with priority of `NONE` are populated only when they undergo a full scan.

The `DBMS_INMEMORY.POPULATE` procedure forces immediate population of an object. The `DBMS_INMEMORY.REPOPULATE` procedure forces immediate repopulation of an object.



See Also:

Oracle Database In-Memory Guide to learn more about IM population

IM Expressions

IM expressions populate frequently evaluated query expressions in the IM column store for subsequent reuse. An IM expression is materialized as a hidden virtual column, prefixed with the string `SYS_IME`, and is accessed in the same way as a non-virtual column.

When you use `DBMS_INMEMORY_ADMIN.IME_CAPTURE_EXPRESSIONS`, the database adds the 20 hottest expressions to their respective tables as `SYS_IME` columns and applies the default `INMEMORY` column compression clause. If any `SYS_IME` columns that were added during a

previous invocation are no longer in the latest expression list, then the database changes their attribute to `NO INMEMORY`.

The maximum number of `SYS_IME` columns for a table, regardless of whether the attribute is `INMEMORY` or `NO INMEMORY`, is 50. After the 50 expression limit is reached for a table, the database will not add new `SYS_IME` columns. To make space for new expressions, you must manually drop `SYS_IME` columns with the `DBMS_INMEMORY.IME_DROP_EXPRESSIONS` or `DBMS_INMEMORY_ADMIN.IME_DROP_ALL_EXPRESSIONS` procedures.



See Also:

Oracle Database In-Memory Guide to learn more about IM expressions

95.2 DBMS_INMEMORY Security Model

The `DBMS_INMEMORY` package subprograms execute with invoker's rights.

The `POPULATE` and `REPOPULATE` procedures require the invoking user to have `SELECT` privileges on the specified object. For `IME_DROP_EXPRESSIONS`, the invoking user must have `ALTER TABLE` privileges on the specified table.

95.3 Summary of DBMS_INMEMORY Subprograms

This table lists and briefly describes the `DBMS_INMEMORY` package subprograms.

Table 95-1 DBMS_INMEMORY Package Subprograms

Subprogram	Description
IME_DROP_EXPRESSIONS Procedure	Drops a specified set of <code>SYS_IME</code> virtual columns from a table
POPULATE Procedure	Forces population of the specified table
REPOPULATE Procedure	Forces repopulation of the specified table
SEGMENT_DEALLOCATE_VERSIONS Procedure	Deallocates non-current IMCUs in the IM column store

95.3.1 IME_DROP_EXPRESSIONS Procedure

This procedure drops a specified set of `SYS_IME` virtual columns from a table.

Syntax

```
DBMS_INMEMORY.IME_DROP_EXPRESSIONS (
  schema_name  IN  VARCHAR2,
  table_name   IN  VARCHAR2,
  column_name  IN  VARCHAR2 DEFAULT NULL);
```


Parameters

Table 95-2 IME_DROP_EXPRESSIONS Procedure Parameters

Parameter	Description
schema_name	The name of the schema that contains the In-Memory table
table_name	The name of the In-Memory table that contains the SYS_IME columns
column_name	The name of the SYS_IME column. By default this value is null, which specifies all SYS_IME columns in this table.

Usage Notes

Typical reasons for dropping SYS_IME columns are space and performance. The maximum number of SYS_IME columns for a table, regardless of whether the attribute is INMEMORY or NO INMEMORY, is 50. After the 50-expression limit is reached for a table, the database will not add new SYS_IME columns. To make space for new expressions, you must manually drop SYS_IME columns with the DBMS_INMEMORY.IME_DROP_EXPRESSIONS or DBMS_INMEMORY_ADMIN.IME_DROP_ALL_EXPRESSIONS procedures.

To drop a specified SYS_IME column or all SYS_IME columns in the requested table, use DBMS_INMEMORY.IME_DROP_EXPRESSIONS . To populate these segments again, either invoke the DBMS_INMEMORY.POPULATE procedure, or perform a full table scan.

95.3.2 POPULATE Procedure

This procedure forces population of the specified table, partition, or subpartition into the IM column store.

Syntax

```
DBMS_INMEMORY.POPULATE (
  schema_name      IN   VARCHAR2,
  table_name       IN   VARCHAR2,
  subobject_name   IN   VARCHAR2 DEFAULT NULL);
```

Parameters

Table 95-3 POPULATE Procedure Parameters

Parameter	Description
schema_name	Name of schema
table_name	Name of table
subobject_name	Partition or subpartition

95.3.3 REPOPULATE Procedure

This procedure forces repopulation of a table, partition, or subpartition that is currently populated in the IM column store.

Syntax

```
DBMS_INMEMORY.REPOPULATE (
  schema_name      IN   VARCHAR2,
  table_name       IN   VARCHAR2,
  subobject_name   IN   VARCHAR2 DEFAULT NULL,
  force            IN   BOOLEAN DEFAULT FALSE);
```

Parameters

Table 95-4 REPOPULATE Procedure Parameters

Parameter	Description
schema_name	Name of the schema that owns the object.
table_name	Name of the table requiring repopulation.
subobject_name	Name of the partition or subpartition. If null, then repopulate the entire table.
force	Whether to repopulate all IMCUs in the segment, just as in initial population. The following values are possible for the <i>force</i> parameter: <ul style="list-style-type: none"> FALSE — The database repopulates only IMCUs containing modified rows. This is the default. TRUE — The database drops the segment, and then rebuilds it. The database increments the statistics and performs all other tasks related to initial population. For example, IMCU 1 contains rows 1 to 500,000, and IMCU 2 contains rows 500,001 to 1,000,000. A statement modifies row 600,000. When <i>force</i> is FALSE , the database only repopulates IMCU 2. When <i>force</i> is TRUE , the database repopulates both IMCUs. Consider further that the <code>INMEMORY_VIRTUAL_COLUMNS</code> initialization parameter is set to <code>ENABLE</code> , and an application creates a new virtual column. When <i>force</i> is FALSE , the database only repopulates IMCU 2 with the new column. When <i>force</i> is TRUE , the database repopulates both IMCUs with the new column.

95.3.4 SEGMENT_DEALLOCATE_VERSIONS Procedure

This procedure deallocates non-current IMCUs in the IM column store.

Syntax

```
DBMS_INMEMORY.SEGMENT_DEALLOCATE_VERSIONS (
  SCHEMA_NAME      IN   VARCHAR2,
```

```
TABLE_NAME      IN  VARCHAR2,
PARTITION_NAME IN  VARCHAR2 DEFAULT NULL,
SPCPRESSURE    IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 95-5 SEGMENT_DEALLOCATE_VERSIONS Procedure Parameters

Parameter	Description
schema_name	Name of the schema that owns the object.
table_name	Name of the table requiring repopulation.
partition_name	Name of the partition or subpartition. If null, then repopulate the entire table.
spcpressure	Whether to force deallocation of non-current IMCUs (<code>TRUE</code>), or wait for the database to deallocate them automatically. By default, the database deallocates non-current IMCUs every two minutes.

Usage Notes

During repopulation, the IM column store maintains both the current IMCU and non-current IMCU. This mechanism, which is called *double buffering*, ensures that queries do not decrease performance because an IMCU is unavailable during repopulation. After repopulation completes, the IM column store retains the non-current IMCU for a short time (2 minutes by default) to optimize queries with older SCNs. Typically, the default behavior is sufficient. However, you can force deallocation of non-current IMCUs by using the `SEGMENT_DEALLOCATE_VERSIONS` procedure.

Example

The following program forces deallocation of non-current IMCUs for the `products` table:

```
BEGIN
  DBMS_INMEMORY.SEGMENT_DEALLOCATE_VERSIONS (
    schema_name => 'SH'
  , table_name  => 'PRODUCTS'
  , spcpressure => TRUE );
END;
```

See Also:

Oracle Database In-Memory Guide to learn more about double buffering in the IM column store

DBMS_INMEMORY_ADMIN

DBMS_INMEMORY_ADMIN provides interfaces for managing an In-Memory FastStart (IM FastStart) area and In-Memory Expressions (IM expressions).

This chapter contains the following topics:

- [DBMS_INMEMORY_ADMIN Overview](#)
- [DBMS_INMEMORY_ADMIN Security Model](#)
- [DBMS_INMEMORY_ADMIN Operational Notes](#)
- [Summary of DBMS_INMEMORY_ADMIN Subprograms](#)



See Also:

Oracle Database In-Memory Guide to learn more about Oracle Database In-Memory features

96.1 DBMS_INMEMORY_ADMIN Overview

This package provides interfaces for managing In-Memory Expressions (IM expressions) and the In-Memory FastStart (IM FastStart) area.

IM Expressions

Analytic queries often contain complex expressions or calculations that consume significant CPU and memory during execution. Use `IME_CAPTURE_EXPRESSIONS` to identify these frequently used (“hot”) expressions and `IME_POPULATE_EXPRESSIONS` to populate them in the IM column store. By using IM expressions, the database avoids repeated computations and improves performance.

The database represents IM expressions as system-generated virtual columns. The name of an IM virtual column begins with `SYS_IME`. You can also use `DBMS_INMEMORY_ADMIN.IME_DROP_ALL_EXPRESSIONS` and `DBMS_INMEMORY.IME_DROP_EXPRESSIONS` to remove existing `SYS_IME` columns.

The `DBA_IM_EXPRESSIONS` view shows the `SYS_IME` columns that have the `INMEMORY` attribute. After using the `IME_CAPTURE_EXPRESSIONS` procedure, you can query this view to see the hot expressions added to different tables in the database.



See Also:

Oracle Database In-Memory Guide to learn more about IM expressions

IM FastStart Area

The IM FastStart area stores data that optimizes the population of the IM column store when the database restarts. Because the database reads columnar data directly from persistent storage without needing to compress or format it, population is faster when a database instance restarts.

When you enable IM FastStart for the IM column store, you must specify an ASSM tablespace for the IM FastStart area. The tablespace stores the data in a SecureFiles LOB named `SYSDBIMFS_LOGSEG$`. The `SYSAUX` tablespace stores the metadata. When data is populated or repopulated in the IM column store, the database automatically writes the data to the IM FastStart area. You cannot manually force a write. If you specify an object as `NO INMEMORY`, then the database removes it from the IM FastStart area.

When the IM FastStart area is under space pressure, the database automatically drops the oldest 15% of segments and continues saving columnar data. If space is unavailable, then the database stops writing to the IM FastStart area.



See Also:

Oracle Database In-Memory Guide to learn more about IM expressions

Automatic In-Memory

Automatic In-Memory uses access tracking and column statistics to manage objects in the IM column store. If the IM column store is full, and if other more frequently accessed segments would benefit from population in the IM column store, then the IM column store evicts inactive segments. If the IM column store is configured to hold all `INMEMORY` segments, however, then Automatic In-Memory takes no action.

By default, Automatic In-Memory checks usage statistics for the past 31 days. You can change the current setting by supplying the `AIM_STATWINDOW_DAYS` parameter to `DBMS_INMEMORY_ADMIN.AIM_SET_PARAMETER`.



See Also:

Oracle Database In-Memory Guide to learn more about Automatic In-Memory

Database In-Memory Wait on Populate

The `POPULATE_WAIT` function initiates population of all `INMEMORY` objects that have a priority greater than or equal to the specified priority, and then returns a status value for the population. A user-specified interval specifies the maximum time that the function waits before returning the value to the caller.

**See Also:**

Oracle Database In-Memory Guide to learn more about the wait on populate feature

96.2 DBMS_INMEMORY_ADMIN Security Model

This package requires administrator privileges. Package subprograms execute with invoker's rights.

96.3 DBMS_INMEMORY_ADMIN Operational Notes

It is possible for a DBMS_INMEMORY_ADMIN FastStart operation to fail or be interrupted.

In a failure or interruption scenario, the following rules determine which subprograms you can use:

- If FASTSTART_ENABLE does not succeed, then the only permitted operation is re-executing FASTSTART_ENABLE.
- If FASTSTART_MIGRATE_STORAGE does not succeed, then the only permitted operation is re-executing FASTSTART_MIGRATE_STORAGE.
- If FASTSTART_DISABLE does not succeed, then all DBMS_INMEMORY_ADMIN operations are permitted.

96.4 Summary of DBMS_INMEMORY_ADMIN Subprograms

This table lists the DBMS_INMEMORY_ADMIN subprograms and briefly describes them.

Table 96-1 DBMS_INMEMORY_ADMIN Package Subprograms

Subprogram	Description
AIM_GET_PARAMETER Procedure	This procedure obtains the current values for parameters that control Automatic In-Memory.
AIM_SET_PARAMETER Procedure	The procedure customizes the execution environment of Automatic In-Memory
FASTSTART_DISABLE Procedure	This procedure disables the In-Memory FastStart (IM FastStart) feature.
FASTSTART_ENABLE Procedure	This procedure enables IM FastStart and assigns a tablespace.
FASTSTART_MIGRATE_STORAGE Procedure	This procedure moves all IM FastStart data and metadata from the existing tablespace to the specified new tablespace.
GET_FASTSTART_TABLESPACE Function	This function returns the name of the tablespace that is currently designated for IM FastStart.
IME_CAPTURE_EXPRESSIONS Procedure	This procedure captures the 20 most frequently accessed ("hottest") expressions in the database in the specified time interval.

Table 96-1 (Cont.) DBMS_INMEMORY_ADMIN Package Subprograms

Subprogram	Description
IME_CLOSE_CAPTURE_WINDOW Procedure	This procedure signals the end of the current expression capture window.
IME_DROP_ALL_EXPRESSIONS Procedure	This procedure drops all SYS_IME expression virtual columns in the database.
IME_GET_CAPTURE_STATE Procedure	This procedure returns the current capture state of the expression capture window and the timestamp of the most recent modification.
IME_OPEN_CAPTURE_WINDOW Procedure	This procedure signals the beginning of an expression capture window.
IME_POPULATE_EXPRESSIONS Procedure	This procedure forces the population of expressions captured in the latest invocation of DBMS_INMEMORY_ADMIN.IME_CAPTURE_EXPRESSIONS.
POPULATE_WAIT Function	Initiates population of all INMEMORY objects that have a priority greater than or equal to the specified priority, and sets a timeout interval within which population must occur

96.4.1 AIM_GET_PARAMETER Procedure

This procedure obtains the current values for parameters that control Automatic In-Memory.

Syntax

```
DBMS_INMEMORY_ADMIN.AIM_GET_PARAMETER (
    parameter IN NUMBER,
    value     OUT NUMBER);
```

Parameters

Parameter	Description
parameter	Specifies a predefined constant that controls Automatic In-Memory. The only valid constant is AIM_STATWINDOW_DAYS, which specifies the number of days in the sliding statistics window. Automatic In-Memory uses this duration to filter statistics for INMEMORY objects as part of its algorithms. For example, if the duration is set to 7 days, then Automatic In-Memory considers only statistics of the past 7 days for its algorithms. The default is 1.
value	Specifies the value assigned to AIM_STATWINDOW_DAYS.

Example 96-1 Getting the Number of Days in the Statistics Window

The following code prints the number of days in the statistics window to the screen:

```
VARIABLE b_statwin NUMBER

BEGIN

DBMS_INMEMORY_ADMIN.AIM_GET_PARAMETER(DBMS_INMEMORY_ADMIN.AIM_STATWINDOW_DAYS
, :b_statwin);
END;
/

PRINT b_statwin
```

Sample output appears below:

```
B_STATWIN
-----
          14
```



See Also:

Oracle Database In-Memory Guide to learn how to use AIM_GET_PARAMETER

96.4.2 AIM_SET_PARAMETER Procedure

The procedure customizes the execution environment of Automatic In-Memory.

Syntax

```
DBMS_INMEMORY_ADMIN.AIM_SET_PARAMETER(
  parameter IN NUMBER,
  value     IN NUMBER);
```

Parameters

Parameter	Description
parameter	Specifies a predefined constant that controls Automatic In-Memory. The only valid constant is AIM_STATWINDOW_DAYS, which specifies the number of days in the sliding statistics window. The default is 1.
value	Assigns the value assigned to AIM_STATWINDOW_DAYS.

Example 96-2 Setting the Number of Days in the Statistics Window

The following example gets the current number of days in the window, sets it to 14, and then prints the value to the screen:

```
VARIABLE b_statwin NUMBER

BEGIN

DBMS_INMEMORY_ADMIN.AIM_GET_PARAMETER(DBMS_INMEMORY_ADMIN.AIM_STATWINDO
W_DAYS, :b_statwin);
END;
/

PRINT b_statwin

BEGIN

DBMS_INMEMORY_ADMIN.AIM_SET_PARAMETER(DBMS_INMEMORY_ADMIN.AIM_STATWINDO
W_DAYS, 14);
END;
/

BEGIN

DBMS_INMEMORY_ADMIN.AIM_GET_PARAMETER(DBMS_INMEMORY_ADMIN.AIM_STATWINDO
W_DAYS, :b_statwin);
END;
/

PRINT b_statwin
```

Sample output appears below:

```
B_STATWIN
-----
          1

B_STATWIN
-----
          14
```

**See Also:**

Oracle Database In-Memory Guide to learn how to use AIM_GET_PARAMETER

96.4.3 FASTSTART_DISABLE Procedure

This procedure disables the In-Memory FastStart (IM FastStart) feature.

Syntax

```
DBMS_INMEMORY_ADMIN.FASTSTART_DISABLE();
```

Security Model

Administrator privileges are required to execute this procedure.

Usage Notes

When you execute the procedure, the database executes the following actions:

1. Waits until all IM FastStart operations complete
2. Disables the IM FastStart feature, and performs the following operations:
 - Cleans the IM FastStart area
 - Deletes IM FastStart metadata stored in the `SYSAUX` tablespace
 - Releases the IM FastStart tablespace (but does not delete it)

This procedure does not interrupt or affect any concurrent IM column store operations.

Examples

The following PL/SQL program disables the IM FastStart feature:

```
EXEC DBMS_INMEMORY_ADMIN.FASTSTART_DISABLE;
```

The following query shows that the LOB for the IM FastStart tablespace has been deleted (sample output included):

```
COL OWNER FORMAT a5
COL SEGMENT_NAME FORMAT a20
SELECT  l.OWNER, l.SEGMENT_NAME, SUM(s.BYTES)/1024/1024 MB
FROM    DBA_LOBS l, DBA_SEGMENTS s
WHERE   l.SEGMENT_NAME = s.SEGMENT_NAME
AND     l.TABLESPACE_NAME = 'FS_TBS'
GROUP BY l.OWNER, l.SEGMENT_NAME;
```

```
no rows selected
```

96.4.4 FASTSTART_ENABLE Procedure

This procedure enables In-Memory FastStart (IM FastStart), and designates a tablespace for the IM FastStart (FastStart) area.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

Syntax

```
DBMS_INMEMORY_ADMIN.FASTSTART_ENABLE (
  tbs_name      IN      VARCHAR2,
  nologging    IN      BOOLEAN DEFAULT TRUE);
```

Parameters

Table 96-2 FASTSTART_ENABLE Procedure Parameters

Parameter	Description
tbs_name	The name of the ASSM tablespace for the FastStart area.
nologging	The logging mode of the LOB created for the FastStart area. If the <code>nologging</code> parameter is set to <code>FALSE</code> , then the database creates the FastStart LOB with the <code>LOGGING</code> option. If set to <code>TRUE</code> (default), then the database creates the LOB with the <code>NOLOGGING</code> option.

Security Model

Administrator privileges are required to execute this procedure.

Usage Notes

To enable IM FastStart, the ASSM tablespace specified in `FASTSTART_ENABLE` must exist, and the `SYSAUX` tablespace must be online. Only one FastStart tablespace can exist for every PDB or non-CDB. The specified tablespace must have enough space to store data for the IM column store, and it must not contain any other data before it is designated for the FastStart area. Oracle recommends sizing the tablespace at least twice of the size of the `INMEMORY_SIZE` initialization parameter.

The database does not create the FastStart area on disk until the IM column store is populated. After population, the data periodically saves the columnar data (but not metadata such as the transaction journal) to the FastStart area, which is represented on disk as the `SYSDBIMFS_LOBSEG$` segment. The database stores the FastStart metadata in the `SYSAUX` tablespace. In an Oracle Real Application Clusters (Oracle RAC) environment, IM FastStart data is shared across all nodes.

**Note:**

IM FastStart is not supported in a standby database instance.

Whereas the initial loading of IMCUs into memory is expensive and CPU-bound, an IM FastStart tablespace requires intermittent I/O. The database periodically writes columnar data to the IM FastStart area. If a database instance must restart, then Oracle Database reads the columnar data directly from the IM FastStart area rather than reconstructing the IMCUs from scratch. No compression or formatting of the columnar data is required.

Examples

This example creates `fs_tbs` as an ASSM tablespace, and then uses `FASTSTART_ENABLE` to specify this tablespace as the IM FastStart area:

```
CREATE TABLESPACE fs_tbs
  DATAFILE 'fs_tbs.dbf' SIZE 500M
  EXTENT MANAGEMENT LOCAL
  SEGMENT SPACE MANAGEMENT AUTO;

EXEC DBMS_INMEMORY_ADMIN.FASTSTART_ENABLE('fs_tbs');
```

The following query shows that the IM FastStart LOB was created (sample output included):

```
COL OWNER FORMAT a5
COL SEGMENT_NAME FORMAT a20
SELECT  l.OWNER, l.SEGMENT_NAME, SUM(s.BYTES)/1024/1024 MB
FROM    DBA_LOBS l, DBA_SEGMENTS s
WHERE   l.SEGMENT_NAME = s.SEGMENT_NAME
AND     l.TABLESPACE_NAME = 'FS_TBS'
GROUP BY l.OWNER, l.SEGMENT_NAME;
```

OWNER	SEGMENT_NAME	MB
SYS	SYSDBIMFS_LOBSEG\$.125

96.4.5 FASTSTART_MIGRATE_STORAGE Procedure

This procedure moves the In-Memory FastStart (IM FastStart) data and catalogs from the current tablespace to a new tablespace.

Syntax

```
DBMS_INMEMORY_ADMIN.FASTSTART_MIGRATE_STORAGE (
  tbs_name      IN      VARCHAR2 );
```

Parameters

Table 96-3 FASTSTART_MIGRATE_STORAGE Procedure Parameters

Parameter	Description
tbs_name	The name of the new ASSM tablespace for the IM FastStart area.

Security Model

DBA privileges are required to execute this procedure.

Usage Notes

When you execute the procedure, the database executes the following actions:

1. Waits until all IM FastStart operations complete
2. Disables the IM FastStart feature
3. Copies IM FastStart data and metadata to the new tablespace, leaving the old tablespace intact
4. Re-enables IM FastStart the feature

Examples

The following program obtains the name of the IM FastStart tablespace, if one exists, and prints the result (sample output included):

```
VARIABLE b_fstbs VARCHAR2(20)
BEGIN
    :b_fstbs := DBMS_INMEMORY_ADMIN.GET_FASTSTART_TABLESPACE;
END;
/
PRINT b_fstbs

B_FSTBS
-----
FS_TBS
```

The following statements create a new tablespace named `fs_tbs2`, and then migrate the IM FastStart area to this tablespace:

```
CREATE TABLESPACE fs_tbs2
    DATAFILE 'fs_tbs2.dbf' SIZE 500M
    EXTENT MANAGEMENT LOCAL
    SEGMENT SPACE MANAGEMENT AUTO;

EXEC DBMS_INMEMORY_ADMIN.FASTSTART_MIGRATE_STORAGE('fs_tbs2');
```

The following program prints the name of the current IM FastStart tablespace (sample output included):

```
BEGIN
  :b_fstbs := DBMS_INMEMORY_ADMIN.GET_FASTSTART_TABLESPACE;
END;
/
PRINT b_fstbs

B_FSTBS
-----
FS_TBS2
```

96.4.6 GET_FASTSTART_TABLESPACE Function

This function returns the tablespace assigned to In-Memory FastStart (IM FastStart). If the feature is disabled, then the function returns `NOT ENABLED`.

Syntax

```
DBMS_INMEMORY_ADMIN.GET_FASTSTART_TABLESPACE ();
```

Security Model

DBA privileges are required to execute this function.

Examples

This program obtains the name of the IM FastStart tablespace, if one exists, and prints the result:

```
VARIABLE b_fstbs VARCHAR2(20)
BEGIN
  :b_fstbs := DBMS_INMEMORY_ADMIN.GET_FASTSTART_TABLESPACE;
END;
/
PRINT b_fstbs

B_FSTBS
-----
NOT ENABLED
```

96.4.7 IME_CAPTURE_EXPRESSIONS Procedure

This procedure captures the 20 most frequently accessed (“hottest”) expressions in the database in the specified time interval.

Syntax

```
DBMS_INMEMORY_ADMIN.IME_CAPTURE_EXPRESSIONS (
  snapshot IN VARCHAR2);
```

Parameters

Table 96-4 IME_CAPTURE_EXPRESSIONS Procedure Parameters

Parameter	Description
snapshot	<p>Specifies a snapshot that defines the time interval in which expression statistics are considered.</p> <p>You can specify any of the following values:</p> <ul style="list-style-type: none"> • CUMULATIVE The database considers all expression statistics since the creation of the database. • CURRENT The database considers only expression statistics from the past 24 hours. • WINDOW The database considers statistics for expressions tracked in the most recent expression capture window. The database adds hidden virtual columns for expressions tracked in the most recent window. If the capture window is currently open, then the database considers all expressions tracked in the current window up until this point, and then materializes the hottest expressions. To list the expressions that have been tracked in the current window, query <code>DBA_EXPRESSION_STATISTICS</code> with <code>SNAPSHOT='WINDOW'</code>.

Usage Notes

When you invoke this procedure, the database queries the Expression Statistics Store (ESS), and considers only expressions on tables that are at least partially populated in the IM column store. The database adds the 20 hottest expressions to their respective tables as hidden virtual columns, prefixed with the string `SYS_IME`, and applies the default `INMEMORY` column compression clause. If any `SYS_IME` columns added during a previous invocation are no longer in the latest top 20 list, then the database marks them as `NO INMEMORY`.

**Note:**

Executing the `IME_CAPTURE_EXPRESSIONS` procedure on a standby database has no effect.

The maximum number of `SYS_IME` columns for a table, regardless of whether the attribute is `INMEMORY` or `NO INMEMORY`, is 50. After the limit is reached for a table, the database will not add new `SYS_IME` columns. To make space for new expressions, you must manually drop `SYS_IME` columns with the [IME_DROP_ALL_EXPRESSIONS Procedure](#) or [IME_DROP_EXPRESSIONS Procedure](#).

The 50-expression limit for each table, which includes both `INMEMORY` and `NO INMEMORY` expressions, is different from the 20-expression limit for the database, which includes only `INMEMORY` expressions. For example, if 20 tables are populated in the IM column store, then each table might each have 1 `SYS_IME` column with the `INMEMORY` attribute, and 49 `SYS_IME` columns with the `NO INMEMORY` attribute.

IM expressions and virtual columns are stored in In-Memory structured called In-Memory Expression Units (IMEUs). Every IMEU is linked to a parent In-Memory Compression Unit (IMCU) from which it inherits compression characteristics.

ESS information is stored in the data dictionary and exposed in the `DBA_EXPRESSION_STATISTICS` view. This view shows the metadata that the optimizer has collected in the ESS. IM expressions are exposed as system-generated virtual columns, prefixed by the string `SYS_IME`, in the `DBA_IM_EXPRESSIONS` view.

Example 96-3 Capturing Expressions in a User-Defined Window

This example demonstrates use of the `WINDOW` capture mode. Your goal is to open and close an expression capture window, and then capture all expressions that the database tracked during this window. You perform the following steps:

1. Open an expression capture window, generate expressions, and then close the window:

```
EXEC DBMS_INMEMORY_ADMIN.IME_OPEN_CAPTURE_WINDOW();
-- Generate expressions for the database to track
EXEC DBMS_INMEMORY_ADMIN.IME_CLOSE_CAPTURE_WINDOW();
```

2. Query `DBA_EXPRESSION_STATISTICS` (sample output included):

```
COL OWNER FORMAT A6
COL TABLE_NAME FORMAT A9
COL COUNT FORMAT 99999
COL CREATED FORMAT A10
COL EXPRESSION_TEXT FORMAT A29

SELECT OWNER, TABLE_NAME, EVALUATION_COUNT AS COUNT,
       CREATED, EXPRESSION_TEXT
FROM   DBA_EXPRESSION_STATISTICS
WHERE  SNAPSHOT = 'WINDOW'
AND    OWNER = 'SH';
```

OWNER	TABLE_NAME	COUNT	CREATED	EXPRESSION_TEXT
SH	SALES	4702	09-OCT-17	"QUANTITY_SOLD"
SH	SALES	4702	09-OCT-17	"QUANTITY_SOLD"*"AMOUNT_SOLD"
SH	SALES	4702	09-OCT-17	"PROD_ID"
SH	SALES	4702	09-OCT-17	"CUST_ID"
SH	SALES	4702	09-OCT-17	"CHANNEL_ID"
SH	SALES	4702	09-OCT-17	"AMOUNT_SOLD"

The preceding query shows both the columns tracked in the ESS and the expressions captured during the window for queries in the `sh` schema. During the most recent window, the database captured one expression: `QUANTITY_SOLD*AMOUNT_SOLD`.

3. Use `IME_CAPTURE_EXPRESSIONS` to make the database consider all expressions in the current window for materialization:

```
EXEC DBMS_INMEMORY_ADMIN.IME_CAPTURE_EXPRESSIONS('WINDOW');
```


4. Query DBA_IM_EXPRESSIONS (sample output included):

```

COL OWNER FORMAT a6
COL TABLE_NAME FORMAT a9
COL COLUMN_NAME FORMAT a25
SET LONG 50
SET LINESIZE 150

SELECT OWNER, TABLE_NAME, COLUMN_NAME, SQL_EXPRESSION
FROM   DBA_IM_EXPRESSIONS;

OWNER  TABLE_NAM COLUMN_NAME          SQL_EXPRESSION
-----
SH      SALES      SYS_IME000100000025201B
"QUANTITY_SOLD"*"AMOUNT_SOLD"

```

The preceding output shows all virtual columns that were added to the table and marked `INMEMORY` as part of the latest `IME_CAPTURE_EXPRESSIONS` invocation. The database gradually populates the captured expressions into the IM column store when it repopulates different IMCUs of the table.

5. Execute the following procedure to explicitly force a population of all captured IM expressions:

```
EXEC DBMS_INMEMORY_ADMIN.IME_POPULATE_EXPRESSIONS();
```

Note that you can populate IM expressions from a specific table by executing the `DBMS_INMEMORY.REPOPULATE` procedure with the `force` parameter set to `TRUE`.

Example 96-4 Capturing Expressions for the Past Day

The following program captures expressions tracked during the last 24 hours:

```
EXEC DBMS_INMEMORY_ADMIN.IME_CAPTURE_EXPRESSIONS('CURRENT');
```

96.4.8 IME_CLOSE_CAPTURE_WINDOW Procedure

This procedure signals the end of the current expression capture window.

Syntax

```
DBMS_INMEMORY_ADMIN.IME_CLOSE_CAPTURE_WINDOW();
```

Usage Notes

On invocation of this procedure, the optimizer saves all gathered statistics to disk, and essentially freezes the expressions tracked in the window. The database preserves the statistics captured in this window until a new expression capture window is opened, at which point the database purges the statistics captured in the previous window.

Example 96-5 Example

This example opens an expression capture window, and then issues `IME_CAPTURE_EXPRESSIONS('WINDOW')` so that the database considers all expressions in the current window for materialization. Finally, the example closes the window.

```
EXEC DBMS_INMEMORY_ADMIN.IME_OPEN_CAPTURE_WINDOW();
-- Generate expressions so that the database can track them
EXEC DBMS_INMEMORY_ADMIN.IME_CLOSE_CAPTURE_WINDOW();
EXEC DBMS_INMEMORY_ADMIN.IME_CAPTURE_EXPRESSIONS('WINDOW');
```

96.4.9 IME_DROP_ALL_EXPRESSIONS Procedure

This procedure drops all `SYS_IME` expression virtual columns in the database.

Syntax

```
DBMS_INMEMORY_ADMIN.IME_DROP_ALL_EXPRESSIONS();
```

Usage Notes

The `IME_DROP_ALL_EXPRESSIONS` procedure drops all `SYS_IME` columns from all tables, regardless of whether they have the `INMEMORY` attribute. In effect, the procedure acts as a database-wide reset button.

Using `IME_DROP_ALL_EXPRESSIONS` triggers a drop of all `IMEUs` and `IMCUs` for segments that have `SYS_IME` columns. For example, if 50 populated tables have one `SYS_IME` column each, then `IME_DROP_ALL_EXPRESSIONS` removes all 50 tables from the IM column store. To populate these segments again, you must use the `DBMS_INMEMORY.POPULATE` procedure or perform a full table scan.

96.4.10 IME_GET_CAPTURE_STATE Procedure

This procedure returns the current capture state of the expression capture window and the timestamp of the most recent modification.

Syntax

```
DBMS_INMEMORY_ADMIN.IME_GET_CAPTURE_STATE (
    p_capture_state OUT VARCHAR2,
    p_last_modified OUT TIMESTAMP);
```

Parameters

Parameter	Description
<code>p_capture_state</code>	<p>Describes the current state of the expression capture window.</p> <p>The following states are possible:</p> <ul style="list-style-type: none"> <code>OPEN</code> — Indicates that the window is open. <code>CLOSED</code> — Indicates that the window is closed. <code>DEFAULT</code> — Indicates that the window has not been used. It is equivalent to the <code>CLOSED</code> state.

Parameter	Description
p_last_modified	Indicates the timestamp of the most recent action.

Usage Notes

This procedure is useful for avoiding conflicting calls for [IME_OPEN_CAPTURE_WINDOW Procedure](#) and [IME_CLOSE_CAPTURE_WINDOW Procedure](#). For example, if the current expression capture window state is `OPEN`, then you cannot open another window, and if the window state is `CLOSED`, then you cannot close a window.

Example 96-6 Determining the State of an Expression Capture Window

This example opens an expression capture window, and then determines its capture state.

```
EXEC DBMS_INMEMORY_ADMIN.IME_OPEN_CAPTURE_WINDOW();

VARIABLE b_state VARCHAR2(25)
VARIABLE b_time  VARCHAR2(10)
EXECUTE DBMS_INMEMORY_ADMIN.IME_GET_CAPTURE_STATE(:b_state, :b_time)
PRINT b_state b_time
```

The following sample output indicates that an expression capture window is currently open:

```
B_STATE
-----
OPEN

B_TIME
-----
09-OCT-17
```

96.4.11 IME_OPEN_CAPTURE_WINDOW Procedure

This procedure signals the beginning of an expression capture window.

Syntax

```
DBMS_INMEMORY_ADMIN.IME_OPEN_CAPTURE_WINDOW();
```

Security Model

Administrator privileges are required to execute this procedure.

Usage Notes

On invocation of this procedure, the optimizer begins a new window snapshot and starts tracking expressions that occur within this window. An expression capture window is global across all instances in an Oracle RAC database.

Conflicting actions are not permitted. For example, in an Oracle RAC database, opening expression capture window on instance 1 at time t0 and attempting to open another expression capture window on instance 2 at time t1 before closing the first window is a conflicting action. To obtain the current capture state and reduce the potential for conflicting procedure invocations, use the [IME_GET_CAPTURE_STATE Procedure](#).

Example

This following program opens an expression capture window:

```
EXEC DBMS_INMEMORY_ADMIN.IME_OPEN_CAPTURE_WINDOW();
```

96.4.12 IME_POPULATE_EXPRESSIONS Procedure

This procedure forces the population of expressions captured in the latest invocation of `DBMS_INMEMORY_ADMIN.IME_CAPTURE_EXPRESSIONS`.

Syntax

```
DBMS_INMEMORY_ADMIN.IME_POPULATE_EXPRESSIONS();
```

Usage Notes

If you do not invoke this procedure, then the database gradually repopulates `SYS_IME` columns when their parent IMCUs are repopulated. If a table is not repopulated, then any new `SYS_IME` columns captured by the `IME_CAPTURE_EXPRESSIONS` procedure are not populated. `IME_POPULATE_EXPRESSIONS` solves this problem by forcing population.

Internally, the procedure invokes `DBMS_INMEMORY.REPOPULATE` for all tables that have `SYS_IME` columns with the `INMEMORY` attribute. To populate `SYS_IME` columns in a specified subset of tables, use `DBMS_INMEMORY.REPOPULATE` instead of `IME_POPULATE_EXPRESSIONS`.

96.4.13 POPULATE_WAIT Function

This function initiates population of all `INMEMORY` objects that have a priority greater than or equal to the specified priority, and returns a status value for the population. A user-specified interval specifies the maximum time that the function waits before returning the value to the caller.

Syntax

```
DBMS_INMEMORY_ADMIN.POPULATE_WAIT (  
    priority    IN    VARCHAR2 DEFAULT 'LOW',  
    percentage  IN    NUMBER   DEFAULT 100,  
    timeout     IN    NUMBER   DEFAULT 99999999,  
    force       IN    BOOLEAN  DEFAULT FALSE)  
RETURN VARCHAR2;
```

Parameters

Table 96-5 POPULATE_WAIT Function Parameters

Parameter	Description
priority	Specifies that the database populate all INMEMORY objects with the specified priority setting or higher. The default priority is LOW. NONE is considered lowest priority. If you set to priority to NONE, then this function waits for all INMEMORY objects to populate.
percentage	Specifies the percentage of population required for the function to consider population to be complete. The default is 100. For example, if percentage is 50 and priority is NONE, and if 50% of the INMEMORY objects are populated in the IM column store, then the function returns the value 0 (population successful).
timeout	Specifies the number of seconds that must pass before the function returns -1, which indicates that the populate operation timed out. The default is 99999999 seconds, which is 115.74 days. Assume that timeout is 600, priority is LOW, and percentage is 100. If 10 minutes pass, but all PRIORITY LOW objects are not yet fully populated, then the function returns -1.
force	Specifies that the database should drop all INMEMORY segments that have a priority greater than or equal than the specified priority, and then repopulate these segments. The default is FALSE. Assume that the INMEMORY attribute applies to the sales table, which is partitioned. Only half the sales partitions are currently populated in the IM column store. If you execute POPULATE_WAIT with force set to TRUE, then the database drops all sales segments, and then repopulates them.

Return Values

The following table describes the possible return values for POPULATE_WAIT. The function returns the values 0, 1, 2, and 3 only if the condition is met before the end of the interval specified by timeout. For example, if timeout is 600, then the function returns 1 only if an out-of-memory error occurs before 600 seconds pass. The function returns -1 only if the end of the timeout interval occurs *before* the database completes the requested operation.

Table 96-6 Return Values for POPULATE_WAIT

Constant	Value	Description
POPULATE_TIMEOUT	-1	The function timed out while waiting for population to complete. Existing population jobs continue running in the background after -1 is returned. Reissuing POPULATE_TIMEOUT after -1 is returned reinitiates population; segments that are already populated are not dropped.

Table 96-6 (Cont.) Return Values for POPULATE_WAIT

Constant	Value	Description
POPULATE_SUCCESS	0	All objects that met the <code>priority</code> criteria were populated to the specified percentage of completion.
POPULATE_OUT_OF_MEMORY	1	The In-Memory pool had insufficient memory to populate the objects that met the <code>priority</code> criteria to the specified percentage of completion.
POPULATE_NO_INMEMORY_OBJECTS	2	No INMEMORY objects met the specified <code>priority</code> criteria.
POPULATE_INMEMORY_SIZE_ZERO	3	The In-Memory column store is not enabled.

Usage Notes

Sample use cases for ensuring that objects are populated include:

- When the database is closed, open the database with `STARTUP RESTRICT` so that only administrators can access the database, and then execute `POPULATE_WAIT` with the desired timeout setting. If `POPULATE_WAIT` returns `-1`, indicating a timeout, then reexecute `POPULATE_WAIT`. When the function returns `0`, disable the restricted session so that non-administrative users can query the database.
- Block database connections by using services or an application tier technique. When no analytic indexes exists, and when the application depends on the IM column store to provide reasonable performance, these techniques prevent runaway queries.

Example 96-7 Specifying a Timeout Interval for In-Memory Population

In this example, the database contains a number of In-Memory tables with a variety of priority settings. Your goal is to populate every In-Memory table to 100% completion in a restricted database session, and then disable the restricted session so that the application can be guaranteed of querying only the In-Memory representations.

Assume that the database is shut down. In SQL*Plus, you connect to an idle instance as SYSDBA, and then execute the following command (sample output included):

```
SQL> STARTUP RESTRICT
ORACLE instance started.

Total System Global Area 1157624280 bytes
Fixed Size                 8839640 bytes
Variable Size             754974720 bytes
Database Buffers          16777216 bytes
Redo Buffers               7933952 bytes
In-Memory Area            369098752 bytes
Database mounted.
Database opened.
```

The database is open, but is accessible only to administrative users. You execute the following statements in SQL*Plus (sample output shown in bold):

```
VARIABLE b_pop_status NUMBER

SELECT DBMS_INMEMORY_ADMIN.POPULATE_WAIT(
       priority => 'NONE' ,
       percentage => 100   ,
       timeout   => 300   )
       INTO b_pop_status
FROM   DUAL;

PRINT b_pop_status
-1
```

After 5 minutes, the function returns the number **-1**. This code indicates that the function timed out while waiting for population to complete. 5 minutes is not long enough to populate all INMEMORY tables. You re-execute the SELECT statement, specifying a 30-minute timeout:

```
SELECT DBMS_INMEMORY_ADMIN.POPULATE_WAIT(
       priority => 'NONE' ,
       percentage => 100   ,
       timeout   => 1800  )
       INTO b_pop_status
FROM   DUAL;

PRINT b_pop_status
0
```

After 8 minutes, the function returns the number **0**. This code indicates that all tables are completely populated. You now disable the restricted session so that the application can start query In-Memory objects with full confidence that only In-Memory representations will be accessed:

```
ALTER SYSTEM DISABLE RESTRICTED SESSION;
```

DBMS_INMEMORY_ADVISE

This package enables you to determine if a workload can benefit from Oracle's Database In-Memory feature.

97.1 DBMS_INMEMORY_ADVISE Overview

DBMS_INMEMORY_ADVISE provides tools to determine the benefit of the Database In-Memory feature to the workflow on a database.

DBMS_INMEMORY_ADVISE perform its analysis on the workload of the current database. You can do the same analysis on another database workload by importing and examining AWR snapshots.

97.2 Summary of DBMS_INMEMORY_ADVISE Subprograms

In Oracle Database 19c, DBMS_INMEMORY_ADVISE includes a single subprogram: IS_INMEMORY_ELIGIBLE.

Table 97-1 DBMS_INMEMORY_ADVISE Subprograms

Subprogram	Description
IS_INMEMORY_ELIGIBLE Procedure	Examines AWR snapshots to determine if a given workload will benefit or not benefit from the Database In-Memory feature.

97.3 IS_INMEMORY_ELIGIBLE Procedure

This procedure examines Automatic Workload Repository (AWR) snapshots from a database to determine the workload's eligibility for Database In-Memory technology.

Many workloads benefit from Database In-Memory, however some may not. `IS_INMEMORY_ELIGIBLE` determines whether or not a workload would benefit from Database In-Memory and should be considered eligible or ineligible. Eligibility is gauged by the percentage of analytical activity in the workload. If you are planning to implement Database In-Memory, you can use this tool to quickly identify and filter out databases that are ineligible; those where analytic activity is low and where you would see no substantive gain from the use of Database In-Memory. You can then focus your Database In-Memory deployment on databases whose workload includes more analytic activity and could therefore benefit substantially.

Criterion Used by IS_INMEMORY_ELIGIBLE

The determination that a workflow is eligible or ineligible for Database In-Memory is based on a system-defined threshold. If the percentage of the workload involved analytic activity is below that threshold, then Database In-Memory will not noticeably improve performance. The

greater the level of activity above that target analytic workload percentage threshold, the greater is the potential benefit that may be seen from use of Database In-Memory.

IS_INMEMORY_ELIGIBLE Procedure Syntax

IS_INMEMORY_ELIGIBLE has three overloads that let you choose how to define the scope of the eligibility test. The output parameters are the same in all three. The optional input parameter SNAP_DBID is also common.

The input parameters are mutually exclusive to each overload as shown in the syntax below. You cannot combine them in a single procedure call.

Syntax 1: Input as Most Recent *n* Days, Including Today

```
DBMS_INMEMORY_ADVISE.IS_INMEMORY_ELIGIBLE (
    TIME_WINDOW_DAYS    IN NUMBER,
    INMEM_ELIGIBLE      OUT BOOLEAN,
    ANALYSIS_SUMMARY    OUT VARCHAR2,
    SNAP_DBID           IN NUMBER DEFAULT NULL
);
```

Syntax 2: Input as a Snapshot Range

```
DBMS_INMEMORY_ADVISE.IS_INMEMORY_ELIGIBLE (
    START_SNAP_ID        IN NUMBER,
    END_SNAP_ID          IN NUMBER,
    INMEM_ELIGIBLE      OUT BOOLEAN,
    ANALYSIS_SUMMARY    OUT VARCHAR2,
    SNAP_DBID           IN NUMBER DEFAULT NULL
);
```

Syntax 3: Input as Time Interval (Start Time and End Time)

```
DBMS_INMEMORY_ADVISE.IS_INMEMORY_ELIGIBLE (
    START_TIME          IN TIMESTAMP,
    END_TIME            IN TIMESTAMP,
    INMEM_ELIGIBLE      OUT BOOLEAN,
    ANALYSIS_SUMMARY    OUT VARCHAR2,
    SNAP_DBID           IN NUMBER DEFAULT NULL
);
```

Parameters

Table 97-2 IS_INMEMORY_ELIGIBLE Procedure Parameters

Parameter	Description
TIME_WINDOW_DAYS	All snapshots occurring within the last <i>n</i> number of days, including today.
START_TIME	Specifies the start of a timespan for snapshot analysis. All AWR snapshots created after START_TIME, up to and included END_TIME are examined.

Table 97-2 (Cont.) IS_INMEMORY_ELIGIBLE Procedure Parameters

Parameter	Description
END_TIME	Specifies the end of a timespan for snapshot analysis. All AWR snapshots created prior to END_TIME, back to and including START_TIME are examined.
START_SNAP_ID	The first snapshot in a sequence of snapshots. This is the starting point of the workload to be analyzed.
END_SNAP_ID	The end of a sequence of snapshots.
INMEM_ELIGIBLE	The determination of whether or not the workflow is eligible for (will benefit from) Database In-Memory. Possible values: True, False.
ANALYSIS_SUMMARY	The analysis that explains the INMEM_ELIGIBLE evaluation. Example: Observed Analytic Workload Percentage is 3% is less than target Analytic Workload Percentage 20% Workloads with a percentage of analytical activity less than target are considered ineligible.
SNAP_DBID	Database ID of a database from where AWR data has been exported. This enables you to analyze the workload on another database. If you are testing for eligibility on the current database, exclude this parameter.

Usage Notes

Within a given workload, the level of analytical activity may vary over a series of snapshots. Depending on which subset of all available snapshots are selected for testing, the analytic workload percentage calculated by IS_INMEMORY_ELIGIBLE may correspondingly vary. So you may want to do several evaluations with different input parameters. Using the TIME_WINDOW_DAYS parameter gives you a quick summary of the workload based on that time window. Then you can drill down into specific time periods, using the parameters based on snapshot IDs to get a perspective on patterns in the workload.

If you are considering whether or not to enable Database In-Memory on your databases, do the following:

1. Run the In-Memory Eligibility Test on candidate databases to find out which databases can or cannot effectively use Database In-Memory.
2. Run the In-Memory Advisor on any Oracle 19c database, except those that the In-Memory Eligibility Test has determined are ineligible.

Examples

Example 1: Testing for eligibility within the time window of the last *n* days as input.

```
set serverout on;
set lines 200;
```

```
DECLARE
    inmem_eligible BOOLEAN;
    analysis_summary VARCHAR2(200);
BEGIN

    dbms_inmemory_advise.is_inmemory_eligible(1, inmem_eligible,
analysis_summary);

    DBMS_OUTPUT.PUT_LINE(
        CASE WHEN inmem_eligible = TRUE
            THEN 'Eligibile for In Memory'
            ELSE 'Not Eligible for In Memory'
        END
    );

    DBMS_OUTPUT.PUT_LINE(analysis_summary);

END;
/
```

Example 2: Testing for eligibility with a range of snapshot IDs as input.

```
set serverout on;
set lines 200;
DECLARE
    inmem_eligible BOOLEAN;
    analysis_summary VARCHAR2(200);
BEGIN

    dbms_inmemory_advise.is_inmemory_eligible(355, 356,
inmem_eligible, analysis_summary);

    DBMS_OUTPUT.PUT_LINE(
        CASE WHEN inmem_eligible = TRUE
            THEN 'Eligibile for In Memory'
            ELSE 'Not Eligible for In Memory'
        END
    );

    DBMS_OUTPUT.PUT_LINE(analysis_summary);

END;
/
```

Example 3: Testing for eligibility with a time interval as input. All snapshots beginning and ending within the time interval are included.

```
set serverout on;
set lines 200;
DECLARE
    inmem_eligible BOOLEAN;
    analysis_summary VARCHAR2(120);
BEGIN
```

```
        dbms_inmemory_advise.is_inmemory_eligible(TO_TIMESTAMP('21-JUN-23
05.22.27.262 PM', 'DD-Mon-RR HH:MI:SS.FF AM'),
        TO_TIMESTAMP('21-JUN-23
05.26.04.446 PM', 'DD-Mon-RR HH:MI:SS.FF AM'),
        inmem_eligible,
analysis_summary
    );

    DBMS_OUTPUT.PUT_LINE(
        CASE WHEN inmem_eligible = TRUE
        THEN 'Eligibile for In Memory'
        ELSE 'Not Eligible for In Memory'
        END
    );

    DBMS_OUTPUT.PUT_LINE(analysis_summary);

END;
/
```

DBMS_IOT

The `DBMS_IOT` package creates a table into which references to the chained rows for an index-organized table can be placed using the `ANALYZE` command. `DBMS_IOT` can also create an exception table into which references to the rows of an index-organized table that violate a constraint can be placed during the `enable_constraint` operation.

`DBMS_IOT` is not loaded during database installation. To install `DBMS_IOT`, run `dbmsiotc.sql`, available in the `ADMIN` directory.

This chapter contains the following topics:

- [Summary of DBMS_IOT Subprograms](#)

Note:

With the introduction of logical-rowids for IOTs with Oracle Database Release 8.1, you no longer need to use the procedures contained in this package which is retained for backward compatibility only. It is however required for servers running with Oracle Database Release 8.0.

98.1 Summary of DBMS_IOT Subprograms

This table lists and briefly describes the `DBMS_IOT` subprograms.

Table 98-1 *DBMS_IOT Package Subprograms*

Subprogram	Description
BUILD_CHAIN_ROWS_TABLE Procedure	Creates a table into which references to the chained rows for an index-organized table can be placed using the <code>ANALYZE</code> command
BUILD_EXCEPTIONS_TABLE Procedure	Creates an exception table into which rows of an index-organized table that violate a constraint can be placed

98.1.1 BUILD_CHAIN_ROWS_TABLE Procedure

This procedure creates a table into which references to the chained rows for an index-organized table can be placed using the `ANALYZE` command.

Syntax

```
DBMS_IOT.BUILD_CHAIN_ROWS_TABLE (
  owner          IN VARCHAR2,
  iot_name       IN VARCHAR2,
  chainrow_table_name IN VARCHAR2 default 'IOT_CHAINED_ROWS');
```

Parameters

Table 98-2 BUILD_CHAIN_ROWS_TABLE Procedure Parameters

Parameter	Description
owner	Owner of the index-organized table.
iot_name	Index-organized table name.
chainrow_table_name	Intended name for the chained-rows table.

Usage Notes

You should create a separate chained-rows table for each index-organized table to accommodate its primary key.

Examples

```
CREATE TABLE l(a char(16),b char(16), c char(16), d char(240),
PRIMARY KEY(a,b,c)) ORGANIZATION INDEX pctthreshold 10 overflow;
EXECUTE DBMS_IOT.BUILD_CHAIN_ROWS_TABLE('SYS','L','LC');
```

A chained-row table is created with the following columns:

Column Name	Null?	Type
OWNER_NAME		VARCHAR2 (30)
TABLE_NAME		VARCHAR2 (30)
CLUSTER_NAME		VARCHAR2 (30)
PARTITION_NAME		VARCHAR2 (30)
SUBPARTITION_NAME		VARCHAR2 (30)
HEAD_ROWID		ROWID
TIMESTAMP		DATE
A		CHAR (16)
B		CHAR (16)
C		CHAR (16)

98.1.2 BUILD_EXCEPTIONS_TABLE Procedure

This procedure creates an exception table.

Rows of an index-organized table that violate a constraint can be placed into this table during the execution of the following SQL statements:

- ALTER TABLE ... ENABLE CONSTRAINT ... EXCEPTIONS INTO
- ALTER TABLE ... ADD CONSTRAINT ... EXCEPTIONS INTO

Syntax

```
DBMS_IOT.BUILD_EXCEPTIONS_TABLE (
  owner          IN VARCHAR2,
  iot_name       IN VARCHAR2,
  exceptions_table_name IN VARCHAR2 default 'IOT_EXCEPTIONS');
```

Parameters

Table 98-3 BUILD_EXCEPTIONS_TABLE Procedure Parameters

Parameter	Description
owner	Owner of the index-organized table.
iot_name	Index-organized table name.
exceptions_table_name	Intended name for exception-table.

Usage Notes

You should create a separate exception table for each index-organized table to accommodate its primary key.

Examples

```
EXECUTE DBMS_IOT.BUILD_EXCEPTIONS_TABLE('SYS','L','LE');
```

An exception table for the preceding index-organized table with the following columns:

Column Name	Null?	Type
ROW_ID		VARCHAR2 (30)
OWNER		VARCHAR2 (30)
TABLE_NAME		VARCHAR2 (30)
CONSTRAINT		VARCHAR2 (30)
A		CHAR (16)
B		CHAR (16)
C		CHAR (16)

DBMS_JAVA

The DBMS_JAVA package provides a PL/SQL interface for accessing database functionality from Java.

For a complete description of this package within the context of DBMS_JAVA, see DBMS_JAVA in the *Oracle Database Java Developer's Guide*

The `DBMS_JOB` package schedules and manages jobs in the job queue.

 **Note:**

The `DBMS_JOB` package has been superseded by the `DBMS_SCHEDULER` package, and support for `DBMS_JOB` might be removed in future releases of Oracle Database. In particular, if you are administering jobs to manage system load, you are encouraged to disable `DBMS_JOB` by revoking the package execution privilege for users.

For more information, see [DBMS_SCHEDULER](#) and "Moving from `DBMS_JOB` to `DBMS_SCHEDULER`" in the *Oracle Database Administrator's Guide*.

This chapter contains the following topics:

- [Security Model](#)
- [Operational Notes](#)
- [Summary of DBMS_JOB Subprograms](#)

100.1 DBMS_JOB Security Model

`DBMS_JOB` uses the same security policies as `DBMS_SCHEDULER`. You must have the `CREATE JOB` privilege to use `DBMS_JOB`.

Jobs cannot be altered or deleted other than jobs owned by the user. This is true for all users including those users granted DBA privileges.

You can execute procedures that are owned by the user for which the user is explicitly granted `EXECUTE`. However, procedures for which the user is granted the execute privilege through roles cannot be executed.

Note that, once a job is started and running, there is no easy way to stop the job.

100.2 DBMS_JOB Operational Notes

These notes describe stopping a job, and working with Oracle Real Application Clusters.

Stopping a Job

Note that, once a job is started and running, there is no easy way to stop the job.

Working with Oracle Real Application Clusters

`DBMS_JOB` supports multi-instance execution of jobs. By default jobs can be executed on any instance, but only one single instance will execute the job. In addition, you can force instance

binding by binding the job to a particular instance. You implement instance binding by specifying an instance number to the instance affinity parameter. Note, however, that in Oracle Database 10g Release 1 (10.1) instance binding is not recommended. Service affinity is preferred. This concept is implemented in the [DBMS_SCHEDULER](#) package.

The following procedures can be used to create, alter or run jobs with instance affinity. Note that not specifying affinity means any instance can run the job.

- `DBMS_JOB.SUBMIT`
- `DBMS_JOB.INSTANCE`
- `DBMS_JOB.CHANGE`
- `DBMS_JOB.RUN`

DBMS_JOB.SUBMIT

To submit a job to the job queue, use the following syntax:

```
DBMS_JOB.SUBMIT(  
  job      OUT   BINARY_INTEGER,  
  what     IN    VARCHAR2,  
  next_date IN   DATE DEFAULT SYSDATE,  
  interval IN   VARCHAR2 DEFAULT 'NULL',  
  no_parse IN   BOOLEAN DEFAULT FALSE,  
  instance IN   BINARY_INTEGER DEFAULT ANY_INSTANCE,  
  force    IN   BOOLEAN DEFAULT FALSE);
```

Use the parameters `instance` and `force` to control job and instance affinity. The default value of `instance` is 0 (zero) to indicate that any instance can execute the job. To run the job on a certain instance, specify the `instance` value. Oracle displays error ORA-23319 if the `instance` value is a negative number or `NULL`.

The `force` parameter defaults to `false`. If `force` is `TRUE`, any positive integer is acceptable as the job instance. If `force` is `FALSE`, the specified instance must be running, or Oracle displays error number ORA-23428.

DBMS_JOB.INSTANCE

To assign a particular instance to execute a job, use the following syntax:

```
DBMS_JOB.INSTANCE( JOB IN BINARY_INTEGER,  
  instance          IN BINARY_INTEGER,  
  force             IN BOOLEAN DEFAULT FALSE);
```

The `FORCE` parameter in this example defaults to `FALSE`. If the `instance` value is 0 (zero), job affinity is altered and any available instance can execute the job despite the value of `force`. If the `INSTANCE` value is positive and the `FORCE` parameter is `FALSE`, job affinity is altered only if the specified instance is running, or Oracle displays error ORA-23428.

If the `force` parameter is `TRUE`, any positive integer is acceptable as the job instance and the job affinity is altered. Oracle displays error ORA-23319 if the `instance` value is negative or `NULL`.

DBMS_JOB.CHANGE

To alter user-definable parameters associated with a job, use the following syntax:

```
DBMS_JOB.CHANGE(  JOB IN BINARY_INTEGER,
what              IN VARCHAR2 DEFAULT NULL,
next_date         IN DATE DEFAULT NULL,
interval          IN VARCHAR2 DEFAULT NULL,
instance          IN BINARY_INTEGER DEFAULT NULL,
force             IN BOOLEAN DEFAULT FALSE );
```

Two parameters, `instance` and `force`, appear in this example. The default value of `instance` is `null` indicating that job affinity will not change.

The default value of `force` is `FALSE`. Oracle displays error `ORA-23428` if the specified instance is not running and error `ORA-23319` if the `instance` number is negative.

DBMS_JOB.RUN

The `force` parameter for `DBMS_JOB.RUN` defaults to `FALSE`. If `force` is `TRUE`, instance affinity is irrelevant for running jobs in the foreground process. If `force` is `FALSE`, the job can run in the foreground only in the specified instance. Oracle displays error `ORA-23428` if `force` is `FALSE` and the connected instance is the incorrect instance.

```
DBMS_JOB.RUN(
  job      IN BINARY_INTEGER,
  force    IN BOOLEAN DEFAULT FALSE);
```

100.3 Summary of DBMS_JOB Subprograms

This table lists the `DBMS_JOB` subprograms and briefly describes them.

Table 100-1 DBMS_JOB Package Subprograms

Subprogram	Description
BROKEN Procedure	Disables job execution
CHANGE Procedure	Alters any of the user-definable parameters associated with a job
INSTANCE Procedure	Assigns a job to be run by a instance
INTERVAL Procedure	Alters the interval between executions for a specified job
NEXT_DATE Procedure	Alters the next execution time for a specified job
REMOVE Procedure	Removes specified job from the job queue
RUN Procedure	Forces a specified job to run
SUBMIT Procedure	Submits a new job to the job queue
USER_EXPORT Procedures	Re-creates a given job for export, or re-creates a given job for export with instance affinity
WHAT Procedure	Alters the job description for a specified job

100.3.1 BROKEN Procedure

This procedure sets the broken flag. Broken jobs are never run.

Syntax

```
DBMS_JOB.BROKEN (
  job      IN BINARY_INTEGER,
```

```
broken    IN  BOOLEAN,
next_date IN  DATE DEFAULT SYSDATE);
```

Parameters

Table 100-2 BROKEN Procedure Parameters

Parameter	Description
job	System-assigned ID of the job being run. To find this ID, query the JOB column of the USER_JOBS or DBA_JOBS view.
broken	Sets the job as broken or not broken. TRUE sets it as broken; FALSE sets it as not broken.
next_date	Next date when the job will be run.

Note:

If you set job as broken while it is running, Oracle resets the job's status to normal after the job completes. Therefore, only execute this procedure for jobs that are not running.

Usage Notes

- Your job will not be available for processing by the job queue in the background until it is committed.
- If a job fails 16 times in a row, Oracle automatically sets it as broken and then stops trying to run it.

100.3.2 CHANGE Procedure

This procedure changes any of the fields a user can set in a job.

Syntax

```
DBMS_JOB.CHANGE (
  job      IN  BINARY_INTEGER,
  what     IN  VARCHAR2,
  next_date IN  DATE,
  interval IN  VARCHAR2,
  instance IN  BINARY_INTEGER DEFAULT NULL,
  force    IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 100-3 CHANGE Procedure Parameters

Parameter	Description
job	System-assigned ID of the job being run. To find this ID, query the JOB column of the USER_JOBS or DBA_JOBS view.
what	PL/SQL procedure to run.

Table 100-3 (Cont.) CHANGE Procedure Parameters

Parameter	Description
<code>next_date</code>	Next date when the job will be run.
<code>interval</code>	Date function; evaluated immediately before the job starts running.
<code>instance</code>	When a job is submitted, specifies which instance can run the job. This defaults to <code>NULL</code> , which indicates that instance affinity is not changed.
<code>force</code>	If this is <code>FALSE</code> , then the specified instance (to which the instance number change) must be running. Otherwise, the routine raises an exception. If this is <code>TRUE</code> , then any positive integer is acceptable as the job instance.

Usage Notes

- Your job will not be available for processing by the job queue in the background until it is committed.
- The parameters `instance` and `force` are added for job queue affinity. Job queue affinity gives users the ability to indicate whether a particular instance or any instance can run a submitted job.
- If the parameters `what`, `next_date`, or `interval` are `NULL`, then leave that value as it is.

Example

```
BEGIN
  DBMS_JOB.CHANGE(14144, null, null, 'sysdate+3');
  COMMIT;
END;
```

100.3.3 INSTANCE Procedure

This procedure changes job instance affinity.

Syntax

```
DBMS_JOB.INSTANCE (
  job          IN BINARY_INTEGER,
  instance     IN BINARY_INTEGER,
  force        IN BOOLEAN DEFAULT FALSE);
```

Parameters**Table 100-4 INSTANCE Procedure Parameters**

Parameter	Description
<code>job</code>	System-assigned ID of the job being run. To find this ID, query the <code>JOB</code> column of the <code>USER_JOBS</code> or <code>DBA_JOBS</code> view.
<code>instance</code>	When a job is submitted, a user can specify which instance can run the job.

Table 100-4 (Cont.) INSTANCE Procedure Parameters

Parameter	Description
force	If this is <code>TRUE</code> , then any positive integer is acceptable as the job instance. If this is <code>FALSE</code> (the default), then the specified instance must be running; otherwise the routine raises an exception.

Usage Notes

Your job will not be available for processing by the job queue in the background until it is committed.

100.3.4 INTERVAL Procedure

This procedure changes how often a job runs.

Syntax

```
DBMS_JOB.INTERVAL (
    job      IN  BINARY_INTEGER,
    interval IN  VARCHAR2);
```

Parameters

Table 100-5 INTERVAL Procedure Parameters

Parameter	Description
job	System-assigned ID of the job being run. To find this ID, query the <code>JOB</code> column of the <code>USER_JOBS</code> or <code>DBA_JOBS</code> view.
interval	Date function, evaluated immediately before the job starts running.

Usage Notes

- If the job completes successfully, then this new date is placed in `next_date`. `interval` is evaluated by plugging it into the statement `select interval into next_date from dual`;
- The `interval` parameter must evaluate to a time in the future. Legal intervals include:

Interval	Description
'sysdate + 7'	Run once a week.
'next_day(sysdate, 'TUESDAY')'	Run once every Tuesday.
'null'	Run only once.

- If `interval` evaluates to `NULL` and if a job completes successfully, then the job is automatically deleted from the queue.
- Your job will not be available for processing by the job queue in the background until it is committed.

100.3.5 NEXT_DATE Procedure

This procedure changes when an existing job next runs.

Syntax

```
DBMS_JOB.NEXT_DATE (  
    job          IN  BINARY_INTEGER,  
    next_date IN  DATE);
```

Parameters

Table 100-6 NEXT_DATE Procedure Parameters

Parameter	Description
job	System-assigned ID of the job being run. To find this ID, query the JOB column of the USER_JOBS or DBA_JOBS view.
next_date	Date of the next refresh: it is when the job will be automatically run, assuming there are background processes attempting to run it.

Usage Notes

Your job will not be available for processing by the job queue in the background until it is committed.

100.3.6 REMOVE Procedure

This procedure removes an existing job from the job queue. This currently does not stop a running job.

Syntax

```
DBMS_JOB.REMOVE (  
    job          IN  BINARY_INTEGER );
```

Parameters

Table 100-7 REMOVE Procedure Parameters

Parameter	Description
job	System-assigned ID of the job being run. To find this ID, query the JOB column of the USER_JOBS or DBA_JOBS view.

Usage Notes

Your job will not be available for processing by the job queue in the background until it is committed.

Example

```
BEGIN  
    DBMS_JOB.REMOVE (14144);
```

```
COMMIT;
END;
```

100.3.7 RUN Procedure

This procedure runs job `JOB` now. It runs it even if it is broken.

Running the job recomputes `next_date`. See data dictionary view `USER_JOBS` or `DBA_JOBS`.

Syntax

```
DBMS_JOB.RUN (
  job      IN  BINARY_INTEGER,
  force    IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 100-8 RUN Procedure Parameters

Parameter	Description
<code>job</code>	System-assigned ID of the job being run. To find this ID, query the <code>JOB</code> column of the <code>USER_JOBS</code> or <code>DBA_JOBS</code> view.
<code>force</code>	If this is <code>TRUE</code> , then instance affinity is irrelevant for running jobs in the foreground process. If this is <code>FALSE</code> , then the job can be run in the foreground only in the specified instance.

Example

```
EXECUTE DBMS_JOB.RUN(14144);
```

WARNING:

This re-initializes the current session's packages.

Exceptions

An exception is raised if `force` is `FALSE`, and if the connected instance is the wrong one.

100.3.8 SUBMIT Procedure

This procedure submits a new job. It chooses the job from the sequence `sys.jobseq`.

Syntax

```
DBMS_JOB.SUBMIT (
  job      OUT BINARY_INTEGER,
  what     IN  VARCHAR2,
  next_date IN DATE DEFAULT SYSDATE,
  interval IN  VARCHAR2 DEFAULT 'null',
  no_parse IN  BOOLEAN DEFAULT FALSE,
```



```
instance IN BINARY_INTEGER DEFAULT any_instance,
force     IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 100-9 SUBMIT Procedure Parameters

Parameter	Description
job	System-assigned ID of the job being run. To find this ID, query the JOB column of the USER_JOBS or DBA_JOBS view
what	<p>PL/SQL text o the job to be run. This must be a valid PL/SQL statement or block of code. For example, to run a stored procedure P, you could pass the string P; (with the semi-colon) to this routine. The SQL that you submit in the what parameter is wrapped in the following PL/SQL block:</p> <pre>DECLARE job BINARY_INTEGER := :job; next_date DATE := :mydate; broken BOOLEAN := FALSE; BEGIN WHAT :mydate := next_date; IF broken THEN :b := 1; ELSE :b := 0; END IF; END;</pre> <p>Ensure that you include the ; semi-colon with the statement.</p>
next_date	Next date when the job will be run.
interval	Date function that calculates the next time to run the job. The default is NULL. This must evaluate to a either a future point in time or NULL.
no_parse	<p>A flag. The default is FALSE. If this is set to FALSE, then Oracle parses the procedure associated with the job. If this is set to TRUE, then Oracle parses the procedure associated with the job the first time that the job is run.</p> <p>For example, if you want to submit a job before you have created the tables associated with the job, then set this to TRUE.</p>
instance	When a job is submitted, specifies which instance can run the job.
force	If this is TRUE, then any positive integer is acceptable as the job instance. If this is FALSE (the default), then the specified instance must be running; otherwise the routine raises an exception.

Usage Notes

- Your job will not be available for processing by the job queue in the background until it is committed.
- The parameters instance and force are added for job queue affinity. Job queue affinity gives users the ability to indicate whether a particular instance or any instance can run a submitted job.

Example

This submits a new job to the job queue. The job calls the procedure DBMS_DDL.ANALYZE_OBJECT to generate optimizer statistics for the table DQUON.ACCOUNTS. The

statistics are based on a sample of half the rows of the `ACCOUNTS` table. The job is run every 24 hours:

```
VARIABLE jobno number;
BEGIN
  DBMS_JOB.SUBMIT(:jobno,
    'dbms_ddl.analyze_object(''TABLE'',
    ''DQUON'', ''ACCOUNTS'',
    ''ESTIMATE'', NULL, 50);'
    SYSDATE, 'SYSDATE + 1');
  COMMIT;
END;
/
Statement processed.
print jobno
JOBNO
-----
14144
```

100.3.9 USER_EXPORT Procedures

There are two overloaded procedures. The first produces the text of a call to re-create the given job. The second alters instance affinity (8i and after) and preserves the compatibility.

Syntax

```
DBMS_JOB.USER_EXPORT (
  job      IN      BINARY_INTEGER,
  mycall   IN OUT  VARCHAR2);

DBMS_JOB.USER_EXPORT (
  job      IN      BINARY_INTEGER,
  mycall   IN OUT  VARCHAR2,
  myinst   IN OUT  VARCHAR2);
```

Parameters

Table 100-10 USER_EXPORT Procedure Parameter

Parameter	Description
job	System-assigned ID of the job being run. To find this ID, query the <code>JOB</code> column of the <code>USER_JOBS</code> or <code>DBA_JOBS</code> view.
mycall	Text of a call to re-create the given job.
myinst	Text of a call to alter instance affinity.

100.3.10 WHAT Procedure

This procedure changes what an existing job does, and replaces its environment.

Syntax

```
DBMS_JOB.WHAT (
  job      IN  BINARY_INTEGER,
  what     IN  VARCHAR2);
```

Parameters

Table 100-11 WHAT Procedure Parameters

Parameter	Description
job	System-assigned ID of the job being run. To find this ID, query the JOB column of the USER_JOBS or DBA_JOBS view.
what	PL/SQL procedure to run.

Usage Notes

- Your job will not be available for processing by the job queue in the background until it is committed.
- Some legal values of `what` (assuming the routines exist) are:
 - `'myproc(''10-JAN-82'', next_date, broken);'`
 - `'scott.emppackage.give_raise(''JENKINS'', 30000.00);'`
 - `'dbms_job.remove(job);'`

101

DBMS_JSON

The `DBMS_JSON` package provides an interface for data-guide operations.

This chapter contains the following topics:

- [DBMS_JSON Overview](#)
- [DBMS_JSON Security Model](#)
- [DBMS_JSON Constants](#)
- [Summary of DBMS_JSON Subprograms](#)

101.1 DBMS_JSON Overview

Package `DBMS_JSON` provides subprograms for manipulating JavaScript Object Notation (JSON) data that is stored in Oracle Database.

101.2 DBMS_JSON Security Model

`PUBLIC` is granted the `EXECUTE` privilege on package `DBMS_JSON`. Its subprograms execute with invoker's rights privileges.

101.3 DBMS_JSON Constants

The `DBMS_JSON` package uses these constants to define the JSON schema types and data-guide formatting options.

Table 101-1 DBMS_JSON Constants Defined for JSON Data-Guide Formatting

Name	Value	Description
<code>FORMAT_FLAT</code>	2	Display flat format
<code>FORMAT_HIERARCHICAL</code>	1	Display hierarchical format
<code>PRETTY</code>	1	Use appropriate indentation to improve readability

Table 101-2 DBMS_JSON Constants for JSON Schema Types

Name	Type	Value	Description
<code>TYPE_ARRAY</code>	<code>NUMBER(2)</code>	6	A JSON array
<code>TYPE_BOOLEAN</code>	<code>NUMBER(2)</code>	2	A JSON boolean
<code>TYPE_GEOJSON</code>	<code>NUMBER(2)</code>	7	Geographic JSON data
<code>TYPE_NULL</code>	<code>NUMBER(2)</code>	1	The JSON <code>NULL</code> value
<code>TYPE_NUMBER</code>	<code>NUMBER(2)</code>	3	A JSON number
<code>TYPE_OBJECT</code>	<code>NUMBER(2)</code>	5	A JSON object

Table 101-2 (Cont.) DBMS_JSON Constants for JSON Schema Types

Name	Type	Value	Description
TYPE_STRING	NUMBER(2)	4	A JSON string
TYPE_BINARY	NUMBER(2)	17	Oracle extended JSON type binary
TYPE_DATE	NUMBER(2)	13	Oracle extended JSON type date
TYPE_DOUBLE	NUMBER(2)	12	Oracle extended JSON type double
TYPE_DSINTERVAL	NUMBER(2)	16	Oracle extended JSON type day-second interval
TYPE_FLOAT	NUMBER(2)	11	Oracle extended JSON type float
TYPE_TIMESTAMP	NUMBER(2)	14	Oracle extended JSON type timestamp
TYPE_YMINTERVAL	NUMBER(2)	15	Oracle extended JSON type year-month interval

Table 101-3 DBMS_JSON Constants for mvrefreshmode Parameter

Name	Type	Value	Description
MV_REFRESH_ON_STATEMENT	NUMBER(2)	1	Creates the materialized view with refresh on statement.
MV_REFRESH_ON_COMMIT	NUMBER(2)	2	Creates the materialized view with refresh on commit.
MV_REFRESH_ON_DEMAND	NUMBER(2)	3	Creates the materialized view with refresh on demand.



See Also:

JSON Developer's Guide

101.4 Summary of DBMS_JSON Subprograms

This table lists the DBMS_JSON subprograms and briefly describes them.

DBMS_JSON Package Subprograms

Subprogram	Description
ADD_VIRTUAL_COLUMNS Procedure	Add virtual columns based on data-guide information. This has no effect when running on the shard catalog server — no virtual column is added.
CREATE_VIEW Procedure	Create a view with relational columns and scalar JSON fields as specified in a data guide.

Subprogram	Description
CREATE_VIEW_ON_PATH Procedure	Create a view based on data-guide information, with relational columns, top-level scalar types, and fully expanded sub-tree under a given path. When running on the shard catalog server this raises an error stating that the data guide is empty.
DROP_VIRTUAL_COLUMNS Procedure	Drop virtual columns created by procedure <code>add_virtual_columns</code> . This has no effect when running on the shard catalog server.
GET_INDEX_DATAGUIDE Function	Get JSON data guide from a data guide-enabled JSON search index. When running on the shard catalog server this returns a single empty row as result.
GET_VIEW_SQL Function	Get the data definition language (DDL) statement for creating a view without actually creating the view.
JSON_TYPE_CONVERTIBLE_CHECK Procedure	Check whether existing data stored as JSON text can be migrated to the JSON data type.
RENAME_COLUMN Procedure	Set the preferred name for a view column or a virtual column creating using a data guide. This has no effect when running on the shard catalog server.

 **Note:**

In the context of sharding, each individual shard maintains its own data-guide information, which is obtained from the JSON documents stored in that shard. When running on individual shard, procedures in this package that use data-guide information use only the information that is maintained for that shard.

101.4.1 ADD_VIRTUAL_COLUMNS Procedure

This procedure adds virtual columns based on the data guide.

The virtual column name is the value of `o:preferred_vc_name` in the data guide. The procedure ignores JSON objects, arrays, and fields under arrays in the data guide. Before it adds virtual columns, procedure `ADD_VIRTUAL_COLUMNS` first drops any existing virtual columns that were projected from fields in the same JSON column by a previous invocation of `ADD_VIRTUAL_COLUMNS` or by data-guide change-trigger procedure `add_vc` (in effect, it does what procedure `DBMS_JSON.DROP_VIRTUAL_COLUMNS` does).

 **See Also:**

- [DROP_VIRTUAL_COLUMNS Procedure](#)
- *Oracle Database JSON Developer's Guide*

Syntax

```
DBMS_JSON.ADD_VIRTUAL_COLUMNS (
    tablename           IN VARCHAR2,
    jcolname           IN VARCHAR2,
    dataguide          IN CLOB,
    resolvenameconflicts IN BOOLEAN DEFAULT TRUE,
    colnameprefix      IN VARCHAR2 DEFAULT NULL,
    mixedcasecolumns   IN BOOLEAN  DEFAULT FALSE);
```

For the following signature you must have a data guide-enabled search index on the JSON column. This is not needed for the previous signature.

```
DBMS_JSON.ADD_VIRTUAL_COLUMNS (
    tablename IN VARCHAR2,
    jcolname IN VARCHAR2,
    frequency NUMBER  DEFAULT 0,
    hidden    BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 101-4 ADD_VIRTUAL_COLUMNS Procedure Parameters

Parameter	Description
tablename	Name of the table containing JSON column jcolname.
jcolname	Name of the JSON column in table tablename that contains the data from which to create the virtual column.
dataguide	The data guide. When o:hidden in the data guide for a particular JSON field is set to TRUE, the corresponding virtual column is added as a hidden column. The default value of o:hidden is FALSE.
resolvenameconflicts	By default, this parameter is set to TRUE. The procedure automatically resolves the virtual column name conflicts by appending a sequence number. If it is set to FALSE, then in the event of any conflicts among o:preferred_column_name, an error is raised.
colnameprefix	By default, the virtual column name is the same as the JSON field name. This parameter allows you to add a prefix to the virtual column names.
mixedcasecolumns	By default, the virtual column names are case sensitive. If this parameter value is set to FALSE, the virtual column names become non-case-sensitive.
frequency	Sets the minimum frequency threshold to display JSON columns. A frequency of 0 means display all JSON columns. Also, all JSON columns are displayed if statistics have not been collected, effectively overriding any value set by this parameter.

Table 101-4 (Cont.) ADD_VIRTUAL_COLUMNS Procedure Parameters

Parameter	Description
hidden	TRUE means the added virtual column is hidden; FALSE means it is not. The default is FALSE.

Usage Notes

Procedure `DBMS_STATS.GATHER_STATS` collects statistics in the data guide. If the frequency statistic has not been collected, frequency is `NULL`. Setting the frequency to a value greater than zero means do not include columns for which there are no frequency statistics collected (statistic is `NULL`), unless `DBMS_STATS.GATHER_STATS` has never been executed. In that case, the frequency parameter is ignored and all columns are displayed in the view.

101.4.2 CREATE_VIEW Procedure

This procedure creates a view with relational columns, using scalar JSON fields as specified in the data guide. A data guide-enabled JSON search index is not required for this procedure; the data guide is passed to the procedure.



See Also:

Oracle Database JSON Developer's Guide

Syntax

```
PROCEDURE CREATE_VIEW (
    viewname          VARCHAR2,
    tablename         VARCHAR2,
    jcolname          VARCHAR2,
    dataguide         CLOB,
    resourcepath      VARCHAR2 DEFAULT NULL,
    materialize       BOOLEAN  DEFAULT FALSE,
    mvrefreshmode     NUMBER   DEFAULT MV_REFRESH_ON_STATEMENT,
    path              VARCHAR2 DEFAULT '$',
    resolvenameconflicts  BOOLEAN  DEFAULT TRUE,
    colnameprefix     VARCHAR2 DEFAULT NULL,
    mixedcasecolumns  BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 101-5 DBMS_JSON.CREATE_VIEW Procedure Parameters

Parameter	Description
viewname	Name of the view.
tablename	Name of the table containing JSON column <code>jcolname</code> .
jcolname	Name of the JSON column in table <code>tablename</code> that is used to create the view.

Table 101-5 (Cont.) DBMS_JSON.CREATE_VIEW Procedure Parameters

Parameter	Description
dataguide	The data guide.
resourcepath	This parameter is for internal use. Value of this parameter is always NULL.
materialize	The value of this parameter is boolean and indicates if the view is materialized or not.
mvrefreshmode	When materialize is true, this parameter specifies the materialized view refresh mode. For more information on materialized view refresh mode options, see DBMS_JSON Constants .
path	The path of the JSON field to be expanded. It uses JSON path-expression syntax. It expands the descendants under the specified path, and creates view columns for each scalar value in the resulting sub-tree. The path \$ creates a view starting from the JSON document root.
resolvenameconflicts	By default, this parameter is set to TRUE. The procedure automatically resolves the virtual column name conflicts by appending a sequence number. If it is set to FALSE, then in the event of any conflicts among <code>o:preferred_column_name</code> , an error is raised.
colnameprefix	By default, the view column name is the same as the JSON field name. This parameter allows users to provide a prefix to prepend to the view column names.
mixedcasecolumns	By default, the view column names are case sensitive. You can use this parameter to change the case sensitivity behavior of the view column names.

101.4.3 CREATE_VIEW_ON_PATH Procedure

This procedure creates a view with relational columns, using top-level scalar values and the scalar values in the expanded sub-tree under a given path. The JSON column must have a data guide-enabled search index.



See Also:

Oracle Database JSON Developer's Guide

Syntax

```
PROCEDURE CREATE_VIEW_ON_PATH(
  viewname VARCHAR2,
  tablename VARCHAR2,
  jcolname VARCHAR2,
  path VARCHAR2,
  frequency NUMBER DEFAULT 0);
```

Parameters

Table 101-6 CREATE_VIEW_ON_PATH Procedure Parameters

Parameter	Description
viewname	Name of the view.
tablename	Name of the table containing JSON column jcolname.
jcolname	Name of the JSON column in table <code>tablename</code> that is used to create the view. The column must have a data guide-enabled JSON search index, or else an error is raised.
path	The path of the JSON field to be expanded. It uses JSON path-expression syntax. It expands the descendants under the specified path, and creates view columns for each scalar value in the resulting sub-tree. The path <code>\$</code> creates a view starting from the JSON document root.
frequency	The minimum frequency threshold for displaying the JSON columns. A frequency of 0 means display all JSON columns. All JSON columns are also displayed if statistics have not been collected, effectively overriding any value set by this parameter. The view only displays JSON fields with frequency greater than the given <code>frequency</code> . It does not display JSON fields added after collecting statistics if the given frequency is greater than 0, if their statistic columns are <code>NULL</code> .

101.4.4 DROP_VIRTUAL_COLUMNS Procedure

Drop all virtual columns that were added using PL/SQL procedure `DBMS_JSON.add_virtual_columns` or using data-guide change-trigger procedure `add_vc`.

See Also:

- [ADD_VIRTUAL_COLUMNS Procedure](#)
- *Oracle Database JSON Developer's Guide*

Syntax

```
PROCEDURE DROP_VIRTUAL_COLUMNS (
    tablename VARCHAR2,
    jcolname VARCHAR2);
```

Parameters

Table 101-7 DBMS_JSON.DROP_VIRTUAL_COLUMNS Procedure Parameters

Parameter	Description
tablename	Name of the table containing JSON column jcolname.
jcolname	Name of the JSON column in table <code>tablename</code> .

101.4.5 GET_INDEX_DATAGUIDE Function

GET_INDEX_DATAGUIDE gets JSON data guide from data guide-enabled JSON search index.



See Also:

Oracle Database JSON Developer's Guide

Syntax

```
FUNCTION GET_INDEX_DATAGUIDE (  
    tablename VARCHAR2,  
    jcolname VARCHAR2,  
    format NUMBER,  
    pretty NUMBER DEFAULT 0)  
RETURN CLOB;
```

Parameters

Table 101-8 DBMS_JSON.GET_INDEX_DATAGUIDE Procedure Parameters

Parameter	Description
tablename	Name of the table containing JSON column jcolname.
jcolname	Name of the JSON column in table tablename that has a data guide-enabled JSON search index.
format	The data-guide format: <ul style="list-style-type: none">• FORMAT_HIERARCHICAL — hierarchical format• FORMAT_FLAT — flat format
pretty	A value of DBMS_JSON.PRETTY means pretty-print the data guide, using indentation to improve readability.

Example 101-1 Example Get Data Guide in Hierarchical Pretty Format

This example returns the data guide in hierarchical format.

```
SELECT DBMS_JSON.GET_INDEX_DATAGUIDE('T1', 'PO',  
DBMS_JSON.FORMAT_HIERARCHICAL, DBMS_JSON.PRETTY)  
FROM DUAL;
```

101.4.6 GET_VIEW_SQL Function

This function returns the creating view DDL without actually creating the view. A data guide-enabled JSON search index is not required for this function; the data guide is passed to the function.



See Also:

Oracle Database JSON Developer's Guide

Syntax

```
FUNCTION GET_VIEW_SQL (
  viewname          VARCHAR2,
  tablename         VARCHAR2,
  jcolname          VARCHAR2,
  dataguide         CLOB,
  materialize       BOOLEAN DEFAULT FALSE,
  mvrefreshmode     NUMBER  DEFAULT MV_REFRESH_ON_STATEMENT,
  path              VARCHAR2 DEFAULT '$',
  resolvenameconflicts  BOOLEAN DEFAULT TRUE,
  colnameprefix     VARCHAR2 DEFAULT NULL,
  mixedcasecolumns  BOOLEAN DEFAULT TRUE)
RETURN CLOB;
```

Parameters

Table 101-9 DBMS_JSON.GET_VIEW_SQL Function Parameters

Parameter	Description
viewname	Name of the view.
tablename	Name of the table containing JSON column <code>jcolname</code> .
jcolname	Name of the JSON column in table <code>tablename</code> that is used to create the view.
dataguide	The data guide.
materialize	The value of this parameter is Boolean and indicates if the view is materialized or not.
mvrefreshmode	When <code>materialize</code> is true, this parameter specifies the materialized view refresh mode. For more information on materialized view refresh mode options, see DBMS_JSON Constants .
path	The path of the JSON field to be expanded. It uses JSON path-expression syntax. It expands the descendants under the specified path, and creates view columns for each scalar value in the resulting sub-tree. The path <code>\$</code> creates a view starting from the JSON document root.
resolvenameconflicts	By default, this parameter is set to <code>TRUE</code> . The function automatically resolves the virtual column name conflicts by appending a sequence number. If it is set to <code>FALSE</code> , then in the event of any conflicts among <code>o:preferred_column_name</code> , an error is raised.

Table 101-9 (Cont.) DBMS_JSON.GET_VIEW_SQL Function Parameters

Parameter	Description
<code>colnameprefix</code>	By default, the view column name is the same as the JSON field name. This parameter allows users to provide a prefix to prepend to the view column names.
<code>mixedcasecolumns</code>	By default, the view column names are case sensitive. You can use this parameter to change the case sensitivity behavior of the view column names.

Usage Notes

- If Wide Tables are enabled for the database (`MAX_COLUMNS=EXTENDED`):
 - When `viewname` is `NULL`, the function returns only the select statement of the view DDL and it can select more than 4096 columns.
 - When `viewname` is not `NULL`, the function returns create view DDL and it selects at most 4096 columns.
 - As one `json_table` can only produce at most 4096 columns, the function will split paths into joins among multiple `json_tables` if the paths are more than 4096, when `viewname` is `NULL`.
- If Wide Tables are not enabled for the database (`MAX_COLUMNS=STANDARD`):
 - When `viewname` is `NULL`, the function returns only the select statement of the view DDL and it can select more than 1000 columns.
 - When `viewname` is not `NULL`, the function returns create view DDL and it selects at most 1000 columns.
 - As one `json_table` can only produce at most 1000 columns, the function will split paths into joins among multiple `json_tables` if the paths are more than 1000, when `viewname` is `NULL`.

 **See Also:**

Oracle Database Reference for more information on the `MAX_COLUMNS` initialization parameter

101.4.7 JSON_TYPE_CONVERTIBLE_CHECK Procedure

This procedure checks whether existing data stored as JSON text can be migrated to the JSON data type.

 **See Also:**

Oracle Database JSON Developer's Guide

Syntax

```
PROCEDURE JSON_TYPE_CONVERTIBLE_CHECK (
  owner          VARCHAR2,
  tableName      VARCHAR2,
  columnName     VARCHAR2,
  statusTableName VARCHAR2,
  fastCheck      BOOLEAN DEFAULT FALSE,
  appendStatus   BOOLEAN DEFAULT FALSE);
```

Parameters

Table 101-10 DBMS_JSON.JSON_TYPE_CONVERTIBLE_CHECK Procedure Parameters

Parameter	Description
owner	Name of the owner of the table.
tableName	Name of the table.
columnName	Name of the column in the table <code>tableName</code> that contains data to convert to the JSON type.
statusTableName	Name of the table to use to add the tracking status of the operation. This table might already exist or it might need to be created. If it already exists, the procedure verifies that it complies with the expected shape.
fastCheck	The value of this optional parameter is Boolean. If this parameter is set to <code>TRUE</code> , the <code>is_json</code> check constraint is run to verify that the input data is convertible. If the parameter is <code>FALSE</code> , then the <code>oson</code> constructor is run to verify that the input data is convertible. The default value is <code>FALSE</code> .
appendStatus	The value of this optional parameter is Boolean. If this parameter is set to <code>TRUE</code> , the status table will not be truncated. If the parameter is <code>FALSE</code> , then if the status table already exists, it will be truncated. In either case, if the status table does not already exist, it is created and will then contain only new data from running the procedure. The default value is <code>FALSE</code> .

101.4.8 RENAME_COLUMN Procedure

This procedure sets the preferred name for a JSON column, to be used by the create view, or add virtual columns procedure.

**See Also:**

Oracle Database JSON Developer's Guide

Syntax

```
PROCEDURE RENAME_COLUMN(
  tablename VARCHAR2,
```

```
jcolname VARCHAR2,  
path VARCHAR2,  
type NUMBER,  
preferred_name VARCHAR2);
```

Parameters

Table 101-11 RENAME_COLUMN Procedure Parameters

Parameter	Description
tablename	Name of the table containing JSON column jcolname.
jcolname	Name of the JSON column in table tablename. It must have a data guide-enabled JSON search index, or else an error is raised.
path	Path to the JSON field on which to set the preferred column name.
type	The type of the JSON field targeted by path. Two JSON fields can have the same path if they are of different types. Possible values: <ul style="list-style-type: none"> • TYPE_NULL • TYPE_STRING • TYPE_NUMBER • TYPE_BOOLEAN • TYPE_OBJECT • TYPE_ARRAY
preferred_name	Preferred name for the JSON field specified by path. If there is a name conflict, a system generated name is used instead.

Example 101-2 Example Renaming a Column

This example renames a field to item_name.

```
EXEC DBMS_JSON.RENAME_COLUMN('T1', 'PO', '$.purchaseOrder.items.name',  
DBMS_JSON.TYPE_STRING, 'item_name');
```

DBMS_JSON_SCHEMA

The `DBMS_JSON_SCHEMA` package provides subprograms for validating and generating JavaScript Object Notation (JSON) schemas that are stored in Oracle Database.

This chapter contains the following topics:

- [DBMS_JSON_SCHEMA Security Model](#)
- [DBMS_JSON_SCHEMA Constants](#)
- [Summary of DBMS_JSON_SCHEMA Subprograms](#)

102.1 DBMS_JSON_SCHEMA Security Model

The `DBMS_JSON_SCHEMA` package is owned by the `SYS` account.

The `PUBLIC` account is granted the `EXECUTE` privilege on the `DBMS_JSON_SCHEMA` package.

The `DBMS_JSON_SCHEMA` package is defined with the `AUTHID CURRENT_USER` clause.

The user who invokes the `DBMS_JSON_SCHEMA.DESCRIBE()` function must have sufficient privileges on the object that is being described.

102.2 DBMS_JSON_SCHEMA Constants

The `DBMS_JSON_SCHEMA` package uses the following constants for schema validation.

Table 102-1 DBMS_JSON_SCHEMA Constants for Schema Validation

Name	Value	Description
<code>RAISE_ERROR</code>	1	Raise errors for invalid schemas.
<code>RAISE_NONE</code>	0	Do not raise errors for invalid schemas.
<code>SCHEMA_INVALID</code>	0	The schema is not valid.
<code>SCHEMA_VALID</code>	1	The schema is valid.



See Also:

JSON Developer's Guide

102.3 Summary of DBMS_JSON_SCHEMA Subprograms

This table lists the DBMS_JSON_SCHEMA subprograms and briefly describes them.

DBMS_JSON_SCHEMA Package Subprograms

Subprogram	Description
DESCRIBE Function	Creates a schema from a specified object (table, view, object type; or a synonym resolving to a table, view, duality view, object or collection type, or domain).
IS_SCHEMA_VALID Function	Check the validity of a JSON schema.
IS_VALID Function	Check the validity of JSON data for a specified schema (function).
IS_VALID Procedure	Check the validity of JSON data for a specified schema (procedure).
VALIDATE_REPORT Function	Reads the error report from the result of a schema validation.

102.3.1 DESCRIBE Function

This procedure creates a schema from a specified object.



See Also:

- *Oracle Database JSON Developer's Guide*

Syntax

```
FUNCTION DESCRIBE (
    object_name IN VARCHAR2,
    owner_name  IN VARCHAR2  DEFAULT NULL,
    column_name IN VARCHAR2  DEFAULT NULL)
RETURN JSON;
```

Parameters

Table 102-2 DESCRIBE Function Parameters

Parameter	Description
object_name	The object to use to create the schema. The object can be a table, view, object type, or a synonym resolving to a table, view, duality view, object type, collection type, or domain.
owner_name	The name of the user who the schema is created for. If the owner_name value is NULL, the table is created in the current user's schema.

Table 102-2 (Cont.) DESCRIBE Function Parameters

Parameter	Description
column_name	If a column name is specified, the schema returned is only for the column in the table or view. The column_name argument can be used only with table or view objects.

102.3.2 IS_SCHEMA_VALID Function

This function checks a schema for validity.

See Also:

- *Oracle Database JSON Developer's Guide*

Syntax

```
FUNCTION IS_SCHEMA_VALID(
  json_data  IN  JSON)
RETURN PLS_INTEGER;
```

Parameters

Table 102-3 DESCRIBE Function Parameters

Parameter	Description
json_data	The schema to check for validity.

The function returns 0 if the schema is not valid.

102.3.3 IS_VALID Function

This function checks the validity of JSON data for a specified schema.

See Also:

- *Oracle Database JSON Developer's Guide*

Syntax

```
FUNCTION IS_VALID(
  json_data  IN  JSON,
  json_schema IN  JSON,
  raise_err  IN  PLS_INTEGER)
```

```

    DEFAULT DBMS_JSON_SCHEMA.RAISE_NONE)
RETURN PLS_INTEGER;

```

Parameters

Table 102-4 IS_VALID Function Parameters

Parameter	Description
json_data	The JSON data to validate.
json_schema	The schema to use to validate the data.
raise_err	<ul style="list-style-type: none"> RAISE_NONE — Do not raise an error for invalid schemas. RAISE_ERROR — Raise an error for invalid schemas.

If the schema is valid, the `SCHEMA_VALID` constant, 1, is returned. If the schema is not valid, the `SCHEMA_INVALID` constant, 0, is returned, unless the `raise_err` value is `RAISE_ERROR`, in which case an error is raised.

102.3.4 IS_VALID Procedure

This procedure checks the validity of JSON data for a specified schema.

See Also:

- Oracle Database JSON Developer's Guide*

Syntax

```

PROCEDURE IS_VALID(
    json_data   IN  JSON,
    json_schema IN  JSON,
    result      OUT BOOLEAN,
    errors      OUT JSON);

```

Parameters

Table 102-5 IS_VALID Procedure Parameters

Parameter	Description
json_data	The JSON data to validate.
json_schema	The schema to use to validate the data.
result	The result of the validation, which is <code>TRUE</code> if the JSON data is valid and <code>FALSE</code> if not.
errors	A list of error messages that indicate why the JSON data was found invalid when validated against the specified schema.

102.3.5 VALIDATE_REPORT Function

This function reads the error report from the result of a schema validation.

See Also:

- *Oracle Database JSON Developer's Guide*

Syntax

```
FUNCTION VALIDATE_REPORT(  
    json_data IN VARCHAR2,  
    json_schema IN VARCHAR2)  
RETURN JSON;
```

Parameters

Table 102-6 VALIDATE_REPORT Function Parameters

Parameter	Description
json_data	The JSON data to validate.
json_schema	The schema to use to validate the data.

DBMS_KAFKA

The `DBMS_KAFKA` package provides a PL/SQL interface for enabling Oracle SQL access to topics in Kafka clusters.

Users granted `READ` access to an Oracle SQL access to Kafka (OSAK) cluster can use the `DBMS_KAFKA` package to create applications that query Kafka data from Oracle Database views and tables.

- [DBMS_KAFKA Overview](#)
- [DBMS_KAFKA LOADING Mode](#)
- [DBMS_KAFKA Global Temporary Tables](#)
- [DBMS_KAFKA Streaming Mode](#)
- [DBMS_KAFKA Seekable Mode](#)
- [ADD_PARTITIONS](#)
- [DROP_ALL_APPS](#)
- [ENABLE_VIEW_QUERY](#)
- [SET_TRACING](#)

103.1 DBMS_KAFKA Overview

The `DBMS_KAFKA` packages enable you to access and process Kafka data with Oracle SQL access to Kafka (OSAK).

To enable applications to consume Kafka data, you use the `DBMS_KAFKA` packages. Before you can use Kafka resources, an administrator for Kafka must have registered and enabled access to a Kafka cluster.

To access the Kafka topics, you create an Oracle SQL Access to Kafka (OSAK) application. You first have to decide what mode to use.

- **Loading mode:** Use to load data from a Kafka topic into an Oracle Database table.
- **Streaming mode:** Use to read sequentially through a Kafka topic.
- **Seekable mode:** Use to randomly access a Kafka topic between starting and ending timestamps.

You then create the application using the appropriate OSAK package:

- `CREATE_LOAD_APP`: Creates an application that can be used in Loading mode.
- `CREATE_STREAMING_APP`: Creates an application that can be used in Streaming mode.
- `CREATE_SEEKABLE_APP`: Creates an application that can be used in Seekable mode.

Other `DBMS_KAFKA` packages enable you to manage the Kafka data.

The following is an overview of the procedure for each package

Loading Data Into a Load Application

- Use `DBMS_KAFKA.CREATE_LOAD_APP` to create an Oracle SQL Access to Kafka Load application
- Optionally, use `DBMS_KAFKA.INIT_OFFSET_TS` or `DBMS_KAFKA.INIT_OFFSET` to set the first Kafka record that you want to be read.
- Run `LOOP` until done.
 - Use `DBMS_KAFKA.EXECUTE_LOAD_APP` to load Kafka data starting from where a previous read left off to the current high water mark.
- Use `DBMS_KAFKA.DROP_LOAD_APP` to drop the load application after you are finished with the Kafka data.

Loading Data Into a Streaming Mode Application

To query Kafka data in Streaming mode to read sequentially through a Kafka topic, the procedure is as follows:

1. Use `DBMS_KAFKA.CREATE_STREAMING_APP` to create the Oracle SQL Access to Kafka streaming application.
2. Optionally, use `DBMS_KAFFA.INIT_OFFSET_TS` or `DBMS_KAFKA.INIT_OFFSET` to set the first Kafka record that you want to be read.
3. Run `LOOP` on the data in SQL:
 - a. Call `DBMS_KAFKA.LOAD_TEMP_TABLE` to load the global temporary table with the next set of rows from Kafka
 - b. Use `SELECT` from the OSAK global temporary table.
 - c. Process the data retrieved
 - d. If the processing was successful, then use `DBMS_KAFKA.UPDATE_OFFSET` to advance to the next set of Kafka records.
 - e. Use `COMMIT` to commit the offset tracking information.
4. When finished with the application, use `DBMS_KAFKA.DROP_STREAMING_APP` to drop the application.

Loading Data into a Seekable Mode Application

To query Kafka data in Seekable mode, so that you can access Kafka records between two timestamps, an overview of the procedure is as follows:

1. `DBMS_KAFKA.CREATE_SEEKABLE_APP` Use to create the Oracle SQL Access to Kafka seekable application
2. Run `LOOP` on the Kafka data in SQL:
 - a. Use `DBMS_KAFKA.SEEK_OFFSET_TS` to seek to a defined window of time in a Kafka topic.
 - b. Call `DBMS_KAFKA.LOAD_TEMP_TABLE` to load a global temporary table with the set of rows from Kafka that you want to analyze.
 - c. Use `SELECT` from the OSAK global temporary table.
 - d. Process the data.

- When done with the application, use `DBMS_KAFKA.DROP_SEEKABLE_APP` to drop the application.

103.2 DBMS_KAFKA LOADING Mode

Use the `DBMS_KAFKA LOADING` mode packages to load Kafka data incrementally into Oracle Database.

Loading procedures enable you to load available Kafka records into Oracle Database, which can then serve as a data warehouse for that data. You can then combine that data with Oracle Database tables for analytics.

An application declares that it is a loading application by calling the PL/SQL procedure `DBMS_KAFKA.CREATE_LOAD_APP` to initialize state for subsequent calls to `DBMS_KAFKA.EXECUTE_LOAD_APP`. `DBMS_KAFKA.CREATE_LOAD_APP` creates a single view over all partitions of the topic. An application can optionally call the `DBMS_KAFKA.INIT_OFFSET[_TS]` procedure to set the starting point in Kafka topic partitions.

The `DBMS_KAFKA.EXECUTE_LOAD_APP` procedure is called in an application loop to load data from where the previous call left off to the current high water mark of the Kafka topic. This procedure runs in an autonomous transaction.

When you are finished working with the Kafka data, you can remove the application by using `DBMS_KAFKA.DROP_LOAD_APP`.

103.2.1 CREATE_LOAD_APP

This procedure creates an Oracle SQL Access to Kafka Load application that retrieves data from all partitions in a Kafka topic to load that Kafka data into an Oracle Database table. It also creates, if not already present, a metadata view that is used to inspect the Kafka cluster for live topic and partition information regarding the Kafka topic. This view is created once, and serves all applications that are sharing the same cluster. This model is restrictive in that only one application instance is allowed to call `DBMS_KAFKA.EXECUTE_LOAD_APP` for the created LOAD application.

Parameters

Parameter	Description
<code>cluster_name</code>	The name of a registered Oracle SQL access to Kafka cluster that has the topic that you want to associate with this application. Case-insensitive. The registered cluster names can be obtained from the OSAK Administrator, by using the following statement: <pre>SELECT cluster_name FROM sys.user_kafka_clusters;</pre>
<code>application_name</code>	The application name. This parameter is also used as the Kafka group that can read the topic. Case-insensitive.
<code>topic_name</code>	The topic name in the Kafka cluster whose contents you want to retrieve. Case-sensitive.

Parameter	Description
options	Includes a list of properties formatted as a JSON document. Options are described in more detail in the topic "DBMS_KAFKA OPTIONS Passed to CREATE_XXX_APP".

Examples

Example 103-1 CREATE_LOAD_APP Procedure for Oracle SQL Access to Kafka

In the following example, a load application called `ExampleApp` is created for data from the Kafka cluster `ExampleCluster`, using the Kafka topic `my-company-app-event1` and the option `ProducerRecord`.

```
PROCEDURE CREATE_LOAD_APP (
    ExampleCluster      IN VARCHAR2,
    ExampleApp          IN VARCHAR2,
    my-company-app-event1 IN VARCHAR2,
    ProducerRecord      IN CLOB
)
```

Related Topics

- [DBMS_KAFKA OPTIONS Passed to CREATE_XXX_APP](#)

103.2.2 DROP_LOAD_APP

The `DBMS_KAFKA_ADM` procedure `DROP_LOAD_APP` drops the Oracle SQL for Kafka (OSAK) LOAD application, and removes related metadata.

Syntax

```
EXEC DROP_LOAD_APP (
    cluster_name      IN VARCHAR2,
    application_name  IN VARCHAR2
);
```

Parameters

Table 103-1 DROP_LOAD_APP Procedure Parameters for DBMS_KAFKA_ADM.

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive.
<i>application_name</i>	Name of an existing application associated with the Kafka cluster. Case-insensitive.

Usage Notes

Use this procedure to drop an Oracle SQL access to Kafka (OSAK) application when you no longer want to load data from a Kafka topic into an Oracle Database table.

Examples

Suppose you have completed your work with the application called `ExampleApp` with data from the Kafka cluster `ExampleCluster`. Use this procedure to drop the application:

```
EXEC DROP_LOAD_APP (
                                ExampleCluster  IN VARCHAR2,
                                ExampleApp       IN VARCHAR2
                                );
```

103.2.3 EXECUTE_LOAD_APP

The `DBMS_KAFKA` procedure `EXECUTE_LOAD_APP` loads a user table from a dedicated Oracle SQL access to Kafka (OSAK) view. To use this procedure, you must previously have created a load application with `CREATE_LOAD_APP`.

Syntax

```
PROCEDURE EXECUTE_LOAD_APP (
                                cluster_name          IN VARCHAR2,
                                application_name      IN VARCHAR2,
                                target_table          IN VARCHAR2,
                                records_loaded        OUT INTEGER,
                                parallel_hint         IN INTEGER DEFAULT 0
                                );
```

Parameters

Table 103-2 EXECUTE_LOAD_APPS Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>cluster_name</i>	Name of a registered Oracle SQL access to Kafka cluster that has the topic that you want associated with this application. Case-insensitive. The registered cluster names can be obtained from the OSAK Administrator, or by using or by using the following SQL statement: <code>SELECT cluster_name from SYS.USER_KAFKA_CLUSTERS;</code>
<i>application_name</i>	The name of an existing application associated with the Kafka cluster Case-insensitive.

Table 103-2 (Cont.) EXECUTE_LOAD_APPS Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>target_table</i>	A target table in the Oracle Database that will be loaded with data from a Kafka topic. It must be consistent with some or all of the columns retrieved from the Kafka cluster topic by the OSAK view created by the <code>LOAD</code> operation.
<i>records_loaded</i>	(OUT) The number of Kafka records loaded
<i>parallel_hint</i>	(IN) (Optional) The degree of parallelism to use when loading the application that maps exclusively to a particular OSAK view. If a parallel hint is not specified, or it is less than or equal to 1, then parallelism is not used to load the table. Note: Only use a parallel hint when <code>PARALLEL_DEGREE_POLICY</code> for the user session or the system is set to <code>MANUAL</code> . For all other policies (for example, <code>AUTO</code>), no parallel hint should be passed. If parallel hint exceeds the granule count of an OSAK view, then an exception will be raised.

Usage Notes

Oracle SQL access to Kafka (OSAK) views are used transparently by PL/SQL calls to load records from a topic in a Kafka cluster previously created by the `CREATE_LOAD_APP` procedure. Applications call `EXECUTE_LOAD_APP` to load an Oracle Database user table from a dedicated OSAK view.

Note:

Only one user can query an OSAK temporary table using a single database application instance serving the OSAK application. However by using `EXECUTE_LOAD_APP`, you load Kafka data into a permanent database table that is accessible by multiple applications.

Each call to the `EXECUTE_LOAD_APP` procedure reads new records from the Kafka topic, and inserts these records into the Oracle Database table. `EXECUTE_LOAD_APP` also advances offsets of all Kafka partitions, so that the next time `EXECUTE_LOAD_APP` is run, it will insert new rows. Using `EXECUTE_LOAD_APP` enables you to perform incremental loads, so that you can update the Oracle Database table with updates to the Kafka topic. Because that Kafka data is moved into standard Oracle Database tables, they become available for processing and analysis by multiple applications.

Examples

Suppose you have completed your initial cluster definition for the Kafka cluster `ExampleCluster`, and registered the cluster. Next, you use this procedure to load data from the Kafka cluster `ExampleCluster` into the application `ExampleLoadApp`:

```
DECLARE
    v_records_inserted INTEGER;
BEGIN
    SYS.DBMS_KAFKA.EXECUTE_LOAD_APP (

'ExampleCluster',

'ExampleLoadApp',

'ExampleLoadTable',

v_records_inserted);
END;
```

103.3 DBMS_KAFKA Global Temporary Tables

Use the `DBMS_KAFKA_LOAD_TEMP_TABLE` mode packages to load Kafka data into a temporary table, from which the Kafka data view in Oracle Database is created.

The `DBMS_KAFKA_LOAD_TEMP_TABLE` procedure is called in an application loop to load data into an Oracle SQL access to Kafka (OSAK) application. For both `STREAMING` and `SEEKABLE` applications, you use `CREATE_APP_xxx` (where `xxx` is either `STREAMING` or `SEEKABLE`) to create the application. Next, you use an application loop while calling `LOAD_TEMP_TABLE` for the application, and process the data loaded into the temporary tables.

103.3.1 LOAD_TEMP_TABLE

The `DBMS_KAFKA` procedure `LOAD_TEMP_TABLE` selects all data from an Oracle SQL access to Kafka view into a temporary table. Use this procedure to create an Oracle SQL access to Kafka (OSAK) dedicated temporary table that an application can use with SQL queries to analyze the data, or to or join with Oracle Database tables.

Syntax

```
FUNCTION LOAD_TEMP_TABLE (
    temporary-table-name IN VARCHAR2
) RETURN INTEGER;
```

Parameters

Table 103-3 LOAD_TEMP_TABLE Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>temporary-table-name</i>	Name of the temporary table that you want to create Type: VARCHAR Case-insensitive.
<i>parallel-hint</i>	(Optional) the degree of parallelism when loading the global temporary table that maps exclusively to a particular OSAK view. If a parallel hint is not specified, or it is less than or equal to 1, then parallelism is not used to load the table. Note: Only use a parallel hint when PARALLEL_DEGREE_POLICY for the user session or the system is set to MANUAL. For all other policies (for example, AUTO), no parallel hint should be passed. If parallel hint exceeds the granule count of an OSAK view, then an exception will be raised.

Usage Notes

Oracle SQL access to Kafka (OSAK) views are used transparently by PL/SQL calls to load records from Kafka topics into either a dedicated OSAK global temporary table or into a user-defined table. STREAMING and SEEKABLE applications call LOAD_TEMP_TABLE which loads an OSAK global temporary table from a dedicated OSAK view, while LOAD applications call EXECUTE_LOAD_APP to load a user table from a dedicated OSAK view.

Caution:

OSAK views are dedicated views, which can serve only one application instance. They are not shared by other instances of the application, and they should not be queried by a generalized tool (for example, SQL*Plus or SQL Developer). Concurrent access of an OSAK view can cause a race condition where a tool could inadvertently read more rows than the dedicated application, and inadvertently advance Kafka offsets beyond what the dedicated application has read. As a result, the application can then fail to obtain from the Kafka topic records that should have been processed.

Examples

Suppose you want to load and process records associated with a streaming application called `ExampleApp` from Kafka cluster `ExampleCluster`. By default, the OSAK views are configured to read from the earliest record present to last record currently published when they are initially created. After you create the streaming

application with `DBMS_KAFKA.CREATE_STREAMING_APP`, the following is an example Kafka data processing loop for that streaming application:

```
BEGIN
  LOOP
    SYS.DBMS_KAFKA.LOAD_TEMP_TABLE

    (ORA$DKVGTT_EXAMPLECLUSTER_EXAMPLEAPP_0);
    FOR kafka_record IN (
      SELECT kafka_offset offset
      FROM ORA$DKVGTT_EXAMPLECLUSTER_EXAMPLEAPP_0)
    LOOP
      SYS.DBMS_OUTPUT.PUT_LINE ('Processing record: ' ||
kafka_record.offset);
      --application logic to process the Kafka records
    END LOOP;
    IF (application logic was successful) THEN
      --Update internal metadata to confirm Kafka records were
successfully processed
      SYS.DBMS_KAFKA.UPDATE_OFFSET

      ('ORA$DKV_EXAMPLECLUSTER_EXAMPLEAPP_0');
      COMMIT;
    ELSE
      --add your application logic to correct for any failures
    END IF;
  END LOOP;
END;
```

103.4 DBMS_KAFKA Streaming Mode

Use the `DBMS_KAFKA STREAMING` mode packages to stream data from a Kafka topic into an Oracle SQL access to Kafka (OSAK) global temporary table from a dedicated OSAK view. To use this package, you must first use `LOAD_TEMP_TABLE` to create the dedicated OSAK view. Use `STREAMING` mode for applications that require access to Kafka topics in a sequential manner from the beginning, or from a specific starting point in a Kafka topic. This mode allows a SQL query using an OSAK temporary table to access Kafka records sequentially in an application processing loop. An application declares that it is a streaming application by calling the PL/SQL procedure `DBMS_KAFKA.CREATE_STREAMING_APP` to initialize state for subsequent queries of OSAK views.

103.4.1 CREATE_STREAMING_APP

The `DBMS_KAFKA` procedure `CREATE_STREAMING_APP` creates an Oracle SQL access to Kafka (OSAK) streaming application. The application includes a set of dedicated OSAK global temporary tables and OSAK views that are used for retrieving new and unread records from partitions in a Kafka topic. It also creates, if not already present, a metadata view that is used

to inspect the Kafka cluster for live topic and partition information regarding the Kafka topic. This view is created once, and serves all applications that are sharing the same cluster.

Syntax

```
PROCEDURE CREATE_STREAMING_APP (
                                cluster_name      IN  VARCHAR2,
                                application_name   IN  VARCHAR2,
                                topic_name       IN  VARCHAR2,
                                options          IN  CLOB,
                                view_count       IN  INTEGER
                                DEFAULT 1
                                );
```

Parameters

Table 103-4 CREATE_STREAMING_APP Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>cluster_name</i>	Name of a registered Oracle SQL access to Kafka cluster that has the topic that you want associated with this application. Case-insensitive. The registered cluster names can be obtained from the OSAK Administrator, or by using or by using the following SQL statement: <code>SELECT cluster_name from SYS.USER_KAFKA_CLUSTERS;</code>
<i>application_name</i>	The name of the application. Also used as the Kafka group that will read the topic. Case-insensitive.
<i>topic_name</i>	The topic name in the Kafka cluster whose contents will be retrieved.
<i>options</i>	Includes a list of properties formatted as a JSON document. Options are described in more detail in the topic "DBMS_KAFKA OPTIONS Passed to CREATE_XXX_APP".
<i>view_count</i>	(OPTIONAL) Identifies the number of Oracle SQL access to Kafka (OSAK) view pairs to create. Valid values are 1 to <i>N</i> , where <i>N</i> is the number of Kafka partitions in a topic, or 0, which defaults to <i>N</i> . (Default is 1).

Usage Notes

Each OSAK view is exclusively used by one instance of an Oracle SQL access to Kafka application. Each application instance call populates the view with Kafka rows. The application then can then run one or more SQL queries against the content in the OSAK view A STREAMING application is different from a LOAD or SEEKING application in that it can choose how many OSAK views need to be created. The

number of OSAK views must be between 1 and N where N is the number of partitions in the Kafka topic.

As with other types of OSAK applications, each application instance exclusively queries one unique OSAK temporary table. Each OSAK view includes the cluster name, the application name, and an application instance identifier (ID). Creating multiple application instances enables applications to scale out and divide the workload of analyzing Kafka data across application instances running concurrently on one or more threads, processes, or systems.

The number of Kafka partitions bound to a specific OSAK view and its associated OSAK global temporary table will vary depending upon how many views are created and how many partitions exist. If N OSAK view/temporary table pairs are created, then the application user must have been allocated at least N sessions per user, so that N application instances can run concurrently.

Examples

Suppose you want to create a set of four views for a streaming application called `ExampleApp`, streamed from a Kafka topic called `ExampleTopic` in the Kafka cluster `ExampleCluster` that has four partitions, where each view is associated with one partition. You can enter the following statement:

```
DECLARE
    v_options VARCHAR2;
BEGIN
    v_options := '{"fmt" : "DSV", "reftable" : "user_reftable_name"}';
    SYS.DBMS_KAFKA.CREATE_STREAMING_APP (
        'ExampleCluster',
        'ExampleApp',
        'ExampleTopic',
        v_options,
        4);
END;
/
```

Alternatively, to create one view for an application that is associated with all four partitions of the topic, you enter the following statement:

```
DECLARE
    v_options VARCHAR2;
BEGIN
    v_options := '{"fmt" : "DSV", "reftable" :
"user_reftable_name"}';
    SYS.DBMS_KAFKA.CREATE_STREAMING_APP (
        'ExampleCluster',
        'ExampleApp',
        'ExampleTopic',
        v_options,
        1);
END;
/
```

Related Topics

- [DBMS_KAFKA OPTIONS Passed to CREATE_xxx_APP](#)

103.4.2 DROP_STREAMING_APP

The `DBMS_KAFKA` procedure `DROP_STREAMING_APP` drops the streaming application. This function removes the Oracle SQL access to Kafka (OSAK) view, and drops all associated database objects.

Syntax

```
PROCEDURE DROP_STREAMING_APP (  
                                cluster_name      IN VARCHAR2,  
                                application_name IN VARCHAR2  
                                );
```

Parameters**Table 103-5 DROP_STREAMING_APP Procedure Parameters for DBMS_KAFKA**

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive.
<i>application_name</i>	The name of an existing application using the Kafka cluster. Case-insensitive.

Usage Notes

When you are done with an application, you use this function to drop an OSAK view associated with an application.

Examples

Suppose you have completed your work with the Kafka cluster `ExampleCluster`, which was being used by Streaming application `ExampleApp`. You can then use this procedure to drop the application::

```
EXEC SYS.DBMS_KAFKA.DROP_STREAMING_APP (  
                                'ExampleCluster',  
                                'ExampleApp');
```

103.4.3 INIT_OFFSET

The `DBMS_KAFKA_ADM` procedure `INIT_OFFSET` enables you to select a particular offset as the starting point for reading Kafka data. Use this option when you want to select a

particular starting point in the data to load, instead of loading data from the first record available.

Syntax

```
PROCEDURE INIT_OFFSET (
    view_name IN VARCHAR2,
    record_count IN INTEGER,
    water_mark IN VARCHAR2 ;
```

Parameters

Table 103-6 INIT_OFFSET Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>view_name</i>	Name of an existing OSAK view (VARCHAR2)
<i>record_count</i>	record number (INTEGER)
<i>water_mark</i>	Watermark (VARCHAR) The high or low watermark that indicates the desired relative positioning. Values are restricted to WATER_MARK_HIGH ('WMH') or WATER_MARK_LOW ('WM') constants. Default: WATER_MARK_HIGH

Usage Notes

The `INIT_OFFSET` procedure enables `STREAMING` or `LOAD` applications to start reading current records after the application has been created without being forced to first read a backlog of old records that are no longer interesting.

Use this function to specify a starting point based on the difference (delta) number of records from either the high or low water mark of every partition where you want your application to read data, instead of starting the read point from the beginning of the data records in the Kafka topic.

Examples

Suppose that you want your application to restart the processing with the last 100 records available and continue on from that point. You can achieve this result by running the following procedure before the application is restarted, or as part of the application logic before data retrieval loop:

```
SYS.DBMS_KAFKA.INIT_OFFSET (
    'ORA$DKV_EXAMPLECLUSTER_EXAMPLEAPP_0',
    100,
    SYS.DBMS_KAFKA.WATER_MARK_HIGH);
```

103.4.4 INIT_OFFSET_TS (Milliseconds Since Epoch)

The `DBMS_KAFKA` procedure `INIT_OFFSET_TS` using milliseconds since epoch specifies a starting offset using a timestamp.

Using milliseconds since epoch initializes the starting offset related to a timestamp for each Kafka partition belonging to the OSAK view. `INIT_OFFSET_TS` would typically be called at the outset of a new application instance dedicated to processing the view or recovering after an application instance shutdown or failure.

Syntax

```
PROCEDURE INIT_OFFSET_TS (
    view_name          IN VARCHAR2,
    start_timestamp_ms IN INTEGER);
```

Parameters

Table 103-7 INIT_OFFSET_TS (Milliseconds Since Epoch) Procedure Parameters for DBMS_KAFKA

Parameter	Description
<code>view_name</code>	Name of an existing Kafka cluster (VARCHAR). Case-insensitive.
<code>start_timestamp</code>	The timestamp of the offset from which you want to start your application (INTEGER). The first record returned will have a timestamp equal to the timestamp provided, or the nearest timestamp greater than the timestamp provided.

Usage Notes

`INIT_OFFSET_TS` using milliseconds since a Kafka epoch initializes the starting offset related to a timestamp for each Kafka partition belonging to the OSAK view. A typical use case is to call `INIT_OFFSET_TS` with a specified epoch starting point at the outset of a new application instance dedicated to processing the view, or to recovering after an application instance shutdown or failure.

This procedure serves to position the processing of Kafka topic records to a point that is relatively current, potentially skipping unprocessed older records in the Kafka partitions.

Note:

Be aware that the time between initializing the offset and the first fetch can be delayed. During this gap in time, it is possible that the record for the chosen offset can be deleted due to either the record exceeding the Kafka retention time, or to the record being explicitly removed.

Examples

Suppose that you want to calculate and return the number of milliseconds since the epoch time from the input `TIMESTAMP`. The timestamp is considered to be in the session's timezone unless the timezone is provided. You provide the parameter

`datetime` (an integer) Timestamp to convert to milliseconds since epoch time. The parameter `timezone` (integer) is optional, providing the timezone of the timestamp. If you do not specify a timezone, then the timezone defaults to the session's timezone:

```
SYS.DBMS_KAFKA.SEEK_OFFSET_TS ('ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0',
                               1593829800,
                               1593833400);
```

```
SYS.DBMS_KAFKA.LOAD_TEMP_TABLE ('ORA$DKVGT_EXAMPLECLUSTER_SEEKABLEAPP_0');
SELECT <columns> FROM ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0;
```

103.4.5 INIT_OFFSET_TS (Timestamp with Separate Timezone Parameter)

The `DBMS_KAFKA` procedure `INIT_OFFSET_TS` using a `TIMESTAMP` with a string parameter specifying the `TIMESTAMP TIME ZONE`. specifies a starting position to return data Using a timestamp specified with a timestamp with time zone positions the processing of Kafka data to a timezone related to a timestamp for each Kafka partition belonging to the Oracle SQL access to Kafka (OSAK) view. `INIT_OFFSET_TS` would typically be called at the outset of a new application instance dedicated to processing the view or recovering after an application instance shutdown or failure.

Syntax

```
PROCEDURE INIT_OFFSET_TS (
                               view_name           IN VARCHAR2,
                               start_timestamp      IN TIMESTAMP,
                               timezone             IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 103-8 INIT_OFFSET_TS Timestamp with Time Zone Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>view_name</i>	Name of an existing Kafka cluster (VARCHAR) Case-insensitive.
<i>start_timestamp</i>	The timestamp of the offset from which you want to start your application (INTEGER). The first record returned will have a timestamp equal to the timestamp provided, or the nearest timestamp greater than the timestamp provided.
<i>timezone</i>	The timezone of the timestamp (INTEGER). If no value is provided, then the default is to use the session timezone.

Usage Notes

`INIT_OFFSET_TS` using a timestamp with a separate time zone parameter initializes the starting offset related to a timestamp and a time zone for each Kafka partition belonging to the OSAK view. A typical use case is to call `INIT_OFFSET_TS` with a timestamp with a

separate time zone parameter at the outset of a new application instance dedicated to processing the view, or to recovering after an application instance shutdown or failure.

This procedure serves to position the processing of Kafka topic records to a point that is relatively current, potentially skipping unprocessed older records in the Kafka partitions.

Note:

Be aware that the time between initializing the offset and the first fetch can be delayed. During this gap in time, it is possible that the record for the chosen offset can be deleted due to either the record exceeding the Kafka retention time, or to the record being explicitly removed.

Examples

Suppose that you want to select a later time to process data from a Kafka topic than at the first record available. For example, if a data center was down for maintenance for a weekend, and you only want to process new Kafka data generated after the data center was reopened at 6 P.M. (18:00:00), then you want to start the data record timestamped after 6 PM. To achieve this with an OSAK view, run the following procedure before the application is restarted, or as part of the application logic before the data retrieval loop:

```
SYS.DBMS_KAFKA.INIT_OFFSET_TS (
'ORA$DKV_EXAMPLECLUSTER_EXAMPLEAPP_0',
18:00:00, 'YYYY/MM/DD HH:MI:SS')
                                TO_DATE ('2023/07/05
                                timestamp=1603507387101;
```

103.4.6 INIT_OFFSET_TS (Timestamp with Time Zone)

The `DBMS_KAFKA` procedure `INIT_OFFSET_TS` using timestamp with timezone specifies a starting offset using a timestamp. Using a timestamp specified with a time zone initializes the starting offset related to a timestamp for each Kafka partition belonging to the Oracle SQL access to Kafka (OSAK) view. `INIT_OFFSET_TS` would typically be called at the outset of a new application instance dedicated to processing the view or recovering after an application instance shutdown or failure.

Syntax

```
PROCEDURE INIT_OFFSET_TS (
                                view_name           IN VARCHAR2,
                                start_timestamp      IN TIMESTAMP WITH TIME
ZONE);
```

Parameters

Table 103-9 INIT_OFFSET_TS Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>view_name</i>	Name of an existing Kafka cluster (VARCHAR) Case-insensitive.
<i>start_timestamp</i>	The timestamp of the offset from which you want to start your application (INTEGER). The first record returned will have a timestamp equal to the timestamp provided, or the nearest timestamp greater than the timestamp provided.
<i>timezone</i>	(Optional). The timezone of the timestamp (INTEGER). If not provided, then it defaults to the session timezone

Usage Notes

INIT_OFFSET_TS initializes the starting offset related to a timestamp for each Kafka partition belonging to the OSAK view. A typical use case is to call INIT_OFFSET_TS at the outset of a new application instance dedicated to processing the view, or to recovering after an application instance shutdown or failure.

This procedure serves to position the processing of Kafka topic records to a point that is relatively current, potentially skipping unprocessed older records in the Kafka partitions.

Note:

Be aware that the time between initializing the offset and the first fetch can be delayed. During this gap in time, it is possible that the record for the chosen offset can be deleted due to either the record exceeding the Kafka retention time, or to the record being explicitly removed.

Examples

Timestamp with specified time zone

Suppose that you want to select a later time to process data from a Kafka topic than at the first record available. For example, if a data center was down for maintenance for a weekend, and you only want to process new Kafka data generated after the data center was reopened at 6 P.M. (18:00:00), then you want to start the data record timestamped after 6pm. To achieve this with an OSAK view, run the following procedure before the application is restarted, or as part of the application logic before the data retrieval loop:

```
SYS.DBMS_KAFKA.SEEK_OFFSET_TS ('ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0',
                               TO_TIMESTAMP ('2020/07/04 02:30:00',
                               'YYYY/MM/DD HH:MI:SS' ,
                               TO_TIMESTAMP ('2020/07/04 03:30:00',
                               'YYYY/MM/DD HH:MI:SS' ),
                               'UTC');
```

```
SYS.DBMS_KAFKA.LOAD_TEMP_TABLE
('ORA$DKVGT_EXAMPLECLUSTER_SEEKABLEAPP_0');
SELECT <columns> FROM ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0;
```

Timestamp without a specified time zone

```
SYS.DBMS_KAFKA.SEEK_OFFSET_TS ('ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0',
                               TO_TIMESTAMP_TZ ('2020/07/04 02:30:00
-8:00', 'YYYY/MM/DD HH:MI:SS TZH:TZM',
                               TO_TIMESTAMP_TZ ('2020/07/04 03:30:00
-8:00', 'YYYY/MM/DD HH:MI:SS TZH:TZM')));
```

```
SYS.DBMS_KAFKA.LOAD_TEMP_TABLE
('ORA$DKVGT_EXAMPLECLUSTER_SEEKABLEAPP_0');
SELECT <columns> FROM ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0;
```

103.4.7 UPDATE_OFFSET

The `DBMS_KAFKA` procedure `UPDATE_OFFSET` update the last Kafka offsets read so the next pass in the loop will retrieve and process new unread Kafka records. `UPDATE_OFFSET` transparently advances Kafka partition offsets of the Kafka group ID for all of the partitions belonging to the Oracle SQL access to Kafka (OSAK) view, so that for every call to `DBMS_KAFKA.LOAD_TEMP_TABLE`, a new set of unread Kafka records is retrieved and processed.

Syntax

```
PROCEDURE UPDATE_OFFSET (view_name IN VARCHAR2);
```

Parameters

Table 103-10 UPDATE_OFFSET Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>view_name</i>	The name of an OSAK view Case-insensitive.

Usage Notes

`UPDATE_OFFSET` advances the Kafka offset read point to the next set of Kafka records if the processing of the earlier records was successful. `UPDATE_OFFSET` also initiates an Oracle Database transaction, if a transaction is not already started, and records the last offsets in metadata tables. For this reason, applications should commit a transaction after each call to `UPDATE_OFFSET`. Because OSAK manages offsets within an Oracle Database transaction, in which ACID (Atomicity, Consistency, Isolation, Durability) is preserved in the transaction, no records are lost or reread. If the transaction fails to complete successfully, then offsets are not advanced, and the application will pick up where it previously off off when it resumes.

Examples

A typical use case is to advance an offset read to the next set of Kafka records after the previous set has been processed successfully, such as in a Streaming mode application. For example:

```
BEGIN
  LOOP
    SYS.DBMS_KAFKA.LOAD_TEMP_TABLE

    (ORA$DKVGT_EXAMPLECLUSTER_EXAMPLEAPP_0);
    FOR kafka_record IN (
      SELECT kafka_offset offset
      FROM ORA$DKVGT_EXAMPLECLUSTER_EXAMPLEAPP_0)
    LOOP
      SYS.DBMS_OUTPUT.PUT_LINE ('Processing record: ' ||
kafka_record.offset);
      --application logic to process the Kafka records
    END LOOP;
    IF (application logic was successful) THEN
      --Update internal metadata to confirm Kafka records were
successfully processed
      SYS.DBMS_KAFKA.UPDATE_OFFSET

    ('ORA$DKV_EXAMPLECLUSTER_EXAMPLEAPP_0');
      COMMIT;
    ELSE
      --application logic to correct what failed
    END IF;
  END LOOP;
END;
```

You can also use it as part of the process of access an OSAK view directly to retrieve updates. For example, suppose you have a Streaming mode application that is monitoring average temperatures over time in a laboratory called Lab1. You can use UPDATE_OFFSET to retrieve the average temperature since it was last checked:

```
EXEC DBMS_KAFKA.ENABLE_VIEW_QUERY(

'ORA$DKV_EXAMPLECLUSTER_STREAMINGAPP_0');
SELECT AVG(temperature) FROM ORA$DKV_EXAMPLECLUSTER_STREAMINGAPP_0
WHERE sensor_name =

'LAB1_SENSOR';
EXEC DBMS_KAFKA.UPDATE_OFFSET(

'ORA$DKV_EXAMPLECLUSTER_STREAMINGAPP_0');
COMMIT;
```

103.5 DBMS_KAFKA Seekable Mode

Use the DBMS_KAFKA SEEKABLE mode packages to read Kafka records that exist between two points in time.

An application declares that it is a loading application by calling the PL/SQL procedure `DBMS_KAFKA.CREATE_SEEKABLE_APP` to set up and create a seekable Oracle SQL access to Kafka (OSAK) view and temporary table.

Use the Seekable mode view with `SEEK_OFFSET_TS` to search through the Kafka data to find a set of data whose timestamps exist between two points in time. You can then use `LOAD_TEMP_TABLE` to load that data range into an OSAK temporary table, and run one or more application queries against the OSAK global temporary table containing the Kafka records in that timestamp range. When you have completed your queries, you can then use `DROP_SEEKABLE_APP` to drop the application.

103.5.1 CREATE_SEEKABLE_APP

The `DBMS_KAFKA` procedure `CREATE_SEEKABLE_APP` Creates one Oracle SQL access to Kafka (OSAK) view and an associated global temporary table You can use `CREATE_SEEKABLE_APP` to seek and load Kafka records between a particular timeframe. Use of this procedure is restricted to one application instance to perform seek operations.

Syntax

```
PROCEDURE CREATE_SEEKABLE_APP (
                                cluster_name          IN  VARCHAR2,
                                application_name       IN  VARCHAR2,
                                topic_name            IN  VARCHAR2,
                                options                IN  CLOB
```

Parameters

Parameter	Description
<i>cluster_name</i>	The name of a registered Oracle SQL access to Kafka cluster that has the topic that you want to associate with this application. Case-insensitive. The registered cluster names can be obtained from the OSAK Administrator, by using the following statement: <pre>SELECT cluster_name FROM sys.user_kafka_clusters;</pre>
<i>application_name</i>	The application name. This parameter is also used as the Kafka group that can read the topic. Case-insensitive.
<i>topic_name</i>	The topic name in the Kafka cluster whose contents you want to retrieve. Case-sensitive.
<i>options</i>	Includes a list of properties formatted as a JSON document. Options are described in more detail in the topic "DBMS_KAFKA OPTIONS Passed to CREATE_XXX_APP".

Examples

Example 103-2 CREATE_SEEKABLE_APP Procedure for Oracle SQL Access to Kafka

```

DECLARE
    v_options VARCHAR2;
BEGIN
    v_options := '{"fmt" : "DSV", "reftable" : "user_reftable_name"}';
    SYS.DBMS_KAFKA.CREATE_SEEKABLE_APP (
        'ExampleCluster',
        'ExampleApp',
        'ExampleTopic',
    );
END;
/

```

Related Topics

- [DBMS_KAFKA OPTIONS Passed to CREATE_xxx_APP](#)

103.5.2 DROP_SEEKABLE_APP

The `DBMS_KAFKA` procedure `DROP_SEEKABLE_APP` drops the seeking application. This function removes the Oracle SQL access to Kafka (OSAK) view, and its related metadata.

Syntax

```

PROCEDURE DROP_SEEKABLE_APP (
    cluster_name      IN VARCHAR2,
    application_name  IN VARCHAR2
);

```

Parameters

Table 103-11 DROP_SEEKABLE_APP Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive.
<i>application_name</i>	The name of an existing application using the Kafka cluster. Case-insensitive.

Usage Notes

When you are done with an application, you use this function to drop an OSAK view associated with an application.

Examples

Suppose you have completed your work with the Kafka cluster `ExampleCluster`, which was being used by the Seekable application `ExampleApp`. You can then use this procedure to drop the application:

```
EXEC SYS.DBMS_KAFKA.DROP_SEEKABLE_APP (
                                     'ExampleCluster',
    'ExampleApp');
```

103.5.3 SEEK_OFFSET_TS (Timestamp with Separate Timezone Parameter)

The `DBMS_KAFKA` procedure `SEEK_OFFSET_TS` using a timestamp with a timezone parameter positions an Oracle SQL access to Kafka (OSAK) view to start reading Kafka records between two Kafka epoch timestamps that you specify. Use this procedure to specify a timeframe for records within a Kafka topic that you want to seek, as specified by epoch time in milliseconds.

Syntax

```
PROCEDURE SEEK_OFFSET_TS (
    view_name           IN VARCHAR2,
    start_timestamp_ms IN INTEGER,
    end_timestamp_ms   IN INTEGER,
    timezone            IN INTEGER);
```

Parameters

Table 103-12 `SEEK_OFFSET_TS` (Timestamp with Separate Timezone Parameter) Procedure Parameters for `DBMS_KAFKA`

Parameter	Description
<i>view_name</i>	Name of an existing Kafka cluster (VARCHAR) Case-insensitive.
<i>start_timestamp</i>	The timestamp of the offset from which you want to start your application (INTEGER). The last record returned will have a timestamp equal to the timestamp provided, or the nearest timestamp greater than the timestamp provided.

Table 103-12 (Cont.) SEEK_OFFSET_TS (Timestamp with Separate Timezone Parameter) Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>end_timestamp</i>	<p>The timestamp of the offset from which you want to end your application (INTEGER). The last record returned will have a timestamp equal to the timestamp provided, or the nearest timestamp less than the timestamp provided. The range of records returned is inclusive of the start timestamp and exclusive on the end timestamp.</p> <p>For example, a range of 2:00PM to 3:00PM returns records with timestamps in the range of 2:00:00.000000 PM to 2:59:59.999999PM. This range enables the application to search from 2:00 to 3:00, and then 3:00 to 4:00, without having overlapping records between the sets.</p>
<i>timezone</i>	<p>The timezone of both of the timestamp arguments (INTEGER). If no value is provided, then the default is to use the session timezone.</p>

Usage Notes

`SEEK_OFFSET_TS` seeks Kafka topic records that exist within a specific timeframe that you select, specified by Kafka epoch time in milliseconds. The last record returned is the last record published.

The purpose of `SEEK_OFFSET_TS` is to position an OSAK view to start reading Kafka records within a given timeframe, as defined by the epoch timestamps that you specify. If the window of records exceeds the range of actual records in a Kafka topic, this procedure will return whatever records do exist.

For example:

- If the timestamps are either both below the low water mark, or both above the high water mark, then no records will be returned.
- If the start timestamp is below the low water mark, then the first record returned will be the low water mark.
- If the end timestamp is above the high water mark, then the last record returned will be the difference of the high water mark (HWM), minus 1 (HWM - 1). For example, in a new topic has 100 records, the offset range is from 0 to 99, and the HWM is set at 100.

Note:

The data retrieved by a SEEKABLE application using Kafka epoch timeframes as the specification for retrieval cannot include any outlier records that are delivered after the load of the OSAK global temporary table, even if they have a timestamp that is within the timestamp window provided.

Examples

Suppose that you want to investigate issues that have occurred in the past. If the data is still present in the Kafka stream, then you can create a Seekable application by calling `DBMS_KAFKA.CREATE_SEEKABLE_APP`. You can then call the `SEEK_OFFSET_TS` procedure to request the OSAK view to retrieve a range of data records. For example, if an IT consultant was informed that a production issue occurred around 3:00 in the morning, then the consultant can use the following procedure to load the temporary table, and then select to retrieve an hour's worth of data around that time:

```
SYS.DBMS_KAFKA.SEEK_OFFSET_TS (
    'ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0',
    TO_DATE ('2023/04/02
02:30:00', 'YYYY/MM/DD HH:MI:SS',
    TO_DATE ('2023/04/02
03:30:00', 'YYYY/MM/DD HH:MI:SS'));
SYS.DBMS_KAFKA.LOAD_TEMP_TABLE

(ORA$DKVGT_EXAMPLECLUSTER_SEEKABLEAPP_0);
SELECT <columns> FROM ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0;
```

Another use case might be if an application with sequential access to a Kafka stream detected a potential anomaly, and was configured to insert a row into an anomaly table. The anomaly table would include the Kafka timestamp, as well as any other data it was configured to record. In that case, another application can then use this information to retrieve records around the suspected record to see if there were any other issues. To achieve this goal, run the following procedure, load the temporary table, and then select and apply application logic to the results:

```
SYS.DBMS_KAFKA.SEEK_OFFSET_TS (
    'ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0',
    TO_DATE ('2020/07/04
02:30:00', 'YYYY/MM/DD HH:MI:SS',
    TO_DATE ('2020/07/04
03:30:00', 'YYYY/MM/DD HH:MI:SS'));
SYS.DBMS_KAFKA.LOAD_TEMP_TABLE

(ORA$DKVGT_EXAMPLECLUSTER_SEEKABLEAPP_0);
SELECT <columns> FROM ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0;
--application logic
```

103.5.4 SEEK_OFFSET_TS (Timestamp in Milliseconds)

The DBMS_KAFKA procedure `SEEK_OFFSET_TS` (timestamp in milliseconds) seeks Kafka records in a topic that exist between a window of time specified by epoch time in milliseconds.

Syntax

```
PROCEDURE SEEK_OFFSET_TS(  
    view_name           IN VARCHAR2,  
    start_timestamp_ms  IN INTEGER,  
    end_timestamp_ms    IN INTEGER);
```

Parameters

Table 103-13 `SEEK_OFFSET_TS` (Timestamp in Milliseconds) Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>view_name</i>	Name of an existing Oracle SQL access to Kafka (OSAK) view. Case-insensitive.
<i>start_timestamp_ms</i>	The timestamp in milliseconds where you want to seek to the first record
<i>end_timestamp_ms</i>	The timestamp in milliseconds where you want to seek to the last record

Usage Notes

`SEEK_OFFSET_TS` seeking a timestamp range in milliseconds seeks Kafka topic records that exist within a starting timestamp and ending timestamp window that you select, specified by Kafka epoch time in milliseconds. The last record returned is the last record published.

The purpose of `SEEK_OFFSET_TS` using milliseconds to specify the window is to position an OSAK view to start reading Kafka records within a given timeframe, as defined by the epoch timestamps that you specify. If the window of records exceeds the range of actual records in a Kafka topic, this procedure will return whatever records do exist.

For example:

- If the timestamps are either both below the low water mark, or both above the high water mark, then no records will be returned.
- If the start timestamp is below the low water mark, then the first record returned will be the low water mark.
- If the end timestamp is above the high water mark, then the last record returned will be the difference of the high water mark (HWM), minus 1 (HWM - 1). For example, in a new topic has 100 records, the offset range is from 0 to 99, and the HWM is set at 100.

 **Note:**

Kafka record timestamps are either assigned by Kafka (that is, by transaction time), or are assigned by the application (that is, valid or decision time). The data retrieved by a SEEKABLE application will not include outlier records that were delivered after the load of the OSAK global temporary table that have a timestamp that is within the timestamp window provided.

Examples

Suppose that you want to investigate issues that have occurred in the past. If the data is still present in the Kafka steam, then you can create a Seekable application by calling `DBMS_KAFKA.CREATE_SEEKABLE_APP`. You can then call the `SEEK_OFFSET_TS` procedure to request the OSAK view to retrieve a range of data records. For example, if an IT consultant was informed that a production issue occurred around 3:00 in the morning, then the consultant can use the following procedure to load the temporary table, and then select to retrieve an hour's worth of data around that time:

```
SYS.DBMS_KAFKA.SEEK_OFFSET_TS (
  'ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0',
  TO_DATE ('2023/04/02
02:30:00', 'YYYY/MM/DD HH:MI:SS',
  TO_DATE ('2023/04/02
03:30:00', 'YYYY/MM/DD HH:MI:SS'));
SYS.DBMS_KAFKA.LOAD_TEMP_TABLE

(ORA$DKVGGTT_EXAMPLECLUSTER_SEEKABLEAPP_0);
SELECT <columns> FROM ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0;
```

Another use case might be if an application with sequential access to a Kafka stream detected a potential anomaly, and was configured to insert a row into an anomaly table. The anomaly table would include the Kafka timestamp, as well as any other data it was configured to record. In that case, another application can then use this information to retrieve records around the suspected record to see if there were any other issues. To achieve this goal, run the following procedure, load the temporary table, and then select and apply application logic to the results:

```
SYS.DBMS_KAFKA.SEEK_OFFSET_TS (
  'ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0',
  TO_DATE ('2020/07/04
02:30:00', 'YYYY/MM/DD HH:MI:SS',
  TO_DATE ('2020/07/04
03:30:00', 'YYYY/MM/DD HH:MI:SS'));
SYS.DBMS_KAFKA.LOAD_TEMP_TABLE

(ORA$DKVGGTT_EXAMPLECLUSTER_SEEKABLEAPP_0);
SELECT <columns> FROM ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0;
```

```
--application logic
```

103.5.5 SEEK_OFFSET_TS (Timestamp with Timezone)

The `DBMS_KAFKA` procedure `SEEK_OFFSET_TS` seeks Kafka records in a topic that exist between a window of time specified by `TIMESTAMP WITH TIME ZONE`. Use this procedure to position an Oracle SQL access to Kafka (OSAK) view to start reading Kafka records between two specified `TIMESTAMP WITH TIME ZONE` timestamps that you specify.

Syntax

```
PROCEDURE SEEK_OFFSET_TS (
    view_name           IN VARCHAR2,
    start_timestamp_ms  IN INTEGER,
    end_timestamp_ms    IN INTEGER);
```

Parameters

Table 103-14 `SEEK_OFFSET_TS` Procedure Parameters for `DBMS_KAFKA`

Parameter	Description
<i>view_name</i>	Name of an existing Kafka view name (VARCHAR). Case-insensitive.
<i>start_timestamp</i>	The timestamp where you want to seek the first record (INTEGER).
<i>end_timestamp</i>	The timestamp where you want to seek to the last record (INTEGER).

Usage Notes

The purpose of `SEEK_OFFSET_TS` defined by start and end timestamps is to position an OSAK view to start reading Kafka records within a given timeframe, as defined by the epoch timestamps that you specify. If the window of records exceeds the range of actual records in a Kafka topic, this procedure will return whatever records do exist.

For example:

- If the timestamps are either both below the low water mark, or both above the high water mark, then no records will be returned.
- If the start timestamp is below the low water mark, then the first record returned will be the low water mark.
- If the end timestamp is above the high water mark, then the last record returned will be the difference of the high water mark (HWM), minus 1 (HWM - 1). For example, in a new topic has 100 records, the offset range is from 0 to 99, and the HWM is set at 100.

 **Note:**

Kafka record timestamps are either assigned by Kafka (that is, transaction time), or are assigned by applications (that is, valid or decision time). The data retrieved by a SEEKABLE application using Kafka epoch timeframes as the specification for retrieval cannot include any outlier records that are delivered after the load of the OSAK global temporary table, even if they have a timestamp that is within the timestamp window provided.

Examples

Suppose that you want to investigate issues that have occurred in the past. If the data is still present in the Kafka steam, then you can create a Seekable application by calling `DBMS_KAFKA.CREATE_SEEKABLE_APP`. You can then call the `SEEK_OFFSET_TS` procedure to request the OSAK view to retrieve a range of data records. For example, if an IT consultant was informed that a production issue occurred around 3:00 in the morning, then the consultant can use the following procedure to load the temporary table, and then select to retrieve an hour's worth of data around that time:

```
SYS.DBMS_KAFKA.SEEK_OFFSET_TS (
    'ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0',
    TO_DATE ('2023/04/02
02:30:00', 'YYYY/MM/DD HH:MI:SS',
    TO_DATE ('2023/04/02
03:30:00', 'YYYY/MM/DD HH:MI:SS'));
SYS.DBMS_KAFKA.LOAD_TEMP_TABLE

(ORA$DKVGTT_EXAMPLECLUSTER_SEEKABLEAPP_0);
SELECT <columns> FROM ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0;
```

Another use case might be if an application with sequential access to a Kafka stream detected a potential anomaly, and was configured to insert a row into an anomaly table. The anomaly table would include the Kafka timestamp, as well as any other data it was configured to record. In that case, another application can then use this information to retrieve records around the suspected record to see if there were any other issues. To achieve this goal, run the following procedure, load the temporary table, and then select and apply application logic to the results:

```
SYS.DBMS_KAFKA.SEEK_OFFSET_TS (
    'ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0',
    TO_DATE ('2020/07/04
02:30:00', 'YYYY/MM/DD HH:MI:SS',
    TO_DATE ('2020/07/04
03:30:00', 'YYYY/MM/DD HH:MI:SS'));
SYS.DBMS_KAFKA.LOAD_TEMP_TABLE

(ORA$DKVGTT_EXAMPLECLUSTER_SEEKABLEAPP_0);
SELECT <columns> FROM ORA$DKV_EXAMPLECLUSTER_SEEKABLEAPP_0;
```



```
--application logic
```

103.6 ADD_PARTITIONS

The `DBMS_KAFKA_ADM` procedure `ADD_PARTITIONS` adds additional Kafka partitions to an existing set of Oracle SQL access to Kafka (OSAK) views.

Syntax

```
PROCEDURE ADD_PARTITIONS (
    cluster_name          IN VARCHAR2,
    application_name     IN VARCHAR2
```

Parameters

Table 103-15 ADD_PARTITIONS procedure parameters for DBMS_KAFKA

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive.
<i>application_name</i>	Name of an existing application associated with the Kafka cluster. Case-insensitive.

Usage Notes

The semantics for `ADD_PARTITIONS` are similar to the `CREATE_XXX_APP` calls, except it preserves state information about existing Kafka topic partitions (for example, `committed_offset`), and binds new partitions either to either existing views, or to new OSAK views.

Caution:

Before calling `ADD_PARTITIONS`, all application instances for this application must be shut down. After `ADD_PARTITIONS` is called successfully, the application instances can be restarted. If the application is a streaming application configured to create one view instance per partition, then new views will be created. Using these views will require starting additional application instances, each dedicated to processing exclusively one of the new views created.

If no partitions have been added to the topic, then the procedure will terminate successfully without altering the existing views.

When an OSAK view is created, and the partitions are assigned, the view manages a list of partitions. For example, suppose an OSAK view was previously assigned to read partitions 0,1,2,3 in a Kafka topic. If `ADD_PARTITIONS` later adds a new partition to this view (partition 16, for example), then the OSAK view is now configured to fetch Kafka records from partitions 0,1,2,3, and 16.

This procedure runs both DDL and DML, which are transactional. This call should only be run outside of any existing transactional context.

Examples

```
BEGIN
  SYS.DBMS_KAFKA.ADD_PARTITIONS ('ExampleCluster',
                                'ExampleApp');
END;
/
```

103.7 DROP_ALL_APPS

The `DBMS_KAFKA` procedure `DROP_ALL_APPS` drops all applications for the Kafka cluster. Use this procedure to confirm that a connection can be established with the configured security information. The function returns the state of the cluster.

Syntax

```
PROCEDURE DROP_ALL_APPS (
  \cluster_name IN VARCHAR2
);
```

Parameters

Table 103-16 DROP_ALL_APPS Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive.

Usage Notes

The `DROP_ALL_APPS` procedure runs both Data Definition Language (DDL) and Data Manipulation Language (DML) changes, which are transactional. Only run this call outside of any existing transactional context.



Note:

This is an autonomous transaction.

Examples

Suppose that one or more of the OSAK applications no longer exist in the Kafka cluster `ExampleCluster`. You can then drop all of the applications in that cluster by using the following statement:

```
EXEC SYS.DBMS_KAFKA.DROP_ALL_APPS ('ExampleCluster');
```

103.8 ENABLE_VIEW_QUERY

The `DBMS_KAFKA` procedure `ENABLE_VIEW_QUERY` sets a context within the current Oracle Database session, enabling an application to query a view. Use this procedure to enable an application to query an Oracle SQL access to Kafka (OSAK) view directly.

Syntax

```
PROCEDURE ENABLE_VIEW_QUERY(view_name IN VARCHAR2);
```

Parameters

Table 103-17 ENABLE_VIEW_QUERY Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>view_name</i>	Name of an existing Kafka view Case-insensitive.

Usage Notes

Only one query against the OSAK view should be done within a transaction. Multiple queries of an OSAK view cannot guarantee repeatable read behavior. Because Kafka is a streaming service, it is possible that new records can be published to a Kafka topic in between the `SELECT` queries. If new records are published, then this can result in additional rows being seen by the application.

Caution:

This is an advanced procedure. Oracle strongly recommends that this call is only used by developers who have a deep understanding of the Oracle SQL access to Kafka (OSAK) processing model and are knowledgeable about debugging Oracle access plans. This includes understanding how Kafka offsets are advanced by OSAK after an OSAK view is queried.

In general, Oracle recommends that you use `LOAD_TEMP_TABLE` or `EXECUTE_LOAD_TABLE`. These procedures query the Kafka views transparently, and load them a single time into either a global temporary table, or into an Oracle Database table for further analysis using SQL.

Examples

Enabling a user to query an OSAK view directly should only be used in two cases:

1. When a query is only referencing the OSAK view in a `FROM` clause to scan a Kafka stream. For example, suppose you want to access an OSAK view directly and retrieve

the average temperature of a sensor in laboratory 1 since it was last checked. You can use the following query:

```
EXEC DBMS_KAFKA.ENABLE_VIEW_QUERY(
    'ORA$DKV_EXAMPLECLUSTER_STREAMINGAPP_0');
SELECT AVG(temperature)
FROM ORA$DKV_EXAMPLECLUSTER_STREAMINGAPP_0WHERE sensor_name =
'LAB1_SENSOR';
EXEC DBMS_KAFKA.UPDATE_OFFSET(
    'ORA$DKV_EXAMPLECLUSTER_STREAMINGAPP_0');
COMMIT;
```

2. When a query creates a simple table join between the OSAK view and an Oracle Database table, where the OSAK view is forced to be the outer table of a join by using the `ORDERED` hint in a query. This case ensures that the Kafka data is retrieved only once. For example:

```
SELECT /*+ ORDERED */ COUNT(*)
FROM thermostat_spec s, ora$dkv_thermostat_0 t
WHERE s.device_type = t.device_type
AND t.current_setting >
    t.temperature_setting +
    s.device_max_variation;
```

103.9 SET_TRACING

The `DBMS_KAFKA` procedure `SET_TRACING` enables or disables debug level tracing for the external table driver code associated with an Oracle SQL access to Kafka (OSAK) application. This function generates logging output to the trace file for the session.

Syntax

```
PROCEDURE SET_TRACING(
    cluster_name          IN VARCHAR2,
    application_name     IN VARCHAR2,
    enable                IN BOOLEAN);
```

Parameters

Table 103-18 DROP_SEEKABLE_APP Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive.
<i>application_name</i>	The name of an existing application using the Kafka cluster. Case-insensitive.

Table 103-18 (Cont.) DROP_SEEKABLE_APP Procedure Parameters for DBMS_KAFKA

Parameter	Description
<i>enable</i>	[true false] Default: false. Set true to enable the debug output, or false to disable the debug output

Usage Notes

Use to generate debug logging output to the trace file for the session. Set to `true` to enable the debug output, or `false` to disable the debug output.

 **Note:**

The following event must already be enabled for the database:

```
event="39431 trace name context forever, level 1" # Enable external
table debug tracing
```

Examples

Suppose you want to start tracing on the Kafka cluster `ExampleCluster`, which was being used by the application `ExampleApp`. You can then use this procedure:

```
EXEC SYS.DBMS_KAFKA.SET_TRACING('KAFKACLUS1', 'KAFKACLUS1', True);
```

103.10 DBMS_KAFKA OPTIONS Passed to CREATE_xxx_APP

The options parameters for the `DBMS_KAFKA.CREATE_LOAD_APP`, `CREATE_STREAMING_APP`, and `CREATE_SEEKABLE_APP` packages are provided to the packages in a JSON document. The `DBMS_KAFKA` options can be used with each of the `DBMS_KAFKA` packages to create and define Oracle SQL access to Kafka (OSAK) applications.

 **Note:**

54 bytes are reserved for the maximum Kafka metadata chunk size in the buffer. For example, a `bufsize` of 1M can hold a record of 1M – 54 bytes. `Bufsize` defaults to 1000 KB with a max of 10,000 KB, so the largest Kafka record size supported is 10000 kb – 54.

Table 103-19 Options for DBMS_KAFKA

Option Name	Description
avrodecimaltype	<p>Specifies the representation of a decimal stored in the byte array.</p> <p>Valid values: <code>int</code>, <code>integer</code>, <code>str</code>, <code>string</code></p> <p>Default: If this parameter is not used, then an Avro decimal column is read assuming byte arrays store the numerical representation of the values (that is, default to <code>int</code>), which is as the Avro specification defines.</p> <p>Only allowed if the <code>fmt</code> option is specified as <code>AVRO</code>.</p> <p>Related access parameter: <code>com.oracle.bigdata.avro.decimaltpe</code></p>
avroschema	<p>JSON document representing the schema of the Kafka value payload. The schema must define an Avro record type.</p> <p>There is no default value. A value must be specified if the <code>fmt</code> option is specified as <code>AVRO</code></p>
blankasnull	<p>When set to <code>true</code>, loads fields consisting of spaces as null.</p> <p>Values: [<code>true</code> <code>false</code>]</p> <p>Default: <code>false</code></p> <p>Only allowed if the <code>fmt</code> option is specified as <code>DSV</code></p> <p>Related access parameter: <code>com.oracle.bigdata.blankasnull</code></p>
bufsize	<p>Sets the buffer size in kilobytes for large record reads. Set this value if you need to read records that are greater than the default buffer size.</p> <p>Default (in kilobytes): 1000</p> <p>Related access parameter: <code>com.oracle.bigdata.buffersize</code></p>
conversionerrs	<p>If a row has data type conversion errors, then the related columns are stored as <code>null</code>, or if the row is rejected.</p> <p>Values: [<code>reject_record</code> <code>store_null</code>]</p> <p>Default: <code>store_null</code></p> <p>Only allowed if the <code>fmt</code> option is specified as <code>DSV</code></p> <p>Related access parameter: <code>com.oracle.bigdata.conversionerrors</code></p>
datefmt	<p>Specifies the date format in the source file. The value <code>auto</code> checks for the following formats.</p> <p><code>J</code>, <code>MM-DD-YYYYBC</code>, <code>MM-DD-YYYY</code>, <code>YYYYMMDD HHMISS</code>, <code>YMMDD HHMISS</code>, <code>YYYY.DDD</code>, <code>YYYY-MM-DD</code></p> <p>Default: <code>yyyy-mm-dd hh24:mi:ss</code></p> <p>Only allowed if the <code>fmt</code> option is specified as <code>DSV</code></p> <p>Related access parameter: <code>com.oracle.bigdata.dateformat</code></p>

Table 103-19 (Cont.) Options for DBMS_KAFKA

Option Name	Description
escapedby	<p>Specifies the character used to escape any embedded field terminators or line terminators in the value for fields. The character value must be wrapped in single-quotes. For example: '\'</p> <p>If the parameter is not specified, then there is no value.</p> <p>Only allowed if <code>fmt</code> option is specified as <code>DSV</code></p> <p>Related access parameter: <code>com.oracle.bigdata.csv.rowformat.fields.escapedby</code></p>
fmt	<p>Format of the value payload of a Kafka record.</p> <p>Values: [<code>DSV</code> <code>JSON</code> <code>AVRO</code>]</p> <p>There is no default value. The format must be specified in the options passed.</p> <p>Related access parameter: <code>com.oracle.bigdata.kafka.format</code></p>
jsont	<p>Store JSON in <code>varchar2</code> (max size) or <code>clob</code> to support large JSON records.</p> <p>Values: [<code>varchar2</code> <code>clob</code>]</p> <p>Default: <code>varchar2</code></p> <p>Only allowed if the <code>fmt</code> option is specified as <code>JSON</code>.</p>
nulldefinedas	<p>Specifies the character used to indicate the value of a field is <code>NULL</code>. If the parameter is not specified, then there is no value.</p> <p>Only allowed if the <code>fmt</code> option is specified as <code>DSV</code></p> <p>Related access parameter: <code>com.oracle.bigdata.csv.rowformat.nulldefinedas</code></p>
quote	<p>Specifies the quote character for the fields. When specified, the characters defined as the quote characters are removed during loading.</p> <p>Valid values: character</p> <p>Default: <code>Null</code>, meaning no quote character</p> <p>Only allowed if the <code>fmt</code> option is specified as <code>DSV</code></p> <p>Related access parameter: <code>com.oracle.bigdata.quote</code></p>
rejectlmt	<p>The operation errors out after a specified number of rows (<code>number</code>, an integer) are rejected. This operation only applies when rejecting records due to conversion errors. To allow all records to be processed even if conversion errors exist, pass the value <code>'unlimited'</code>.</p> <p>Valid values: [<code>number</code> <code>'unlimited'</code>]</p> <p>Default: <code>0</code>, which means that no conversion errors are allowed.</p>
removequotes	<p>Removes any quotes that are around any field in the source file.</p> <p>Values: [<code>true</code> <code>false</code>]</p> <p>Default: <code>false</code></p> <p>Only allowed if the <code>fmt</code> option is specified as <code>DSV</code></p> <p>Related access parameter: <code>com.oracle.bigdata.removequotes</code></p>

Table 103-19 (Cont.) Options for DBMS_KAFKA

Option Name	Description
separator	<p>Specifies the character used to separate the field values. The character value must be wrapped in single quotes. For example: ' '</p> <p>Default: ' '</p> <p>Related access parameter: com.oracle.bigdata.csv.rowformat.fields.terminator</p>
terminator	<p>Specifies the character used to separate the record values. The character value must be wrapped in single quotes. For example: ' '</p> <p>Default: '\n'</p> <p>Related access parameter: com.oracle.bigdata.csv.rowformat.lines.terminator</p>
trimspaces	<p>Specifies how the leading and trailing spaces of the fields are trimmed.</p> <p>Valid values: rtrim, ltrim, notrim, ltrim, ldtrim</p> <p>Default: notrim</p> <p>Only allowed if the <code>fmt</code> option is specified as DSV</p> <p>Related access parameter: com.oracle.bigdata.trimspaces</p>
truncatecol	<p>If the data in the file is too long for a field, then this option truncates the value of the field rather than rejecting the row or setting the field to NULL.</p> <p>Values: [true false]</p> <p>Default: false</p> <p>Only allowed if the <code>fmt</code> option is specified as DSV</p> <p>Related access parameter: com.oracle.bigdata.truncatecol</p>
tsfmt	<p>Specifies the timestamp format in the source file. The value <code>auto</code> checks for the following formats: YYYY-MM-DD HH:MI:SS.FF, YYYY-MM-DD HH:MI:SS.FF3, MM/DD/YYYY HH:MI:SS.FF3</p> <p>Default: yyyy-mm-dd hh24:mi:ss.ff</p> <p>Only allowed if the <code>fmt</code> option is specified as DSV</p> <p>Related access parameter: com.oracle.bigdata.timestampformat</p>
tslzfmt	<p>Specifies the timestamp with local timezone format in the source file. The value <code>auto</code> checks for the following formats: DD Mon YYYY HH:MI:SS.FF TZR, MM/DD/YYYY HH:MI:SS.FF TZR, YYYY-MM-DD HH:MI:SS+/-TZR, YYYY-MM-DD HH:MI:SS.FF3, DD.MM.YYYY HH:MI:SS TZR</p> <p>Default: yyyy-mm-dd hh24:mi:ss.ff</p> <p>Only allowed if the <code>fmt</code> option is specified as DSV</p> <p>Related access parameter: com.oracle.bigdata.timestampformat</p>

Table 103-19 (Cont.) Options for DBMS_KAFKA

Option Name	Description
tstzfmt	<p>Specifies the timestamp with timezone format in the source file. The value <code>auto</code> checks for the following formats:</p> <p>DD Mon YYYY HH:MI:SS.FF TZR, MM/DD/YYYY HH:MI:SS.FF TZR, YYYY-MM-DD HH:MI:SS+/-TZR, YYYY-MM-DD HH:MI:SS.FF3, DD.MM.YYYY HH:MI:SS TZR</p> <p>Default: <code>yyyy-mm-dd hh24:mi:ss.ff</code></p> <p>Only allowed if the <code>fmt</code> option is specified as <code>DSV</code></p> <p>Related access parameter: <code>com.oracle.bigdata.timestamptzformat</code></p>

Example 103-3 AVRO Schema Record Type

The following is an example of an AVRO data schema. In this case, the type of AVRO data defined is a record, and the data is a record of sensor values for a temperature monitor as monitored over a set period of time.

```
{
  "type" : "record",
  "name" : "sensor_value",
  "namespace" : "example.sensor",
  "fields" : [ {
    "name" : "EventTime",
    "type" : "long",
    "logicalType" : "timestamp-millis"
  }, {
    "name" : "IotDeviceType",
    "type" : "int"
  }, {
    "name" : "IotDeviceUnitId",
    "type" : "int"
  }, {
    "name" : "TempSetting",
    "type" : "double"
  }, {
    "name" : "TempReading",
    "type" : "double"
  } ]
}
```

DBMS_KAFKA_ADM

The `DBMS_KAFKA_ADM` package provides a PL/SQL interface to create cluster definitions, which you can then use to grant access to Kafka cluster data for applications.

Administrators granted the `OSAK_ADMIN_ROLE` can use `DBMS_KAFKA_ADM` package to create applications that query Kafka data from Oracle Database views and tables.

- [DBMS_KAFKA_ADM Overview](#)
- [DBMS_KAFKA_ADM Security Model](#)
- [DBMS_KAFKA_ADM Constants](#)
- [Summary of DBMS_KAFKA_ADM Procedures](#)
- [CHECK_CLUSTER](#)
- [DEREGISTER_CLUSTER](#)
- [DISABLE_CLUSTER](#)
- [ENABLE_CLUSTER](#)
- [REGISTER_CLUSTER](#)
- [UPDATE_CLUSTER_INFO](#)

104.1 DBMS_KAFKA_ADM Overview

The `DBMS_KAFKA_ADM` package enables you to manage the Oracle SQL access to a Kafka cluster.

To set up access to Kafka topics, you require the privileges granted with `OSAK_ADMIN_ROLE`. You use these privileges to provide a cluster definition that helps you to manage resources when connecting to Kafka clusters. The ability of users to share a cluster definition enables the underlying framework to share connections to the clusters. Sharing connections conserves memory and network resources.

104.2 DBMS_KAFKA_ADM Security Model

Oracle recommends that you grant the `OSAK_ADMIN_ROLE` in the target Oracle Database to an administrator user for Oracle SQL Access to Kafka.

Using the `OSAK_ADMIN_ROLE` simplifies the process of granting system privileges required to create and administer Oracle SQL access to Kafka applications. Also, administrators with the `OSAK_ADMIN_ROLE` grant access for other users to the Oracle Database object that has the relevant Kafka view and table for which they need access.

In addition to the `OSAK_ADMIN_ROLE`, an administrator for Oracle SQL access to Kafka applications must have the following system privileges:

- `CREATE SESSION`

- ALTER SESSION
- CREATE CREDENTIAL, to create a Kafka SASL-SSL (Simple Authentication and Security Layer) password or OSS (Oracle Streaming Service) authToken
- CREATE ANY DIRECTORY, to create cluster access and cluster configuration directory
- DROP ANY DIRECTORY, to drop cluster access and cluster configuration directory
- READ ON privileges to sys.dbms_kafka_clusters
- READ ON privileges to sys.dbms_kafka_applications
- READ ON privileges to sys.dbms_kafka_messages
- EXECUTE ON privileges to sys.dbms_kafka_admin

104.3 DBMS_KAFKA_ADM Constants

The DBMS_KAFKA_ADM package is a stateful package that uses the constants described here as part of the declared package state in the package specification.

The DBMS_KAFKA_ADM constants include constants with literal initial values and constants that you specify in your package build.

Kafka Providers

The provider of the Kafka server can be either Apache, or Oracle Cloud Infrastructure (OCI) Oracle Streaming Service (OSS).

```
KAFKA_PROVIDER_APACHE CONSTANT VARCHAR2(6) := 'APACHE';
KAFKA_PROVIDER_OSS CONSTANT VARCHAR2(3) := 'OSS';
```

States of a cluster definition

```
STATE_CONNECTED CONSTANT INTEGER := 0;
STATE_MAINTENANCE CONSTANT INTEGER := 1;
STATE_BROKEN CONSTANT INTEGER := 2;
STATE_DEREGISTERED CONSTANT INTEGER := 3;
```

Kafka connection modes

Kafka connection modes specify one of the following connection mode constants:

- High Throughput

If the connection mode (`connmode`) is `high_throughput`, then the applications associated with this connection require all of the data to be delivered as fast as possible. This connection mode is optimal for use from STREAMING and LOADING applications.

For example:

```
CONNECTION_MODE_HI_THRU CONSTANT VARCHAR2(15) := 'high_throughput';
```

- Low Latency

If the connection mode (`connmode`) is `low_latency`, then the underlying layer attempts to return the first rows as fast as possible. This connection mode is most useful for applications that use only a small amount of Kafka data for each load.

For example:

```
CONNECTION_MODE_LO_LAT CONSTANT VARCHAR2(11) := 'low_latency';
```

- Options

```
OPT_CONNECTION_MODE CONSTANT VARCHAR2(30) := 'connmode';
```

104.4 Summary of DBMS_KAFKA_ADM Procedures

DBMS_KAFKA_ADM procedures enable you to create, delete, and configure Oracle SQL access to Kafka.

Kafka providers

Kafka provider constants are used to define the Kafka cluster. Because the security models are different between an Apache Kafka-based cluster and an Oracle Streaming Service-based cluster, you must define to which type of Kafka environment you are connecting, so that the correct secure connection parameters can be passed.

For example:

```
KAFKA_PROVIDER_APACHE CONSTANT VARCHAR2(6) := 'APACHE';  
KAFKA_PROVIDER_OSS CONSTANT VARCHAR2(3) := 'OSS';
```

States of a cluster definition

```
STATE_CONNECTED CONSTANT INTEGER := 0;  
STATE_MAINTENANCE CONSTANT INTEGER := 1;  
STATE_BROKEN CONSTANT INTEGER := 2;  
STATE_DEREGISTERED CONSTANT INTEGER := 3;
```

Kafka connection modes

Kafka connection modes specify the Kafka rules that Oracle SQL access to Kafka follows to read a batch of records. Depending on the requirements for your application, you can specify either a low latency rule or a high throughput rule, depending on which option is the more efficient use of resources. You should consider tradeoffs between throughput and latency when you create your connections. The latency between the time that a record is generated and the time that you want that data made available to your application should determine the whether you make low latency your priority, or high throughput your priority.

If your application requires data access in near real-time, so that your application can react to data within seconds or a minute of its being generated by the Kafka cluster, then you should choose low latency connections. With a low latency connection, the Oracle SQL Kafka connection buffers are set to a smaller size, and the reads to the Kafka topic are made frequently, so that the delay between the time a record is generated to the Kafka topic and consumed by the application using Oracle SQL access to Kafka is within the performance requirements of your application. Each read from the Kafka topic is expected to consist of a relatively few number of records, and the number of reads from the Kafka cluster are high.

This form of Kafka connection is particularly suited to updating an application with near real-time concurrent transactions, or where the application must monitor and react to changes quickly. However, this configuration can be resource-intensive, as the number of transactions are relatively high for the amount of data received in each transaction.

If your application does not have near real-time requirements, so that your application can delay updates in favor of processing a large batch of records, in a cadence of 15 minutes, or an hour, or every 8 hours, then a high throughput connection can be a more efficient choice. With a connection configured for high throughput, each batch of Kafka data is streamed more infrequently, but the amount of data streamed in each transaction is larger. Accordingly, the Oracle SQL access to Kafka buffer size is larger, and the network I/O and memory allocations are configured for these larger batches. Because these transactions are streamed less frequently, the overall amount of server resources consumed by the Oracle SQL access to Kafka transaction is less

- Low Latency

```
CONNECTION_MODE_LO_LAT CONSTANT VARCHAR2(11) := 'low_latency';
```

- High Throughput

```
CONNECTION_MODE_HI_THRU CONSTANT VARCHAR2(15) := 'high_throughput';
```

- Options

```
OPT_CONNECTION_MODE CONSTANT VARCHAR2(30) := 'connmode';
```

This table lists the DBMS_KAFKA_ADM procedures, and briefly describes them.

Table 104-1 DBMS_KAFKA_ADM Package Procedures

Subprogram	Description
CHECK_CLUSTER	Tests the Kafka cluster connectivity.
DEREGISTER_CLUSTER	Deregisters the Kafka cluster.
DISABLE_CLUSTER	Disables the Kafka cluster.
ENABLE_CLUSTER	Enables the Kafka cluster.
REGISTER_CLUSTER	Registers the Kafka cluster.
UPDATE_CLUSTER_INFO	Updates the host server, or Kafka cluster options, or both.

104.5 CHECK_CLUSTER

The DBMS_KAFKA_ADM procedure `CHECK_CLUSTER` tests the Kafka cluster connectivity. Use this procedure to confirm that a connection can be established with the configured security information. The function returns the state of the cluster.

Syntax

```
FUNCTION CHECK_CLUSTER(
    cluster_name IN VARCHAR2
) RETURN INTEGER;
```

Parameters

Table 104-2 CHECK_CLUSTER procedure parameters for DBMS_KAFKA_ADM

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive.

Usage Notes

As the Oracle SQL access to Kafka cluster administrator, you should check the connectivity of the cluster. Checking the connectivity ensures that the bootstrap server list and the security related configuration that you have provided for the Kafka cluster is proper, and that a connection can be successfully established. You can use this function to test the connection when you run `REGISTER_CLUSTER`, and the security configuration has been established. After the cluster connection has been verified, you can make the cluster definition available to be used by user applications.

You also use this function if users have reported issues when calling `DBMS_KAFKA.LOAD_TEMP_TABLE` and `DBMS_KAFKA.EXECUTE_LOAD_APP`, both of which select from Oracle SQL access to Kafka views.

Examples

Suppose you have completed your initial cluster definition for the cluster `ExampleCluster`, and registered the cluster. Next, you use this procedure to check the configuration:

```
EXEC SYS.DBMS_OUTPUT.PUT_LINE (
    SYS.DBMS_KAFKA_ADM.CHECK_CLUSTER ('ExampleCluster'));
```

104.6 DEREGISTER_CLUSTER

The `DBMS_KAFKA_ADM` procedure `DEREGISTER_CLUSTER` deregisters the Kafka cluster.

**Note:**

This procedure will only deregister and remove the cluster if there are no user applications associated with the cluster

Syntax

```
PROCEDURE DEREGISTER_CLUSTER (
    cluster_name IN VARCHAR2,
```

```

);
forced IN BOOLEAN DEFAULT FALSE

```

Parameters

Table 104-3 DEREGISTER_CLUSTER Procedure Parameters for DBMS_KAFKA_ADM

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive.
forced	(Optional) Marks the cluster as deregistered even if there are user applications still defined. Default: FALSE. Values: [TRUE FALSE]

Usage Notes

When a cluster definition is no longer needed, the OSAK Administrator can remove the cluster definition.

If the `forced` parameter is passed as `TRUE`, then the cluster's state is marked as deregistered. Applications that are still associated with this cluster will no longer be functional. When the last application is dropped, this deregistered cluster definition will also be removed.

Examples

In the following example, an unused cluster definition for the Kafka cluster `ExampleCluster` is deregistered:

```
EXEC SYS.DBMS_KAFKA_ADM.DEREGISTER_CLUSTER ('ExampleCluster');
```

Suppose that there are still user applications (views and tables) associated with the cluster `ExampleCluster`, but you want to deregister the cluster. In the following example, the cluster `ExampleCluster` is deregistered with the `forced` parameter set to `TRUE`:

```
exec DBMS_KAFKA_ADM.DEREGISTER_CLUSTER(
  cluster_name => 'ExampleCluster',
  forced => TRUE);
```

104.7 DISABLE_CLUSTER

The `DBMS_KAFKA_ADM` procedure `DISABLE_CLUSTER` disables the Kafka cluster.

**Note:**

When this procedure completes successfully, the state of the application changes to MAINTENANCE.

Syntax

```
PROCEDURE DISABLE_CLUSTER(  
    cluster_name      IN VARCHAR2  
);
```

Parameters**Table 104-4** DISABLE_CLUSTER Procedure Parameters for DBMS_KAFKA_ADM

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive.

Usage Notes

A disabled cluster will prevent the cluster security information from being retrieved, thus preventing Kafka connections from being created or accessed.

Before you begin maintenance on a Kafka cluster, an Oracle SQL access to Kafka administrator should disable access to the cluster by using the DBMS_KAFKA_ADM.DISABLE_CLUSTER procedure. After the maintenance is completed, you can reenable the cluster access by using the DBMS_KAFKA_ADM.ENABLE_CLUSTER procedure.

This procedure raises an exception if the state cannot be changed to MAINTENANCE

Examples

In the following example, the cluster definition for ExampleCluster is temporarily disabled. In this state, views cannot connect to or retrieve data from the Kafka cluster:

```
EXEC SYS.DBMS_KAFKA_ADM.DISABLE_CLUSTER ('ExampleCluster');
```

104.8 ENABLE_CLUSTER

The DBMS_KAFKA_ADM procedure ENABLE_CLUSTER enables the Kafka cluster.

**Note:**

When this procedure completes successfully, the state of the application changes to `CONNECTED`.

Syntax

```
PROCEDURE ENABLE_CLUSTER(
    cluster_name    IN VARCHAR2
);
```

Parameters

Table 104-5 ENABLE_CLUSTER Procedure Parameters for DBMS_KAFKA_ADM

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive.

Usage Notes

After you complete maintenance on a Kafka cluster, an Oracle SQL access to Kafka administrator should enable access to the cluster by using the `DBMS_KAFKA_ADM.ENABLE_CLUSTER` procedure.

This procedure raises an exception if the state cannot be changed to `CONNECTED`.

Examples

Suppose that you have disabled the cluster `ExampleCluster` to perform maintenance, and you now want to reenble the ability of views to connect to and retrieve data from that Kafka cluster. Enter the following command:

```
EXEC SYS.DBMS_KAFKA_ADM.ENABLE_CLUSTER ('ExampleCluster');
```

104.9 REGISTER_CLUSTER

The `DBMS_KAFKA_ADM` procedure `REGISTER_CLUSTER` registers the Kafka cluster and makes it available for access on Oracle Database.

Syntax

```
FUNCTION REGISTER_CLUSTER (
    cluster_name          IN VARCHAR2,
    startup_servers       IN VARCHAR2,
    kafka_provider_provider IN VARCHAR2,
    cluster_access_dir    IN VARCHAR2,
    credential_name       IN VARCHAR2 DEFAULT
NULL,
```

```

        cluster_config_dir      IN VARCHAR2 DEFAULT NULL,
        cluster_description    IN VARCHAR2 DEFAULT NULL,
        options                 IN CLOB DEFAULT NULL
    ) RETURN INTEGER;

```

Parameters

Table 104-6 REGISTER_CLUSTER Procedure Parameters for DBMS_KAFKA_ADM

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive
<i>bootstrap_servers</i>	The startup servers of the Kafka cluster Case-sensitive
<i>kafka_provider_provider</i>	The provider of the Kafka server, which can be either Apache or Oracle Cloud Infrastructure (OCI) Oracle Streaming Service (OSS).. Syntax: <code>DBMS_KAFKA_ADM.KAFKA_PROVIDER_provider</code> Values for <i>provider</i> : [APACHE OSS] Case-insensitive See also the <code>DBMS_KAFKA_ADM</code> constant <code>KAFKA_PROVIDER</code>
<i>cluster_access_dir</i>	The Oracle directory object for determining access to this cluster Case-insensitive
<i>credential_name</i>	Credential name associated with the password to connect to Kafka. See <code>SYS.DBMS_CREDENTIAL</code> for possible name values and how to create a credential. Must be provided if Kafka connection requires a password, otherwise <code>NULL</code>
<i>cluster_config_dir</i>	The Oracle directory object containing the cluster configuration files required for secure clusters. The value is <code>NULL</code> for OSS or non-secure clusters. Case-insensitive
<i>cluster_description</i>	(Optional) A text description of the cluster. Maximum length: 400 characters.
<i>options</i>	(Optional) Cluster options. The format is a JSON-formatted document. For possible options, see <code>SYS.DBMS_KAFKA_ADM.OPT_%</code>

Usage Notes

`REGISTER_CLUSTER` automatically runs a `CHECK_CLUSTER` call after the cluster definition has been stored. The status returned from the `CHECK_CLUSTER` call is the returned value from the `REGISTER_CLUSTER`. This procedure raises an exception if the state cannot be determined.

At the end of the lifecycle for an Oracle SQL access to Kafka (OSAK) cluster, the administrator can remove the OSAK cluster by using the `DBMS_KAFKA_ADM.DEREGISTER_CLUSTER` function.

Examples

In the following example, the function `request` with `REGISTER_CLUSTER` registers the Kafka cluster `KAFKACLUS1` that is on the server `mykafkastartup`, using Apache as the provider. The cluster access directory on the Oracle Database instance is `OSAK_KAFKACLUS1_ACCESS`, accessed with the credential `KAFKACLUS1CRED1`, using the cluster configuration directory `OSAK_KAFKACLUS1_CONFIG`. The description for this cluster (which is optional), is "My test cluster kafkaclus1." A user (`examplekafka-user`) is granted `READ` access to the Kafka cluster data on `OSAK_KAFKACLUS1_ACCESS`,

```
SQL> select DBMS_KAFKA_ADM.REGISTER_CLUSTER ('KAFKACLUS1',
                                             'mykafkastartup-host:9092',
DBMS_KAFKA_ADM.KAFKA_PROVIDER_APACHE,
                                             'OSAK_KAFKACLUS1_ACCESS'
                                             'KAFKACLUS1CRED1',
                                             'OSAK_KAFKACLUS1_CONFIG',
                                             'My test cluster kafkaclus1') from
dual;
```

Output: Successful registration return 0 (zero)

```
SQL> DBMS_KAFKA_ADM_RE...
0
```

```
SQL> grant read on directory OSAK_KAFKACLUS1_ACCESS to
examplekafka-user;
```

You can also create non-secured cluster access. In the following example, a non-secure Kafka cluster access is registered using Oracle SQL access to Kafka (OSAK):

1. The cluster access database directory is created with an empty path. This directory is used to control which Oracle users can access the Kafka cluster:

```
SQL> CREATE DIRECTORY
OSAK_KAFKACLUS2_ACCESS AS '';
```

2. A cluster configuration operating system directory using the path structure *Oracle base/osak/cluster_name/config* is created, with the corresponding Oracle directory object, where the Oracle base is `/u01/app/oracle`, and the Kafka cluster name is `kafkaclus2`:

```
$mkdir /u01/app/oracle/osak/kafkaclus2/config;
```

```
.
.
.
```

```
SQL> CREATE DIRECTORY OSAK_KAFKACLUS2_CONFIG AS 'u01/app/oracle/
osak/kafkaclus2/config';
```

3. Create an empty `osakafka.properties` file, or create an `osakafka.properties` file with OSAK tuning or debugging properties, as you decide is required for your enterprise.

4. Register the Kafka cluster using `DBMS_KAFKA_ADM.REGISTER_CLUSTER()`. For example:

```
SQL> select DBMS_KAFKA_ADM.REGISTER_CLUSTER (
           cluster_name => 'KAFKACLUS2',
           bootstrap_servers => 'mykafkastartup-host:9092',
           kafka_provider => DBMS_KAFKA_ADM.KAFKA_PROVIDER_APACHE,
           cluster_access_dir => 'OSAK_KAFKACLUS2_ACCESS',
           credential_name => NULL,
           cluster_config_dir => 'OSAK_KAFKACLUS2_CONFIG',
           cluster_description => 'My test cluster kafkaclus2',
           options => NULL)
from dual;
Output: Successful registration return 0 (zero)
SQL> DBMS_KAFKA_ADM_RE...
           0
```

5. Grant read access to users. In this example, user `examplekafka-user2` is granted access:

```
SQL> grant read on directory
osak_kafkaclus2_access to examplekafka-user2;
```

104.10 UPDATE_CLUSTER_INFO

The `DBMS_KAFKA_ADM` procedure `UPDATE_CLUSTER_INFO` updates the Kafka host server, or the options for the Kafka cluster, or both.

Syntax

```
PROCEDURE UPDATE_CLUSTER_INFO (
           cluster_name          IN VARCHAR2,
           startup_servers       IN VARCHAR2 DEFAULT NULL,
           options                IN CLOB DEFAULT NULL
);
```

Parameters

Table 104-7 UPDATE_CLUSTER_INFO Procedure Parameters for DBMS_KAFKA_ADM

Parameter	Description
<i>cluster_name</i>	Name of an existing Kafka cluster Case-insensitive
<i>startup_servers</i>	The startup servers of the Kafka cluster Case-sensitive Because this is part of the Kafka source configuration, this string is treated as an opaque value (used as is), which is passed to the Kafka cluster connection logic.
<i>options</i>	(Optional) Cluster options. The format is a JSON-formatted document. For possible options, see <code>SYS.DBMS_KAFKA_ADM.OPT_%</code>

Usage Notes

The `UPDATE_CLUSTER_INFO` procedure updates the Kafka cluster definition, including the startup server list, or cluster options, or both. It also disconnects from the Kafka server. As the Oracle SQL access to Kafka (OSAK) Administrator, use this procedure if the Kafka cluster environment changes, and you need to change the cluster definition and configuration.

If an update fails, then the procedure raises an exception.

Examples

In the following example, the Kafka administrator has reconfigured the cluster to use the servers `newhost` and `host2`, and is now updating the list of startup servers for the Kafka cluster `ExampleCluster`:

```
EXEC SYS.DBMS_KAFKA_ADM.UPDATE_CLUSTER_INFO
('ExampleCluster',
`newhost:9092,host2:9092`);
```

105

DBMS_LDAP

The DBMS_LDAP package lets you access data from LDAP servers.

For a complete description of this package within the context of Oracle Internet Directory, see `DBMS_LDAP` in the *Application Developer's Guide for Oracle Identity Management*.

DBMS_LDAP_UTL

The DBMS_LDAP_UTL package contains the Oracle Extension utility functions.

For a complete description of this package within the context of Oracle Internet Directory, see DBMS_LDAP_UTL in the [Application Developer's Guide for Oracle Identity Management](#).

DBMS_LIBCACHE

The `DBMS_LIBCACHE` package consists of one subprogram that prepares the library cache on an Oracle instance by extracting SQL and PL/SQL from a remote instance and compiling this SQL locally without execution. The value of compiling the cache of an instance is to prepare the information the application requires to execute in advance of failover or switchover.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_LIBCACHE Subprograms](#)

107.1 DBMS_LIBCACHE Overview

Compiling a shared cursor consists of open, parse, and bind operations, plus the type-checking and execution plan functions performed at the first execution. All of these steps are executed in advance by the package `DBMS_LIBCACHE` for `SELECT` statements.

The open and parse functions are executed in advance for PL/SQL and DML. For PL/SQL, executing the parse phase has the effect of loading all library cache heaps other than the `MCODE`.

107.2 DBMS_LIBCACHE Security Model

To execute `DBMS_LIBCACHE` you must directly access the same objects as do SQL statements. You can best accomplish this by utilizing the same user id as the original system on the remote system.

When there are multiple schema users, `DBMS_LIBCACHE` should be called for each.

Alternatively, `DBMS_LIBCACHE` may be called with the generic user `PARSER`. However, this user cannot parse the SQL that uses objects with access granted through roles. This is a standard PL/SQL security limitation.

107.3 Summary of DBMS_LIBCACHE Subprograms

The `DBMS_LIBCACHE` package includes the `COMPILE_FROM_REMOTE` procedure subprogram.

Table 107-1 *DBMS_LIBCACHE Package Subprograms*

Subprogram	Description
COMPILE_FROM_REMOTE Procedure	Extracts SQL in batch from the source instance and compiles the SQL at the target instance

107.3.1 COMPILE_FROM_REMOTE Procedure

This procedure extracts SQL in batch from the source instance and compiles the SQL at the target instance.

Syntax

```
DBMS_LIBCACHE.COMPILE_FROM_REMOTE (
  p_db_link          IN      dbms_libcache$def.db_link%type,
  p_username         IN      VARCHAR2 default null,
  p_threshold_executions IN  NATURAL default 3,
  p_threshold_sharable_mem IN NATURAL default 1000,
  p_parallel_degree  IN      NATURAL default 1);
```

Parameters

Table 107-2 COMPILE_FROM_REMOTE Procedure Parameters

Parameter	Description
p_db_link	Database link to the source name (mandatory). The database link pointing to the instance that will be used for extracting the SQL statements. The user must have the role <code>SELECT_ON_CATALOG</code> at the source instance. For improved security, the connection may use a password file or LDAP authentication. The database link is mandatory only for releases with <code>dbms_libcache\$def.ACCESS_METHOD = DB_LINK_METHOD</code>
p_instance_name	(Reserved for future use). The name of the instance that will be used for extracting the SQL statements. The instance name must be unique for all instances excluding the local instance. The name is not case sensitive.
p_username	Source username (default is all users). The name of the username that will be used for extracting the SQL statements. The username is an optional parameter that is used to ensure the parsing user id is the same as that on the source instance. For an application where users connect as a single <code>user_id</code> , for example <code>APPS</code> , <code>APPS</code> is the parsing <code>user_id</code> that is recorded in the shared pool. To select only SQL statements parsed by <code>APPS</code> , enter the string 'APPS' in this field. To also select statements executed by batch, repeat the executing the procedure with the schema owner, for example <code>GL</code> . If the username is supplied, it must be valid. The name is not case sensitive.
p_threshold_executions	The lower bound for the number of executions, below which a SQL statement will not be selected for parsing. This parameter is optional. It allows the application to extract and compile statements with executions, for example, greater than 3. The default value is 1. This means SQL statements that have never executed, including invalid SQL statements, will not be extracted.

Table 107-2 (Cont.) COMPILE_FROM_REMOTE Procedure Parameters

Parameter	Description
<code>p_threshold_sharable_mem</code>	The lower bound for the size of the shared memory consumed by the cursors on the source instance. Below this value a SQL statement will not be selected for parsing. This parameter is optional. It allows the application to extract and compile statements with shared memory for example, greater than 10000 bytes.
<code>p_parallel_degree</code>	The number of parallel jobs that execute to complete the parse operation. These tasks are spawned as parallel jobs against a sub-range of the SQL statements selected for parsing. This parameter is reserved for parallel compile jobs which are currently not implemented.

DBMS_LOB

The `DBMS_LOB` package provides subprograms to operate on BLOBs, CLOBs, NCLOBs, BFILEs, and temporary LOBs. You can use `DBMS_LOB` to access and manipulate specific parts of a LOB or complete LOBs.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Datatypes](#)
- [Operational Notes](#)
- [Rules and Limits](#)
- [Exceptions](#)
- [Summary of DBMS_LOB Subprograms](#)



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide

108.1 DBMS_LOB Overview

`DBMS_LOB` can read and modify BLOBs, CLOBs, and NCLOBs; it provides read-only operations for BFILEs. The bulk of the LOB operations are provided by this package.

108.2 DBMS_LOB Security Model

This package must be created under `SYS`. Operations provided by this package are performed under the current calling user, not under the package owner `SYS`.

Any `DBMS_LOB` subprogram called from an anonymous PL/SQL block is executed using the privileges of the current user.

When creating the procedure, users can set the `AUTHID` to indicate whether they want definer's rights or invoker's rights. For example:

```
CREATE PROCEDURE procl AUTHID DEFINER ...
```

or

```
CREATE PROCEDURE procl AUTHID CURRENT_USER ...
```

 **See Also:**

For more information on AUTHID and privileges, see *Oracle Database PL/SQL Language Reference*

You can provide secure access to BFILEs using the DIRECTORY feature discussed in BFILENAME function in the *Oracle Database SecureFiles and Large Objects Developer's Guide* and the *Oracle Database SQL Language Reference*.

For information about the security model pertaining to temporary LOBs, see [Operational Notes](#).

108.3 DBMS_LOB Constants

This topic describes the constants used by the DBMS_LOB package

These are shown in following tables:

- [Table 108-1](#)
- [Table 108-2](#)
- [Table 108-3](#)
- [Table 108-4](#)
- [Table 108-5](#)
- [Table 108-6](#)

Table 108-1 DBMS_LOB Constants - Basic

Constant	Type	Value	Description
CALL	PLS_INTEGER	12	Create the TEMP LOB with call duration
FILE_READONLY	BINARY_INTEGER	0	Open the specified BFILE read-only
LOB_READONLY	BINARY_INTEGER	0	Open the specified LOB read-only
LOB_READWRITE	BINARY_INTEGER	1	Open the specified LOB read-write
LOBMAXSIZE	INTEGER	18446744073709551615	Maximum size of a LOB in bytes
SESSION	PLS_INTEGER	10	Create the TEMP LOB with session duration

Table 108-2 DBMS_LOB Constants - Option Types

Constant	Definition	Value	Description
OPT_COMPRESS	BINARY_INTEGER	1	Set/Get the SECUREFILE compress option value

Table 108-2 (Cont.) DBMS_LOB Constants - Option Types

Constant	Definition	Value	Description
OPT_DEDUPLICATE	BINARY_INTEGER	4	Set/Get the SECUREFILE Deduplicate option value
OPT_ENCRYPT	BINARY_INTEGER	2	Get the SECUREFILE encrypt option value

Table 108-3 DBMS_LOB Constants - Option Values

Constant	Definition	Value	Description
COMPRESS_OFF	BINARY_INTEGER	0	For SETOPTIONS Procedures , set compress off; for GETOPTIONS Functions , compress is off
COMPRESS_ON	BINARY_INTEGER	1	For SETOPTIONS Procedures , set compress on; for GETOPTIONS Functions , compress is on
DEDUPLICATE_OFF	BINARY_INTEGER	0	For SETOPTIONS Procedures , set deduplicate is off; for GETOPTIONS Functions , deduplicate is off
DEDUPLICATE_ON	BINARY_INTEGER	4	For SETOPTIONS Procedures , set deduplicate is on; for GETOPTIONS Functions , deduplicate is on
ENCRYPT_OFF	BINARY_INTEGER	0	For GETOPTIONS Functions , encrypt is off
ENCRYPT_ON	BINARY_INTEGER	2	For GETOPTIONS Functions , encrypt is on

Table 108-4 DBMS_LOB Constants - DBFS State Value Types

Constant	Definition	Value	Description
DBFS_LINK_NEVER	PLS_INTEGER	0	LOB has never been archived
DBFS_LINK_NO	PLS_INTEGER	2	LOB was archived, but as been read back in to the RDBMS
DBFS_LINK_YES	PLS_INTEGER	1	LOB is currently archived

Table 108-5 DBMS_LOB Constants - DBFS Cache Flags

Constant	Definition	Value	Description
DBFS_LINK_CACHE	PLS_INTEGER	1	Put the LOB data to the archive, but keep the data in the RDBMS as a cached version
DBFS_LINK_NOCACHE	PLS_INTEGER	0	Put the LOB data to the archive, and remove the data from the RDBMS.

Table 108-6 DBMS_LOB Constants - Miscellaneous

Constant	Definition	Value	Description
CONTENTTYPE_MAX_SIZE	PLS_INTEGER	128	Maximum number of bytes allowed in the content type string
DBFS_LINK_PATH_MAX_SIZE	PLS_INTEGER	1024	The maximum length of DBFS pathnames

108.4 DBMS_LOB Datatypes

The table in this topic describes the datatypes used by DBMS_LOB.

Table 108-7 Datatypes Used by DBMS_LOB

Type	Description
BLOB	Source or destination binary LOB.
RAW	Source or destination RAW buffer (used with BLOB).
CLOB	Source or destination character LOB (including NCLOB).
VARCHAR2	Source or destination character buffer (used with CLOB and NCLOB).
INTEGER	Specifies the size of a buffer or LOB, the offset into a LOB, or the amount to access.
BFILE	Large, binary object stored outside the database.

The DBMS_LOB package defines no special types.

An NCLOB is a CLOB for holding fixed-width and varying-width, multibyte national character sets.

The clause ANY_CS in the specification of DBMS_LOB subprograms for CLOBs enables the CLOB type to accept a CLOB or NCLOB locator variable as input.

108.5 DBMS_LOB Operational Notes

All DBMS_LOB subprograms work based on LOB locators. For the successful completion of DBMS_LOB subprograms, you must provide an input locator that represents a LOB that already exists in the database tablespaces or external file system.

See also Chapter 1 of *Oracle Database SecureFiles and Large Objects Developer's Guide*

Starting from 12.2 release, you can select a persistent LOB locator from a remote table into a local variable. The remote column can be of type BLOB, CLOB, or NCLOB. You cannot select BFILE from a remote table. The LOB variable that refers to the LOB value in a remote table is called a remote locator.

All the `DBMS_LOB` APIs other than the ones that are meant for BFILES will now accept and support operations on remote LOB locators. All the APIs that take in two locators must have both LOBs collocated at one database.



See Also:

Distributed LOBs chapter in *Oracle Database SecureFiles and Large Objects Developer's Guide*.

To use LOBs in your database, you must first use SQL data definition language (DDL) to define the tables that contain LOB columns.

- Internal LOBs
- External LOBs
- Temporary LOBs

Internal LOBs

To populate your table with internal LOBs after LOB columns are defined in a table, you use the SQL data manipulation language (DML) to initialize or populate the locators in the LOB columns.

External LOBs

For an external LOB (BFILE) to be represented by a LOB locator, you must:

- Ensure that a `DIRECTORY` object representing a valid, existing physical directory has been defined, and that physical files (the LOBs you plan to add) exist with read permission for the database. If your operating system uses case-sensitive path names, then be sure you specify the directory in the correct format.
- Pass the `DIRECTORY` object and the filename of the external LOB you are adding to the `BFILENAME` function to create a LOB locator for your external LOB.

Once you have completed these tasks, you can insert or update a row containing a LOB column using the specified LOB locator.

After the LOBs are defined and created, you can then `SELECT` from a LOB locator into a local PL/SQL LOB variable and use this variable as an input parameter to `DBMS_LOB` for access to the LOB value.

For details on the different ways to do this, See *Oracle Database SecureFiles and Large Objects Developer's Guide*

Temporary LOBs

The database supports the definition, creation, deletion, access, and update of temporary LOBs. Your temporary tablespace stores the temporary LOB data. Temporary LOBs are not permanently stored in the database. Their purpose is mainly to perform transformations on LOB data.

For temporary LOBs, you must use the OCI, PL/SQL, or another programmatic interface to create or manipulate them. Temporary LOBs can be either `BLOBs`, `CLOBs`, or `NCLOBs`.

A temporary LOB is empty when it is created. By default, all temporary LOBs are deleted at the end of the session in which they were created. If a process dies unexpectedly or if the database crashes, then temporary LOBs are deleted, and the space for temporary LOBs is freed.

There is also an interface to let you group temporary LOBs together into a logical bucket. The duration represents this logical store for temporary LOBs. Each temporary LOB can have separate storage characteristics, such as `CACHE/NOCACHE`. There is a default store for every session into which temporary LOBs are placed if you don't specify a specific duration. Additionally, you are able to perform a free operation on durations, which causes all contents in a duration to be freed.

There is no support for consistent read (CR), undo, backup, parallel processing, or transaction management for temporary LOBs. Because CR and roll backs are not supported for temporary LOBs, you must free the temporary LOB and start over again if you encounter an error.

Because CR, undo, and versions are not generated for temporary LOBs, there is potentially a performance impact if you assign multiple locators to the same temporary LOB. Semantically, each locator should have its own copy of the temporary LOB.

A copy of a temporary LOB is created if the user modifies the temporary LOB while another locator is also pointing to it. The locator on which a modification was performed now points to a new copy of the temporary LOB. Other locators no longer see the same data as the locator through which the modification was made. A deep copy was not incurred by permanent LOBs in these types of situations, because CR snapshots and version pages enable users to see their own versions of the LOB cheaply.

You can gain pseudo-REF semantics by using pointers to locators in OCI and by having multiple pointers to locators point to the same temporary LOB locator, if necessary. In PL/SQL, you must avoid using more than one locator for each temporary LOB. The temporary LOB locator can be passed by reference to other procedures.

Because temporary LOBs are not associated with any table schema, there are no meanings to the terms in-row and out-of-row temporary LOBs. Creation of a temporary LOB instance by a user causes the engine to create and return a locator to the LOB data. The PL/SQL `DBMS_LOB` package, PRO*C/C++, OCI, and other programmatic interfaces operate on temporary LOBs through these locators just as they do for permanent LOBs.

There is no support for client side temporary LOBs. All temporary LOBs reside in the server.

Temporary LOBs do not support the `EMPTY_BLOB` or `EMPTY_CLOB` functions that are supported for permanent LOBs. The `EMPTY_BLOB` function specifies the fact that the LOB is initialized, but not populated with any data.

A temporary LOB instance can only be destroyed by using OCI or the `DBMS_LOB` package by using the appropriate `FREETEMPORARY` or `OCIDurationEnd` statement.

A temporary LOB instance can be accessed and modified using appropriate OCI and `DBMS_LOB` statements, just as for regular permanent internal LOBs. To make a temporary LOB permanent, you must explicitly use the OCI or `DBMS_LOB COPY` command, and copy the temporary LOB into a permanent one.

Security is provided through the LOB locator. Only the user who created the temporary LOB is able to see it. Locators are not expected to be able to pass from one user's

session to another. Even if someone did pass a locator from one session to another, they would not access the temporary LOBs from the original session. Temporary LOB lookup is localized to each user's own session. Someone using a locator from somewhere else is only able to access LOBs within his own session that have the same LOB ID. Users should not try to do this, but if they do, they are not able to affect anyone else's data.

The database keeps track of temporary LOBs for each session in a `v$` view called `V$TEMPORARY_LOBS`, which contains information about how many temporary LOBs exist for each session. `v$` views are for DBA use. From the session, the database can determine which user owns the temporary LOBs. By using `V$TEMPORARY_LOBS` in conjunction with `DBA_SEGMENTS`, a DBA can see how much space is being used by a session for temporary LOBs. These tables can be used by DBAs to monitor and guide any emergency cleanup of temporary space used by temporary LOBs.

The following notes are specific to temporary LOBs:

1. All functions in `DBMS_LOB` return `NULL` if any of the input parameters are `NULL`. All procedures in `DBMS_LOB` raise an exception if the LOB locator is input as `NULL`.
2. Operations based on `CLOBs` do not verify if the character set IDs of the parameters (`CLOB` parameters, `VARCHAR2` buffers and patterns, and so on) match. It is the user's responsibility to ensure this.
3. Data storage resources are controlled by the DBA by creating different temporary tablespaces. DBAs can define separate temporary tablespaces for different users, if necessary.



See Also:

Oracle Database PL/SQL Language Reference for more information on `NOCOPY` syntax

108.6 DBMS_LOB Rules and Limits

This topic describes general `DBMS_LOB` rules and limits, rules and limits specific to external files (`BFILEs`), and maximum LOB and buffer sizes.

General Rules and Limits

- Oracle Database does not support constraints on columns or attributes whose type is a LOB, with the following exception: `NOT NULL` constraints are supported for a LOB column or attribute.
- The following rules apply in the specification of subprograms in this package:
 - `newlen`, `offset`, and `amount` parameters for subprograms operating on `BLOBs` and `BFILEs` must be specified in terms of *bytes*.
 - `newlen`, `offset`, and `amount` parameters for subprograms operating on `CLOBs` must be specified in terms of *characters*.

In multi-byte character sets, it is not possible to interpret these offsets correctly.

- A subprogram raises an `INVALID_ARGVAL` exception if the following restrictions are not followed in specifying values for parameters (unless otherwise specified):

1. Only positive, absolute offsets from the beginning of LOB data are permitted: Negative offsets from the tail of the LOB are not permitted.
2. Only positive, nonzero values are permitted for the parameters that represent size and positional quantities, such as `amount`, `offset`, `newlen`, `nth`, and so on. Negative offsets and ranges observed in SQL string functions and operators are not permitted.
3. The value of `offset`, `amount`, `newlen`, `nth` must not exceed the value `lobmaxsize` 18446744073709551615 ($2^{64}-1$) in any DBMS_LOB subprogram.
4. For CLOBs in a database with a multibyte database character set and for NCLOBs, the maximum value for these parameters must not exceed `trunc(lobmaxsize/2)=9223372036854775807` characters.

- PL/SQL language specifications stipulate an upper limit of 32767 bytes (not characters) for RAW and VARCHAR2 parameters used in DBMS_LOB subprograms. For example, if you declare a variable to be:

```
charbuf VARCHAR2(3000)
```

Then, `charbuf` can hold 3000 single byte characters or 1500 2-byte fixed width characters. This has an important consequence for DBMS_LOB subprograms for CLOBs and NCLOBs.

- The `%CHARSET` clause indicates that the form of the parameter with `%CHARSET` must match the form of the `ANY_CS` parameter to which it refers.

For example, in DBMS_LOB subprograms that take a VARCHAR2 buffer parameter, the form of the VARCHAR2 buffer must match the form of the CLOB parameter. If the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.

For DBMS_LOB subprograms that take two CLOB parameters, both CLOB parameters must have the same form; that is, they must both be NCLOBs, or they must both be CLOBs.

- If the value of `amount` plus the `offset` exceeds the maximum LOB size allowed by the database, then access exceptions are raised.

Under these input conditions, read subprograms, such as `READ`, `COMPARE`, `INSTR`, and `SUBSTR`, read until End of Lob/File is reached. For example, for a `READ` operation on a BLOB or BFILE, if the user specifies offset value of 3 GB and an amount value of 2 GB on a LOB that is 4GB in size, then `READ` returns only 1GB (4GB-3GB) bytes.

- Functions with `NULL` or invalid input values for parameters return a `NULL`. Procedures with `NULL` values for destination LOB parameters raise exceptions.
- Operations involving patterns as parameters, such as `INSTR` do not support regular expressions or special matching characters (such as `%` in the `LIKE` operator in SQL) in the `pattern` parameter or substrings.
- The End Of LOB condition is indicated by the `READ` procedure using a `NO_DATA_FOUND` exception. This exception is raised only upon an attempt by the user to read beyond the end of the LOB. The `READ` buffer for the last read contains 0 bytes.

- For consistent LOB updates, you must lock the row containing the destination LOB before making a call to any of the procedures (mutators) that modify LOB data.
- Unless otherwise stated, the default value for an `offset` parameter is 1, which indicates the first byte in the `BLOB` or `BFILE` data, and the first character in the `CLOB` or `NCLOB` value. No default values are specified for the `amount` parameter — you must input the values explicitly.
- You must lock the row containing the destination internal LOB before calling any subprograms that modify the LOB, such as `APPEND`, `COPY`, `ERASE`, `TRIM`, or `WRITE`. These subprograms do not implicitly lock the row containing the LOB.

Rules and Limits Specific to External Files (BFILES)

- The subprograms `COMPARE`, `INSTR`, `READ`, `SUBSTR`, `FILECLOSE`, `FILECLOSEALL` and `LOADFROMFILE` operate only on an *opened* `BFILE` locator; that is, a successful `FILEOPEN` call must precede a call to any of these subprograms.
- For the functions `FILEEXISTS`, `FILEGETNAME` and `GETLENGTH`, a file's open/close status is unimportant; however, the file must exist physically, and you must have adequate privileges on the `DIRECTORY` object and the file.
- `DBMS_LOB` does not support any concurrency control mechanism for `BFILE` operations.
- In the event of several open files in the session whose closure has not been handled properly, you can use the `FILECLOSEALL` subprogram to close all files opened in the session and resume file operations from the beginning.
- If you are the creator of a `DIRECTORY`, or if you have system privileges, then use the `CREATE OR REPLACE`, `DROP`, and `REVOKE` statements in SQL with extreme caution.

If you, or other grantees of a particular directory object, have several open files in a session, then any of the preceding commands can adversely affect file operations. In the event of such abnormal termination, your only choice is to invoke a program or anonymous block that calls `FILECLOSEALL`, reopen your files, and restart your file operations.

- All files opened during a user session are implicitly closed at the end of the session. However, Oracle strongly recommends that you close the files after *both* normal and abnormal termination of operations on the `BFILE`.

In the event of normal program termination, proper file closure ensures that the number of files that are open simultaneously in the session remains less than `SESSION_MAX_OPEN_FILES`.

In the event of abnormal program termination from a PL/SQL program, it is imperative that you provide an exception handler that ensures closure of all files opened in that PL/SQL program. This is necessary because after an exception occurs, only the exception handler has access to the `BFILE` variable in its most current state.

After the exception transfers program control outside the PL/SQL program block, all references to the open `BFILEs` are lost. The result is a larger open file count which may or may not exceed the `SESSION_MAX_OPEN_FILES` value.

For example, consider a `READ` operation past the end of the `BFILE` value, which generates a `NO_DATA_FOUND` exception:

```
-- This assumes a directory 'DDD' whose path is already known
DECLARE
    fil BFILE:= bfilename('DDD', 'filename.foo');
    pos INTEGER;
```

```

        amt BINARY_INTEGER;
        buf RAW(40);
BEGIN
    SELECT ad_graphic INTO fil FROM print_media WHERE product_id = 3106;
    dbms_lob.open(fil, dbms_lob.lob_readonly);
    amt := 40; pos := 1 + dbms_lob.getlength(fil); buf := '';
    dbms_lob.read(fil, amt, pos, buf);
    dbms_output.put_line('Read F1 past EOF: '||
        utl_raw.cast_to_varchar2(buf));
    dbms_lob.close(fil);
END;

ORA-01403: no data found
ORA-06512: at "SYS.DBMS_LOB", line 373
ORA-06512: at line 10

```

After the exception has occurred, the BFILE locator variable `file` goes out of scope, and no further operations on the file can be done using that variable. Therefore, the solution is to use an exception handler:

```

DECLARE
    fil BFILE;
    pos INTEGER;
    amt BINARY_INTEGER;
    buf RAW(40);
BEGIN
    SELECT ad_graphic INTO fil FROM print_media WHERE product_id = 3106;
    dbms_lob.open(fil, dbms_lob.lob_readonly);
    amt := 40; pos := 1 + dbms_lob.getlength(fil); buf := '';
    dbms_lob.read(fil, amt, pos, buf);
    dbms_output.put_line('Read F1 past EOF: '||
        utl_raw.cast_to_varchar2(buf));
    dbms_lob.close(fil);
exception
    WHEN no_data_found
    THEN
        BEGIN
            dbms_output.put_line('End of File reached. Closing file');
            dbms_lob.fileclose(fil);
            -- or dbms_lob.filecloseall if appropriate
        END;
END;
/

Statement processed.
End of File reached. Closing file

```

In general, you should ensure that files opened in a PL/SQL block using `DBMS_LOB` are closed before normal or abnormal termination of the block.

Maximum LOB Size

The maximum size for LOBs supported by the database is equal to the value of the blocksize of the tablespace the LOB column resides in times the value $2^{32}-1$ (4294967295). This allows for a maximum LOB size ranging from 8 terabytes to 128 terabytes.

Maximum Buffer Size

The maximum buffer size, 32767 bytes.

For BLOBs, where buffer size is expressed in bytes, the number of bytes cannot exceed 32767.

For CLOBs or NCLOBs, where buffer size is expressed in characters, the number of characters cannot result in a buffer larger than 32767 bytes. For example, if you are using fixed-width, two-byte characters, then specifying 20000 characters is an error (20000*2 = 40000, which is greater than 32767).

108.7 DBMS_LOB Exceptions

The table in the topic describes the exceptions for DBMS_LOB.

Table 108-8 DBMS_LOB Exceptions

Exception	Code	Description
ACCESS_ERROR	22925	You are trying to write too much data to the LOB: LOB size is limited to 4 gigabytes.
CONTENTTYPE_TOOLONG	43859	The length of the <code>contenttype</code> string exceeds the defined maximum. Modify the length of the <code>contenttype</code> string and retry the operation.
CONTENTTYPEBUF_WRONG	43862	The length of the <code>contenttype</code> buffer is less than defined constant. Modify the length of the <code>contenttype</code> buffer and retry the operation.
INVALID_ARGVAL	21560	The argument is expecting a non-NULL, valid value but the argument value passed in is NULL, invalid, or out of range.
INVALID_DIRECTORY	22287	The directory used for the current operation is not valid if being accessed for the first time, or if it has been modified by the DBA since the last access.
NO_DATA_FOUND	1403	ENDOFLOB indicator for looping read operations. This is not a hard error.
NOEXIST_DIRECTORY	22285	The directory leading to the file does not exist.
NOPRIV_DIRECTORY	22286	The user does not have the necessary access privileges on the directory or the file for the operation.
OPEN_TOOMANY	22290	The number of open files has reached the maximum limit.
OPERATION_FAILED	22288	The operation attempted on the file failed.
QUERY_WRITE	14553	Cannot perform a LOB write inside a query or PDML parallel execution server
SECUREFILE_BADLOB	43856	A non-SECUREFILE LOB type was used in a SECUREFILE only call
SECUREFILE_BADPARAM	43857	An invalid argument was passed to a SECUREFILE subprogram
SECUREFILE_MARKERASED	43861	The mark provided to a FRAGMENT_* operation has been deleted
SECUREFILE_OUTOFBOUNDS	43883	Attempted to perform a FRAGMENT_* operation past the LOB end

Table 108-8 (Cont.) DBMS_LOB Exceptions

Exception	Code	Description
UNOPENED_FILE	22289	The file is not open for the required operation to be performed.
VALUE_ERROR	6502	PL/SQL error for invalid values to subprogram's parameters.

108.8 Summary of DBMS_LOB Subprograms

This table lists the DBMS_LOB subprograms and briefly describes them.

Table 108-9 DBMS_LOB Package Subprograms

Subprogram	Description
APPEND Procedures	Appends the contents of the source LOB to the destination LOB
CLOB2FILE Procedure	Writes the content of a CLOB into a file.
CLOSE Procedure	Closes a previously opened internal or external LOB
COMPARE Functions	Compares two entire LOBs or parts of two LOBs
CONVERTTOBLOB Procedure	Reads character data from a source CLOB or NCLOB instance, converts the character data to the specified character, writes the converted data to a destination BLOB instance in binary format, and returns the new offsets
CONVERTTOCLOB Procedure	Takes a source BLOB instance, converts the binary data in the source instance to character data using the specified character, writes the character data to a destination CLOB or NCLOB instance, and returns the new offsets
COPY Procedures	Copies all, or part, of the source LOB to the destination LOB
COPY_DBFS_LINK Procedures	Copies the DBFS Link in the source LOB to the destination LOB
COPY_FROM_DBFS_LINK	Retrieves the data for the LOB from the DBFS store
CREATETEMPORARY Procedures	Creates a temporary BLOB or CLOB and its corresponding index in the user's default temporary tablespace
DBFS_LINK_GENERATE_PATH Functions	Returns a unique file path name for use in creating a DBFS Link
ERASE Procedures	Erases all or part of a LOB
FILECLOSE Procedure	Closes the file
FILECLOSEALL Procedure	Closes all previously opened files
FILEEXISTS Function	Checks if the file exists on the server
FILEGETNAME Procedure	Gets the directory object name and file name
FILEISOPEN Function	Checks if the file was opened using the input BFILE locators
FILEOPEN Procedure	Opens a file
FRAGMENT_DELETE Procedure	Deletes the data at the specified offset for the specified length from the LOB
FRAGMENT_INSERT Procedures	Inserts the specified data (limited to 32K) into the LOB at the specified offset

Table 108-9 (Cont.) DBMS_LOB Package Subprograms

Subprogram	Description
FRAGMENT_MOVE Procedure	Moves the amount of bytes (BLOB) or characters (CLOB/NCLOB) from the specified offset to the new offset specified
FRAGMENT_REPLACE Procedures	Replaces the data at the specified offset with the specified data (not to exceed 32k)
FREETEMPORARY Procedures	Frees the temporary BLOB or CLOB in the default temporary tablespace
GET_DBFS_LINK Functions	Returns the DBFS Link path associated with the specified SecureFile
GET_DBFS_LINK_STATE Procedures	Retrieves the current DBFS Link state of the specified SecureFile
GET_LOB_DEDUPLICATION_RATIO Function	Returns the deduplication ratio, which indicates that amount of space you can save by enabling deduplication.
GETCHUNKSIZE Functions	Returns the amount of space used in the LOB chunk to store the LOB value
GETCONTENTTYPE Functions	Returns the content ID string previously set by means of the SETCONTENTTYPE Procedure
GETLENGTH Functions	Gets the length of the LOB value
GETOPTIONS Functions	Obtains settings corresponding to the <code>option_type</code> field for a particular LOB
GET_STORAGE_LIMIT Function	Returns the storage limit for LOBs in your database configuration
INSTR Functions	Returns the matching position of the <i>n</i> th occurrence of the pattern in the LOB
ISOPEN Functions	Checks to see if the LOB was already opened using the input locator
ISREMOTE Function	Checks to see if the LOB is local to the database or if it belongs to a remote database.
ISSECUREFILE Function	Returns <code>TRUE</code> if the LOB locator passed to is for a SecureFiles LOB, otherwise, returns <code>FALSE</code>
ISTEMPORARY Functions	Checks if the locator is pointing to a temporary LOB
LOADBLOBFROMFILE Procedure	Loads BFILE data into an internal BLOB
LOADCLOBFROMFILE Procedure	Loads BFILE data into an internal CLOB
MOVE_TO_DBFS_LINK Procedures	Writes the specified SecureFile data to the DBFS store
OPEN Procedures	Opens a LOB (internal, external, or temporary) in the indicated mode
READ Procedures	Reads data from the LOB starting at the specified offset
SET_DBFS_LINK Procedures	Links the specified SecureFile to the specified path name. It does not copy the data to the path
SETCONTENTTYPE Procedure	Sets the content type string for the data in the LOB
SETOPTIONS Procedures	Enables CSCE features on a per-LOB basis, overriding the default LOB column settings

Table 108-9 (Cont.) DBMS_LOB Package Subprograms

Subprogram	Description
SUBSTR Functions	Returns part of the LOB value starting at the specified offset
TRIM Procedures	Trims the LOB value to the specified shorter length
WRITE Procedures	Writes data to the LOB from a specified offset
WRITEAPPEND Procedures	Writes a buffer to the end of a LOB

108.8.1 APPEND Procedures

This procedure appends the contents of a source internal LOB to a destination LOB. It appends the complete source LOB.

Syntax

```
DBMS_LOB.APPEND (
  dest_lob IN OUT NOCOPY BLOB,
  src_lob IN BLOB);

DBMS_LOB.APPEND (
  dest_lob IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  src_lob IN CLOB CHARACTER SET dest_lob%CHARSET);
```

Parameters

Table 108-10 APPEND Procedure Parameters

Parameter	Description
dest_lob	Locator for the internal LOB to which the data is to be appended.
src_lob	Locator for the internal LOB from which the data is to be read.

Exceptions

Table 108-11 APPEND Procedure Exceptions

Exception	Description
VALUE_ERROR	Either the source or the destination LOB is NULL.
QUERY_WRITE	Cannot perform a LOB write inside a query or PDML parallel execution server

Usage Notes

- It is not mandatory that you wrap the LOB operation inside the Open/Close interfaces. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

If you do not wrap the LOB operation inside the Open/Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the `OPEN` or `CLOSE` statement.

- If `APPEND` is called on a LOB that has been archived, it implicitly gets the LOB before the first byte is written
- If `APPEND` is called on a SecureFiles LOB that is a DBFS Link, an exception is thrown.

See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.2 CLOB2FILE Procedure

This procedure writes the content of a CLOB into a bfile. This procedure gets called from the deprecated `dbms_xslprocessor.clob2file` internally.

Syntax

```
DBMS_LOB.CLOB2FILE(
  src_cl      IN CLOB,
  file_loc    IN VARCHAR2,
  file_name   IN VARCHAR2,
  csid        IN NUMBER := 0,
  open_mode   IN VARCHAR2 := 'wb');
```

Parameters

Table 108-12 CLOB2FILE Procedure Parameters

Parameter	Description
<code>src_cl</code>	Source CLOB locator to write into a file
<code>file_loc</code>	Directory object name where the file is located
<code>file_name</code>	File name
<code>csid</code>	Character set id of the CLOB locator <ul style="list-style-type: none"> • Must be a valid Oracle id; otherwise returns an error • If the value is 0, then the content of the output file will be in the database character set
<code>open_mode</code>	The mode to open the output file in. <ul style="list-style-type: none"> • <code>wb</code> — write byte mode, overwrites the file The default value is <code>wb</code> .

108.8.3 CLOSE Procedure

This procedure closes a previously opened internal or external LOB.

Syntax

```
DBMS_LOB.CLOSE (  
    lob_loc    IN OUT NOCOPY BLOB);  
  
DBMS_LOB.CLOSE (  
    lob_loc    IN OUT NOCOPY CLOB CHARACTER SET ANY_CS);  
  
DBMS_LOB.CLOSE (  
    file_loc   IN OUT NOCOPY BFILE);
```

Parameters

Table 108-13 CLOSE Procedure Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .

Exceptions

No error is returned if the `BFILE` exists but is not opened. An error is returned if the LOB is not open.

Usage Notes

`CLOSE` requires a round-trip to the server for both internal and external LOBs. For internal LOBs, `CLOSE` triggers other code that relies on the close call, and for external LOBs (`BFILEs`), `CLOSE` actually closes the server-side operating system file.

It is not mandatory that you wrap all LOB operations inside the Open/Close interfaces. However, if you open a LOB, you must close it before you commit the transaction; an error is produced if you do not. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

It is an error to commit the transaction before closing all opened LOBs that were opened by the transaction. When the error is returned, the openness of the open LOBs is discarded, but the transaction is successfully committed. Hence, all the changes made to the LOB and non-LOB data in the transaction are committed, but the domain and function-based indexes are not updated. If this happens, you should rebuild the functional and domain indexes on the LOB column.



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.4 COMPARE Functions

This function compares two entire LOBs or parts of two LOBs.

Syntax

```
DBMS_LOB.COMPARE (
  lob_1          IN BLOB,
  lob_2          IN BLOB,
  amount         IN INTEGER := DBMS_LOB.LOBMAXSIZE,
  offset_1       IN INTEGER := 1,
  offset_2       IN INTEGER := 1)
RETURN INTEGER;

DBMS_LOB.COMPARE (
  lob_1          IN CLOB CHARACTER SET ANY_CS,
  lob_2          IN CLOB CHARACTER SET lob_1%CHARSET,
  amount         IN INTEGER := DBMS_LOB.LOBMAXSIZE,
  offset_1       IN INTEGER := 1,
  offset_2       IN INTEGER := 1)
RETURN INTEGER;

DBMS_LOB.COMPARE (
  lob_1          IN BFILE,
  lob_2          IN BFILE,
  amount         IN INTEGER,
  offset_1       IN INTEGER := 1,
  offset_2       IN INTEGER := 1)
RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(COMPARE, WNDS, WNPS, RNDS, RNPS);
```

Parameters

Table 108-14 COMPARE Function Parameters

Parameter	Description
lob_1	LOB locator of first target for comparison.
lob_2	LOB locator of second target for comparison.
amount	Number of bytes (for BLOBs) or characters (for CLOBs/NCLOBs) to compare.
offset_1	Offset in bytes or characters on the first LOB (origin: 1) for the comparison.
offset_2	Offset in bytes or characters on the second LOB (origin: 1) for the comparison.

Return Values

- INTEGER: 0 if the comparison succeeds, nonzero if not.
- NULL, if any of amount, offset_1 or offset_2 is not a valid LOB offset value. A valid offset is within the range of 1 to LOBMAXSIZE inclusive.

Usage Notes

- You can only compare LOBs of the same datatype (LOBs of BLOB type with other BLOBs, and CLOBs with CLOBs, and BFILEs with BFILEs). For BFILEs, the file must be already opened using a successful FILEOPEN operation for this operation to succeed.
- COMPARE returns 0 if the data exactly matches over the range specified by the offset and amount parameters. COMPARE returns -1 if the first CLOB is less than the second, and 1 if it is greater.
- For fixed-width n -byte CLOBs, if the input amount for COMPARE is specified to be greater than $(DBMS_LOB.LOBMAXSIZE/n)$, then COMPARE matches characters in a range of size $(DBMS_LOB.LOBMAXSIZE/n)$, or $\text{Max}(\text{length}(\text{clob1}), \text{length}(\text{clob2}))$, whichever is lesser.
- If COMPARE is called on any LOB that has been archived, it implicitly gets the LOB before the compare begins.
- If COMPARE () is called on a SecureFiles LOB that is a DBFS Link, the linked LOB is streamed from DBFS, if possible, otherwise an exception is thrown.

Exceptions

Table 108-15 COMPARE Function Exceptions for BFILE operations

Exception	Description
UNOPENED_FILE	File was not opened using the input locator.
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.5 CONVERTTOBLOB Procedure

This procedure reads character data from a source CLOB or NCLOB instance, converts the character data to the character set you specify, writes the converted data to a destination BLOB instance in binary format, and returns the new offsets.

You can use this interface with any combination of persistent or temporary LOB instances as the source or destination.

Syntax

```

DBMS_LOB.CONVERTTOBLOB (
  dest_lob      IN OUT      NOCOPY BLOB,
  src_clob      IN          CLOB CHARACTER SET ANY_CS,
  amount        IN          INTEGER,
  dest_offset   IN OUT      INTEGER,
  src_offset    IN OUT      INTEGER,
  blob_csid     IN          NUMBER,
  lang_context  IN OUT      INTEGER,
  warning       OUT         INTEGER);

```

Parameters

Table 108-16 CONVERTTOBLOB Procedure Parameters

Parameter	Description
dest_lob	LOB locator of the destination LOB instance.
src_clob	LOB locator of the source LOB instance.
amount	Number of characters to convert from the source LOB. If you want to copy the entire LOB, pass the constant <code>DBMS_LOB.LOBMAXSIZE</code> . If you pass any other value, it must be less than or equal to the size of the LOB.
dest_offset	(IN) Offset in bytes in the destination LOB for the start of the write. Specify a value of 1 to start at the beginning of the LOB. (OUT) The new offset in bytes after the end of the write.
src_offset	(IN) Offset in characters in the source LOB for the start of the read. (OUT) Offset in characters in the source LOB right after the end of the read.
blob_csid	Desired character set ID of the converted data.
lang_context	(IN) Language context, such as shift status, for the current conversion. (OUT) The language context at the time when the current conversion is done. This information is returned so you can use it for subsequent conversions without losing or misinterpreting any source data. For the very first conversion, or if do not care, use the default value of zero.
warning	(OUT) Warning message. This parameter indicates when something abnormal happened during the conversion. You are responsible for checking the warning message. Currently, the only possible warning is — inconvertible character. This occurs when the character in the source cannot be properly converted to a character in destination. The default replacement character (for example, '?') is used in place of the inconvertible character. The return value of this error message is defined as the constant <code>warn_inconvertible_char</code> in the <code>DBMS_LOB</code> package.

Usage Notes

Preconditions

Before calling the `CONVERTTOBLOB` procedure, the following preconditions must be met:

- Both the source and destination LOB instances must exist.
- If the destination LOB is a persistent LOB, the row must be locked. To lock the row, select the LOB using the `FOR UPDATE` clause of the `SELECT` statement.

Constants and Defaults

All parameters are required. You must pass a variable for each `OUT` or `IN OUT` parameter. You must pass either a variable or a value for each `IN` parameter.

[Table 108-17](#) gives a summary of typical values for each parameter. The first column lists the parameter, the second column lists the typical value, and the last column describes the result of passing the value. Note that constants are used for some values. These constants are defined in the `dbmslob.sql` package specification file.

Table 108-17 DBMS_LOB.CONVERTTLOB Typical Values

Parameter	Value	Description
<code>amount</code>	<code>LOBMAXSIZE (IN)</code>	convert the entire file
<code>dest_offset</code>	<code>1 (IN)</code>	start from the beginning
<code>src_offset</code>	<code>1 (IN)</code>	start from the beginning
<code>blob_csid</code>	<code>DEFAULT_CSID (IN)</code>	default CSID, use same CSID as source LOB
<code>lang_context</code>	<code>DEFAULT_LANG_CTX (IN)</code>	default language context
<code>warning</code>	<code>NO_WARNING (OUT)</code> <code>WARN_INCONVERTIBLE_CHAR (OUT)</code>	no warning message, success character in source cannot be properly converted

General Notes

- You must specify the desired character set for the destination LOB in the `blob_csid` parameter. You can pass a zero value for `blob_csid`. When you do so, the database assumes that the desired character set is the same as the source LOB character set.
- You must specify the offsets for both the source and destination LOBs, and the number of characters to copy from the source LOB. The `amount` and `src_offset` values are in characters and the `dest_offset` is in bytes. To convert the entire LOB, you can specify `LOBMAXSIZE` for the `amount` parameter.
- `CONVERTTLOB` gets the source and/or destination LOBs as necessary prior to conversion and write of the data.

Exceptions

[Table 108-18](#) gives possible exceptions this procedure can throw. The first column lists the exception string and the second column describes the error conditions that can cause the exception.

Table 108-18 CONVERTTLOB Procedure Exceptions

Exception	Description
<code>VALUE_ERROR</code>	Any of the input parameters are <code>NULL</code> or <code>INVALID</code> .

Table 108-18 (Cont.) CONVERTTOBLOB Procedure Exceptions

Exception	Description
INVALID_ARGVAL	One or more of the following: - src_offset or dest_offset < 1. - src_offset or dest_offset > LOBMAXSIZE. - amount < 1. - amount > LOBMAXSIZE.



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for more information on using LOBs in application development

108.8.6 CONVERTTOCLOB Procedure

This procedure takes a source BLOB instance, converts the binary data in the source instance to character data using the character set you specify, writes the character data to a destination CLOB or NCLOB instance, and returns the new offsets.

You can use this interface with any combination of persistent or temporary LOB instances as the source or destination.

Syntax

```
DBMS_LOB.CONVERTTOCLOB (
    dest_lob      IN OUT NOCOPY  CLOB CHARACTER SET ANY_CS,
    src_blob      IN              BLOB,
    amount        IN              INTEGER,
    dest_offset   IN OUT          INTEGER,
    src_offset    IN OUT          INTEGER,
    blob_csid     IN              NUMBER,
    lang_context  IN OUT          INTEGER,
    warning       OUT             INTEGER);
```

Parameters

Table 108-19 CONVERTTOCLOB Procedure Parameters

Parameter	Description
dest_lob	LOB locator of the destination LOB instance.
src_blob	LOB locator of the source LOB instance.
amount	Number of bytes to convert from the source LOB. If you want to copy the entire BLOB, pass the constant DBMS_LOB.LOBMAXSIZE. If you pass any other value, it must be less than or equal to the size of the BLOB.

Table 108-19 (Cont.) CONVERTTOCLOB Procedure Parameters

Parameter	Description
dest_offset	(IN) Offset in characters in the destination LOB for the start of the write. Specify a value of 1 to start at the beginning of the LOB. (OUT) The new offset in characters after the end of the write. This offset always points to the beginning of the first complete character after the end of the write.
src_offset	(IN) Offset in bytes in the source LOB for the start of the read. (OUT) Offset in bytes in the source LOB right after the end of the read.
blob_csid	The character set ID of the source data
lang_context	(IN) Language context, such as shift status, for the current conversion. (OUT) The language context at the time when the current conversion is done. This information is returned so you can use it for subsequent conversions without losing or misinterpreting any source data. For the very first conversion, or if do not care, use the default value of zero.
warning	Warning message. This parameter indicates when something abnormal happened during the conversion. You are responsible for checking the warning message. Currently, the only possible warning is — inconvertible character. This occurs when the character in the source cannot be properly converted to a character in destination. The default replacement character (for example, '?') is used in place of the inconvertible character. The return value of this error message is defined as the constant <code>warn_inconvertible_char</code> in the <code>DBMS_LOB</code> package.

Usage Notes

Preconditions

Before calling the `CONVERTTOCLOB` procedure, the following preconditions must be met:

- Both the source and destination LOB instances must exist.
- If the destination LOB is a persistent LOB, the row must be locked before calling the `CONVERTTOCLOB` procedure. To lock the row, select the LOB using the `FOR UPDATE` clause of the `SELECT` statement.

Constants and Defaults

All parameters are required. You must pass a variable for each `OUT` or `IN OUT` parameter. You must pass either a variable or a value for each `IN` parameter.

[Table 108-20](#) gives a summary of typical values for each parameter. The first column lists the parameter, the second column lists the typical value, and the last column describes the result of passing the value. Note that constants are used for some values. These constants are defined in the `dbmslob.sql` package specification file.

Table 108-20 DBMS_LOB.CONVERTTOCLOB Typical Values

Parameter	Value	Description
amount	LOBMAXSIZE (IN)	convert the entire file
dest_offset	1 (IN)	start from the beginning
src_offset	1 (IN)	start from the beginning
csid	DEFAULT_CSID (IN)	default CSID, use destination CSID
lang_context	DEFAULT_LANG_CTX (IN)	default language context
warning	NO_WARNING (OUT) WARN_INCONVERTIBLE_CHAR (OUT)	no warning message, success character in source cannot be properly converted

General Notes

- You must specify the desired character set for the source LOB in the `blob_csid` parameter. You can pass a zero value for `blob_csid`. When you do so, the database assumes that the desired character set is the same as the destination LOB character set.
- You must specify the offsets for both the source and destination LOBs, and the number of characters to copy from the source LOB. The `amount` and `src_offset` values are in bytes and the `dest_offset` is in characters. To convert the entire LOB, you can specify `LOBMAXSIZE` for the `amount` parameter.
- `CONVERTTOCLOB` gets the source and/or destination LOBs as necessary prior to conversion and write of the data.

Exceptions**Table 108-21 CONVERTTOCLOB Procedure Exceptions**

Exception	Description
VALUE_ERROR	Any of the input parameters are NULL or INVALID.
INVALID_ARGVAL	One or more of the following: <ul style="list-style-type: none"> - <code>src_offset</code> or <code>dest_offset</code> < 1. - <code>src_offset</code> or <code>dest_offset</code> > <code>LOBMAXSIZE</code>. - <code>amount</code> < 1. - <code>amount</code> > <code>LOBMAXSIZE</code>.

 **See Also:**

Oracle Database SecureFiles and Large Objects Developer's Guide for more information on using LOBs in application development

108.8.7 COPY Procedures

This procedure copies all, or a part of, a source internal LOB to a destination internal LOB. You can specify the offsets for both the source and destination LOBs, and the number of bytes or characters to copy.

Syntax

```
DBMS_LOB.COPY (
  dest_lob  IN OUT NOCOPY BLOB,
  src_lob   IN           BLOB,
  amount    IN           INTEGER,
  dest_offset IN         INTEGER := 1,
  src_offset IN         INTEGER := 1);
```

```
DBMS_LOB.COPY (
  dest_lob  IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  src_lob   IN           CLOB CHARACTER SET dest_lob%CHARSET,
  amount    IN           INTEGER,
  dest_offset IN         INTEGER := 1,
  src_offset IN         INTEGER := 1);
```

Parameters

Table 108-22 COPY Procedure Parameters

Parameter	Description
dest_lob	LOB locator of the copy target.
src_lob	LOB locator of source for the copy.
amount	Number of bytes (for BLOBs) or characters (for CLOBs) to copy.
dest_offset	Offset in bytes or characters in the destination LOB (origin: 1) for the start of the copy.
src_offset	Offset in bytes or characters in the source LOB (origin: 1) for the start of the copy.

Exceptions

Table 108-23 COPY Procedure Exceptions

Exception	Description
VALUE_ERROR	Any of the input parameters are NULL or invalid.
INVALID_ARGVAL	Either: <ul style="list-style-type: none"> - src_offset or dest_offset < 1 - src_offset or dest_offset > LOBMAXSIZE - amount < 1 - amount > LOBMAXSIZE
QUERY_WRITE	Cannot perform a LOB write inside a query or PDML parallel execution server

Usage Notes

- If the offset you specify in the destination LOB is beyond the end of the data currently in this LOB, then zero-byte fillers or spaces are inserted in the destination BLOB or CLOB respectively. If the offset is less than the current length of the destination LOB, then existing data is overwritten.
- It is not an error to specify an amount that exceeds the length of the data in the source LOB. Thus, you can specify a large amount to copy from the source LOB, which copies data from the `src_offset` to the end of the source LOB.
- It is not mandatory that you wrap the LOB operation inside the Open/Close interfaces. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.
- If you do not wrap the LOB operation inside the Open/Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the `OPEN` or `CLOSE` statement.
- Prior to copy, the source and destination LOBs are retrieved, if they are currently archived. For a complete over-write, the destination LOB is not retrieved.
- If the source LOB is a DBFS Link, the data is streamed from DBFS, if possible, otherwise an exception is thrown. If the destination LOB is a DBFS Link, an exception is thrown.

See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.8 COPY_DBFS_LINK Procedures

This procedure copies the DBFS Link in the source LOB to the destination LOB.

Syntax

```
DBMS_LOB.COPY_DBFS_LINK (
  lob_loc_dst   IN OUT BLOB,
  lob_loc_src   IN     BLOB,
  flags         IN     PLS_INTEGER DEFAULT DBFS_LINK_NOCACHE);
```

```
DBMS_LOB.COPY_DBFS_LINK (
  lob_loc_dst   IN OUT CLOB CHARACTER SET ANY_CS,
  lob_loc_src   IN     CLOB CHARACTER SET ANY_CS,
  flags         IN     PLS_INTEGER DEFAULT DBFS_LINK_NOCACHE);
```

Parameters

Table 108-24 COPY_DBFS_LINK Procedure Parameters

Parameter	Description
lob_loc_dst	LOB to be made to reference the same storage data as lob_loc_src
lob_loc_src	LOB from which to copy the reference
flags	Options to COPY_DBFS_LINK: <ul style="list-style-type: none"> • DBFS_LINK_NOCACHE specifies to only copy the DBFS Link • DBFS_LINK_CACHE specifies to copy the DBFS Link and read the data into the database LOB specified by lob_loc_dst so that the data is cached

Exceptions

Table 108-25 COPY_DBFS_LINK Procedure Exceptions

Exception	Description
SECUREFILE_BADLOB	Either lob_loc_src or lob_loc_dst is not a SECUREFILE
INVALID_ARGVAL	lob_loc_src LOB has not been archived
ORA-01555	If the source LOB has been retrieved, never archived, or if the LOB has been migrated in and out (modified or not) since the locator was gotten.

108.8.9 COPY_FROM_DBFS_LINK

This procedure retrieves the archived SecureFiles LOB data from the DBFS HSM store and to the database.

Syntax

```
DBMS_LOB.COPY_FROM_DBFS_LINK (
  lob_loc      IN OUT BLOB);

DBMS_LOB.COPY_FROM_DBFS_LINK (
  lob_loc      IN OUT CLOB CHARACTER SET ANY_CS);
```

Parameters

Table 108-26 COPY_FROM_DBFS_LINK Procedure Parameters

Parameter	Description
lob_loc	LOB to be retrieved from the archive

Usage Note

COPY_FROM_DBFS_LINK does not remove the underlying DBFS file.

If the LOB is successfully retrieved, COPY_FROM_DBFS_LINK silently returns success.

Exceptions

Table 108-27 COPY_FROM_DBFS_LINK Procedure Exceptions

Exception	Description
SECUREFILE_BADLOB	lob_loc is not a SECUREFILE
ORA-01555	If the LOB has already been retrieved and has been modified since retrieval, if the LOB has been migrated in and out (modified or not) since the locator was retrieved

108.8.10 CREATETEMPORARY Procedures

This procedure creates a temporary BLOB or CLOB and its corresponding index in your default temporary tablespace.

Syntax

```
DBMS_LOB.CREATETEMPORARY (
  lob_loc IN OUT NOCOPY BLOB,
  cache   IN           BOOLEAN,
  dur     IN           PLS_INTEGER := DBMS_LOB.SESSION);
```

```
DBMS_LOB.CREATETEMPORARY (
  lob_loc IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  cache   IN           BOOLEAN,
  dur     IN           PLS_INTEGER := 10);
```

Parameters

Table 108-28 CREATETEMPORARY Procedure Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .
cache	Specifies if LOB should be read into buffer cache or not.
dur	1 of 2 predefined duration values (SESSION or CALL) which specifies a hint as to whether the temporary LOB is cleaned up at the end of the session or call. If dur is omitted, then the session duration is used.

See Also:

- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure
- *Oracle Database PL/SQL Language Reference* for more information about NOCOPY and passing temporary lob as parameters

108.8.11 DBFS_LINK_GENERATE_PATH Functions

This subprogram returns a unique file path name for use in creating a DBFS Link.

Syntax

```
DBMS_LOB.DBFS_LINK_GENERATE_PATH (
  lob_loc      IN BLOB,
  storage_dir  IN VARCHAR2)
RETURN VARCHAR2;

DBMS_LOB.DBFS_LINK_GENERATE_PATH (
  lob_loc      IN CLOB CHARACTER SET ANY_CS,
  storage_dir  IN VARCHAR2)
RETURN VARCHAR2;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES (dbfs_link_generate_path,
  WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 108-29 DBFS_LINK_GENERATE_PATH Function Parameters

Parameter	Description
lob_loc	LOB to be retrieved from DBFS
storage_dir	DBFS directory that will be the parent directory of the file

Exceptions

Table 108-30 DBFS_LINK_GENERATE_PATH Function Exceptions

Exception	Description
SECUREFILE_WRONGTYPE	lob_loc is not a SECUREFILE

Usage Notes

Returns a globally unique file pathname that can be used for archiving. This is guaranteed to be globally unique across all calls to this function for different LOBs and versions of that LOB. It is always the same for the same LOB and version.

108.8.12 ERASE Procedures

This procedure erases an entire internal LOB or part of an internal LOB.

Syntax

```
DBMS_LOB.ERASE (
  lob_loc      IN OUT NOCOPY BLOB,
  amount       IN OUT NOCOPY INTEGER,
  offset       IN              INTEGER := 1);
```

```
DBMS_LOB.ERASE (
  lob_loc      IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  amount       IN OUT NOCOPY INTEGER,
  offset       IN             INTEGER := 1);
```

Parameters

Table 108-31 ERASE Procedure Parameters

Parameter	Description
lob_loc	Locator for the LOB to be erased. For more information, see Operational Notes .
amount	Number of bytes (for BLOBs or BFILES) or characters (for CLOBs or NCLOBs) to be erased.
offset	Absolute offset (origin: 1) from the beginning of the LOB in bytes (for BLOBs) or characters (CLOBs).

Usage Notes

- When data is erased from the middle of a LOB, zero-byte fillers or spaces are written for BLOBs or CLOBs respectively.
- The actual number of bytes or characters erased can differ from the number you specified in the `amount` parameter if the end of the LOB value is reached before erasing the specified number. The actual number of characters or bytes erased is returned in the `amount` parameter.
- ERASE gets the LOB if it is archived, unless the erase covers the entire LOB.
- If the LOB to be erased is a DBFS Link, an exception is thrown.



Note:

The length of the LOB is not decreased when a section of the LOB is erased. To decrease the length of the LOB value, see the "[TRIM Procedures](#)".

Exceptions

Table 108-32 ERASE Procedure Exceptions

Exception	Description
VALUE_ERROR	Any input parameter is NULL.
INVALID_ARGVAL	Either: - amount < 1 or amount > LOBMAXSIZE - offset < 1 or offset > LOBMAXSIZE
QUERY_WRITE	Cannot perform a LOB write inside a query or PDML parallel execution server

Usage Notes

It is not mandatory that you wrap the LOB operation inside the Open/Close interfaces. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

If you do not wrap the LOB operation inside the Open/Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the `OPEN` or `CLOSE` statement.

See Also:

- ["TRIM Procedures"](#)
- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure

108.8.13 FILECLOSE Procedure

This procedure closes a `BFILE` that has already been opened through the input locator.

Note:

The database has only read-only access to `BFILEs`. This means that `BFILEs` cannot be written through the database.

Syntax

```
DBMS_LOB.FILECLOSE (  
    file_loc IN OUT NOCOPY BFILE);
```

Parameters

Table 108-33 FILECLOSE Procedure Parameters

Parameter	Description
<code>file_loc</code>	Locator for the <code>BFILE</code> to be closed.

Exceptions

Table 108-34 FILECLOSE Procedure Exceptions

Exception	Description
VALUE_ERROR	NULL input value for <code>file_loc</code> .
UNOPENED_FILE	File was not opened with the input locator.
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.

See Also:

- ["FILEOPEN Procedure"](#)
- ["FILECLOSEALL Procedure"](#)
- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure

108.8.14 FILECLOSEALL Procedure

This procedure closes all `BFILE`s opened in the session.

Syntax

```
DBMS_LOB.FILECLOSEALL;
```

Exceptions

Table 108-35 FILECLOSEALL Procedure Exception

Exception	Description
UNOPENED_FILE	No file has been opened in the session.

See Also:

- ["FILEOPEN Procedure"](#)
- ["FILECLOSE Procedure"](#)
- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure

108.8.15 FILEEXISTS Function

This function finds out if a specified `BFILE` locator points to a file that actually exists on the server's file system.

Syntax

```
DBMS_LOB.FILEEXISTS (  
    file_loc    IN    BFILE)  
    RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(FILEEXISTS, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 108-36 FILEEXISTS Function Parameter

Parameter	Description
<code>file_loc</code>	Locator for the <code>BFILE</code> .

Return Values

Table 108-37 FILEEXISTS Function Return Values

Return	Description
0	Physical file does not exist.
1	Physical file exists.

Exceptions

Table 108-38 FILEEXISTS Function Exceptions

Exception	Description
<code>NOEXIST_DIRECTORY</code>	Directory does not exist.
<code>NOPRIV_DIRECTORY</code>	You do not have privileges for the directory.
<code>INVALID_DIRECTORY</code>	Directory has been invalidated after the file was opened.

See Also:

- "[FILEISOPEN Function](#)".
- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure

108.8.16 FILEGETNAME Procedure

This procedure determines the directory object and filename, given a BFILE locator.

This function only indicates the directory object name and filename assigned to the locator, not if the physical file or directory actually exists.

The maximum constraint values for the `dir_alias` buffer is 30, and for the entire path name, it is 2000.

Syntax

```
DBMS_LOB.FILEGETNAME (
  file_loc  IN   BFILE,
  dir_alias OUT  VARCHAR2,
  filename  OUT  VARCHAR2);
```

Parameters

Table 108-39 FILEGETNAME Procedure Parameters

Parameter	Description
<code>file_loc</code>	Locator for the BFILE
<code>dir_alias</code>	Directory object name
<code>filename</code>	Name of the BFILE

Exceptions

Table 108-40 FILEGETNAME Procedure Exceptions

Exception	Description
<code>VALUE_ERROR</code>	Any of the input parameters are NULL or INVALID.
<code>INVALID_ARGVAL</code>	<code>dir_alias</code> or <code>filename</code> are NULL.

See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.17 FILEISOPEN Function

This function finds out whether a BFILE was opened with the specified FILE locator.

Syntax

```
DBMS_LOB.FILEISOPEN (
  file_loc  IN   BFILE)
RETURN INTEGER;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES(fileisopen, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 108-41 FILEISOPEN Function Parameter

Parameter	Description
file_loc	Locator for the BFILE.

Return Values

INTEGER: 0 = file is not open, 1 = file is open

Usage Notes

If the input FILE locator was never passed to the FILEOPEN procedure, then the file is considered not to be opened by this locator. However, a different locator may have this file open. In other words, openness is associated with a specific locator.

Exceptions

Table 108-42 FILEISOPEN Function Exceptions

Exception	Description
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.

See Also:

- ["FILEEXISTS Function"](#)
- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure

108.8.18 FILEOPEN Procedure

This procedure opens a BFILE for read-only access. BFILE data may not be written through the database.

Syntax

```
DBMS_LOB.FILEOPEN (
    file_loc  IN OUT NOCOPY BFILE,
    open_mode IN             BINARY_INTEGER := file_readonly);
```

Parameters

Table 108-43 FILEOPEN Procedure Parameters

Parameter	Description
file_loc	Locator for the BFILE.
open_mode	File access is read-only.

Exceptions

Table 108-44 FILEOPEN Procedure Exceptions

Exception	Description
VALUE_ERROR	file_loc or open_mode is NULL.
INVALID_ARGVAL	open_mode is not equal to FILE_READONLY.
OPEN_TOOMANY	Number of open files in the session exceeds session_max_open_files.
NOEXIST_DIRECTORY	Directory associated with file_loc does not exist.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.



See Also:

- ["FILECLOSE Procedure"](#)
- ["FILECLOSEALL Procedure"](#)
- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure

108.8.19 FRAGMENT_DELETE Procedure

This procedure deletes the data at the specified offset for the specified length from the LOB without having to rewrite all the data in the LOB following the specified offset.

Syntax

```
DBMS_LOB.FRAGMENT_DELETE (
  lob_loc      IN OUT NOCOPY BLOB,
  amount       IN              INTEGER,
  offset       IN              INTEGER);

DBMS_LOB.FRAGMENT_DELETE (
  lob_loc      IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  amount       IN              INTEGER,
  offset       IN              INTEGER);
```

Parameters

Table 108-45 FRAGMENT_DELETE Procedure Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .
amount	Number of bytes (BLOB) or characters (CLOB/NCLOB) to be removed from the LOB
offset	Offset into the LOB in bytes (BLOB) or characters (CLOB/NCLOB) to begin the deletion

Exceptions

Table 108-46 FRAGMENT_DELETE Procedure Exceptions

Exception	Description
INVALID_ARGVAL	A parameter value was invalid
QUERY_WRITE	Cannot perform operation during a query
SECUREFILE_BADLOB	A non-SECUREFILE LOB was used in a SECUREFILE LOB only call
SECUREFILE_OUTOFBOUNDS	Attempted to perform a FRAGMENT_* operation past LOB end

108.8.20 FRAGMENT_INSERT Procedures

This procedure inserts the specified data (limited to 32K) into the LOB at the specified offset.

Syntax

```
DBMS_LOB.FRAGMENT_INSERT (
  lob_loc      IN OUT NOCOPY BLOB,
  amount       IN           INTEGER,
  offset       IN           INTEGER,
  buffer       IN           RAW);

DBMS_LOB.FRAGMENT_INSERT (
  lob_loc      IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  amount       IN           INTEGER,
  offset       IN           INTEGER,
  buffer       IN           VARCHAR2 CHARACTER SET lob_loc%CHARSET);
```

Parameters

Table 108-47 FRAGMENT_INSERT Procedure Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .
amount	Number of bytes (BLOB) or characters (CLOB/NCLOB) to be inserted into the LOB

Table 108-47 (Cont.) FRAGMENT_INSERT Procedure Parameters

Parameter	Description
offset	Offset into the LOB in bytes (BLOB) or characters (CLOB/NCLOB) to begin the insertion
buffer	Data to insert into the LOB

Exceptions

Table 108-48 FRAGMENT_INSERT Procedure Exceptions

Exception	Description
INVALID_ARGVAL	A parameter value was invalid
QUERY_WRITE	Cannot perform operation during a query
SECUREFILE_BADLOB	A non-SECUREFILE LOB was used in a SECUREFILE LOB only call
SECUREFILE_OUTOFBOUNDS	Attempted to perform a FRAGMENT_* operation past LOB end

Usage Notes

FRAGMENT_INSERT gets the LOB, if necessary, before performing operations on the LOB.

108.8.21 FRAGMENT_MOVE Procedure

This procedure moves the amount of bytes (BLOB) or characters (CLOB/NCLOB) from the specified offset to the new offset specified.

Syntax

```
DBMS_LOB.FRAGMENT_MOVE (
  lob_loc      IN OUT NOCOPY BLOB,
  amount       IN           INTEGER,
  src_offset   IN           INTEGER,
  dest_offset  IN           INTEGER);

DBMS_LOB.FRAGMENT_MOVE (
  lob_loc      IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  amount       IN           INTEGER,
  src_offset   IN           INTEGER,
  dest_offset  IN           INTEGER);
```

Parameters

Table 108-49 FRAGMENT_MOVE Procedure Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .
amount	Number of bytes (BLOB) or characters (CLOB/NCLOB) to be moved in the LOB

Table 108-49 (Cont.) FRAGMENT_MOVE Procedure Parameters

Parameter	Description
src_offset	Beginning offset into the LOB in bytes (BLOB) or characters (CLOB/NCLOB) to put the data
dest_offset	Beginning offset into the LOB in bytes (BLOB) or characters (CLOB/NCLOB) to remove the data

Exceptions

Table 108-50 FRAGMENT_MOVE Procedure Exceptions

Exception	Description
INVALID_ARGVAL	A parameter value was invalid
QUERY_WRITE	Cannot perform operation during a query
SECUREFILE_BADLOB	A non-SECUREFILE LOB was used in a SECUREFILE LOB only call
SECUREFILE_OUTOFBOUNDS	Attempted to perform a FRAGMENT_* operation past LOB end

Usage Notes

- All offsets are pre-move offsets.
- Offsets of more than 1 past the end of the LOB are not permitted.
- FRAGMENT_MOVE gets the LOB, if necessary, before performing operations on the LOB.

108.8.22 FRAGMENT_REPLACE Procedures

This procedure replaces the data at the specified offset with the specified data (not to exceed 32k).

Syntax

```

DBMS_LOB.FRAGMENT_REPLACE (
  lob_loc      IN OUT NOCOPY BLOB,
  old_amount   IN           INTEGER,
  new_amount   IN           INTEGER,
  offset       IN           INTEGER,
  buffer       IN           RAW);

DBMS_LOB.FRAGMENT_REPLACE (
  lob_loc      IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,  old_amount
IN           INTEGER,
  new_amount   IN           INTEGER,
  offset       IN           INTEGER,
  buffer       IN           VARCHAR2 CHARACTER SET lob_loc%CHARSET);

```


Parameters

Table 108-51 FRAGMENT_REPLACE Function Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .
old_amount	Number of bytes (BLOB) or characters (CLOB/NCLOB) to be replaced in the LOB
new_amount	Number of bytes (BLOB) or characters (CLOB/NCLOB) to written to the LOB
offset	Beginning offset into the LOB in bytes (BLOB) or characters (CLOB/NCLOB) to put the data
buffer	Data to insert into the LOB

Exceptions

Table 108-52 FRAGMENT_REPLACE Procedure Exceptions

Exception	Description
INVALID_ARGVAL	A parameter value was invalid
QUERY_WRITE	Cannot perform operation during a query
SECUREFILE_BADLOB	A non-SECUREFILE LOB was used in a SECUREFILE LOB only call
SECUREFILE_OUTOFBOUNDS	Attempted to perform a FRAGMENT_* operation past LOB end

Usage Notes

- Invoking this procedure is equivalent to deleting the old amount of bytes/characters at offset and then inserting the new amount of bytes/characters at offset.
- FRAGMENT_REPLACE gets the LOB, if necessary, before performing operations on the LOB.

108.8.23 FREETEMPORARY Procedures

This procedure frees the temporary BLOB or CLOB in the default temporary tablespace.

Syntax

```
DBMS_LOB.FREETEMPORARY (
    lob_loc IN OUT NOCOPY BLOB);

DBMS_LOB.FREETEMPORARY (
    lob_loc IN OUT NOCOPY CLOB CHARACTER SET ANY_CS);
```

Parameters

Table 108-53 FREETEMPORARY Procedure Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .

Usage Notes

- When a new temporary LOB is created, and there is currently no temporary LOB in use with the same duration (session, call), a new temporary LOB segment is created. When the temporary LOB is freed, the space it consumed is released to the temporary segment. If there are no other temporary LOBs for the same duration, the temporary segment is also freed.
- After the call to `FREETEMPORARY`, the LOB locator that was freed is marked as invalid.
- If an invalid LOB locator is assigned to another LOB locator using `OCILOBLocatorAssign` in OCI or through an assignment operation in PL/SQL, then the target of the assignment is also freed and marked as invalid.



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.24 GET_DBFS_LINK Functions

This function returns the DBFS path name for the specified SecureFile LOB.

Syntax

```
DBMS_LOB.GET_DBFS_LINK (
  lob_loc          IN      BLOB,
  storage_path     OUT  VARCHAR2(DBFS_LINK_PATH_MAX_SIZE),
  lob_length       OUT  NUMBER);
```

```
DBMS_LOB.GET_DBFS_LINK (
  lob_loc          IN      CLOB CHARACTER SET ANY_CS,
  storage_path     OUT  VARCHAR2(DBFS_LINK_PATH_MAX_SIZE),
  lob_length       OUT  NUMBER);
```

Parameters

Table 108-54 GET_DBFS_LINK Function Parameters

Parameter	Description
lob_loc	LOB to be retrieved from DBFS
storage_path	Path where the LOB is stored in DBFS

Table 108-54 (Cont.) GET_DBFS_LINK Function Parameters

Parameter	Description
lob_length	LOB length at the time of write to DBFS

Return Values

The Archive ID

Exceptions

Table 108-55 GET_DBFS_LINK Function Exceptions

Exception	Description
SECUREFILE_BADLOB	lob_loc is not a SECUREFILE
ORA-01555	The LOB has already been retrieved and has been modified since retrieval or the LOB has been migrated in and out (modified or not) since the locator was retrieved

108.8.25 GET_DBFS_LINK_STATE Procedures

GET_DBFS_LINK_STATE retrieves the current link state of the specified SecureFile.

Syntax

```
DBMS_LOB.GET_DBFS_LINK_STATE (
  lob_loc      IN BLOB,
  storage_path OUT VARCHAR2(DBFS_LINK_PATH_MAX_SIZE),
  state        OUT NUMBER,
  cached       OUT BOOLEAN);
```

```
DBMS_LOB.GET_DBFS_LINK_STATE (
  lob_loc      IN CLOB CHARACTER SET ANY_CS,
  storage_path OUT VARCHAR2(DBFS_LINK_PATH_MAX_SIZE),
  state        OUT NUMBER,
  cached       OUT BOOLEAN);
```

Parameters

Table 108-56 GET_DBFS_LINK_STATE Procedure Parameters

Parameter	Description
lob_loc	LOB to be retrieved from the archive
storage_path	Path where the LOB is stored in the DBFS HSM store
state	One of DBFS_LINK_NEVER, DBFS_LINK_NO or DBFS_LINK_YES
cached	If the LOB is archived and the data was specified to be cached on put

Exceptions

Table 108-57 GET_DBFS_LINK_STATE Procedure Exceptions

Exception	Description
SECUREFILE_BADLOB	lob_loc is not a SECUREFILE

Usage Notes

- If the LOB has never been archived, state is set to DBMS_LOB.DBFS_LINK_NEVER. If the LOB has been archived, state is set to DBMS_LOB.DBFS_LINK_YES. If the LOB has been previously retrieved from the archive, state is set to DBFS_LINK_NO.
- If the LOB was archived, but the data was left in the RDBMS, cached is set to TRUE. If the data was removed after the link was created, cached is set to FALSE, and NULL if state is DBMS_LOB.DBFS_LINK_NEVER.

108.8.26 GET_LOB_DEDUPLICATION_RATIO Function

The GET_LOB_DEDUPLICATION_RATIO function estimates the storage space that you can save by enabling the deduplication feature for an existing SecureFile LOB and returns the deduplication ratio.

The deduplication ratio is estimated for the number of rows in the LOB column that you specify. For example, let's consider that the deduplication ratio is 2.33. It indicates that after you enable the deduplication feature, you can save around half of the space for the sampled rows in the LOB column.

Disclaimer: The deduplication ratio is an approximate value, which is calculated based on the sampled rows in the LOB column. The actual space that you save when you enable deduplication for the complete table may be different.

Syntax

```
DBMS_LOB.GET_LOB_DEDUPLICATION_RATIO (
    tablespacename      IN    VARCHAR2,
    tabowner            IN    VARCHAR2,
    tabname             IN    VARCHAR2,
    lobcolumnname      IN    VARCHAR2,
    partname           IN    VARCHAR2,
    dedup_ratio        OUT   NUMBER,
    subset_numrows     IN    NUMBER DEFAULT DEDUP_RATIO_LOB_MAXROWS
)
```

Parameters

Table 108-58 GET_DBFS_LINK_STATE Procedure Parameters

Parameter	Description
tablespacena me	Name of the tablespace

Table 108-58 (Cont.) GET_DBFS_LINK_STATE Procedure Parameters

Parameter	Description
tabowner	Owner of the table
tabname	Name of the table
lobcolumnname	Name of the LOB column for which you want to calculate the deduplication ratio
partname	In case of partitioned tables, enter the related partition name
subset_numrows	Number of rows sampled to estimate the deduplication ratio. By default, the deduplication ratio is calculated for all the rows.

Return Values

Returns the deduplication ratio, `dedup_ratio`, which indicates the space that you can save by enabling the deduplication feature.

Example

The following sample code calculates and returns the deduplication ratio for `c`, a LOB column, in `ACME_TABLE`, which is owned by `JOHN`.

```

DECLARE
    dedup_ratio    number;
    l_table_name   varchar2(128) = "ACME_TABLE";
    l_column_name  varchar2(3000) = "C";
    l_tablespace_name varchar2(128) := "TBS";
    l_owner        varchar2(128) := "JOHN";
BEGIN
    dedup_ratio := dbms_lob.GET_LOB_DEDUPLICATION_RATIO(
        l_tablespace_name,
        l_owner,
        l_table_name,
        l_column_name,
        '',
        dedup_ratio,
        -1);
    dbms_output.put_line('Deduplication ratio: ' || dedup_ratio);
END;

```

Usage Notes

- The maximum number of LOBs that this function can process is 100000 or 1% of the total number of rows in the table, whichever is lesser.

108.8.27 GETCONTENTTYPE Functions

This procedure returns the content type string previously set by means of the SETCONTENTTYPE Procedure.

Syntax

```
DBMS_LOB.GETCONTENTTYPE (
    lob_loc IN BLOB)
RETURN VARCHAR2;

DBMS_LOB.GETCONTENTTYPE (
    lob_loc IN CLOB CHARACTER SET ANY_CS)
RETURN VARCHAR2;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES(getcontenttype, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 108-59 GETCONTENTTYPE Function Parameters

Parameter	Description
lob_loc	LOB whose content type is to be retrieved

Return Values

The returned content type.

If the SecureFiles LOB does not have a contenttype associated with it, GETCONTENTTYPE() returns NULL.

Exceptions

Table 108-60 GETCONTENTTYPE Function Exceptions

Exception	Description
SECUREFILE_BADLOB	lob_loc is not a SECUREFILE

Related Topics

- [SETCONTENTTYPE Procedure](#)
This procedure sets the content type string for the data in the LOB.

108.8.28 GET_STORAGE_LIMIT Function

This function returns the LOB storage limit for the specified LOB.

Syntax

```
DBMS_LOB.GET_STORAGE_LIMIT (
    lob_loc IN CLOB CHARACTER SET ANY_CS)
RETURN INTEGER;
```

```
DBMS_LOB.GET_STORAGE_LIMIT (
    lob_loc IN BLOB)
RETURN INTEGER;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES(get_storage_limit, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 108-61 GET_STORAGE_LIMIT Function Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .

Return Value

The value returned from this function is the maximum allowable size for specified LOB locator. For BLOBS, the return value depends on the block size of the tablespace the LOB resides in and is calculated as $(2^{32})-1$ (4294967295) times the block size of the tablespace. For CLOBS/NCLOBS, the value returned is the $(2^{32})-1$ (4294967295) times the block size of the tablespace divided by the character width of the CLOB/NCLOB.

Usage



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for details on LOB storage limits

108.8.29 GETCHUNKSIZE Functions

When creating the table, you can specify the chunking factor, a multiple of tablespace blocks in bytes. This corresponds to the chunk size used by the LOB data layer when accessing or modifying the LOB value. Part of the chunk is used to store system-related information, and the rest stores the LOB value. This function returns the amount of space used in the LOB chunk to store the LOB value.

Syntax

```
DBMS_LOB.GETCHUNKSIZE (
    lob_loc IN BLOB)
RETURN INTEGER;
```

```
DBMS_LOB.GETCHUNKSIZE (
    lob_loc IN CLOB CHARACTER SET ANY_CS)
RETURN INTEGER;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES(getchunksize, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 108-62 GETCHUNKSIZE Function Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .

Return Values

The return value is a usable chunk size in bytes.

Usage Notes

- With regard to basic LOB files, performance is improved if you enter read/write requests using a multiple of this chunk size. For writes, there is an added benefit, because LOB chunks are versioned, and if all writes are done on a chunk basis, then no extra or excess versioning is done or duplicated. You could batch up the `WRITE` until you have enough for a chunk, instead of issuing several `WRITE` calls for the same chunk.

These tactics of performance improvement do not apply to SecureFiles.
- Note that chunk size is independent of LOB type (`BLOB`, `CLOB`, `NCLOB`, Unicode or other character set).



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.30 GETLENGTH Functions

This function gets the length of the specified LOB. The length in bytes or characters is returned.

The length returned for a `BFILE` includes the `EOF`, if it exists. Any 0-byte or space filler in the LOB caused by previous `ERASE` or `WRITE` operations is also included in the length count. The length of an empty internal LOB is 0.

Syntax

```
DBMS_LOB.GETLENGTH (
  lob_loc   IN BLOB)
RETURN INTEGER;
```

```
DBMS_LOB.GETLENGTH (
  lob_loc   IN CLOB CHARACTER SET ANY_CS)
RETURN INTEGER;
```

```
DBMS_LOB.GETLENGTH (
  file_loc  IN BFILE)
RETURN INTEGER;
```


Pragmas

```
pragma restrict_references(GETLENGTH, WNDS, WNPS, RNDS, RNPS);
```

Parameters

Table 108-63 GETLENGTH Function Parameter

Parameter	Description
file_loc	The file locator for the LOB whose length is to be returned.

Return Values

The length of the LOB in bytes or characters as an `INTEGER`. `NULL` is returned if the input LOB is `NULL` or if the input `lob_loc` is `NULL`. An error is returned in the following cases for `BFILEs`:

- `lob_loc` does not have the necessary directory and operating system privileges
- `lob_loc` cannot be read because of an operating system read error

 **See Also:**

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.31 GETOPTIONS Functions

This function obtains compression, deduplication, and encryption settings corresponding to the `option_type` field for a particular LOB.

Syntax

```
DBMS_LOB.GETOPTIONS (
  lob_loc          IN      BLOB,
  option_types     IN      PLS_INTEGER)
RETURN PLS_INTEGER;
```

```
DBMS_LOB.GETOPTIONS (
  lob_loc          IN      CLOB CHARACTER SET ANY_CS,
  option_types     IN      PLS_INTEGER)
RETURN PLS_INTEGER;
```

Parameters

Table 108-64 GETOPTIONS Function Parameter

Parameter	Description
lob_loc	Locator for the LOB to be examined. For more information, see Operational Notes .
option_type	See Table 108-2

Return Values

The return values are a combination of COMPRESS_ON, ENCRYPT_ON and DEDUPLICATE_ON (see Table 108-3) depending on which option types (see Table 108-2) are passed in.

Exceptions

Table 108-65 GETOPTIONS Procedure Exceptions

Exception	Description
INVALID_ARGVAL	A parameter value was invalid
QUERY_WRITE	Cannot perform operation during a query
SECUREFILE_BADLOB	A non-SECUREFILE LOB was used in a SECUREFILE LOB only call

Usage Notes

You cannot turn compression or deduplication on or off for a SecureFile column that does not have those features on. The GetOptions Functions and [SETOPTIONS Procedures](#) work on individual SecureFiles. You can turn off a feature on a particular SecureFile and turn on a feature that has already been turned off by SetOptions, but you cannot turn on an option that has not been given to the SecureFile when the table was created.

108.8.32 INSTR Functions

This function returns the matching position of the *n*th occurrence of the pattern in the LOB, starting from the offset you specify.

Syntax

```
DBMS_LOB.INSTR (
  lob_loc   IN   BLOB,
  pattern   IN   RAW,
  offset    IN   INTEGER := 1,
  nth       IN   INTEGER := 1)
RETURN INTEGER;
```

```
DBMS_LOB.INSTR (
  lob_loc   IN   CLOB          CHARACTER SET ANY_CS,
  pattern   IN   VARCHAR2     CHARACTER SET lob_loc%CHARSET,
  offset    IN   INTEGER := 1,
  nth       IN   INTEGER := 1)
RETURN INTEGER;
```

```
DBMS_LOB.INSTR (
  file_loc  IN   BFILE,
  pattern   IN   RAW,
  offset    IN   INTEGER := 1,
  nth       IN   INTEGER := 1)
RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(INSTR, WNDS, WNPS, RNDS, RNPS);
```

Parameters

Table 108-66 INSTR Function Parameters

Parameter	Description
lob_loc	Locator for the LOB to be examined. For more information, see Operational Notes .
file_loc	The file locator for the LOB to be examined.
pattern	Pattern to be tested for. The pattern is a group of RAW bytes for BLOBs, and a character string (VARCHAR2) for CLOBs. The maximum size of the pattern is 16383 bytes.
offset	Absolute offset in bytes (BLOBs) or characters (CLOBs) at which the pattern matching is to start. (origin: 1)
nth	Occurrence number, starting at 1.

Return Values

Table 108-67 INSTR Function Return Values

Return	Description
INTEGER	Offset of the start of the matched pattern, in bytes or characters. It returns 0 if the pattern is not found.
NULL	Either: -any one or more of the IN parameters was NULL or INVALID. -offset < 1 or offset > LOBMAXSIZE. -nth < 1. -nth > LOBMAXSIZE.

Usage Notes

The form of the VARCHAR2 buffer (the pattern parameter) must match the form of the CLOB parameter. In other words, if the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.

For BFILEs, the file must be already opened using a successful FILEOPEN operation for this operation to succeed.

Operations that accept RAW or VARCHAR2 parameters for pattern matching, such as INSTR, do not support regular expressions or special matching characters (as in the case of SQL LIKE) in the pattern parameter or substrings.

Exceptions

Table 108-68 INSTR Function Exceptions for BFILES

Exception	Description
UNOPENED_FILE	File was not opened using the input locator.

Table 108-68 (Cont.) INSTR Function Exceptions for BFILES

Exception	Description
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.

 **See Also:**

- ["SUBSTR Functions"](#)
- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure

108.8.33 ISOPEN Functions

This function checks to see if the LOB was already opened using the input locator. This subprogram is for internal and external LOBs.

Syntax

```
DBMS_LOB.ISOPEN (
    lob_loc IN BLOB)
    RETURN INTEGER;

DBMS_LOB.ISOPEN (
    lob_loc IN CLOB CHARACTER SET ANY_CS)
    RETURN INTEGER;

DBMS_LOB.ISOPEN (
    file_loc IN BFILE)
    RETURN INTEGER;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES (isopen, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 108-69 ISOPEN Function Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .
file_loc	File locator.

Return Values

The return value is 1 if the LOB is open, 0 otherwise.

Usage Notes

For `BFILES`, openness is associated with the locator. If the input locator was never passed to `OPEN`, the `BFILE` is not considered to be opened by this locator. However, a different locator may have opened the `BFILE`. More than one `OPEN` can be performed on the same `BFILE` using different locators.

For internal LOBs, openness is associated with the LOB, not with the locator. If `locator1` opened the LOB, then `locator2` also sees the LOB as open. For internal LOBs, `ISOPEN` requires a round-trip, because it checks the state on the server to see if the LOB is indeed open.

For external LOBs (`BFILES`), `ISOPEN` also requires a round-trip, because that's where the state is kept.

 **See Also:**

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.34 ISREMOTE Function

This function checks to see if the LOB is local to the database or if it belongs to a remote database.

Syntax

```
DBMS_LOB.ISREMOTE (
    lob_loc IN BLOB)
    RETURN BOOLEAN;

DBMS_LOB.ISREMOTE (
    lob_loc IN CLOB CHARACTER SET ANY_CS)
    RETURN BOOLEAN;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES(isremote, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 108-70 ISREMOTE Function Parameter

Parameter	Description
<code>lob_loc</code>	Locator for the LOB.

Return Values

`BOOLEAN`: `TRUE` for remote LOBs obtained over a database link; `FALSE` for LOBs obtained from local database

 **See Also:**

- *Distributed LOBs* chapter in Database SecureFiles and Large Objects Developer's Guide for more details on the usage of this procedure.

108.8.35 ISSECUREFILE Function

This function returns `TRUE` if the LOB locator passed to it is for a SecureFile LOB. It returns `FALSE` otherwise.

Syntax

```
DBMS_LOB ISSECUREFILE(
    lob_loc IN BLOB)
RETURN BOOLEAN;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES(issecurefile, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 108-71 ISSECUREFILE Function Parameter

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .

Return Values

This function returns `TRUE` if the LOB locator passed to it is for a SecureFile LOB. It returns `FALSE` otherwise.

108.8.36 ISTEMPORARY Functions

This function determines whether a LOB instance is temporary.

Syntax

```
DBMS_LOB.ISTEMPORARY (
    lob_loc IN BLOB)
RETURN INTEGER;

DBMS_LOB.ISTEMPORARY (
    lob_loc IN CLOB CHARACTER SET ANY_CS)
RETURN INTEGER;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES(istemporary, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 108-72 ISTEMPORARY Procedure Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .

Return Values

The return value is 1 if the LOB is temporary and exists; 0 if the LOB is not temporary or does not exist; NULL if the given locator is NULL.

Usage Notes

When you free a Temporary LOB with `FREETEMPORARY`, the LOB locator is not set to NULL. Consequently, `ISTEMPORARY` will return 0 for a locator that has been freed but not explicitly reset to NULL.

 **See Also:**

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.37 LOADBLOBFROMFILE Procedure

This procedure loads data from BFILE to internal BLOB. This achieves the same outcome as `LOADFROMFILE`, and returns the new offsets.

Syntax

```
DBMS_LOB.LOADBLOBFROMFILE (
  dest_lob    IN OUT NOCOPY BLOB,
  src_bfile   IN           BFILE,
  amount      IN           INTEGER,
  dest_offset IN OUT      INTEGER,
  src_offset  IN OUT      INTEGER);
```

Parameters

Table 108-73 LOADBLOBFROMFILE Procedure Parameters

Parameter	Description
dest_lob	BLOB locator of the target for the load.
src_bfile	BFILE locator of the source for the load.
amount	Number of bytes to load from the BFILE. You can also use <code>DBMS_LOB.LOBBMAXSIZE</code> to load until the end of the BFILE.
dest_offset	(IN) Offset in bytes in the destination BLOB (origin: 1) for the start of the write. (OUT) New offset in bytes in the destination BLOB right after the end of this write, which is also where the next write should begin.

Table 108-73 (Cont.) LOADBLOBFROMFILE Procedure Parameters

Parameter	Description
src_offset	(IN) Offset in bytes in the source BFILE (origin: 1) for the start of the read. (OUT) Offset in bytes in the source BFILE right after the end of this read, which is also where the next read should begin.

Usage Notes

- You can specify the offsets for both the source and destination LOBs, and the number of bytes to copy from the source BFILE. The amount and src_offset, because they refer to the BFILE, are in terms of bytes, and the dest_offset is in bytes for BLOBs.
- If the offset you specify in the destination LOB is beyond the end of the data currently in this LOB, then zero-byte fillers or spaces are inserted in the destination BLOB. If the offset is less than the current length of the destination LOB, then existing data is overwritten.
- There is an error if the input amount plus offset exceeds the length of the data in the BFILE (unless the amount specified is LOBMAXSIZE which you can specify to continue loading until the end of the BFILE is reached).
- It is not mandatory that you wrap the LOB operation inside the OPEN/CLOSE operations. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.
- If you do not wrap the LOB operation inside the OPEN/CLOSE, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the OPEN or CLOSE statement.
- LOADFROMFILE gets the destination LOB prior to the load unless the load covers the entire LOB.

Constants and Defaults

There is no easy way to omit parameters. You must either declare a variable for IN/OUT parameter or provide a default value for the IN parameter. Here is a summary of the constants and the defaults that can be used.

Table 108-74 Suggested Values of the Parameter

Parameter	Default Value	Description
amount	DBMS_LOB.LOBMAXSIZE (IN)	Load the entire file
dest_offset	1 (IN)	start from the beginning
src_offset	1 (IN)	start from the beginning

Constants defined in DBMSLOB.SQL


```
lobmaxsize          CONSTANT INTEGER          := DBMS_LOB.LOBMAXSIZE;
```

Exceptions

Table 108-75 LOADBLOBFROMFILE Procedure Exceptions

Exception	Description
VALUE_ERROR	Any of the input parameters are NULL or INVALID.
INVALID_ARGVAL	Either: <ul style="list-style-type: none"> - src_offset or dest_offset < 1. - src_offset or dest_offset > LOBMAXSIZE. - amount < 1. - amount > LOBMAXSIZE.



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.38 LOADCLOBFROMFILE Procedure

This procedure loads data from a BFILE to an internal CLOB/NCLOB with necessary character set conversion and returns the new offsets.

Syntax

```
DBMS_LOB.LOADCLOBFROMFILE (
  dest_lob          IN OUT NOCOPY  NOCOPY CLOB CHARACTER SET ANY_CS,
  src_bfile         IN             BFILE,
  amount            IN             INTEGER,
  dest_offset       IN OUT         INTEGER,
  src_offset        IN OUT         INTEGER,
  bfile_csid        IN             NUMBER,
  lang_context      IN OUT         INTEGER,
  warning           OUT            INTEGER);
```

Parameters

Table 108-76 LOADCLOBFROMFILE Procedure Parameters

Parameter	Description
dest_lob	CLOB/NCLOB locator of the target for the load.
src_bfile	BFILE locator of the source for the load.
amount	Number of bytes to load from the BFILE. Use DBMS_LOB.LOBMAXSIZE of load until the end of the BFILE.

Table 108-76 (Cont.) LOADCLOBFROMFILE Procedure Parameters

Parameter	Description
<code>dest_offset</code>	(IN) Offset in characters in the destination CLOB (origin: 1) for the start of the write. (OUT) The new offset in characters right after the end of this load, which is also where the next load should start. It always points to the beginning of the first complete character after the end of load. If the last character is not complete, offset goes back to the beginning of the partial character.
<code>src_offset</code>	(IN) Offset in bytes in the source BFILE (origin: 1) for the start of the read. (OUT) Offset in bytes in the source BFILE right after the end of this read, which is also where the next read should begin.
<code>bfile_csid</code>	Character set id of the source (BFILE) file.
<code>lang_context</code>	(IN) Language context, such as shift status, for the current load. (OUT) The language context at the time when the current load stopped, and what the next load should be using if continuing loading from the same source. This information is returned to the user so that they can use it for the continuous load without losing or misinterpreting any source data. For the very first load or if do not care, simply use the default 0. The details of this language context is hidden from the user. One does not need to know what it is or what's in it in order to make the call
<code>warning</code>	(OUT) Warning message. This indicates something abnormal happened during the loading. It may or may not be caused by the user's mistake. The loading is completed as required, and it's up to the user to check the warning message. Currently, the only possible warning is the inconvertible character. This happens when the character in the source cannot be properly converted to a character in destination, and the default replacement character (for example, '?') is used in place. The message is defined the constant value <code>DBMS_LOB.WARN_INCONVERTIBLE_CHAR</code> .

Usage Notes

You can specify the offsets for both the source and destination LOBs, and the number of bytes to copy from the source BFILE. The `amount` and `src_offset`, because they refer to the BFILE, are in terms of bytes, and the `dest_offset` is in characters for CLOBs.

If the offset you specify in the destination LOB is beyond the end of the data currently in this LOB, then zero-byte fillers or spaces are inserted in the destination CLOB. If the offset is less than the current length of the destination LOB, then existing data is overwritten.

There is an error if the input amount plus offset exceeds the length of the data in the BFILE (unless the amount specified is `LOBMAXSIZE` which you can specify to continue loading until the end of the BFILE is reached).

Note the following requirements:

- The destination character set is always the same as the database character set in the case of CLOB and national character set in the case of NCLOB.

- `csid=0` indicates the default behavior that uses database `csid` for CLOB and national `csid` for NLOB in the place of source `csid`. Conversion is still necessary if it is of varying width
- It is not mandatory that you wrap the LOB operation inside the `OPEN/CLOSE` operations. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

If you do not wrap the LOB operation inside the `OPEN/CLOSE`, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the `OPEN` or `CLOSE` statement.

The source `BFILE` can contain data in the Unicode character set. The Unicode standard defines many encoding schemes that provide mappings from Unicode characters to sequences of bytes. [Table 108-77](#) lists Unicode encodings schemes supported by this subprogram.

Table 108-77 Supported Unicode Encoding Schemes

Encoding Scheme	Oracle Name	bfile_csid Value
UTF-8	AL32UTF8	873
UTF-16BE	AL16UTF16	2000
UTF-16LE	AL16UTF16LE	2002
CESU-8	UTF8	871
UTF-EBCDIC	UTFE	872
UTF-16	UTF16	1000

All three `UTF-16` encoding schemes encode Unicode characters as 2-byte unsigned integers. Integers can be stored in big-endian or in little-endian byte order. The `UTF-16BE` encoding scheme defines big-endian data. The `UTF-16LE` scheme defines little-endian data. The `UTF-16` scheme requires that the source `BFILE` contains the Byte Order Mark (BOM) character in the first two bytes to define the byte order. The BOM code is `0xFEFF`. If the code is stored as `{0xFE, 0xFF}`, the data is interpreted as big-endian. If it is stored as `{0xFF, 0xFE}`, the data is interpreted as little-endian.

In `UTF-8` and in `CESU-8` encodings the Byte Order Mark is stored as `{0xEF, 0xBB, 0xBF}`. With any of the Unicode encodings, the corresponding BOM sequence at the beginning of the file is recognized and not loaded into the destination LOB.

Constants

Here is a summary of the constants and the suggested values that can be used.

Table 108-78 Suggested Values of the `LOADCLOBFROMFILE` Parameter

Parameter	Suggested Value	Description
<code>amount</code>	<code>DBMS_LOB.LOBMAXSIZE (IN)</code>	Load the entire file
<code>dest_offset</code>	<code>1 (IN)</code>	start from the beginning

Table 108-78 (Cont.) Suggested Values of the LOADCLOBFROMFILE Parameter

Parameter	Suggested Value	Description
src_offset	1 (IN)	start from the beginning
csid	0 (IN)	default csid, use destination csid
lang_context	0 (IN)	default language context
warning	0 (OUT)	no warning message, everything is ok

Constants defined in DBMSLOB.SQL

```
lobmaxsize          CONSTANT INTEGER      := 18446744073709551615;
warn_inconvertible_char  CONSTANT INTEGER      := 1;
default_csid        CONSTANT INTEGER      := 0;
default_lang_ctx    CONSTANT INTEGER      := 0;
no_warning          CONSTANT INTEGER      := 0;
```

Exceptions

Table 108-79 LOADCLOBFROMFILE Procedure Exceptions

Exception	Description
VALUE_ERROR	Any of the input parameters are NULL or INVALID.
INVALID_ARGVAL	Either: - src_offset or dest_offset < 1. - src_offset or dest_offset > LOBMAXSIZE. - amount < 1. - amount > LOBMAXSIZE.



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.39 MOVE_TO_DBFS_LINK Procedures

This procedure archives the specified LOB data (from the database) into the DBFS HSM Store.

Syntax

```
DBMS_LOB.MOVE_TO_DBFS_LINK (
  lob_loc      IN OUT BLOB,
  storage_path IN      VARCHAR2(dbfs_link_path_max_size),
  flags        IN      BINARY_INTEGER DEFAULT DBFS_LINK_NOCACHE);

DBMS_LOB.MOVE_TO_DBFS_LINK (
  lob_loc      IN OUT CLOB CHARACTER SET ANY_CS,
```

```

storage_path IN VARCHAR2(dbfs_link_path_max_size),
flags       IN BINARY_INTEGER DEFAULT DBFS_LINK_NOCACHE);

```

Parameters

Table 108-80 MOVE_TO_DBFS_LINK Procedure Parameters

Parameter	Description
lob_loc	LOB to be archived
storage_path	Path where the LOB will be stored
flags	Either <code>DBFS_LINK_CACHE</code> or <code>DBFS_LINK_NOCACHE</code> . If <code>DBFS_LINK_CACHE</code> is specified, the LOB data continues to be stored in the RDBMS as well as being written to the DBFS store. <code>DBFS_LINK_NOCACHE</code> specifies that the LOB data should be deleted from the RDBMS once written to the DBFS.

Exceptions

Table 108-81 MOVE_TO_DBFS_LINK Procedure Exceptions

Exception	Description
<code>SECUREFILE_BADLOB</code>	lob_loc is not a SECUREFILE

Usage Notes

- If the LOB is already archived, the procedure silently returns as if the put was successful. In that case, if `DBFS_LINK_NOCACHE` is specified, or `flags` is defaulted, the LOB data is removed from the RDBMS.
- Calling this procedure multiple times on the same LOB with the same flags has no effect.
- Calling the procedure on a LOB that is already archived causes the LOB to be cached (`DBFS_LINK_CACHE`) or removed (`DBFS_LINK_NOCACHE`) according to the flag setting.

108.8.40 OPEN Procedures

This procedure opens a LOB, internal or external, in the indicated mode. Valid modes include read-only, and read/write.

Syntax

```

DBMS_LOB.OPEN (
  lob_loc  IN OUT NOCOPY BLOB,
  open_mode IN          BINARY_INTEGER);

DBMS_LOB.OPEN (
  lob_loc  IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  open_mode IN          BINARY_INTEGER);

DBMS_LOB.OPEN (
  file_loc IN OUT NOCOPY BFILE,
  open_mode IN          BINARY_INTEGER := file_readonly);

```

Parameters

Table 108-82 OPEN Procedure Parameters

Parameter	Description
lob_loc	LOB locator. For more information, see Operational Notes .
open_mode	Mode in which to open. For BLOB and CLOB types, the mode can be either: LOB_READONLY or LOB_READWRITE. For BFILE types, the mode must be FILE_READONLY.

Usage Notes

Note:

If the LOB was opened in read-only mode, and if you try to write to the LOB, then an error is returned. BFILE can only be opened with read-only mode.

OPEN requires a round-trip to the server for both internal and external LOBs. For internal LOBs, OPEN triggers other code that relies on the OPEN call. For external LOBs (BFILES), OPEN requires a round-trip because the actual operating system file on the server side is being opened.

It is not mandatory that you wrap all LOB operations inside the Open/Close interfaces. However, if you open a LOB, you must close it before you commit the transaction; an error is produced if you do not. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

It is an error to commit the transaction before closing all opened LOBs that were opened by the transaction. When the error is returned, the openness of the open LOBs is discarded, but the transaction is successfully committed. Hence, all the changes made to the LOB and non-LOB data in the transaction are committed, but the domain and function-based indexes are not updated. If this happens, you should rebuild the functional and domain indexes on the LOB column.

See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.41 READ Procedures

This procedure reads a piece of a LOB, and returns the specified amount into the `buffer` parameter, starting from an absolute offset from the beginning of the LOB.

The number of bytes or characters actually read is returned in the `amount` parameter. If the input `offset` points past the End of LOB, then `amount` is set to 0, and a `NO_DATA_FOUND` exception is raised.

Syntax

```
DBMS_LOB.READ (
  lob_loc   IN          BLOB,
  amount    IN OUT     NOCOPY INTEGER,
  offset     IN          INTEGER,
  buffer     OUT        RAW);

DBMS_LOB.READ (
  lob_loc   IN          CLOB CHARACTER SET ANY_CS,
  amount    IN OUT     NOCOPY INTEGER,
  offset     IN          INTEGER,
  buffer     OUT        VARCHAR2 CHARACTER SET lob_loc%CHARSET);

DBMS_LOB.READ (
  file_loc  IN          BFILE,
  amount    IN OUT     NOCOPY INTEGER,
  offset     IN          INTEGER,
  buffer     OUT        RAW);
```

Parameters

Table 108-83 READ Procedure Parameters

Parameter	Description
<code>lob_loc</code>	Locator for the LOB to be read. For more information, see Operational Notes .
<code>file_loc</code>	The file locator for the LOB to be examined.
<code>amount</code>	Number of bytes (for BLOBs) or characters (for CLOBs) to read, or number that were read.
<code>offset</code>	Offset in bytes (for BLOBs) or characters (for CLOBs) from the start of the LOB (origin: 1).
<code>buffer</code>	Output buffer for the read operation.

Exceptions

[Table 108-84](#) lists exceptions that apply to any LOB instance. [Table 108-85](#) lists exceptions that apply only to BFILES.

Table 108-84 READ Procedure Exceptions

Exception	Description
<code>VALUE_ERROR</code>	Any of <code>lob_loc</code> , <code>amount</code> , or <code>offset</code> parameters are NULL.

Table 108-84 (Cont.) READ Procedure Exceptions

Exception	Description
INVALID_ARGVAL	Either: <ul style="list-style-type: none"> - amount < 1 - amount > 32767 bytes (or the character equivalent) - offset < 1 - offset > LOBMAXSIZE - amount is greater, in bytes or characters, than the capacity of buffer.
NO_DATA_FOUND	End of the LOB is reached, and there are no more bytes or characters to read from the LOB: amount has a value of 0.

Table 108-85 READ Procedure Exceptions for BFILES

Exception	Description
UNOPENED_FILE	File is not opened using the input locator.
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.

Usage Notes

- The form of the VARCHAR2 buffer must match the form of the CLOB parameter. In other words, if the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.
- When calling DBMS_LOB.READ from the client (for example, in a BEGIN/END block from within SQL*Plus), the returned buffer contains data in the client's character set. The database converts the LOB value from the server's character set to the client's character set before it returns the buffer to the user.
- READ gets the LOB, if necessary, before the read.
- If the LOB is a DBFS LINK, data is streamed from DBFS, if possible, otherwise an exception is thrown.



See Also:

Oracle Database SecureFiles and Large Objects Developer's Guide for additional details on usage of this procedure

108.8.42 SET_DBFS_LINK Procedures

This function links the specified SecureFile to the specified path name. It does not copy the data to the path.

Syntax

```
DBMS_LOB.SET_DBFS_LINK (
  lob_loc      IN OUT BLOB,
  archive_id   IN      RAW(1024));

DBMS_LOB.SET_DBFS_LINK(
  lob_loc_dst  IN OUT CLOB CHARACTER SET ANY_CS,
  archive_id   IN      RAW(1024));
```

Parameters

Table 108-86 SET_DBFS_LINK Procedure Parameters

Parameter	Description
lob_loc	LOB for which to store the reference value
archive_id	Archive ID as returned by calling either of the GET_DBFS_LINK Functions

Exceptions

Table 108-87 SET_DBFS_LINK Procedure Exceptions

Exception	Description
SECUREFILE_BADLOB	lob_loc is not a SECUREFILE

108.8.43 SETCONTENTTYPE Procedure

This procedure sets the content type string for the data in the LOB.

Syntax

```
DBMS_LOB.SETCONTENTTYPE (
  lob_loc      IN OUT NOCOPY BLOB,
  contenttype  IN      VARCHAR2);

DBMS_LOB.SETCONTENTTYPE (
  lob_loc      IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  contenttype  IN      VARCHAR2);
```

Parameters

Table 108-88 SETCONTENTTYPE Procedure Parameters

Parameter	Description
lob_loc	LOB to be assigned the content type

Table 108-88 (Cont.) SETCONTENTTYPE Procedure Parameters

Parameter	Description
contenttype	String to be assigned

Exceptions

Table 108-89 SETCONTENTTYPE Procedure Exceptions

Exception	Description
SECUREFILE_BADLOB	lob_loc is not a SECUREFILE

Usage Notes

To clear an existing content type associated with a SECUREFILE, invoke SETCONTENTTYPE with contenttype set to empty string.

108.8.44 SETOPTIONS Procedures

This procedure enables/disables compression and deduplication on a per-LOB basis, overriding the default LOB column settings.

Syntax

```

DBMS_LOB.SETOPTIONS (
  lob_loc          IN      BLOB,
  option_types     IN      PLS_INTEGER,
  options          IN      PLS_INTEGER);

DBMS_LOB.SETOPTIONS (
  lob_loc          IN      CLOB CHARACTER SET ANY_CS,
  option_types     IN      PLS_INTEGER,
  options          IN      PLS_INTEGER);

```

Parameters

Table 108-90 SETOPTIONS Procedure Parameter

Parameter	Description
lob_loc	Locator for the LOB to be examined. For more information, see Operational Notes .
option_type	See Table 108-2
options	See Table 108-3

Exceptions

Table 108-91 SETOPTIONS Procedure Exceptions

Exception	Description
SECUREFILE_BADLOB	Unsupported object type for the operation
INVALID_ARGVAL	A parameter value was invalid
QUERY_WRITE	Cannot perform operation during a query

Usage Notes

- DBMS_LOB.SETOPTIONS cannot be used to enable or disable encryption on individual LOBs.
- You cannot turn the compression or deduplication features on or off for a SecureFile column if they were not turned when the table was created.
The [GETOPTIONS Functions](#) and SETOPTIONS Procedures work on individual SecureFiles. You can turn off compression or deduplication on a particular SecureFiles LOB and turn them on, *if they have already been turned off by SETOPTIONS*.
- This call incurs a round-trip to the server to make the changes persistent.

108.8.45 SUBSTR Functions

This function returns `amount` bytes or characters of a LOB, starting from an absolute `offset` from the beginning of the LOB.

For fixed-width `n`-byte CLOBs, if the input `amount` for SUBSTR is greater than $(32767/n)$, then SUBSTR returns a character buffer of length $(32767/n)$, or the length of the CLOB, whichever is lesser. For CLOBs in a varying-width character set, `n` is the maximum byte-width used for characters in the CLOB.

Syntax

```
DBMS_LOB.SUBSTR (
  lob_loc      IN      BLOB,
  amount       IN      INTEGER := 32767,
  offset       IN      INTEGER := 1)
RETURN RAW;

DBMS_LOB.SUBSTR (
  lob_loc      IN      CLOB CHARACTER SET ANY_CS,
  amount       IN      INTEGER := 32767,
  offset       IN      INTEGER := 1)
RETURN VARCHAR2 CHARACTER SET lob_loc%CHARSET;

DBMS_LOB.SUBSTR (
  file_loc     IN      BFILE,
  amount       IN      INTEGER := 32767,
  offset       IN      INTEGER := 1)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(SUBSTR, WNDS, WNPS, RNDS, RNPS);
```

Parameters

Table 108-92 SUBSTR Function Parameters

Parameter	Description
lob_loc	Locator for the LOB to be read. For more information, see Operational Notes .
file_loc	The file locator for the LOB to be examined.
amount	Number of bytes (for BLOBs) or characters (for CLOBs) to be read.
offset	Offset in bytes (for BLOBs) or characters (for CLOBs) from the start of the LOB (origin: 1).

Return Values

Table 108-93 SUBSTR Function Return Values

Return	Description
RAW	Function overloading that has a BLOB or BFILE in parameter.
VARCHAR2	CLOB version.
NULL	Either: - any input parameter is NULL - amount < 1 - amount > 32767 - offset < 1 - offset > LOBMAXSIZE

Exceptions

Table 108-94 SUBSTR Function Exceptions for BFILE operations

Exception	Description
UNOPENED_FILE	File is not opened using the input locator.
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.

Usage Notes

- The form of the VARCHAR2 buffer must match the form of the CLOB parameter. In other words, if the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.
- When calling DBMS_LOB.SUBSTR from the client (for example, in a BEGIN/END block from within SQL*Plus), the returned buffer contains data in the client's character

set. The database converts the LOB value from the server's character set to the client's character set before it returns the buffer to the user.

- `DBMS_LOB.SUBSTR` will return 8191 or more characters based on the characters stored in the LOBs. If all characters are not returned as a consequence of the character byte size exceeding the available buffer, the user should either call `DBMS_LOB.SUBSTR` with a new offset to read the remaining characters, or call the subprogram on loop until all the data is extracted.
- `SUBSTR` gets the LOB, if necessary, before read.
- If the LOB is a DBFS Link, the data is streamed from DBFS, if possible, otherwise, an exception is thrown.

See Also:

- ["INSTR Functions"](#)
- ["READ Procedures"](#)
- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure

108.8.46 TRIM Procedures

This procedure trims the value of the internal LOB to the length you specify in the `newlen` parameter.

Specify the length in bytes for `BLOBs`, and specify the length in characters for `CLOBs`.

Note:

The `TRIM` procedure decreases the length of the LOB to the value specified in the `newlen` parameter.

If you attempt to `TRIM` an empty LOB, then nothing occurs, and `TRIM` returns no error. If the new length that you specify in `newlen` is greater than the size of the LOB, then an exception is raised.

Syntax

```
DBMS_LOB.TRIM (
  lob_loc      IN OUT NOCOPY BLOB,
  newlen       IN          INTEGER);

DBMS_LOB.TRIM (
  lob_loc      IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  newlen       IN          INTEGER);
```

Parameters

Table 108-95 TRIM Procedure Parameters

Parameter	Description
lob_loc	Locator for the internal LOB whose length is to be trimmed. For more information, see Operational Notes .
newlen	New, trimmed length of the LOB value in bytes for BLOBs or characters for CLOBs.

Exceptions

Table 108-96 TRIM Procedure Exceptions

Exception	Description
VALUE_ERROR	lob_loc is NULL.
INVALID_ARGVAL	Either: - new_len < 0 - new_len > LOBMAXSIZE
QUERY_WRITE	Cannot perform a LOB write inside a query or PDML parallel execution server

Usage Notes

- It is not mandatory that you wrap the LOB operation inside the Open/Close interfaces. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.
- If you do not wrap the LOB operation inside the Open/Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the OPEN or CLOSE statement.
- TRIM gets the LOB, if necessary, before altering the length of the LOB, unless the new length specified is '0'

See Also:

- ["ERASE Procedures"](#)
- ["WRITEAPPEND Procedures"](#)
- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure

108.8.47 WRITE Procedures

This procedure writes a specified amount of data into an internal LOB, starting from an absolute offset from the beginning of the LOB. The data is written from the `buffer` parameter.

`WRITE` replaces (overwrites) any data that already exists in the LOB at the offset, for the length you specify.

Syntax

```
DBMS_LOB.WRITE (
  lob_loc IN OUT NOCOPY BLOB,
  amount  IN              INTEGER,
  offset  IN              INTEGER,
  buffer  IN              RAW);

DBMS_LOB.WRITE (
  lob_loc IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
  amount  IN              INTEGER,
  offset  IN              INTEGER,
  buffer  IN              VARCHAR2 CHARACTER SET lob_loc%CHARSET);
```

Parameters

Table 108-97 WRITE Procedure Parameters

Parameter	Description
<code>lob_loc</code>	Locator for the internal LOB to be written to. For more information, see Operational Notes
<code>amount</code>	Number of bytes (for BLOBs) or characters (for CLOBs) to write
<code>offset</code>	Offset in bytes (for BLOBs) or characters (for CLOBs) from the start of the LOB (origin: 1) for the write operation.
<code>buffer</code>	Input buffer for the write

Exceptions

Table 108-98 WRITE Procedure Exceptions

Exception	Description
<code>VALUE_ERROR</code>	Any of <code>lob_loc</code> , <code>amount</code> , or <code>offset</code> parameters are NULL, out of range, or INVALID.
<code>INVALID_ARGVAL</code>	Either: <ul style="list-style-type: none"> - <code>amount < 1</code> - <code>amount > 32767</code> bytes (or the character equivalent) - <code>offset < 1</code> - <code>offset > LOBMAXSIZE</code>
<code>QUERY_WRITE</code>	Cannot perform a LOB write inside a query or PDML parallel execution server
<code>SECUREFILE_OUTOFBOUNDS</code>	Attempted to perform a write operation past the end of a LOB having <code>FRAGMENT_*</code> on it

Usage Notes

- There is an error if the input amount is more than the data in the buffer. If the input amount is less than the data in the buffer, then only amount bytes or characters from the buffer is written to the LOB. If the offset you specify is beyond the end of the data currently in the LOB, then zero-byte fillers or spaces are inserted in the BLOB or CLOB respectively.
- The form of the VARCHAR2 buffer must match the form of the CLOB parameter. In other words, if the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.
- When calling DBMS_LOB.WRITE from the client (for example, in a BEGIN/END block from within SQL*Plus), the buffer must contain data in the client's character set. The database converts the client-side buffer to the server's character set before it writes the buffer data to the LOB.
- It is not mandatory that you wrap the LOB operation inside the Open/Close interfaces. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.
- If you do not wrap the LOB operation inside the Open/Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the OPEN or CLOSE statement.
- WRITE gets the LOB, if necessary, before writing the LOB, unless the write is specified to overwrite the entire LOB.



See Also:

- ["APPEND Procedures"](#)
- ["COPY Procedures"](#)
- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure

108.8.48 WRITEAPPEND Procedures

This procedure writes a specified amount of data to the end of an internal LOB. The data is written from the `buffer` parameter.

Syntax

```
DBMS_LOB.WRITEAPPEND (  
    lob_loc IN OUT NOCOPY BLOB,  
    amount IN             INTEGER,  
    buffer IN             RAW);
```

```
DBMS_LOB.WRITEAPPEND (
```



```
lob_loc IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
amount IN INTEGER,
buffer IN VARCHAR2 CHARACTER SET lob_loc%CHARSET);
```

Parameters

Table 108-99 WRITEAPPEND Procedure Parameters

Parameter	Description
lob_loc	Locator for the internal LOB to be written to. For more information, see Operational Notes
amount	Number of bytes (for BLOBs) or characters (for CLOBs) to write
buffer	Input buffer for the write

Usage Notes

There is an error if the input amount is more than the data in the buffer. If the input amount is less than the data in the buffer, then only amount bytes or characters from the buffer are written to the end of the LOB.

Exceptions

Table 108-100 WRITEAPPEND Procedure Exceptions

Exception	Description
VALUE_ERROR	Any of lob_loc, amount, or offset parameters are NULL, out of range, or INVALID.
INVALID_ARGVAL	Either: - amount < 1 - amount > 32767 bytes (or the character equivalent)
QUERY_WRITE	Cannot perform a LOB write inside a query or PDML parallel execution server

Usage Notes

- The form of the VARCHAR2 buffer must match the form of the CLOB parameter. In other words, if the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.
- When calling DBMS_LOB.WRITEAPPEND from the client (for example, in a BEGIN/END block from within SQL*Plus), the buffer must contain data in the client's character set. The database converts the client-side buffer to the server's character set before it writes the buffer data to the LOB.
- It is not mandatory that you wrap the LOB operation inside the Open/Close interfaces. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

- If you do not wrap the LOB operation inside the Open/Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the `OPEN` or `CLOSE` statement.
- `WRITEAPPEND` gets the LOB, if necessary, before appending to the LOB.

 **See Also:**

- ["APPEND Procedures"](#)
- ["COPY Procedures"](#)
- ["WRITE Procedures"](#)
- *Oracle Database SecureFiles and Large Objects Developer's Guide* for additional details on usage of this procedure

DBMS_LOCK

The `DBMS_LOCK` package provides an interface to Oracle Lock Management services.

You can request a lock of a specific mode, give it a unique name recognizable in another procedure in the same or another instance, change the lock mode, and release it.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Rules and Limits](#)
- [Operational Notes](#)
- [Summary of DBMS_LOCK Subprograms](#)



See Also:

For more information, and an example of how to use the `DBMS_LOCK` package, see *Oracle Database Development Guide*.

109.1 DBMS_LOCK Overview

The `DBMS_LOCK` package has many beneficial uses.

These uses include the following:

- Providing exclusive access to a device, such as a terminal
- Providing application-level enforcement of read locks
- Detecting when a lock is released and cleanup after the application
- Synchronizing applications and enforcing sequential processing

109.2 DBMS_LOCK Security Model

There might be operating system-specific limits on the maximum number of total locks available. This *must* be considered when using locks or making this package available to other users. Consider granting the `EXECUTE` privilege only to specific users or roles.

A better alternative would be to create a cover package limiting the number of locks used and grant `EXECUTE` privilege to specific users. An example of a cover package is documented in the `DBMS_LOCK.SQL` package specification file. The abbreviations for these locks as they appear in Enterprise Manager monitors are in parentheses.

109.3 DBMS_LOCK Constants

The `DBMS_LOCK` package includes several constants to use when specifying parameter values.

These constants are shown in the following table.

Table 109-1 DBMS_LOCK Constants

Name	Alternate Name(s)	Type	Value	OEM Abbreviation	Description
NL_MODE	NuLl	INTEGER	1	-	-
SS_MODE	Sub Shared	INTEGER	2	ULRS	This can be used on an aggregate object to indicate that share locks are being acquired on subparts of the object.
SX_MODE	<ul style="list-style-type: none"> Sub eXclusive Row Exclusive Mode 	INTEGER	3	ULRX	This can be used on an aggregate object to indicate that exclusive locks are being acquired on sub-parts of the object.
S_MODE	<ul style="list-style-type: none"> Shared Row Exclusive Mode Intended Exclusive 	INTEGER	4	ULRSX	-
SSX_MODE	<ul style="list-style-type: none"> Shared Sub eXclusive Share Row Exclusive Mode 	INTEGER	5	-	This indicates that the entire aggregate object has a share lock, but some of the sub-parts may additionally have exclusive locks.
X_MODE	Exclusive	INTEGER	6	ULX	-

These are the various lock modes (nl -> "NuLl", ss -> "Sub Shared", sx -> "Sub eXclusive", s -> "Shared", ssx -> "Shared Sub eXclusive", x -> "eXclusive").

109.4 DBMS_LOCK. Rules and Limits

When another process holds "held", an attempt to get "get" succeeds or fails, based on the held mode and type of get.

The following table describes the results:

Table 109-2 Lock Compatibility

HELD MODE	GET NL	GET SS	GET SX	GET S	GET SSX	GET X
NL	Success	Success	Success	Success	Success	Success
SS	Success	Success	Success	Success	Success	Fail

Table 109-2 (Cont.) Lock Compatibility

HELD MODE	GET NL	GET SS	GET SX	GET S	GET SSX	GET X
SX	Success	Success	Success	Fail	Fail	Fail
S	Success	Success	Fail	Success	Fail	Fail
SSX	Success	Success	Fail	Fail	Fail	Fail
X	Success	Fail	Fail	Fail	Fail	Fail

```
maxwait constant integer := 32767;
```

The constant `maxwait` waits forever.

109.5 DBMS_LOCK Operational Notes

User locks never conflict with Oracle locks because they are identified with the prefix "UL". You can view these locks using the Enterprise Manager lock monitor screen or the appropriate fixed views.

User locks are automatically released when a session terminates. The lock identifier is a number in the range of 0 to 1073741823.

Because a reserved user lock is the same as an Oracle lock, it has all the functionality of an Oracle lock, such as deadlock detection. Be certain that any user locks used in distributed transactions are released upon `COMMIT`, or an undetected deadlock may occur.

`DBMS_LOCK` is most efficient with a limit of a few hundred locks for each session. Oracle strongly recommends that you develop a standard convention for using these locks in order to avoid conflicts among procedures trying to use the same locks. For example, include your company name as part of your lock names.

109.6 Summary of DBMS_LOCK Subprograms

This table lists the `DBMS_LOCK` subprograms and briefly describes them.

Table 109-3 DBMS_LOCK Package Subprograms

Subprogram	Description
ALLOCATE_UNIQUE Procedure	Allocates a unique lock ID to a named lock
ALLOCATE_UNIQUE_AUTONOMOUS Procedure	Allocates a unique lock ID to a named lock
CONVERT Function	Converts a lock from one mode to another
RELEASE Function	Releases a lock
REQUEST Function	Requests a lock of a specific mode.

109.6.1 ALLOCATE_UNIQUE Procedure

This procedure allocates a unique lock identifier (in the range of 1073741824 to 1999999999) a specified lock name. Lock identifiers are used to enable applications to coordinate their use of locks. This is provided because it may be easier for applications to coordinate their use of locks based on lock names rather than lock numbers.

Syntax

```
DBMS_LOCK.ALLOCATE_UNIQUE (
    lockname      IN VARCHAR2,
    lockhandle    OUT VARCHAR2,
    expiration_secs IN INTEGER DEFAULT 864000);
```

Parameters

Table 109-4 ALLOCATE_UNIQUE Procedure Parameters

Parameter	Description
lockname	Name of the lock for which you want to generate a unique ID. Do not use lock names beginning with ORA\$; these are reserved for products supplied by Oracle.
lockhandle	Returns the handle to the lock ID generated by ALLOCATE_UNIQUE. You can use this handle in subsequent calls to REQUEST, CONVERT, and RELEASE. A handle is returned instead of the actual lock ID to reduce the chance that a programming error accidentally creates an incorrect, but valid, lock ID. This provides better isolation between different applications that are using this package. LOCKHANDLE can be up to VARCHAR2 (128). All sessions using a lock handle returned by ALLOCATE_UNIQUE with the same lock name are referring to the same lock. Therefore, do not pass lock handles from one session to another.
expiration_secs	Number of seconds to wait after the last ALLOCATE_UNIQUE has been performed on a specified lock, before permitting that lock to be deleted from the DBMS_LOCK_ALLOCATED table. The default waiting period is 10 days. You should not delete locks from this table. Subsequent calls to ALLOCATE_UNIQUE may delete expired locks to recover space.

Usage Notes

If you choose to identify locks by name, you can use ALLOCATE_UNIQUE to generate a unique lock identification number for these named locks.

The first session to call ALLOCATE_UNIQUE with a new lock name causes a unique lock ID to be generated and stored in the dbms_lock_allocated table. Subsequent calls (usually by other sessions) return the lock ID previously generated.

A lock name is associated with the returned lock ID for at least expiration_secs (defaults to 10 days) past the last call to ALLOCATE_UNIQUE with the specified lock

name. After this time, the row in the `dbms_lock_allocated` table for this lock name may be deleted in order to recover space. `ALLOCATE_UNIQUE` performs a commit.

⚠ WARNING:

Named user locks may be less efficient, because Oracle uses SQL to determine the lock associated with a specified name.

Exceptions

ORA-20000, ORU-10003: Unable to find or insert lock <lockname> into catalog `dbms_lock_allocated`.

109.6.2 ALLOCATE_UNIQUE_AUTONOMOUS Procedure

This procedure allocates a unique lock identifier (in the range of 1073741824 to 1999999999) a specified lock name and is an autonomous version of the `ALLOCATE_UNIQUE` procedure. This procedure works exactly same as that of `ALLOCATE_UNIQUE`, except that the procedure will run as an autonomous transaction. Therefore the commits in `ALLOCATE_UNIQUE_AUTONOMOUS` procedure will not affect the calling procedure. The `ALLOCATE_UNIQUE_AUTONOMOUS` procedure is implemented in DB 12.1 and later releases.

Syntax

```
DBMS_LOCK.ALLOCATE_UNIQUE_AUTONOMOUS (
    lockname          IN  VARCHAR2,
    lockhandle        OUT VARCHAR2,
    expiration_secs   IN  INTEGER   DEFAULT 864000);
```

Parameters

Table 109-5 ALLOCATE_UNIQUE_AUTONOMOUS Procedure Parameters

Parameter	Description
lockname	Name of the lock for which you want to generate a unique ID. Do not use lock names beginning with <code>ORA\$</code> ; these are reserved for products supplied by Oracle.
lockhandle	Returns the handle to the lock ID generated by <code>ALLOCATE_UNIQUE_AUTONOMOUS</code> . You can use this handle in subsequent calls to <code>REQUEST</code> , <code>CONVERT</code> , and <code>RELEASE</code> . A handle is returned instead of the actual lock ID to reduce the chance that a programming error accidentally creates an incorrect, but valid, lock ID. This provides better isolation between different applications that are using this package. <code>LOCKHANDLE</code> can be up to <code>VARCHAR2 (128)</code> . All sessions using a lock handle returned by <code>ALLOCATE_UNIQUE_AUTONOMOUS</code> with the same lock name are referring to the same lock. Therefore, do not pass lock handles from one session to another.

Table 109-5 (Cont.) ALLOCATE_UNIQUE_AUTONOMOUS Procedure Parameters

Parameter	Description
<code>expiration_secs</code>	<p>Number of seconds to wait after the last <code>ALLOCATE_UNIQUE_AUTONOMOUS</code> has been performed on a specified lock, before permitting that lock to be deleted from the <code>ALLOCATE_UNIQUE_AUTONOMOUS</code> table.</p> <p>The default waiting period is 10 days. You should not delete locks from this table. Subsequent calls to <code>ALLOCATE_UNIQUE_AUTONOMOUS</code> may delete expired locks to recover space.</p>

Usage Notes

If you choose to identify locks by name, you can use `ALLOCATE_UNIQUE_AUTONOMOUS` to generate a unique lock identification number for these named locks.

The first session to call `ALLOCATE_UNIQUE_AUTONOMOUS` with a new lock name causes a unique lock ID to be generated and stored in the `dbms_lock_allocated` table. Subsequent calls (usually by other sessions) return the lock ID previously generated.

A lock name is associated with the returned lock ID for at least `expiration_secs` (defaults to 10 days) past the last call to `ALLOCATE_UNIQUE_AUTONOMOUS` with the specified lock name. After this time, the row in the `dbms_lock_allocated` table for this lock name may be deleted in order to recover space. `ALLOCATE_UNIQUE_AUTONOMOUS` performs a commit.

WARNING:

Named user locks may be less efficient, because Oracle uses SQL to determine the lock associated with a specified name.

Exceptions

ORA-20000, ORU-10003: Unable to find or insert lock <lockname> into catalog `dbms_lock_allocated`.

109.6.3 CONVERT Function

This function converts a lock from one mode to another. `CONVERT` is an overloaded function that accepts either a user-defined lock identifier, or the lock handle returned by the `ALLOCATE_UNIQUE` procedure.

Syntax

```
DBMS_LOCK.CONVERT(
  id          IN INTEGER ||
  lockhandle  IN VARCHAR2,
  lockmode   IN INTEGER,
  timeout     IN NUMBER DEFAULT MAXWAIT)
RETURN INTEGER;
```


Parameters

Table 109-6 CONVERT Function Parameters

Parameter	Description
id or lockhandle	User assigned lock identifier, from 0 to 1073741823, or the lock handle, returned by <code>ALLOCATE_UNIQUE</code> , of the lock mode you want to change
lockmode	New mode that you want to assign to the specified lock. For the available modes and their associated integer identifiers, see Constants .
timeout	Number of seconds to continue trying to change the lock mode. If the lock cannot be converted within this time period, then the call returns a value of 1 (timeout).

Return Values

Table 109-7 CONVERT Function Return Values

Return Value	Description
0	Success
1	Timeout
2	Deadlock
3	Parameter error
4	Don't own lock specified by id or lockhandle
5	Illegal lock handle

109.6.4 RELEASE Function

This function explicitly releases a lock previously acquired using the `REQUEST` function.

Locks are automatically released at the end of a session. `RELEASE` is an overloaded function that accepts either a user-defined lock identifier, or the lock handle returned by the `ALLOCATE_UNIQUE` procedure.

Syntax

```
DBMS_LOCK.RELEASE (
    id          IN INTEGER)
    RETURN INTEGER;
```

```
DBMS_LOCK.RELEASE (
    lockhandle IN VARCHAR2)
    RETURN INTEGER;
```

Parameters

Table 109-8 RELEASE Function Parameter

Parameter	Description
id or lockhandle	User assigned lock identifier, from 0 to 1073741823, or the lock handle, returned by <code>ALLOCATE_UNIQUE</code> , of the lock mode you want to change

Return Values

Table 109-9 RELEASE Function Return Values

Return Value	Description
0	Success
3	Parameter error
4	Do not own lock specified by id or lockhandle
5	Illegal lock handle

109.6.5 REQUEST Function

This function requests a lock with a specified mode.

`REQUEST` is an overloaded function that accepts either a user-defined lock identifier, or the lock handle returned by the `ALLOCATE_UNIQUE` procedure.

Syntax

```
DBMS_LOCK.REQUEST(
  id          IN  INTEGER ||
  lockhandle  IN  VARCHAR2,
  lockmode    IN  INTEGER DEFAULT X_MODE,
  timeout     IN  INTEGER DEFAULT MAXWAIT,
  release_on_commit IN  BOOLEAN DEFAULT FALSE)
RETURN INTEGER;
```

The current default values, such as `X_MODE` and `MAXWAIT`, are defined in the `DBMS_LOCK` package specification.

Parameters

Table 109-10 REQUEST Function Parameters

Parameter	Description
id or lockhandle	User assigned lock identifier, from 0 to 1073741823, or the lock handle, returned by <code>ALLOCATE_UNIQUE</code> , of the lock mode you want to change
lockmode	Mode that you are requesting for the lock. For the available modes and their associated integer identifiers, see Constants .

Table 109-10 (Cont.) REQUEST Function Parameters

Parameter	Description
<code>timeout</code>	Number of seconds to continue trying to grant the lock. If the lock cannot be granted within this time period, then the call returns a value of 1 (<code>timeout</code>).
<code>release_on_commit</code>	Set this parameter to <code>TRUE</code> to release the lock on commit or roll-back. Otherwise, the lock is held until it is explicitly released or until the end of the session.

Return Values**Table 109-11 REQUEST Function Return Values**

Return Value	Description
0	Success
1	Timeout
2	Deadlock
3	Parameter error
4	Already own lock specified by <code>id</code> or <code>lockhandle</code>
5	Illegal lock handle

DBMS_LOGMNR

The `DBMS_LOGMNR` package, one of a set of LogMiner packages, contains the subprograms you use to initialize the LogMiner tool and to begin and end a LogMiner session.

Note:

The ability to create flat file dictionary dumps of pluggable databases (PDBs) is desupported in Oracle Database 21c.

In previous releases, using a flat file dictionary was one means of mining the redo logs for the changes associated with a specific PDB whose data dictionary was contained within the flat file. This feature is now desupported. Starting with Oracle Database 21c, Oracle recommends that you call `DBMS_LOGMNR.START_LOGMNR`, and supply the system change number (SCN) or time range that you want to mine. The SCN or time range options of `START_LOGMNR` are enhanced to support mining of individual PDBs.

The `CONTINUOUS_MINE` functionality of the LogMiner package is obsolete. It was deprecated in Oracle Database 12c release 2 (12.2). There is no replacement functionality.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Views](#)
- [Operational Notes](#)
- [Summary of DBMS_LOGMNR Subprograms](#)

See Also:

Oracle Database Utilities for information regarding LogMiner.

110.1 DBMS_LOGMNR Overview

Oracle LogMiner, which is part of Oracle Database, enables you to query online and archived redo log files through a SQL interface. The `DBMS_LOGMNR` package provides the majority of the tools needed to start and stop LogMiner and specify the redo log files of interest. All changes made to user data or to the database dictionary are recorded in the Oracle redo log files, so that database recovery operations can be performed. You can take advantage of the data recorded in the redo log files to accomplish other tasks, such as the following::

- Pinpointing when a logical corruption to a database, such as errors made at the application level, may have begun
- Determining what actions you would have to take to perform fine-grained recovery at the transaction level.
- Performance tuning and capacity planning through trend analysis.
- Tracking any data manipulation language (DML) and data definition language (DDL) statements run on the database, the order in which they were executed, and who executed them.

 **See Also:**

[DBMS_LOGMNR_D](#) for information on the package subprograms that extract a LogMiner dictionary and re-create LogMiner tables in alternate tablespaces

110.2 DBMS_LOGMNR Security Model

You must have the `EXECUTE_CATALOG_ROLE` role to use the `DBMS_LOGMNR` package.

110.3 DBMS_LOGMNR Constants

The `DBMS_LOGMNR` package defines several enumerated constants for specifying parameter values. Enumerated constants must be prefixed with the package name, for example, `DBMS_LOGMNR.NEW`.

 **Note:**

The `continuous_mine` option for the `dbms_logmnr.start_logmnr` package is desupported in Oracle Database 19c (19.1), and is no longer available. The use of flat files is desupported for PDBs in Oracle Database 19c, and desupported entirely in later releases.

The following table describes the constants for the `ADD_LOGFILE` options flag in the `DBMS_LOGMNR` package.

Table 110-1 Constants for ADD_LOGFILE Options Flag

Constant	Description
NEW	Implicitly calls the <code>DBMS_LOGMNR.END_LOGMNR</code> procedure to end the current LogMiner session and then creates a new session. The new session starts a new list of redo log files to be analyzed, beginning with the redo log file you specify.
ADDFILE	Adds the specified redo log file to the list of redo log files to be analyzed. Any attempt to add a duplicate file raises an exception (ORA-01289). This is the default if no options flag is specified.

Table 110-2 describes the constants for the `START_LOGMNR` options flag in the `DBMS_LOGMNR` package.

Table 110-2 Constants for `START_LOGMNR` Options Flag

Constant	Description
<code>COMMITTED_DATA_ONLY</code>	<p>If set, DML statements corresponding to committed transactions are returned. DML statements corresponding to a committed transaction are grouped together. Transactions are returned in their commit order. Transactions that are rolled back or in-progress are filtered out, as are internal redo records (those related to index operations, management, and so on).</p> <p>If this option is not set, all rows for all transactions (committed, rolled back, and in-progress) are returned in the order in which they are found in the redo logs (in order of SCN values).</p>
<code>SKIP_CORRUPTION</code>	<p>Directs a select operation on the <code>V\$logmnr_contents</code> view to skip any corruptions in the redo log file being analyzed and continue processing. This option works only when a block in the redo log file (and not the header of the redo log file) is corrupt. You should check the <code>INFO</code> column in the <code>V\$logmnr_contents</code> view to determine the corrupt blocks skipped by LogMiner. When a corruption in the redo log file is skipped, the <code>OPERATION</code> column contains the value <code>CORRUPTED_BLOCKS</code>, and the <code>STATUS</code> column contains the value 1343.</p>
<code>DDL_DICT_TRACKING</code>	<p>If the LogMiner dictionary in use is in the redo log files, LogMiner updates its internal dictionary if a DDL event occurs. This ensures that correct <code>SQL_REDO</code> and <code>SQL_UNDO</code> information is maintained for objects that are modified after the LogMiner internal dictionary is built. The database to which LogMiner is connected must be open.</p> <p>This option cannot be used in conjunction with the <code>DICT_FROM_ONLINE_CATALOG</code> option.</p>
<code>DICT_FROM_ONLINE_CATALOG</code>	<p>Directs LogMiner to use the current online database dictionary rather than a LogMiner dictionary contained in the redo log files being analyzed.</p> <p>This option cannot be used in conjunction with the <code>DDL_DICT_TRACKING</code> option. The database to which LogMiner is connected must be the same one that generated the redo log files.</p> <p>Expect to see a value of 2 in the <code>STATUS</code> column of the <code>V\$logmnr_contents</code> view if the table definition in the database does not match the table definition in the redo log file.</p>
<code>DICT_FROM_REDO_LOGS</code>	<p>If set, LogMiner expects to find a LogMiner dictionary in the redo log files that were specified. The redo log files are specified with the <code>DBMS_LOGMNR.ADD_LOGFILE</code> procedure or with the <code>DBMS_LOGMNR.START_LOGMNR</code> procedure.</p>
<code>NO_SQL_DELIMITER</code>	<p>If set, the SQL delimiter (a semicolon) is not placed at the end of reconstructed SQL statements. This is helpful for applications that open a cursor and then execute the reconstructed statements.</p>
<code>NO_ROWID_IN_STMT</code>	<p>If set, the <code>ROWID</code> clause is not included in the reconstructed SQL statements. The redo log file may already contain logically unique identifiers for modified rows if supplemental logging is enabled.</p> <p>When using this option, you must be sure that supplemental logging was enabled in the source database at the appropriate level and that no duplicate rows exist in the tables of interest. LogMiner does not make any guarantee regarding the uniqueness of logical row identifiers.</p>

Table 110-2 (Cont.) Constants for START_LOGMNR Options Flag

Constant	Description
PRINT_PRETTY_SQL	If set, LogMiner formats the reconstructed SQL statements for ease of reading. These reconstructed SQL statements are not executable.
STRING_LITERALS_IN_STMT	If set, SQL_REDO and SQL_UNDO use literals for numbers and datetime and interval column types.

To specify more than one option, use a plus sign (+) between them. For example:

```
EXECUTE DBMS_LOGMNR.START_LOGMNR (OPTIONS => -
    DBMS_LOGMNR.DDL_DICT_TRACKING + DBMS_LOGMNR.DICT_FROM_REDO_LOGS);
```

110.4 DBMS_LOGMNR Views

The `DBMS_LOGMNR` package uses the views listed under *Accessing Logminer Operational Information In Views* in *Oracle Database Utilities*.



See Also:

Oracle Database Utilities

110.5 DBMS_LOGMNR Operational Notes

A **LogMiner session** begins with a call to `DBMS_LOGMNR.ADD_LOGFILE` or `DBMS_LOGMNR.START_LOGMNR` (the former if you plan to specify log files explicitly; the latter if you plan to use continuous mining). The session ends with a call to `DBMS_LOGMNR.END_LOGMNR`.

Within a LogMiner session, you can specify the redo log files to be analyzed and the SCN or time range of interest; then you can issue SQL `SELECT` statements against the `V$LOGMNR_CONTENTS` view to retrieve the data of interest.

`ADD_LOGFILE` Procedure must be invoked before `START_LOGMNR` Procedure.



Note:

You must add log files before filtering. Continuous logging is no longer supported. If logfiles have not been added that match the time or the SCN that you provide, then `DBMS_LOGMNR.START_LOGMNR` fails with the error `ORA-01291: missing logfile`.

110.6 Summary of DBMS_LOGMNR Subprograms

This table lists the DBMS_LOGMNR subprograms and briefly describes them.

In a multitenant container database (CDB) some subprograms must be called from the root. There may be other differences as well. See the individual subprogram descriptions for details.

Table 110-3 DBMS_LOGMNR Package Subprograms

Subprogram	Description
ADD_LOGFILE Procedure	Adds a redo log file to the existing or newly created list of redo log files for LogMiner to process, so that if a new list is created, this marks the beginning of a LogMiner session
COLUMN_PRESENT Function	Call this function for any row returned from the V\$logmnr_contents view to determine if undo or redo column values exist for the column specified by the column_name input parameter to this function
END_LOGMNR Procedure	Finishes a LogMiner session
MINE_VALUE Function	Call this function for any row returned from the V\$logmnr_contents view to retrieve the undo or redo column value of the column specified by the column_name input parameter to this function
REMOVE_LOGFILE Procedure	Removes a redo log file from the list of redo log files for LogMiner to process
START_LOGMNR Procedure	Initializes the LogMiner utility and starts LogMiner (unless the session was already started with a call to DBMS_LOGMNR.ADD_LOGFILE)

110.6.1 ADD_LOGFILE Procedure

This procedure adds a file to an existing or newly created list of log files for LogMiner to process.

Note:

The `continuous_mine` option for the `dbms_logmnr.start_logmnr` package is desupported in Oracle Database 19c (19.1), and is no longer available. The export of the LogMiner dictionary to flat files is desupported for PDBs in Oracle Database 19c, and desupported entirely in later releases.

In a CDB, the `ADD_LOGFILE` procedure must be called from the root database. You must have the `LOGMINING` administrative privilege to use this procedure.

Syntax

```
DBMS_LOGMNR.ADD_LOGFILE (
    LogFileName      IN VARCHAR2,
    options          IN BINARY_INTEGER default ADDFILE );
```


Parameters

Table 110-4 ADD_LOGFILE Procedure Parameters

Parameter	Description
LogFileNames	Specifies the name of the redo log file to add to the list of redo log files to be analyzed during this session.
options	Does one of the following: <ul style="list-style-type: none"> Starts a new LogMiner session and a new list of redo log files for analysis (DBMS_LOGMNR.NEW) Adds a file to an existing list of redo log files for analysis (DBMS_LOGMNR.ADDFILE) See Table 110-1 .

Exceptions

Table 110-5 ADD_LOGFILE Procedure Exceptions

Exception	Description
ORA-01284	Specified file cannot be opened.
ORA-01287	Specified file is from a different database incarnation.
ORA-01289	Specified file has already been added to the list. Duplicate redo log files cannot be added.
ORA-01290	Specified file is not in the current list and therefore cannot be removed from the list.
ORA-01324	Specified file cannot be added to the list because there is a DB_ID mismatch.

Usage Notes

- The DBMS_LOGMNR.ADD_LOGFILE call from a PDB connection is not supported for adhoc users and returns error 65040.
- Dumping Flat File dictionary and mining using Flat File dictionary are not supported from a PDB connection in Oracle Database 19c, and desupported entirely in later releases.
- Before querying the V\$LOGMNR_CONTENTS view, you must make a successful call to the DBMS_LOGMNR.START_LOGMNR procedure (within the current LogMiner session).
- The LogMiner session must be set up with a list of redo log files to be analyzed. Use the ADD_LOGFILE procedure to specify the list of redo log files to analyze.
- If you want to analyze more than one redo log file, you must call the ADD_LOGFILE procedure separately for each redo log file. The redo log files do not need to be registered in any particular order.
- Both archived and online redo log files can be mined.
- After you have added the first redo log file to the list, each additional redo log file that you add to the list must be associated with the same database and database RESETLOGS SCN as the first redo log file. (The database RESETLOGS SCN uniquely identifies each execution of an ALTER DATABASE OPEN RESETLOGS statement. When

the online redo logs are reset, Oracle creates a new and unique incarnation of the database.)

- To analyze the redo log files from a different database (or a database incarnation with a different database `RESETLOGS SCN`) than that with which the current list of redo log files is associated, use the `END_LOGMNR` procedure to end the current LogMiner session, and then build a new list using the `ADD_LOGFILE` procedure.
- LogMiner matches redo log files by the log sequence number. Thus, two redo log files with different names but with the same log sequence number will return the ORA-01289 exception. For instance, the online counterpart of an archived redo log file has a different name from the archived redo log file, but attempting to register it with LogMiner after registering the archived counterpart will result in the ORA-01289 exception being returned.

110.6.2 COLUMN_PRESENT Function

This function is designed to be used in conjunction with the `MINE_VALUE` function.

If the `MINE_VALUE` function returns a `NULL` value, it can mean either:

- The specified column is not present in the redo or undo portion of the data.
- The specified column is present and has a `NULL` value.

To distinguish between these two cases, use the `COLUMN_PRESENT` function, which returns a 1 if the column is present in the redo or undo portion of the data. Otherwise, it returns a 0.

Syntax

```
DBMS_LOGMNR.COLUMN_PRESENT (
    sql_redo_undo    IN RAW,
    column_name      IN VARCHAR2 default '') RETURN NUMBER;
```

Parameters

Table 110-6 COLUMN_PRESENT Function Parameters

Parameter	Description
<code>sql_redo_undo</code>	Specifies either the <code>REDO_VALUE</code> or the <code>UNDO_VALUE</code> column in the <code>V\$logmnr_contents</code> view from which to extract data values. See the Usage Notes for more information.
<code>column_name</code>	Specifies the fully qualified name (<code>schema.table.column</code>) of the column for which this function will return information. In a CDB, the column name is specified as follows: <code>container_name:schema.table.column</code>

Return Values

[Table 110-7](#) describes the return values for the `COLUMN_PRESENT` function. The `COLUMN_PRESENT` function returns 1 if the self-describing record (the first parameter) contains the column specified in the second parameter. This can be used to determine the meaning of `NULL` values returned by the `DBMS_LOGMNR.MINE_VALUE` function.

Table 110-7 Return Values for COLUMN_PRESENT Function

Return	Description
0	Specified column is not present in this row of V\$LOGMNR_CONTENTS.
1	Column is present in this row of V\$LOGMNR_CONTENTS.

Exceptions**Table 110-8 COLUMN_PRESENT Function Exceptions**

Exception	Description
ORA-01323	Currently, a LogMiner dictionary is not associated with the LogMiner session. You must specify a LogMiner dictionary for the LogMiner session.
ORA-00904	Value specified for the <code>column_name</code> parameter is not a fully qualified column name.

Usage Notes

- To use the `COLUMN_PRESENT` function, you must have successfully started LogMiner.
- The `COLUMN_PRESENT` function must be invoked in the context of a select operation on the `V$LOGMNR_CONTENTS` view.
- The `COLUMN_PRESENT` function does not support `LONG`, `LOB`, `ADT`, or `COLLECTION` datatypes.
- The value for the `sql_redo_undo` parameter depends on the operation performed and the data of interest:
 - If an update operation was performed and you want to know what the value was prior to the update operation, specify `UNDO_VALUE`.
 - If an update operation was performed and you want to know what the value is after the update operation, specify `REDO_VALUE`.
 - If an insert operation was performed, typically you would specify `REDO_VALUE` (because the value of a column prior to an insert operation will always be `NULL`).
 - If a delete operation was performed, typically you would specify `UNDO_VALUE` (because the value of a column after a delete operation will always be `NULL`).

110.6.3 END_LOGMNR Procedure

This procedure finishes a LogMiner session. Because this procedure performs cleanup operations that may not otherwise be done, you must use it to properly end a LogMiner session. This procedure is called automatically when you log out of a

database session or when you call `DBMS_LOGMNR.ADD_LOGFILE` and specify the `NEW` option.

Syntax

```
DBMS_LOGMNR.END_LOGMNR;
```

Exceptions

Table 110-9 END_LOGMNR Procedure Exception

Exception	Description
ORA-01307	No LogMiner session is currently active. The <code>END_LOGMNR</code> procedure was called without adding any log files or before the <code>START_LOGMNR</code> procedure was called

110.6.4 MINE_VALUE Function

This function facilitates queries based on a column's data value.

This function takes two arguments. The first one specifies whether to mine the redo (`REDO_VALUE`) or undo (`UNDO_VALUE`) portion of the data. The second argument is a string that specifies the fully qualified name of the column to be mined. The `MINE_VALUE` function always returns a string that can be converted back to the original datatype.

Syntax

```
DBMS_LOGMNR.MINE_VALUE (
    sql_redo_undo    IN RAW,
    column_name      IN VARCHAR2 default '') RETURN VARCHAR2;
```

Parameters

Table 110-10 MINE_VALUE Function Parameters

Parameter	Description
<code>sql_redo_undo</code>	Specifies either the <code>REDO_VALUE</code> or the <code>UNDO_VALUE</code> column in the <code>V\$logmnr_contents</code> view from which to extract data values. See the Usage Notes for more information.
<code>column_name</code>	Specifies the fully qualified name (<code>schema.table.column</code>) of the column for which this function will return information. In a CDB, the column name is specified as follows: <code>container_name:schema.table.column</code>

Return Values

Table 110-11 Return Values for MINE_VALUE Function

Return	Description
NULL	The column is not contained within the self-describing record, or the column value is NULL. To distinguish between the two different null possibilities, use the <code>DBMS_LOGMNR.COLUMN_PRESENT</code> function.

Table 110-11 (Cont.) Return Values for MINE_VALUE Function

Return	Description
NON-NULL	The column is contained within the self-describing record; the value is returned in string format.

Exceptions**Table 110-12 MINE_VALUE Function Exceptions**

Exception	Description
ORA-01323	Invalid state. Currently, a LogMiner dictionary is not associated with the LogMiner session. You must specify a LogMiner dictionary for the LogMiner session.
ORA-00904	Invalid identifier. The value specified for the <code>column_name</code> parameter was not a fully qualified column name.

Usage Notes

- To use the `MINE_VALUE` function, you must have successfully started LogMiner.
- The `MINE_VALUE` function must be invoked in the context of a select operation from the `V$logmnr_contents` view.
- The `MINE_VALUE` function does not support `LONG`, `LOB`, `ADT`, or `COLLECTION` datatypes.
- The value for the `sql_redo_undo` parameter depends on the operation performed and the data of interest:
 - If an update operation was performed and you want to know what the value was prior to the update operation, specify `UNDO_VALUE`.
 - If an update operation was performed and you want to know what the value is after the update operation, specify `REDO_VALUE`.
 - If an insert operation was performed, typically you would specify `REDO_VALUE` (because the value of a column prior to an insert operation will always be null).
 - If a delete operation was performed, typically you would specify `UNDO_VALUE` (because the value of a column after a delete operation will always be null).
- If the `DBMS_LOGMNR.MINE_VALUE` function is used to get an `NCHAR` value that includes characters not found in the database character set, then those characters are returned as the replacement character (for example, an inverted question mark) of the database character set.

110.6.5 REMOVE_LOGFILE Procedure

This procedure removes a redo log file from an existing list of redo log files for LogMiner to process.

In a CDB, the `REMOVE_LOGFILE` procedure must be called from the root database. You must have the `LOGMINING` administrative privilege to use this procedure.

Syntax

```
DBMS_LOGMNR.REMOVE_LOGFILE (
    LogFileName      IN VARCHAR2);
```

Parameters

Table 110-13 REMOVE_LOGFILE Procedure Parameters

Parameter	Description
LogFileName	Specifies the name of the redo log file to be removed from the list of redo log files to be analyzed during this session.

Exceptions

Table 110-14 REMOVE_LOGFILE Procedure Exception

Exception	Description
ORA-01290	Cannot remove unlisted log file

Usage Notes

- Before querying the `V$LOGMNR_CONTENTS` view, you must make a successful call to the `DBMS_LOGMNR.START_LOGMNR` procedure (within the current LogMiner session).
- You can use this procedure to remove a redo log file from the list of redo log files for LogMiner to process if you know that redo log file does not contain any data of interest.
- Multiple redo log files can be removed by calling this procedure repeatedly.
- The redo log files do not need to be removed in any particular order.
- To start a new list of redo log files for analysis, use the `END_LOGMNR` procedure to end the current LogMiner session, and then build a new list using the `ADD_LOGFILE` procedure.
- Even if you remove all redo log files from the list, any subsequent calls you make to the `ADD_LOGFILE` procedure must match the database ID and `RESETLOGS SCN` of the removed redo log files. Therefore, to analyze the redo log files from a different database (or a database incarnation with a different database `RESETLOGS SCN`) than that with which the current list of redo log files is associated, use the `END_LOGMNR` procedure to end the current LogMiner session, and then build a new list using the `ADD_LOGFILE` procedure.

110.6.6 START_LOGMNR Procedure

This procedure starts LogMiner by loading the dictionary that LogMiner will use to translate internal schema object identifiers to names.

In a CDB, the `START_LOGMNR` procedure must be called from the root database. You must have the `LOGMINING` administrative privilege to use this procedure.

 **Note:**

The ability to create flat file dictionary dumps of pluggable databases (PDBs) is desupported in Oracle Database 21c.

In previous releases, using a flat file dictionary was one means of mining the redo logs for the changes associated with a specific PDB whose data dictionary was contained within the flat file. This feature is now desupported. Starting with Oracle Database 21c, Oracle recommends that you call `DBMS_LOGMNR.START_LOGMNR`, and supply the system change number (SCN) or time range that you want to mine. The SCN or time range options of `START_LOGMNR` are enhanced to support mining of individual PDBs.

Syntax

```
DBMS_LOGMNR.START_LOGMNR (
  startScn          IN NUMBER default 0,
  endScn           IN NUMBER default 0,
  startTime        IN DATE default '01-jan-1988',
  endTime         IN DATE default '31-dec-2110',
  DictFileName     IN VARCHAR2 default '',
  Options         IN BINARY_INTEGER default 0 );
```

Parameters

Table 110-15 START_LOGMNR Procedure Parameters

Parameter	Description
startScn	Directs LogMiner to return only redo records with an SCN greater than or equal to the <code>startScn</code> specified. This fails if there is no redo log file containing the specified <code>startScn</code> value. (You can query the <code>FILENAME</code> , <code>LOW_SCN</code> , and <code>NEXT_SCN</code> columns in the <code>V\$LOGMNR_LOGS</code> view for each redo log file to determine the range of SCN values contained in each redo log file.)
endScn	Directs LogMiner to return only redo records with an SCN less than or equal to the <code>endScn</code> specified. If you specify an <code>endScn</code> value that is beyond the value in any redo log file, then LogMiner uses the greatest <code>endScn</code> value in the redo log file that contains the most recent changes. (You can query the <code>FILENAME</code> , <code>LOW_SCN</code> , and <code>NEXT_SCN</code> columns in the <code>V\$LOGMNR_LOGS</code> view for each redo log file to determine the range of SCN values contained in each redo log file.)
startTime	Directs LogMiner to return only redo records with a timestamp greater than or equal to the <code>startTime</code> specified. This fails if there is no redo log file containing the specified <code>startTime</code> value. (You can query the <code>FILENAME</code> , <code>LOW_TIME</code> , and <code>HIGH_TIME</code> columns in the <code>V\$LOGMNR_LOGS</code> view for each redo log file to determine the range of time covered in each redo log file.) This parameter is ignored if <code>startScn</code> is specified. See the Usage Notes for additional information.

Table 110-15 (Cont.) START_LOGMNR Procedure Parameters

Parameter	Description
endTime	Directs LogMiner to return only redo records with a timestamp less than or equal to the <code>endTime</code> specified. If you specify an <code>endTime</code> value that is beyond the value in any redo log file, then LogMiner will use the greatest <code>endTime</code> in the redo log file that contains the most recent changes. You can query the <code>FILENAME</code> , <code>LOW_TIME</code> , and <code>HIGH_TIME</code> columns in the <code>V\$LOGMNR_LOGS</code> view for each redo log file to determine the range of time covered in each redo log file.) This parameter is ignored if <code>endScn</code> is specified. See the Usage Notes for additional information.
DictFileName	Specifies the flat file that contains the LogMiner dictionary. It is used to reconstruct <code>SQL_REDO</code> and <code>SQL_UNDO</code> columns in <code>V\$LOGMNR_CONTENTS</code> , as well as to fully translate <code>SEG_NAME</code> , <code>SEG_OWNER</code> , <code>SEG_TYPE_NAME</code> , <code>TABLE_NAME</code> , and <code>TABLE_SPACE</code> columns. The fully qualified path name for the LogMiner dictionary file must be specified. (This file must have been created previously through the <code>DBMS_LOGMNR_D.BUILD</code> procedure.) You need to specify this parameter only if neither <code>DICT_FROM_REDO_LOGS</code> nor <code>DICT_FROM_ONLINE_CATALOG</code> is specified.
options	See Table 110-2 .

Exceptions

Table 110-16 START_LOGMNR Procedure Exceptions

Exception	Description
ORA-01280	Internal error encountered.
ORA-01281	<code>startScn</code> or <code>endScn</code> parameter value is not a valid SCN, or <code>endScn</code> is less than <code>startScn</code> .
ORA-01282	value for the <code>startTime</code> parameter was greater than the value specified for the <code>endTime</code> parameter, or there was no redo log file that was compatible with the date range specified with the <code>startTime</code> and <code>endTime</code> parameters.
ORA-01283	Options parameter specified is invalid.
ORA-01284	LogMiner dictionary file specified in the <code>DictFileName</code> parameter has a full path length greater than 256 characters, or the file cannot be opened.
ORA-01285	Error reading specified file.
ORA-01291	Redo log files that are needed to satisfy the user's requested SCN or time range are missing.
ORA-01292	No log file has been specified for the current LogMiner session.
ORA-01293	Mounted database required for specified LogMiner options.
ORA-01294	Error occurred while processing information in the specified dictionary file, possible corruption.

Table 110-16 (Cont.) START_LOGMNR Procedure Exceptions

Exception	Description
ORA-01295	Specified LogMiner dictionary does not correspond to the database that produced the log files being analyzed.
ORA-01296	Character set mismatch between specified LogMiner dictionary and log files.
ORA-01297	Redo version mismatch between LogMiner dictionary and log files.
ORA-01299	Specified LogMiner dictionary corresponds to a different database incarnation.
ORA-01300	Writable database required for specified LogMiner options.

Usage Notes

 **Note:**

The `continuous_mine` option for the `dbms_logmnr.start_logmnr` package is desupported in Oracle Database 19c (19.1), and is no longer available.

- The `DBMS_LOGMNR.ADD_LOGFILE` call from a PDB connection is not supported for adhoc users and returns error 65040.
- Users can specify the SCN range or the time range. The required logfiles will be added programmatically.
- Dumping Flat File dictionary and mining using Flat File dictionary are not supported from a PDB connection.
- LogMiner can use a dictionary that you previously extracted to the redo log files or to a flat file, or you can specify that LogMiner use the online catalog if LogMiner is mining data from the source system.
- After executing the `START_LOGMNR` procedure, you can query the following views:
 - `V$LOGMNR_CONTENTS` - contains history of information in redo log files
 - `V$LOGMNR_DICTIONARY` - contains current information about the LogMiner dictionary file extracted to a flat file
 - `V$LOGMNR_PARAMETERS` - contains information about the LogMiner session

(You can query the `V$LOGMNR_LOGS` view after a redo log file list has been added to the list of files that LogMiner is to mine.)
- Parameters and options are not persistent across calls to `DBMS_LOGMNR.START_LOGMNR`. You must specify all desired parameters and options (including SCN and time ranges) each time you call `DBMS_LOGMNR.START_LOGMNR`.
- Be aware that specifying redo log files using a timestamp is not precise.
- Keep the following in mind regarding starting and ending times or SCN ranges:
 - If you specify neither a `startTime` nor a `startScn` parameter, LogMiner will set the `startScn` parameter to use the lowest SCN value from the redo log file that contains the oldest changes.

- If you specify both time and SCN values, LogMiner uses the SCN value or values and ignores the time values.
- If you specify starting and ending time or SCN values and they are found in the LogMiner redo log file list, then LogMiner mines the logs indicated by those values.
- If you specify starting and ending times or SCN values that are not in the LogMiner redo log file list, and you specify `DBMS_LOGMNR.START_LOGMNR`, and you specify:
 - * 0 for the `startTime` or `startScn` value, then the lowest SCN in the LogMiner redo log file list will be used as the `startScn`
 - * A nonzero number for the `startTime` or `startScn` value, then an error is returned
 - * 0 or a nonzero number for the `endTime` or `endScn` value, then the highest SCN in the LogMiner redo log file list will be used as the `endScn`
- If you specify starting and ending times or SCN values and they are not found in the LogMiner redo log file list, and you specify `DBMS_LOGMNR.START_LOGMNR`, and you specify:
 - * 0 for the `startTime` or `startScn` value, then an error is returned.
 - * A `startTime` or `startScn` value that is greater than any value in the database's archived redo log files, then LogMiner starts mining in the online redo log file. LogMiner will continue to process the online redo log file until it finds a change at, or beyond, the requested starting point before it returns rows from the `V$logmnr_contents` view.
 - * An `endTime` or `endScn` parameter value that indicates a time or SCN in the future, then LogMiner includes the online redo log files when it mines. When you query the `V$logmnr_contents` view, rows will be returned from this view as changes are made to the database, and will not stop until LogMiner sees a change beyond the requested ending point.
 - * 0 for the `endTime` or `endScn` parameter value, then LogMiner includes the online redo log files when it mines. When you query the `V$logmnr_contents` view, rows will be returned from this view as changes are made to the database, and will not stop until you enter CTL+C or you terminate the PL/SQL cursor.

DBMS_LOGSTDBY

The `DBMS_LOGSTDBY` package provides subprograms for configuring and managing the logical standby database environment.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Summary of DBMS_LOGSTDBY Subprograms](#)



See Also:

Oracle Data Guard Concepts and Administration

111.1 DBMS_LOGSTDBY Overview

The `DBMS_LOGSTDBY` package helps you manage the SQL Apply (logical standby database) environment.

The subprograms in the `DBMS_LOGSTDBY` package help you to accomplish the following main objectives:

- Manage configuration parameters used by SQL Apply.
For example, controlling how transactions are applied on the logical standby database, how much shared pool is used, and how many processes are used by SQL Apply to mine and apply the changes.
- Ensure an appropriate level of supplemental logging is enabled, and a LogMiner dictionary is built correctly for logical standby database creation.
- Provide a way to skip the application of changes to selected tables or entire schemas in the logical standby database, and specify ways to handle exceptions encountered by SQL Apply.
- Allow controlled access to tables in the logical standby database that may require maintenance.

111.2 DBMS_LOGSTDBY Security Model

You must have the `DBA` role to use the `DBMS_LOGSTDBY` package.

A prototype role, `LOGSTDBY_ADMINISTRATOR`, is created by default with `RESOURCE` and `EXECUTE` privileges on `DBMS_LOGSTDBY`. If you choose to use this role, consider granting `ALTER`

DATABASE and ALTER SESSION privileges to the role so that the grantee can start and stop SQL Apply and can enable and disable the database guard.

The procedures associated with skipping transactions (SKIP and UNSKIP, SKIP_ERROR and UNSKIP_ERROR, and SKIP_TRANSACTION and UNSKIP_TRANSACTION) all require DBA privileges to execute because their scope may contain wildcard schemas. Oracle recommends that where SKIP procedures are specified, these be owned by a secure account with appropriate privileges on the schemas they act on (for example, SYS).

111.3 DBMS_LOGSTDBY Constants

The DBMS_LOGSTDBY package defines several enumerated constants for specifying parameter values. Enumerated constants must be prefixed with the package name, for example, DBMS_LOGSTDBY.SKIP_ACTION_SKIP.

The following table describes the constants for the `proc_name` parameter in the DBMS_LOGSTDBY.SKIP procedure.

Table 111-1 Constants for SKIP Options Flag

Constant	Description
MAX_EVENTS	Maximum number of events to log in the DBA_LOGSTDBY_EVENTS view. See the DBMS_LOGSTDBY APPLY_SET Procedure.
SKIP_ACTION_APPLY	Used inside the user-defined procedure registered with DBMS_LOGSTDBY.SKIP. Use this constant when setting the value of the SKIP_ACTION parameter with DBMS_LOGSTDBY_CONTEXT if you want SQL Apply to apply the DDL or PL/SQL statement.
SKIP_ACTION_ERROR	Used inside the user-defined procedure registered with DBMS_LOGSTDBY.SKIP. Use this constant when setting the value of the SKIP_ACTION parameter with DBMS_LOGSTDBY_CONTEXT if you want SQL Apply to error out.
SKIP_ACTION_REPLACE	Used inside the user-defined procedure registered with DBMS_LOGSTDBY.SKIP. Use this constant when setting the value of the SKIP_ACTION parameter with DBMS_LOGSTDBY_CONTEXT if you want SQL Apply to apply the replacement DDL. (This constant should not be used while handling an Oracle Supplied PL/SQL procedure call).
SKIP_ACTION_SKIP	Used inside the user-defined procedure registered with DBMS_LOGSTDBY.SKIP. Use this constant when setting the value of the SKIP_ACTION parameter with DBMS_LOGSTDBY_CONTEXT if you want SQL Apply to skip the associated DDL or Oracle supplied PL/SQL procedure call.

111.4 Summary of DBMS_LOGSTDBY Subprograms

This table describes each subprogram of the DBMS_LOGSTDBY procedure, including a reference to the section where each procedure is described in more detail.

In a multitenant container database (CDB), some subprograms must be called from the root. There may be other differences as well. See the individual subprogram descriptions for details.

Table 111-2 DBMS_LOGSTDBY Package Subprograms

Subprogram	Description
APPLY_SET Procedure	Sets the values of various parameters that configure and maintain SQL Apply.
APPLY_UNSET Procedure	Restores the default values of various parameters that configure and maintain SQL Apply.
BUILD Procedure	Ensures supplemental logging is enabled properly and builds the LogMiner dictionary.
INSTANTIATE_TABLE Procedure	Creates and populates a table in the standby database from a corresponding table in the primary database.
IS_APPLY_SERVER Function	This function returns <code>TRUE</code> if it is executed from PL/SQL in the context of a logical standby apply server process. This function is used in conjunction with triggers that have the <code>fire_once</code> parameter in the <code>DBMS_DDL.SET_TRIGGER FIRING_PROPERTY</code> subprogram set to <code>FALSE</code> (the default is <code>TRUE</code>). Such triggers are executed when the relevant target is updated by an apply process. This function can be used within the body of the trigger to ensure that the trigger takes different (or no) actions on the primary or on the standby.
MAP_PRIMARY_SCN Function	Maps an SCN relevant to the primary database to a corresponding SCN at the logical standby database. The mapped SCN is conservative in nature, and can thus be used to flash back the logical standby database to compensate for a flashback database operation performed at the primary database.
PREPARE_FOR_NEW_PRIMARY Procedure	Used after a failover, this procedure ensures a local logical standby database that was not involved in the failover has not processed more redo than the new primary database and reports the set of archive redo log files that must be replaced to ensure consistency
PURGE_SESSION Procedure	Identifies the archived redo log files that have been applied to the logical standby database and are no longer needed by SQL Apply
REBUILD Procedure	Records relevant metadata (including the LogMiner dictionary) in the redo stream in case a database that has recently changed its role to a primary database following a failover operation fails to do so during the failover process
SET_TABLESPACE Procedure	Moves metadata tables required by SQL Apply to the user-specified tablespace. By default, the metadata tables are created in the <code>SYSAUX</code> tablespace.

Table 111-2 (Cont.) DBMS_LOGSTDBY Package Subprograms

Subprogram	Description
SKIP Procedure	Specifies rules that control database operations that should not be applied to the logical standby database
SKIP_ERROR Procedure	Specifies rules regarding what action to take upon encountering errors.
SKIP_TRANSACTION Procedure	Specifies transactions that should not be applied on the logical standby database. Be careful in using this procedure, because not applying specific transactions may cause data corruption at the logical standby database.
UNSKIP Procedure	Deletes rules specified by the <code>SKIP</code> procedure.
UNSKIP_ERROR Procedure	Deletes rules specified by the <code>SKIP_ERROR</code> procedure.
UNSKIP_TRANSACTION Procedure	Deletes rules specified by the <code>SKIP_TRANSACTION</code> procedure.

111.4.1 APPLY_SET Procedure

Use this procedure to set values of parameters that configure and manage SQL Apply in a logical standby database environment. All parameters, except for `PRESERVE_COMMIT_ORDER`, can be changed without having to stop SQL Apply.

In a CDB, the `APPLY_SET` procedure must be called from the root database.

Syntax

```
DBMS_LOGSTDBY.APPLY_SET (
    inname          IN VARCHAR,
    value           IN VARCHAR);
```

Parameters

Table 111-3 APPLY_SET Procedure Parameters

Parameter	Description
<code>APPLY_SERVERS</code>	Controls the number of <code>APPLIER</code> processes used to apply changes. The maximum number allowed is 1024, provided the <code>MAX_SERVERS</code> parameter is set to accommodate this.

Table 111-3 (Cont.) APPLY_SET Procedure Parameters

Parameter	Description
EVENT_LOG_DEST	<p>Controls where SQL Apply records the occurrence of an interesting event. It takes the following values:</p> <ul style="list-style-type: none"> DEST_ALL - All events will be recorded in the DBA_LOGSTDBY_EVENTS view and in the alert log. DEST_EVENTS_TABLE - All events that contain information about user data will be recorded only in the DBA_LOGSTDBY_EVENTS view. This is the default value. <p>For example, if SQL Apply receives an ORA-1403 error, the whole event is recorded in the DBA_LOGSTDBY_EVENTS view. Whereas, the alert log records only that SQL Apply stopped because of ORA-1403. No information regarding the user table or offending statement is logged in the alert log. However, if you stop the SQL Apply engine, it gets recorded in both the DBA_LOGSTDBY_EVENTS view and in the alert log.</p> <p>Note that this parameter affects the behavior of the following parameters: RECORD_APPLIED_DDL, RECORD_SKIP_DDL, RECORD_SKIP_ERRORS, and RECORD_UNSUPPORTED_OPERATIONS. For example, if RECORD_APPLIED_DDL is set to TRUE, but EVENT_LOG_DEST is set to DEST_EVENTS_TABLE, then the applied DDL string will only be recorded in the DBA_LOGSTDBY_EVENTS view.</p>
LOG_AUTO_DEL_RETENTION_TARGET	<p>This parameter setting is only meaningful if LOG_AUTO_DELETE has been set to TRUE. The value you supply for this parameter controls how long (in minutes) a remote archived log that is received from the primary database will be retained at the logical standby database once all redo records contained in the log have been applied at the logical standby database. The default value is 1440 minutes.</p>
LOG_AUTO_DELETE	<p>Automatically deletes foreign archived redo log files as soon as they have been applied on the logical standby database. By default, a foreign archived redo log file is not deleted until 24 hours (the default value of LOG_AUTO_DEL_RETENTION_TARGET parameter) after it has been applied at the logical standby database. Set to TRUE to enable automatic deletion of archived redo log files. Set to FALSE to disable automatic deletion. The default value is TRUE.</p>
MAX_EVENTS_RECORDED	<p>Number of recent events that will be visible through the DBA_LOGSTDBY_EVENTS view. To record all events encountered by SQL Apply, use the DBMS_LOGSTDBY.MAX_EVENTS constant as the number value. The default value is 10,000.</p>
MAX_SERVERS	<p>Number of processes that SQL Apply uses to read and apply redo. The default value is 9. The maximum number allowed is 2048.</p>

Table 111-3 (Cont.) APPLY_SET Procedure Parameters

Parameter	Description
MAX_SGA	Number of megabytes from shared pool in System Global Area (SGA) that SQL Apply will use. The default value is 30 megabytes or one quarter of the value set for SHARED_POOL_SIZE, whichever is lower. The maximum size allowed is 4095 megabytes.
PREPARE_SERVERS	Controls the number of PREPARER processes used to prepare changes. The maximum number allowed is 1024, provided the MAX_SERVERS parameter is set to accommodate this.
PRESERVE_COMMIT_ORDER	<p>TRUE: Transactions are applied to the logical standby database in the exact order in which they were committed on the primary database. This is the default parameter setting.</p> <p>FALSE: Transactions containing non-overlapping sets of rows may be committed in a different order than they were committed on the primary database.</p> <p>Regardless of the level chosen, modifications done to the same row are always applied in the same order as they happened on the primary database. See the Usage Notes for details and recommendations.</p> <p>You cannot modify this parameter while SQL Apply is running.</p>
RECORD_APPLIED_DDL	<p>Controls whether DDL statements that have been applied to the logical standby database are recorded in the location specified by the EVENT_LOG_DEST parameter. Specify one of the following values:</p> <p>TRUE: Indicates that DDL statements applied to the logical standby database are recorded in the DBA_LOGSTDBY_EVENTS table and the alert log.</p> <p>FALSE: Indicates that applied DDL statements are not recorded. This is the default parameter setting.</p>
RECORD_SKIP_DDL	<p>Controls whether skipped DDL statements are recorded in the location specified by the EVENT_LOG_DEST parameter. Specify one of the following values:</p> <p>TRUE: Skipped DDL statements are recorded in the DBA_LOGSTDBY_EVENTS table and the alert log. This is the default parameter setting.</p> <p>FALSE: Skipped DDL statements are not recorded in the DBA_LOGSTDBY_EVENTS table and the alert log.</p>
RECORD_SKIP_ERRORS	<p>Controls whether skipped errors (as described by the SKIP_ERROR procedure) are recorded in the location specified by the EVENT_LOG_DEST parameter. Specify one of the following values:</p> <p>TRUE: Skipped errors are recorded in the DBA_LOGSTDBY_EVENTS table and the alert log. This is the default parameter setting.</p> <p>FALSE: Skipped errors are not recorded in the DBA_LOGSTDBY_EVENTS table and the alert log.</p>

Table 111-3 (Cont.) APPLY_SET Procedure Parameters

Parameter	Description
RECORD_UNSUPPORTED_OPERATIONS	<p>Captures information about transactions running on the primary database that will not be supported by a logical standby database. This procedure records its information as events in the DBA_LOGSTDBY_EVENTS table. Specify one of the following values:</p> <p>TRUE: The information is captured and recorded as events in the DBA_LOGSTDBY_EVENTS table.</p> <p>FALSE: The information is not captured. This is the default.</p>

If a parameter is changed while SQL Apply is running, the change will take effect at some point in the future. In such a case, an informational row is inserted into the DBA_LOGSTDBY_EVENTS view at the time the parameter change takes effect.

Additionally, if you are modifying a parameter while SQL Apply is running on an Oracle RAC configuration, you must be connected to the same instance where SQL Apply is running.

Exceptions

Table 111-4 APPLY_SET Procedure Exceptions

Exception	Description
ORA-16103	Logical Standby apply must be stopped to allow this operation
ORA-16104	invalid Logical Standby option requested
ORA-16236	Logical Standby metadata operation in progress

Usage Notes

- Use the APPLY_UNSET procedure to restore the default settings of a parameter.
- See *Oracle Data Guard Concepts and Administration* for help with tuning SQL Apply and for information about setting appropriate values for different parameters.

Examples

To record DDLs in the DBA_LOGSTDBY_EVENTS view and in the alert log, issue the following statement:

```
SQL> EXECUTE DBMS_LOGSTDBY.APPLY_SET('RECORD_APPLIED_DDL', TRUE);
```

111.4.2 APPLY_UNSET Procedure

Use the APPLY_UNSET procedure to restore the default values of the parameters that you changed with the APPLY_SET procedure.

In a CDB, the APPLY_UNSET procedure must be called from the root database.

Syntax

```
DBMS_LOGSTDBY.APPLY_UNSET (
    inname          IN VARCHAR);
```

Parameters

The parameter information for the `APPLY_UNSET` procedure is the same as that described for the `APPLY_SET` procedure. See [Table 111-3](#) for complete parameter information.

Exceptions

Table 111-5 `APPLY_UNSET` Procedure Exceptions

Exception	Description
ORA-16103	Logical Standby apply must be stopped to allow this operation
ORA-16104	invalid Logical Standby option requested
ORA-16236	Logical Standby metadata operation in progress

Usage Notes

- Use the `APPLY_SET` procedure to specify a nondefault value for a parameter.

Examples

If you previously specified that applied DDLs show up in the `DBA_LOGSTDBY_EVENTS` view and the alert log, you can restore the default behavior of SQL Apply regarding applied DDL statements with the following statement:

```
SQL> EXECUTE DBMS_LOGSTDBY.APPLY_UNSET('RECORD_APPLIED_DDL');
```

111.4.3 BUILD Procedure

Use this procedure on the primary database to record relevant metadata (LogMiner dictionary) information in the redo log, which will subsequently be used by SQL Apply. This procedure will enable database-wide primary- and unique-key supplemental logging, if necessary.

In a CDB, the `BUILD` procedure must be called from the root database on the primary. Additionally, you cannot add or remove PDBs from a CDB while this procedure is executing.

 **Note:**

In databases created using Oracle Database 11g release 2 (11.2) or later, supplemental logging information is automatically propagated to any existing physical standby databases. However, for databases in earlier releases, or if the database was created using an earlier release and then upgraded to 11.2, you must check whether supplemental logging is enabled at the physical standby(s) if it is also enabled at the primary database. If it is not enabled at the physical standby(s), then before performing a switchover or failover, you must enable supplemental logging on all existing physical standby databases. To do so, issue the following SQL command on each physical standby:

```
SQL> ALTER DATABASE ADD SUPPLEMENTAL LOG DATA (PRIMARY KEY, UNIQUE INDEX)
COLUMNS;
```

If you do not do this, then any logical standby that is also in the same Data Guard configuration will be unusable if a switchover or failover is performed to one of the physical standby databases. If a switchover or failover has already occurred and supplemental logging was not enabled, then you must recreate all logical standby databases.

Syntax

```
DBMS_LOGSTDBY.BUILD;
```

Usage Notes

- Supplemental log information includes extra information in the redo logs that uniquely identifies a modified row in the logical standby database, and also includes information that helps efficient application of changes to the logical standby database.
- LogMiner dictionary information allows SQL Apply to interpret data in the redo logs.
- `DBMS_LOGSTDBY.BUILD` should be run only once for each logical standby database you want to create. You do not need to use `DBMS_LOGSTDBY.BUILD` for each Oracle RAC instance.
- `DBMS_LOGSTDBY.BUILD` waits for all transactions (including distributed transactions) that are active at the time of the procedure invocation to complete before returning. See *Oracle Database Administrator's Guide* for information about how to handle in-doubt transactions.

Examples

To build the LogMiner dictionary in the redo stream of the primary database and to record additional information so that a logical standby database can be instantiated, issue the following SQL statement at the primary database

```
SQL> EXECUTE DBMS_LOGSTDBY.BUILD;
```

111.4.4 INSTANTIATE_TABLE Procedure

This procedure creates and populates a table in the standby database from a corresponding table in the primary database.

The table requires the name of the database link (`dblink`) as an input parameter. If the table already exists in the logical standby database, it will be dropped and re-created based on the table definition at the primary database. This procedure only brings over the data associated with the table, and not the associated indexes and constraints.

Use the `INSTANTIATE_TABLE` procedure to:

- Add a table to a standby database.
- Re-create a table in a standby database.

In a CDB, the `INSTANTIATE_TABLE` procedure must be called from within the container in which the table to be instantiated resides. Additionally, the database link that is provided to the primary database must point to the corresponding container on the primary.

Syntax

```
DBMS_LOGSTDBY.INSTANTIATE_TABLE (
    schema_name      IN VARCHAR2,
    table_name       IN VARCHAR2,
    dblink           IN VARCHAR2);
```

Parameters

Table 111-6 INSTANTIATE_TABLE Procedure Parameters

Parameter	Description
<code>schema_name</code>	Name of the schema
<code>table_name</code>	Name of the table to be created or re-created in the standby database
<code>dblink</code>	Name of the database link account that has privileges to read and lock the table in the primary database, as well as the <code>SELECT_CATALOG_ROLE</code> on the primary database

Exceptions

Table 111-7 INSTANTIATE_TABLE Procedure Exceptions

Exception	Description
ORA-16103	Logical Standby apply must be stopped to allow this operation
ORA-16236	Logical Standby metadata operation in progress
ORA-16276	Specified database link does not correspond to primary database
ORA-16277	Specified table is not supported by logical standby database
ORA-16278	Specified table has a multi-object skip rule defined

Usage Notes

- Use this procedure to create and populate a table in a way that keeps the data on the standby database transactionally consistent with the primary database.
- This table will not be synchronized with the rest of the tables being maintained by SQL Apply and SQL Apply will not start to maintain it until SQL Apply encounters redo that occurred after the table was instantiated from the primary. The SCN at which the table was instantiated from the primary database is available in the `DBA_LOGSTDBY_EVENTS` view.
- The specified table must be a table that is supported by logical standby (that is, it does not appear in the `DBA_LOGSTDBY_UNSUPPORTED_TABLES` view on the primary database).
- If there are any skip rules that specifically name this table (without any wildcards), those skip rules will be dropped as part of `INstantiate_Table`, so that the table will be properly maintained by SQL Apply in the future. If there are skip rules that indirectly reference this table (match a skip rule with a wildcard in the `schema_name` or `table_name`, and have a `TABLE`, `DML`, or `SCHEMA_DDL` statement type), `INstantiate_Table` will fail with an ORA-16278 error. Any multi-object skip rules that pertain to the table must be dropped or changed before re-attempting the `INstantiate_Table` call.

Examples

```
SQL> EXECUTE DBMS_LOGSTDBY.INSTANTIATE_TABLE (-  
    SCHEMA_NAME => 'HR', TABLE_NAME => 'EMPLOYEES', -  
    DBLINK => 'INSTANTIATE_TBL_LINK');
```

111.4.5 IS_APPLY_SERVER Function

This function returns `TRUE` if it is executed from PL/SQL in the context of a logical standby apply server process.

This function is used in conjunction with triggers that have the `fire_once` parameter in the `DBMS_DDL.SET_TRIGGER_FIRING_PROPERTY` subprogram set to `FALSE` (the default is `TRUE`). Such triggers are executed when the relevant target is updated by an apply process. This function can be used within the body of the trigger to ensure that the trigger takes different (or no) actions on the primary or on the standby.

Syntax

```
DBMS_LOGSTDBY.IS_APPLY_SERVER  
RETURN BOOLEAN;
```

Parameters

None

111.4.6 MAP_PRIMARY_SCN Function

This function returns an SCN on the standby that predates the supplied SCN from the primary database by at least 5 minutes.

It can be used to determine a safe SCN to use in a compensating flashback database operation at the logical standby database, following a flashback database operation or a point-in-time recovery operation at the primary database.

Syntax

```
DBMS_LOGSTDBY.MAP_PRIMARY_SCN(primary_scn NUMBER) RETURN NUMBER;
```

Exceptions

Table 111-8 MAP_PRIMARY_SCN Function Exceptions

Exception	Description
ORA-20001	Primary SCN is before mapped range
ORA-20002	SCN mapping requires PRESERVE_COMMIT_ORDER to be TRUE

Usage Notes

Use this function to get a conservative SCN at the logical standby database that corresponds to an SCN at the primary database. This function is useful in the context of doing compensating flashback database operations at the logical standby following a flashback database or a point-in-time recovery operation done at the primary database.

111.4.7 PREPARE_FOR_NEW_PRIMARY Procedure

The `PREPARE_FOR_NEW_PRIMARY` procedure must be invoked at a logical standby database following a failover, if that standby database was not the target of the failover operation.

Such a standby database must process the exact same set of redo logs processed at the new primary database. This routine ensures that the local logical standby database has not processed more redo than the new primary database and reports the set of archive logs that must be replaced to ensure consistency. The set of replacement logs will be reported in the alert.log. These logs must be copied to the logical standby and registered using the `ALTER DATABASE REGISTER LOGICAL LOGFILE` statement.

In a CDB, the `PREPARE_FOR_NEW_PRIMARY` procedure must be called from the root database.

Syntax

```
DBMS_LOGSTDBY.PREPARE_FOR_NEW_PRIMARY (
    FORMER_STANDBY_TYPE    IN VARCHAR2,
    DBLINK                  IN VARCHAR2);
```

Parameters

Table 111-9 PREPARE_FOR_NEW_PRIMARY Procedure Parameters

Parameter	Description
FORMER_STANDBY_TYPE	The type of standby database that was the target of the failover operation to become the new primary database. Valid values are 'PHYSICAL' if the new primary was formerly a physical standby, and 'LOGICAL' if the new primary database was formerly a logical standby database.

Table 111-9 (Cont.) PREPARE_FOR_NEW_PRIMARY Procedure Parameters

Parameter	Description
DBLINK	The name of a database link to the new primary database

Exceptions

Table 111-10 PREPARE_FOR_NEW_PRIMARY Procedure Exceptions

Exception	Description
ORA-16104	Invalid Logical Standby option.
ORA-16109	Failed to apply log data from previous primary.

Usage Notes

- This routine is intended only for logical standby systems. This routine will fail if the new primary database was formerly a logical standby database and the LogMiner dictionary build has not completed successfully. Log files displayed in the alert log will be referred to as *terminal logs*. Users should keep in mind that file paths are relative to the new primary database and may not resolve locally. Upon manual registration of the terminal logs, users should complete the process by calling either `START LOGICAL STANDBY APPLY` if the new primary database was formerly a physical standby database or `START LOGICAL STANDBY APPLY NEW PRIMARY` if the new primary database was formerly a logical standby database. See the alert log for more details regarding the reasons for any exception.

Examples

```
SQL> EXECUTE DBMS_LOGSTDBY.PREPARE_FOR_NEW_PRIMARY ( -
          FORMER_STANDBY_TYPE => 'LOGICAL',      -
          DBLINK => 'dblink_to_newprimary');
```

111.4.8 PURGE_SESSION Procedure

`PURGE_SESSION` identifies all archived redo log files that have been applied to the logical standby database and are no longer needed by SQL Apply.

Once identified, you can issue operating system commands to delete some or all of the unnecessary archived redo log files.

In a CDB, the `PURGE_SESSION` procedure must be called from the root database.

Syntax

```
DBMS_LOGSTDBY.PURGE_SESSION;
```

Exceptions

Table 111-11 PURGE_SESSION Procedure Exceptions

Exception	Description
ORA-01309	Invalid session

Usage Notes

- This procedure does not delete the archived redo log files. You must issue operating system commands to delete unneeded files.
- This procedure updates the `DBA_LOGMNR_PURGED_LOG` view that displays the archived redo log files that have been applied to the logical standby database.
- In Oracle Database 10g Release 2, metadata related to the archived redo log files (and the actual archived redo log files) are purged automatically based on the default setting of the `LOG_AUTO_DELETE` parameter described in the `DBMS_LOGSTDBY.APPLY_SET` procedure described.

Example

To identify and remove unnecessary files:

1. Enter the following statement on the logical standby database:

```
SQL> EXECUTE DBMS_LOGSTDBY.PURGE_SESSION;
```

2. Query the `DBA_LOGMNR_PURGED_LOG` view to list the archived redo log files that can be removed:

```
SQL> SELECT * FROM DBA_LOGMNR_PURGED_LOG;
```

```
FILE_NAME
-----
/boston/arc_dest/arc_1_40_509538672.log
/boston/arc_dest/arc_1_41_509538672.log
/boston/arc_dest/arc_1_42_509538672.log
/boston/arc_dest/arc_1_43_509538672.log
/boston/arc_dest/arc_1_44_509538672.log
/boston/arc_dest/arc_1_45_509538672.log
/boston/arc_dest/arc_1_46_509538672.log
/boston/arc_dest/arc_1_47_509538672.log
```

3. Use operating system-specific commands to delete archived redo log files from the file system.

111.4.9 REBUILD Procedure

This procedure is used if a database that has recently changed its role to a primary database following a failover operation fails to record relevant metadata (including the LogMiner dictionary) in the redo stream required for other logical standby databases.

In a CDB, the `REBUILD` procedure must be called from the root database.

Syntax

```
DBMS_LOGSTDBY.REBUILD;
```

Usage Notes

- LogMiner dictionary information is logged in the redo log files. The standby redo log files (if present) are archived.

Examples

```
SQL> EXECUTE DBMS_LOGSTDBY.REBUILD;
```


111.4.10 SET_TABLESPACE Procedure

This procedure moves metadata tables required by SQL Apply to the user-specified tablespace.

By default, the metadata tables are created in the `SYSAUX` tablespace. SQL Apply cannot be running when you invoke this procedure.

In a CDB, the `SET_TABLESPACE` procedure must be called from the root database.

Syntax

```
DBMS_LOGSTDBY.SET_TABLESPACE (
    NEW_TABLESPACE IN VARCHAR2)
```

Parameters

Table 111-12 SET_TABLE SPACE Procedure Parameters

Parameter	Description
<code>NEW_TABLESPACE</code>	Name of the new tablespace where metadata tables will reside.

Exceptions

Table 111-13 SET_TABLESPACE Procedure Exceptions

Exception	Description
<code>ORA-16103</code>	Logical Standby apply must be stopped to allow this operation
<code>ORA-16236</code>	Logical Standby metadata operation in progress

Examples

To move metadata tables to a new tablespace named `LOGSTDBY_TBS`, issue the following statement:

```
SQL> EXECUTE DBMS_LOGSTDBY.SET_TABLESPACE (new_tablespace => 'LOGSTDBY_TBS');
```

111.4.11 SKIP Procedure

The `SKIP` procedure can be used to define rules that will be used by SQL Apply to skip the application of certain changes to the logical standby database.

For example, the `SKIP` procedure can be used to skip changes to a subset of tables in the logical standby database. It can also be used to specify DDL statements that should not be applied at the logical standby database or should be modified before they are applied in the logical standby database. One reason why a DDL statement may need to be modified is to accommodate a different directory structure on the logical standby database.



Note:

For information about skipping containers, see "[Skipping Containers](#)."

Syntax

```
DBMS_LOGSTDBY.SKIP (
    stmt                IN VARCHAR2,
    schema_name         IN VARCHAR2 DEFAULT NULL,
    object_name         IN VARCHAR2 DEFAULT NULL,
    proc_name           IN VARCHAR2 DEFAULT NULL,
    use_like             IN BOOLEAN DEFAULT TRUE,
    esc                 IN CHAR1 DEFAULT NULL);
```

Parameters

Table 111-14 SKIP Procedure Parameters

Parameter	Description
stmt	Either a keyword that identifies a set of SQL statements or a specific SQL statement. The use of keywords simplifies configuration since keywords, generally defined by the database object, identify all SQL statements that operate on the specified object. Table 111-15 shows a list of keywords and the equivalent SQL statements, either of which is a valid value for this parameter. The keyword <code>PL/SQL</code> is used for the execution of Oracle-supplied packages which are supported for replication.
schema_name	The name of one or more schemas (wildcards are permitted) associated with the SQL statements identified by the <code>stmt</code> parameter. If not applicable, this value must be set to <code>NULL</code> .
object_name	The name of one or more objects (wildcards are permitted) associated with the SQL statements identified by the <code>stmt</code> . If not applicable, this value must be set to <code>NULL</code> .

Table 111-14 (Cont.) SKIP Procedure Parameters

Parameter	Description
proc_name	<p>Name of a stored procedure to call when SQL Apply determines that a particular statement matches the filter defined by the <code>stmt</code>, <code>schema_name</code>, and <code>object_name</code> parameters. Specify the procedure in the following format: <code>'schema.package.procedure'</code></p> <p>This procedure returns a value that directs SQL Apply to perform one of the following: execute the statement, skip the statement, or execute a replacement statement.</p> <p>The procedures to be invoked in the case of DDL or PL/SQL take no arguments. You can access the various information needed inside the procedure by accessing the context associated with the namespace, <code>LSBY_APPLY_CONTEXT</code>.</p> <p>For a full list of parameters that are accessible in the context of the skip procedure, see the <code>DBMS_LOGSTDBY_CONTEXT</code> package.</p> <p>The parameters of interest in the case of DDLs are: <code>STATEMENT</code>, <code>STATEMENT_TYPE</code>, <code>SCHEMA</code>, <code>NAME</code>, <code>CURRENT_SCHEMA</code>, <code>XIDUSN</code>, <code>XIDSLT</code>, <code>XIDSQN</code> and <code>SKIP_ACTION</code>.</p> <p>The parameters of interest in the case of PL/SQL are: <code>STATEMENT</code>, <code>PACKAGE_SCHEMA</code>, <code>PACKAGE_NAME</code>, <code>PROCEDURE_NAME</code>, <code>CURRENT_SCHEMA</code>, <code>XIDUSN</code>, <code>XIDSLT</code>, <code>XIDSQN</code>, <code>EXIT_STATUS</code>, and <code>SKIP_ACTION</code>.</p> <p>Note 1: The <code>DBMS_LOGSTDBY.SKIP_ACTION_REPLACE</code> constant is not supported for PL/SQL.</p> <p>Note 2: SQL Apply calls the skip handler when the procedure's exit is processed.</p> <p>Note 3: The <code>use_like</code> parameter must be set to <code>FALSE</code> for PL/SQL since wildcarding PL/SQL is not supported.</p>

Table 111-14 (Cont.) SKIP Procedure Parameters

Parameter	Description
proc_name (cont.)	<p>A sample conditional skip rule on DBMS_RLS.DROP_POLICY is as follows:</p> <pre> create or replace procedure sec_mgr.skip_drop_policy is l_stmt CLOB; l_pkgown varchar2(30); l_pkgnam varchar2(30); l_procnm varchar2(30); l_cur_schema varchar2(30); l_xidusn number; l_xidslt number; l_xidsqn number; l_exit_status number; l_skip_action number; Begin -- read all relevant info dbms_logstdby_context.get_context(name => 'STATEMENT', value => l_stmt); dbms_logstdby_context.get_context(name => 'PACKAGE_SCHEMA', value => l_pkgown); dbms_logstdby_context.get_context(name => 'PACKAGE_NAME', value => l_pkgnam); dbms_logstdby_context.get_context(name => 'PROCEDURE_NAME', value => l_procnm); dbms_logstdby_context.get_context(name => 'CURRENT_SCHEMA', value => l_cur_schema); dbms_logstdby_context.get_context(name => 'XIDUSN', value => l_xidusn); dbms_logstdby_context.get_context(name => 'XIDSLT', value => l_xidslt); dbms_logstdby_context.get_context(name => 'XIDSQN', value => l_xidsqn); dbms_logstdby_context.get_context(name => 'EXIT_STATUS', value => l_ext_status); if 0 == l_ext_status then Insert Into sec_mgr.logit Values ('Success: ' l_pkgown '.' l_pkgnm '.' l_procnm ' by ' l_current_user); If l_current_user != 'TESTSCHEMA' Then l_skip_action := DBMS_LOGSTDBY.SKIP_ACTION_APPLY; Else l_skip_action := DBMS_LOGSTDBY.SKIP_ACTION_SKIP; End If; End If; dbms_logstdby_context.set_context(name=>'SKIP_ACTION', value => l_skip_action); End skip_drop_policy; EXECUTE DBMS_LOGSTDBY.SKIP(- stmt => 'PL/SQL', - schema_name => 'SYS', - </pre>

Table 111-14 (Cont.) SKIP Procedure Parameters

Parameter	Description
	<pre>object_name => 'DBMS_RLS.DROP_POLICY', - proc_name => 'SEC_MGR.SKIP_DROP_POLICY' - use_like=> FALSE);</pre>
use_like	Allows pattern matching to isolate the tables that you want to skip on the logical standby database. The use_like parameter matches a portion of one character value to another by searching the first value for the pattern specified by the second, and calculates strings using characters as defined by the input character set. This parameter follows the same rules for pattern matching described in <i>Oracle Database SQL Language Reference</i> .
esc	Identifies an escape character (such as the character "/") that you can use for pattern matching. If the escape character appears in the pattern before the character "%" or "_" then Oracle interprets this character literally in the pattern, rather than as a special pattern matching character. See <i>Oracle Database SQL Language Reference</i> for more information about pattern matching.

Usage Notes

- This procedure requires DBA privileges to execute.
- You cannot associate a stored procedure to be invoked in the context of a DML statement. For example, the following statement returns the ORA-16104: invalid Logical Standby option requested error:

```
SQL> EXECUTE DBMS_LOGSTDBY.SKIP(-
      stmt => 'DML', -
      schema_name => 'HR', -
      object_name => 'EMPLOYEES', -
      proc_name => 'DML_HANDLER');
```

Also, if an event matches multiple rules either because of the use of wildcards while specifying the rule or because of a specification of overlapping rules. For example, if you specify a rule for the SCHEMA_DDL event for the HR.EMPLOYEES table, and a rule for the ALTER TABLE event for the HR.EMPLOYEES table, only one of the matching procedures will be invoked (alphabetically, by procedure). In the following code example, consider the following rules:

```
SQL> EXECUTE DBMS_LOGSTDBY.SKIP( -
      stmt => 'SCHEMA_DDL', -
      schema_name => 'HR', -
      object_name => 'EMPLOYEES', -
      proc_name => 'SCHEMA_DDL_HANDLER');
SQL> EXECUTE DBMS_LOGSTDBY.SKIP( -
      stmt => 'ALTER TABLE', -
      schema_name => 'HR', -
      object_name => 'EMPLOYEES', -
      proc_name => 'TABLE_ALTER_HANDLER');
```

On encountering an ALTER TABLE statement, the schema_ddl_handler procedure will be invoked because its name will be at the top of an alphabetically sorted list of procedures that are relevant to the statement. Collisions on a rule set because of a specification containing wildcard entries are resolved in a similar fashion. For example, the rules in the

following example will result in the `empddl_handler` procedure being invoked upon encountering the `ALTER TABLE HR.EMPLOYEES ADD COLUMN RATING NUMBER` statement:

```
SQL> EXECUTE DBMS_LOGSTDBY.SKIP(-
      stmt => 'ALTER TABLE', -
      schema_name => 'HR', -
      object_name => 'EMP%', -
      proc_name => 'EMPDDL_HANDLER');
SQL> EXECUTE DBMS_LOGSTDBY.SKIP( -
      stmt => 'ALTER TABLE', -
      schema_name => 'HR', -
      object_name => 'EMPLOYEES', -
      proc_name => 'EMPLOYEE_DDL_HANDLER');
```

- Use the `SKIP` procedure with caution, particularly when skipping DDL statements. If a `CREATE TABLE` statement is skipped, for example, you must also specify other DDL statements that refer to that table in the `SKIP` procedure. Otherwise, the statements will fail and cause an exception. When this happens, SQL Apply stops running.
- Before calling the `SKIP` procedure, SQL Apply must be halted. Do this by issuing an `ALTER DATABASE STOP LOGICAL STANDBY APPLY` statement. Once all desired filters have been specified, issue an `ALTER DATABASE START LOGICAL STANDBY APPLY IMMEDIATE` statement to start SQL Apply using the new filter settings.
- See the `UNSKIP` procedure for information about reversing (undoing) the settings of the `SKIP` procedure.
- For `USER` statements, the `SCHEMA_NAME` parameter will be the user and specify '%' for the `OBJECT_NAME` parameter.
- If the `PROC_NAME` parameter is supplied, it must already exist in `DBA PROCEDURES` and it must execute with `DEFINER` rights. If the procedure is declared with `INVOKER` rights, the `ORA-1031: insufficient privileges` message will be returned.
- If the procedure returns a `REPLACEMENT` statement, the `REPLACEMENT` statement will be executed using the `SYSTEM` and `OBJECT` privileges of the owner of the procedure.
- The PL/SQL block of a `SKIP` procedure cannot contain transaction control statements (for example, `COMMIT`, `ROLLBACK`, `SAVEPOINT`, and `SET CONSTRAINT`) unless the block is declared to be an autonomous transaction.

Skip Statement Options

[Table 111-15](#) lists the supported values for the `stmt` parameter of the `SKIP` procedure. The left column of the table lists the keywords that may be used to identify the set of SQL statements to the right of the keyword. In addition, any of the SQL statements listed in the `sys.audit_actions` table (shown in the right column of [Table 111-15](#)) are also valid values. Note that keywords are generally defined by database object.

Table 111-15 Supported Values for the `stmt` Parameter

Keyword	Associated SQL Statements
There is no keyword for this group of SQL statements.	GRANT REVOKE ANALYZE TABLE ANALYZE INDEX ANALYZE CLUSTER
CLUSTER	AUDIT CLUSTER CREATE CLUSTER DROP CLUSTER TRUNCATE CLUSTER
CONTAINER	See " Skipping Containers "
CONTEXT	CREATE CONTEXT DROP CONTEXT
DATABASE LINK	CREATE DATABASE LINK CREATE PUBLIC DATABASE LINK DROP DATABASE LINK DROP PUBLIC DATABASE LINK
DIMENSION	ALTER DIMENSION CREATE DIMENSION DROP DIMENSION
DIRECTORY ¹	CREATE DIRECTORY DROP DIRECTORY
DML	Includes DML statements on a table (for example: INSERT, UPDATE, and DELETE)
INDEX	ALTER INDEX CREATE INDEX DROP INDEX
NON_SCHEMA_DDL	<i>All DDL that does not pertain to a particular schema</i> Note: SCHEMA_NAME and OBJECT_NAME must be null
PL/SQL ²	Execute Oracle-supplied package.

Table 111-15 (Cont.) Supported Values for the stmt Parameter

Keyword	Associated SQL Statements
PROCEDURE ³	ALTER FUNCTION ALTER PACKAGE ALTER PACKAGE BODY ALTER PROCEDURE CREATE FUNCTION CREATE LIBRARY CREATE PACKAGE CREATE PACKAGE BODY CREATE PROCEDURE DROP FUNCTION DROP LIBRARY DROP PACKAGE DROP PACKAGE BODY DROP PROCEDURE
PROFILE	ALTER PROFILE CREATE PROFILE DROP PROFILE
ROLE	ALTER ROLE CREATE ROLE DROP ROLE SET ROLE
ROLLBACK STATEMENT	ALTER ROLLBACK SEGMENT CREATE ROLLBACK SEGMENT DROP ROLLBACK SEGMENT
SCHEMA_DDL	<i>All DDL statements that create, modify, or drop schema objects (for example: tables, indexes, and columns)</i> Note: SCHEMA_NAME and OBJECT_NAME must <i>not</i> be null
SEQUENCE	ALTER SEQUENCE CREATE SEQUENCE DROP SEQUENCE
SYNONYM	CREATE PUBLIC SYNONYM CREATE SYNONYM DROP PUBLIC SYNONYM DROP SYNONYM
SYSTEM AUDIT	AUDIT SQL_statements NOAUDIT SQL_statements

Table 111-15 (Cont.) Supported Values for the `stmt` Parameter

Keyword	Associated SQL Statements
TABLE	CREATE TABLE ALTER TABLE DROP TABLE TRUNCATE TABLE
TABLESPACE	CREATE TABLESPACE DROP TABLESPACE ALTER TABLESPACE
TRIGGER	ALTER TRIGGER CREATE TRIGGER DISABLE ALL TRIGGERS DISABLE TRIGGER DROP TRIGGER ENABLE ALL TRIGGERS ENABLE TRIGGER
TYPE	ALTER TYPE ALTER TYPE BODY CREATE TYPE CREATE TYPE BODY DROP TYPE DROP TYPE BODY
USER	ALTER USER CREATE USER DROP USER
VIEW	CREATE VIEW DROP VIEW
VIEW	CREATE VIEW DROP VIEW

- ¹ All directory objects are owned by SYS, but for the purpose of filtering them with a skip directive the schema should be specified as '%'
- ² See *Oracle Data Guard Concepts and Administration* for information about supported packages.
- ³ Java schema objects (sources, classes, and resources) are considered the same as procedure for purposes of skipping (ignoring) SQL statements.

Exceptions

Table 111-16 DBMS_LOGSTDBY.SKIP Procedure Exceptions

Exception	Description
ORA-01031	Insufficient privileges: <ul style="list-style-type: none"> Procedure used INVOKER rights Procedure needs DBA privileges
ORA-16103	Logical standby apply must be stopped to allow this operation.
ORA-16104	Invalid logical standby option requested.
ORA-16203	"Unable to interpret SKIP procedure return values." Indicates that a SKIP procedure has either generated an exception or has returned ambiguous values. You can identify the offending procedure by examining the DBA_LOGSTDBY_EVENTS view.
ORA-16236	Logical standby metadata operation in progress.

Examples

Example 1. Skipping all DML and DDL changes made to a schema

The following example shows how to specify rules so that SQL Apply will skip both DDL and DML statements made to the HR schema.

```
SQL> EXECUTE DBMS_LOGSTDBY.SKIP (STMT => 'SCHEMA_DDL', -
      schema_name => 'HR', -
      object_name => '%', -
      proc_name => null);
SQL> EXECUTE DBMS_LOGSTDBY.SKIP (STMT => 'DML', -
      schema_name => 'HR', -
      object_name => '%', -
      proc_name => null);
```

Example 2. Creating a procedure to handle different file system organization

For example, if the file system organization in the logical standby database is different than that in the primary database, you can write a SKIP procedure to handle DDL statements with file specifications transparently. The following procedure can handle DDL statements as long as you follow a specific naming convention for the file specification string.

1. Create the SKIP procedure to handle tablespace DDL statements:

```
CREATE OR REPLACE PROCEDURE sys.handle_tbs_ddl
IS
  l_old_stmt varchar2(4000);
  l_stmt_typ varchar2(40);
  l_schema  varchar2(30);
  l_name    varchar2(30);
  l_xidusn  number;
  l_xidslt  number;
  l_xidsqn  number;
  l_skip_action number;
  l_new_stmt varchar2(4000);
```

```

-- read all information
dbms_logstdby_context.get_context(name=>'STATEMENT',value=>l_old_stmt);
dbms_logstdby_context.get_context(name=>'STATEMENT_TYPE',value=>l_stmt_type);
dbms_logstdby_context.get_context(name=>'OWNER',value=>l_schema);
dbms_logstdby_context.get_context(name=>'NAME',value=>l_name);
dbms_logstdby_context.get_context(name=>'XIDUSN',value=>l_xidusn);
dbms_logstdby_context.get_context(name=>'XIDSLT',value=>l_xidslt);
dbms_logstdby_context.get_context(name=>'XIDSQN',value=>l_xidsqn);
dbms_logstdby_context.get_context(name=>'CONTAINER_NAME',value=>l_conname);

--
-- All primary file specification that contains a directory
-- /usr/orcl/primary/dbs
-- should go to /usr/orcl/stdby directory specification

BEGIN
  l_new_stmt := replace (l_old_stmt, '/usr/orcl/primary/dbs','/usr/orcl/stdby');
  l_skip_action := DBMS_LOGSTDBY.SKIP_ACTION_REPLACE;
EXCEPTION
  WHEN OTHERS THEN
    l_skip_action := DBMS_LOGSTDBY.SKIP_ACTION_ERROR;
    l_new_stmt := NULL;
END;

dbms_logstdby_context.set_context(name=>new_statement, value => l_new_stmt);
dbms_logstdby_context.set_context(name=>'SKIP_ACTION', value => l_skip_action);
END handle_tbs_ddl;

```

2. Register the SKIP procedure with SQL Apply:

```

SQL> EXECUTE DBMS_LOGSTDBY.SKIP (stmt => 'TABLESPACE', -
                               proc_name => 'SYS.HANDLE_TBS_DDL');

```

Skipping Containers

To skip a container (either a PDB or the root), use the `CONTAINER` keyword. All SQL statements executed on the container, as well as any other actions taken on the container, are skipped.

You can skip a particular PDB within a CDB. For example, the following command skips the PDB named `PDB1`. The command must be executed at the root level:

```

SQL> EXECUTE DBMS_LOGSTDBY.SKIP(stmt => 'CONTAINER', object_name => 'PDB1');

```

As shown in the following example, you could also skip only the root of the CDB, but not any of the PDBs that exist under the root. The command must be executed at the root level:

```

SQL> EXECUTE DBMS_LOGSTDBY.SKIP(stmt => 'CONTAINER', object_name => 'CDB$ROOT');

```

Note:

To create other skip rules for a container, create the rules from within the container. The container to which the rules will apply is automatically derived from the container in which the rules are created.

111.4.12 SKIP_ERROR Procedure

The `SKIP_ERROR` procedure specifies the action to take when a logical standby database detects an error.

Upon encountering an error, the logical standby database uses the criteria contained in this procedure to determine a course of action. The default action when a match is found is to skip the error and continue with applying changes. However, if a procedure is supplied, then `SKIP_ERROR` can take other actions depending on the situation. It can do nothing, which causes SQL Apply to stop, or it can change the error message text and stop SQL Apply, or it can actually skip the error.

Syntax

```
DBMS_LOGSTDBY.SKIP_ERROR (
    stmt                IN VARCHAR2,
    schema_name         IN VARCHAR2 DEFAULT NULL,
    object_name         IN VARCHAR2 DEFAULT NULL,
    proc_name           IN VARCHAR2 DEFAULT NULL,
    use_like             IN BOOLEAN  DEFAULT NULL,
    esc                 IN CHAR1    DEFAULT NULL);
```

Parameters

Table 111-17 SKIP_ERROR Procedure Parameters

Parameter	Description
<code>stmt</code>	Either a keyword that identifies a set of SQL statements or a specific SQL statement. The use of keywords simplifies configuration because keywords, generally defined by the database object, identify all SQL statements that operate on the specified object. Table 111-15 shows a list of keywords and the equivalent SQL statements, either of which is a valid value for this parameter.
<code>schema_name</code>	The name of one or more schemas (wildcards are permitted) associated with the SQL statements identified by the <code>stmt</code> parameter. If not applicable, this value must be set to <code>NULL</code> .
<code>object_name</code>	The name of one or more objects (wildcards are permitted) associated with the SQL statements identified by the <code>stmt</code> . If not applicable, this value must be set to <code>NULL</code> .

Table 111-17 (Cont.) SKIP_ERROR Procedure Parameters

Parameter	Description
proc_name	<p>Name of a stored procedure to call when SQL Apply encounters an error and determines a particular statement matches the filter defined by the <code>stmt</code>, <code>schema_name</code>, and <code>object_name</code> parameters. Specify the procedure in the following format:</p> <pre>'"schema"."package"."procedure"'</pre> <p>This procedure returns an error message that directs SQL Apply to perform one of the following actions:</p> <ul style="list-style-type: none"> • Silently skip the error and continue with SQL Apply • Replace the error message that would have been created with a custom one, and stop SQL Apply • Do nothing, causing SQL Apply to stop and the original error message to be logged <p>The procedure registered with SQL Apply does not take any parameters. The context associated with <code>LSBY_APPLY_CONTEXT</code> can be used to retrieve all relevant information related to the error. See the <code>DBMS_LOGSTDBY_CONTEXT</code> package for a list of all parameters associated with <code>LSBY_APPLY_CONTEXT</code>.</p> <p>The parameters of interest for procedures registered with <code>SKIP_ERROR</code> are <code>CONTAINER_NAME</code>, <code>STATEMENT</code>, <code>STATEMENT_TYPE</code>, <code>SCHEMA</code>, <code>NAME</code>, <code>XIDUSN</code>, <code>XIDSLT</code>, <code>XIDSN</code>, <code>ERROR</code> and <code>NEW_ERROR</code>.</p>
use_like	<p>Allows pattern matching to isolate the tables that you want to skip on the logical standby database. The <code>use_like</code> parameter matches a portion of one character value to another by searching the first value for the pattern specified by the second, and calculates strings using characters as defined by the input character set. This parameter follows the same rules for pattern matching described in <i>Oracle Database SQL Language Reference</i>.</p>
esc	<p>Identifies an escape character (such as the characters "%" or "_") that you can use for pattern matching. If the escape character appears in the pattern before the character "%" or "_" then Oracle interprets this character literally in the pattern, rather than as a special pattern matching character.</p>

Usage Notes

- A stored procedure provided to the `SKIP_ERROR` procedure is called when SQL Apply encounters an error that could shut down the application of redo logs to the standby database.
- Running this stored procedure affects the error being written in the `STATUS` column of the `DBA_LOGSTDBY_EVENTS` table. The `STATUS_CODE` column remains unchanged. If the stored procedure is to have no effect, that is, apply will be stopped, then the `NEW_ERROR` is written to the events table. To truly have no effect, set `NEW_ERROR` to `ERROR` in the procedure.
- If the stored procedure requires that a shutdown be avoided, then you must set `NEW_ERROR` to `NULL`.
- This procedure requires `DBA` privileges to execute.
- For `USER` statements, the `SCHEMA_NAME` parameter will be the user and you should specify '%' for the `OBJECT_NAME` parameter.

- If the `PROC_NAME` parameter is specified, it must already exist in `DBA PROCEDURES` and it must execute with `DEFINERS` rights. If the procedure is declared with `INVOKERS` rights, the `ORA-1031: insufficient privileges` message will be returned.
- The PL/SQL block of a `SKIP_ERROR` procedure cannot contain transaction control statements (for example: `COMMIT`, `ROLLBACK`, `SAVEPOINT`, and `SET CONSTRAINT`) unless the block is declared to be an autonomous transaction using the following syntax:

```
PRAGMA AUTONOMOUS_TRANSACTION
```

Exceptions

Table 111-18 SKIP_ERROR Procedure Exceptions

Exception	Description
ORA-01031	Insufficient privileges: <ul style="list-style-type: none"> • Procedure used <code>INVOKER</code> rights • Procedure needs <code>DBA</code> privileges
ORA-16103	Logical Standby apply must be stopped to allow this operation
ORA-16104	invalid Logical Standby option requested
ORA-16236	Logical Standby metadata operation in progress

Example 1

The following example shows how to specify rules so that SQL Apply will skip any error raised from any `GRANT DDL` command.

```
SQL> EXECUTE DBMS_LOGSTDBY.SKIP_ERROR('GRANT')
```

Example 2

To skip errors on `GRANT` statements on `SYS` or `HR` schemas, define a procedure `handle_error_ddl` and register it. In the following example, assume that `handle_error_ddl` is a free-standing procedure in the `SYS` schema.

1. Create the error-handler procedure:

```
CREATE OR REPLACE PROCEDURE sys.handle_error_ddl
is
  l_stmt      VARCHAR2(4000);
  l_stmt_type VARCHAR2(40);
  l_schema   VARCHAR2(30);
  l_name     VARCHAR2(30);
  l_xidusn   NUMBER;
  l_xidslt   NUMBER;
  l_xidsqn   NUMBER;
  l_error    VARCHAR2(4000);
  l_conname  VARCHAR2(30);
  l_newerr   VARCHAR2(4000);

BEGIN
  dbms_logstdby_context.get_context(name=>'STATEMENT',value=>l_stmt);

  dbms_logstdby_context.get_context(name=>'STATEMENT_TYPE',value=>l_stmt_type);
```

```

dbms_logstdby_context.get_context(name=>'SCHEMA',value=>l_schema);
dbms_logstdby_context.get_context(name=>'NAME',value=>l_name);
dbms_logstdby_context.get_context(name=>'XIDUSN',value=>l_xidusn);
dbms_logstdby_context.get_context(name=>'XIDSLT',value=>l_xidslt);
dbms_logstdby_context.get_context(name=>'XIDSQN',value=>l_xidsqn);
dbms_logstdby_context.get_context(name=>'ERROR',value=>l_error);
dbms_logstdby_context.get_context(name=>'CONTAINER_NAME',value=>l_conname);

-- default error to what we already have
l_new_error := l_error;

-- Ignore any GRANT errors on SYS or HR schemas

IF INSTR(UPPER(l_stmt), 'GRANT') > 0
THEN
IF l_schema is NULL
OR (l_schema is NOT NULL AND
(UPPER(l_schema) = 'SYS' OR
UPPER(l_schema) = 'HR'))
THEN
l_new_error := NULL;
-- record the fact that we just skipped an error on 'SYS' or 'HR' schemas
-- code not shown here
END IF;
END IF;

dbms_logstdby_context.set_context(name => 'NEW_ERROR', value => l_new_error);

END handle_error_ddl;
/

```

2. Register the error handler with SQL Apply:

```

SQL> EXECUTE DBMS_LOGSTDBY.SKIP_ERROR ( -
statement => 'NON_SCHEMA_DDL', -
schema_name => NULL, -
object_name => NULL, -
proc_name => 'SYS.HANDLE_ERROR_DDL');

```

111.4.13 SKIP_TRANSACTION Procedure

This procedure provides a way to skip (ignore) applying transactions to the logical standby database. You can skip specific transactions by specifying transaction identification information.

Syntax

```

DBMS_LOGSTDBY.SKIP_TRANSACTION (
xidusn_p          IN NUMBER,
xidslt_p          IN NUMBER,
xidsqn_p          IN NUMBER,
con_name_p        VARCHAR2   IN   DEFAULT NULL
);

```

Parameters

Table 111-19 SKIP_TRANSACTION Procedure Parameters

Parameter	Description
xidusn_p NUMBER	Transaction ID undo segment number of the transaction being skipped
xidslt_p NUMBER	Transaction ID slot number of the transaction being skipped
xidsqn_p NUMBER	Transaction ID sequence number of the transaction being skipped
con_name_p	The transaction name.

Usage Notes

If SQL Apply stops due to a particular transaction (for example, a DDL transaction), you can specify that transaction ID and then continue to apply. You can call this procedure multiple times for as many transactions as you want SQL Apply to ignore.

WARNING:

SKIP_TRANSACTION is an inherently dangerous operation. Do not invoke this procedure unless you have examined the transaction in question through the **V\$logmnr_contents** view and have taken compensating actions at the logical standby database. **SKIP_TRANSACTION** is not the appropriate procedure to invoke to skip DML changes to a table.

To skip a DML failure, use a **SKIP** procedure, such as **SKIP('DML', 'MySchema', 'MyFailed Table')**. Using the **SKIP_TRANSACTION** procedure for DML transactions may skip changes for other tables, thus logically corrupting them.

- This procedure requires **DBA** privileges to execute.
- Use the **DBA_LOGSTDBY_SKIP_TRANSACTION** view to list the transactions that are going to be skipped by SQL Apply.

Exceptions

Table 111-20 SKIP_TRANSACTION Procedure Exceptions

Exception	Description
ORA-01031	Need DBA privileges
ORA-16103	Logical Standby apply must be stopped to allow this operation
ORA-16104	invalid Logical Standby option requested

Examples

To skip a DDL transaction with (xidusn_p, xidslt_p, xidsqn_p) of (1.13.1726) you can register a rule as shown in the following example:


```
SQL> EXECUTE DBMS_LOGSTDBY.SKIP_TRANSACTION (-
        xidusn_p => 1, xidslt_p => 13, xidsqn_p => 1726);
```

111.4.14 UNSKIP Procedure

Use the `UNSKIP` procedure to delete rules specified earlier with the `SKIP` procedure.

The parameters specified in the `UNSKIP` procedure must match exactly for it to delete an already-specified rule.

The `container_name` argument is valid only in a CDB.

Syntax

```
DBMS_LOGSTDBY.UNSKIP (
    stmt                IN VARCHAR2,
    schema_name         IN VARCHAR2 DEFAULT NULL,
    object_name         IN VARCHAR2 DEFAULT NULL,
    container_name      IN VARCHAR2 DEFAULT NULL);
```

Parameters

The parameter information for the `UNSKIP` procedure is the same as that described for the `SKIP` procedure. See [Table 111-14](#) for complete parameter information.

Exceptions

Table 111-21 UNSKIP Procedure Exceptions

Exception	Description
ORA-01031	need DBA privileges to execute this procedure
ORA-16103	Logical Standby apply must be stopped to allow this operation
ORA-16104	invalid Logical Standby option requested

Usage Notes

WARNING:

If DML changes for a table have been skipped and not compensated for, you must follow the call to the `UNSKIP` procedure with a call to the `INstantiate_Table` procedure to synchronize this table with those maintained by SQL Apply.

- This procedure requires DBA privileges to execute.
- Wildcards passed in the `schema_name` or the `object_name` parameter are not expanded. The wildcard character is matched at the character level. Thus, you can delete only one specified rule by invoking the `UNSKIP` procedure, and you will need a distinct `UNSKIP` procedure call to delete each rule that was previously specified.

For example, assume you have specified the following two rules to skip applying DML statements to the `HR.EMPLOYEE` and `HR.EMPTEMP` tables:

```
SQL> EXECUTE DBMS_LOGSTDBY.SKIP (STMT => 'DML', -
    SCHEMA_NAME => 'HR', -
    OBJECT_NAME => 'EMPLOYEE', -
    PROC_NAME => null);
SQL> EXECUTE DBMS_LOGSTDBY.SKIP (STMT => 'DML', -
    SCHEMA_NAME => 'HR', -
    OBJECT_NAME => 'EMPTEMP', -
    PROC_NAME => null);
```

In the following example, the wildcard in the `TABLE_NAME` parameter cannot be used to delete the rules that were specified:

```
SQL> EXECUTE DBMS_LOGSTDBY.UNSKIP (STMT => 'DML', -
    SCHEMA_NAME => 'HR', -
    OBJECT_NAME => 'EMP%');
```

In fact, this `UNSKIP` procedure matches neither of the rules, because the wildcard character in the `TABLE_NAME` parameter is not expanded. Instead, the wildcard character will be used in an exact match to find the corresponding `SKIP` rule.

111.4.15 UNSKIP_ERROR Procedure

Use the `UNSKIP_ERROR` procedure to delete rules specified earlier with the `SKIP_ERROR` procedure.

The parameters specified in the `UNSKIP_ERROR` procedure must match exactly for the procedure to delete an already-specified rule.

The `container_name` argument is valid only in a CDB.

Syntax

```
DBMS_LOGSTDBY.UNSKIP_ERROR (
    stmt                IN VARCHAR2,
    schema_name         IN VARCHAR2 DEFAULT NULL,
    object_name         IN VARCHAR2 DEFAULT NULL,
    container_name      IN VARCHAR2 DEFAULT NULL);
```

Parameters

The parameter information for the `UNSKIP_ERROR` procedure is the same as that described for the `SKIP_ERROR` procedure. See [Table 111-17](#) for complete parameter information.

Exceptions

Table 111-22 UNSKIP_ERROR Procedure Exceptions

Exception	Description
ORA-01031	Need DBA privileges
ORA-16103	Logical Standby apply must be stopped to allow this operation
ORA-16104	invalid Logical Standby option requested

Usage Notes

- This procedure requires DBA privileges to execute.

- Wildcards passed in the `schema_name` or the `object_name` parameters are not expanded. Instead, the wildcard character is treated as any other character and an exact match is made. Thus, you can delete only one specified rule by invoking the `UNSKIP_ERROR` procedure, and you need a distinct `UNSKIP_ERROR` procedure call to delete each rule that you previously specified.

For example, assume you have specified the following two rules to handle the `HR.EMPLOYEE` and `HR.EMPTEMP` tables:

```
SQL> EXECUTE DBMS_LOGSTDBY.SKIP_ERROR (STMT => 'DML', -
    SCHEMA_NAME => 'HR', -
    OBJECT_NAME => 'EMPLOYEE', -
    PROC_NAME => 'hr_employee_handler');
SQL> EXECUTE DBMS_LOGSTDBY.SKIP_ERROR (STMT => 'DML', -
    SCHEMA_NAME => 'HR', -
    OBJECT_NAME => 'EMPTEMP', -
    PROC_NAME => 'hr_tempemp_handler');
```

In this case, the following `UNSKIP` procedure cannot be used to delete the rules that you have specified:

```
SQL> EXECUTE DBMS_LOGSTDBY.UNSKIP_ERROR (STMT => 'DML', -
    SCHEMA_NAME => 'HR', -
    OBJECT_NAME => 'EMP%');
```

In fact, the `UNSKIP` procedure will match neither of the rules, because the wildcard character in the `OBJECT_NAME` parameter will not be expanded.

Example

To remove a handler that was previously registered with SQL Apply from getting called on encountering an error, you can issue the following statement:

```
DBMS_LOGSTDBY.UNSKIP_ERROR ( -
    statement => 'NON_SCHEMA_DDL', -
    schema_name => NULL, -
    object_name => NULL);
```

111.4.16 UNSKIP_TRANSACTION Procedure

Use the `UNSKIP_TRANSACTION` procedure to delete rules specified earlier with the `SKIP_TRANSACTION` procedure.

The parameters specified in the `UNSKIP_TRANSACTION` procedure must match exactly for the procedure to delete an already-specified rule.

Syntax

```
DBMS_LOGSTDBY.UNSKIP_TRANSACTION (
    xidusn_p          IN NUMBER,
    xidslt_p          IN NUMBER,
    xidsqn_p          IN NUMBER);
```

Parameters

Table 111-23 UNSKIP_TRANSACTION Procedure Parameters

Parameter	Description
XIDUSN	Transaction ID undo segment number of the transaction being skipped
XIDSLT	Transaction ID slot number of the transaction being skipped
XIDSQN	Transaction ID sequence number of the transaction being skipped

Exceptions

Table 111-24 UNSKIP_TRANSACTION Procedure Exceptions

Exception	Description
ORA-01031	need DBA privileges to execute this procedure
ORA-16103	Logical Standby apply must be stopped to allow this operation
ORA-16104	invalid Logical Standby option requested

Usage Notes

- This procedure requires DBA privileges to execute.
- Query the DBA_LOGSTDBY_SKIP_TRANSACTION view to list the transactions that are going to be skipped by SQL Apply.

Examples

To remove a rule that was originally specified to skip the application of a transaction with (XIDUSN, XIDSLT, XIDSQN) of (1.13.1726) issue the following statement:

```
SQL> DBMS_LOGSTDBY.UNSKIP_TRANSACTION (XIDUSN => 1, XIDSLT => 13, XIDSQN => 1726);
```

DBMS_LOGMNR_D

The `DBMS_LOGMNR_D` package, one of a set of LogMiner packages, contains two subprograms: the `BUILD` procedure and the `SET_TABLESPACE` procedure.

- The `BUILD` procedure extracts the LogMiner data dictionary to either the redo log files or to a flat file. This information is saved in preparation for future analysis of redo log files using the LogMiner tool.
- The `SET_TABLESPACE` procedure re-creates all LogMiner tables in an alternate tablespace.

The **LogMiner data dictionary** consists of the memory data structures and the database tables that are used to store and retrieve information about objects and their versions. It is referred to as the **LogMiner dictionary** throughout the LogMiner documentation.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_LOGMNR_D Subprograms](#)



See Also:

Oracle Database Utilities for information regarding LogMiner.

112.1 DBMS_LOGMNR_D Overview

LogMiner requires a dictionary to translate object IDs into object names when it returns redo data to you.

LogMiner gives you two options for supplying the dictionary:

- Using the online catalog
- Extracting a LogMiner dictionary to the redo log files
- Extracting a LogMiner dictionary to a flat file (for non-CDBs only)

 **Note:**

In previous releases, using a flat file dictionary was one means of mining the redo logs for the changes associated with a specific PDB whose data dictionary was contained within the flat file. This feature is desupported for PDBs in Oracle Database 19c, and desupported in later releases. With Oracle Database 19c and later releases, Oracle recommends that you call `DBMS_LOGMNR.START_LOGMNR`, and supply the system change number (SCN) or time range that you want to mine. The SCN or time range options of `START_LOGMNR` are enhanced to support mining of individual PDBs.

Use the `BUILD` procedure to extract the LogMiner dictionary to the redo log files or a flat file. If you want to specify the online catalog as the dictionary source, you do so when you start LogMiner with the `DBMS_LOGMNR.START_LOGMNR` package.

Use the `SET_TABLESPACE` procedure if you want LogMiner tables to use a tablespace other than the default `SYSAUX` tablespace.

 **See Also:**

[DBMS_LOGMNR](#) for information on the package subprograms used in running a LogMiner session.

112.2 DBMS_LOGMNR_D Security Model

You must have the `EXECUTE_CATALOG_ROLE` role to use the `DBMS_LOGMNR_D` package.

112.3 Summary of DBMS_LOGMNR_D Subprograms

This table lists and briefly describes the `DBMS_LOGMNR_D` subprograms.

In a multitenant container database (CDB), some subprograms must be called from the root. There can be other differences as well. See the individual subprogram descriptions for details.

Table 112-1 DBMS_LOGMNR_D Package Subprograms

Subprogram	Description
BUILD Procedure	Extracts the LogMiner dictionary to either a flat file or one or more redo log files
SET_TABLESPACE Procedure	Re-creates all LogMiner tables in an alternate tablespace

112.3.1 BUILD Procedure

This procedure extracts the LogMiner data dictionary to the redo log files.

The following considerations apply to a multitenant container database (CDB) environment.

- In a CDB environment, when you extract to the redo log files, the `BUILD` procedure must be called from the root database. The LogMiner data dictionary for the entire CDB is extracted to the redo log files.
- You cannot add or remove PDBs from a CDB while this procedure is running.

Note:

In previous releases, using a flat file dictionary was one means of mining the redo logs for the changes associated with a specific PDB whose data dictionary was contained within the flat file. This feature is desupported for PDBs in Oracle Database 19c, and desupported in later releases. With Oracle Database 19c and later releases, Oracle recommends that you call `DBMS_LOGMNR.START_LOGMNR`, and supply the system change number (SCN) or time range that you want to mine. The SCN or time range options of `START_LOGMNR` are enhanced to support mining of individual PDBs.

Syntax

```
DBMS_LOGMNR_D.BUILD (
    dictionary_filename IN VARCHAR2,
    dictionary_location IN VARCHAR2,
    options             IN NUMBER);
```


Parameters

Table 112-2 BUILD Procedure Parameters

Parameter	Description
<code>dictionary_filename</code>	Specifies the name of the LogMiner dictionary file.
<code>dictionary_location</code>	Specifies the directory object for the LogMiner dictionary file.
<code>options</code>	Specifies that the LogMiner dictionary is written to the redo log files (<code>STORE_IN_REDO_LOGS</code>).

Exceptions

Table 112-3 BUILD Procedure Exceptions

Exception	Description
ORA-01302	<p>Dictionary build options are missing or incorrect.</p> <p>This error is returned under the following conditions:</p> <ul style="list-style-type: none"> • If the value of the <code>OPTIONS</code> parameter is not one of the supported values (<code>STORE_IN_REDO_LOGS</code>), or is not specified • If the <code>STORE_IN_REDO_LOGS</code> option is not specified and neither the <code>dictionary_filename</code> nor the <code>dictionary_location</code> parameter is specified • If the <code>STORE_IN_REDO_LOGS</code> option is specified and either the <code>dictionary_filename</code> or the <code>dictionary_location</code> parameter is specified
ORA-01308	<p>Initialization parameter <code>UTL_FILE_DIR</code> is not set.</p>
	<div style="border: 1px solid #0070C0; padding: 10px; background-color: #E6F2FF;"> <p> Note:</p> <p>In earlier releases, you used the <code>UTL_FILE_DIR</code> initialization parameter to specify a directory location. However, as of Oracle Database 18c, the <code>UTL_FILE_DIR</code> initialization parameter is desupported. It is still supported for backward compatibility, but Oracle recommends that you instead use directory objects.</p> </div>
ORA-01336	<p>Specified dictionary file cannot be opened.</p> <p>This error is returned when the dictionary file is read-only.</p>
ORA-01308	<p>Dictionary directory is not set.</p> <p>This error is returned under the following conditions:</p> <ul style="list-style-type: none"> • The specified value for the <code>dictionary_location</code> is not a directory object. • The specified value for the <code>dictionary_location</code> is a directory object that is defined to be a file path that cannot be accessed.

Usage Notes

- To extract the LogMiner dictionary to the redo log files, specify only the `STORE_IN_REDO_LOGS` option. The size of the LogMiner dictionary may cause it to be contained in multiple redo log files.
- The combinations of parameters used result in the following behavior:
- If you do not specify any parameters, an error is returned.

- If you do not specify a filename and location, but do specify the `STORE_IN_REDO_LOGS` option, the LogMiner dictionary is extracted to the redo log files.
- If you specify a filename and location, as well as the `STORE_IN_REDO_LOGS` option, an error is returned.
- Ideally, the LogMiner dictionary file is created after all database dictionary changes have been made, and before the creation of any redo log files that you want to analyze. You can use LogMiner to dump the LogMiner dictionary to the redo log files, perform DDL operations, and dynamically apply the DDL changes to the LogMiner dictionary.
- The database must be open when you run the `DBMS_LOGMNR_D.BUILD` procedure.
- To extract a LogMiner dictionary file to the redo log files, the following conditions must be met:
 - Archivelog mode must be enabled in order to generate usable redo log files.
 - The `COMPATIBLE` parameter in the initialization parameter file must be set to 9.2.0 or higher.
 - The database to which LogMiner is attached must be Oracle9i or later.

In addition, supplemental logging (at least the minimum level) should be enabled to ensure that you can take advantage of all the features that LogMiner offers.

Examples

Example: Extracting the LogMiner Dictionary to the Redo Log Files

The following example extracts the LogMiner dictionary to the redo log files.

```
SQL> EXECUTE dbms_logmnr_d.build( -  
          options => dbms_logmnr_d.store_in_redo_logs);
```

112.3.2 SET_TABLESPACE Procedure

This procedure moves LogMiner tables from the default `SYSAUX` tablespace to an alternate tablespace.

By default, all LogMiner tables are created to use the `SYSAUX` tablespace. However, it may be desirable to have LogMiner tables use an alternate tablespace. Use this procedure to move LogMiner tables to this alternate tablespace

In a CDB, only the LogMiner metadata in the local container is moved to the requested tablespace.

Syntax

```
DBMS_LOGMNR_D.SET_TABLESPACE (  
    new_tablespace          IN VARCHAR2);
```

Parameters

Table 112-4 SET_TABLESPACE Parameter

Parameter	Description
<code>new_tablespace</code>	A string naming a preexisting tablespace. To move all LogMiner tables to employ this tablespace, supply this parameter.

Usage Notes

- Users upgrading from earlier versions of Oracle Database may find LogMiner tables in the `SYSTEM` tablespace. Oracle encourages such users to consider using the `SET_TABLESPACE` procedure to move the tables to the `SYSAUX` tablespace once they are confident that they will not be downgrading to an earlier version of Oracle Database.
- Users of this routine must supply an existing tablespace.

Example: Using the DBMS_LOGMNR_D.SET_TABLESPACE Procedure

The following example shows the creation of an alternate tablespace and execution of the `DBMS_LOGMNR_D.SET_TABLESPACE` procedure.

```
SQL> CREATE TABLESPACE logmnrts$ datafile '/usr/oracle/dbs/logmnrts.f'  
      SIZE 25 M REUSE AUTOEXTEND ON MAXSIZE UNLIMITED;  
  
SQL> EXECUTE dbms_logmnr_d.set_tablespace('logmnrts$');
```

DBMS_LOGSTDBY_CONTEXT

As of Oracle Database 12c release 1 (12.1), SQL Apply processes have access to a context namespace called `LSBY_APPLY_CONTEXT`. You can use the procedures provided in the `DBMS_LOGSTDBY_CONTEXT` package to set and retrieve various parameters associated with `LSBY_APPLY_CONTEXT`. This is useful when writing skip procedures that are registered with SQL Apply using the `DBMS_LOGSTDBY.SKIP` and `DBMS_LOGSTDBY.SKIP_ERROR` procedures.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_LOGSTDBY_CONTEXT Subprograms](#)



See Also:

Oracle Data Guard Concepts and Administration for more information about SQL Apply and logical standby databases

113.1 DBMS_LOGSTDBY_CONTEXT Overview

SQL Apply processes have access to a context namespace called `LSBY_APPLY_CONTEXT`.

The following table lists the predefined parameters associated with `LSBY_APPLY_CONTEXT` that you can set and retrieve by using the procedures provided in the `DBMS_LOGSTDBY_CONTEXT` package. The ability to set and retrieve the parameters in this way is useful when writing skip procedures that are registered with SQL Apply using the `DBMS_LOGSTDBY.SKIP` and `DBMS_LOGSTDBY.SKIP_ERROR` procedures.

Table 113-1 Predefined Parameters of Namespace `LSBY_APPLY_CONTEXT`

Parameter	Description
<code>STATEMENT</code>	First 4000 bytes of the statement that the Apply process is processing.
<code>STATEMENT_TYPE</code>	See Table 111-15 for a list of various statement types.
<code>PACKAGE_SCHEMA</code>	Schema that owns the PL/SQL package being processed (if applicable).
<code>PACKAGE_NAME</code>	Name of the PL/SQL package being processed (if applicable).
<code>PROCEDURE_NAME</code>	Name of the PL/SQL procedure being processed (if applicable).
<code>CURRENT_SCHEMA</code>	Current schema in effect when the DDL or PL/SQL procedure was executed at the primary.
<code>XIDUSN</code>	XIDUSN of the transaction at the primary database.

Table 113-1 (Cont.) Predefined Parameters of Namespace LSBY_APPLY_CONTEXT

Parameter	Description
XIDSLT	XIDSLT of the transaction at the primary database.
XIDSQN	XIDSQN of the transaction at the primary database.
SCHEMA	Schema that owns the object being processed by SQL Apply (in the case of DML or DDL operations).
NAME	Object name being processed by SQL Apply (in case of DML or DDL operations).
CONTAINER_NAME	Container where the target object or the PL/SQL procedure resides (in the case of a multitenant container database (CDB)).
ERROR	Text of the original error encountered by the SQL Apply process (if applicable).
NEW_ERROR	Text of the new error to be raised by the SQL Apply process (if applicable, See the DBMS_LOGSTDBY SKIP_ERROR Procedure).
NEW_STMT	Text of the replacement statement that SQL Apply must execute (If applicable, See the DBMS_LOGSTDBY SKIP Procedure).
SKIP_ACTION	The skip action to be performed by SQL Apply (See the DBMS_LOGSTDBY SKIP Procedure).

113.2 DBMS_LOGSTDBY_CONTEXT Security Model

The security model for the DBMS_LOGSTDBY_CONTEXT package is the same as for the DBMS_LOGSTDBY package.



See Also:

[DBMS_LOGSTDBY](#)

113.3 Summary of DBMS_LOGSTDBY_CONTEXT Subprograms

This table lists and briefly describes the DBMS_LOGSTDBY_CONTEXT package subprograms.

Table 113-2 DBMS_LOGSTDBY_CONTEXT Package Subprograms

Subprogram	Description
CLEAR_ALL_CONTEXT Procedure	Clears all parameters contained within namespace LSBY_APPLY_CONTEXT.
CLEAR_CONTEXT Procedure	Clears the specific parameter.
GET_CONTEXT Procedure	Retrieves the value for the specified parameter.

Table 113-2 (Cont.) DBMS_LOGSTDBY_CONTEXT Package Subprograms

Subprogram	Description
SET_CONTEXT Procedure	Sets the named parameter with the specified value.

113.3.1 CLEAR_ALL_CONTEXT Procedure

This procedure clears all parameters contained within namespace `LSBY_APPLY_CONTEXT`.

Syntax

```
DBMS_LOGSTDBY_CONTEXT.CLEAR_ALL_CONTEXT;
```

Parameters

None

113.3.2 CLEAR_CONTEXT Procedure

This procedure clears the specific parameter.

Syntax

```
DBMS_LOGSTDBY_CONTEXT.CLEAR_CONTEXT (
    name          IN VARCHAR2);
```

Parameters

Table 113-3 CLEAR_CONTEXT Procedure Parameters

Parameter	Description
name	Name of the parameter to be cleared.

113.3.3 GET_CONTEXT Procedure

This procedure retrieves the value for the specified parameter.

Syntax

```
DBMS_LOGSTDBY_CONTEXT.GET_CONTEXT (
    name          IN VARCHAR2,
    value         OUT VARCHAR2);
```

Parameters

Table 113-4 GET_CONTEXT Procedure Parameters

Parameter	Description
name	Name of the parameter.
value	The value retrieved for the parameter.

113.3.4 SET_CONTEXT Procedure

This procedure sets the named parameter with the specified value.

Syntax

```
DBMS_LOGSTDBY_CONTEXT.SET_CONTEXT (  
    name          IN VARCHAR2  
    value         IN VARCHAR2);
```

Parameters

Table 113-5 *SET_CONTEXT Procedure Parameters*

Parameter	Description
name	Name of the parameter to be set.
value	Value to be assigned to the parameter being set.

DBMS_MEMOPTIMIZE

The `DBMS_MEMOPTIMIZE` package provides the interface for managing the Memoptimized Rowstore data buffered in the large pool and the memoptimize pool.

This chapter contains the following topics:

- [DBMS_MEMOPTIMIZE Overview](#)
- [Summary of DBMS_MEMOPTIMIZE Subprograms](#)

114.1 DBMS_MEMOPTIMIZE Overview

The `DBMS_MEMOPTIMIZE` package provides the interface for managing Memoptimized Rowstore data buffered in the large pool and the memoptimize pool.

The Memoptimized Rowstore provides the following functionality:

- **Fast Ingest**
Fast ingest optimizes the processing of high-frequency, single-row data inserts. Fast ingest uses the large pool in the SGA for buffering the inserts before writing them to disk.
- **Fast Lookup**
Fast lookup enables fast retrieval of data for high-frequency queries. Fast lookup uses a separate memory area in the SGA called the *memoptimize pool* for buffering data queried from tables.

The `DBMS_MEMOPTIMIZE` package provides the following operations related to the Memoptimized Rowstore:

- **Fast ingest operations:**
 - Provide the low high-water mark (low HWM) of the sequence numbers of rows that have been successfully written from the large pool to disk across all the sessions.
 - Provide the high-water mark (HWM) sequence number of the row that has been written to the large pool for the current session.
 - Flush all the fast ingest data from the large pool to disk for the current session.
- **Fast lookup operations:**
 - Remove data for a table from the memoptimize pool.
 - Populate data for a table in the memoptimize pool.

114.2 Summary of DBMS_MEMOPTIMIZE Subprograms

This table lists the `DBMS_MEMOPTIMIZE` subprograms and briefly describes them.

Table 114-1 DBMS_MEMOPTIMIZE Package Subprograms Related to Fast Ingest

Procedure	Description
GET_APPLY_HWM_SEQID Function	Returns the low high-water mark (low HWM) of the sequence numbers of rows that have been successfully written to disk globally across all the sessions.
GET_WRITE_HWM_SEQID Function	Returns the high-water mark (HWM) sequence number of the row that has been written to the large pool for the current session.
WRITE_END Procedure	Flushes all the fast ingest data from the large pool to disk for the current session.

Table 114-2 DBMS_MEMOPTIMIZE Package Subprograms Related to Fast Lookup

Procedure	Description
DROP_OBJECT Procedure	Removes data for a table from the memoptimize pool.
POPULATE Procedure	Populates data for a table in the memoptimize pool.

114.2.1 DROP_OBJECT Procedure

This procedure removes data for a table from the memoptimize pool.

Syntax

```
DBMS_MEMOPTIMIZE.DROP_OBJECT (
    schema_name      IN VARCHAR2,
    table_name       IN VARCHAR2,
    partition_name   IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 114-3 DROP_OBJECT Procedure Parameters

Parameter	Description
schema_name	Name of the schema.
table_name	Name of the table for which the data needs to be removed from the memoptimize pool.
partition_name	Name of the table partition for which the data needs to be removed from the memoptimize pool. This is an optional parameter and its default value is NULL.

114.2.2 GET_APPLY_HWM_SEQID Function

This function returns the low high-water mark (low HWM) of sequence numbers of the records that have been successfully written to disk across all the sessions.

Syntax

```
DBMS_MEMOPTIMIZE.GET_APPLY_HWM_SEQID
    RETURN number;
```

Return Value

Returns the low high-water mark (low HWM) of sequence numbers of the records that have been successfully written to disk across all the sessions.

114.2.3 GET_WRITE_HWM_SEQID Function

This function returns the high-water mark (HWM) sequence number of the record that has been written to the large pool for the current session.

Syntax

```
DBMS_MEMOPTIMIZE.GET_WRITE_HWM_SEQID
    RETURN number;
```

Return Value

Returns the high-water mark (HWM) sequence number of the record that has been written to the large pool for the current session.

114.2.4 POPULATE Procedure

This procedure populates the data for a table in the memoptimize pool.

Syntax

```
DBMS_MEMOPTIMIZE.POPULATE (
    schema_name      IN VARCHAR2,
    table_name       IN VARCHAR2,
    partition_name   IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 114-4 POPULATE Procedure Parameters

Parameter	Description
schema_name	Name of the schema.
table_name	Name of the table for which the data needs to be populated in the memoptimize pool.

Table 114-4 (Cont.) POPULATE Procedure Parameters

Parameter	Description
<code>partition_name</code>	Name of the table partition for which the data needs to be populated in the memoptimize pool. This is an optional parameter and its default value is NULL.

114.2.5 WRITE_END Procedure

This procedure flushes all the fast ingest data from the large pool to disk for the current session.

Syntax

```
DBMS_MEMOPTIMIZE.WRITE_END;
```

DBMS_MEMOPTIMIZE_ADMIN

The `DBMS_MEMOPTIMIZE_ADMIN` package provides the interface for flushing the Memoptimized Rowstore data buffered in the large pool to disk.

This chapter contains the following topics:

- [DBMS_MEMOPTIMIZE_ADMIN Overview](#)
- [Summary of DBMS_MEMOPTIMIZE_ADMIN Subprograms](#)

115.1 DBMS_MEMOPTIMIZE_ADMIN Overview

The `DBMS_MEMOPTIMIZE_ADMIN` package provides the interface for flushing the Memoptimized Rowstore data that is buffered in the large pool to disk.

The Memoptimized Rowstore provides the following functionality:

- **Fast Ingest**
Fast ingest optimizes the processing of high-frequency, single-row data inserts. Fast ingest uses the large pool in the SGA for buffering the inserts before writing them to disk.
- **Fast Lookup**
Fast lookup enables fast retrieval of data for high-frequency queries. Fast lookup uses a separate memory area in the SGA called the *memoptimize pool* for buffering the data queried from tables.

The `DBMS_MEMOPTIMIZE_ADMIN` package provides the following operation related to fast ingest of the Memoptimized Rowstore:

- Flush fast ingest data from the large pool to disk for all sessions.

115.2 Summary of DBMS_MEMOPTIMIZE_ADMIN Subprograms

This table lists the `DBMS_MEMOPTIMIZE_ADMIN` subprograms and briefly describes them.

Table 115-1 DBMS_MEMOPTIMIZE_ADMIN Package Subprograms

Procedure	Description
WRITES_FLUSH Procedure	Flushes all the fast ingest data of the Memoptimize Rowstore from the large pool to disk for all the sessions.

115.2.1 WRITES_FLUSH Procedure

This procedure flushes all the fast ingest data of the Memoptimized Rowstore from the large pool to disk for all the sessions.

Syntax

```
DBMS_MEMOPTIMIZE_ADMIN.WRITES_FLUSH;
```

DBMS_METADATA

The `DBMS_METADATA` package provides a way for you to retrieve metadata from the database dictionary as XML or creation DDL and to submit the XML to re-create the object.



See Also:

Oracle Database Utilities for more information and for examples of using the `DBMS_METADATA` package.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Rules and Limits](#)
- [Data Structures - Object and Table Types](#)
- [Subprogram Groupings](#)
 - [Subprograms for Retrieving Multiple Objects From the Database](#)
 - [Subprograms for Submitting XML to the Database](#)
- [Summary of All DBMS_METADATA Subprograms](#)

116.1 DBMS_METADATA Overview

You can use the `DBMS_METADATA` package to retrieve metadata and to submit XML.

Retrieving Metadata

If you are retrieving metadata, you can specify:

- The kind of object to be retrieved. This can be either a particular object type (such as a table, index, or procedure) or a heterogeneous collection of object types that form a logical unit (such as a database export or schema export).
- Optional selection criteria, such as owner or name.
- Parse items (attributes of the returned objects to be parsed and returned separately).
- Optional transformations on the output, implemented by XSLT (Extensible Stylesheet Language Transformation) scripts. By default the output is represented in XML, but you can specify transformations (into SQL DDL, for example), which are implemented by XSLT stylesheets stored in the database or externally.

`DBMS_METADATA` provides the following retrieval interfaces:

- For programmatic use: `OPEN`, `SET_FILTER`, `SET_COUNT`, `GET_QUERY`, `SET_PARSE_ITEM`, `ADD_TRANSFORM`, `SET_TRANSFORM_PARAM`, `SET_REMAP_PARAM`, `FETCH_xxx`, and `CLOSE` retrieve multiple objects.
- For use in SQL queries and for browsing: `GET_XML`, `GET_DDL` and `GET_SXML` return metadata for a single named object. The `GET_DEPENDENT_XML`, `GET_DEPENDENT_DDL`, `GET_GRANTED_XML`, and `GET_GRANTED_DDL` interfaces return metadata for one or more dependent or granted objects. These procedures do not support heterogeneous object types.

Submitting XML

If you are submitting XML, you specify:

- The type of object
- Optional transform parameters to modify the object (for example, changing the object's owner)
- Parse items (attributes of the submitted objects to be parsed and submitted separately)
- Whether to execute the operation or simply return the generated DDL

DBMS_METADATA provides a programmatic interface for submission of XML. It is comprised of the following procedures: `OPENW`, `ADD_TRANSFORM`, `SET_TRANSFORM_PARAM`, `SET_REMAP_PARAM`, `SET_PARSE_ITEM`, `CONVERT`, `PUT`, and `CLOSE`.

116.2 DBMS_METADATA Security Model

The DBMS_METADATA package considers a privileged user to be one who is connected as user `SYS` or who has the `SELECT_CATALOG_ROLE` role.

The object views of the Oracle metadata model implement security as follows:

- Nonprivileged users can see the metadata of only their own objects.
- Nonprivileged users can also retrieve public synonyms, system privileges granted to them, and object privileges granted to them or by them to others. This also includes privileges granted to `PUBLIC`.
- If callers request objects they are not privileged to retrieve, no exception is raised; the object is simply not retrieved.
- If nonprivileged users are granted some form of access to an object in someone else's schema, they will be able to retrieve the grant specification through the Metadata API, but not the object's actual metadata.
- In stored procedures, functions, and definers-rights packages, roles (such as `SELECT_CATALOG_ROLE`) are disabled. Therefore, such a PL/SQL program can only fetch metadata for objects in its own schema. If you want to write a PL/SQL program that fetches metadata for objects in a different schema (based on the invoker's possession of `SELECT_CATALOG_ROLE`), you must make the program invokers-rights.
- For all objects that have passwords, except database links (for example, users and roles), the following rules apply:
 - A user who has the `SELECT_CATALOG_ROLE` can see all metadata for an object except the passwords for that object.

- The SYS user, users who have the EXP_FULL_DATABASE role, and users who own an object can see all metadata for that object, including passwords.
- For database links the password is never displayed. For security reasons Oracle restricts visibility of the password value to SYS users who query the link\$.passwordx column directly. Instead of the password, DBMS_METADATA returns the following invalid syntax:

```
IDENTIFIED BY VALUES ':1'
```

A user who knows the password of the database link can manually replace the :1 with the password.

116.3 Rules and Limits

In an Oracle Shared Server (OSS) environment, the DBMS_METADATA package must disable session migration and connection pooling.

This results in any shared server process that is serving a session running the package to effectively become a default, dedicated server for the life of the session. You should ensure that sufficient shared servers are configured when the package is used and that the number of servers is not artificially limited by too small a value for the MAX_SHARED_SERVERS initialization parameter.

116.4 DBMS_METADATA Data Structures - Object and Table Types

The DBMS_METADATA package defines, in the SYS schema, the OBJECT and TABLE types shown in this code.

```
CREATE TYPE sys.ku$_parsed_item AS OBJECT (
  item          VARCHAR2(30),
  value         VARCHAR2(4000),
  object_row    NUMBER )
/

CREATE PUBLIC SYNONYM ku$_parsed_item FOR sys.ku$_parsed_item;

CREATE TYPE sys.ku$_parsed_items IS TABLE OF sys.ku$_parsed_item
/

CREATE PUBLIC SYNONYM ku$_parsed_items FOR sys.ku$_parsed_items;

CREATE TYPE sys.ku$_ddl AS OBJECT (
  ddlText      CLOB,
  parsedItems  sys.ku$_parsed_items )
/

CREATE PUBLIC SYNONYM ku$_ddl FOR sys.ku$_ddl;

CREATE TYPE sys.ku$_ddls IS TABLE OF sys.ku$_ddl
/

CREATE PUBLIC SYNONYM ku$_ddls FOR sys.ku$_ddls;

CREATE TYPE sys.ku$_multi_ddl AS OBJECT (
  object_row    NUMBER,
  ddls          sys.ku$_ddls )
```

```

/

CREATE OR REPLACE PUBLIC SYNONYM ku$_multi_ddl FOR sys.ku$_multi_ddl;

CREATE TYPE sys.ku$_multi_ddls IS TABLE OF sys.ku$_multi_ddl;
/

CREATE OR REPLACE PUBLIC SYNONYM ku$_multi_ddls FOR
    sys.ku$_multi_ddls;

CREATE TYPE sys.ku$_ErrorLine IS OBJECT (
    errorNumber    NUMBER,
    errorText      VARCHAR2(2000) )
/

CREATE PUBLIC SYNONYM ku$_ErrorLine FOR sys.ku$_ErrorLine;

CREATE TYPE sys.ku$_ErrorLines IS TABLE OF sys.ku$_ErrorLine
/
CREATE PUBLIC SYNONYM ku$ErrorLines FOR sys.ku$_ErrorLines;

CREATE TYPE sys.ku$_SubmitResult AS OBJECT (
    ddl            sys.ku$_ddl,
    errorLines     sys.ku$_ErrorLines );
/

CREATE TYPE sys.ku$_SubmitResults IS TABLE OF sys.ku$_SubmitResult
/

CREATE PUBLIC SYNONYM ku$_SubmitResults FOR sys.ku$_SubmitResults;

```

**Note:**

The maximum size of the VARCHAR2, NVARCHAR2, and RAW datatypes has been increased to 32 KB when the COMPATIBLE initialization parameter is set to 12.0 and the MAX_STRING_SIZE initialization parameter is set to EXTENDED. The DBMS_METADATA package supports this increased size unless the version of the metadata is earlier than Oracle Database 12c Release 1 (12.1).

116.5 DBMS_METADATA Subprogram Groupings

The DBMS_METADATA subprograms retrieve objects from, and submit XML to, a database. Some subprograms are used for both activities, while others are used only for retrieval or only for submission.

- [Table 116-1](#) provides a summary, in alphabetical order, of DBMS_METADATA subprograms used to retrieve multiple objects from a database.
- [Table 116-2](#) provides a summary, in alphabetical order, of DBMS_METADATA subprograms used to submit XML metadata to a database.

116.5.1 DBMS_METADATA Subprograms for Retrieving Multiple Objects From the Database

DBMS_METADATA uses these subprograms used for retrieving multiple objects from the database.

Table 116-1 DBMS_METADATA Subprograms for Retrieving Multiple Objects

Subprogram	Description
ADD_TRANSFORM Function	Specifies a transform that <code>FETCH_XXX</code> applies to the XML representation of the retrieved objects
CLOSE Procedure	Invalidates the handle returned by <code>OPEN</code> and cleans up the associated state
FETCH_XXX Functions and Procedures	Returns metadata for objects meeting the criteria established by <code>OPEN</code> , <code>SET_FILTER</code> , <code>SET_COUNT</code> , <code>ADD_TRANSFORM</code> , and so on
GET_QUERY Function	Returns the text of the queries that are used by <code>FETCH_XXX</code>
GET_XXX Functions	Fetches the metadata for a specified object as XML, SXML, or DDL, using only a single call
OPEN Function	Specifies the type of object to be retrieved, the version of its metadata, and the object model
SET_COUNT Procedure	Specifies the maximum number of objects to be retrieved in a single <code>FETCH_XXX</code> call
SET_FILTER Procedure	Specifies restrictions on the objects to be retrieved, for example, the object name or schema
SET_PARSE_ITEM Procedure	Enables output parsing by specifying an object attribute to be parsed and returned
SET_TRANSFORM_PARAM and SET_REMAP_PARAM Procedures	Specifies parameters to the XSLT stylesheets identified by <code>transform_handle</code>

116.5.2 DBMS_METADATA Subprograms for Submitting XML to the Database

DBMS_METADATA uses these subprograms for submitting XML to the database.

Table 116-2 DBMS_METADATA Subprograms for Submitting XML

Subprogram	Description
ADD_TRANSFORM Function	Specifies a transform for the XML documents
CLOSE Procedure	Closes the context opened with <code>OPENW</code>
CONVERT Functions and Procedures	Converts an XML document to DDL
OPENW Function	Opens a write context
PUT Function	Submits an XML document to the database
SET_PARSE_ITEM Procedure	Specifies an object attribute to be parsed

Table 116-2 (Cont.) DBMS_METADATA Subprograms for Submitting XML

Subprogram	Description
SET_TRANSFORM_PARAM and SET_REMAP_PARAM Procedures	<code>SET_TRANSFORM_PARAM</code> specifies a parameter to a transform <code>SET_REMAP_PARAM</code> specifies a remapping for a transform

116.6 Summary of All DBMS_METADATA Subprograms

This table lists the DBMS_METADATA subprograms and briefly describes them.

Table 116-3 DBMS_METADATA Package Subprograms

Subprogram	Description
ADD_TRANSFORM Function	Specifies a transform that <code>FETCH_xxx</code> applies to the XML representation of the retrieved objects
CLOSE Procedure	Invalidates the handle returned by <code>OPEN</code> and cleans up the associated state
CONVERT Functions and Procedures	Converts an XML document to DDL
FETCH_xxx Functions and Procedures	Returns metadata for objects meeting the criteria established by <code>OPEN</code> , <code>SET_FILTER</code> , <code>SET_COUNT</code> , <code>ADD_TRANSFORM</code> , and so on
GET_xxx Functions	Fetches the metadata for a specified object as XML, SXML, or DDL, using only a single call
GET_QUERY Function	Returns the text of the queries that are used by <code>FETCH_xxx</code>
OPEN Function	Specifies the type of object to be retrieved, the version of its metadata, and the object model
OPENW Function	Opens a write context
PUT Function	Submits an XML document to the database
SET_COUNT Procedure	Specifies the maximum number of objects to be retrieved in a single <code>FETCH_xxx</code> call
SET_FILTER Procedure	Specifies restrictions on the objects to be retrieved, for example, the object name or schema
SET_PARSE_ITEM Procedure	Enables output parsing by specifying an object attribute to be parsed and returned
SET_TRANSFORM_PARAM and SET_REMAP_PARAM Procedures	Specifies parameters to the XSLT stylesheets identified by <code>transform_handle</code>

116.6.1 ADD_TRANSFORM Function

The `DBMS_METADATA.ADD_TRANSFORM` function is used for both retrieval and submission.

- When this procedure is used to retrieve objects, it specifies a transform that `FETCH_xxx` applies to the XML representation of the retrieved objects.

- When used to submit objects, it specifies a transform that `CONVERT` or `PUT` applies to the XML representation of the submitted objects. It is possible to add more than one transform.

 **See Also:**

- [Subprograms for Retrieving Multiple Objects From the Database](#)
- [Subprograms for Submitting XML to the Database](#)
- ["SET_TRANSFORM_PARAM and SET_REMAP_PARAM Procedures"](#) for information about how to modify and customize transform output

Syntax

```
DBMS_METADATA.ADD_TRANSFORM (
    handle      IN NUMBER,
    name        IN VARCHAR2,
    encoding    IN VARCHAR2 DEFAULT NULL,
    object_type IN VARCHAR2 DEFAULT NULL)
RETURN NUMBER;
```

Parameters

Table 116-4 ADD_TRANSFORM Function Parameters

Parameters	Description
handle	The handle returned from <code>OPEN</code> when this transform is used to retrieve objects. Or the handle returned from <code>OPENW</code> when this transform is used in the submission of XML metadata.
name	The name of the transform. The name can be an internal keyword like <code>DDL</code> to use internally stored stylesheets. If the name contains a colon, it is interpreted as <code>directory_object_name:file_name</code> of a user-supplied Extensible Stylesheet Language Transformation (XSLT) script. Otherwise, name designates a transform implemented by <code>DBMS_METADATA</code> . See Table 116-5 for descriptions of available transforms.
encoding	The name of the Globalization Support character set in which the stylesheet pointed to by name is encoded. This is only valid if name is a URL. If left <code>NULL</code> and the URL is external to the database, UTF-8 encoding is assumed. If left <code>NULL</code> and the URL is internal to the database (that is, it begins with <code>/oradb/</code>), then the encoding is assumed to be the database character set.

Table 116-4 (Cont.) ADD_TRANSFORM Function Parameters

Parameters	Description
object_type	<p>The definition of this parameter depends upon whether you are retrieving objects or submitting XML metadata.</p> <ol style="list-style-type: none"> When you use <code>ADD_TRANSFORM</code> to retrieve objects, the following definition of <code>object_type</code> applies: Designates the object type to which the transform applies. (Note that this is an object type name, not a path name.) By default the transform applies to the object type of the <code>OPEN</code> handle. When the <code>OPEN</code> handle designates a heterogeneous object type, the following behavior can occur: <ul style="list-style-type: none"> if <code>object_type</code> is omitted, the transform applies to all object types within the heterogeneous collection if <code>object_type</code> is specified, the transform only applies to that specific object type within the collection <p>If you omit this parameter you can add the DDL transform to all objects in a heterogeneous collection with a single call. If you supply this parameter, you can add a transform for a specific object type.</p> When you use <code>ADD_TRANSFORM</code> in the submission of XML metadata, this parameter is the object type to which the transform applies. By default, it is the object type of the <code>OPENW</code> handle. Because the <code>OPENW</code> handle cannot designate a heterogeneous object type, the caller would normally leave this parameter <code>NULL</code> in the <code>ADD_TRANSFORM</code> calls.

The following table describes the transforms available on the `ADD_TRANSFORM` function.

Because new transforms are occasionally added, you might want to query the `DBMS_METADATA_TRANSFORMS` view to see all valid Oracle-supplied transforms for specific object types.

Table 116-5 Transforms Available on ADD_TRANSFORM Function

Object Type	Transform Name	Input Doc Type	Output Doc Type	Description
All	DDL	XML	DDL	Convert XML to SQL to create the object
All	MODIFY	XML	XML	Modify XML document according to transform parameters
Subset	SXML	XML	SXML	Convert XML to SXML
Subset	MODIFYSXML	SXML	SXML	Modify SXML document according to transform parameters
Subset	SXMLDDL	SXML	DDL	Convert SXML to DDL

Table 116-5 (Cont.) Transforms Available on ADD_TRANSFORM Function

Object Type	Transform Name	Input Doc Type	Output Doc Type	Description
Subset	ALTERXML	SXML difference document	ALTER_XML	<p>Generate ALTER_XML from SXML difference document. (See the DBMS_METADATA_DIFF PL/SQL package for more information about SXML difference format.)</p> <p>The following parameters are valid for the ALTERXML transform:</p> <ul style="list-style-type: none"> • XPATH - The XPATH of the object being altered • NAME - Name of the object being altered • ALTERABLE - Affirms that the object can be altered. If the object cannot be altered, a NOT_ALTERABLE element is inserted whose value indicates the reason. • CLAUSE_TYPE - The type of clause (for example, ADD_COLUMN) • COLUMN_ATTRIBUTE - The attribute being modified • CONSTRAINT_TYPE - The type of constraint (for example, UNIQUE or PRIMARY)
Subset	ALTERDDL	ALTER_XML	ALTER_DDL	Convert ALTER_XML to ALTER_DDL

Return Values

The opaque handle that is returned is used as input to SET_TRANSFORM_PARAM and SET_REMAP_PARAM. Note that this handle is different from the handle returned by OPEN or OPENW; it refers to the transform, not the set of objects to be retrieved.

Usage Notes

- With no transforms added, objects are returned by default as XML documents. You call ADD_TRANSFORM to specify the XSLT stylesheets to be used to transform the returned XML documents.
- You can call ADD_TRANSFORM more than once to apply multiple transforms to XML documents. The transforms are applied in the order in which they were specified, the output of the first transform being used as input to the second, and so on.
- The output of a DDL transform is *not* an XML document. Therefore, no transform should be added after the DDL transform.
- Each transform expects a certain format XML document as input. If the input document is unspecified, metadata XML format is assumed.

- When the ALTERXML transform is used, parse items are returned in a PARSE_LIST element of the ALTER_XML document. Each PARSE_LIST_ITEM element contains an ITEM and a VALUE. For example:

```
<PARSE_LIST>
  <PARSE_LIST_ITEM>
    <ITEM>XPATH</ITEM>
    <VALUE>/sxml:TABLE/sxml:RELATIONAL_TABLE/sxml:COL_LIST/
sxml:COL_LIST_ITEM[14]</VALUE>
  </PARSE_LIST_ITEM>
  <PARSE_LIST_ITEM>
    <ITEM>NAME</ITEM>
    <VALUE>Z1</VALUE>
  </PARSE_LIST_ITEM>
  <PARSE_LIST_ITEM>
    <ITEM>CLAUSE_TYPE</ITEM>
    <VALUE>ADD_COLUMN</VALUE>
  </PARSE_LIST_ITEM>
  <PARSE_LIST_ITEM>
    <ITEM>COLUMN_ATTRIBUTE</ITEM>
    <VALUE>NOT_NULL</VALUE>
  </PARSE_LIST_ITEM>
</PARSE_LIST>
```

Exceptions

- INVALID_ARGVAL. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- INVALID_OPERATION. ADD_TRANSFORM was called after the first call to FETCH_XXX for the OPEN context. After the first call to FETCH_XXX is made, no further calls to ADD_TRANSFORM for the current OPEN context are permitted.
- INCONSISTENT_ARGS. The arguments are inconsistent. Possible inconsistencies include the following:
 - encoding is specified even though name is not a URL.
 - object_type is not part of the collection designated by handle.

116.6.2 CLOSE Procedure

This procedure is used for both retrieval and submission. This procedure invalidates the handle returned by OPEN (or OPENW) and cleans up the associated state.



See Also:

For more information about related subprograms:

- [Subprograms for Retrieving Multiple Objects From the Database](#)
- [Subprograms for Submitting XML to the Database](#)

Syntax

```
DBMS_METADATA.CLOSE (
  handle IN NUMBER);
```

Parameters

Table 116-6 CLOSE Procedure Parameters

Parameter	Description
handle	The handle returned from OPEN (or OPENW).

Usage Notes



Note:

The following notes apply only to object retrieval

You can prematurely terminate the stream of objects established by OPEN or (OPENW).

- If a call to FETCH_XXX returns NULL, indicating no more objects, a call to CLOSE is made transparently. In this case, you can still call CLOSE on the handle and not get an exception. (The call to CLOSE is not required.)
- If you know that only one specific object will be returned, you should explicitly call CLOSE after the single FETCH_XXX call to free resources held by the handle.

Exceptions

- INVALID_ARGVAL. The value for the handle parameter is NULL or invalid.

116.6.3 CONVERT Functions and Procedures

The DBMS_METADATA.CONVERT functions and procedures transform input XML documents.

The CONVERT functions return creation DDL. The CONVERT procedures return either XML or DDL, depending on the specified transforms.



See Also:

- [Subprograms for Submitting XML to the Database](#)

Syntax

The CONVERT functions are as follows:

```
DBMS_METADATA.CONVERT (
  handle    IN NUMBER,
  document  IN sys.XMLType)
RETURN sys.ku$_multi_ddls;
```

```
DBMS_METADATA.CONVERT (
  handle    IN NUMBER,
```

```
document IN CLOB)
RETURN sys.ku$_multi_ddls;
```

The CONVERT procedures are as follows:

```
DBMS_METADATA.CONVERT (
  handle   IN NUMBER,
  document IN sys.XMLType,
  result   IN OUT NOCOPY CLOB);
```

```
DBMS_METADATA.CONVERT (
  handle   IN NUMBER,
  document IN CLOB,
  result   IN OUT NOCOPY CLOB);
```

Parameters

Table 116-7 CONVERT Subprogram Parameters

Parameter	Description
handle	The handle returned from OPENW
document	The XML document containing object metadata of the type of the OPENW handle
result	The converted document

Return Values

Either XML or DDL, depending on the specified transforms.

Usage Notes

You can think of CONVERT as the second half of FETCH_XXX, either FETCH_DDL (for the function variants) or FETCH_CLOB (for the procedure variants). There are two differences:

- FETCH_XXX gets its XML document from the database, but CONVERT gets its XML document from the caller
- FETCH_DDL returns its results in a sys.ku\$_ddls nested table, but CONVERT returns a sys.ku\$_multi_ddls nested table

The transforms specified with ADD_TRANSFORM are applied in turn, and the result is returned to the caller. For the function variants, the DDL transform must be specified. If parse items were specified, they are returned in the parsedItems column. Parse items are ignored by the procedure variants.

The encoding of the XML document is embedded in its CLOB or XMLType representation. The version of the metadata is embedded in the XML. The generated DDL is valid for the database version specified in OPENW.

Exceptions

- INVALID_ARGVAL. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- INCONSISTENT_OPERATION. No transform was specified. The DDL transform was not specified (function variants only).

- `INCOMPATIBLE_DOCUMENT`. The version of the XML document is not compatible with this version of the software.

116.6.4 FETCH_xxx Functions and Procedures

These functions and procedures return metadata for objects meeting the criteria established by `OPEN`, `SET_FILTER`, `SET_COUNT`, `ADD_TRANSFORM`, and so on.

See "[Usage Notes](#)" for the variants.



See Also:

For more information about related subprograms:

- [Subprograms for Retrieving Multiple Objects From the Database](#)

Syntax

The `FETCH` functions are as follows:

```
DBMS_METADATA.FETCH_XML (
    handle IN NUMBER)
RETURN sys.XMLType;

DBMS_METADATA.FETCH_DDL (
    handle IN NUMBER)
RETURN sys.ku$_ddl;

DBMS_METADATA.FETCH_CLOB (
    handle          IN NUMBER,
    cache_lob       IN BOOLEAN DEFAULT TRUE,
    lob_duration    IN PLS_INTEGER DEFAULT DBMS_LOB.SESSION)
RETURN CLOB;
```

The `FETCH` procedures are as follows:

```
DBMS_METADATA.FETCH_CLOB (
    handle IN NUMBER,
    doc    IN OUT NOCOPY CLOB);

DBMS_METADATA.FETCH_XML_CLOB (
    handle IN NUMBER,
    doc    IN OUT NOCOPY CLOB,
    parsed_items OUT sys.ku$_parsed_items,
    object_type_path OUT VARCHAR2);
```

Parameters

Table 116-8 `FETCH_xxx` Function Parameters

Parameters	Description
<code>handle</code>	The handle returned from <code>OPEN</code> .
<code>cache_lob</code>	<code>TRUE</code> =read LOB into buffer cache

Table 116-8 (Cont.) FETCH_XXX Function Parameters

Parameters	Description
<code>lob_duration</code>	The duration for the temporary LOB created by <code>FETCH_CLOB</code> , either <code>DBMS_LOB.SESSION</code> (the default) or <code>DBMS_LOB.CALL</code> .
<code>doc</code>	The metadata for the objects, or <code>NULL</code> if all objects have been returned.
<code>parsed_items</code>	A nested table containing the items specified by <code>SET_PARSE_ITEM</code> . If <code>SET_PARSE_ITEM</code> was not called, a <code>NULL</code> is returned.
<code>object_type_path</code>	For heterogeneous object types, this is the full path name of the object type for the objects returned by the call to <code>FETCH_XXX</code> . If <code>handle</code> designates a homogeneous object type, a <code>NULL</code> is returned.

Return Values

The metadata for the objects or `NULL` if all objects have been returned.

Usage Notes

These functions and procedures return metadata for objects meeting the criteria established by the call to `OPEN` that returned the handle, and subsequent calls to `SET_FILTER`, `SET_COUNT`, `ADD_TRANSFORM`, and so on. Each call to `FETCH_XXX` returns the number of objects specified by `SET_COUNT` (or less, if fewer objects remain in the underlying cursor) until all objects have been returned. After the last object is returned, subsequent calls to `FETCH_XXX` return `NULL` and cause the stream created by `OPEN` to be transparently closed.

There are several different `FETCH_XXX` functions and procedures:

- The `FETCH_XML` function returns the XML metadata for an object as an `XMLType`. It assumes that if any transform has been specified, that transform will produce an XML document. In particular, it assumes that the DDL transform has not been specified.
- The `FETCH_DDL` function returns the DDL (to create the object) in a `sys.ku$_ddl$` nested table. It assumes that the DDL transform has been specified. Each row of the `sys.ku$_ddl$` nested table contains a single DDL statement in the `ddlText` column; if requested, parsed items for the DDL statement will be returned in the `parsedItems` column. Multiple DDL statements may be returned under the following circumstances:
 - When you call `SET_COUNT` to specify a count greater than 1
 - When an object is transformed into multiple DDL statements. For example, A `TYPE` object that has a DDL transform applied to it can be transformed into both `CREATE TYPE` and `CREATE TYPE BODY` statements. A `TABLE` object can be transformed into a `CREATE TABLE`, and one or more `ALTER TABLE` statements
- The `FETCH_CLOB` function simply returns the object, transformed or not, as a `CLOB`. By default, the `CLOB` is read into the buffer cache and has session duration, but these defaults can be overridden with the `cache_lob` and `lob_duration` parameters.

- The `FETCH_CLOB` procedure returns the objects by reference in an `IN OUT NOCOPY` parameter. This is faster than the function variant, which returns LOBs by value, a practice that involves an expensive LOB copy.
- The `FETCH_XML_CLOB` procedure returns the XML metadata for the objects as a CLOB in an `IN OUT NOCOPY` parameter. This helps to avoid LOB copies, which can consume a lot of resources. It also returns a nested table of parse items and the full path name of the object type of the returned objects.
- All LOBs returned by `FETCH_xxx` are temporary LOBs. You must free the LOB. If the LOB is supplied as an `IN OUT NOCOPY` parameter, you must also create the LOB.
- If `SET_PARSE_ITEM` was called, `FETCH_DDL` and `FETCH_XML_CLOB` return attributes of the object's metadata (or the DDL statement) in a `sys.ku$_parsed_items` nested table. For `FETCH_XML_CLOB`, the nested table is an `OUT` parameter. For `FETCH_DDL`, it is a column in the returned `sys.ku$_ddls` nested table. Each row of the nested table corresponds to an item specified by `SET_PARSE_ITEM` and contains the following columns:
 - `item`—the name of the attribute as specified in the `name` parameter to `SET_PARSE_ITEM`.
 - `value`—the attribute value, or `NULL` if the attribute is not present in the DDL statement.
 - `object_row`—a positive integer indicating the object to which the parse item applies. If multiple objects are returned by `FETCH_xxx`, (because `SET_COUNT` specified a count greater than 1) then `object_row=1` for all items for the first object, 2 for the second, and so on.
- The rows of the `sys.ku$_parsed_items` nested table are ordered by ascending `object_row`, but otherwise the row order is undetermined. To find a particular parse item within an object row the caller must search the table for a match on `item`.
- In general there is no guarantee that a requested parse item will be returned. For example, the parse item may not apply to the object type or to the particular line of DDL, or the item's value may be `NULL`.
- If `SET_PARSE_ITEM` was not called, `NULL` is returned as the value of the parsed items nested table.
- It is expected that the same variant of `FETCH_xxx` will be called for all objects selected by `OPEN`. That is, programs will not intermix calls to `FETCH_XML`, `FETCH_DDL`, `FETCH_CLOB`, and so on using the same `OPEN` handle. The effect of calling different variants is undefined; it might do what you expect, but there are no guarantees.
- Every object fetched will be internally consistent with respect to on-going DDL (and the subsequent recursive DML) operations against the dictionary. In some cases, multiple queries may be issued, either because the object type is heterogeneous or for performance reasons (for example, one query for heap tables, one for index-organized tables). Consequently the `FETCH_xxx` calls may in fact be fetches from different underlying cursors (meaning that read consistency is not guaranteed).

 **Caution:**

Do not run functions and procedures within a query, because they can fail when the handle is for an open context for a heterogeneous object.

Exceptions

Most exceptions raised during execution of the query are propagated to the caller. Also, the following exceptions may be raised:

- `INVALID_ARGVAL`. A `NULL` or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- `INCONSISTENT_OPERATION`. Either `FETCH_XML` was called when the DDL transform had been specified, or `FETCH_DDL` was called when the DDL transform had *not* been specified.

116.6.5 GET_xxx Functions

`GET_xxx` functions let you fetch metadata for objects with a single call.

The `GET_xxx` functions are:

- `GET_XML`
- `GET_DDL`
- `GET_SXML`
- `GET_DEPENDENT_XML`
- `GET_DEPENDENT_DDL`
- `GET_GRANTED_XML`
- `GET_GRANTED_DDL`



See Also:

[Subprograms for Retrieving Multiple Objects From the Database](#) for more information about related subprograms

Syntax

```
DBMS_METADATA.GET_XML (
object_type      IN VARCHAR2,
name             IN VARCHAR2,
schema          IN VARCHAR2 DEFAULT NULL,
version         IN VARCHAR2 DEFAULT 'COMPATIBLE',
model           IN VARCHAR2 DEFAULT 'ORACLE',
transform       IN VARCHAR2 DEFAULT NULL)
RETURN CLOB;
```

```
DBMS_METADATA.GET_DDL (
object_type      IN VARCHAR2,
name             IN VARCHAR2,
schema          IN VARCHAR2 DEFAULT NULL,
version         IN VARCHAR2 DEFAULT 'COMPATIBLE',
model           IN VARCHAR2 DEFAULT 'ORACLE',
transform       IN VARCHAR2 DEFAULT 'DDL')
```

```
RETURN CLOB;
```

```
DBMS_METADATA.GET_SXML (  
  object_type      IN VARCHAR2,  
  name             IN VARCHAR2 DEFAULT NULL,  
  schema           IN VARCHAR2 DEFAULT NULL,  
  version          IN VARCHAR2 DEFAULT 'COMPATIBLE',  
  model            IN VARCHAR2 DEFAULT 'ORACLE',  
  transform        IN VARCHAR2 DEFAULT 'XML')  
RETURN CLOB;
```

```
DBMS_METADATA.GET_DEPENDENT_XML (  
  object_type      IN VARCHAR2,  
  base_object_name IN VARCHAR2,  
  base_object_schema IN VARCHAR2 DEFAULT NULL,  
  version          IN VARCHAR2 DEFAULT 'COMPATIBLE',  
  model            IN VARCHAR2 DEFAULT 'ORACLE',  
  transform        IN VARCHAR2 DEFAULT NULL,  
  object_count     IN NUMBER   DEFAULT 10000)  
RETURN CLOB;
```

```
DBMS_METADATA.GET_DEPENDENT_DDL (  
  object_type      IN VARCHAR2,  
  base_object_name IN VARCHAR2,  
  base_object_schema IN VARCHAR2 DEFAULT NULL,  
  version          IN VARCHAR2 DEFAULT 'COMPATIBLE',  
  model            IN VARCHAR2 DEFAULT 'ORACLE',  
  transform        IN VARCHAR2 DEFAULT 'DDL',  
  object_count     IN NUMBER   DEFAULT 10000)  
RETURN CLOB;
```

```
DBMS_METADATA.GET_GRANTED_XML (  
  object_type      IN VARCHAR2,  
  grantee          IN VARCHAR2 DEFAULT NULL,  
  version          IN VARCHAR2 DEFAULT 'COMPATIBLE',  
  model            IN VARCHAR2 DEFAULT 'ORACLE',  
  transform        IN VARCHAR2 DEFAULT NULL,  
  object_count     IN NUMBER   DEFAULT 10000)  
RETURN CLOB;
```

```
DBMS_METADATA.GET_GRANTED_DDL (  
  object_type      IN VARCHAR2,  
  grantee          IN VARCHAR2 DEFAULT NULL,  
  version          IN VARCHAR2 DEFAULT 'COMPATIBLE',  
  model            IN VARCHAR2 DEFAULT 'ORACLE',  
  transform        IN VARCHAR2 DEFAULT 'DDL',  
  object_count     IN NUMBER   DEFAULT 10000)  
RETURN CLOB;
```

Parameters

Table 116-9 GET_XXX Function Parameters

Parameter	Description
object_type	The type of object that you want to be retrieved. This parameter takes the same values as the OPEN object_type parameter, except that it cannot be a heterogeneous object type. The attributes of the object type must be appropriate to the function. That is, for GET_XXX it must be a named object.
name	The object name. This object name is used internally in a NAME filter. (If the name is longer than 30 characters, then it will be used in a LONGNAME filter.) If this parameter is NULL, then no NAME or LONGNAME filter is specified. See SET_FILTER Procedure for a list of filters.
schema	The object schema. This object schema is used internally in a SCHEMA filter. The default is the current user.
version	The version of metadata that you want to be extracted. This parameter takes the same values as the OPEN version parameter.
model	The object model that you want to use. This parameter takes the same values as the OPEN model parameter.
transform	The name of a transformation on the output. This parameter takes the same values as the ADD_TRANSFORM name parameter. For GET_XML this name must not be DDL.
base_object_name	The base object name. The base object name is used internally in a BASE_OBJECT_NAME filter.
base_object_schema	The base object schema. The base object schema is used internally in a BASE_OBJECT_SCHEMA filter. The default is the current user.
grantee	The grantee. The grantee is used internally in a GRANTEE filter. The default is the current user.
object_count	The maximum number of objects to return. See SET_COUNT Procedure .

Return Values

The metadata for the specified object as XML or DDL.

Usage Notes

- These functions enable you to fetch metadata for objects with a single call. They encapsulate calls to OPEN, SET_FILTER, and so on. The function that you use depends on the characteristics of the object type, and on whether you want XML, SXML, or DDL.
 - GET_XXX is used to fetch named objects, especially schema objects (tables, views).
 - GET_DEPENDENT_XXX is used to fetch dependent objects (audits, object grants).
 - GET_GRANTED_XXX is used to fetch granted objects (system grants, role grants).

- For some object types, you can use more than one function. For example, you can use `GET_xxx` to fetch an index by name, or `GET_DEPENDENT_xxx` to fetch the same index by specifying the table on which it is defined.
- `GET_xxx` only returns a single named object.
- For `GET_DEPENDENT_xxx` and `GET_GRANTED_xxx`, an arbitrary number of dependent or granted objects can match the input criteria. You can specify an object count when fetching these objects. (The default count of 10000 should be adequate in most cases.)
- If the DDL transform is specified, then session-level transform parameters are inherited.
- If you start these functions from SQL*Plus, then to obtain complete, uninterrupted output, you should set the `PAGESIZE` to 0, and set `LONG` to some large number.
- Currently, `GET_DDL` for a `USER` object does not return the `CONTAINER` clause.

Exceptions

- `INVALID_ARGVAL`. A `NULL` or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- `OBJECT_NOT_FOUND`. The specified object was not found in the database.

Examples

Example: Fetch the XML Representation of `SCOTT.EMP`

To generate complete, uninterrupted output, set the `PAGESIZE` to 0 and set `LONG` to some large number, as shown, before executing your query.

```
SET LONG 2000000
SET PAGESIZE 0
SELECT DBMS_METADATA.GET_XML('TABLE', 'EMP', 'SCOTT')
FROM DUAL;
```

Example: Fetch the DDL for all Complete Tables in the Current Schema, Filter Out Nested Tables and Overflow Segments

This example fetches the DDL for all "complete" tables in the current schema, filtering out nested tables and overflow segments. The example uses `SET_TRANSFORM_PARAM` (with the handle value = `DBMS_METADATA.SESSION_TRANSFORM` meaning "for the current session") to specify that storage clauses are not to be returned in the SQL DDL. Afterwards, the example resets the session-level parameters to their defaults.

To generate complete, uninterrupted output, set the `PAGESIZE` to 0 and set `LONG` to some large number, as shown, before running your query.

```
SET LONG 2000000
SET PAGESIZE 0
EXECUTE
DBMS_METADATA.SET_TRANSFORM_PARAM(DBMS_METADATA.SESSION_TRANSFORM, 'STORAGE', f
alse);
SELECT DBMS_METADATA.GET_DDL('TABLE', u.table_name)
      FROM USER_ALL_TABLES u
      WHERE u.nested='NO'
      AND (u.iot_type is null or u.iot_type='IOT');
```

```
EXECUTE
DBMS_METADATA.SET_TRANSFORM_PARAM(DBMS_METADATA.SESSION_TRANSFORM, 'DEFAULT');
```

Example: Fetch the DDL For All Object Grants On HR.EMPLOYEES

```
SELECT
DBMS_METADATA.GET_DEPENDENT_DDL('OBJECT_GRANT', 'EMPLOYEES', 'HR')
FROM DUAL;
```

Example: Fetch the DDL For System Grants Granted To SCOTT

```
SELECT DBMS_METADATA.GET_GRANTED_DDL('SYSTEM_GRANT', 'SCOTT')
FROM DUAL;
```

 **Note:**

If you use the package `DBMS_METADATA.GET_GRANTED_DDL` to grant system privileges to a nonprivileged user granted system privileges, and you then attempt to use that nonprivileged user to grant privileges to other users by using `GRANT INHERIT PRIVILEGES`, then you receive the error "ORA-31703: cannot grant INHERIT PRIVILEGES privilege on behalf of other users". The `DBMS_METADATA.GET_GRANTED_DDL` procedure returns only privileges directly granted to the user.

Example: Fetch the DDL For All User SCOTT Object Grants on HR.EMPLOYEES

```
SQL> SELECT DBMS_METADATA.GET_GRANTED_DDL('OBJECT_GRANT', 'SCOTT')
FROM dual ;
DBMS_METADATA.GET_GRANTED_DDL('OBJECT_GRANT', 'SCOTT')
```

Example: Fetch the DDL for the SQL Domain DAY_OF_WEEK

```
SQL> SET LONG 2000000
SELECT DBMS_METADATA.GET_DDL('SQL_DOMAIN', 'DAY_OF_WEEK');
```

116.6.6 GET_QUERY Function

This function returns the text of the queries that are used by `FETCH_XXX`. This function assists in debugging.

 **See Also:**

For more information about related subprograms:

- [Subprograms for Retrieving Multiple Objects From the Database](#)

Syntax

```
DBMS_METADATA.GET_QUERY (  
    handle IN NUMBER)  
RETURN VARCHAR2;
```

Parameters

Table 116-10 GET_QUERY Function Parameters

Parameter	Description
handle	The handle returned from OPEN. It cannot be the handle for a heterogeneous object type.

Return Values

The text of the queries that will be used by `FETCH_XXX`.

Exceptions

- INVALID_ARGVAL. A NULL or invalid value was supplied for the `handle` parameter.

116.6.7 OPEN Function

The `DBMS_METADATA.OPEN` function specifies the type of object to be retrieved, the version of its metadata, and the object model.

The return value is an opaque context handle for the set of objects to be used in subsequent calls.



See Also:

For more information about related subprograms, see:

[Subprograms for Retrieving Multiple Objects From the Database](#)

Syntax

```
DBMS_METADATA.OPEN (  
    object_type IN VARCHAR2,  
    version     IN VARCHAR2 DEFAULT 'COMPATIBLE',  
    model       IN VARCHAR2 DEFAULT 'ORACLE',  
    network_link IN VARCHAR2 DEFAULT NULL)  
RETURN NUMBER;
```

Parameters

Table 116-11 Open Function Parameters

Parameter	Description
object_type	<p>The type of object to be retrieved. The table "DBMS_METADATA: Object Types" lists the valid object type names and their meanings. These object types are supported for the ORACLE model of metadata (see model in this table).</p> <p>The Attributes column in the DBMS_METADATA: Object Types table specifies some object type attributes:</p> <ul style="list-style-type: none"> • Schema objects, such as tables, belong to schemas. • Named objects have unique names (if they are schema objects, the name is unique to the schema). • Dependent objects, such as indexes, are defined with reference to a base schema object. • Granted objects are granted or assigned to a user or role and therefore have a named grantee. • Heterogeneous object types denote a collection of related objects of different types. See the table "Object Types Returned for the Heterogeneous Object Type" for a listing of object types returned for the heterogeneous object type. <p>These attributes are relevant when choosing object selection criteria. See "SET_FILTER Procedure" for more information.</p>
version	<p>The version of metadata to be extracted. Database objects or attributes that are incompatible with the version will not be extracted. Legal values for this parameter are as follows:</p> <p>COMPATIBLE (default)—the version of the metadata corresponds to the database compatibility level.</p> <p>LATEST—the version of the metadata corresponds to the database version.</p> <p>A specific database version. The value cannot be lower than 9.2.0.</p>
model	<p>Specifies which view to use, because the API can support multiple views on the metadata. Only the ORACLE model is supported.</p>
network_link	<p>The name of a database link to the database whose metadata is to be retrieved. If NULL (the default), then metadata is retrieved from the database on which the caller is running</p>

The table [Table 116-12](#) provides the name, meaning, attributes, and notes for the DBMS_METADATA package object types. In the attributes column, S represents a schema object, N represents a named object, D represents a dependent object, G represents a granted object, and H represents a heterogeneous object.

Table 116-12 DBMS_METADATA: Object Types

Type Name	Meaning	Attributes	Notes
AQ_QUEUE	queues	SND	Dependent on table
AQ_QUEUE_TABLE	additional metadata for queue tables	ND	Dependent on table

Table 116-12 (Cont.) DBMS_METADATA: Object Types

Type Name	Meaning	Attributes	Notes
AQ_TRANSFORM	transforms	SN	None
ASSOCIATION	associate statistics	D	None
AUDIT	audits of SQL statements	DG	Modeled as dependent, granted object. The base object name is the statement audit option name (for example, ALTER SYSTEM). There is no base object schema. The grantee is the user or proxy whose statements are audited.
AUDIT_OBJ	audits of schema objects	D	None
CLUSTER	clusters	SN	None
COMMENT	comments	D	None
CONSTRAINT	constraints	SND	Constraints do not include the following: <ul style="list-style-type: none"> • Primary key constraint for IOT • Column NOT NULL constraints • Certain REF SCOPE and WITH ROWID constraints for tables with REF columns
CONTEXT	application contexts	N	None
DATABASE_EXPORT	all metadata objects in a database	H	Corresponds to a full database export
DB_LINK	database links	SN	Modeled as schema objects because they have owners. For public links, the owner is PUBLIC. For private links, the creator is the owner.
DEFAULT_ROLE	default roles	G	Granted to a user by ALTER USER
DIMENSION	dimensions	SN	None
DIRECTORY	directories	N	None
FGA_POLICY	fine-grained audit policies	D	Not modeled as named object because policy names are not unique.
FUNCTION	stored functions	SN	None
INDEX_STATISTICS	precomputed statistics on indexes	D	The base object is the index's table.
INDEX	indexes	SND	None
INDEXTYPE	indextypes	SN	None
JAVA_SOURCE	Java sources	SN	None
JOB	jobs	S	None
LIBRARY	external procedure libraries	SN	None
MATERIALIZED_VIEW	materialized views	SN	None
MATERIALIZED_VIEW_LOG	materialized view logs	D	None
OBJECT_GRANT	object grants	DG	None

Table 116-12 (Cont.) DBMS_METADATA: Object Types

Type Name	Meaning	Attributes	Notes
ON_USER_GRANT	Grants	G	Modeled as user grants. Grants the privileges of one user to other user in the form GRANT ... ON USER The grantee is the user. Example: GRANT INHERIT PRIVILEGES ON USER "USER1" TO "USER2".
OPERATOR	operators	SN	None
PACKAGE	stored packages	SN	By default, both package specification and package body are retrieved. See "SET_FILTER Procedure" .
PACKAGE_SPEC	package specifications	SN	None
PACKAGE_BODY	package bodies	SN	None
PROCEDURE	stored procedures	SN	None
PROFILE	profiles	N	None
PROXY	proxy authentications	G	Granted to a user by ALTER USER
REF_CONSTRAINT	referential constraint	SND	None
REFRESH_GROUP	refresh groups	SN	None
RESOURCE_COST	resource cost info	H	None
RLS_CONTEXT	driving contexts for enforcement of fine-grained access-control policies	D	Corresponds to the DBMS_RLS.ADD_POLICY_CONTENT procedure
RLS_GROUP	fine-grained access-control policy groups	D	Corresponds to the DBMS_RLS.CREATE_GROUP procedure
RLS_POLICY	fine-grained access-control policies	D	Corresponds to DBMS_RLS.ADD_GROUPED_POLICY. Not modeled as named objects because policy names are not unique.
RMGR_CONSUMER_GROUP	resource consumer groups	SN	Oracle Data Pump does not use these object types. Instead, it exports resource manager objects as procedural objects.
RMGR_INITIAL_CONSUMER_GROUP	assign initial consumer groups to users	G	None
RMGR_PLAN	resource plans	SN	None
RMGR_PLAN_DIRECTIVE	resource plan directives	D	Dependent on resource plan
ROLE	roles	N	None
ROLE_GRANT	role grants	G	None
ROLLBACK_SEGMENT	rollback segments	N	None
SCHEMA_EXPORT	all metadata objects in a schema	H	Corresponds to user-mode export.
SEQUENCE	sequences	SN	None

Table 116-12 (Cont.) DBMS_METADATA: Object Types

Type Name	Meaning	Attributes	Notes
SQL_DOMAIN	SQL domains	SN	A domain is a high-level dictionary object that belongs to a schema and encapsulates a set of properties and constraints. The attributes and constraints are defined and managed only for the domain, and are automatically applied to all the columns of the given domain.
SYNONYM	synonyms	See notes	Private synonyms are schema objects. Public synonyms are not, but for the purposes of this API, their schema name is PUBLIC. The name of a synonym is considered to be the synonym itself. For example, in CREATE PUBLIC SYNONYM FOO FOR BAR, the resultant object is considered to have name FOO and schema PUBLIC.
SYSTEM_GRANT	system privilege grants	G	None
TABLE	tables	SN	None
TABLE_DATA	metadata describing row data for a table, nested table, or partition	SND	For partitions, the object name is the partition name. For nested tables, the object name is the storage table name. The base object is the top-level table to which the table data belongs. For nested tables and partitioning, this is the top-level table (<i>not</i> the parent table or partition). For nonpartitioned tables and non-nested tables this is the table itself.
TABLE_EXPORT	metadata for a table and its associated objects	H	Corresponds to table-mode export
TABLE_STATISTICS	precomputed statistics on tables	D	None
TABLESPACE	tablespaces	N	None
TABLESPACE_QUOTA	tablespace quotas	G	Granted with ALTER USER
TRANSPORTABLE_EXPORT	metadata for objects in a transportable tablespace set	H	Corresponds to transportable tablespace export
TRIGGER	triggers	SND	None
TRUSTED_DB_LINK	trusted links	N	None
TYPE	user-defined types	SN	By default, both type and type body are retrieved. See "SET_FILTER Procedure".
TYPE_SPEC	type specifications	SN	None
TYPE_BODY	type bodies	SN	None
USER	users	N	None
VIEW	views	SN	None
XMLSCHEMA	XML schema	SN	The object's name is its URL (which can be longer than 30 characters). Its schema is the user who registered it.

Table 116-12 (Cont.) DBMS_METADATA: Object Types

Type Name	Meaning	Attributes	Notes
XS_USER	Real Application Security (RAS) user	N	Corresponds to RAS users
XS_ROLE	Real Application Security (RAS) role	N	Corresponds to RAS roles
XS_ROLESET	Real Application Security (RAS) role sets	N	Corresponds to RAS role sets
XS_ROLE_GRANT	Real Application Security (RAS) role grants	N	Corresponds to RAS role grants
XS_SECURITY_CLASS	Real Application Security (RAS) security class	SN	Corresponds to RAS security classes
XS_DATA_SECURITY	Real Application Security (RAS) data security policy	SN	Corresponds to RAS data security policies
XS_ACL	Real Application Security (RAS) ACL	SN	Corresponds to RAS access control lists (ACLs) and associated access control entries (ACEs)
XS_ACL_PARAM	Real Application Security (RAS) ACL parameter	N	Corresponds to RAS access control lists (ACL) parameters
XS_NAMESPACE	Real Application Security (RAS) namespace	N	Corresponds to RAS namespaces.

Table [Table 116-13](#) lists the types of objects returned for the major heterogeneous object types. For `SCHEMA_EXPORT`, certain object types are only returned if the `INCLUDE_USER` filter is specified at `TRUE`. In the table, such object types are marked `INCLUDE_USER`.

Table 116-13 Object Types Returned for the Heterogeneous Object Type

Object Type	DATABASE_EXPORT	SCHEMA_EXPORT	TABLE_EXPORT	TRANSPORTABLE_EXPORT
ASSOCIATION	Yes	No	No	No
AUDIT	Yes	No	No	No
AUDIT_OBJ	Yes	Yes	Yes	Yes
CLUSTER	Yes	Yes	No	Yes
COMMENT	Yes	Yes	Yes	Yes
CONSTRAINT	Yes	Yes	Yes	Yes
CONTEXT	Yes	No	No	No
DB_LINK	Yes	Yes	No	No
DEFAULT_ROLE	Yes	INCLUDE_USER	No	No
DIMENSION	Yes	Yes	No	No
DIRECTORY	Yes	No	No	No
FGA_POLICY	Yes	No	No	Yes
FUNCTION	Yes	Yes	No	No

Table 116-13 (Cont.) Object Types Returned for the Heterogeneous Object Type

Object Type	DATABASE_EXPORT	SCHEMA_EXPORT	TABLE_EXPORT	TRANSPORTABLE_EXPORT
INDEX_STATISTICS	Yes	Yes	Yes	Yes
INDEX	Yes	Yes	Yes	Yes
INDEXTYPE	Yes	Yes	No	No
JAVA_SOURCE	Yes	Yes	No	No
JOB	Yes	Yes	No	No
LIBRARY	Yes	Yes	No	No
MATERIALIZED_VIEW	Yes	Yes	No	No
MATERIALIZED_VIEW_LOG	Yes	Yes	No	No
OBJECT_GRANT	Yes	Yes	Yes	Yes
OPERATOR	Yes	Yes	No	No
PACKAGE	Yes	Yes	No	No
PACKAGE_SPEC	Yes	Yes	No	No
PACKAGE_BODY	Yes	Yes	No	No
PASSWORD_HISTORY	Yes	INCLUDE_USER	No	No
PASSWORD_VERIFY_FUNCTION	Yes	No	No	No
PROCEDURE	Yes	Yes	No	No
PROFILE	Yes	No	No	No
PROXY	Yes	No	No	No
REF_CONSTRAINT	Yes	Yes	Yes	Yes
REFRESH_GROUP	Yes	Yes	No	No
RESOURCE_COST	Yes	No	No	No
RLS_CONTEXT	Yes	No	No	Yes
RLS_GROUP	Yes	No	No	Yes
RLS_POLICY	Yes	Table data is retrieved according to policy	Table data is retrieved according to policy	Yes
ROLE	Yes	No	No	No
ROLE_GRANT	Yes	No	No	No
ROLLBACK_SEGMENT	Yes	No	No	No
SEQUENCE	Yes	Yes	No	No
SYNONYM	Yes	Yes	No	No
SYSTEM_GRANT	Yes	INCLUDE_USER	No	No
TABLE	Yes	Yes	Yes	Yes
TABLE_DATA	Yes	Yes	Yes	Yes
TABLE_STATISTICS	Yes	Yes	Yes	Yes

Table 116-13 (Cont.) Object Types Returned for the Heterogeneous Object Type

Object Type	DATABASE_EXPORT	SCHEMA_EXPORT	TABLE_EXPORT	TRANSPORTABLE_EXPORT
TABLESPACE	Yes	No	No	No
TABLESPACE_QUOTA	Yes	INCLUDE_USER	No	No
TRIGGER	Yes	Yes	Yes	Yes
TRUSTED_DB_LINK	Yes	No	No	No
TYPE	Yes	Yes	No	Yes, if the types are used by tables in the transportable set
TYPE_SPEC	Yes	Yes	No	Yes, if the types are used by tables in the transportable set
TYPE_BODY	Yes	Yes	No	Yes, if the types are used by tables in the transportable set
USER	Yes	INCLUDE_USER	No	No
VIEW	Yes	Yes	No	No
XMLSCHEMA	Yes	Yes	No	No

Return Values

An opaque handle to the class of objects. This handle is used as input to `SET_FILTER`, `SET_COUNT`, `ADD_TRANSFORM`, `GET_QUERY`, `SET_PARSE_ITEM`, `FETCH_xxx`, and `CLOSE`.

Exceptions

- `INVALID_ARGVAL`. A `NULL` or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- `INVALID_OBJECT_PARAM`. The `version` or `model` parameter was not valid for the `object_type`.

116.6.8 OPENW Function

This function specifies the type of object to be submitted and the object model. The return value is an opaque context handle.



See Also:

For more information about related subprograms:

- [Subprograms for Submitting XML to the Database](#)

Syntax

```
DBMS_METADATA.OPENW
(object_type IN VARCHAR2,
```



```

version      IN VARCHAR2 DEFAULT 'COMPATIBLE',
model        IN VARCHAR2 DEFAULT 'ORACLE')
RETURN NUMBER;

```

Parameters

Table 116-14 OPENW Function Parameters

Parameter	Description
object_type	The type of object to be submitted. Valid types names and their meanings are listed in Table 116-12 . The type cannot be a heterogeneous object type.
version	The version of DDL to be generated by the <code>CONVERT</code> function. DDL clauses that are incompatible with the version will not be generated. The legal values for this parameter are as follows: <ul style="list-style-type: none"> <code>COMPATIBLE</code> - This is the default. The version of the DDL corresponds to the database compatibility level. Database compatibility must be set to 9.2.0 or higher. <code>LATEST</code> - The version of the DDL corresponds to the database version. A specific database version. The value cannot be lower than 9.2.0.
model	Specifies which view to use. Only the Oracle proprietary (<code>ORACLE</code>) view is supported by <code>DBMS_METADATA</code> .

Return Values

An opaque handle to write context. This handle is used as input to the `ADD_TRANSFORM`, `CONVERT`, `PUT`, and `CLOSE` procedures.

Exceptions

- `INVALID_ARGVAL`. A `NULL` or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- `INVALID_OBJECT_PARAM`. The `model` parameter was not valid for the `object_type`.

116.6.9 PUT Function

This function submits an XML document containing object metadata to the database to create the object.



See Also:

For more information about related subprograms:

- [Subprograms for Submitting XML to the Database](#)

Syntax

```

DBMS_METADATA.PUT (
  handle      IN          NUMBER,
  document    IN          sys.XMLType,

```

```

    flags      IN          NUMBER,
    results    IN OUT NOCOPY sys.ku$_SubmitResults)
RETURN BOOLEAN;

DBMS_METADATA.PUT (
    handle     IN          NUMBER,
    document   IN          CLOB,
    flags      IN          NUMBER,
    results    IN OUT NOCOPY sys.ku$_SubmitResults)
RETURN BOOLEAN;

```

Parameters

Table 116-15 PUT Function Parameters

Parameter	Description
handle	The handle returned from <code>OPENW</code> .
document	The XML document containing object metadata for the type of the <code>OPENW</code> handle.
flags	Reserved for future use
results	Detailed results of the operation.

Return Values

TRUE if all SQL operations succeeded; FALSE if there were any errors.

Usage Notes

The `PUT` function converts the XML document to DDL just as `CONVERT` does (applying the specified transforms in turn) and then submits each resultant DDL statement to the database. As with `CONVERT`, the DDL transform must be specified. The DDL statements and associated parse items are returned in the `sys.ku$_SubmitResults` nested table. With each DDL statement is a nested table of error lines containing any errors or exceptions raised by the statement.

The encoding of the XML document is embedded in its CLOB or XMLType representation. The version of the metadata is embedded in the XML. The generated DDL is valid for the database version specified in `OPENW`.

Exceptions

- `INVALID_ARGVAL`. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- `INCONSISTENT_OPERATION`. The DDL transform was not specified.
- `INCOMPATIBLE_DOCUMENT`. The version of the XML document is not compatible with this version of the software.

116.6.10 SET_COUNT Procedure

This procedure specifies the maximum number of objects to be retrieved in a single `FETCH_XXX` call.

By default, each call to `FETCH_XXX` returns one object. You can use the `SET_COUNT` procedure to override this default. If `FETCH_XXX` is called from a client, specifying a count value greater than 1 can result in fewer server round trips and, therefore, improved performance.

For heterogeneous object types, a single `FETCH_XXX` operation only returns objects of a single object type.



See Also:

For more information about related subprograms:

- [Subprograms for Retrieving Multiple Objects From the Database](#)

Syntax

```
DBMS_METADATA.SET_COUNT (
    handle          IN NUMBER,
    value           IN NUMBER,
    object_type_path IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 116-16 SET_COUNT Procedure Parameters

Parameter	Description
handle	The handle returned from <code>OPEN</code> .
value	The maximum number of objects to retrieve.
object_type_path	A path name designating the object types to which the count value applies. By default, the count value applies to the object type of the <code>OPEN</code> handle. When the <code>OPEN</code> handle designates a heterogeneous object type, behavior can be either of the following: <ul style="list-style-type: none"> • If <code>object_type_path</code> is omitted, then the count applies to all object types within the heterogeneous collection. • If <code>object_type_path</code> is specified, then the count only applies to the specific node (or set of nodes) within the tree of object types forming the heterogeneous collection.

Exceptions

- `INVALID_ARGVAL`. A `NULL` or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- `INVALID_OPERATION`. `SET_COUNT` was called after the first call to `FETCH_XXX` for the `OPEN` context. After the first call to `FETCH_XXX` is made, no further calls to `SET_COUNT` for the current `OPEN` context are permitted.
- `INCONSISTENT_ARGS`. `object_type` parameter is not consistent with handle.

116.6.11 SET_FILTER Procedure

This procedure specifies restrictions on the objects to be retrieved, for example, the object name or schema.

See Also:

For more information about related subprograms:

- [Subprograms for Retrieving Multiple Objects From the Database](#)

Syntax

```
DBMS_METADATA.SET_FILTER (  
    handle          IN NUMBER,  
    name            IN VARCHAR2,  
    value           IN VARCHAR2,  
    object_type_path IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_METADATA.SET_FILTER (  
    handle          IN NUMBER,  
    name            IN VARCHAR2,  
    value           IN BOOLEAN DEFAULT TRUE,  
    object_type_path IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_METADATA.SET_FILTER (  
    handle          IN NUMBER,  
    name            IN VARCHAR2,  
    value           IN NUMBER,  
    object_type_path IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 116-17 SET_FILTER Procedure Parameters

Parameter	Description
handle	The handle returned from OPEN.

Table 116-17 (Cont.) SET_FILTER Procedure Parameters

Parameter	Description
name	<p>The name of the filter. For each filter, Table 116-18 lists the <code>object_type</code> it applies to, its name, its datatype (text or Boolean), and its meaning or effect (including its default value, if any).</p> <p>The Datatype column of Table 116-18 also indicates whether a text filter is an expression filter. An expression filter is the right-hand side of a SQL comparison (that is, a SQL comparison operator (=, !=, and so on.)) and the value compared against. The value must contain parentheses and quotation marks where appropriate. Note that in PL/SQL and SQL*Plus, two single quotes (<i>not</i> a double quote) are needed to represent an apostrophe. For example, an example of a <code>NAME_EXPR</code> filter in PL/SQL is as follows:</p> <pre>'IN ('DEPT','EMP')'</pre> <p>The filter value is combined with a particular object attribute to produce a <code>WHERE</code> condition in the query that fetches the objects. In the preceding example, the filter is combined with the attribute corresponding to an object name; objects named 'DEPT' and 'EMP' are selected.</p>
value	The value of the filter. Text, Boolean, and Numeric filters are supported.
object_type_path	A path name designating the object types to which the filter applies. By default, the filter applies to the object type of the <code>OPEN</code> handle. When the <code>OPEN</code> handle designates a heterogeneous object type, you can use this parameter to specify a filter for a specific node or set of nodes within the tree of object types that form the heterogeneous collection. See Table 116-19 for a listing of some of the values for this parameter.

[Table 116-18](#) describes the object type, name, datatype, and meaning of the filters available with the `SET_FILTER` procedure.

Table 116-18 SET_FILTER: Filters

Object Type	Name	Datatype	Meaning
Named objects	NAME	Text	Objects with this exact name are selected.
Named objects	NAME_EXPR	Text expression	<p>The filter value is combined with the object attribute corresponding to the object name to produce a <code>WHERE</code> condition in the query that fetches the objects.</p> <p>By default, all named objects of <code>object_type</code> are selected.</p>
Named objects	EXCLUDE_NAME_EXPR	Text expression	<p>The filter value is combined with the attribute corresponding to the object name to specify objects that are to be excluded from the set of objects fetched.</p> <p>By default, all named objects of the object type are selected.</p>

Table 116-18 (Cont.) SET_FILTER: Filters

Object Type	Name	Datatype	Meaning
TABLE_EXPORT	EXCLUDE_TABLES	Boolean	If TRUE, all paths associated with tables are excluded from the set of objects fetched. If FALSE (the default), all paths associated with tables are fetched.
Schema objects	SCHEMA	Text	Objects in this schema are selected. If the object type is SYNONYM, then specify PUBLIC to select public synonyms.
Schema objects	SCHEMA_EXPR	Text expression	The filter value is combined with the attribute corresponding to the object's schema. The default is determined as follows: - if BASE_OBJECT_SCHEMA is specified, then objects in that schema are selected; - otherwise, objects in the current schema are selected.
PACKAGE, TYPE	SPECIFICATION	Boolean	If TRUE, retrieve the package or type specification. Defaults to TRUE.
PACKAGE, TYPE	BODY	Boolean	If TRUE, retrieve the package or type body. Defaults to TRUE.
TABLE, CLUSTER, INDEX, TABLE_DATA, TABLE_EXPORT, TRANSPORTABLE_EXPORT	TABLESPACE	Text	Objects in this tablespace (or having a partition in this tablespace) are selected.
TABLE, CLUSTER, INDEX, TABLE_DATA, TABLE_EXPORT, TRANSPORTABLE_EXPORT	TABLESPACE_EXPR	Text expression	The filter value is combined with the attribute corresponding to the object's tablespace (or in the case of a partitioned table or index, the partition's tablespaces). By default, objects in all tablespaces are selected.
TABLE, objects dependent on tables	PRIMARY	Boolean	If TRUE, retrieve primary tables (that is, tables for which the secondary object bit in obj\$ is clear. Defaults to TRUE.
TABLE, objects dependent on tables	SECONDARY	Boolean	If TRUE, retrieve secondary tables (that is, tables for which the secondary object bit in obj\$ is set). Defaults to TRUE.
Dependent Objects	BASE_OBJECT_NAME	Text	Objects are selected that are defined or granted on objects with this name. Specify SCHEMA for triggers on schemas. Specify DATABASE for database triggers. Column-level comments cannot be selected by column name; the base object name must be the name of the table, view, or materialized view containing the column.

Table 116-18 (Cont.) SET_FILTER: Filters

Object Type	Name	Datatype	Meaning
Dependent Objects	BASE_OBJECT_SCHEMA	Text	Objects are selected that are defined or granted on objects in this schema. If BASE_OBJECT_NAME is specified with a value other than SCHEMA or DATABASE, this defaults to the current schema.
Dependent Objects	BASE_OBJECT_NAME_EXPR	Text expression	The filter value is combined with the attribute corresponding to the name of the base object. Not valid for schema and database triggers.
Dependent Objects	EXCLUDE_BASE_OBJECT_NAME_EXPR	Text expression	The filter value is combined with the attribute corresponding to the name of the base object to specify objects that are to be excluded from the set of objects fetched. Not valid for schema and database triggers.
Dependent Objects	BASE_OBJECT_SCHEMA_EXPR	Text expression	The filter value is combined with the attribute corresponding to the schema of the base object.
Dependent Objects	BASE_OBJECT_TYPE	Text	The object type of the base object.
Dependent Objects	BASE_OBJECT_TYPE_EXPR	Text expression	The filter value is combined with the attribute corresponding to the object type of the base object. By default no filtering is done on object type.
Dependent Objects	BASE_OBJECT_TABLESPACE	Text	The tablespace of the base object.
Dependent Objects	BASE_OBJECT_TABLESPACE_EXPR	Text expression	The filter value is combined with the attribute corresponding to the tablespaces of the base object. By default, no filtering is done on the tablespace.
INDEX, TRIGGER	SYSTEM_GENERATED	Boolean	If TRUE, select indexes or triggers even if they are system-generated. If FALSE, omit system-generated indexes or triggers. Defaults to TRUE.
Granted Objects	GRANTEE	Text	Objects are selected that are granted to this user or role. Specify PUBLIC for grants to PUBLIC.
Granted Objects	PRIVNAME	Text	The name of the privilege or role to be granted. For TABLESPACE_QUOTA, only UNLIMITED can be specified.
Granted Objects	GRANTEE_EXPR	Text expression	The filter value is combined with the attribute corresponding to the grantee name.
Granted Objects	EXCLUDE_GRANTEE_EXPR	Text expression	The filter value is combined with the attribute corresponding to the grantee name to specify objects that are to be excluded from the set of objects fetched.
OBJECT_GRANT	GRANTOR	Text	Object grants are selected that are granted by this user.

Table 116-18 (Cont.) SET_FILTER: Filters

Object Type	Name	Datatype	Meaning
SYNONYM, JAVA_SOURCE, XMLSCHEMA	LONGNAME	Text	A name longer than 30 characters. Objects with this exact name are selected. If the object name is 30 characters or less, the NAME filter must be used.
SYNONYM, JAVA_SOURCE, XMLSCHEMA	LONGNAME_EXPR	Text	The filter value is combined with the attribute corresponding to the object's long name. By default, no filtering is done on the long name of an object.
All objects	CUSTOM_FILTER	Text	The text of a WHERE condition. The condition is appended to the query that fetches the objects. By default, no custom filter is used. The other filters are intended to meet the needs of the majority of users. Use CUSTOM_FILTER when no defined filters exists for your purpose. Of necessity such a filter depends on the detailed structure of the UDTs and views used in the query. Because filters may change from version to version, upward compatibility is not guaranteed.
All objects	EDITION	Text	The edition filter is accepted for any object type, but affects only objects that support editions. The filter is only accepted for local objects (that is, the network_link parameter is not specified in the OPEN call). The edition name must be a valid edition name. If an edition is not specified, the edition of the active session is used.
SCHEMA_EXPORT	SCHEMA	Text	The schema whose objects are selected.
SCHEMA_EXPORT	SCHEMA_EXPR	Text expression	The filter value is either: combined with the attribute corresponding to a schema name to produce a WHERE condition in the query that fetches schema objects, combined with the attribute corresponding to a base schema name to produce a WHERE condition in the query that fetches dependent objects. By default the current user's objects are selected.
SCHEMA_EXPORT	INCLUDE_USER	Boolean	If TRUE, retrieve objects containing privileged information about the user. For example, USER, PASSWORD_HISTORY, TABLESPACE_QUOTA. Defaults to FALSE.
TABLE_EXPORT	SCHEMA	Text	Objects (tables and their dependent objects) in this schema are selected.

Table 116-18 (Cont.) SET_FILTER: Filters

Object Type	Name	Datatype	Meaning
TABLE_EXPORT	SCHEMA_EXPR	Text expression	The filter value is either: combined with the attribute corresponding to a schema name to produce a WHERE condition in the query that fetches the tables, combined with the attribute corresponding to a base schema name to produce a WHERE condition in the query that fetches the tables' dependent objects. By default the current user's objects are selected.
TABLE_EXPORT	NAME	Text	The table with this exact name is selected along with its dependent objects.
TABLE_EXPORT	NAME_EXPR	Text expression	The filter value is combined with the attribute corresponding to a table name in the queries that fetch tables and their dependent objects. By default all tables in the selected schemas are selected, along with their dependent objects.
Heterogeneous objects	BEGIN_WITH	Text	The fully qualified path name of the first object type in the heterogeneous collection to be retrieved. Objects normally fetched prior to this object type will not be retrieved.
Heterogeneous objects	BEGIN_AFTER	Text	The fully qualified path name of an object type after which the heterogeneous retrieval should begin. Objects of this type will not be retrieved, nor will objects normally fetched prior to this object type.
Heterogeneous objects	END_BEFORE	Text	The fully qualified path name of an object type where the heterogeneous retrieval should end. Objects of this type will not be retrieved, nor will objects normally fetched after this object type.
Heterogeneous objects	END_WITH	Text	The fully qualified path name of the last object type in the heterogeneous collection to be retrieved. Objects normally fetched after this object type will not be retrieved.

Table 116-18 (Cont.) SET_FILTER: Filters

Object Type	Name	Datatype	Meaning
Heterogeneous objects	INCLUDE_PATH_EXP R, EXCLUDE_PATH_EXP R	Text expression	<p>For these two filters, the filter value is combined with the attribute corresponding to an object type path name to produce a WHERE condition in the query that fetches the object types belonging to the heterogeneous collection. Objects of types satisfying this condition are included (INCLUDE_PATH_EXPR) or excluded (EXCLUDE_PATH_EXPR) from the set of object types fetched. Path names in the filter value do not have to be fully qualified. See Table 116-19 for valid path names that can be used with these filters.</p> <p>BEGIN_WITH, BEGIN_AFTER, END_BEFORE, END_WITH, INCLUDE_PATH_EXPR, and EXCLUDE_PATH_EXPR all restrict the set of object types in the heterogeneous collection. By default, objects of all object types in the heterogeneous collection are retrieved.</p>

Usage Notes

- Each call to SET_FILTER causes a WHERE condition to be added to the underlying query that fetches the set of objects. The WHERE conditions are concatenated with the AND keyword so that you can use multiple SET_FILTER calls to refine the set of objects to be returned. For example to specify that you want the object named EMP in schema SCOTT, do the following:

```
SET_FILTER(handle, 'SCHEMA', 'SCOTT');
SET_FILTER(handle, 'NAME', 'EMP');
```

- You can use the same text expression filter multiple times with different values. All the filter conditions will be applied to the query. For example, to get objects with names between Felix and Oscar, do the following:

```
SET_FILTER(handle, 'NAME_EXPR', '>=' 'FELIX' ');
SET_FILTER(handle, 'NAME_EXPR', '<=' 'OSCAR' ');
```

- With SET_FILTER, you can specify the schema of objects to be retrieved, but security considerations may override this specification. If the caller is SYS or has the SELECT_CATALOG_ROLE role, then any object can be retrieved; otherwise, only the following can be retrieved:

- Schema objects owned by the current user
- Public synonyms
- System privileges granted to the current user or to PUBLIC
- Grants on objects for which the current user is owner, grantor, or grantee (either explicitly or as PUBLIC).
- SCHEMA_EXPORT where the name is the current user
- TABLE_EXPORT where SCHEMA is the current user

If you request objects that you are not privileged to retrieve, no exception is raised; the object is not retrieved, as if it did not exist.

In stored procedures, functions, and definers-rights packages, roles (such as `SELECT_CATALOG_ROLE`) are disabled. Therefore, such a PL/SQL program can only fetch metadata for objects in its own schema. If you want to write a PL/SQL program that fetches metadata for objects in a different schema (based on the invoker's possession of `SELECT_CATALOG_ROLE`), you must make the program invokers-rights.

- For heterogeneous object types, the `BEGIN_WITH` and `BEGIN_AFTER` filters allow restart on an object type boundary. Appropriate filter values are returned by the `FETCH_XML_CLOB` procedure.

Filters on heterogeneous objects provide default values for filters on object types within the collection. You can override this default for a particular object type by specifying the appropriate filter for the specific object type path. For example, for `SCHEMA_EXPORT` the `NAME` filter specifies the schema to be fetched including all the tables in the schema, but you can further restrict this set of tables by supplying a `NAME_EXPR` filter explicitly for the `TABLE` object type path. [Table 116-19](#) lists valid object type path names for the major heterogeneous object types along with an explanation of the scope of each path name. (The same information is available in the following catalog views: `DATABASE_EXPORT_OBJECTS`, `SCHEMA_EXPORT_OBJECTS`, and `TABLE_EXPORT_OBJECTS`.) See [Table 116-18](#) for filters defined for each path name. These path names are valid in the `INCLUDE_PATH_EXPR` and `EXCLUDE_PATH_EXPR` filters. Path names marked with an asterisk (*) are *only* valid in those filters; they cannot be used as values of the `SET_FILTER` `object_type_path` parameter.

Table 116-19 Object Type Path Names for Heterogeneous Object Types

Heterogeneous Type	Path Name (*=valid only in xxx_PATH_EXPR)	Scope
TABLE_EXPORT	AUDIT_OBJ	Object audits on the selected tables
TABLE_EXPORT	COMMENT	Table and column comments for the selected tables
TABLE_EXPORT	CONSTRAINT	Constraints (including referential constraints) on the selected tables
TABLE_EXPORT	*GRANT	Object grants on the selected tables
TABLE_EXPORT	INDEX	Indexes (including domain indexes) on the selected tables
TABLE_EXPORT	OBJECT_GRANT	Object grants on the selected tables
TABLE_EXPORT	REF_CONSTRAINT	Referential (foreign key) constraints on the selected tables
TABLE_EXPORT	STATISTICS	Statistics on the selected tables
TABLE_EXPORT	TABLE_DATA	Row data for the selected tables
TABLE_EXPORT	TRIGGER	Triggers on the selected tables
SCHEMA_EXPORT	ASSOCIATION	Statistics type associations for objects in the selected schemas
SCHEMA_EXPORT	AUDIT_OBJ	Audits on all objects in the selected schemas
SCHEMA_EXPORT	CLUSTER	Clusters in the selected schemas and their indexes
SCHEMA_EXPORT	COMMENT	Comments on all objects in the selected schemas
SCHEMA_EXPORT	CONSTRAINT	Constraints (including referential constraints) on all objects in the selected schemas

Table 116-19 (Cont.) Object Type Path Names for Heterogeneous Object Types

Heterogeneous Type	Path Name (*=valid only in xxx_PATH_EXPR)	Scope
SCHEMA_EXPORT	DB_LINK	Private database links in the selected schemas
SCHEMA_EXPORT	DEFAULT_ROLE	Default roles granted to users associated with the selected schemas
SCHEMA_EXPORT	DIMENSION	Dimensions in the selected schemas
SCHEMA_EXPORT	FUNCTION	Functions in the selected schemas and their dependent grants and audits
SCHEMA_EXPORT	*GRANT	Grants on objects in the selected schemas
SCHEMA_EXPORT	INDEX	Indexes (including domain indexes) on tables and clusters in the selected schemas
SCHEMA_EXPORT	INDEXTYPE	Indextypes in the selected schemas and their dependent grants and audits
SCHEMA_EXPORT	JAVA_SOURCE	Java sources in the selected schemas and their dependent grants and audits
SCHEMA_EXPORT	JOB	Jobs in the selected schemas
SCHEMA_EXPORT	LIBRARY	External procedure libraries in the selected schemas
SCHEMA_EXPORT	MATERIALIZED_VIEW	Materialized views in the selected schemas
SCHEMA_EXPORT	MATERIALIZED_VIEW_LOG	Materialized view logs on tables in the selected schemas
SCHEMA_EXPORT	OBJECT_GRANT	Grants on objects in the selected schemas
SCHEMA_EXPORT	OPERATOR	Operators in the selected schemas and their dependent grants and audits
SCHEMA_EXPORT	PACKAGE	Packages (both specification and body) in the selected schemas, and their dependent grants and audits
SCHEMA_EXPORT	PACKAGE_BODY	Package bodies in the selected schemas
SCHEMA_EXPORT	PACKAGE_SPEC	Package specifications in the selected schemas
SCHEMA_EXPORT	PASSWORD_HISTORY	The password history for users associated with the selected schemas
SCHEMA_EXPORT	PROCEDURE	Procedures in the selected schemas and their dependent grants and audits
SCHEMA_EXPORT	REF_CONSTRAINT	Referential (foreign key) constraints on tables in the selected schemas
SCHEMA_EXPORT	REFRESH_GROUP	Refresh groups in the selected schemas
SCHEMA_EXPORT	SEQUENCE	Sequences in the selected schemas and their dependent grants and audits
SCHEMA_EXPORT	STATISTICS	Statistics on tables and indexes in the selected schemas
SCHEMA_EXPORT	SYNONYM	Private synonyms in the selected schemas
SCHEMA_EXPORT	TABLE	Tables in the selected schemas and their dependent objects (indexes, constraints, triggers, grants, audits, comments, table data, and so on)

Table 116-19 (Cont.) Object Type Path Names for Heterogeneous Object Types

Heterogeneous Type	Path Name (*=valid only in xxx_PATH_EXPR)	Scope
SCHEMA_EXPORT	TABLE_DATA	Row data for tables in the selected schemas
SCHEMA_EXPORT	TABLESPACE_QUOTA	Tablespace quota granted to users associated with the selected schemas
SCHEMA_EXPORT	TRIGGER	Triggers on tables in the selected schemas
SCHEMA_EXPORT	XS_SECURITY_CLASSES	Oracle Real Application Security (RAS) security classes
SCHEMA_EXPORT	XS_DATA_SECURITY	Oracle Real Application Security (RAS) data security policies
SCHEMA_EXPORT	XS_ACL	Oracle Real Application Security (RAS) access control lists (ACLs)
SCHEMA_EXPORT	TYPE	Types (both specification and body) in the selected schemas, and their dependent grants and audits
SCHEMA_EXPORT	TYPE_BODY	Type bodies in the selected schemas
SCHEMA_EXPORT	TYPE_SPEC	Type specifications in the selected schemas
SCHEMA_EXPORT	USER	User definitions for users associated with the selected schemas
SCHEMA_EXPORT	VIEW	Views in the selected schemas and their dependent objects (grants, constraints, comments, audits)
DATABASE_EXPORT	ASSOCIATION	Statistics type associations for objects in the database
DATABASE_EXPORT	AUDIT	Audits of SQL statements
DATABASE_EXPORT	AUDIT_OBJ	Audits on all objects in the database
DATABASE_EXPORT	CLUSTER	Clusters and their indexes
DATABASE_EXPORT	COMMENT	Comments on all objects
DATABASE_EXPORT	CONSTRAINT	Constraints (including referential constraints)
DATABASE_EXPORT	CONTEXT	Application contexts
DATABASE_EXPORT	DB_LINK	Private and public database links
DATABASE_EXPORT	DEFAULT_ROLE	Default roles granted to users in the database
DATABASE_EXPORT	DIMENSION	Dimensions in the database
DATABASE_EXPORT	DIRECTORY	Directory objects in the database
DATABASE_EXPORT	FGA_POLICY	Fine-grained audit policies
DATABASE_EXPORT	FUNCTION	Functions
DATABASE_EXPORT	* GRANT	Object and system grants
DATABASE_EXPORT	INDEX	Indexes (including domain indexes) on tables and clusters
DATABASE_EXPORT	INDEXTYPE	Indextypes and their dependent grants and audits
DATABASE_EXPORT	JAVA_SOURCE	Java sources and their dependent grants and audits
DATABASE_EXPORT	JOB	Jobs
DATABASE_EXPORT	LIBRARY	External procedure libraries

Table 116-19 (Cont.) Object Type Path Names for Heterogeneous Object Types

Heterogeneous Type	Path Name (*=valid only in xxx_PATH_EXPR)	Scope
DATABASE_EXPORT	MATERIALIZED_VIEW	Materialized views
DATABASE_EXPORT	MATERIALIZED_VIEW_LOG	Materialized view logs
DATABASE_EXPORT	OBJECT_GRANT	All object grants in the database
DATABASE_EXPORT	OPERATOR	Operators and their dependent grants and audits
DATABASE_EXPORT	PACKAGE	Packages (both specification and body) and their dependent grants and audits
DATABASE_EXPORT	PACKAGE_BODY	Package bodies
DATABASE_EXPORT	PACKAGE_SPEC	Package specifications
DATABASE_EXPORT	PASSWORD_HISTORY	Password histories for database users
DATABASE_EXPORT	*PASSWORD_VERIFY_FUNCTION	The password complexity verification function
DATABASE_EXPORT	PROCEDURE	Procedures and their dependent grants and objects
DATABASE_EXPORT	PROFILE	Profiles
DATABASE_EXPORT	PROXY	Proxy authentications
DATABASE_EXPORT	REF_CONSTRAINT	Referential (foreign key) constraints on tables in the database
DATABASE_EXPORT	REFRESH_GROUP	Refresh groups
DATABASE_EXPORT	*RESOURCE_COST	Resource cost information
DATABASE_EXPORT	RLS_CONTEXT	Fine-grained access-control driving contexts
DATABASE_EXPORT	RLS_GROUP	Fine-grained access-control policy groups
DATABASE_EXPORT	RLS_POLICY	Fine-grained access-control policies
DATABASE_EXPORT	ROLE	Roles
DATABASE_EXPORT	ROLE_GRANT	Role grants to users in the database
DATABASE_EXPORT	ROLLBACK_SEGMENT	Rollback segments
DATABASE_EXPORT	*SCHEMA (named object)	Database schemas including for each schema all related and dependent objects: user definitions and their attributes (default roles, role grants, tablespace quotas, and so on), objects in the schema (tables, view, packages, types, and so on), and their dependent objects (grants, audits, indexes, constraints, and so on). The NAME and NAME_EXPR filters can be used with this object type path name to designate the database schemas to be fetched.
DATABASE_EXPORT	SEQUENCE	Sequences
DATABASE_EXPORT	STATISTICS	Statistics on tables and indexes
DATABASE_EXPORT	SYNONYM	Public and private synonyms
DATABASE_EXPORT	SYSTEM_GRANT	System privilege grants
DATABASE_EXPORT	TABLE	Tables and their dependent objects (indexes, constraints, triggers, grants, audits, comments, table data, and so on)

Table 116-19 (Cont.) Object Type Path Names for Heterogeneous Object Types

Heterogeneous Type	Path Name (*=valid only in xxx_PATH_EXPR)	Scope
DATABASE_EXPORT	TABLE_DATA	Row data for all tables
DATABASE_EXPORT	TABLESPACE	Tablespace definitions
DATABASE_EXPORT	TABLESPACE_QUOTA	Tablespace quota granted to users in the database
DATABASE_EXPORT	TRIGGER	Triggers on the database, on schemas, and on schema objects
DATABASE_EXPORT	XS_USER	Oracle Real Application Security (RAS) users
DATABASE_EXPORT	XS_ROLE	Oracle Real Application Security (RAS) roles
DATABASE_EXPORT	XS_SECURITY_CLASSES	Oracle Real Application Security (RAS) security classes
DATABASE_EXPORT	XS_DATA_SECURITY	Oracle Real Application Security (RAS) data security policies
DATABASE_EXPORT	XS_ACL	Oracle Real Application Security (RAS) access control lists (ACLs)
DATABASE_EXPORT	XS_NAMESPACE	Oracle Real Application Security (RAS) namespaces
DATABASE_EXPORT	TRUSTED_DB_LINK	Trusted links
DATABASE_EXPORT	TYPE	Types (both specification and body) and their dependent grants and audits
DATABASE_EXPORT	TYPE_BODY	Type bodies
DATABASE_EXPORT	TYPE_SPEC	Type specifications
DATABASE_EXPORT	USER	User definitions
DATABASE_EXPORT	VIEW	Views

Exceptions

- **INVALID_ARGVAL.** A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- **INVALID_OPERATION.** SET_FILTER was called after the first call to FETCH_xxx for the OPEN context. After the first call to FETCH_xxx is made, no further calls to SET_FILTER are permitted.
- **INCONSISTENT_ARGS.** The arguments are inconsistent. Possible inconsistencies include the following:
 - The filter name is not valid for the object type associated with the OPEN context.
 - The filter name is not valid for the object_type_path.
 - The object_type_path is not part of the collection designated by handle .
 - The filter value is the wrong datatype.

116.6.12 SET_PARSE_ITEM Procedure

This procedure is used for both retrieval and submission. This procedure enables output parsing and specifies an object attribute to be parsed and returned.

See Also:

For more information about related subprograms:

- [Subprograms for Retrieving Multiple Objects From the Database](#)
- [Subprograms for Submitting XML to the Database](#)

Syntax

The following syntax applies when `SET_PARSE_ITEM` is used for object retrieval:

```
DBMS_METADATA.SET_PARSE_ITEM (
    handle      IN NUMBER,
    name        IN VARCHAR2,
    object_type IN VARCHAR2 DEFAULT NULL);
```

The following syntax applies when `SET_PARSE_ITEM` is used for XML submission:

```
DBMS_METADATA.SET_PARSE_ITEM (
    handle      IN NUMBER,
    name        IN VARCHAR2);
```

Parameters

Table 116-20 SET_PARSE_ITEM Procedure Parameters

Parameter	Description
handle	The handle returned from <code>OPEN</code> (or <code>OPENW</code>).
name	The name of the object attribute to be parsed and returned. See Table 116-21 for the attribute object type, name, and meaning.
object_type	Designates the object type to which the parse item applies (this is an object type name, not a path name). By default, the parse item applies to the object type of the <code>OPEN</code> handle. When the <code>OPEN</code> handle designates a heterogeneous object type, behavior can be either of the following: <ul style="list-style-type: none"> • If <code>object_type</code> is omitted, then the parse item applies to all object types within the heterogeneous collection • If <code>object_type</code> is specified, then the parse item only applies to that specific object type within the collection This parameter only applies when <code>SET_PARSE_ITEM</code> is used for object retrieval.

[Table 116-21](#) describes the object type, name, and meaning of the items available in the `SET_PARSE_ITEM` procedure.

Because new items are occasionally added, you can query the `DBMS_METADATA_PARSE_ITEMS` view to see a complete list of valid parse items or to find valid parse items for a specific object type.

Table 116-21 SET_PARSE_ITEM: Parse Items

Object Type	Name	Meaning
All objects	VERB	If <code>FETCH_XML_CLOB</code> is called, no value is returned. If <code>FETCH_DDL</code> is called, then for every row in the <code>sys.ku\$_ddl\$</code> nested table returned by <code>FETCH_DDL</code> the verb in the corresponding <code>ddlText</code> is returned. If the <code>ddlText</code> is a SQL DDL statement, then the SQL verb (for example, <code>CREATE</code> , <code>GRANT</code> , <code>AUDIT</code>) is returned. If the <code>ddlText</code> is a procedure call (for example, <code>DBMS_AQADM.CREATE_QUEUE_TABLE()</code>) then the <code>package.procedure-name</code> is returned.
All objects	OBJECT_TYPE	If <code>FETCH_XML_CLOB</code> is called, an object type name from Table 116-12 is returned. If <code>FETCH_DDL</code> is called and the <code>ddlText</code> is a SQL DDL statement whose verb is <code>CREATE</code> or <code>ALTER</code> , the object type as used in the DDL statement is returned (for example, <code>TABLE</code> , <code>PACKAGE_BODY</code> , and so on). Otherwise, an object type name from Table 116-12 is returned.
Schema objects	SCHEMA	The object schema is returned. If the object is not a schema object, no value is returned.
Named objects	NAME	The object name is returned. If the object is not a named object, no value is returned.
TABLE, TABLE_DATA, INDEX	TABLESPACE	The name of the object's tablespace or, if the object is a partitioned table, the default tablespace is returned. For a <code>TABLE_DATA</code> object, this is always the tablespace where the rows are stored.
TRIGGER	ENABLE	If the trigger is enabled, <code>ENABLE</code> is returned. If the trigger is disabled, <code>DISABLE</code> is returned.
OBJECT_GRANT, TABLESPACE_QUOTA	GRANTOR	The grantor is returned.
Dependent objects (including domain index secondary tables)	BASE_OBJECT_NAME	The name of the base object is returned. If the object is not a dependent object, no value is returned.
Dependent objects (including domain index secondary tables)	BASE_OBJECT_SCHEMA	The schema of the base object is returned. If the object is not a dependent object, no value is returned.
Dependent objects (including domain index secondary tables)	BASE_OBJECT_TYPE	The object type of the base object is returned. If the object is not a dependent object, no value is returned.
Granted objects	GRANTEE	The grantee is returned. If the object is not a granted object, no value is returned.

Usage Notes

These notes apply when using `SET_PARSE_ITEM` to retrieve objects.

By default, the `FETCH_XXX` routines return an object's metadata as XML or creation DDL. By calling `SET_PARSE_ITEM` you can request that individual attributes of the object be returned as well.

You can call `SET_PARSE_ITEM` multiple times to ask for multiple items to be parsed and returned. Parsed items are returned in the `sys.ku$_parsed_items` nested table.

For `TABLE_DATA` objects, the following parse item return values are of interest:

If Object Is	NAME, SCHEMA	BASE_OBJECT_NAME, BASE_OBJECT_SCHEMA
nonpartitioned table	table name, schema	table name, schema
table partition	partition name, schema	table name, schema
nested table	storage table name, schema	name and schema of top-level table (<i>not</i> the parent nested table)

Tables are not usually thought of as dependent objects. However, secondary tables for domain indexes are dependent on the domain indexes. Consequently, the `BASE_OBJECT_NAME`, `BASE_OBJECT_SCHEMA` and `BASE_OBJECT_TYPE` parse items for secondary `TABLE` objects return the name, schema, and type of the domain index.

See Also:

- ["FETCH_XXX Functions and Procedures"](#)
- *Oracle Database Utilities* for more information about using the metadata APIs.

By default, the `CONVERT` and `PUT` procedures simply transform an object's XML metadata to DDL. By calling `SET_PARSE_ITEM` you can request that individual attributes of the object be returned as well.

Exceptions

- `INVALID_ARGVAL`. A `NULL` or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- `INVALID_OPERATION`. `SET_PARSE_ITEM` was called after the first call to `FETCH_XXX` for the `OPEN` context. After the first call to `FETCH_XXX` is made, no further calls to `SET_PARSE_ITEM` are permitted.
- `INCONSISTENT_ARGS`. The attribute `name` is not valid for the object type associated with the `OPEN` context.

116.6.13 SET_TRANSFORM_PARAM and SET_REMAP_PARAM Procedures

These procedures are used for both retrieval and submission. SET_TRANSFORM_PARAM and SET_REMAP_PARAM specify parameters to the XSLT stylesheet identified by transform_handle.

Use them to modify or customize the output of the transform.



See Also:

For more information about related subprograms:

- [Subprograms for Retrieving Multiple Objects From the Database](#)
- [Subprograms for Submitting XML to the Database](#)

Syntax

```
DBMS_METADATA.SET_TRANSFORM_PARAM (  
  transform_handle  IN NUMBER,  
  name              IN VARCHAR2,  
  value            IN VARCHAR2,  
  object_type      IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_METADATA.SET_TRANSFORM_PARAM (  
  transform_handle  IN NUMBER,  
  name              IN VARCHAR2,  
  value            IN BOOLEAN DEFAULT TRUE,  
  object_type      IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_METADATA.SET_TRANSFORM_PARAM (  
  transform_handle  IN NUMBER,  
  name              IN VARCHAR2,  
  value            IN NUMBER,  
  object_type      IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_METADATA.SET_REMAP_PARAM (  
  transform_handle  IN NUMBER,  
  name              IN VARCHAR2,  
  old_value        IN VARCHAR2,  
  new_value        IN VARCHAR2,  
  object_type      IN VARCHAR2 DEFAULT NULL);
```

Parameters

[Table 116-22](#) describes the parameters for the SET_TRANSFORM_PARAM and SET_REMAP_PARAM procedures.

Because new parameters are occasionally added, you might want to query the DBMS_METADATA_TRANSFORM_PARAMS view to see all the valid transform parameters for each transform or to find valid transform parameters for specific object types.

Table 116-22 SET_TRANSFORM_PARAM and SET_REMAP_PARAM Parameters

Parameters	Description
name	<p>The name of the transform parameter.</p> <p>For descriptions of the parameters available for each transform on the SET_TRANSFORM_PARAM procedure, see the following:</p> <p>Table 116-23 - DDL transform</p> <p>Table 116-24 - MODIFY transform</p> <p>Table 116-26 - SXML transform</p> <p>Table 116-27 - MODIFYSXML transform</p> <p>Table 116-28 - SXMLDDL transform</p> <p>For descriptions of the parameters available for the MODIFY transform on the SET_REMAP_PARAM procedure, see Table 116-25.</p> <p>For descriptions of the parameters available for the ALTERXML transform, see Table 116-4.</p>
new_value	The new value for the remapping. This parameter is valid only for SET_REMAP_PARAM.
object_type	<p>Designates the object type to which the transform or remap parameter applies. By default, it applies to the same object type as the transform. In cases where the transform applies to all object types within a heterogeneous collection, the following apply:</p> <ul style="list-style-type: none"> • If object_type is omitted, the parameter applies to all applicable object types within the heterogeneous collection. • If object_type is specified, the parameter only applies to that object type. <p>This allows a caller who has added a transform to a heterogeneous collection to specify different transform parameters for different object types within the collection.</p>
old_value	The old value for the remapping. This parameter is valid only for SET_REMAP_PARAM.
transform_handle	<p>Either (1) the handle returned from ADD_TRANSFORM, or (2) the enumerated constant SESSION_TRANSFORM that designates the DDL transform for the whole session.</p> <p>Note that the handle returned by OPEN is not a valid transform handle.</p> <p>For SET_REMAP_PARAM, the transform handle must designate the MODIFY transform.</p>
value	The value of the transform. This parameter is valid only for SET_TRANSFORM_PARAM.

[Table 116-23](#) describes the object type, name, datatype, and meaning of the parameters for the DDL transform in the SET_TRANSFORM_PARAM procedure.

Table 116-23 SET_TRANSFORM_PARAM: Transform Parameters for the DDL Transform

Object Type	Name	Datatype	Meaning
USER, TABLE, CLUSTER, VIEW, MATERIALIZED_VIEW PROCEDURE, FUNCTION, PACKAGE, TYPE, TRIGGER	COLLATION_CLAUSE	Text	<p>There are three possible values:</p> <ul style="list-style-type: none"> NEVER — Collation clauses are never generated. ALWAYS — Collation clauses are always generated. NON_DEFAULT — Collation clauses other than USING_NLS_COMP are generated.
TABLE	OMIT_ENCRYPTION_CLAUSE	BOOLEAN	<p>If set to Y, directs Data Pump to suppress column encryption clauses. Columns encrypted in the source database are not encrypted in imported tables. Defaults to N.</p> <p>If set to N, directs Data Pump to create column encryption clauses, as in the source database.</p>
TABLE	DWCS_CVT_IOTS	BOOLEAN	<p>If set to Y, directs Data Pump to transform Index Organized tables to heap organized tables by suppressing the ORGANIZATION INDEX clause when creating the table. Defaults to N.</p> <p>If set to N, the generated DDL retains the table characteristics of the source object.</p>
TABLE, CONSTRAINT	DWCS_CVT_CONSTRAINTS	BOOLEAN	<p>If set to Y, directs Data Pump to create pk/fk/uk constraints as disabled. Defaults to N.</p> <p>If set to N, directs Data Pump to create pk/fk/uk constraints based on the source database status.</p>
TABLE, CONSTRAINT	CONSTRAINT_USE_DEFAULT_INDEX	BOOLEAN	<p>This transform parameter affects the generation of index relating the pk/uk constraint. If set to Y, forces the name of an index automatically created to enforce the constraint to be identical to the constraint name. Defaults to N.</p> <p>If set to N, the index is created as it was named on the source database.</p>
TABLE, CONSTRAINT	CONSTRAINT_NAME_FROM_INDEX	BOOLEAN	<p>This transform parameter affects the generation of pk/uk constraints which reference user created indexes. If set to Y, forces the name of the constraint to match the name of the index. Defaults to N.</p> <p>If set to N, the constraint is created as it was named on the source database.</p>

Table 116-23 (Cont.) SET_TRANSFORM_PARAM: Transform Parameters for the DDL Transform

Object Type	Name	Datatype	Meaning
TABLE	INCLUDE_SHARDING_CLAUSES	BOOLEAN	<p>This transform parameter enables sharding keywords for the transform to facilitate creating sharded tables, sequences, tablespaces and tablespace set. Options: [TRUE FALSE]</p> <p>Default: FALSE.</p> <p>When set to TRUE, sharding syntax keywords are available:</p> <p>SHARDED keyword DUPLICATED keyword PARTITION BY keyword, with the keyword options CONSISTENT HASH and PARTITIONS AUTO</p> <p>When the INCLUDE_SHARDING_CLAUSES parameter is set to FALSE in CREATE TABLE, the DDL will contain PARTITION BY RANGE and not include the PARTITIONS AUTO clause.</p>
All objects	PRETTY	BOOLEAN	If TRUE, format the output with indentation and line feeds. Defaults to TRUE.
All objects	SQLTERMINATOR	BOOLEAN	If TRUE, append a SQL terminator (; or /) to each DDL statement. Defaults to FALSE.
TABLE	CONSTRAINTS	BOOLEAN	If TRUE, include all non-referential table constraints in the DDL. If FALSE, omit them. Defaults to TRUE.
TABLE	REF_CONSTRAINTS	BOOLEAN	If TRUE, include all referential constraints (foreign keys) in the DDL. If FALSE, omit them. Defaults to TRUE.

Table 116-23 (Cont.) SET_TRANSFORM_PARAM: Transform Parameters for the DDL Transform


Object Type	Name	Datatype	Meaning
TABLE	CONSTRAINTS_AS_ALTER	BOOLEAN	If TRUE, include table constraints as separate ALTER TABLE (and, if necessary, CREATE INDEX) statements. If FALSE, specify table constraints as part of the CREATE TABLE statement. Defaults to FALSE. Requires that CONSTRAINTS be TRUE.
			<div style="border: 1px solid #0070C0; padding: 10px; background-color: #E6F2FF;"> <p> Note:</p> <p>The CONSTRAINTS_AS_ALTER parameter has no effect when an index and a constraint are created for a table in two separate DDL statements.</p> </div>
TABLE, TYPE	OID	BOOLEAN	If TRUE, include the Object ID (OID) clause in the DDL. If FALSE, omit it. Defaults to FALSE.
TABLE	SIZE_BYTE_KEYWORD	BOOLEAN	If TRUE, include the BYTE keyword as part of the size specification of CHAR and VARCHAR2 columns that use byte semantics. If FALSE, omit the keyword. Defaults to FALSE.
TABLE, INDEX	PARTITIONING	BOOLEAN	If TRUE, include partitioning clauses in the DDL. If FALSE, omit them. Defaults to TRUE.
INDEX, CONSTRAINT, ROLLBACK_SEGMENTS, CLUSTER, TABLE, TABLESPACE	SEGMENT_ATTRIBUTES	BOOLEAN	If TRUE, include segment attributes clauses (physical attributes, storage attributes, tablespace, logging) in the DDL. If FALSE, omit them. Defaults to TRUE.
INDEX, CONSTRAINT, ROLLBACK_SEGMENTS, CLUSTER, TABLE	STORAGE	BOOLEAN	If TRUE, include storage clauses in the DDL. If FALSE, omit them. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.

Table 116-23 (Cont.) SET_TRANSFORM_PARAM: Transform Parameters for the DDL Transform

Object Type	Name	Datatype	Meaning
INDEX, CONSTRAINT, ROLLBACK_SEGME NT, CLUSTER, TABLE	TABLESPACE	BOOLEAN	If TRUE, include tablespace clauses in the DDL. If FALSE, omit them. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.
TYPE, PACKAGE	SPECIFICATION	BOOLEAN	If TRUE, include the type or package specification in the DDL. If FALSE, omit it. Defaults to TRUE.
TYPE, PACKAGE	BODY	BOOLEAN	If TRUE, include the type body or package body in the DDL. If FALSE, omit it. Defaults to TRUE.
VIEW	FORCE	BOOLEAN	If TRUE, use the FORCE keyword in the CREATE VIEW statement. If FALSE, do not use the FORCE keyword in the CREATE VIEW statement. Defaults to TRUE.
OUTLINE	INSERT	BOOLEAN	If TRUE, include the INSERT statements into the OL\$ dictionary tables that will create the outline and its hints. If FALSE, omit a CREATE OUTLINE statement. Defaults to FALSE. Note: This object type is being deprecated.
All objects	DEFAULT	BOOLEAN	Calling SET_TRANSFORM_PARAM with this parameter set to TRUE has the effect of resetting all parameters for the transform to their default values. Setting this FALSE has no effect. There is no default.
All objects	INHERIT	BOOLEAN	If TRUE, inherits session-level parameters. Defaults to FALSE. If an application calls ADD_TRANSFORM to add the DDL transform, then by default the only transform parameters that apply are those explicitly set for that transform handle. This has no effect if the transform handle is the session transform handle.
ROLE	REVOKE_FROM	Text	The name of a user from whom the role must be revoked. If this is a non-null string and if the CREATE ROLE statement grants you the role, a REVOKE statement is included in the DDL after the CREATE ROLE statement. Note: When you issue a CREATE ROLE statement, Oracle may grant you the role. You can use this transform parameter to undo the grant. Defaults to null string.

Table 116-23 (Cont.) SET_TRANSFORM_PARAM: Transform Parameters for the DDL Transform

Object Type	Name	Datatype	Meaning
TABLESPACE	REUSE	BOOLEAN	<p>If TRUE, include the REUSE parameter for datafiles in a tablespace to indicate that existing files can be reused. If FALSE, omit the REUSE parameter.</p> <p>Defaults to FALSE.</p>
CLUSTER, INDEX, ROLLBACK_SEGMENT, TABLE, TABLESPACE	PCTSPACE	NUMBER	<p>A number representing the percentage by which space allocation for the object type is to be modified. The value is the number of one-hundredths of the current allocation. For example, 100 means 100%.</p> <p>If the object type is TABLESPACE, the following size values are affected:</p> <ul style="list-style-type: none"> - in file specifications, the value of SIZE - MINIMUM EXTENT - EXTENT MANAGEMENT LOCAL UNIFORM SIZE <p>For other object types, INITIAL and NEXT are affected.</p>
TABLE	LOB_STORAGE	Text	<p>Specifies the storage type to use for LOB segments. The options are as follows:</p> <ul style="list-style-type: none"> • SECUREFILE - LOB storage is returned as SECUREFILE • BASICFILE - LOB storage is returned as BASICFILE • DEFAULT - The keyword (SECUREFILE or BASICFILE) is omitted in the LOB STORE AS clause. • NO_CHANGE - LOB segments are created with the same storage they had in the source database. This is the default. <p>Specifying this transform changes the LOB storage for all tables in the job, including tables that provide storage for materialized views.</p>
TABLE	TABLE_COMPRESSION_CLAUSE	Text	<p>Specifies a table compression clause (for example, COMPRESS BASIC) to use when the table is created.</p> <p>Specify NONE to omit the table compression clause. The table will have the default compression for the tablespace.</p> <p>Specifying this transform changes the compression type for all tables in the job, including tables that provide storage for materialized views.</p>

Table 116-24 describes the object type, name, datatype, and meaning of the parameters for the MODIFY transform in the SET_TRANSFORM_PARAM procedure.

Table 116-24 SET_TRANSFORM_PARAM: Transform Parameters for the MODIFY Transform

Object Type	Name	Datatype	Meaning
All objects	OBJECT_ROW	NUMBER	A number designating the object row for an object. The object in the document that corresponds to this number will be copied to the output document. This parameter is additive. By default, all objects are copied to the output document.

Table 116-25 describes the object type, name, datatype, and meaning of the parameters for the MODIFY transform in the SET_REMAP_PARAM procedure.

Table 116-25 SET_REMAP_PARAM: Transform Parameters for the MODIFY Transform

Object Type	Name	Datatype	Meaning
LIBRARY, TABLESPACE, DIRECTORY	REMAP_DATAFILE	Text	Objects in the document will have their filespecs renamed as follows: any filespec matching <code>old_value</code> will be changed to <code>new_value</code> . Filespecs should <i>not</i> be enclosed in quotes. This parameter is additive. By default, filespecs are not renamed.
Named objects and all objects dependent on named objects	REMAP_NAME	Text	Any named object in the document whose name matches <code>old_value</code> will have its name changed to <code>new_value</code> . Any dependent object whose base object name matches <code>old_value</code> will have its base schema name changed to <code>new_value</code> . This parameter is additive. By default, names are not remapped. (Use <code>REMAP_TABLESPACE</code> to remap the name of a <code>TABLESPACE</code> object.)

Table 116-25 (Cont.) SET_REMAP_PARAM: Transform Parameters for the MODIFY Transform

Object Type	Name	Datatype	Meaning
Schema Objects, Dependent Objects, Granted Objects, USER	REMAP_SCHEMA	Text	<p>Any schema object in the document whose name matches <code>old_value</code> will have its schema name changed to <code>new_value</code>.</p> <p>Any dependent object whose base object schema name matches <code>old_value</code> will have its base object schema name changed to <code>new_value</code>.</p> <p>Any granted object whose grantee name matches <code>old_value</code> will have its grantee name changed to <code>new_value</code>.</p> <p>Any user whose name matches <code>old_value</code> will have its name changed to <code>new_value</code>.</p> <p>This parameter is additive.</p> <p>By default, schemas are not remapped.</p> <p>NOTE: The mapping may not be 100 percent complete because there are certain schema references that Import is not capable of finding. For example, Import will not find schema references embedded within the body of definitions of triggers, types, views, procedures, and packages.</p>
TABLE, CLUSTER, CONSTRAINT, INDEX, ROLLBACK_SEGMENT, MATERIALIZED_VIEW, IEW, MATERIALIZED_VIEW, IEW_LOG, TABLESPACE_QUOTA	REMAP_TABLESPACE	Text	<p>Objects in the document will have their tablespaces renamed as follows: any tablespace name matching <code>old_value</code> will be changed to <code>new_value</code>.</p> <p>This parameter is additive.</p> <p>By default, tablespaces are not remapped.</p>

Table 116-26 SET_TRANSFORM_PARAM: Transform Parameters for the SXML Transform

Object type	Name	Datatype	Meaning
USER, TABLE, CLUSTER, VIEW, MATERIALIZED_VIEW, PROCEDURE, FUNCTION, PACKAGE, TYPE, TRIGGER	COLLATION_CLAUSE	Text	<p>There are three possible values:</p> <ul style="list-style-type: none"> NEVER — Collation clauses are never generated. ALWAYS — Collation clauses are always generated. NON_DEFAULT — Collation clauses other than <code>USING_NLS_COMP</code> are generated.
TABLE, TYPE	OID	Boolean	<p>If <code>TRUE</code>, include the Oracle Internet Directory (OID) clause in the SXML. If <code>FALSE</code>, omit it. Defaults to <code>FALSE</code>.</p>

Table 116-26 (Cont.) SET_TRANSFORM_PARAM: Transform Parameters for the SXML Transform

Object type	Name	Datatype	Meaning
TABLE, INDEX, CLUSTER, MATERIALIZED_VIEW, MATERIALIZED_VIEW_LOG.	STORAGE	Boolean	If TRUE, include storage clauses in the SXML. If FALSE, omit them. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.
TABLE, INDEX, CLUSTER, MATERIALIZED_VIEW, MATERIALIZED_VIEW_LOG.	TABLESPACE	Boolean	If TRUE, include tablespace clauses in the SXML. If FALSE, omit them. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.
TABLE	REF_CONSTRAINTS	Boolean	If TRUE, include all referential constraints (foreign keys) in the SXML. If FALSE, omit them. Defaults to TRUE.
TABLE, INDEX, MATERIALIZED_VIEW	PHYSICAL_PROPERTIES	Boolean	If TRUE, include segment attributes clauses (physical attributes, storage attributes, tablespace, logging) in the SXML. If FALSE, omit them. Defaults to TRUE.
INDEX, CONSTRAINT, ROLLBACK_SEGMENT, CLUSTER, TABLE, TABLESPACE	SEGMENT_ATTRIBUTES	Boolean	If TRUE, include segment attributes clauses (physical attributes, storage attributes, tablespace, logging) in the SXML. If FALSE, omit them. Defaults to TRUE.
TABLE, INDEX	PARTITIONING	Boolean	If TRUE, include partitioning clauses in the SXML. If FALSE, omit them. Defaults to TRUE.
TABLE	CONSTRAINTS	Boolean	If TRUE, include all non-referential table constraints in the SXML. If FALSE, omit them. Defaults to TRUE.

Table 116-27 SET_TRANSFORM_PARAM: Transform Parameters for the MODIFYXML Transform

Object type	Name	Datatype	Meaning
TABLE, INDEX, MATERIALIZED_VIEW, MATERIALIZED_VIEW_LOG	STORAGE	Boolean	If TRUE, include storage clauses in the output SXML. If FALSE, omit them. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.
TABLE, INDEX, MATERIALIZED_VIEW, MATERIALIZED_VIEW_LOG	TABLESPACE	Boolean	If TRUE, include tablespace clauses in the output SXML. If FALSE, omit them. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.

Table 116-27 (Cont.) SET_TRANSFORM_PARAM: Transform Parameters for the MODIFYXML Transform

Object type	Name	Datatype	Meaning
TABLE	REF_CONSTRAINTS	Boolean	If TRUE, include all referential constraints (foreign keys) in the output SXML. If FALSE, omit them. Defaults to TRUE.
TABLE, INDEX, VIEW, MATERIALIZED_VIEW, IEW, MATERIALIZED_VIEW, IEW_LOG	REMAP_NAME	Text	Any NAME element in the document that matches old_value will be changed to new_value. This does not apply to column names. (See REMAP_COLUMN_NAME).
TABLE, INDEX, VIEW, MATERIALIZED_VIEW, IEW, MATERIALIZED_VIEW, IEW_LOG	REMAP_SCHEMA	Text	Any SCHEMA element in the document matching old_value will be changed to new_value.
TABLE, INDEX, VIEW, MATERIALIZED_VIEW, IEW	REMAP_COLUMN_NAME	Text	Any column in the document whose name matches old_value will have its name changed to new_value.
TABLE, INDEX, MATERIALIZED_VIEW, IEW, MATERIALIZED_VIEW, IEW_LOG	SEGMENT_ATTRIBUTES	Boolean	If TRUE, include segment attributes clauses (physical attributes, storage attributes, tablespace, logging) in the output SXML. If FALSE, omit them. Defaults to TRUE.
TABLE	CONSTRAINTS	Boolean	If TRUE, include all non-referential table constraints in the output SXML. If FALSE, omit them. Defaults to TRUE.

Table 116-28 SET_TRANSFORM_PARAM: Transform Parameters for the SXMLDDL Transform

Object type	Name	Datatype	Meaning
USER, TABLE, CLUSTER, VIEW, MATERIALIZED_VIEW, PROCEDURE, FUNCTION, PACKAGE, TYPE, TRIGGER	COLLATION_CLAUSE	Text	There are three possible values: <ul style="list-style-type: none"> NEVER — Collation clauses are never generated. ALWAYS — Collation clauses are always generated. NON_DEFAULT — Collation clauses other than USING_NLS_COMP are generated.
TABLE	OID	Boolean	If TRUE, include OIDs in the DDL. If FALSE, omit them. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.

Table 116-28 (Cont.) SET_TRANSFORM_PARAM: Transform Parameters for the SXMLDDL Transform

Object type	Name	Datatype	Meaning
TABLE, INDEX, CLUSTER, MATERIALIZED_VIEW, MATERIALIZED_VIEW_LOG.	TABLESPACE	Boolean	If TRUE, include tablespace clauses in the DDL. If FALSE, omit them. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.
TABLE, INDEX, CLUSTER, MATERIALIZED_VIEW, MATERIALIZED_VIEW_LOG.	STORAGE	Boolean	If TRUE, include storage clauses in the DDL. If FALSE, omit them. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.
TABLE	REF_CONSTRAINTS	Boolean	If TRUE, include all referential constraints (foreign keys) in the DDL. If FALSE, omit them. Defaults to TRUE.
INDEX	PRESERVE_LOCAL	Boolean	If PARTITIONING is FALSE and PRESERVE_LOCAL is TRUE and the index is a locally partitioned index, include the LOCAL keyword in the DDL. Defaults to FALSE.
TABLE, INDEX, CLUSTER, MATERIALIZED_VIEW, MATERIALIZED_VIEW_LOG.	SEGMENT_ATTRIBUTES	Boolean	If TRUE, include segment attributes clauses (physical attributes, storage attributes, tablespace, logging) in the DDL. If FALSE, omit them. Defaults to TRUE.
TABLESPACE	REUSE	Boolean	If TRUE, include the REUSE parameter for datafiles in a tablespace to indicate that existing files can be reused. If FALSE, omit the REUSE parameter. Defaults to FALSE.
TABLE, INDEX	PARTITIONING	Boolean	If TRUE, include partitioning clauses in the DDL. If FALSE, omit them. Defaults to TRUE.
TABLE	CONSTRAINTS	Boolean	If TRUE, include all non-referential table constraints in the output SXML. If FALSE, omit them. Defaults to TRUE.

Exceptions

- **INVALID_ARGVAL.** A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- **INVALID_OPERATION.** Either SET_TRANSFORM_PARAM or SET_REMAP_PARAM was called after the first call to FETCH_XXX for the OPEN context. After the first call to FETCH_XXX is made, no further calls to SET_TRANSFORM_PARAM or SET_REMAP_PARAM are permitted.
- **INCONSISTENT_ARGS.** The arguments are inconsistent. This can mean the following:

- The transform parameter `name` is not valid for the object type associated with the `OPEN` context or for the transform associated with the transform handle.
- The transform applies to all object types in a heterogeneous collection, but `object_type` is not part of the collection.

Usage Notes

XSLT allows parameters to be passed to stylesheets. You call `SET_TRANSFORM_PARAM` or `SET_REMAP_PARAM` to specify the value of a parameter to be passed to the stylesheet identified by `transform_handle`.

Normally, if you call `SET_TRANSFORM_PARAMETER` multiple times for the same parameter name, each call overrides the prior call. For example, the following sequence simply sets the `STORAGE` transform parameter to `TRUE`.

```
SET_TRANSFORM_PARAM(tr_handle,'STORAGE',false);
SET_TRANSFORM_PARAM(tr_handle,'STORAGE',true);
```

However, some transform parameters are additive which means that all specified parameter values are applied to the document, not just the last one. For example, the `OBJECT_ROW` parameter to the `MODIFY` transform is additive. If you specify the following, then both specified rows are copied to the output document.

```
SET_TRANSFORM_PARAM(tr_handle,'OBJECT_ROW',5);
SET_TRANSFORM_PARAM(tr_handle,'OBJECT_ROW',8);
```

The `REMAP_TABLESPACE` parameter is also additive. If you specify the following, then tablespaces `TBS1` and `TBS3` are changed to `TBS2` and `TBS4`, respectively.

```
SET_REMAP_PARAM(tr_handle,'REMAP_TABLESPACE','TBS1','TBS2');
SET_REMAP_PARAM(tr_handle,'REMAP_TABLESPACE','TBS3','TBS4');
```

The order in which the transformations are performed is undefined. For example, if you specify the following, the result is undefined.

```
SET_REMAP_PARAM(tr_handle,'REMAP_TABLESPACE','TBS1','TBS2');
SET_REMAP_PARAM(tr_handle,'REMAP_TABLESPACE','TBS2','TBS3');
```



Note:

The number of remap parameters that can be specified for a `MODIFY` transform is limited to ten. That is, you can specify up to ten `REMAP_DATAFILE` parameters, up to ten `REMAP_SCHEMA` parameters and so on. Additional instances are ignored. To work around this, you can perform another `DBMS_METADATA.ADD_TRANSFORM` and specify additional remap parameters.

The `GET_DDL`, `GET_DEPENDENT_DDL`, and `GET_GRANTED_DDL` functions allow the casual browser to extract the creation DDL for an object. So that you can specify transform parameters, this package defines an enumerated constant `SESSION_TRANSFORM` as the handle of the DDL transform at the session level. You can call `SET_TRANSFORM_PARAM` using `DBMS_METADATA.SESSION_TRANSFORM` as the transform handle to set transform parameters for the whole session. `GET_DDL`, `GET_DEPENDENT_DDL`, and `GET_GRANTED_DDL` inherit these parameters when they invoke the DDL transform.



Note:

The enumerated constant must be prefixed with the package name
`DBMS_METADATA.SESSION_TRANSFORM`.

DBMS_METADATA_DIFF

The `DBMS_METADATA_DIFF` package contains the interfaces for comparing two metadata documents in SXML format.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Browsing APIs for Fetching and Comparing Objects](#)
- [Summary of DBMS_METADATA_DIFF Subprograms](#)



See Also:

Oracle Database Utilities for more information and for examples of using the `DBMS_METADATA_DIFF` package.

117.1 DBMS_METADATA_DIFF Overview

You can use the interfaces contained in the `DBMS_METADATA_DIFF` package to compare two metadata documents in SXML format.

The result of the comparison is an SXML difference document. This document can be converted to other formats using the `DBMS_METADATA` `submit` interface and the `CONVERT` API.

117.2 DBMS_METADATA_DIFF Security Model

The browsing interface of the `DBMS_METADATA_DIFF` package actually uses the `DBMS_METADATA` package to fetch the metadata to be compared. Therefore, the security model used for `DBMS_METADATA` also applies to `DBMS_METADATA_DIFF`. (Note, however, that `DBMS_METADATA_DIFF` does not support all object types.)



See Also:

[DBMS_METADATA](#) for information about the `DBMS_METADATA` security model

117.3 DBMS_METADATA_DIFF — Browsing APIs for Fetching and Comparing Objects

These functions allow you to compare the metadata for two objects with a single call.

Syntax

```
DBMS_METADATA_DIFF.COMPARE_SXML (
object_type   IN VARCHAR2,
name1        IN VARCHAR2,
name2        IN VARCHAR2,
schema1      IN VARCHAR2 DEFAULT NULL,
schema2      IN VARCHAR2 DEFAULT NULL,
network_link1 IN VARCHAR2 DEFAULT NULL,
network_link2 IN VARCHAR2 DEFAULT NULL)
RETURN CLOB;
```

```
DBMS_METADATA_DIFF.COMPARE_ALTER (
object_type   IN VARCHAR2,
name1        IN VARCHAR2,
name2        IN VARCHAR2,
schema1      IN VARCHAR2 DEFAULT NULL,
schema2      IN VARCHAR2 DEFAULT NULL,
network_link1 IN VARCHAR2 DEFAULT NULL,
network_link2 IN VARCHAR2 DEFAULT NULL)
RETURN CLOB;
```

```
DBMS_METADATA_DIFF.COMPARE_ALTER_XML (
object_type   IN VARCHAR2,
name1        IN VARCHAR2,
name2        IN VARCHAR2,
schema1      IN VARCHAR2 DEFAULT NULL,
schema2      IN VARCHAR2 DEFAULT NULL,
network_link1 IN VARCHAR2 DEFAULT NULL,
network_link2 IN VARCHAR2 DEFAULT NULL)
RETURN CLOB;
```

Parameters

Table 117-1 COMPARE_xxx Function Parameters

Parameters	Description
object_type	The type of object to be compared. Valid type names are CLUSTER, CONTEXT, DB_LINK, FGA_POLICY, INDEX, MATERIALIZED_VIEW, MATERIALIZED_VIEW_LOG, QUEUE, QUEUE_TABLE, RLS_CONTEXT, RLS_GROUP, RLS_POLICY, ROLE, SEQUENCE, SYNONYM, TABLE, TABLESPACE, TRIGGER, TYPE, TYPE_SPEC, TYPE_BODY, USER, and VIEW.
name1	The name of the first object in the comparison.
name2	The name of the second object in the comparison.
schema1	The schema of the first object in the comparison. The default is the current user.

Table 117-1 (Cont.) COMPARE_xxx Function Parameters

Parameters	Description
schema2	The schema of the second object in the comparison. The default is the value of schema1.
network_link1	The name of a database link to the database on which the first object resides. If NULL (the default), then the object is assumed to be in the database on which the caller is running.
network_link2	The name of a database link to the database on which the second object resides. The default is the value of network_link1.

Return Values

DBMS_METADATA_DIFF.COMPARE_xxx returns the differences between two objects.

Exceptions

- INVALID_ARGVAL
A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- OBJECT_NOT_FOUND
The specified object was not found in the database.

Usage Notes

These functions encapsulate calls to both DBMS_METADATA and DBMS_METADATA_DIFF functions and procedures to fetch the metadata for each of the two objects and compare them.

Which function you use depends on the comparison format you want:

- COMPARE_SXML returns an SXML difference document.
- COMPARE_ALTER returns a set of ALTER statements for making the first object like the second object.
- COMPARE_ALTER_XML returns an ALTER_XML document.

117.4 Summary of DBMS_METADATA_DIFF Subprograms

The DBMS_METADATA_DIFF subprograms provide comparison functionality for different object types.

These subprograms are used to:

- Specify the type of objects to be compared
- Specify the SXML documents to be compared
- Show the differences between the compared documents
- Clean up after the comparison

Table 117-2 provides a summary of DBMS_METADATA_DIFF subprograms.

Table 117-2 DBMS_METADATA_DIFF Package Subprograms

Subprogram	Description
OPENC Function	Specifies the type of objects to be compared
ADD_DOCUMENT Procedure	Specifies an SXML document to be compared
FETCH_CLOB Functions and Procedures	Returns a CLOB showing the differences between the two documents specified by <code>ADD_DOCUMENT</code>
CLOSE Procedure	Invalidates the handle returned by <code>OPENC</code> and cleans up associated state

117.4.1 OPENC Function

This function specifies the type of objects to be compared. The return value is an opaque context handle.

Syntax

```
DBMS_METADATA_DIFF.OPENC (
  object_type IN VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 117-3 OPENC Function Parameters

Parameters	Description
<code>object_type</code>	The type of object to be compared. Valid type names are CLUSTER, CONTEXT, DB_LINK, FGA_POLICY, INDEX, MATERIALIZED_VIEW, MATERIALIZED_VIEW_LOG, QUEUE, QUEUE_TABLE, RLS_CONTEXT, RLS_GROUP, RLS_POLICY, ROLE, SEQUENCE, SYNONYM, TABLE, TABLESPACE, TRIGGER, TYPE, TYPE_SPEC, TYPE_BODY, USER, and VIEW.

Return Values

The opaque handle that is returned is used as input to `ADD_DOCUMENT`, `FETCH_XXX` and `CLOSE`.

Exceptions

- INVALID_ARGVAL

A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.

117.4.2 ADD_DOCUMENT Procedure

This procedure specifies an SXML document that is to be compared.

Syntax

```
DBMS_METADATA_DIFF.ADD_DOCUMENT(  
handle IN NUMBER, document IN sys.XMLType);
```

```
DBMS_METADATA_DIFF.ADD_DOCUMENT(  
handle IN NUMBER, document IN CLOB);
```

Parameters

Table 117-4 ADD_DOCUMENT Procedure Parameters

Parameter	Description
handle	The handle returned from OPENC
document	A document to be compared. The document must be of the type specified in OPENC.

Usage Notes

Because the comparison interface allows you to compare exactly two SXML documents, a program must call `ADD_DOCUMENT` exactly twice for each `OPENC` handle. In the comparison result, the document specified by the first call is document 1, and the document specified by the second call is document 2.

Exceptions

- `INVALID_ARGVAL`

A `NULL` or invalid value was supplied for an input parameter. The error message text identifies the parameter.

117.4.3 FETCH_CLOB Functions and Procedures

The `FETCH_CLOB` functions and procedures return a CLOB showing the differences between the two documents specified by `ADD_DOCUMENT`.

Syntax

```
DBMS_METADATA_DIFF.FETCH_CLOB(  
handle IN NUMBER)  
RETURN CLOB;
```

```
DBMS_METADATA_DIFF.FETCH_CLOB(  
  
handle IN NUMBER,  
doc IN OUT NOCOPY CLOB);
```

```
DBMS_METADATA_DIFF.FETCH_CLOB(  
handle IN NUMBER,  
doc IN OUT NOCOPY CLOB  
diffs OUT BOOLEAN);
```

Parameters

Table 117-5 FETCH_CLOB Subprogram Parameters

Parameter	Description
handle	The handle returned from OPENC.
doc	A CLOB containing the differences between documents 1 and 2.
diffs	TRUE if the documents are different or FALSE if they are identical.

Return Values

The differences between documents 1 and 2.

Exceptions

- INVALID_ARGVAL
A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.

117.4.4 CLOSE Procedure

This procedure invalidates the handle returned by OPENC and cleans up associated state.

Syntax

```
DBMS_METADATA_DIFF.CLOSE(  
handle IN NUMBER);
```

Parameters

Table 117-6 CLOSE Function Parameters

Parameters	Description
handle	The handle returned from OPENC

Exceptions

- INVALID_ARGVAL
A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.

DBMS_MGD_ID_UTL

The `DBMS_MGD_ID_UTL` package contains various utility functions and procedures.

These consist of the following utility subprograms:

- A logging utility that sets and gets Java and PL/SQL logging levels.
- A proxy utility consisting of two procedures used to set and unset the host and port of the proxy server.
- A metadata utility consisting of functions and procedures used for managing metadata.



See Also:

Oracle Database Development Guide for more information.

This chapter describes each of these utility subprograms and contains the following topics:

- [Security Model](#)
- [Constants](#)
- [Exceptions](#)
- [Summary of DBMS_MGD_ID_UTL Subprograms](#)

The examples in this chapter assume that the user has run the following set of commands before running the contents of each script:

```
SQL> connect / as sysdba;
Connected.
SQL> create user mgduser identified by password;
SQL> grant connect, resource to mgduser;
SQL> connect mgduser
Enter password: mgduserpassword
Connected.
SQL> set serveroutput on;
```

118.1 DBMS_MGD_ID_UTL Security Model

You must run the `catmgd.sql` script to load the `DBMS_MGD_ID_UTL` package and Identity Code Package schema objects in the `MGDSYS` schema.

`DBMS_MGD_ID_UTL` is a `MGDSYS`-owned package. Any `DBMS_MGD_ID_UTL` subprogram called from an anonymous PL/SQL block is run using the privileges of the current user.

A user must be granted `connect` and `resource` roles to use the `DBMS_MGD_ID_UTL` package and its subprograms.

`EXECUTE` privilege is granted to `PUBLIC` for these ADTs: `MGD_ID`, `MGD_ID_COMPONENT`, `MGD_ID_COMPONENT_VARRAY`, and for this package `DBMS_MGD_ID_UTL`.

SELECT or READ privilege is granted to PUBLIC for these read-only views:
MGD_ID_CATEGORY and MGD_ID_SCHEME and for these metadata views:
USER_MGD_ID_CATEGORY and USER_MGD_ID_SCHEME, and for table
MGD_ID_XML_VALIDATOR, and for sequence MGD\$SEQUENCE_CATEGORY.

INSERT, UPDATE and DELETE privilege is granted to PUBLIC for these metadata views:
USER_MGD_ID_CATEGORY and USER_MGD_ID_SCHEME.

Public synonyms, by the same name, are created for these ADTs: MGD_ID,
MGD_ID_COMPONENT, MGD_ID_COMPONENT_VARRAY and for this package DBMS_MGD_ID_UTL,
as well as for these read-only views: MGD_ID_CATEGORY and MGD_ID_SCHEME and for
these metadata views: USER_MGD_ID_CATEGORY and USER_MGD_ID_SCHEME, and for table
MGD_ID_XML_VALIDATOR.

118.2 DBMS_MGD_ID_UTL Constants

The DBMS_MGD_ID_UTL package defines several constants for specifying parameter values.

These constants are shown in the following tables.

Table 118-1 DBMS_MGD_ID_UTL Constants — Installed Category IDs and Names

Name	Value
EPC_ENCODING_CATEGORY_ID	1
EPC_ENCODING_CATEGORY_NAME	EPC

Table 118-2 DBMS_MGD_ID_UTL Constants — Logging Levels

Name	Value
LOGGING_LEVEL_0 OFF	0
LOGGING_LEVEL_1 SEVERE	1
LOGGING_LEVEL_2 WARNING	2
LOGGING_LEVEL_3 INFO	3
LOGGING_LEVEL_4 FINE	4
LOGGING_LEVEL_5 FINER	5
LOGGING_LEVEL_6 FINEST	6
LOGGING_LEVEL_7 ALL	7

118.3 DBMS_MGD_ID_UTL Exceptions

The table in this topic lists the DBMS_MGD_ID_UTL exceptions.

Table 118-3 Exceptions Raised by DBMS_MGD_ID_UTL Package

Name	Error Code	Description
TDTJavaException	-55200	During the tag data translation, a Java exception was raised.
TDTCategoryNotFound	-55201	The specified category was not found.
TDTSchemeNotFound	-55202	During the tag data translation, the specified scheme was not found.
TDTLevelNotFound	-55203	During the tag data translation, the specified level was not found.
TDTOptionNotFound	-55204	During the tag data translation, the specified option was not found.
TDTFieldValidationException	-55205	During the tag data translation, the validation operation failed on a field.
TDTUndefinedField	-55206	During the tag data translation, an undefined field was detected.
TDTRuleEvaluationFailed	-55207	During the tag data translation, the rule evaluation operation failed.
TDTTooManyMatchingLevels	-55208	During the tag data translation, too many matching levels were found.

118.4 Summary of DBMS_MGD_ID_UTL Subprograms

This table describes the utility subprograms in the DBMS_MGD_ID_UTL package.

All the values and names passed to the procedures defined in the DBMS_MGD_ID_UTL package are case insensitive unless otherwise mentioned. To preserve the case, enclose the values with double quotation marks.

Table 118-4 DBMS_MGD_ID_UTL Package Subprograms

Subprogram	Description
ADD_SCHEME Procedure	Adds a tag data translation scheme to an existing category
CREATE_CATEGORY Function	Creates a new category or a new version of a category
EPC_TO_ORACLE_SCHEME Function	Converts the EPCglobal tag data translation (TDT) XML to Oracle tag data translation XML
GET_CATEGORY_ID Function	Returns the category ID given the category name and the category version
GET_COMPONENTS Function	Returns all relevant separated component names separated by semicolon (;) for the specified scheme
GET_ENCODINGS Function	Returns a list of semicolon (;) separated encodings (formats) for the specified scheme

Table 118-4 (Cont.) DBMS_MGD_ID_UTL Package Subprograms

Subprogram	Description
GET_JAVA_LOGGING_LEVEL Function	Returns an integer representing the current Java trace logging level
GET_PLSQL_LOGGING_LEVEL Function	Returns an integer representing the current PL/SQL trace logging level
GET_SCHEME_NAMES Function	Returns a list of semicolon (;) separated scheme names for the specified category
GET_TDT_XML Function	Returns the Oracle tag data translation XML for the specified scheme
GET_VALIDATOR Function	Returns the Oracle Database tag data translation schema
REFRESH_CATEGORY Function	Refreshes the metadata information on the Java stack for the specified category
REMOVE_CATEGORY Procedure	Removes a category including all the related TDT XML if the value of <code>category_version</code> parameter is NULL
REMOVE_PROXY Procedure	Unsets the host and port of the proxy server
REMOVE_SCHEME Procedure	Removes a tag data translation scheme from a category
SET_JAVA_LOGGING_LEVEL Procedure	Sets the Java logging level
SET_PLSQL_LOGGING_LEVEL Procedure	Sets the PL/SQL tracing logging level
SET_PROXY Procedure	Sets the host and port of the proxy server for Internet access
VALIDATE_SCHEME Function	Validates the input tag data translation XML against the Oracle tag data translation schema

118.4.1 ADD_SCHEME Procedure

This procedure adds a tag data translation scheme to an existing category.

Syntax

```
DBMS_MGD_ID_UTL.ADD_SCHEME (
    category_id IN VARCHAR2,
    tdt_xml     IN CLOB);
```

Parameters

Table 118-5 ADD_SCHEME Procedure Parameters

Parameter	Description
<code>category_id</code>	Category ID
<code>tdt_xml</code>	Tag data translation XML

Examples

This example performs the following actions:

1. Creates a category.

2. Adds a contractor scheme and an employee scheme to the MGD_SAMPLE_CATEGORY category.
3. Validates the MGD_SAMPLE_CATEGORY scheme.
4. Tests the tag translation of the contractor scheme and the employee scheme.
5. Removes the contractor scheme.
6. Tests the tag translation of the contractor scheme and this returns the expected exception for the removed contractor scheme.
7. Tests the tag translation of the employee scheme and this returns the expected values.
8. Removes the MGD_SAMPLE_CATEGORY category.

```
--contents of add_scheme2.sql
SET LINESIZE 160
-----
---CREATE CATEGORY, ADD_SCHEME, REMOVE_SCHEME, REMOVE_CATEGORY-----
-----
DECLARE
  amt          NUMBER;
  buf          VARCHAR2(32767);
  pos          NUMBER;
  tdt_xml      CLOB;
  validate_tdtxml VARCHAR2(1042);
  category_id  VARCHAR2(256);
BEGIN
  -- remove the testing category if already existed
  DBMS_MGD_ID_UTL.remove_category('MGD_SAMPLE_CATEGORY', '1.0');
  -- Step 1. Create the testing category 'MGD_SAMPLE_CATEGORY', version 1.0.
  category_id := DBMS_MGD_ID_UTL.CREATE_CATEGORY('MGD_SAMPLE_CATEGORY', '1.0', 'Oracle',
'http://www.example.com/mgd/sample');
  -- Step 2. Add contractor scheme to the category.
  DBMS_LOB.CREATETEMPORARY(tdt_xml, true);
  DBMS_LOB.OPEN(tdt_xml, DBMS_LOB.LOB_READWRITE);

  buf := '<?xml version="1.0" encoding="UTF-8"?>
<TagDataTranslation version="0.04" date="2005-04-18T16:05:00Z"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema"
      xmlns="oracle.mgd.idcode">
<scheme name="CONTRACTOR_TAG" optionKey="1" xmlns="">
<level type="URI" prefixMatch="example.contractor.">
  <option optionKey="1" pattern="example.contractor.([0-9]*).([0-9]*)"
    grammar="'example.contractor.'" contractorID '.' divisionID">
    <field seq="1" characterSet="[0-9]*" name="contractorID"/>
    <field seq="2" characterSet="[0-9]*" name="divisionID"/>
  </option>
</level>
<level type="BINARY" prefixMatch="11">
  <option optionKey="1" pattern="11([01]{7})([01]{6})"
    grammar="'11'" contractorID divisionID ">
    <field seq="1" characterSet="[01]*" name="contractorID"/>
    <field seq="2" characterSet="[01]*" name="divisionID"/>
  </option>
</level>
</scheme>
</TagDataTranslation>';

  amt := length(buf);
  pos := 1;
  DBMS_LOB.WRITE(tdt_xml, amt, pos, buf);
```

```

DBMS_LOB.CLOSE(tdt_xml);

DBMS_MGD_ID_UTL.ADD_SCHEME(category_id, tdt_xml);

-- Add the employee scheme to the category.
DBMS_LOB.CREATETEMPORARY(tdt_xml, true);
DBMS_LOB.OPEN(tdt_xml, DBMS_LOB.LOB_READWRITE);

buf := '<?xml version="1.0" encoding="UTF-8"?>
<TagDataTranslation version="0.04" date="2005-04-18T16:05:00Z"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema"
      xmlns="oracle.mgd.idcode">
<scheme name="EMPLOYEE_TAG" optionKey="1" xmlns="">
  <level type="URI" prefixMatch="example.employee.">
    <option optionKey="1" pattern="example.employee.([0-9]*).([0-9]*"
      grammar="'example.employee.' employeeID '.' divisionID">
      <field seq="1" characterSet="[0-9]*" name="employeeID"/>
      <field seq="2" characterSet="[0-9]*" name="divisionID"/>
    </option>
  </level>
  <level type="BINARY" prefixMatch="01">
    <option optionKey="1" pattern="01([01]{7})([01]{6})"
      grammar="'01' employeeID divisionID ">
      <field seq="1" characterSet="[01]*" name="employeeID"/>
      <field seq="2" characterSet="[01]*" name="divisionID"/>
    </option>
  </level>
</scheme>
</TagDataTranslation>';

amt := length(buf);
pos := 1;
DBMS_LOB.WRITE(tdt_xml, amt, pos, buf);
DBMS_LOB.CLOSE(tdt_xml);
DBMS_MGD_ID_UTL.ADD_SCHEME(category_id, tdt_xml);

-- Step 3. Validate the scheme.
dbms_output.put_line('Validate the MGD_SAMPLE_CATEGORY Scheme');
validate_tdtxml := DBMS_MGD_ID_UTL.validate_scheme(tdt_xml);
dbms_output.put_line(validate_tdtxml);
dbms_output.put_line('Length of scheme xml is: '||DBMS_LOB.GETLENGTH(tdt_xml));

-- Step 4. Test tag translation of contractor scheme.
dbms_output.put_line(
  mgd_id.translate('MGD_SAMPLE_CATEGORY', NULL,
    'example.contractor.123.45',
    NULL, 'BINARY'));

dbms_output.put_line(
  mgd_id.translate('MGD_SAMPLE_CATEGORY', NULL,
    '111111011101101',
    NULL, 'URI'));

-- Test tag translation of employee scheme.
dbms_output.put_line(
  mgd_id.translate('MGD_SAMPLE_CATEGORY', NULL,
    'example.employee.123.45',
    NULL, 'BINARY'));

dbms_output.put_line(
  mgd_id.translate('MGD_SAMPLE_CATEGORY', NULL,

```

```

        '011111011101101',
        NULL, 'URI'));

DBMS_MGD_ID_UTL.REMOVE_SCHEME(category_id, 'CONTRACTOR_TAG');

-- Step 6. Test tag translation of contractor scheme. Doesn't work any more.
BEGIN
  dbms_output.put_line(
    mgd_id.translate('MGD_SAMPLE_CATEGORY', NULL,
                    'example.contractor.123.45',
                    NULL, 'BINARY'));

  dbms_output.put_line(
    mgd_id.translate('MGD_SAMPLE_CATEGORY', NULL,
                    '111111011101101',
                    NULL, 'URI'));
EXCEPTION
  WHEN others THEN
    dbms_output.put_line('Contractor tag translation failed: '||SQLERRM);
END;

-- Step 7. Test tag translation of employee scheme. Still works.
BEGIN
  dbms_output.put_line(
    mgd_id.translate('MGD_SAMPLE_CATEGORY', NULL,
                    'example.employee.123.45',
                    NULL, 'BINARY'));

  dbms_output.put_line(
    mgd_id.translate('MGD_SAMPLE_CATEGORY', NULL,
                    '011111011101101',
                    NULL, 'URI'));
EXCEPTION
  WHEN others THEN
    dbms_output.put_line('Employee tag translation failed: '||SQLERRM);
END;

-- Step 8. Remove the testing category, which also removes all the associated schemes
DBMS_MGD_ID_UTL.remove_category('MGD_SAMPLE_CATEGORY', '1.0');
END;
/
SHOW ERRORS;

```

SQL> @add_scheme3.sql

```

.
.
.
Validate the MGD_SAMPLE_CATEGORY Scheme
EMPLOYEE_TAG;URI,BINARY;divisionID,employeeID
Length of scheme xml is: 933
111111011101101
example.contractor.123.45
011111011101101
example.employee.123.45
Contractor tag translation failed: ORA-55203: Tag data translation level not found
ORA-06512: at "MGDSYS.DBMS_MGD_ID_UTL", line 54
ORA-06512: at "MGDSYS.MGD_ID", line 242
ORA-29532: Java call terminated by uncaught Java
exception: oracle.mgd.idcode.exceptions.TDTLevelNotFound: Matching level not
found for any configured scheme
011111011101101
example.employee.123.45

```

118.4.2 CREATE_CATEGORY Function

This function creates a new category or a new version of a category.

Syntax

```
DBMS_MGD_ID_UTL.CREATE_CATEGORY (
  category_name     IN  VARCHAR2,
  category_version  IN  VARCHAR2,
  agency            IN  VARCHAR2,
  URI               IN  VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 118-6 CREATE_CATEGORY Function Parameters

Parameter	Description
category_name	Name of category
category_version	Category version
agency	Organization that owns the category. For example, EPCglobal owns the category EPC.
URI	URI that provides additional information about the category

Usage Notes

The return value is the category ID.

Examples

See the [ADD_SCHEME Procedure](#) for an example of creating the MGD_SAMPLE_CATEGORY category.

118.4.3 EPC_TO_ORACLE_SCHEME Function

This function converts the EPCglobal tag data translation (TDT) XML to Oracle Database tag data translation XML.

Syntax

```
DBMS_MGD_ID_UTL.EPC_TO_ORACLE_SCHEME (
  xml_scheme IN CLOB)
RETURN CLOB;
```

Parameters

Table 118-7 EPC_TO_ORACLE_SCHEME Function Parameters

Parameter	Description
xml_scheme	Name of EPC tag scheme to be converted

Usage Notes

The return value is the contents of the CLOB containing the Oracle Datanase tag data translation XML.

Examples

The following example converts standard EPCglobal Tag Data Translation (TDT) files into Oracle Database TDT files:

```
--Contents of MGD_ID_DOC2.sql
-----
-- EPC_TO_ORACLE_SCHEME --
-----
call DBMS_MGD_ID_UTL.set_proxy('www-proxy.example.com', '80');

BEGIN
  DBMS_JAVA.set_output(1000000);
  DBMS_OUTPUT.ENABLE(1000000);
  DBMS_MGD_ID_UTL.set_java_logging_level(DBMS_MGD_ID_UTL.LOGGING_LEVEL_SEVERE);
END;
/

DECLARE
  epcScheme          CLOB;
  oracleScheme       CLOB;
  amt                NUMBER;
  buf                VARCHAR2(32767);
  pos                NUMBER;
  seq                BINARY_INTEGER;
  validate_epcscheme VARCHAR2(256);
  validate_oraclescheme VARCHAR2(256);
BEGIN

  DBMS_LOB.CREATETEMPORARY(epcScheme, true);
  DBMS_LOB.OPEN(epcScheme, DBMS_LOB.LOB_READWRITE);

  buf := '<?xml version="1.0" encoding="UTF-8"?>
<epcTagDataTranslation version="0.04" date="2005-04-18T16:05:00Z"
  epcTDSVersion="1.1r1.27"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema"
  xsi:noNamespaceSchemaLocation="EpcTagDataTranslation.xsd">
<scheme name="GID-96" optionKey="1" tagLength="96">
  <level type="BINARY" prefixMatch="00110101"
    requiredFormattingParameters="taglength">
    <option optionKey="1" pattern="00110101([01]{28})([01]{24})([01]{36})"
      grammar="'00110101' generalmanager objectclass serial">
      <field seq="1" decimalMinimum="0" decimalMaximum="268435455"
        characterSet="[01]*" bitLength="28" name="generalmanager"/>
      <field seq="2" decimalMinimum="0" decimalMaximum="16777215"
        characterSet="[01]*" bitLength="24" name="objectclass"/>

```

```

        <field seq="3" decimalMinimum="0" decimalMaximum="68719476735"
            characterSet="[01]*" bitLength="36" name="serial"/>
    </option>
</level>
<level type="TAG_ENCODING" prefixMatch="urn:epc:tag:gid-96"
    requiredFormattingParameters="taglength">
    <option optionKey="1"
        pattern="urn:epc:tag:gid-96:([0-9]*)\.[(0-9]*)\.[(0-9)*]"
        grammar="'urn:epc:tag:gid-96:' generalmanager '.' objectclass '.' serial">
        <field seq="1" decimalMinimum="0" decimalMaximum="268435455"
            characterSet="[0-9]*" name="generalmanager"/>
        <field seq="2" decimalMinimum="0" decimalMaximum="16777215"
            characterSet="[0-9]*" name="objectclass"/>
        <field seq="3" decimalMinimum="0" decimalMaximum="68719476735"
            characterSet="[0-9]*" name="serial"/>
    </option>
</level>
<level type="PURE_IDENTITY" prefixMatch="urn:epc:id:gid">
    <option optionKey="1"
        pattern="urn:epc:id:gid:([0-9]*)\.[(0-9]*)\.[(0-9)*]"
        grammar="'urn:epc:id:gid:' generalmanager '.' objectclass '.' serial">
        <field seq="1" decimalMinimum="0" decimalMaximum="268435455"
            characterSet="[0-9]*" name="generalmanager"/>
        <field seq="2" decimalMinimum="0" decimalMaximum="16777215"
            characterSet="[0-9]*" name="objectclass"/>
        <field seq="3" decimalMinimum="0" decimalMaximum="68719476735"
            characterSet="[0-9]*" name="serial"/>
    </option>
</level>
<level type="LEGACY" prefixMatch="generalmanager=">
    <option optionKey="1"
        pattern="generalmanager=([0-9]*);objectclass=([0-9]*);serial=([0-9]*)"
        grammar="'generalmanager='generalmanager';objectclass='objectclass
';serial=' serial">
        <field seq="1" decimalMinimum="0" decimalMaximum="268435455"
            characterSet="[0-9]*" name="generalmanager"/>
        <field seq="2" decimalMinimum="0" decimalMaximum="16777215"
            characterSet="[0-9]*" name="objectclass"/>
        <field seq="3" decimalMinimum="0" decimalMaximum="68719476735"
            characterSet="[0-9]*" name="serial"/>
    </option>
</level>
</scheme>
</epcTagDataTranslation>';
amt := length(buf);
pos := 1;
DBMS_LOB.WRITE(epcScheme, amt, pos, buf);
DBMS_LOB.CLOSE(epcScheme);
oracleScheme := DBMS_MGD_ID_UTL.epc_to_oracle_scheme(epcScheme);
dbms_output.put_line('Length of oracle scheme xml is: '||DBMS_LOB.GETLENGTH(oracleScheme));
dbms_output.put_line(DBMS_LOB.SUBSTR(oracleScheme, DBMS_LOB.GETLENGTH(oracleScheme), 1));
dbms_output.put_line(' ');
dbms_output.put_line('Validate the Oracle Scheme');
validate_oraclescheme := DBMS_MGD_ID_UTL.validate_scheme(oracleScheme);
dbms_output.put_line('Validation result: '||validate_oraclescheme);
END;
/
SHOW ERRORS;

SQL> @mgd_id_doc2.sql
PL/SQL procedure successfully completed.

```



```

Length of oracle scheme xml is: 2475
<?xml version = '1.0' encoding = 'UTF-8'?>
<TagDataTranslation version="0.04"
date="2005-04-18T16:05:00Z" xmlns:xsi="http://www.w3.org/2001/XMLSchema"
xmlns="oracle.mgd.idcode"><scheme name="GID-96" optionKey="1" xmlns=""><level
type="BINARY" prefixMatch="00110101" requiredFormattingParameters=""><option
optionKey="1" pattern="00110101([01]{28})([01]{24})([01]{36})"
grammar="'00110101' generalmanager objectclass serial"><field seq="1"
decimalMinimum="0" decimalMaximum="268435455" characterSet="[01]*"
bitLength="28" name="generalmanager"/><field seq="2" decimalMinimum="0"
decimalMaximum="16777215" characterSet="[01]*" bitLength="24"
name="objectclass"/><field seq="3" decimalMinimum="0"
decimalMaximum="68719476735" characterSet="[01]*" bitLength="36"
name="serial"/></option></level><level type="TAG_ENCODING"
prefixMatch="urn:epc:tag:gid-96" requiredFormattingParameters=""><option
optionKey="1" pattern="urn:epc:tag:gid-96:([0-9]*)\.[(0-9]*)\.[(0-9)*]"
grammar="'urn:epc:tag:gid-96:' generalmanager '.' objectclass '.' serial"><field
seq="1" decimalMinimum="0" decimalMaximum="268435455" characterSet="[0-9]*"
name="generalmanager"/><field seq="2" decimalMinimum="0"
decimalMaximum="16777215" characterSet="[0-9]*" name="objectclass"/><field
seq="3" decimalMinimum="0" decimalMaximum="68719476735" characterSet="[0-9]*"
name="serial"/></option></level><level type="PURE_IDENTITY"
prefixMatch="urn:epc:id:gid"><option optionKey="1"
pattern="urn:epc:id:gid:([0-9]*)\.[(0-9]*)\.[(0-9)*]" grammar="'urn:epc:id:gid:'
generalmanager '.' objectclass '.' serial"><field seq="1" decimalMinimum="0"
decimalMaximum="268435455" characterSet="[0-9]*" name="generalmanager"/><field
seq="2" decimalMinimum="0" decimalMaximum="16777215" characterSet="[0-9]*"
name="objectclass"/><field seq="3" decimalMinimum="0"
decimalMaximum="68719476735" characterSet="[0-9]*"
name="serial"/></option></level><level type="LEGACY"
prefixMatch="generalmanager"><option optionKey="1"
pattern="generalmanager=([0-9]*);objectclass=([0-9]*);serial=([0-9]*)"
grammar="'generalmanager='generalmanager';objectclass='objectclass ';serial='
serial"><field seq="1" decimalMinimum="0" decimalMaximum="268435455"
characterSet="[0-9]*" name="generalmanager"/><field seq="2" decimalMinimum="0"
decimalMaximum="16777215" characterSet="[0-9]*" name="objectclass"/><field
seq="3" decimalMinimum="0" decimalMaximum="68719476735" characterSet="[0-9]*"
name="serial"/></option></level></scheme></TagDataTranslation>
Validate the Oracle Scheme
Validation result:
GID-96;LEGACY,TAG_ENCODING,PURE_IDENTITY,BINARY;objectclass,generalmanager,serial,

PL/SQL procedure successfully completed.
.
.
.

```

118.4.4 GET_CATEGORY_ID Function

This function returns the category ID for a given category name and category version.

Syntax

```

DBMS_MGD_ID_UTL.GET_CATEGORY_ID (
    category name      IN  VARCHAR2,
    category version  IN  VARCHAR2)
RETURN VARCHAR2;

```

Parameters

Table 118-8 GET_CATEGORY_ID Function Parameters

Parameter	Description
category_name	Name of category
category_version	Category version

Usage Notes

- If the value of `category_version` is NULL, then the ID of the latest version of the specified category is returned.
- The return value is the category ID for the specified category name.

Examples

The following example returns a category ID given a category name and its version:

```
-- Contents of get_category1.sql file
SELECT DBMS_MGD_ID_UTL.get_category_id('EPC', NULL) FROM DUAL;
```

```
SQL> @get_category1.sql
.
.
.
DBMS_MGD_ID_UTL.GET_CATEGORY_ID('EPC',NULL)-----
-----1
.
.
.
```

118.4.5 GET_COMPONENTS Function

This function returns all relevant separated component names separated by semicolon (;) for the specified scheme.

Syntax

```
DBMS_MGD_ID_UTL.GET_COMPONENTS (
    category_id IN VARCHAR2,
    scheme_name IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 118-9 GET_COMPONENTS Function Parameters

Parameter	Description
category_id	Category ID
scheme_name	Name of scheme

Usage Notes

The return value contains the component names separated by a semicolon (;) for the specified scheme.

Examples

The following example gets the components:

```
--Contents of get_components.sql
DECLARE
  id          mgd_id;
  getcomps    VARCHAR2(1000);
  getencodings VARCHAR2(1000);
  getschemenames VARCHAR2(1000);
BEGIN
  DBMS_MGD_ID_UTL.set_java_logging_level(DBMS_MGD_ID_UTL.LOGGING_LEVEL_OFF);
  DBMS_MGD_ID_UTL.refresh_category(DBMS_MGD_ID_UTL.get_category_id('EPC', NULL));
  getcomps := DBMS_MGD_ID_UTL.get_components(1,'SGTIN-64');
  dbms_output.put_line('Component names are: ' || getcomps);
  getencodings := DBMS_MGD_ID_UTL.get_encodings(1,'SGTIN-64');
  dbms_output.put_line('Encodings are: ' || getencodings);
  getschemenames := DBMS_MGD_ID_UTL.get_scheme_names(1);
  dbms_output.put_line('Scheme names are: ' || getschemenames);
END;
/
SHOW ERRORS;

SQL> @get_components.sql
.
.
.
Component names are:
filter,gtin,companyprefixlength,companyprefix,companyprefixindex,itemref,serial
Encodings are: ONS_HOSTNAME,LEGACY,TAG_ENCODING,PURE_IDENTITY,BINARY
Scheme names are:
GIAI-64,GIAI-96,GID-96,GRAI-64,GRAI-96,SGLN-64,SGLN-96,SGTIN-64,SGTIN-96,SSCC-64
,SSCC-96,USDOD-64,USDOD-96
PL/SQL procedure successfully completed.
.
.
.
```

118.4.6 GET_ENCODINGS Function

This function returns a list of semicolon (;) separated encodings (formats) for the specified scheme.

Syntax

```
DBMS_MGD_ID_UTL.GET_ENCODINGS (
  category_id IN VARCHAR2,
  scheme_name IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 118-10 GET_ENCODINGS Function Parameters

Parameter	Description
category_id	Category ID
scheme_name	Name of scheme

Usage Notes

The return value contains the encodings separated by a semicolon (;) for the specified scheme.

Examples

See the [GET_COMPONENTS Function](#) for an example.

118.4.7 GET_JAVA_LOGGING_LEVEL Function

This function returns an integer representing the current trace logging level.

Syntax

```
DBMS_MGD_ID_UTL.GET_JAVA_LOGGING_LEVEL
RETURN INTEGER;
```

Usage Notes

The return value is the integer value denoting the current Java logging level.

Examples

The following example gets the Java logging level.

```
--Contents of getjavalogginglevel.sql
DECLARE
    loglevel    NUMBER;
BEGIN
    DBMS_MGD_ID_UTL.set_java_logging_level(DBMS_MGD_ID_UTL.LOGGING_LEVEL_OFF);
    loglevel := DBMS_MGD_ID_UTL.get_java_logging_level();
    dbms_output.put_line('Java logging level = ' || loglevel);
END;
/
SHOW ERRORS;

SQL> @getjavalogginglevel.sql
.
.
.
Java logging level = 0
PL/SQL procedure successfully completed.
.
.
.
```

118.4.8 GET_PLSQL_LOGGING_LEVEL Function

This function returns an integer representing the current PL/SQL trace logging level.

Syntax

```
DBMS_MGD_ID_UTL.GET_PLSQL_LOGGING_LEVEL  
  RETURN INTEGER;  
  
PRAGMA restrict_references (get_plsql_logging_level, WNDS);
```

Usage Notes

The return value is the integer value denoting the current PL/SQL logging level.

Examples

The following example gets the PL/SQL logging level.

```
--Contents of getplsqllogginglevel.sql  
DECLARE  
    loglevel    NUMBER;  
BEGIN  
    DBMS_MGD_ID_UTL.set_plsql_logging_level(0);  
    loglevel := DBMS_MGD_ID_UTL.get_plsql_logging_level();  
    dbms_output.put_line('PL/SQL logging level = ' || loglevel);  
END;  
/  
SHOW ERRORS;  
  
SQL> @getplsqllogginglevel.sql  
.  
.  
.  
PL/SQL logging level = 0  
PL/SQL procedure successfully completed.  
.  
.  
.
```

118.4.9 GET_SCHEME_NAMES Function

This function returns a list of semicolon (;) separated scheme names for the specified category.

Syntax

```
DBMS_MGD_ID_UTL.GET_SCHEME_NAMES (  
    category_id IN VARCHAR2)  
  RETURN VARCHAR2;
```

Parameters

Table 118-11 GET_SCHEME_NAMES Function Parameters

Parameter	Description
category_id	Category ID

Usage Notes

The return value contains the scheme names for the specified category ID.

Examples

See the [GET_COMPONENTS Function](#) for an example.

118.4.10 GET_TDT_XML Function

This function returns the Oracle Database tag data translation XML for the specified scheme.

Syntax

```
DBMS_MGD_ID_UTL.GET_TDT_XML (
    category_id IN VARCHAR2,
    scheme_name IN VARCHAR2)
RETURN CLOB;
```

Parameters

Table 118-12 GET_TDT_XML Function Parameters

Parameter	Description
category_id	Category ID
scheme_name	Name of scheme

Usage Notes

The return value contains the Oracle Database tag data translation XML for the specified scheme.

Examples

The following example gets the Oracle Database TDT XML for the specified scheme:

```
--Contents of get_tdtxml.sql
DECLARE
    gettdtxml    CLOB;

BEGIN
    gettdtxml := DBMS_MGD_ID_UTL.get_tdt_xml(1,'SGTIN-64');
    dbms_output.put_line('Length of tdt XML is '||DBMS_LOB.GETLENGTH(gettdtxml));
    dbms_output.put_line(DBMS_LOB.SUBSTR(gettdtxml, DBMS_LOB.GETLENGTH(gettdtxml), 1));
END;
/
```

SHOW ERRORS;

SQL> @get_tdtxml.sql

```
.
.
.
Length of tdt XML is 22884
<?xml version = '1.0' encoding = "UTF-8"?>
<TagDataTranslation version="0.04"
date="2005-04-18T16:05:00Z" xmlns:xsi="http://www.w3.org/2001/XMLSchema"
xmlns="oracle.mgd.idcode"><scheme name="SGTIN-64"
optionKey="companyprefixlength" xmlns="">
  <level type="BINARY"
prefixMatch="10" requiredFormattingParameters="filter">
  <option
optionKey="12" pattern="10([01]{3})([01]{14})([01]{20})([01]{25})" grammar="'10'
filter companyprefixindex itemref serial">
  <field seq="1"
decimalMinimum="0" decimalMaximum="7" characterSet="[01]*" bitLength="3"
length="1" padChar="0" padDir="LEFT" name="filter"/>
  <field seq="2"
decimalMinimum="0" decimalMaximum="16383" characterSet="[01]*" bitLength="14"
name="companyprefixindex"/>
  <field seq="3" decimalMinimum="0"
decimalMaximum="9" characterSet="[01]*" bitLength="20" length="1" padChar="0"
padDir="LEFT" name="itemref"/>
  <field seq="4" decimalMinimum="0"
decimalMaximum="33554431" characterSet="[01]*" bitLength="25" name="serial"/>
.
.
.
  <field seq="1" decimalMinimum="0" decimalMaximum="9999999" characterSet="[0-9]*"
length="7" padChar="0" padDir="LEFT" name="itemref"/>
  <field seq="2" decimalMinimum="0" decimalMaximum="999999" characterSet="[0-9]*" length="6"
padChar="0" padDir="LEFT" name="companyprefix"/>
  </option>
</level>

</scheme></TagDataTranslation>
PL/SQL procedure successfully completed.
.
.
.
```

118.4.11 GET_VALIDATOR Function

This function returns the Oracle Database tag data translation schema.

Syntax

```
DBMS_MGD_ID_UTL.GET_VALIDATOR
RETURN CLOB;
```

Usage Notes

The return value contains the Oracle Database tag data translation schema.

Examples

This example returns the Oracle Database TDT schema.

```
--Contents of get_validator.sql
DECLARE
  getvalidator          CLOB;
BEGIN
  getvalidator := DBMS_MGD_ID_UTL.get_validator;
  dbms_output.put_line('Length of validated oracle scheme xml is '||
DBMS_LOB.GETLENGTH(getvalidator));
  dbms_output.put_line(DBMS_LOB.SUBSTR(getvalidator, DBMS_LOB.GETLENGTH(getvalidator), 1));
END;
/
SHOW ERRORS;

SQL> @get_validator.sql
.
.
.
Length of validated oracle scheme xml is 5780
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema
targetNamespace="oracle.mgd.idcode"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"

xmlns:tdt="oracle.mgd.idcode" elementFormDefault="unqualified"

attributeFormDefault="unqualified" version="1.0">
  <xsd:annotation>

<xsd:documentation>
  <![CDATA[
<epcglobal:copyright>Copyright ?2004
Epcglobal Inc., All
Rights
Reserved.</epcglobal:copyright>
<epcglobal:disclaimer>EPCglobal Inc., its
members, officers, directors,
employees, or agents shall not be liable for any
injury, loss, damages,
financial or otherwise, arising from, related to, or
caused by the use of this
document. The use of said document shall constitute
your express consent to
the foregoing
exculpation.</epcglobal:disclaimer>
<epcglobal:specification>Tag Data
Translation (TDT) version
1.0</epcglobal:specification>
]>
</xsd:documentation>
  </xsd:annotation>
  <xsd:simpleType
name="LevelTypeList">
    <xsd:restriction base="xsd:string">

</xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="TagLengthList"

<xsd:restriction base="xsd:string">
    </xsd:restriction>
  </xsd:simpleType>
```



```
<xsd:simpleType name="SchemeNameList">
  <xsd:restriction base="xsd:string">

</xsd:restriction>
</xsd:simpleType>
<xsd:simpleType
name="InputFormatList">
  <xsd:restriction base="xsd:string">

<xsd:enumeration value="BINARY"/>
  <xsd:enumeration value="STRING"/>

</xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="ModeList">

<xsd:restriction base="xsd:string">
  <xsd:enumeration value="EXTRACT"/>

<xsd:enumeration value="FORMAT"/>
</xsd:restriction>
</xsd:simpleType>

<xsd:simpleType name="CompactionMethodList">
  <xsd:restriction
base="xsd:string">
  <xsd:enumeration value="32-bit"/>
<xsd:enumeration value="16-bit"/>
  <xsd:enumeration value="8-bit"/>

<xsd:enumeration value="7-bit"/>      <xsd:enumeration value="6-bit"/>

<xsd:enumeration value="5-bit"/>
</xsd:restriction>
</xsd:simpleType>

<xsd:simpleType name="PadDirectionList">
  <xsd:restriction
base="xsd:string">
  <xsd:enumeration value="LEFT"/>
  <xsd:enumeration
value="RIGHT"/>
</xsd:restriction>
</xsd:simpleType>
<xsd:complexType
name="Field">
  <xsd:attribute name="seq" type="xsd:integer" use="required"/>

<xsd:attribute name="name" type="xsd:string" use="required"/>
  <xsd:attribute
name="bitLength" type="xsd:integer"/>
  <xsd:attribute name="characterSet"
type="xsd:string" use="required"/>
  <xsd:attribute name="compaction"
type="tdt:CompactionMethodList"/>
  <xsd:attribute name="compression"
type="xsd:string"/>
  <xsd:attribute name="padChar" type="xsd:string"/>

<xsd:attribute name="padDir" type="tdt:PadDirectionList"/>
```

```
<xsd:attribute
name="decimalMinimum" type="xsd:long"/>
  <xsd:attribute name="decimalMaximum"
type="xsd:long"/>
  <xsd:attribute name="length" type="xsd:integer"/>
</xsd:complexType>
  <xsd:complexType name="Option">
    <xsd:sequence>

<xsd:element name="field" type="tdt:Field" maxOccurs="unbounded"/>

</xsd:sequence>
  <xsd:attribute name="optionKey" type="xsd:string"
use="required"/>
  <xsd:attribute name="pattern" type="xsd:string"/>

<xsd:attribute name="grammar" type="xsd:string" use="required"/>

</xsd:complexType>
  <xsd:complexType name="Rule">
    <xsd:attribute
name="type" type="tdt:ModeList" use="required"/>
    <xsd:attribute
name="inputFormat" type="tdt:InputFormatList"
use="required"/>
    <xsd:attribute name="seq" type="xsd:integer"
use="required"/>
    <xsd:attribute name="newFieldName" type="xsd:string"
use="required"/>
    <xsd:attribute name="characterSet" type="xsd:string"
use="required"/>
    <xsd:attribute name="padChar" type="xsd:string"/>

<xsd:attribute name="padDir" type="tdt:PadDirectionList"/>
  <xsd:attribute
name="decimalMinimum" type="xsd:long"/>
  <xsd:attribute name="decimalMaximum"
type="xsd:long"/>
  <xsd:attribute name="length" type="xsd:string"/>

<xsd:attribute name="function" type="xsd:string" use="required"/>

<xsd:attribute name="tableURI" type="xsd:string"/>
  <xsd:attribute
name="tableParams" type="xsd:string"/>
  <xsd:attribute name="tableXPath"
type="xsd:string"/>
  <xsd:attribute name="tableSQL" type="xsd:string"/>

</xsd:complexType>
  <xsd:complexType name="Level">
    <xsd:sequence>
<xsd:element name="option" type="tdt:Option" minOccurs="1"
maxOccurs="unbounded"/>
    <xsd:element name="rule" type="tdt:Rule"
minOccurs="0"
maxOccurs="unbounded"/>
  </xsd:sequence>
```

```

<xsd:attribute name="type" type="tdt:LevelTypeList" use="required"/>
<xsd:attribute name="prefixMatch" type="xsd:string" use="optional"/>
<xsd:attribute name="requiredParsingParameters" type="xsd:string"/>
<xsd:attribute name="requiredFormattingParameters" type="xsd:string"/>

</xsd:complexType>
  <xsd:complexType name="Scheme">
    <xsd:sequence>
<xsd:element name="level" type="tdt:Level" minOccurs="1" maxOccurs="5"/>

</xsd:sequence>
  <xsd:attribute name="name" type="tdt:SchemeNameList"
use="required"/>
  <xsd:attribute name="optionKey" type="xsd:string"
use="required"/>
  <xsd:attribute name="tagLength" type="tdt:TagLengthList"
use="optional"/>
</xsd:complexType>
<xsd:complexType
name="TagDataTranslation">
  <xsd:sequence>
    <xsd:element name="scheme"
type="tdt:Scheme" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute
name="version" type="xsd:string" use="required"/>
  <xsd:attribute name="date"
type="xsd:dateTime" use="required"/>
</xsd:complexType>
  <xsd:element
name="TagDataTranslation" type="tdt:TagDataTranslation"/>
</xsd:schema>

```

PL/SQL procedure successfully completed.

.
.

.

118.4.12 REFRESH_CATEGORY Function

This function refreshes the metadata information on the Java stack for the specified category.

This function must be called before using MGD_ID functions.

Syntax

```

DBMS_MGD_ID_UTL.REFRESH_CATEGORY (
  category_id IN VARCHAR2);

```

Parameters

Table 118-13 REFRESH_CATEGORY Function Parameters

Parameter	Description
category_id	Category ID

Examples

The following example refreshes the metadata information for the EPC category ID.

```
--Contents of toString3.sql
call DBMS_MGD_ID_UTL.set_proxy('www-proxy.example.com', '80');
DECLARE
id          MGD_ID;
BEGIN
  DBMS_MGD_ID_UTL.set_java_logging_level(DBMS_MGD_ID_UTL.LOGGING_LEVEL_OFF);
  DBMS_MGD_ID_UTL.refresh_category(DBMS_MGD_ID_UTL.get_category_id('EPC', NULL));
  dbms_output.put_line('..Testing to_string');
  DBMS_OUTPUT.PUT_LINE('test to_string');
  id := mgd_id('EPC', NULL, 'urn:epc:id:gid:0037000.30241.1041970',
'scheme=GID-96');
  DBMS_OUTPUT.PUT_LINE('mgd_id object as a string');
  DBMS_OUTPUT.PUT_LINE(id.to_string);
END;
/
SHOW ERRORS;
call DBMS_MGD_ID_UTL.remove_proxy();

SQL> @toString3.sql
..Testing to_string
test to_string
mgd_id object as a string
category_id =1;schemes = GID-96;objectclass = 30241;generalmanager =
0037000;scheme = GID-96;1 = 1;serial = 1041970

PL/SQL procedure successfully completed.
```

118.4.13 REMOVE_CATEGORY Procedure

This procedure removes a category including all the related TDT XML.

This procedure is overloaded. The different functionality of each form of syntax is presented along with the definitions.

Syntax

Removes a category based on the specified category ID.

```
DBMS_MGD_ID_UTL.REMOVE_CATEGORY (
  category_id IN VARCHAR2);
```

Removes a category based on the specified category name and category version.

```
DBMS_MGD_ID_UTL.REMOVE_CATEGORY (
  category_name IN VARCHAR2,
  category_version IN VARCHAR2);
```

Parameters

Table 118-14 REMOVE_CATEGORY Procedure Parameters

Parameter	Description
category_id	Category ID

Table 118-14 (Cont.) REMOVE_CATEGORY Procedure Parameters

Parameter	Description
category_name	Name of category
category_version	Category version

Usage Notes

If the value of `category_version` is NULL, all versions for the specified category will be removed.

Examples

See the [ADD_SCHEME Procedure](#) for an example of removing a category.

118.4.14 REMOVE_PROXY Procedure

This procedure unsets the host and port of the proxy server.

Syntax

```
DBMS_MGD_ID_UTL.REMOVE_PROXY;
```

Examples

See the [REFRESH_CATEGORY Function](#) for an example.

118.4.15 REMOVE_SCHEME Procedure

This procedure removes a tag data translation scheme from a category.

Syntax

```
DBMS_MGD_ID_UTL.REMOVE_SCHEME (
  category_id IN VARCHAR2,
  scheme_name IN VARCHAR2);
```

Parameters**Table 118-15 REMOVE_SCHEME Procedure Parameters**

Parameter	Description
category_id	Category ID
scheme_name	Name of scheme

Examples

See the [ADD_SCHEME Procedure](#) for an example of removing a scheme.

118.4.16 SET_JAVA_LOGGING_LEVEL Procedure

This procedure sets the Java trace logging level.

Syntax

```
DBMS_MGD_ID_UTL.SET_JAVA_LOGGING_LEVEL (  
    logginglevel IN INTEGER);
```

Parameters

Table 118-16 SET_JAVA_LOGGING_LEVEL Procedure Parameters

Parameter	Description
logginglevel	Logging level. The Java logging level can be one of the following values in descending order: <ul style="list-style-type: none">• LOGGING_LEVEL_OFF CONSTANT INTEGER := 0• LOGGING_LEVEL_SEVERE CONSTANT INTEGER := 1• LOGGING_LEVEL_WARNING CONSTANT INTEGER := 2• LOGGING_LEVEL_INFO CONSTANT INTEGER := 3• LOGGING_LEVEL_FINE CONSTANT INTEGER := 4• LOGGING_LEVEL_FINER CONSTANT INTEGER := 5• LOGGING_LEVEL_FINEST CONSTANT INTEGER := 6• LOGGING_LEVEL_ALL CONSTANT INTEGER := 7

Examples

See the [GET_JAVA_LOGGING_LEVEL Function](#) for an example.

118.4.17 SET_PLSQL_LOGGING_LEVEL Procedure

This procedure sets the PL/SQL trace logging level.

Syntax

```
DBMS_MGD_ID_UTL.SET_PLSQL_LOGGING_LEVEL (  
    level IN INTEGER);  
  
PRAGMA restrict_references(set_plsql_logging_level, WNDS);
```

Parameters

Table 118-17 SET_PLSQL_LOGGING_LEVEL Procedure Parameters

Parameter	Description
level	<p>Logging level. The PL/SQL logging level can be one of the following values in descending order:</p> <ul style="list-style-type: none"> • LOGGING_LEVEL_OFF CONSTANT INTEGER := 0 • LOGGING_LEVEL_SEVERE CONSTANT INTEGER := 1 • LOGGING_LEVEL_WARNING CONSTANT INTEGER := 2 • LOGGING_LEVEL_INFO CONSTANT INTEGER := 3 • LOGGING_LEVEL_FINE CONSTANT INTEGER := 4 • LOGGING_LEVEL_FINER CONSTANT INTEGER := 5 • LOGGING_LEVEL_FINEST CONSTANT INTEGER := 6 • LOGGING_LEVEL_ALL CONSTANT INTEGER := 7

Examples

See the [GET_PLSQL_LOGGING_LEVEL Function](#) for an example.

118.4.18 SET_PROXY Procedure

This procedure sets the host and port of the proxy server for Internet access.

This procedure must be called if the database server accesses the Internet using a proxy server. Internet access is necessary because some rules need to look up the Object Naming Service (ONS) table to get the company prefix index.

You do not need to call this procedure does if you are only using schemes that do not contain any rules requiring Internet access.

Syntax

```
DBMS_MGD_ID_UTL.SET_PROXY (
    prox_host IN VARCHAR2,
    proxy_port IN VARCHAR2);
```

Parameters

Table 118-18 SET_PROXY Procedure Parameters

Parameter	Description
proxy_host	Name of host
proxy_port	Host port number

Examples

See the [REFRESH_CATEGORY Function](#) for an example.

118.4.19 VALIDATE_SCHEME Function

This function validates the input tag data translation XML against the Oracle Database tag data translation schema.

Syntax

```
DBMS_MGD_ID_UTL.VALIDATE_SCHEME (  
    xml_scheme IN CLOB)  
RETURN VARCHAR2;
```

Parameters

Table 118-19 VALIDATE_SCHEME Function Parameters

Parameter	Description
xml_scheme	Scheme to be validated.

Usage Notes

The return value contains the components names for the specified scheme.

Examples

See the [ADD_SCHEME Procedure](#) or the [EPC_TO_ORACLE_SCHEME Function](#) for an example.

DBMS_MGWADM

DBMS_MGWADM defines the Messaging Gateway administrative interface. The package and object types are owned by SYS.

Note:

- DBMS_MGWADM is deprecated in 23ai and will be desupported in a future release.
- You must run the `catmgw.sql` script located under the `$ORACLE_HOME/mgw/admin` directory to load the Messaging Gateway packages and types into the database.

See Also:

Oracle Database Advanced Queuing User's Guide contains information on loading database objects and using DBMS_MGWADM

This chapter contains the following topics:

- [Security Model](#)
- [Deprecated Subprograms](#)
- [Constants](#)
- [Data Structures](#)
- [Summary of DBMS_MGWADM Subprograms](#)

119.1 DBMS_MGWADM Security Model

A user with administrative privilege can run all procedures in DBMS_MGWADM.

119.2 DBMS_MGWADM Deprecated Subprograms

Oracle recommends that you do not use deprecated procedures in new applications. Support for deprecated features is for backward compatibility only.

The following subprograms are deprecated with Oracle Database 11g Release 1 having been superseded by improved technology:

- [ADD_SUBSCRIBER Procedure](#) - use instead [CREATE_JOB Procedure](#)
- [ALTER_PROPAGATION_SCHEDULE Procedure](#) - use instead [ALTER_JOB Procedure](#)
- [ALTER_SUBSCRIBER Procedure](#) - use instead [ALTER_JOB Procedure](#)

- [DB_CONNECT_INFO Procedure](#) - use instead [ALTER_AGENT Procedures](#)
- [DISABLE_PROPAGATION_SCHEDULE Procedure](#) - use instead [DISABLE_JOB Procedure](#)
- [ENABLE_PROPAGATION_SCHEDULE Procedure](#) - use instead [ENABLE_JOB Procedure](#)
- [REMOVE_SUBSCRIBER Procedure](#) - use instead [REMOVE_JOB Procedure](#)
- [RESET_SUBSCRIBER Procedure](#) - use instead [RESET_JOB Procedure](#)
- [SCHEDULE_PROPAGATION Procedure](#) - use instead [CREATE_JOB Procedure](#)
- [UNSCHEDULE_PROPAGATION Procedure](#) - use instead [REMOVE_JOB Procedure](#)

119.3 DBMS_MGWADM Constants

The `DBMS_MGWADM` package defines various constants for specifying parameter values.

- [Table 119-1](#)
- [Table 119-2](#)
- [Table 119-3](#)
- [Table 119-4](#)
- [Table 119-5](#)
- [Table 119-6](#)
- [Table 119-7](#)
- [Table 119-8](#)
- [Table 119-9](#)
- [Table 119-10](#)
- [Table 119-11](#)

Table 119-1 DBMS_MGWADM Constants—Cleanup Actions

Name	Type	Description
<code>CLEAN_STARTUP_STATE</code>	<code>CONSTANT BINARY_INTEGER</code>	Sets the Messaging Gateway agent to a known state so that it can be started
<code>CLEAN_LOG_QUEUES</code>	<code>CONSTANT BINARY_INTEGER</code>	Messaging Gateway agent will clean log queues for all configured messaging system links
<code>RESET_SUB_MISSING_LOG_RECORD</code>	<code>CONSTANT BINARY_INTEGER</code>	Messaging Gateway agent recovers a Messaging Gateway subscriber that has failed due to a missing log record
<code>RESET_SUB_MISSING_MESSAGE</code>	<code>CONSTANT BINARY_INTEGER</code>	Messaging Gateway agent recovers a Messaging Gateway subscriber that has failed due to a missing persistent source message

Table 119-2 DBMS_MGWADM Constants—Force Values

Name	Type	Description
FORCE	CONSTANT BINARY_INTEGER	Represents a forced action
NO_FORCE	CONSTANT BINARY_INTEGER	Represents a normal, nonforced action

Table 119-3 DBMS_MGWADM Constants—Logging Levels

Name	Type	Description
BASIC_LOGGING	CONSTANT BINARY_INTEGER	The standard (the least) information written to the log file
TRACE_DEBUG_LOGGING	CONSTANT BINARY_INTEGER	The greatest information written to the log file
TRACE_HIGH_LOGGING	CONSTANT BINARY_INTEGER	The third level of detail of logging information written to the log file
TRACE_LITE_LOGGING	CONSTANT BINARY_INTEGER	The second level detail of logging information written to the log file

Table 119-4 DBMS_MGWADM Constants—Named Property Constants

Name	Type	Description
MGWPROP_PREFIX	CONSTANT VARCHAR2	A constant (MGWPROP\$_) for the reserved property name prefix
MGWPROP_REMOVE	CONSTANT VARCHAR2	A constant (MGWPROP\$_REMOVE) for the reserved property name used to remove an existing property
MGWPROP_REMOVE_ALL	CONSTANT VARCHAR2	A constant (MGWPROP\$_REMOVE_ALL) for the reserved property name used to remove all properties

Table 119-5 DBMS_MGWADM Constants—Other Constants

Name	Type	Description
JMS_CONNECTION	CONSTANT BINARY_INTEGER	Used to indicate that JMS connections will be used to access JMS destinations in a domain-independent manner that supports a unified messaging model
JMS_QUEUE_CONNECTION	CONSTANT BINARY_INTEGER	Used to indicate that JMS queue connections will be used to access JMS destinations
JMS_TOPIC_CONNECTION	CONSTANT BINARY_INTEGER	Used to indicate that JMS topic connections will be used to access JMS destinations
NO_CHANGE	CONSTANT VARCHAR2	Indicates that an existing value should be preserved (not changed). This is used for certain APIs where the desire is to change one or more parameters but leave others unchanged.

Table 119-5 (Cont.) DBMS_MGWADM Constants—Other Constants

Name	Type	Description
DEFAULT_AGENT	CONSTANT VARCHAR2	Name of the Messaging Gateway default agent

Table 119-6 DBMS_MGWADM Constants—Propagation Types

Name	Type	Description
INBOUND_PROPAGATION	CONSTANT BINARY_INTEGER	Represents the propagation type for non-Oracle to Oracle Database Advanced Queuing propagation. The propagation source is a queue in a foreign (non-Oracle) messaging system and the destination is a local Oracle Database Advanced Queuing queue.
OUTBOUND_PROPAGATION	CONSTANT BINARY_INTEGER	Represents the propagation type for Oracle Database Advanced Queuing to non-Oracle propagation. The propagation source is a local Oracle Database Advanced Queuing queue and the destination is a queue in a foreign (non-Oracle) messaging system.

Table 119-7 DBMS_MGWADM Constants—Queue Domain Types

Name	Type	Description
DOMAIN_QUEUE	CONSTANT BINARY_INTEGER	Represents a queue destination. A JMS queue (point-to-point model) is classified as a queue.
DOMAIN_TOPIC	CONSTANT BINARY_INTEGER	Represents a topic destination. A JMS topic (publish-subscribe model) is classified as a topic.

Table 119-8 DBMS_MGWADM Constants—Shutdown Modes

Name	Type	Description
SHUTDOWN_IMMEDIATE	CONSTANT BINARY_INTEGER	Represents the immediate shutdown mode
SHUTDOWN_NORMAL	CONSTANT BINARY_INTEGER	Represents the normal shutdown mode

Table 119-9 DBMS_MGWADM Constants—WebSphere MQ Interface Types

Name	Type	Description
MQSERIES_BASE_JAVA_INTER FACE	CONSTANT BINARY_INTEGER	Represents the Base Java interface for the WebSphere MQ messaging system

Table 119-10 DBMS_MGWADM Constants—target_type Argument of SET_OPTION and REMOVE_OPTION Procedures

Name	Type	Description
AGENT_JAVA_PROP	CONSTANT PLS_INTEGER	Used for an agent option used to set a Java System property
MSGLINK_OPTION	CONSTANT PLS_INTEGER	Used for a messaging system link option
JOB_OPTION	CONSTANT PLS_INTEGER	Used for a propagation job option

Table 119-11 DBMS_MGWADM Constants—conntype Argument of CREATE_AGENT and ALTER_AGENT Procedures

Name	Type	Description
JDBC_OCI	CONSTANT VARCHAR2	Used to specify the JDBC OCI driver
JDBC_THIN	CONSTANT VARCHAR2	Used to specify the JDBC Thin driver

119.4 DBMS_MGWADM Data Structures

The DBMS_MGWADM package defines several OBJECT types.

DBMS_MGWADM Object Types

- [SYS.MGW_MQSERIES_PROPERTIES Object Type](#)
- [SYS.MGW_PROPERTIES Object Type](#)
- [SYS.MGW_PROPERTY Object Type](#)
- [SYS.MGW_TIBRV_PROPERTIES Object Type](#)

119.4.1 DBMS_MGWADM SYS.MGW_MQSERIES_PROPERTIES Object Type

This type specifies basic properties for a WebSphere MQ messaging system link.

Syntax

```
TYPE SYS.MGW_MQSERIES_PROPERTIES IS OBJECT (
    queue_manager      VARCHAR2(64),
    hostname           VARCHAR2(64),
    port               INTEGER,
    channel            VARCHAR2(64),
    interface_type     INTEGER,
    username           VARCHAR2(64),
    password           VARCHAR2(64),
    inbound_log_queue  VARCHAR2(64),
    outbound_log_queue VARCHAR2(64),

    -- Methods
    STATIC FUNCTION construct
    RETURN SYS.MGW_MQSERIES_PROPERTIES,
```

```

STATIC FUNCTION alter_construct
RETURN SYS.MGW_MQSERIES_PROPERTIES );

```

Attributes

Table 119-12 SYS.MGW_MQSERIES_PROPERTIES Attributes

Attribute	Description
queue_manager	The name of the WebSphere MQ queue manager
hostname	The host on which the WebSphere MQ messaging system resides. If hostname is <code>NULL</code> , then a WebSphere MQ bindings connection is used. If not <code>NULL</code> , then a client connection is used and requires that a port and channel be specified.
port	The port number. This is used only for client connections; that is, when hostname is not <code>NULL</code> .
channel	The channel used when establishing a connection to the queue manager. This is used only for client connections; that is, when hostname is not <code>NULL</code> .
interface_type	The type of messaging interface to use. Values: <ul style="list-style-type: none"> • <code>DBMS_MGWADM.MQSERIES_BASE_JAVA_INTERFACE</code> if the WebSphere MQ Base Java interface should be used. • <code>DBMS_MGWADM.JMS_CONNECTION</code> if the link is to be used to access JMS destinations in a unified, domain-independent manner. • <code>DBMS_MGWADM.JMS_QUEUE_CONNECTION</code> if the link is to be used for accessing JMS queues • <code>DBMS_MGWADM.JMS_TOPIC_CONNECTION</code> if the link is to be used for accessing JMS topics.
username	The username used for authentication to the WebSphere MQ messaging system
password	The password used for authentication to the WebSphere MQ messaging system
inbound_log_queue	The name of the WebSphere MQ queue used for propagation recovery purposes when this messaging link is used for inbound propagation; that is, when queues associated with this link serve as a propagation source: <ul style="list-style-type: none"> • For <code>MQSERIES_BASE_JAVA_INTERFACE</code>, this is the name of a physical WebSphere MQ queue created using WebSphere MQ administration tools. • For the <code>JMS_CONNECTION</code> interface and the <code>JMS_QUEUE_CONNECTION</code> interface, this is the name of a physical WebSphere MQ queue created using WebSphere MQ administration tools. • For <code>JMS_TOPIC_CONNECTION</code> interface, this specifies the name of a WebSphere MQ JMS topic. The physical WebSphere MQ queue used by subscribers of that topic must be created using WebSphere MQ administration tools. By default, the physical queue used is <code>SYSTEM.JMS.D.SUBSCRIBER.QUEUE</code>.

Table 119-12 (Cont.) SYS.MGW_MQSERIES_PROPERTIES Attributes

Attribute	Description
outbound_log_queue	<p>The name of the WebSphere MQ queue used for propagation recovery purposes when this messaging link is used for outbound propagation; that is, when queues associated with this link serve as a propagation destination:</p> <ul style="list-style-type: none"> For MQSERIES_BASE_JAVA_INTERFACE, this is the name of a physical WebSphere MQ queue created using WebSphere MQ administration tools. For the JMS_CONNECTION interface and the JMS_QUEUE_CONNECTION interface, this is the name of a physical WebSphere MQ queue created using WebSphere MQ administration tools. For JMS_TOPIC_CONNECTION interface, this specifies the name of a WebSphere MQ JMS topic. The physical WebSphere MQ queue used by subscribers of that topic must be created using WebSphere MQ administration tools. By default, the physical queue used is SYSTEM.JMS.D.SUBSCRIBER.QUEUE.

Methods**Table 119-13 SYS.MGW_MQSERIES_PROPERTIES Methods**

Method	Description
construct	Constructs a new SYS.MGW_MQSERIES_PROPERTIES instance. All attributes are assigned a value of NULL.
alter_construct	Constructs a new SYS.MGW_MQSERIES_PROPERTIES instance for altering the properties of an existing messaging link. All attributes having a VARCHAR2 datatype are assigned a value of DBMS_MGWADM.NO_CHANGE. Attributes of other datatypes are assigned a value of NULL.

119.4.2 DBMS_MGWADM SYS.MGW_PROPERTIES Object Type

This type specifies an array of properties.

Syntax

```
TYPE SYS.MGW_PROPERTIES AS VARRAY (2000) OF SYS.MGW_PROPERTY;
```

Attributes**Table 119-14 SYS.MGW_PROPERTIES Attributes**

Attribute	Description
name	Property name
value	Property value

Usage Notes

Unless noted otherwise, Messaging Gateway uses named properties as follows:

- Names with the `MGWPROP$_` prefix are reserved. They are used for special purposes and are invalid when used as a normal property name.
- A property name can exist only once in a property list; that is, a list can contain only one value for a given name. The name is case-insensitive.
- In general, a property list is order-independent, and the property names may appear in any order. An alter property list is an exception.
- You can use a new property list to alter an existing property list. Each new property modifies the original list in one of the following ways: adds a new property, modifies a property, removes a property, or removes all properties.

The alter list is processed in order, from the first element to the last element. Thus the order in which the elements appear in the alter list is meaningful, especially when the alter list is used to remove properties from an existing list.

The property name and value are used to determine how that element affects the original list. The following rules apply:

- Add or modify property

```
MGW_PROPERTY.NAME = property_name
MGW_PROPERTY.VALUE = property_value
```

If a property of the given name already exists, then the current value is replaced with the new value; otherwise the new property is added to the end of the list.

- Remove property

```
MGW_PROPERTY.NAME = 'MGWPROP$_REMOVE'
MGW_PROPERTY.VALUE = name_of_property_to_remove
```

No action is taken if the property name does not exist in the original list.

- Remove all properties

```
MGW_PROPERTY.NAME = 'MGWPROP$_REMOVE_ALL'
MGW_PROPERTY.VALUE = not used
```

See Also:

"The `DBMS_MGWADM` package defines constants to represent the reserved property names on [Table 119-4](#)

119.4.3 DBMS_MGWADM SYS.MGW_PROPERTY Object Type

This type specifies a named property which is used to specify optional properties for messaging links, foreign queues, and subscribers.

Syntax

```
TYPE SYS.MGW_PROPERTY IS OBJECT(
  name VARCHAR2(500),
```



```

value VARCHAR2(4000),

-- Methods
STATIC FUNCTION construct --- (1)
RETURN SYS.MGW_PROPERTY,

STATIC FUNCTION construct( --- (2)
    p_name IN VARCHAR2,
    p_value IN VARCHAR2)
RETURN SYS.MGW_PROPERTY );

```

Attributes

Table 119-15 SYS.MGW_PROPERTY Attributes

Attribute	Description
name	Property name
value	Property value

Methods

Table 119-16 SYS.MGW_PROPERTY Methods

Method	Description
construct --- (1)	Constructs a new <code>MGW_PROPERTY</code> instance. All attributes are assigned a value of <code>NULL</code>
construct --- (2)	Constructs a new <code>MGW_PROPERTY</code> instance initialized using the given parameters

See Also:

"The `DBMS_MGWADM` package defines constants to represent the reserved property names on [Table 119-4](#)

119.4.4 SYS.MGW_TIBRV_PROPERTIES Object Type

A type that specifies basic properties for a TIB/Rendezvous messaging system link. The Messaging Gateway agent creates a TIB/Rendezvous transport of type `TibrvRvdTransport` for each Messaging Gateway link.

Syntax

```

TYPE SYS.MGW_TIBRV_PROPERTIES IS OBJECT(
    service VARCHAR2(128),
    daemon VARCHAR2(128),
    network VARCHAR2(256),
    cm_name VARCHAR2(256),
    cm_ledger VARCHAR2(256),

-- Methods
STATIC FUNCTION construct

```

```
RETURN SYS.MGW_TIBRV_PROPERTIES,

STATIC FUNCTION alter_construct
RETURN SYS.MGW_TIBRV_PROPERTIES );
```

Attributes

Table 119-17 SYS.MGW_TIBRV_PROPERTIES Attributes

Attribute	Description
service	The service parameter for the rvd transport
daemon	The daemon parameter for the rvd transport
network	The network parameter for the rvd transport
cm_name	The CM correspondent name. Reserved for future use.
cm_ledger	The CM ledger file name. Reserved for future use.

Methods

Table 119-18 SYS.MGW_TIBRV_PROPERTIES Methods

Method	Description
construct	Constructs a new SYS.MGW_TIBRV_PROPERTIES instance. All attributes will be assigned a value of NULL.
alter_construct	Constructs a new SYS.MGW_TIBRV_PROPERTIES instance. This function is useful for altering the properties of an existing messaging link. All attributes having a VARCHAR2 datatype will be assigned a value of DBMS_MGWADM.NO_CHANGE. Attributes of other datatypes will be assigned a value of NULL.

119.5 Summary of DBMS_MGWADM Subprograms

This table lists the DBMS_MGWADM subprograms and briefly describes them.

Table 119-19 DBMS_MGWADM Package Subprograms

Subprogram	Description
ADD_SUBSCRIBER Procedure	Adds a subscriber used to consume messages from a source queue for propagation to a destination
ALTER_AGENT Procedures	Alters Messaging Gateway agent parameters
ALTER_JOB Procedure	Alters the properties of a propagation job
ALTER_MSGSYSTEM_LINK Procedure for TIB/Rendezvous	Alters the properties of a TIB/Rendezvous messaging system link
ALTER_MSGSYSTEM_LINK Procedure for WebSphere MQ	Alters the properties of a WebSphere MQ messaging system link
ALTER_PROPAGATION_SCHEDULE Procedure	Alters a propagation schedule

Table 119-19 (Cont.) DBMS_MGWADM Package Subprograms

Subprogram	Description
ALTER_SUBSCRIBER Procedure	Alters the parameters of a subscriber used to consume messages from a source queue for propagation to a destination
CLEANUP_GATEWAY Procedures	Cleans up Messaging Gateway
CREATE_AGENT Procedure	Creates a Messaging Gateway agent that will be used to process propagation jobs
CREATE_JOB Procedure	Creates a job used to propagate message from a source to a destination
CREATE_MSGSYSTEM_LINK Procedures for TIB/Rendezvous	Creates a messaging system link to a TIB/Rendezvous messaging system
CREATE_MSGSYSTEM_LINK Procedures for WebSphere MQ	Creates a messaging system link to a WebSphere MQ messaging system
DB_CONNECT_INFO Procedure	Configures connection information used by the Messaging Gateway agent for connections to Oracle Database
DISABLE_JOB Procedure	Disables a propagation job
DISABLE_PROPAGATION_SCHEDULE Procedure	Disables a propagation schedule
ENABLE_JOB Procedure	Enables a propagation job
ENABLE_PROPAGATION_SCHEDULE Procedure	Enables a propagation schedule
REGISTER_FOREIGN_QUEUE Procedure	Registers a non-Oracle queue entity in Messaging Gateway
REMOVE_AGENT Procedure	Removes a Messaging Gateway agent
REMOVE_JOB Procedure	Removes a propagation job
REMOVE_MSGSYSTEM_LINK Procedure	Removes a messaging system link for a non-Oracle messaging system
REMOVE_OPTION Procedure	Removes a Messaging Gateway configuration option
REMOVE_SUBSCRIBER Procedure	Removes a subscriber used to consume messages from a source queue for propagation to a destination
RESET_JOB Procedure	Resets the propagation error state for a propagation job
RESET_SUBSCRIBER Procedure	Resets the propagation error state for a subscriber
SCHEDULE_PROPAGATION Procedure	Schedules message propagation from a source to a destination
SET_LOG_LEVEL Procedures	Dynamically alters the Messaging Gateway agent logging level
SET_OPTION Procedure	Sets a Messaging Gateway configuration option
SHUTDOWN Procedures	Shuts down the Messaging Gateway agent
STARTUP Procedures	Starts the Messaging Gateway agent
UNREGISTER_FOREIGN_QUEUE Procedure	Removes a non-Oracle queue entity in Messaging Gateway
UNSCHEDULE_PROPAGATION Procedure	Removes a propagation schedule

119.5.1 ADD_SUBSCRIBER Procedure

This procedure adds a subscriber used to consume messages from a source queue for propagation to a destination.



Note:

This subprogram has been deprecated as a result of improved technology (see [CREATE_JOB Procedure](#)), and is retained only for reasons of backward compatibility.

Syntax

```
DBMS_MGWADM.ADD_SUBSCRIBER(
  subscriber_id      IN VARCHAR2,
  propagation_type   IN BINARY_INTEGER,
  queue_name         IN VARCHAR2,
  destination        IN VARCHAR2,
  rule               IN VARCHAR2 DEFAULT NULL,
  transformation     IN VARCHAR2 DEFAULT NULL,
  exception_queue    IN VARCHAR2 DEFAULT NULL
  options            IN SYS.MGW_PROPERTIES DEFAULT NULL);
```

Parameters

Table 119-20 ADD_SUBSCRIBER Procedure Parameters

Parameter	Description
subscriber_id	Specifies a user-defined name that identifies this subscriber
propagation_type	Specifies the type of message propagation. DBMS_MGWADM.OUTBOUND_PROPAGATION is for Oracle Database Advanced Queuing to non-Oracle propagation. DBMS_MGWADM.INBOUND_PROPAGATION is for non-Oracle to Oracle Database Advanced Queuing propagation
queue_name	Specifies the source queue to which this subscriber is being added. The syntax and interpretation of this parameter depend on the value specified for propagation_type.
destination	Specifies the destination queue to which messages consumed by this subscriber are propagated. The syntax and interpretation of this parameter depend on the value specified for propagation_type.
rule	Specifies an optional subscription rule used by the subscriber to dequeue messages from the source queue. This is NULL if no rule is needed. The syntax and interpretation of this parameter depend on the value specified for propagation_type.

Table 119-20 (Cont.) ADD_SUBSCRIBER Procedure Parameters

Parameter	Description
<code>transformation</code>	Specifies the transformation needed to convert between the Oracle Database Advanced Queuing payload and an ADT defined by Messaging Gateway. The type of transformation needed depends on the value specified for <code>propagation_type</code> . If <code>NULL</code> , then the Oracle Database Advanced Queuing payload type must be supported by Messaging Gateway.
<code>exception_queue</code>	Specifies a queue used for exception message logging purposes. This queue must be on the same messaging system as the propagation source. If <code>NULL</code> , then an exception queue is not used and propagation stops if a problem occurs. The syntax and interpretation of this parameter depend on the value specified for <code>propagation_type</code> . The source queue and exception queue cannot be the same queue.
<code>options</code>	Optional subscriber properties. <code>NULL</code> if there are none. Typically these are lesser used configuration properties supported by the messaging system.

Usage Notes **See Also:**

"Handling Arbitrary Payload Types Using Message Transformations", in *Oracle Database Advanced Queuing User's Guide* for more information regarding message conversion and transformation

If the non-Oracle messaging link being accessed for the subscriber uses a JMS interface, then the Messaging Gateway agent will use the Oracle JMS interface to access the Oracle Database Advanced Queuing queues. Otherwise the native Oracle Database Advanced Queuing interface will be used. Parameters are interpreted differently when the Messaging Gateway agent uses Oracle JMS for JMS connections.

Transformations are not currently supported if the Oracle JMS interface is used for propagation. The transformation parameter must be `NULL`.

 **See Also:**

For additional information regarding subscriber options

- "WebSphere MQ System Properties" in *Oracle Database Advanced Queuing User's Guide*
- "TIB/Rendezvous System Properties" in *Oracle Database Advanced Queuing User's Guide*

OUTBOUND_PROPAGATION Subscribers

The parameters for a subscriber used for outbound propagation are interpreted as follows:

- `queue_name` specifies the local Oracle Database Advanced Queuing queue that is the propagation source. This must have a syntax of `schema.queue`.
- `destination` specifies the foreign queue to which messages are propagated. This must have a syntax of `registered_queue@message_link`.
- `rule` specifies an optional Oracle Database Advanced Queuing subscriber rule if the native Oracle Database Advanced Queuing interface is used, or a JMS selector if the Oracle JMS interface is used. If `NULL`, then no rule or selector is used.
- `transformation` specifies the transformation used to convert the Oracle Database Advanced Queuing payload to an ADT defined by Messaging Gateway.

Messaging Gateway propagation dequeues messages from the Oracle Database Advanced Queuing queue using the transformation to convert the Oracle Database Advanced Queuing payload to a known ADT defined by Messaging Gateway. The message is then enqueued in the foreign messaging system based on the Messaging Gateway ADT.

- `exception_queue` specifies the name of a local Oracle Database Advanced Queuing queue to which messages are moved if an exception occurs. This must have a syntax of `schema.queue`.

If the native Oracle Database Advanced Queuing interface is used, then a subscriber will be added to the Oracle Database Advanced Queuing queue when this procedure is called, whether or not Messaging Gateway is running. The local subscriber will be of the form `sys.aq$agent('MGW_subscriber_id', NULL, NULL)`.

If the Oracle JMS interface is used, then the Messaging Gateway agent will create a JMS durable subscriber with the name of `MGW_subscriber_id`. If the agent is not running when this procedure is called, then the durable subscriber will be created the next time the agent starts.

The exception queue has the following caveats:

- The user is responsible for creating the Oracle Database Advanced Queuing queue to be used as the exception queue.
- The payload type of the source and exception queue must match.
- The exception queue must be created as a queue type of `DBMS_AQADM.NORMAL_QUEUE` rather than `DBMS_AQADM.EXCEPTION_QUEUE`. Enqueue restrictions prevent Messaging Gateway propagation from using an Oracle Database Advanced Queuing queue of type `EXCEPTION_QUEUE` as a Messaging Gateway exception queue.

INBOUND_PROPAGATION Subscribers

The parameters for a subscriber used for inbound propagation are interpreted as follows:

- `queue_name` specifies the foreign queue that is the propagation source. This must have a syntax of `registered_queue@message_link`.
- `destination` specifies the local Oracle Database Advanced Queuing queue to which messages are propagated. This must have a syntax of `schema.queue`.

- `rule` specifies an optional subscriber rule that is valid for the foreign messaging system. This is `NULL` if no rule is needed.
- `transformation` specifies the transformation used to convert an ADT defined by Messaging Gateway to the Oracle Database Advanced Queuing payload type.
Messaging Gateway propagation dequeues messages from the foreign messaging system and converts the message body to a known ADT defined by Messaging Gateway. The transformation is used to convert the Messaging Gateway ADT to an Oracle Database Advanced Queuing payload type when the message is enqueued to the Oracle Database Advanced Queuing queue.
- `exception_queue` specifies the name of a foreign queue to which messages are moved if an exception occurs. This must have a syntax of `registered_queue@message_link`.

Whether or not a subscriber is needed depends on the requirements of the non-Oracle messaging system. If a durable subscriber is necessary, then it will be created by the Messaging Gateway agent. If the agent is not running at the time this procedure is called, then the creation of the subscriber on the non-Oracle messaging system will occur when the agent next starts.

The exception queue has the following caveats:

- The exception queue must be a registered non-Oracle queue.
- The source and exception queues must use the same messaging system link.

119.5.2 ALTER_AGENT Procedures

This procedure configures Messaging Gateway agent parameters.

Syntax

```
DBMS_MGWADM.ALTER_AGENT (
    max_memory      IN BINARY_INTEGER DEFAULT NULL,
    max_threads     IN BINARY_INTEGER DEFAULT NULL,
    service         IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE );
```

```
DBMS_MGWADM.ALTER_AGENT (
    agent_name      IN VARCHAR2,
    username        IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
    password        IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
    database        IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
    conntype       IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
    max_memory      IN PLS_INTEGER DEFAULT NULL,
    max_threads     IN PLS_INTEGER DEFAULT NULL,
    service         IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
    initfile        IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
    comment         IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE );
```

Parameters

Table 119-21 ALTER_AGENT Procedure Parameters

Parameter	Description
<code>max_memory</code>	The maximum heap size, in MB, used by the Messaging Gateway agent. If it is <code>NULL</code> , then the current value is unchanged.

Table 119-21 (Cont.) ALTER_AGENT Procedure Parameters

Parameter	Description
max_threads	The number of messaging threads that the Messaging Gateway agent creates. If it is NULL, then the current value is unchanged. The maximum value of max_threads is limited to 128.
service	Specifies the database service that the Oracle Scheduler job class used by this agent will have affinity to. In an Oracle RAC environment, this means that the Messaging Gateway agent will run on only those database instances that are assigned to the service. If NULL, the job class used by this agent will be altered to belong to the default service which is mapped to every instance. If DBMS_MGWADM.NO_CHANGE, the current value is unchanged.
agent_name	Identifies the Messaging Gateway agent. DBMS_MGWADM.DEFAULT_AGENT specifies the default agent.
username	Specifies the username used for connections to the Oracle Database. NULL is not allowed. If DBMS_MGWADM.NO_CHANGE, then the current value is unchanged. If a username is specified then a password must also be specified.
password	Specifies the password used for connections to the Oracle Database. NULL is not allowed. If DBMS_MGWADM.NO_CHANGE, then the current value is unchanged. A password must be specified if a username is specified.
database	Specifies the database connect string used for connections to the Oracle Database. NULL indicates that a local connection should be used. If DBMS_MGWADM.NO_CHANGE, then the current value is unchanged. Oracle strongly recommends that a connect string, rather than NULL, be specified. Usually it will be a net service name from tnsnames.ora.
conntype	Specifies the type of connection to the Oracle Database, DBMS_MGWADM.JDBC_OCI or DBMS_MGWADM.JDBC_THIN. If DBMS_MGWADM.NO_CHANGE, then the current value is unchanged
initfile	Specifies a Messaging Gateway initialization file used by this agent. NULL indicates that the default initialization file is used. If a value is specified, it should be the full path name of the file. If DBMS_MGWADM.NO_CHANGE, then the current value is unchanged.
comment	Optional comments for this agent. NULL if a comment is not desired. If DBMS_MGWADM.NO_CHANGE, then the current value is unchanged.

Usage Notes

- Default values for these configuration parameters are set when the Messaging Gateway agent is installed.
- Changes to the max_memory and max_threads parameters take effect the next time the Messaging Gateway agent is active. If the Messaging Gateway agent is currently active, then it must be shut down and restarted for the changes to take effect.
- The service parameter is used to set an Oracle Scheduler job class attribute. The job class is used to create a Scheduler job that starts the Messaging Gateway agent. An Oracle administrator must create the database service. If the value is

NULL, the job class will belong to an internal service that is mapped to all instances.

- The `username`, `password`, and `database` parameters specify connection information used by the Messaging Gateway agent for connections to the Oracle Database. An Oracle administrator should create the user and grant it the role `MGW_AGENT_ROLE`.

119.5.3 ALTER_JOB Procedure

This procedure alters the properties of a propagation job.

Syntax

```
DBMS_MGWADM.ALTER_JOB (
  job_name      IN  VARCHAR2,
  rule          IN  VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
  transformation IN  VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
  exception_queue IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
  poll_interval IN  PLS_INTEGER DEFAULT 0,
  options       IN  SYS.MGW_PROPERTIES DEFAULT NULL,
  comments      IN  VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE );
```

Parameters

Table 119-22 ALTER_JOB Procedure Parameters

Parameter	Description
<code>job_name</code>	Identifies the propagation job
<code>rule</code>	Specifies an optional subscription rule used to dequeue messages from the propagation source. The syntax and interpretation of this parameter depend on the propagation type. A NULL value indicates that no subscription rule is needed. If <code>DBMS_MGWADM.NO_CHANGE</code> , then the current value is unchanged.
<code>transformation</code>	Specifies the transformation needed to convert between the Oracle Streams AQ payload and an ADT defined by Messaging Gateway. The type of transformation needed depends on the value specified for <code>propagation_type</code> . A NULL value indicates that no transformation is needed. If <code>DBMS_MGWADM.NO_CHANGE</code> , the current value is unchanged.
<code>exception_queue</code>	Specifies a queue used for exception message logging purposes. This queue must be on the same messaging system as the propagation source. In cases in which no exception queue is associated with the job, propagation stops if a problem occurs. The syntax and interpretation of this parameter depend on the propagation type. A NULL value indicates that no exception queue is used. If <code>DBMS_MGWADM.NO_CHANGE</code> , the current value is unchanged.

Table 119-22 (Cont.) ALTER_JOB Procedure Parameters

Parameter	Description
<code>poll_interval</code>	<p>Specifies the polling interval, in seconds, used by the Messaging Gateway agent when checking for messages in the source queue. If no messages are available the agent will not poll again until the polling interval has passed. Once the agent detects a message it will continue propagating messages as long as any are available.</p> <p>Values: NULL, 0, or value > 0:</p> <ul style="list-style-type: none"> • If zero (default), the current value will not be changed. • If NULL, the current value will be reset and the Messaging Gateway default polling interval will be used. The default polling interval is 5 seconds and can be overridden by the Messaging Gateway initialization file.
<code>options</code>	<p>Optional job properties. If NULL, no options will be changed. If not NULL, then the properties specified in this list are combined with the current optional properties to form a new set of job options.</p>
<code>comments</code>	<p>An optional comment for this agent, or NULL if one is not desired. If DBMS_MGWADM.NO_CHANGE, the current value will not be changed.</p>

Usage Notes

- If the non-Oracle messaging link being accessed for the propagation job uses a JMS interface, then the Messaging Gateway agent will use the Oracle JMS interface to access the Oracle Streams AQ queues. Otherwise the native Oracle Streams AQ interface will be used. Parameters are interpreted differently when the Messaging Gateway agent uses Oracle JMS for JMS connections.
- The subscriber rule cannot be altered when propagating from a JMS source. Instead, the propagation job must be dropped and re-created with the new rule. For JMS, changing the message selector on a durable subscription is equivalent to deleting and re-creating the subscription.
- Transformations are not currently supported if the Oracle JMS interface is used for propagation. The transformation parameter must be DBMS_MGWADM.NO_CHANGE (the default value).
- The options parameter specifies a set of properties used to alter the current optional properties. Each property affects the current property list in a particular manner; add a new property, replace an existing property, remove an existing property or remove all properties.

Note:

- [SYS.MGW_PROPERTY Object Type](#) for more information about the options parameter
- [OUTBOUND_PROPAGATION Jobs](#) for outbound propagation parameter interpretation
- [INBOUND_PROPAGATION Jobs](#) for inbound propagation parameter interpretation

119.5.4 ALTER_MSGSYSTEM_LINK Procedure for TIB/Rendezvous

This procedure alters the properties of a TIB/Rendezvous messaging system link.

Syntax

```
DBMS_MGWADM.ALTER_MSGSYSTEM_LINK (
  linkname      IN  VARCHAR2,
  properties    IN  SYS.MGW_TIBRV_PROPERTIES,
  options       IN  SYS.MGW_PROPERTIES DEFAULT NULL,
  comment       IN  VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE );
```

Parameters

Table 119-23 ALTER_MSGSYSTEM_LINK Procedure Parameters for TIB/Rendezvous

Parameters	Description
linkname	The messaging system link name
properties	Basic properties for a TIB/Rendezvous messaging system link. If NULL, then no link properties will be changed.
options	Optional link properties. If NULL, then no options will be changed. If not NULL, then the properties specified in this list are combined with the current options properties to form a new set of link options.
comment	A user-specified description, or NULL if one is not desired. If DBMS_MGWADM.NO_CHANGE, then the current value will not be changed.

Usage Notes

To retain an existing value for a messaging link property with a VARCHAR2 datatype, specify DBMS_MGWADM.NO_CHANGE for that particular property. To preserve an existing value for a property of another datatype, specify NULL for that property.

The options parameter specifies a set of properties used to alter the current optional properties. Each property affects the current property list in a particular manner: add a new property, replace an existing property, remove an existing property, or remove all properties.



See Also:

[SYS.MGW_PROPERTIES Object Type](#)

Some properties cannot be modified, and this procedure will fail if an attempt is made to alter such a property. For properties and options that can be changed, a few are dynamic, and Messaging Gateway uses the new values immediately. Others require the Messaging Gateway agent to be shut down and restarted before they take effect.

 **See Also:**

"TIB/Rendezvous System Properties" in *Oracle Database Advanced Queuing User's Guide* for more information about the messaging system properties and options

119.5.5 ALTER_MSGSYSTEM_LINK Procedure for WebSphere MQ

This procedure alters the properties of a WebSphere MQ messaging system link.

Syntax

```
DBMS_MGWADM.ALTER_MSGSYSTEM_LINK (
    linkname   IN   VARCHAR2,
    properties IN   SYS.MGW_MQSERIES_PROPERTIES,
    options    IN   SYS.MGW_PROPERTIES DEFAULT NULL,
    comment    IN   VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE);
```

Parameters

Table 119-24 ALTER_MSGSYSTEM_LINK Procedure Parameters for WebSphere MQ

Parameters	Description
linkname	The messaging system link name
properties	Basic properties for a WebSphere MQ messaging system link. If it is NULL, then no link properties are changed.
options	Optional link properties. NULL if no options are changed. If not NULL, then the properties specified in this list are combined with the current options properties to form a new set of link options.
comment	An optional description or NULL if not desired. If DBMS_MGWADM.NO_CHANGE is specified, then the current value is not changed.

Usage Notes

To retain an existing value for a messaging link property with a VARCHAR2 datatype, specify DBMS_MGWADM.NO_CHANGE for that particular property. To preserve an existing value for a property of another datatype, specify NULL for that property.

The options parameter specifies a set of properties used to alter the current optional properties. Each property affects the current property list in a particular manner: add a new property, replace an existing property, remove an existing property, or remove all properties.

 **See Also:**

[SYS.MGW_PROPERTIES Object Type](#)

Some properties cannot be modified, and this procedure will fail if an attempt is made to alter such a property. For properties and options that can be changed, a few are dynamic, and Messaging Gateway uses the new values immediately. Others require the Messaging Gateway agent to be shut down and restarted before they take effect.

See Also:

"WebSphere MQ System Properties" in *Oracle Database Advanced Queuing User's Guide* for more information about the messaging system properties and options

119.5.6 ALTER_PROPAGATION_SCHEDULE Procedure

This procedure alters a propagation schedule.

Note:

This subprogram has been deprecated as a result of improved technology (see [ALTER_JOB Procedure](#)), and is retained only for reasons of backward compatibility.

Syntax

```
DBMS_MGWADM.ALTER_PROPAGATION_SCHEDULE (
  schedule_id  IN VARCHAR2,
  duration     IN NUMBER DEFAULT NULL,
  next_time   IN VARCHAR2 DEFAULT NULL,
  latency      IN NUMBER DEFAULT NULL);
```

Parameters

Table 119-25 ALTER_PROPAGATION_SCHEDULE Procedure Parameters

Parameter	Description
schedule_id	Identifies the propagation schedule to be altered
duration	Reserved for future use
next_time	Reserved for future use
latency	Specifies the polling interval, in seconds, used by the Messaging Gateway agent when checking for messages in the source queue. If no messages are available in the source queue, then the agent will not poll again until the polling interval has passed. Once the agent detects a message it will continue propagating messages as long as any are available. Values: NULL or value > 0. If latency is NULL, then the Messaging Gateway agent default polling interval will be used. The default polling interval is 5 seconds, but it can be overridden by the Messaging Gateway initialization file.

Usage Notes

This procedure always overwrites the existing value for each parameter. If a given parameter is not specified, then the existing values are overwritten with the default value.

119.5.7 ALTER_SUBSCRIBER Procedure

This procedure alters the parameters of a subscriber used to consume messages from a source queue for propagation to a destination.



Note:

This subprogram has been deprecated as a result of improved technology (see [ALTER_JOB Procedure](#)), and is retained only for reasons of backward compatibility.

Syntax

```
DBMS_MGWADM.ALTER_SUBSCRIBER (
  subscriber_id   IN VARCHAR2,
  rule            IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
  transformation  IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
  exception_queue IN VARCHAR2 DEFAULT DBMS_MGWADM.NO_CHANGE,
  options        IN SYS.MGW_PROPERTIES DEFAULT NULL );
```

Parameters

Table 119-26 ALTER_SUBSCRIBER Procedure Parameters

Parameter	Description
subscriber_id	Identifies the subscriber to be altered
rule	Specifies an optional subscription rule used by the subscriber to dequeue messages from the source queue. The syntax and interpretation of this parameter depend on the subscriber propagation type. A NULL value indicates that no subscription rule is needed. If DBMS_MGWADM.NO_CHANGE, then the current value is unchanged.
transformation	Specifies the transformation needed to convert between the Oracle Database Advanced Queuing payload and an ADT defined by Messaging Gateway. The type of transformation needed depends on the subscriber propagation type. A NULL value indicates that no transformation is needed. If DBMS_MGWADM.NO_CHANGE, then the current value is unchanged.

Table 119-26 (Cont.) ALTER_SUBSCRIBER Procedure Parameters

Parameter	Description
<code>exception_queue</code>	<p>Specifies a queue used for exception message logging. This queue must be on the same messaging system as the propagation source. If no exception queue is associated with the subscriber, then propagation stops if a problem occurs. The syntax and interpretation of this parameter depend on the subscriber propagation type.</p> <p>A <code>NULL</code> value indicates that no exception queue is used. If <code>DBMS_MGWADM.NO_CHANGE</code>, then the current value is unchanged.</p> <p>The source queue and exception queue cannot be the same queue.</p>
<code>options</code>	<p>Optional subscriber properties. If <code>NULL</code>, then no options will be changed. If not <code>NULL</code>, then the properties specified in this list are combined with the current optional properties to form a new set of subscriber options.</p>

Usage Notes

If the non-Oracle messaging link being accessed for the subscriber uses a JMS interface, then the Messaging Gateway agent will use the Oracle JMS interface to access the Oracle Database Advanced Queuing queues. Otherwise the native Oracle Database Advanced Queuing interface will be used. Parameters are interpreted differently when the Messaging Gateway agent uses Oracle JMS for JMS connections.

When propagating from a JMS source, the subscriber rule cannot be altered. Instead, the subscriber must be removed and added with the new rule. For JMS, changing the message selector on a durable subscription is equivalent to deleting and re-creating the subscription.

Transformations are not currently supported if the Oracle JMS interface is used for propagation. The transformation parameter must be `DBMS_MGWADM.NO_CHANGE` (the default value).

The `options` parameter specifies a set of properties used to alter the current optional properties. Each property affects the current property list in a particular manner: add a new property, replace an existing property, remove an existing property, or remove all properties.

 **See Also:**

- [SYS.MGW_PROPERTIES Object Type](#) for more information on the options parameter
- "WebSphere MQ System Properties" in *Oracle Database Advanced Queuing User's Guide* for more information about WebSphere MQ subscriber options
- "TIB/Rendezvous System Properties" in *Oracle Database Advanced Queuing User's Guide* for more information about TIB/Rendezvous subscriber options
- "[OUTBOUND_PROPAGATION Subscribers](#)" for outbound propagation parameter interpretation
- "[INBOUND_PROPAGATION Subscribers](#)" for inbound propagation parameter interpretation

119.5.8 CLEANUP_GATEWAY Procedures

This procedure cleans up Messaging Gateway. The procedure performs cleanup or recovery actions that may be needed when Messaging Gateway is left in some abnormal or unexpected condition. The `MGW_GATEWAY` view lists Messaging Gateway status and configuration information that pertains to the cleanup actions.

Syntax

```
DBMS_MGWADM.CLEANUP_GATEWAY (
    action      IN      BINARY_INTEGER,
    sarg        IN      VARCHAR2 DEFAULT NULL);

DBMS_MGWADM.CLEANUP_GATEWAY (
    agent_name  IN      VARCHAR2,  action      IN      BINARY_INTEGER,
    sarg        IN      VARCHAR2 DEFAULT NULL );
```

Parameters

Table 119-27 CLEANUP_GATEWAY Procedure Parameters

Parameter	Description
action	The cleanup action to be performed. Values: <ul style="list-style-type: none"> • <code>DBMS_MGWADM.CLEAN_STARTUP_STATE</code> for Messaging Gateway start up state recovery • <code>DBMS_MGWADM.CLEAN_LOG_QUEUES</code> for log queue cleanup • <code>DBMS_MGWADM.RESET_SUB_MISSING_LOG_REC</code> for propagation job recovery due to missing log record • <code>DBMS_MGWADM.RESET_SUB_MISSING_MESSAGE</code> for propagation job recovery due to missing message
sarg	Optional argument whose meaning depends on the value specified for <code>action</code> . This should be <code>NULL</code> if it is not used for the specified action.

Table 119-27 (Cont.) CLEANUP_GATEWAY Procedure Parameters

Parameter	Description
agent_name	Identifies the Messaging Gateway agent. DBMS_MGWADM.DEFAULT_AGENT specifies the default agent.

Usage Notes**CLEAN_STARTUP_STATE**

sarg is not used and must be NULL.

The CLEAN_STARTUP_STATE action recovers Messaging Gateway to a known state when the Messaging Gateway agent has crashed or some other abnormal event occurs, and Messaging Gateway cannot be restarted. This should be done only when the Messaging Gateway agent has been started but appears to have crashed or has been nonresponsive for an extended period of time.

The CLEAN_STARTUP_STATE action may be needed when the MGW_GATEWAY view shows that the AGENT_STATUS value is something other than NOT_STARTED or START_SCHEDULED, and the AGENT_PING value is UNREACHABLE for an extended period of time.

If the AGENT_STATUS value is BROKEN, then the Messaging Gateway agent cannot be started until the problem has been resolved and the CLEAN_STARTUP_STATE action used to reset the agent status. A BROKEN status can indicate that the Messaging Gateway start job detected a Messaging Gateway agent already running. This condition that should never occur under normal use.

Cleanup tasks include:

- Removing the Scheduler job used to start the external Messaging Gateway agent process.
- Setting certain configuration information to a known state. For example, setting the agent status to NOT_STARTED.

Execution of this command fails if:

- The agent status is NOT_STARTED or START_SCHEDULED.
- No shutdown attempt has been made prior to calling this procedure, except if the agent status is STARTING.
- The Messaging Gateway agent is successfully contacted.

The assumption is that the agent is active, and this procedure fails. If the agent does not respond after several attempts have been made, then the cleanup tasks are performed. This procedure takes at least several seconds and possibly up to one minute. This is expected behavior under conditions where this particular cleanup action is appropriate and necessary.

 **Note:**

Terminate any Messaging Gateway agent process that may still be running after a `CLEAN_STARTUP_STATE` action has been successfully performed. This should be done before calling `DBMS_MGWADM.STARTUP` to start Messaging Gateway. The process is usually named `extprocmgwextproc`.

`CLEAN_LOG_QUEUES`

`sarg` is not used and must be `NULL`.

The Messaging Gateway agent will clean log queues for all configured messaging system links. The agent will temporarily stop all propagation activity and then remove all obsolete and bad log records from the log queues for all links. The procedure will fail if the Messaging Gateway agent is not running.

This cleanup action is automatically performed each time the Messaging Gateway agent is started.

 **Note:**

The `CLEAN_LOG_QUEUES` action is performed only on agent startup. If this procedure is called when the agent is running, then the Messaging Gateway agent ignores it.

`RESET_SUB_MISSING_LOG_REC`

`sarg` specifies a Messaging Gateway job name (or subscriber ID) to be reset. It must not be `NULL`.

The Messaging Gateway agent recovers a Messaging Gateway propagation job that has failed due to a missing log record. The agent will reset the source and destination log records. The procedure will fail if the Messaging Gateway agent is not running.

 **Note:**

If the messages in the source queue had already been propagated to the destination queue, then this action may result in duplicate messages.

`RESET_SUB_MISSING_MESSAGE`

`sarg` specifies a Messaging Gateway job name (or subscriber ID) to be reset. It must not be `NULL`.

The Messaging Gateway agent recovers a Messaging Gateway propagation job that has failed due to a missing persistent source message. The agent will treat the message as a non-persistent message and continue processing that propagation job. The procedure will fail if the Messaging Gateway agent is not running.

119.5.9 CREATE_AGENT Procedure

This procedure creates a Messaging Gateway agent that will be used to process propagation jobs.

Syntax

```
DBMS_MGWADM.CREATE_AGENT (
    agent_name      IN  VARCHAR2,
    username        IN  VARCHAR2 DEFAULT NULL,
    password        IN  VARCHAR2 DEFAULT NULL,
    database        IN  VARCHAR2 DEFAULT NULL,
    conntype        IN  VARCHAR2 DEFAULT DBMS_MGWADM.JDBC_OCI,
    max_memory      IN  PLS_INTEGER DEFAULT 64,
    max_threads     IN  PLS_INTEGER DEFAULT 1,
    service         IN  VARCHAR2 DEFAULT NULL,
    initfile        IN  VARCHAR2 DEFAULT NULL,
    comment         IN  VARCHAR2  DEFAULT NULL );
```

Parameters

Table 119-28 CREATE_AGENT Procedure Parameters

Parameter	Description
agent_name	A name used to identify the agent
username	Specifies the username used for connections to the Oracle Database
password	Specifies the password used for connections to the Oracle Database. A password must be specified if a username is specified.
database	Specifies the database connect string used for connections to the Oracle Database. NULL indicates that a local connection should be used. A value can be specified only if username is specified. Oracle strongly recommends that a connect string, rather than NULL be specified. Usually it will be a net service name from tnsnames.ora.
conntype	Specifies the type of connection to the Oracle Database. Values: DBMS_MGWADM.JDBC_OCI, DBMS_MGWADM.JDBC_THIN
max_memory	Specifies the maximum heap size, in MB, used by the Messaging Gateway agent
max_threads	Specifies the number of messaging threads that the Messaging Gateway agent creates. This determines the number of propagation jobs that the agent can concurrently process. The maximum value of max_threads is limited to 128.
service	Specifies the database service that the Oracle Scheduler job class used by this agent will have affinity to. In an Oracle RAC environment, this means that the Messaging Gateway agent will only run on those database instances that are assigned to the service. If NULL, then the job class will belong to the default service which is mapped to every instance.
initfile	Specifies a Messaging Gateway initialization file used by this agent. NULL indicates that the default initialization file is used. If a value is specified, it should be the full path name of the file.
comment	An optional comment for this agent. NULL if one is not desired.

Usage Notes

- The Messaging Gateway automatically configures a default agent when Messaging Gateway is installed. The name of the default agent is `DEFAULT_AGENT`. This procedure can be used to create additional agents.
- The `username`, `password`, and `database` parameters specify connection information used by the Messaging Gateway agent for connections to the Oracle Database. An Oracle administrator should create the database user and grant it the role `MGW_AGENT_ROLE`. It is not mandatory that the connection information be specified when this procedure is called but it must be set before the agent can be started.
- The `service` parameter is used to create an Oracle Scheduler job class. The job class is used to create a Scheduler job that starts the Messaging Gateway agent. An Oracle administrator must create the database service. If the value is `NULL`, the job class will belong to an internal service that is mapped to all instances.

119.5.10 CREATE_JOB Procedure

This procedure creates a job used to propagate message from a source to a destination.

Syntax

```
DBMS_MGWADM.CREATE_JOB (
    job_name          IN    VARCHAR2,
    propagation_type IN    PLS_INTEGER,
    source            IN    VARCHAR2,
    destination      IN    VARCHAR2,
    rule             IN    VARCHAR2 DEFAULT NULL,
    transformation   IN    VARCHAR2 DEFAULT NULL,
    exception_queue  IN    VARCHAR2 DEFAULT NULL,
    poll_interval    IN    PLS_INTEGER DEFAULT NULL,
    options          IN    SYS.MGW_PROPERTIES DEFAULT NULL,
    enabled          IN    BOOLEAN DEFAULT TRUE,
    comments        IN    VARCHAR2 DEFAULT NULL);
```

Parameters

Table 119-29 CREATE_JOB Procedure Parameters

Parameter	Description
<code>job_name</code>	A user defined name to identify the propagation job
<code>propagation_type</code>	Specifies the type of message propagation. <ul style="list-style-type: none"> • <code>DBMS_MGWADM.OUTBOUND_PROPAGATION</code> for Oracle Streams AQ to non-Oracle propagation. • <code>DBMS_MGWADM.INBOUND_PROPAGATION</code> for non-Oracle to Oracle Streams AQ propagation.
<code>source</code>	Specifies the source queue whose messages are to be propagated. The syntax and interpretation of this parameter depend on the value specified for <code>propagation_type</code> .
<code>destination</code>	Specifies the destination queue to which messages are propagated. The syntax and interpretation of this parameter depend on the value specified for <code>propagation_type</code> .

Table 119-29 (Cont.) CREATE_JOB Procedure Parameters

Parameter	Description
rule	Specifies an optional subscription rule used to dequeue messages from the source queue. This should be <code>NULL</code> if no rule is needed. The syntax and interpretation of this parameter depend on the value specified for <code>propagation_type</code> .
transformation	Specifies the transformation needed to convert between the Oracle Streams AQ payload and an ADT defined by Messaging Gateway. The type of transformation needed depends on the value specified for <code>propagation_type</code> . If no transformation is specified the Oracle Streams AQ payload type must be supported by Messaging Gateway.
exception_queue	Specifies a queue used for exception message logging purposes. This queue must be on the same messaging system as the propagation source. If <code>NULL</code> , an exception queue will not be used and propagation will stop if a problem occurs. The syntax and interpretation of this parameter depend on the value specified for <code>propagation_type</code> . The source queue and exception queue cannot be the same queue.
poll_interval	Specifies the polling interval, in seconds, used by the Messaging Gateway agent when checking for messages in the source queue. If no messages are available the agent will not poll again until the polling interval has passed. Once the agent detects a message it will continue propagating messages as long as any are available. Values: <code>NULL</code> or value > 0. If <code>NULL</code> , then the Messaging Gateway default polling interval will be used. The default polling interval is 5 seconds and can be overridden by the Messaging Gateway initialization file.
options	Optional job properties, <code>NULL</code> if there are none. Typically these are lesser used configuration properties supported by the messaging system.
enabled	Specifies whether this propagation job is enabled after creation. Values: <code>TRUE</code> , <code>FALSE</code> . <ul style="list-style-type: none"> • If <code>TRUE</code> (default), the job will be enabled after it is created. • If <code>FALSE</code>, the job will be disabled after it is created. A propagation job must be enabled and the Messaging Gateway agent running before messages can be propagated.
comments	An optional comment for this job. <code>NULL</code> if one is not desired.

Usage Notes

- The job must be enabled and Messaging Gateway agent started in order for messages to be propagated.
- If the non-Oracle messaging link being accessed for the propagation job uses a JMS interface, then the Messaging Gateway agent will use the Oracle JMS interface to access the Oracle Streams AQ queues. Otherwise the native Oracle Streams AQ interface will be used. Parameters are interpreted differently when the Messaging Gateway agent uses Oracle JMS for JMS connections.

- Transformations are not currently supported if the Oracle JMS interface is used for propagation. The transformation parameter must be `NULL`.

OUTBOUND_PROPAGATION Jobs

The parameters for an outbound propagation job are interpreted as follows:

- `source` specifies the local Oracle Streams AQ queue that is the propagation source. This must have syntax of `schema.queue`. This can be either a multiple consumer queue or a single consumer queue.
- `destination` specifies the non-Oracle queue to which messages are propagated. This must have syntax of `registered_queue@message_link`.
- `rule` specifies an optional Oracle Streams AQ subscriber rule if the native Oracle Stream AQ interface is used, or a JMS selector if the Oracle JMS interface is used. If `NULL`, then no rule or selector is used. This parameter must be `NULL` if the native Oracle Stream AQ interface is used and the propagation source is a single consumer queue.
- `transformation` specifies the transformation used to convert the Oracle Streams AQ payload to an ADT defined by Messaging Gateway. The full transformation name (`schema.name`) should be used if one is specified.

Messaging Gateway propagation dequeues messages from the Oracle Streams AQ queue using the transformation to convert the Oracle Streams AQ payload to a known ADT defined by Messaging Gateway. The message is then enqueued in the non-Oracle messaging system based on the Messaging Gateway ADT.

- `exception_queue` specifies the name of a local Oracle Streams AQ queue to which messages are moved if an exception occurs. The syntax must be `schema.queue`.

If the native Oracle Streams AQ interface is used and the source is a multiple consumer queue, then a subscriber will be added to the Oracle Streams AQ queue when this procedure is called, whether or not the Messaging Gateway agent is running. The local subscriber will be of the form `sys.aq$_agent('MGW_job_name', NULL, NULL)`.

If the Oracle JMS interface is used, then the Messaging Gateway agent will create a JMS durable subscriber with the name of `MGW_job_name`. If the agent is not running when this procedure is called, then the durable subscriber will be created the next time the agent starts.

The exception queue has the following conditions:

- The user is responsible for creating the Oracle Streams AQ queue to be used as the exception queue.
- The payload type of the source queue and exception queue must match.
- The exception queue must be created as a queue type of `DBMS_AQADM.NORMAL_QUEUE`. Enqueue restrictions prevent Messaging Gateway from using an Oracle Streams AQ queue of type `DBMS_AQADM.EXCEPTION_QUEUE` as a Messaging Gateway exception queue.

INBOUND_PROPAGATION Jobs

The parameters for an inbound propagation job are interpreted as follows:

- `source` specifies the non-Oracle queue that is the propagation source. The syntax must be `registered_queue@message_link`.

- `destination` specifies the local Oracle Streams AQ queue to which messages are propagated. The syntax must be `schema.queue`.
- `rule` specifies an optional subscriber rule that is valid for the non-Oracle messaging system. This should be `NULL` if no rule is needed.
- `transformation` specifies the transformation used to convert an ADT defined by Messaging Gateway to the Oracle Streams AQ payload type. The full transformation name (`schema.name`) should be used if one is specified

Messaging Gateway propagation dequeues messages from the non-Oracle messaging system and converts the message body to a known ADT defined by Messaging Gateway. The transformation is used to convert the Messaging Gateway ADT to an Oracle Streams AQ payload type when the message is enqueued to the Oracle Streams AQ queue.

- `exception_queue` specifies the name of a registered non-Oracle queue to which messages are moved if an exception occurs. The syntax must be `registered_queue@message_link`.

Whether or not a subscriber is needed for the source queue depends on the requirements of the non-Oracle messaging system. If a durable subscriber is necessary, then the Messaging Gateway agent will create it. If the agent is not running when this procedure is called, then the subscriber will be created on the non-Oracle messaging system the next time the agent starts.

The exception queue has the following conditions:

- The exception queue must be a registered non-Oracle queue.
- The source queue and exception queue must use the same messaging system link.

119.5.11 CREATE_MSGSYSTEM_LINK Procedures for TIB/Rendezvous

This procedure creates a link to a TIB/Rendezvous messaging system.

Syntax

```
DBMS_MGWADM.CREATE_MSGSYSTEM_LINK (
    linkname      IN  VARCHAR2,
    properties    IN  SYS.MGW_TIBRV_PROPERTIES,
    options       IN  SYS.MGW_PROPERTIES DEFAULT NULL,
    comment       IN  VARCHAR2 DEFAULT NULL );
```

```
DBMS_MGWADM.CREATE_MSGSYSTEM_LINK (
    linkname      IN  VARCHAR2,
    agent_name    IN  VARCHAR2,
    properties    IN  SYS.MGW_TIBRV_PROPERTIES,
    options       IN  SYS.MGW_PROPERTIES DEFAULT NULL,
    comment       IN  VARCHAR2 DEFAULT NULL );
```

Parameters

Table 119-30 CREATE_MSGSYSTEM_LINK Procedure Parameters for TIB/Rendezvous

Parameter	Description
<code>linkname</code>	A user-defined name to identify this messaging system link
<code>properties</code>	Basic properties of a TIB/Rendezvous messaging system link.

Table 119-30 (Cont.) CREATE_MSGSYSTEM_LINK Procedure Parameters for TIB/Rendezvous

Parameter	Description
options	Optional link properties. NULL if there are none. These are less frequently used configuration properties supported by the messaging system
comment	A user-specified description. NULL if one is not desired.
agent_name	Specifies the Messaging Gateway agent that will be used to process all propagation jobs associated with this link. DBMS_MGWADM.DEFAULT_AGENT specifies the default agent.

Usage Notes

The Messaging Gateway default agent will process the propagation jobs associated with this link if an agent name is not specified.



See Also:

"TIB/Rendezvous System Properties" in *Oracle Database Advanced Queuing User's Guide* for more information about the messaging system properties and options

119.5.12 CREATE_MSGSYSTEM_LINK Procedures for WebSphere MQ

This procedure creates a messaging system link to a WebSphere MQ messaging system.

Syntax

```
DBMS_MGWADM.CREATE_MSGSYSTEM_LINK(
    linkname      IN VARCHAR2,
    properties    IN SYS.MGW_MQSERIES_PROPERTIES,
    options       IN SYS.MGW_PROPERTIES DEFAULT NULL,
    comment       IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_MGWADM.CREATE_MSGSYSTEM_LINK(
    linkname      IN VARCHAR2,
    agent_name    IN VARCHAR2,
    properties    IN SYS.MGW_MQSERIES_PROPERTIES,
    options       IN SYS.MGW_PROPERTIES DEFAULT NULL,
    comment       IN VARCHAR2 DEFAULT NULL);
```


Parameters

Table 119-31 CREATE_MSGSYSTEM_LINK Procedure Parameters for WebSphere MQ

Parameter	Description
linkname	A user-defined name to identify the messaging system link
properties	Basic properties of a WebSphere MQ messaging system link
options	Optional link properties. <code>NULL</code> if there are none. These are less frequently used configuration properties supported by the messaging system.
comment	A user-specified description. <code>NULL</code> if one is not desired
agent_name	Specifies the Messaging Gateway agent that will be used to process all propagation jobs associated with this link. <code>DBMS_MGWADM.DEFAULT_AGENT</code> specifies the default agent.

Usage Notes

The Messaging Gateway default agent will process the propagation jobs associated with this link if an agent name is not specified.



See Also:

"WebSphere MQ System Properties" in *Oracle Database Advanced Queuing User's Guide* for more information about the messaging system properties and options

119.5.13 DB_CONNECT_INFO Procedure

This deprecated procedure configures connection information used by the Messaging Gateway default agent for connections to Oracle Database.



Note:

This subprogram has been deprecated as a result of improved technology (see [ALTER_AGENT Procedures](#)), and is retained only for reasons of backward compatibility.

Syntax

```
DBMS_MGWADM.DB_CONNECT_INFO (
  username      IN VARCHAR2,
  password      IN VARCHAR2,
  database      IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 119-32 DB_CONNECT_INFO Procedure Parameters

Parameter	Description
username	The username used for connections to Oracle Database. NULL is not allowed
password	The password used for connections to Oracle Database. NULL is not allowed
database	The database connect string used by the Messaging Gateway agent. NULL indicates that a local connection should be used. Oracle strongly recommends that a not NULL value be specified. Usually it will be a net service name from <code>tnsnames.ora</code> .

Usage Notes

The Messaging Gateway agent connects to Oracle Database as the user configured by this procedure. An Oracle administrator should create the user, grant it the role `MGW_AGENT_ROLE`, and then call this procedure to configure Messaging Gateway. Role `MGW_AGENT_ROLE` is used to grant this user special privileges needed to access Messaging Gateway configuration information stored in the database, enqueue or dequeue messages to and from Oracle Database Advanced Queuing queues, and perform certain Oracle Database Advanced Queuing administration tasks.

119.5.14 DISABLE_JOB Procedure

This procedure disables a propagation job.

Syntax

```
DBMS_MGWADM.DISABLE_JOB (
    job_name IN VARCHAR2);
```

Parameters

Table 119-33 DISABLE_JOB Procedure Parameters

Parameter	Description
job_name	Identifies the propagation job

119.5.15 DISABLE_PROPAGATION_SCHEDULE Procedure

This **deprecated procedure** disables a propagation schedule.



Note:

This subprogram has been deprecated as a result of improved technology (see [DISABLE_JOB Procedure](#)), and is retained only for reasons of backward compatibility.

Syntax

```
DBMS_MGWADM.DISABLE_PROPAGATION_SCHEDULE (  
    schedule_id IN VARCHAR2);
```

Parameters

Table 119-34 DISABLE_PROPAGATION_SCHEDULE Procedure Parameters

Parameter	Description
schedule_id	Identifies the propagation schedule to be disabled

119.5.16 ENABLE_JOB Procedure

This procedure enables a propagation job.

Syntax

```
DBMS_MGWADM.ENABLE_JOB (  
    job_name IN VARCHAR2 );
```

Parameters

Table 119-35 ENABLE_JOB Procedure Parameters

Parameter	Description
job_name	Identifies the propagation job

119.5.17 ENABLE_PROPAGATION_SCHEDULE Procedure

This deprecated procedure enables a propagation schedule.



Note:

This subprogram has been deprecated as a result of improved technology (see [ENABLE_JOB Procedure](#)), and is retained only for reasons of backward compatibility.

Syntax

```
DBMS_MGWADM.ENABLE_PROPAGATION_SCHEDULE (
    schedule_id IN VARCHAR2 );
```

Parameters

Table 119-36 ENABLE_PROPAGATION_SCHEDULE Procedure Parameters

Parameter	Description
schedule_id	Identifies the propagation schedule to be enabled

119.5.18 REGISTER_FOREIGN_QUEUE Procedure

This procedure registers a non-Oracle queue entity in Messaging Gateway.

Syntax

```
DBMS_MGWADM.REGISTER_FOREIGN_QUEUE (
    name           IN VARCHAR2,
    linkname       IN VARCHAR2,
    provider_queue IN VARCHAR2 DEFAULT NULL,
    domain         IN INTEGER DEFAULT NULL,
    options        IN SYS.MGW_PROPERTIES DEFAULT NULL,
    comment        IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 119-37 REGISTER_FOREIGN_QUEUE Procedure Parameters

Parameters	Description
name	The registered queue name. This name identifies the foreign queue within Messaging Gateway and need not match the name of the queue in the foreign messaging system.
linkname	The link name for the messaging system on which this queue exists
provider_queue	The message provider (native) queue name. If NULL, then the value provided for the name parameter is used as the provider queue name.

Table 119-37 (Cont.) REGISTER_FOREIGN_QUEUE Procedure Parameters

Parameters	Description
domain	The domain type of the queue. NULL means the domain type is automatically determined based on the messaging system of the queue. DBMS_MGWADM.DOMAIN_QUEUE is for a queue (point-to-point model). DBMS_MGWADM.DOMAIN_TOPIC is for a topic (publish-subscribe model).
options	Optional queue properties
comment	A user-specified description. Can be NULL.

Usage Notes

This procedure does not create the physical queue in the non-Oracle messaging system. The non-Oracle queue must be created using the administration tools for that messaging system.

 **See Also:**

For more information when registering queues for the WebSphere MQ messaging system or the TIB/Rendezvous messaging system, specifically "Optional Foreign Queue Configuration Properties" in *Oracle Database Advanced Queuing User's Guide*.

119.5.19 REMOVE_AGENT Procedure

This procedure removes a Messaging Gateway agent.

Syntax

```
DBMS_MGWADM.REMOVE_AGENT (
    agent_name IN VARCHAR2 );
```

Parameters**Table 119-38 REMOVE_AGENT Procedure Parameters**

Parameters	Description
agent_name	Identifies the Messaging Gateway agent

Usage Notes

All messaging system links associated with this Messaging Gateway agent must be removed and the agent must be stopped before it can be removed. The Messaging Gateway default agent cannot be removed.

119.5.20 REMOVE_JOB Procedure

This procedure removes a propagation job.

Syntax

```
DBMS_MGWADM.REMOVE_JOB (
    job_name IN VARCHAR2, force IN PLS_INTEGER DEFAULT
    DBMS_MGWADM.NO_FORCE);
```

Parameters

Table 119-39 REMOVE_JOB Procedure Parameters

Parameters	Description
job_name	Identifies the propagation job
force	Specifies whether the procedure should succeed even if Messaging Gateway is not able to perform all cleanup actions pertaining to this propagation job. Values: DBMS_MGWADM.NO_FORCE, DBMS_MGWADM.FORCE <ul style="list-style-type: none"> NO_FORCE (default) means the job is not removed if Messaging Gateway is unable to clean up successfully FORCE means the job is removed even though all cleanup actions may not be done

Usage Notes

- The Messaging Gateway agent uses various resources of the Oracle Database and the non-Oracle messaging system for its propagation work. These resources need to be released when the job is removed. For example, Messaging Gateway may create a durable subscriber on the source queue that should be removed when the job is removed. Therefore, this procedure should normally be called when the Messaging Gateway agent is running and able to access the non-Oracle messaging system associated with this job.
- For outbound propagation, a local subscriber is removed from the Oracle Streams AQ queue when the propagation source is a multiple consumer queue.

119.5.21 REMOVE_MSGSYSTEM_LINK Procedure

This procedure removes a messaging system link for a non-Oracle messaging system.

Syntax

```
DBMS_MGWADM.REMOVE_MSGSYSTEM_LINK (
    linkname IN VARCHAR2);
```

Parameters

Table 119-40 REMOVE_MSGSYSTEM_LINK Procedure Parameters

Parameters	Description
linkname	The messaging system link name

Usage Notes

All registered queues associated with this link must be removed before the messaging system link can be removed. This procedure fails if there is a registered foreign (non-Oracle) queue that references this link.

119.5.22 REMOVE_OPTION Procedure

This procedure removes a Messaging Gateway configuration option. It can be used to remove an agent option, a messaging link option, or a propagation job option.

Syntax

```
DBMS_MGWADM.REMOVE_OPTION (
    target_type  IN  PLS_INTEGER,
    target_name  IN  VARCHAR2,
    option_name  IN  VARCHAR2);
```

Parameters

Table 119-41 REMOVE_OPTION Procedure Parameters

Parameter	Description
target_type	Specifies the target type of the Messaging Gateway entity: <ul style="list-style-type: none"> DBMS_MGWADM.AGENT_JAVA_PROP to remove a Java System property for a Messaging Gateway agent DBMS_MGWADM.MSGLINK_OPTION to remove a messaging link option DBMS_MGWADM.JOB_OPTION to remove a propagation job option
target_name	Name or identifier of the target. The value for this parameter depends on the value specified for target_type parameter. This must not be NULL.
option_name	Option name. This must not be NULL.



See Also:

[Table 119-10](#) regarding options for the option_type parameter

Usage Notes

DBMS_MGWADM.AGENT_JAVA_PROP Target

The procedure removes an agent option used to set a Java System property when the Messaging Gateway agent is started. The agent must be restarted for the change to take effect.

The parameters are interpreted as follows:

- `target_name` specifies the name of the Messaging Gateway agent. `DBMS_MGWADM.DEFAULT_AGENT` can be used for the default agent.
- `option_name` specifies the Java System property
- `encrypted` can be either `TRUE` or `FALSE`

DBMS_MGWADM.MSGLINK_OPTION Target

The procedure removes a single option for a Messaging Gateway messaging system link. This is equivalent to calling `DBMS_MGWADM.ALTER_MSGSYSTEM_LINK` and using the `options` parameter to remove an option.

The parameters are interpreted as follows:

- `target_name` specifies the name of the message system link
- `option_name` specifies the option to set
- `encrypted` must be `FALSE`

DBMS_MGWADM.JOB_OPTION Target

The procedure removes a single option for a Messaging Gateway propagation job. This is equivalent to calling `DBMS_MGWADM.ALTER_JOB` and using the `options` parameter to remove an option.

The parameters are interpreted as follows:

- `target_name` specifies the name of the propagation job
- `option_name` specifies the option to set
- `encrypted` must be `FALSE`

119.5.23 REMOVE_SUBSCRIBER Procedure

This procedure removes a subscriber used to consume messages from a source queue for propagation to a destination.



Note:

This subprogram has been deprecated as a result of improved technology (see [REMOVE_JOB Procedure](#)), and is retained only for reasons of backward compatibility.

Syntax

```
DBMS_MGWADM.REMOVE_SUBSCRIBER (  
    subscriber_id IN VARCHAR2,  
    force         IN BINARY_INTEGER DEFAULT DBMS_MGWADM.NO_FORCE );
```


Parameters

Table 119-42 REMOVE_SUBSCRIBER Procedure Parameters

Parameter	Description
subscriber_id	Identifies the subscriber to be removed
force	Specifies whether this procedure should succeed even if Messaging Gateway is not able to perform all cleanup actions pertaining to this subscriber. Values: DBMS_MGWADM.NO_FORCE, DBMS_MGWADM.FORCE <ul style="list-style-type: none"> NO_FORCE means the subscriber is not removed if Messaging Gateway is unable to clean up successfully (default) FORCE means the subscriber is removed even though all cleanup actions may not be done

Usage Notes

- The Messaging Gateway agent uses various resources of Oracle Database and the non-Oracle messaging system for its propagation work. These resources are typically associated with each subscriber and need to be released when the subscriber is no longer needed. Therefore, this procedure should only be called when the Messaging Gateway agent is running and able to access the non-Oracle messaging system associated with this subscriber.
- For outbound propagation, a local subscriber is removed from the Oracle Database Advanced Queuing queue.

119.5.24 RESET_JOB Procedure

This procedure resets the propagation error state for a propagation job.

Syntax

```
DBMS_MGWADM.RESET_JOB (
    job_name IN VARCHAR2);
```

Parameters

Table 119-43 RESET_JOB Procedure Parameters

Parameter	Description
job_name	Identifies the propagation job

Usage Notes

This procedure can be used to reset a propagation job that has been set to a failed state and propagation activities have been stopped. The administrator should correct the problem and then call this procedure to allow the agent to retry the propagation job. The STATUS field of the MGW_JOBS view indicates the job status.

119.5.25 RESET_SUBSCRIBER Procedure

This procedure resets the propagation error state for a subscriber.

Note:

This subprogram has been deprecated as a result of improved technology (see [RESET_JOB Procedure](#)), and is retained only for reasons of backward compatibility.

Syntax

```
DBMS_MGWADM.RESET_SUBSCRIBER (
    subscriber_id IN VARCHAR2 );
```

Parameters

Table 119-44 RESET_SUBSCRIBER Procedure Parameters

Parameter	Description
subscriber_id	Identifies the subscriber

119.5.26 SCHEDULE_PROPAGATION Procedure

This procedure schedules message propagation from a source to a destination.

The schedule must be enabled and Messaging Gateway started in order for messages to be propagated.

Note:

This subprogram has been deprecated as a result of improved technology (see [CREATE_JOB Procedure](#)), and is retained only for reasons of backward compatibility.

Syntax

```
DBMS_MGWADM.SCHEDULE_PROPAGATION (
    schedule_id      IN VARCHAR2,
    propagation_type IN BINARY_INTEGER,
    source           IN VARCHAR2,
    destination      IN VARCHAR2,
    start_time       IN DATE DEFAULT SYSDATE,
    duration         IN NUMBER DEFAULT NULL,
    next_time        IN VARCHAR2 DEFAULT NULL,
    latency          IN NUMBER DEFAULT NULL);
```

Parameters

Table 119-45 SCHEDULE_PROPAGATION Procedure Parameters

Parameter	Description
<code>schedule_id</code>	Specifies a user-defined name that identifies the schedule
<code>propagation_type</code>	Specifies the type of message propagation. DBMS_MGWADM.OUTBOUND_PROPAGATION is for Oracle Database Advanced Queuing to non-Oracle propagation. DBMS_MGWADM.INBOUND_PROPAGATION is for non-Oracle to Oracle Database Advanced Queuing propagation.
<code>source</code>	Specifies the source queue whose messages are to be propagated. The syntax and interpretation of this parameter depend on the value specified for <code>propagation_type</code> .
<code>destination</code>	Specifies the destination queue to which messages are propagated. The syntax and interpretation of this parameter depend on the value specified for <code>propagation_type</code> .
<code>start_time</code>	Reserved for future use
<code>duration</code>	Reserved for future use
<code>next_time</code>	Reserved for future use
<code>latency</code>	Specifies the polling interval, in seconds, used by the Messaging Gateway agent when checking for messages in the source queue. If no messages are available in the source queue, then the agent will not poll again until the polling interval has passed. Once the agent detects a message it will continue propagating messages as long as any are available. Values: NULL or value > 0. If <code>latency</code> is NULL, then the Messaging Gateway agent default polling interval will be used. The default polling interval is 5 seconds but it can be overridden by the Messaging Gateway initialization file.

Usage Notes

For outbound propagation, parameters are interpreted as follows:

- `source` specifies the local Oracle Database Advanced Queuing queue from which messages are propagated. This must have a syntax of `schema.queue`.
- `destination` specifies the foreign queue to which messages are propagated. This must have a syntax of `registered_queue@message_link`.

For inbound propagation, parameters are interpreted as follows:

- `source` specifies the foreign queue from which messages are propagated. This must have a syntax of `registered_queue@message_link`.
- `destination` specifies the local Oracle Database Advanced Queuing queue to which messages are propagated. This must have a syntax of `schema.queue`.

The schedule is set to an enabled state when it is created.

119.5.27 SET_LOG_LEVEL Procedures

This procedure dynamically alters the Messaging Gateway agent logging level. The Messaging Gateway agent must be running.

Syntax

```
DBMS_MGWADM.SET_LOG_LEVEL (
    log_level    IN    BINARY_INTEGER);
```

```
DBMS_MGWADM.SET_LOG_LEVEL (
    agent_name   IN    VARCHAR2,
    log_level    IN    BINARY_INTEGER);
```

Parameters

Table 119-46 SET_LOG_LEVEL Procedure Parameters

Parameter	Description
log_level	Level at which the Messaging Gateway agent logs information. DBMS_MGWADM.BASIC_LOGGING generates the least information while DBMS_MGWADM.TRACE_DEBUG_LOGGING generates the most information.
agent_name	Identifies the Messaging Gateway agent. DBMS_MGWADM.DEFAULT_AGENT specifies the default agent.



See Also:

[Table 119-3](#) for details on the log_level parameter

119.5.28 SET_OPTION Procedure

This procedure sets a Messaging Gateway configuration option. It can be used to set an agent option, a messaging link option, or a propagation job option.

Syntax

```
DBMS_MGWADM.SET_OPTION (
    target_type  IN    PLS_INTEGER,
    target_name  IN    VARCHAR2,
    option_name  IN    VARCHAR2,
    option_value IN    VARCHAR2,
    encrypted    IN    BOOLEAN DEFAULT FALSE );
```

Parameters

Table 119-47 SET_OPTION Procedure Parameters

Parameter	Description
target_type	Specifies the target type of the Messaging Gateway entity: <ul style="list-style-type: none"> DBMS_MGWADM.AGENT_JAVA_PROP to set a Java System property for a Messaging Gateway agent DBMS_MGWADM.MSGLINK_OPTION to set a messaging link option DBMS_MGWADM.JOB_OPTION to set a propagation job option
target_name	Name or identifier of the target. The value for this parameter depends on the value specified for target_type parameter. This must not be NULL.
option_name	Option name. This must not be NULL.
option_value	Option value
encrypted	Indicates whether the value should be stored as encrypted: <ul style="list-style-type: none"> TRUE if the value should be stored in an encrypted form FALSE if the value should be stored in a cleartext form

**See Also:**

[Table 119-10](#) regarding options for the option_type parameter

Usage Notes

DBMS_MGWADM.AGENT_JAVA_PROP Target

The procedure will store an agent option used to set a Java System property when the Messaging Gateway agent is started. The agent must be restarted for the change to take effect.

The parameters are interpreted as follows:

- target_name specifies the name of the Messaging Gateway agent. DBMS_MGWADM.DEFAULT_AGENT can be used for the default agent.
- option_name specifies the Java System property
- encrypted can be either TRUE or FALSE

DBMS_MGWADM.MSGLINK_OPTION Target

The procedure will set or alter a single option for a Messaging Gateway messaging system link. This is equivalent to calling DBMS_MGWADM.ALTER_MSGSYSTEM_LINK and using the options parameter to set an option.

The parameters are interpreted as follows:

- target_name specifies the name of the message system link
- option_name specifies the option to set
- encrypted must be FALSE

DBMS_MGWADM.JOB_OPTION Target

The procedure will set or alter a single option for a Messaging Gateway propagation job. This is equivalent to calling `DBMS_MGWADM.ALTER_JOB` and using the `options` parameter to set an option.

The parameters are interpreted as follows:

- `target_name` specifies the name of the propagation job
- `option_name` specifies the option to set
- `encrypted` must be `FALSE`

119.5.29 SHUTDOWN Procedures

This procedure shuts down the Messaging Gateway agent. No propagation activity occurs until Messaging Gateway is restarted.

Syntax

```
DBMS_MGWADM.SHUTDOWN (
    sdmode          IN BINARY_INTEGER DEFAULT DBMS_MGWADM.SHUTDOWN_NORMAL);
```

```
DBMS_MGWADM.SHUTDOWN (
    agent_name     IN VARCHAR2);
```

Parameters

Table 119-48 SHUTDOWN Procedure Parameters

Parameter	Description
<code>sdmode</code>	The shutdown mode. The only value currently supported is <code>DBMS_MGWADM.SHUTDOWN_NORMAL</code> for normal shutdown. The Messaging Gateway agent may attempt to complete any propagation work currently in progress.
<code>agent_name</code>	Identifies the Messaging Gateway agent. <code>DBMS_MGWADM.DEFAULT_AGENT</code> specifies the default agent.

Usage Notes

The Messaging Gateway default agent is shut down if no agent name is specified.

119.5.30 STARTUP Procedures

This procedure starts the Messaging Gateway agent. It must be called before any propagation activity can take place.

Syntax

```
DBMS_MGWADM.STARTUP (
    instance       IN BINARY_INTEGER DEFAULT 0,
    force          IN BINARY_INTEGER DEFAULT DBMS_MGWADM.NO_FORCE);
```

```
DBMS_MGWADM.STARTUP (
    agent_name     IN VARCHAR2);
```

Parameters

Table 119-49 STARTUP Procedure Parameters

Parameter	Description
instance	Specifies which instance can run the job queue job used to start the Messaging Gateway agent. If this is zero, then the job can be run by any instance. Caution: This parameter has been deprecated.
force	If this is DBMS_MGWADM.FORCE, then any positive integer is acceptable as the job instance. If this is DBMS_MGWADM.NO_FORCE (the default), then the specified instance must be running; otherwise the routine raises an exception. Caution: This parameter has been deprecated.
agent_name	Identifies the Messaging Gateway agent. DBMS_MGWADM.DEFAULT_AGENT specifies the default agent.

Usage Notes

- The Messaging Gateway default agent will be started if an agent name is not specified.
- The `force` and `instance` parameters are no longer used and will be ignored. If the `instance` affinity parameters were being used to start the default agent on a specific instance, the administrator will need to create a database service and then assign that service to the default agent using the `DBMS_MGWADM.ALTER_AGENT` procedure.
- The Messaging Gateway agent cannot be started until an agent user has been configured by the `DBMS_MGWADM.CREATE_AGENT` or `DBMS_MGWADM.ALTER_AGENT` subprograms.

119.5.31 UNREGISTER_FOREIGN_QUEUE Procedure

This procedure removes a non-Oracle queue entity in Messaging Gateway.

Syntax

```
DBMS_MGWADM.UNREGISTER_FOREIGN_QUEUE(
    name          IN VARCHAR2,
    linkname      IN VARCHAR2);
```

Parameters

Table 119-50 UNREGISTER_FOREIGN_QUEUE Procedure Parameters

Parameter	Description
name	The queue name
linkname	The link name for the messaging system on which the queue exists

Usage Notes

- This procedure does not remove the physical queue in the non-Oracle messaging system.

- All propagation jobs, subscribers and schedules referencing this queue must be removed before it can be unregistered. This procedure fails if a propagation job, subscriber, or propagation schedule references the non-Oracle queue.

119.5.32 UNSCHEDULE_PROPAGATION Procedure

This deprecated procedure removes a propagation schedule.

Note:

This subprogram has been deprecated as a result of improved technology (see [REMOVE_JOB Procedure](#)), and is retained only for reasons of backward compatibility.

Syntax

```
DBMS_MGWADM.UNSCHEDULE_PROPAGATION (  
    schedule_id    IN VARCHAR2 );
```

Parameters

Table 119-51 UNSCHEDULE_PROPAGATION Procedure Parameters

Parameter	Description
schedule_id	Identifies the propagation schedule to be removed

DBMS_MGWMSG

DBMS_MGWMSG provides object types used by the canonical message types to convert message bodies, and methods, constants, and subprograms for working with Messaging Gateway message types.

This chapter contains the following topics:

- [Security Model](#)
- [Constants](#)
- [Types](#)
- [Summary of DBMS_MGWMSG Subprograms](#)



See Also:

[DBMS_MGWADM](#) which describes the Messaging Gateway administrative interface, [DBMS_MGWADM](#)

120.1 DBMS_MGWMSG Security Model

The EXECUTE privilege is granted to PUBLIC on all types defined in the DBMS_MGWMSG package as well as the canonical types. The DBMS_MGWMSG packages and object types are owned by SYS.



Note:

You must run the `catmgw.sql` script to load the Messaging Gateway packages and object types into the database. Refer to the *Oracle Database Advanced Queuing User's Guide* for information on loading database objects and using DBMS_MGWMSG.

120.2 DBMS_MGWMSG Constants

The DBMS_MGWMSG package defines constants for specifying various parameter values.

Table 120-1 DBMS_MGWMSG Constants: Value Types and Constants Representing the Type of Value for a SYS.MGW_NAME_VALUE_T Object

Value	Constant
TEXT_VALUE	CONSTANT BINARY_INTEGER := 1
RAW_VALUE	CONSTANT BINARY_INTEGER := 2

Table 120-1 (Cont.) DBMS_MGWMSG Constants: Value Types and Constants Representing the Type of Value for a SYS.MGW_NAME_VALUE_T Object

Value	Constant
BOOLEAN_VALUE	CONSTANT BINARY_INTEGER := 3
BYTE_VALUE	CONSTANT BINARY_INTEGER := 4
SHORT_VALUE	CONSTANT BINARY_INTEGER := 5
INTEGER_VALUE	CONSTANT BINARY_INTEGER := 6
LONG_VALUE	CONSTANT BINARY_INTEGER := 7
FLOAT_VALUE	CONSTANT BINARY_INTEGER := 8
DOUBLE_VALUE	CONSTANT BINARY_INTEGER := 9
DATE_VALUE	CONSTANT BINARY_INTEGER := 10

Table 120-2 DBMS_MGWMSG Constants: Boolean Values—Constants Representing a Boolean as a Numeric Value

Value	Constant
BOOLEAN_FALSE	CONSTANT BINARY_INTEGER := 0
BOOLEAN_TRUE	CONSTANT BINARY_INTEGER := 1

Table 120-3 DBMS_MGWMSG Constants: Case Comparisons

Value	Constant
CASE_SENSITIVE	CONSTANT BINARY_INTEGER := 0
CASE_INSENSITIVE	CONSTANT BINARY_INTEGER := 1

Table 120-4 Constants for the TIB/Rendezvous field type

Value	Constant
TIBRVMSG_BOOL	CONSTANT INTEGER := 1
TIBRVMSG_F32	CONSTANT INTEGER := 2
TIBRVMSG_F64	CONSTANT INTEGER := 3
TIBRVMSG_I8	CONSTANT INTEGER := 4
TIBRVMSG_I16	CONSTANT INTEGER := 5
TIBRVMSG_I32	CONSTANT INTEGER := 6
TIBRVMSG_I64	CONSTANT INTEGER := 7
TIBRVMSG_IPADDR32	CONSTANT INTEGER := 8
TIBRVMSG_IPPORT16	CONSTANT INTEGER := 9
TIBRVMSG_DATETIME	CONSTANT INTEGER := 10
TIBRVMSG_F32ARRAY	CONSTANT INTEGER := 11
TIBRVMSG_F64ARRAY	CONSTANT INTEGER := 12

Table 120-4 (Cont.) Constants for the TIB/Rendezvous field type

Value	Constant
TIBRVMSG_I8ARRAY	CONSTANT INTEGER := 13
TIBRVMSG_I16ARRAY	CONSTANT INTEGER := 14
TIBRVMSG_I32ARRAY	CONSTANT INTEGER := 15
TIBRVMSG_I64ARRAY	CONSTANT INTEGER := 16
TIBRVMSG_OPAQUE	CONSTANT INTEGER := 17
TIBRVMSG_STRING	CONSTANT INTEGER := 18
TIBRVMSG_XML	CONSTANT INTEGER := 19

120.3 DBMS_MGWMSG Types

DBMS_MGWMSG uses types to specify certain information.

- [SYS.MGW_NAME_VALUE_T Type](#)
- [SYS.MGW_NAME_VALUE_T Type-Attribute Mapping](#)
- [SYS.MGW_NAME_TYPE_ARRAY_T Type](#)
- [SYS.MGW_TEXT_VALUE_T Type](#)
- [SYS.MGW_RAW_VALUE_T Type](#)
- [SYS.MGW_BASIC_MSG_T Type](#)
- [SYS.MGW_NUMBER_ARRAY_T Type](#)
- [SYS.MGW_TIBRV_FIELD_T Type](#)
- [SYS.MGW_TIBRV_MSG_T Type](#)

120.3.1 DBMS_MGWMSG SYS.MGW_NAME_VALUE_T Type

This type specifies a named value.

The name attribute, type attribute, and one of the <>_value attributes are typically not NULL.

Syntax

```

TYPE SYS.MGW_NAME_VALUE_T IS OBJECT (
  name          VARCHAR2 (250),
  type          INTEGER,
  integer_value INTEGER,
  number_value  NUMBER,
  text_value    VARCHAR2 (4000),
  raw_value     RAW (2000),
  date_value    DATE,

  -- Methods
  STATIC FUNCTION CONSTRUCT
  RETURN SYS.MGW_NAME_VALUE_T,

  STATIC FUNCTION CONSTRUCT_BOOLEAN (
    name IN VARCHAR2,

```

```

    value IN INTEGER )
RETURN SYS.MGW_NAME_VALUE_T,

STATIC FUNCTION CONSTRUCT_BYTE (
    name IN VARCHAR2,
    value IN INTEGER )
RETURN SYS.MGW_NAME_VALUE_T,

STATIC FUNCTION CONSTRUCT_SHORT (
    name IN VARCHAR2,
    value IN INTEGER )
RETURN SYS.MGW_NAME_VALUE_T,

STATIC FUNCTION CONSTRUCT_INTEGER (
    name IN VARCHAR2,
    value IN INTEGER )
RETURN SYS.MGW_NAME_VALUE_T,

STATIC FUNCTION CONSTRUCT_LONG (
    name IN VARCHAR2,
    value IN NUMBER )
RETURN SYS.MGW_NAME_VALUE_T,

STATIC FUNCTION CONSTRUCT_FLOAT (
    name IN VARCHAR2,
    value IN NUMBER )
RETURN SYS.MGW_NAME_VALUE_T,

STATIC FUNCTION CONSTRUCT_DOUBLE (
    name IN VARCHAR2,
    value IN NUMBER )
RETURN SYS.MGW_NAME_VALUE_T,

STATIC FUNCTION CONSTRUCT_TEXT (
    name IN VARCHAR2,
    value IN VARCHAR2 )
RETURN SYS.MGW_NAME_VALUE_T,

STATIC FUNCTION CONSTRUCT_RAW (
    name IN VARCHAR2,
    value IN RAW )
RETURN SYS.MGW_NAME_VALUE_T,

STATIC FUNCTION CONSTRUCT_DATE (
    name IN VARCHAR2,
    value IN DATE )
RETURN SYS.MGW_NAME_VALUE_T );

```

Attributes

Table 120-5 SYS.MGW_NAME_VALUE_T Attributes

Attribute	Description
name	Name associated with the value
type	Value type. Refer to the DBMS_MGWMSG.<>_VALUE constants in Table 120-1 . This indicates which Java datatype and class are associated with the value. It also indicates which attribute stores the value.

Table 120-5 (Cont.) SYS.MGW_NAME_VALUE_T Attributes

Attribute	Description
<code>integer_value</code>	Stores a numeric integer value
<code>number_value</code>	Stores a numeric float or large integer value
<code>text_value</code>	Stores a text value
<code>raw_value</code>	Stores a RAW (bytes) value
<code>date_value</code>	Stores a date value

SYS.MGW_NAME_VALUE_T Type-Attribute Mapping

[Table 120-6](#) shows the mapping between the value type and the attribute used to store the value.

Table 120-6 SYS.MGW_NAME_VALUE_T Type Attribute Mapping

Type	Value Stored in Attribute
<code>DBMS_MGWMSG.TEXT_VALUE</code>	<code>text_value</code>
<code>DBMS_MGWMSG.RAW_VALUE</code>	<code>raw_value</code>
<code>DBMS_MGWMSG.BOOLEAN_VALUE</code>	<code>integer_value</code>
<code>DBMS_MGWMSG.BYTE_VALUE</code>	<code>integer_value</code>
<code>DBMS_MGWMSG.SHORT_VALUE</code>	<code>integer_value</code>
<code>DBMS_MGWMSG.INTEGER_VALUE</code>	<code>integer_value</code>
<code>DBMS_MGWMSG.LONG_VALUE</code>	<code>number_value</code>
<code>DBMS_MGWMSG.FLOAT_VALUE</code>	<code>number_value</code>
<code>DBMS_MGWMSG.DOUBLE_VALUE</code>	<code>number_value</code>
<code>DBMS_MGWMSG.DATE_VALUE</code>	<code>date_value</code>

CONSTRUCT Method

This method constructs a new `SYS.MGW_NAME_VALUE_T` instance. All attributes are assigned a value of `NULL`.

Syntax

```
STATIC FUNCTION CONSTRUCT
RETURN SYS.MGW_NAME_VALUE_T;
```

CONSTRUCT_TYPE Methods

These methods construct a new `SYS.MGW_NAME_VALUE_T` instance initialized with the value of a specific type. Each method sets the `name` and `type` attributes and one of the `<>_value` attributes, as shown in the mappings in [Table 120-6](#).

Syntax

```
STATIC FUNCTION CONSTRUCT_<> (
    name    IN VARCHAR2,
```

```
value IN datatype )
RETURN SYS.MGW_NAME_VALUE_T;
```

Usage Notes

The `construct_boolean` method sets the value to either `DBMS_MGWMSG.BOOLEAN_TRUE` or `DBMS_MGWMSG.BOOLEAN_FALSE`.

120.3.2 DBMS_MGWMSG SYS.MGW_NAME_TYPE_ARRAY_T Type

This type specifies an array of name-value pairs. An object of `SYS.MGW_NAME_VALUE_ARRAY_T` type can have up to 1024 elements.

Syntax

```
TYPE SYS.MGW_NAME_VALUE_ARRAY_T
AS VARRAY (1024) OF SYS.MGW_NAME_VALUE_T;
```

120.3.3 DBMS_MGWMSG SYS.MGW_TEXT_VALUE_T Type

This type specifies a `TEXT` value. It can store a large value as a `CLOB` or a smaller value (size \leq 4000) as `VARCHAR2`. Only one of the `<` `>` `_value` attributes should be set.

Syntax

```
TYPE SYS.MGW_TEXT_VALUE_T IS OBJECT(
    small_value VARCHAR2(4000),
    large_value CLOB,

-- Methods
    STATIC FUNCTION CONSTRUCT
    RETURN SYS.MGW_TEXT_VALUE_T);
```

Attributes

Table 120-7 SYS.MGW_TEXT_VALUE_T Attributes

Attribute	Description
<code>small_value</code>	Small <code>TEXT</code> value. Used for values \leq 4000.
<code>large_value</code>	Large <code>TEXT</code> value. Used when the value is too large for the <code>small_value</code> attribute.

CONSTRUCT Method

This method constructs a new `SYS.MGW_TEXT_VALUE_T` instance. All attributes are assigned a value of `NULL`.

Syntax

```
STATIC FUNCTION CONSTRUCT
RETURN SYS.MGW_TEXT_VALUE_T;
```

120.3.4 DBMS_MGWMSG SYS.MGW_RAW_VALUE_T Type

This type specifies a RAW value. This type can store a large value as a BLOB or a smaller value (size <= 2000) as RAW. You must set no more than one of the < >_value attributes.

Syntax

```
TYPE SYS.MGW_RAW_VALUE_T IS OBJECT(
    small_value RAW(2000),
    large_value BLOB,

--Methods
STATIC FUNCTION CONSTRUCT
RETURN SYS.MGW_RAW_VALUE_T);
```

Attributes

Table 120-8 SYS.MGW_RAW_VALUE_T Attributes

Attribute	Description
small_value	Small RAW (bytes) value <= 2000
large_value	Large RAW value. Used when the value is too large for the small_value attribute.

CONSTRUCT Method

This method constructs a new SYS.MGW_RAW_VALUE_T instance. All attributes are assigned a value of NULL.

Syntax

```
STATIC FUNCTION CONSTRUCT
RETURN SYS.MGW_RAW_VALUE_T;
```

120.3.5 DBMS_MGWMSG SYS.MGW_BASIC_MSG_T Type

This is a canonical type for a basic TEXT or RAW message. Only a single TEXT or RAW value is typically set. An object of this type must not have both TEXT and RAW set to a not NULL value at the same time.

Syntax

```
TYPE SYS.MGW_BASIC_MSG_T IS OBJECT(
    header SYS.MGW_NAME_VALUE_ARRAY_T,
    text_body SYS.MGW_TEXT_VALUE_T,
    raw_body SYS.MGW_RAW_VALUE_T,

--Methods
STATIC FUNCTION CONSTRUCT
RETURN SYS.MGW_BASIC_MSG_T);
```

Attributes

Table 120-9 SYS.MGW_BASIC_MSG_T Attributes

Attribute	Description
header	Message header information as an array of name-value pairs
text_body	Message body for a TEXT message
raw_body	Message body for a RAW (bytes) message

CONSTRUCT Method

This method constructs a new SYS.MGW_BASIC_MSG_T instance. All attributes are assigned a value of NULL.

Syntax

```
STATIC FUNCTION CONSTRUCT
RETURN SYS.MGW_BASIC_MSG_T;
```

120.3.6 DBMS_MGWMSG SYS.MGW_NUMBER_ARRAY_T Type

A type that specifies an array of numbers.

Syntax

```
TYPE SYS.MGW_NUMBER_ARRAY_T AS VARRAY(1024) OF NUMBER;
```

120.3.7 DBMS_MGWMSG SYS.MGW_TIBRV_FIELD_T Type

This type represents a TIB/Rendezvous message field, typically used in a read-only fashion to retrieve field information from a SYS.MGW_TIBRV_MSG_T instance.

Syntax

```
TYPE SYS.MGW_TIBRV_FIELD_T IS OBJECT(
  field_name      VARCHAR2(256),
  field_id        INTEGER,
  field_type      INTEGER,
  number_value    NUMBER,
  number_array_value SYS.MGW_NUMBER_ARRAY_T,
  text_value      VARCHAR2(4000),
  raw_value       RAW(2000),
  date_value      DATE,
  clob_value      CLOB,
  blob_value      BLOB);
```

Attributes

Table 120-10 SYS.MGW_TIBRV_FIELD_T Attributes

Attribute	Description
field_name	Field name. This will be NULL if the field has no name.

Table 120-10 (Cont.) SYS.MGW_TIBRV_FIELD_T Attributes

Attribute	Description
field_id	Field identifier. If the field identifier is zero (0), then that field is considered not to have a field identifier. Otherwise the field identifier is a nonzero value that is unique for all fields of that message.
field_type	Field wire format datatype. The DBMS_MGWMSG.TIBRVMSG_<> constants represent valid values for this attribute. The value of this field discriminates which value attribute is used to store the field data.
number_value	Used to store a numeric value
number_array_value	Used to store a numeric array value
text_value	Used to store a small text value
raw_value	Used to store a small raw value
date_value	Used to store a date value
clob_value	Used to store a large text value. This is used when the text data will not fit in text_value, that is, when size is larger than 4000.
blob_value	Used to store a large raw value. This is used when the raw data will not fit in raw_value; that is, when size is larger than 2000.

SYS.MGW_TIBRV_FIELD_T Type and Attribute Mapping

[Table 120-11](#) describes the mapping in type SYS.MGW_TIBRV_FIELD_T between the field type and attribute used to store the value.

Table 120-11 SYS.MGW_TIBRV_FIELD_T Type and Attribute Mapping

Field Type (DBMS_MGWMSG constant)	Value Stored in Attribute
TIBRVMSG_BOOL	number_value
TIBRVMSG_F32	number_value
TIBRVMSG_F64	number_value
TIBRVMSG_I8	number_value
TIBRVMSG_I16	number_value
TIBRVMSG_I32	number_value
TIBRVMSG_I64	number_value
TIBRVMSG_IPADDR32	text_value
TIBRVMSG_IPPORT16	number_value
TIBRVMSG_DATETIME	date_value
TIBRVMSG_F32ARRAY	number_array_value
TIBRVMSG_F64ARRAY	number_array_value
TIBRVMSG_I8ARRAY	number_array_value
TIBRVMSG_I16ARRAY	number_array_value
TIBRVMSG_I32ARRAY	number_array_value

Table 120-11 (Cont.) SYS.MGW_TIBRV_FIELD_T Type and Attribute Mapping

Field Type (DBMS_MGWMSG constant)	Value Stored in Attribute
TIBRVMSG_I64ARRAY	number_array_value
TIBRVMSG_OPAQUE	raw_value or blob_value
TIBRVMSG_STRING	text_value or clob_value
TIBRVMSG_XML	raw_value or blob_value

120.3.8 DBMS_MGWMSG SYS.MGW_TIBRV_MSG_T Type

This type represents a TIB/Rendezvous message. You must never directly reference the attributes of this type. Instead use the type methods.

Syntax

```

TYPE SYS.MGW_TIBRV_MSG_T IS OBJECT(
    send_subject    VARCHAR2(256),
    reply_subject   VARCHAR2(256),
    cm_time_limit   NUMBER,
    cm_sender_name  VARCHAR2(256),
    cm_sequence_num NUMBER,
    fields          SYS.MGW_TIBRV_IFIELDS_T,
    clob_data1      CLOB,
    clob_data2      CLOB,
    clob_data3      CLOB,
    blob_data1      BLOB,
    blob_data2      BLOB,
    blob_data3      BLOB,

    STATIC FUNCTION construct
    RETURN SYS.MGW_TIBRV_MSG_T,

    MEMBER PROCEDURE add_bool (
        name IN  VARCHAR2,
        id   IN  INTEGER,
        value IN INTEGER ),

    MEMBER PROCEDURE add_f32 (
        name IN  VARCHAR2,
        id   IN  INTEGER,
        value IN  FLOAT ),

    MEMBER PROCEDURE add_f64 (
        name IN  VARCHAR2,
        id   IN  INTEGER,
        value IN  DOUBLE ),

    MEMBER PROCEDURE add_i8 (
        name IN  VARCHAR2,
        id   IN  INTEGER,
        value IN  INTEGER ),

    MEMBER PROCEDURE add_i16 (
        name IN  VARCHAR2,
        id   IN  INTEGER,

```

```
value IN INTEGER ),

MEMBER PROCEDURE add_i32 (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN INTEGER ),

MEMBER PROCEDURE add_i64 (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN NUMBER ),

MEMBER PROCEDURE add_ipaddr32 (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN VARCHAR2 ),

MEMBER PROCEDURE add_ipport16 (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN INTEGER ),

MEMBER PROCEDURE add_datetime (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN DATE ),

MEMBER PROCEDURE add_f32array (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN SYS.MGW_NUMBER_ARRAY_T ),

MEMBER PROCEDURE add_f64array (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN SYS.MGW_NUMBER_ARRAY_T ),

MEMBER PROCEDURE add_i8array (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN SYS.MGW_NUMBER_ARRAY_T ),

MEMBER PROCEDURE add_i16array (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN SYS.MGW_NUMBER_ARRAY_T ),

MEMBER PROCEDURE add_i32array (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN SYS.MGW_NUMBER_ARRAY_T ),

MEMBER PROCEDURE add_i64array (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN SYS.MGW_NUMBER_ARRAY_T ),

MEMBER PROCEDURE add_string (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN VARCHAR2 ),
```

```
MEMBER PROCEDURE add_string (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN CLOB ),

MEMBER PROCEDURE add_opaque (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN RAW ),

MEMBER PROCEDURE add_opaque (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN BLOB ),

MEMBER PROCEDURE add_xml (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN RAW ),

MEMBER PROCEDURE add_xml (
    name IN VARCHAR2,
    id IN INTEGER,
    value IN BLOB ),

MEMBER PROCEDURE set_send_subject (
    value IN VARCHAR2 ),

MEMBER PROCEDURE set_reply_subject (
    value IN VARCHAR2 ),

MEMBER PROCEDURE set_cm_time_limit (
    value IN NUMBER ),

MEMBER PROCEDURE set_cm_sender_name (
    value IN VARCHAR2 ),

MEMBER PROCEDURE set_cm_sequence_num (
    value IN NUMBER ),

MEMBER FUNCTION get_send_subject
RETURN VARCHAR2,

MEMBER FUNCTION get_reply_subject
RETURN VARCHAR2,

MEMBER FUNCTION get_cm_time_limit
RETURN NUMBER,

MEMBER FUNCTION get_cm_sender_name
RETURN VARCHAR2,

MEMBER FUNCTION get_cm_sequence_num
RETURN NUMBER,

MEMBER FUNCTION get_field_count
RETURN INTEGER,

MEMBER FUNCTION get_field (
    idx IN INTEGER )
```

```

RETURN SYS.MGW_TIBRV_FIELD_T,

MEMBER FUNCTION get_field_by_name (
    name    IN VARCHAR2 )
RETURN SYS.MGW_TIBRV_FIELD_T,

MEMBER FUNCTION get_field_by_id (
    id      IN INTEGER )
RETURN SYS.MGW_TIBRV_FIELD_T,

MEMBER FUNCTION find_field_name (
    name    IN VARCHAR2,
    start_idx IN INTEGER )
RETURN INTEGER,

MEMBER FUNCTION find_field_id (
    id      IN INTEGER,
    start_idx IN INTEGER )
RETURN INTEGER
);

```

Attributes

Table 120-12 SYS.MGW_TIBRV_MSG_T Type Attributes

Attribute	Description
send_subject	Send subject name
reply_subject	Reply subject name
cm_time_limit	Time limit for a certified message
cm_sender_name	Sender name of a certified message
cm_sequence_num	Sequence number of a certified message
fields	Collection of message fields
clob_data1	Used to store a large text value
clob_data2	Used to store a large text value
clob_data3	Used to store a large text value
blob_data1	Used to store a large raw value
blob_data2	Used to store a large raw value
blob_data3	Used to store a large raw value

Construct Method

Constructs a new SYS.MGW_TIBRV_MSG_T instance. All attributes are set to NULL.

Syntax

```

STATIC FUNCTION construct
RETURN SYS.MGW_TIBRV_MSG_T;

```

ADD_<> Methods

Adds a new field to the message.

Syntax

```
MEMBER PROCEDURE ADD_<> (
    name IN VARCHAR2,
    id   IN INTEGER,
    value IN datatype );
```

Parameters

Table 120-13 SYS.MGW_TIBRV_MSG_T ADD_<> Method Parameters

Parameter	Description
name	Field name
id	Field identifier
value	Field data

Table 120-14 shows, for each add method, the field type that will be assigned and valid values for the field data.

Table 120-14 MGW_TIBRV_MSG_T Add Method Field Types

Method Name	Field Type Assigned	Comment
add_bool	TIBRVMSG_BOOL	Valid values: 0 (false), 1 (true)
add_f32	TIBRVMSG_F32	n/a
add_f64	TIBRVMSG_F64	n/a
add_i8	TIBRVMSG_I8	Valid range: -128...127
add_i16	TIBRVMSG_I16	Valid range: -32768...32767
add_i32	TIBRVMSG_I32	Valid range: -2147483648... 2147483647
add_i64	TIBRVMSG_I64	n/a
add_ipaddr32	TIBRVMSG_IPADDR32	n/a
add_ipport16	TIBRVMSG_IPPORT16	n/a
add_datetime	TIBRVMSG_DATETIME	n/a
add_f32array	TIBRVMSG_F32ARRAY	n/a
add_f64array	TIBRVMSG_F64ARRAY	n/a
add_i8array	TIBRVMSG_I8ARRAY	Valid range: -128...127
add_i16array	TIBRVMSG_I16ARRAY	Valid range: -32768...32767
add_i32array	TIBRVMSG_I32ARRAY	Valid range: -2147483648... 2147483647
add_i64array	TIBRVMSG_I64ARRAY	n/a
add_opaque	TIBRVMSG_OPAQUE	Value stored as RAW if size < 2000; otherwise value stored in BLOB
add_string	TIBRVMSG_STRING	Value stored as VARCHAR2 if size < 4000; otherwise value stored in CLOB
add_xml	TIBRVMSG_XML	Value stored as RAW if size < 2000; otherwise value stored in BLOB

SET_<> Methods

Accessor methods to set an instance attribute to a specific value.

Syntax

```
MEMBER PROCEDURE SET_<> (
    value IN datatype );
```

Parameters**Table 120-15 SYS.MGW_TIBRV_MSG_T SET_<> Method Parameters**

Parameter	Description
value	Value to be assigned

GET_<> Methods

Accessor methods to retrieve the value for an instance attribute.

Syntax

```
MEMBER PROCEDURE GET_<>
RETURN datatype;
```

Parameters

None

Return Values

Returns the attribute value.

GET_FIELD_COUNT Function

Gets the number of message fields.

Syntax

```
MEMBER PROCEDURE get_field_count
RETURN INTEGER;
```

Parameters

None

Return Values

Returns the number of fields, or zero (0) if there are none.

GET_FIELD Function

Retrieves field information for the field having a given field collection index. This method should only be called if the `GET_FIELD_COUNT` Function returns a nonzero value and `idx` must specify a valid collection index; that is, `1<=idx<=get_field_count()`.

Syntax

```
MEMBER PROCEDURE get_field (
    idx    IN    INTEGER )
RETURN SYS.MGW_TIBRV_FIELD_T;
```

Parameters

Table 120-16 SYS.MGW_TIBRV_MSG_T GET_FIELD Function Parameters

Parameter	Description
idx	Specifies the 1-based field collection index of the field to retrieve



Note:

A 1-based index begins at one (1) instead of zero (0).

Return Values

Returns the field information.

GET_FIELD_BY_NAME Function

Retrieves field information for the first field that has a given field name. The name comparison is case-sensitive.

Syntax

```
MEMBER PROCEDURE get_field_by_name (
    name IN  VARCHAR2 )
RETURN SYS.MGW_TIBRV_FIELD_T;
```

Parameters

Table 120-17 SYS.MGW_TIBRV_MSG_T GET_FIELD_BY_NAME Function Parameters

Parameter	Description
name	Specifies the field name to search for. This can be NULL to find the first field that does not have a field name.

Return Values

Returns the field information, or NULL if no match was found.

GET_FIELD_BY_ID Function

Retrieves field information for the first field that has a given field identifier.

A field can have either a unique identifier or no identifier. If the field identifier value is zero (0) or NULL, then the field is considered to have no identifier. Otherwise, the identifier is a nonzero value that is unique for all the fields of this message.

Syntax


```
MEMBER PROCEDURE get_field_by_id (
    id IN INTEGER )
RETURN SYS.MGW_TIBRV_FIELD_T;
```

Parameters

Table 120-18 SYS.MGW_TIBRV_MSG_T GET_FIELD_BY_ID Function Parameters

Parameter	Description
id	Specifies the field identifier to search for. This can be zero (0) or NULL to find the first field that does not have an identifier.

Return Values

Returns the field information, or NULL if no match was found.

FIND_FIELD_NAME Function

Searches for a field with a given field name, starting from a given index of the field collection. It returns the index of that field. The name comparison is case-sensitive. This function is useful for finding all the fields that have the same name.

Syntax

```
MEMBER PROCEDURE find_field_name (
    name IN VARCHAR2,
    start_idx IN INTEGER )
RETURN INTEGER;
```

Parameters

Table 120-19 SYS.MGW_TIBRV_MSG_T FIND_FIELD_NAME Function Parameters

Parameter	Description
name	Specifies the field name to search for. This can be NULL to search for a field that does not have a field name.
start_idx	Specifies the 1-based field collection index from which the search should start.

Return Values

Returns the field index (> 0) if a match was found, or zero (0) if no match was found.

FIND_FIELD_ID Function

Searches for a field with a given field identifier, starting from a given index of the field collection. It returns the index of that field.

Syntax

```
MEMBER PROCEDURE find_field_id (
    id IN INTEGER,
    start_idx IN INTEGER )
RETURN INTEGER;
```

Parameters

Table 120-20 SYS.MGW_TIBRV_MSG_T FIND_FIELD_ID Function Parameters

Parameter	Description
id	Specifies the field identifier to search for. This can be zero (0) or NULL to find a field that does not have an identifier.
start_idx	Specifies the 1-based field collection index from which the search should start.

Return Values

Returns the field index (> 0) if a match was found, or zero (0) if no match was found.

120.4 Summary of DBMS_MGWMSG Subprograms

This table lists the DBMS_MGWMSG subprograms and briefly describes them.

Table 120-21 DBMS_MGWMSG Package Subprograms

Subprogram	Description
LCR_TO_XML Function	Converts a SYS.ANYDATA object encapsulating a row LCR (LCR\$_ROW_RECORD) or a DDL LCR (LCR\$_DDL_RECORD) to a SYS.XMLTYPE object
NVARRAY_ADD Procedure	Appends a name-value element to the end of a name-value array
NVARRAY_FIND_NAME Function	Searches a name-value array for the element with the name you specify in p_name
NVARRAY_FIND_NAME_TYPE Function	Searches a name-value array for an element with the name and value type you specify
NVARRAY_GET Function	Gets the name-value element of the name you specify in p_name from a name-value array
NVARRAY_GET_BOOLEAN Function	Gets the value of the name-value array element that you specify in p_name and with the BOOLEAN_VALUE value type
NVARRAY_GET_BYTE Function	Gets the value of the name-value array element that you specify in p_name and with the BYTE_VALUE value type
NVARRAY_GET_DATE Function	Gets the value of the name-value array element that you specify in p_name and with the DATE_VALUE value type
NVARRAY_GET_DOUBLE Function	Gets the value of the name-value array element that you specify in p_name and with the DOUBLE_VALUE value type
NVARRAY_GET_FLOAT Function	Gets the value of the name-value array element that you specify in p_name and with the FLOAT_VALUE value type
NVARRAY_GET_INTEGER Function	Gets the value of the name-value array element that you specify in p_name and with the INTEGER_VALUE value type
NVARRAY_GET_LONG Function	Gets the value of the name-value array element that you specify in p_name and with the LONG_VALUE value type
NVARRAY_GET_RAW Function	Gets the value of the name-value array element that you specify in p_name and with the RAW_VALUE value type

Table 120-21 (Cont.) DBMS_MGWMSG Package Subprograms

Subprogram	Description
NVARARRAY_GET_SHORT Function	Gets the value of the name-value array element that you specify in <code>p_name</code> and with the <code>SHORT_VALUE</code> value type
NVARARRAY_GET_TEXT Function	Gets the value of the name-value array element that you specify in <code>p_name</code> and with the <code>TEXT_VALUE</code> value type
XML_TO_LCR Function	Converts a <code>SYS.XMLTYPE</code> object to a <code>SYS.ANYDATA</code> object encapsulating a row LCR (<code>LCR\$_ROW_RECORD</code>) or a DDL LCR (<code>LCR\$_DDL_RECORD</code>)

120.4.1 LCR_TO_XML Function

This function converts a `SYS.ANYDATA` object encapsulating a row LCR (Logical Change Record, in this case a `LCR$_ROW_RECORD`) or a DDL LCR (`LCR$_DDL_RECORD`) to a `SYS.XMLTYPE` object.



See Also:

[XML_TO_LCR Function](#)

Syntax

```
DBMS_MGWMSG.LCR_TO_XML (
  p_anydata IN SYS.ANYDATA )
RETURN SYS.XMLTYPE;
```

Parameters

Table 120-22 LCR_TO_XML Function Parameters

Parameter	Description
<code>p_anydata</code>	An <code>ANYDATA</code> object to be converted

Return Values

Returns a `SYS.XMLTYPE` object.

Usage Notes

An exception is raised if the encapsulated type `p_anydata` is not an LCR.

120.4.2 NVARRAY_ADD Procedure

This procedure appends a name-value element to the end of a name-value array.

Syntax

```
DBMS_MGWMSG.NVARRAY_ADD (
    p_array IN OUT SYS.MGW_NAME_VALUE_ARRAY_T,
    p_value IN     SYS.MGW_NAME_VALUE_T );
```

Parameters

Table 120-23 NVARRAY_ADD Procedure Parameters

Parameter	Description
p_array	On input, the name-value array instance to modify. If NULL, then a new array is created. On output, the modified name-value array instance.
p_value	The value to add. If NULL, then p_array is not changed.

120.4.3 NVARRAY_FIND_NAME Function

This function searches a name-value array for the element with the name you specify in p_name.

Syntax

```
DBMS_MGWMSG.NVARRAY_FIND_NAME (
    p_array IN SYS.MGW_NAME_VALUE_ARRAY_T,
    p_name IN VARCHAR2,
    p_compare IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN BINARY_INTEGER;
```

Parameters

Table 120-24 NVARRAY_FIND_NAME Function Parameters

Parameters	Description
p_array	The name-value array to search
p_name	The name to find
p_compare	Name comparison method. Values are CASE_SENSITIVE and CASE_INSENSITIVE.

Return Values

Returns a positive integer that is the array index of the matching element or zero (0) if the specified name is not found.

120.4.4 NVARRAY_FIND_NAME_TYPE Function

This function searches a name-value array for an element with the name and value type you specify.

Syntax

```
DBMS_MGWMSG.NVARRAY_FIND_NAME_TYPE (
  p_array    IN SYS.MGW_NAME_VALUE_ARRAY_T,
  p_name     IN VARCHAR2,
  p_type     IN BINARY_INTEGER
  p_compare  IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN BINARY_INTEGER;
```

Parameters

Table 120-25 NVARRAY_FIND_NAME_TYPE Function Parameters

Parameter	Description
p_array	The name-value array to search
p_name	The name to find
p_type	The value type. Refer to the value type constants in Table 120-1 .
p_compare	Name comparison method. Values are CASE_SENSITIVE and CASE_INSENSITIVE.

Return Values

Returns a positive integer that is the array index of the matching element, zero (0) if the specified name is not found, or negative one (-1) if the specified name is found but a type mismatch exists.

120.4.5 NVARRAY_GET Function

This function gets the name-value element of the name you specify in p_name from a name-value array.

Syntax

```
DBMS_MGWMSG.NVARRAY_GET (
  p_array    IN SYS.MGW_NAME_VALUE_ARRAY_T,
  p_name     IN VARCHAR2,
  p_compare  IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN SYS.MGW_NAME_VALUE_T;
```

Parameters

Table 120-26 NVARRAY_GET Function Parameters

Parameter	Description
p_array	The name-value array
p_name	The value name

Table 120-26 (Cont.) NVARRAY_GET Function Parameters

Parameter	Description
p_compare	Name comparison method. Values are CASE_SENSITIVE and CASE_INSENSITIVE.

Return Values

Returns the matching element, or NULL if the specified name is not found.

120.4.6 NVARRAY_GET_BOOLEAN Function

This function gets the value of the name-value array element that you specify in p_name and with the BOOLEAN_VALUE value type.

Syntax

```
DBMS_MGWMSG.NVARRAY_GET_BOOLEAN (
    p_array    IN SYS.MGW_NAME_VALUE_ARRAY_T,
    p_name     IN VARCHAR2,
    p_compare  IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN INTEGER;
```

Parameters**Table 120-27 NVARRAY_GET_BOOLEAN Function Parameters**

Parameter	Description
p_array	The name-value array
p_name	The value name
p_compare	Name comparison method. Values are CASE_SENSITIVE and CASE_INSENSITIVE.

Return Values

Returns the value, or NULL if either the specified name is not found or a type mismatch exists.

120.4.7 NVARRAY_GET_BYTE Function

This function gets the value of the name-value array element that you specify in p_name and with the BYTE_VALUE value type.

Syntax

```
DBMS_MGWMSG.NVARRAY_GET_BYTE (
    p_array    IN SYS.MGW_NAME_VALUE_ARRAY_T,
    p_name     IN VARCHAR2,
    p_compare  IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN INTEGER;
```

Parameters

Table 120-28 NVARRAY_GET_BYTE Function Parameters

Parameter	Description
p_array	The name-value array
p_name	The value name
p_compare	Name comparison method. Values are CASE_SENSITIVE and CASE_INSENSITIVE.

Return Values

Returns the value, or NULL if either the specified name is not found or a type mismatch exists.

120.4.8 NVARRAY_GET_DATE Function

This function gets the value of the name-value array element that you specify in p_name and with the DATE_VALUE value type.

Syntax

```
DBMS_MGWMSG.NVARRAY_GET_DATE (
  p_array    IN SYS.MGW_NAME_VALUE_ARRAY_T,
  p_name     IN VARCHAR2,
  p_compare  IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN DATE;
```

Parameters

Table 120-29 NVARRAY_GET_DATE Function Parameters

Parameters	Description
p_array	The name-value array
p_name	The value name
p_compare	Name comparison method. Values are CASE_SENSITIVE and CASE_INSENSITIVE.

Return Values

Returns the value, or NULL if either the specified name is not found or a type mismatch exists.

120.4.9 NVARRAY_GET_DOUBLE Function

This function gets the value of the name-value array element that you specify in p_name and with the DOUBLE_VALUE value type.

Syntax

```
DBMS_MGWMSG.NVARRAY_GET_DOUBLE (
  p_array    IN SYS.MGW_NAME_VALUE_ARRAY_T,
  p_name     IN VARCHAR2,
```

```
p_compare IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN NUMBER;
```

Parameters

Table 120-30 NVARRAY_GET_DOUBLE Function Parameters

Parameter	Description
p_array	The name-value array
p_name	The value name
p_compare	Name comparison method. Values are CASE_SENSITIVE and CASE_INSENSITIVE.

Return Values

Returns the value, or NULL if either the specified name is not found or a type mismatch exists.

120.4.10 NVARRAY_GET_FLOAT Function

This function gets the value of the name-value array element that you specify in p_name and with the FLOAT_VALUE value type.

Syntax

```
DBMS_MGWMSG.NVARRAY_GET_FLOAT (
    p_array IN SYS.MGW_NAME_VALUE_ARRAY_T,
    p_name IN VARCHAR2,
    p_compare IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN NUMBER;
```

Parameters

Table 120-31 NVARRAY_GET_FLOAT Function Parameters

Parameter	Description
p_array	The name-value array
p_name	The value name
p_compare	Name comparison method. Values are CASE_SENSITIVE and CASE_INSENSITIVE.

Return Values

Returns the value, or NULL if either the specified name is not found or a type mismatch exists.

120.4.11 NVARRAY_GET_INTEGER Function

This function gets the value of the name-value array element that you specify in `p_name` and with the `INTEGER_VALUE` value type.

Syntax

```
DBMS_MGWMSG.NVARRAY_GET_INTEGER (
  p_array   IN SYS.MGW_NAME_VALUE_ARRAY_T,
  p_name    IN VARCHAR2,
  p_compare IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN INTEGER;
```

Parameters

Table 120-32 NVARRAY_GET_INTEGER Function Parameters

Parameter	Description
<code>p_array</code>	The name-value array
<code>p_name</code>	The value name
<code>p_compare</code>	Name comparison method. Values are <code>CASE_SENSITIVE</code> and <code>CASE_INSENSITIVE</code> .

Return Values

Returns the value, or `NULL` if either the specified name is not found or a type mismatch exists.

120.4.12 NVARRAY_GET_LONG Function

This function gets the value of the name-value array element that you specify in `p_name` and with the `LONG_VALUE` value type.

Syntax

```
DBMS_MGWMSG.NVARRAY_GET_LONG (
  p_array   IN SYS.MGW_NAME_VALUE_ARRAY_T,
  p_name    IN VARCHAR2,
  p_compare IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN NUMBER;
```

Parameters

Table 120-33 NVARRAY_GET_LONG Function Parameters

Parameter	Description
<code>p_array</code>	The name-value array
<code>p_name</code>	The value name
<code>p_compare</code>	Name comparison method. Values are <code>CASE_SENSITIVE</code> and <code>CASE_INSENSITIVE</code> .

Return Values

Returns the value, or NULL if either the specified name is not found or a type mismatch exists.

120.4.13 NVARRAY_GET_RAW Function

This function gets the value of the name-value array element that you specify in `p_name` and with the `RAW_VALUE` value type.

Syntax

```
DBMS_MGWMSG.NVARRAY_GET_RAW (
    p_array    IN SYS.MGW_NAME_VALUE_ARRAY_T,
    p_name     IN VARCHAR2,
    p_compare  IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN RAW;
```

Parameters

Table 120-34 NVARRAY_GET_RAW Function Parameters

Parameter	Description
<code>p_array</code>	The name-value array
<code>p_name</code>	The value name
<code>p_compare</code>	Name comparison method. Values are <code>CASE_SENSITIVE</code> and <code>CASE_INSENSITIVE</code> .

Return Values

Returns the value, or NULL if either the specified name is not found or a type mismatch exists.

120.4.14 NVARRAY_GET_SHORT Function

This function gets the value of the name-value array element that you specify in `p_name` and with the `SHORT_VALUE` value type.

Syntax

```
DBMS_MGWMSG.NVARRAY_GET_SHORT (
    p_array    IN SYS.MGW_NAME_VALUE_ARRAY_T,
    p_name     IN VARCHAR2,
    p_compare  IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN INTEGER;
```

Parameters

Table 120-35 NVARRAY_GET_SHORT Function Parameters

Parameter	Description
<code>p_array</code>	The name-value array

Table 120-35 (Cont.) NVARRAY_GET_SHORT Function Parameters

Parameter	Description
p_name	The value name
p_compare	Name comparison method. Values are CASE_SENSITIVE and CASE_INSENSITIVE.

Return Values

Returns the value, or NULL if either the specified name is not found or a type mismatch exists.

120.4.15 NVARRAY_GET_TEXT Function

This function gets the value of the name-value array element that you specify in p_name and with the TEXT_VALUE value type.

Syntax

```
DBMS_MGWMSG.NVARRAY_GET_TEXT (
    p_array    IN SYS.MGW_NAME_VALUE_ARRAY_T,
    p_name     IN VARCHAR2,
    p_compare  IN BINARY_INTEGER DEFAULT CASE_SENSITIVE )
RETURN VARCHAR2;
```

Parameters**Table 120-36 NVARRAY_GET_TEXT Function Parameters**

Parameter	Description
p_array	The name-value array
p_name	The value name
p_compare	Name comparison method. Values are CASE_SENSITIVE and CASE_INSENSITIVE.

Return Values

Returns the value, or NULL if either the specified name is not found or a type mismatch exists.

120.4.16 XML_TO_LCR Function

This function converts a SYS.XMLTYPE object to a SYS.ANYDATA object encapsulating a row LCR (LCR\$_ROW_RECORD) or a DDL LCR (LCR\$_DDL_RECORD).

**See Also:**

[LCR_TO_XML Function](#)

Syntax

```
DBMS_MGWMSG.XML_TO_LCR (  
  p_xmldata IN SYS.XMLTYPE )  
  RETURN SYS.ANYDATA;
```

Parameters

Table 120-37 XML_TO_LCR Function Parameters

Parameter	Description
p_xmldata	An XMLTYPE object representing an LCR

Return Values

Returns a SYS.ANYDATA object.

Usage Notes

An exception is raised if p_xmldata cannot be converted to an LCR.

DBMS_MLE

The `DBMS_MLE` package allows users to execute JavaScript code inside the Oracle Database and exchange data seamlessly between PL/SQL and JavaScript. The JavaScript code itself can execute PL/SQL and SQL through built-in JavaScript modules. JavaScript data types are automatically mapped to Oracle Database data types and vice versa.

With the `DBMS_MLE` package, developers can write their data processing logic in JavaScript.

This chapter contains the following topics:

- [DBMS_MLE Overview](#)
- [DBMS_MLE Security Model](#)
- [Summary of DBMS_MLE Subprograms](#)

121.1 DBMS_MLE Overview

Runtime state for MLE execution is encapsulated in execution contexts that users can explicitly create and destroy. Users can also export values from PL/SQL to MLE, and import values from MLE back into PL/SQL.

The following example captures the typical workflow for MLE execution:

```
set serveroutput on;
declare
  ctx dbms_mle.context_handle_t;
  source clob;
  greeting varchar2(100);
begin
  ctx := dbms_mle.create_context(); -- Create execution context for MLE execution
  dbms_mle.export_to_mle(ctx, 'person', 'World'); -- Export value from PL/SQL
  source := q'~
    var bindings = require("mle-js-bindings");
    var person = bindings.importValue("person"); // Import value previously exported
from PL/SQL
    var greeting = "Hello, " + person + "!";
    bindings.exportValue("greeting", greeting); // Export value to PL/SQL
  ~';
  dbms_mle.eval(ctx, 'JAVASCRIPT', source); -- Evaluate the source code snippet in the
execution context
  dbms_mle.import_from_mle(ctx, 'greeting', greeting); -- Import value previously
exported from MLE
  dbms_output.put_line('Greetings from MLE: ' || greeting);
  dbms_mle.drop_context(ctx); -- Drop the execution context once no longer required
end;
/
```

Executing the above code block produces the following output:

```
Greetings from MLE: Hello, World!
```

121.2 DBMS_MLE Security Model

Access to MLE features is protected by database privileges. The user must have the `EXECUTE DYNAMIC MLE` privilege while calling any of its functions and procedures that pertain to MLE execution. In addition to this, the user must also have the `EXECUTE ON JAVASCRIPT` privilege to execute JavaScript code. An `ORA-01031` error is raised if the user calling any of the `DBMS_MLE` subprograms does not have the appropriate privileges. See the summary of `DBMS_MLE` subprograms for the privileges required to call each `DBMS_MLE` subprogram.

121.3 Summary of DBMS_MLE Subprograms

This table lists the `DBMS_MLE` subprograms and briefly describes them.

Table 121-1 DBMS_MLE Package Subprograms

Subprogram	Description
<code>CREATE_CONTEXT</code> Function	Creates an MLE context for executing snippets in JavaScript.
<code>DISABLE_CTX_STDERR</code> Procedure	This procedure disables <code>stderr</code> stream of the specified MLE context, so that future writes to <code>stderr</code> are discarded.
<code>DISABLE_CTX_STDOUT</code> Procedure	This procedure disables <code>stdout</code> stream of the specified MLE context, so that future writes to <code>stdout</code> are discarded.
<code>DISABLE_DEBUGGING</code> Procedure	This procedure disables any currently enabled debugpoints for the current session.
<code>DISABLE_ICS_STDERR</code> Procedure	This procedure disables the <code>stderr</code> stream of the inlined MLE call specification context, so that future writes to <code>stderr</code> are discarded for the calling user in the current session.
<code>DISABLE_ICS_STDOUT</code> Procedure	This procedure disables the <code>stdout</code> stream of an inlined call specification context, so that future writes to <code>stdout</code> are discarded for the calling user in the current session.
<code>DISABLE_STDERR</code> Procedure	This procedure disables the <code>stderr</code> stream of MLE contexts, so that future writes to <code>stderr</code> are discarded.
<code>DISABLE_STDOUT</code> Procedure	This procedure disables the <code>stdout</code> stream of MLE contexts, so that future writes to <code>stdout</code> are discarded.
<code>DROP_CONTEXT</code> Procedure	This procedure is used to drop an MLE context that was previously created using the <code>CREATE_CONTEXT</code> procedure. After the context is dropped, the context handle is no longer valid and cannot be used anymore.
<code>ENABLE_DEBUGGING</code> Procedure	This procedure enables a set of debugpoints for the current session.
<code>EVAL</code> Procedure	This procedure executes the given JavaScript code within the context identified by the context handle.
<code>EXPORT_TO_MLE</code> Procedure	This procedure allows you to assign the given value, with appropriate conversion, to the named property in the MLE context. The property is created if it is not already present.
<code>GET_AVAILABLE_LANGUAGES</code> Function	This function returns the set of available MLE languages.
<code>GET_CTX_ERROR_STACK</code> Function	This function retrieves the JavaScript stack trace for the most recent application error in the given execution context.

Table 121-1 (Cont.) DBMS_MLE Package Subprograms

Subprogram	Description
GET_ERROR_STACK Function	This function retrieves the JavaScript stack trace for the most recent application error in the given module (and optional environment) call.
IMPORT_FROM_MLE Procedure	This procedure retrieves the value of the named property from the MLE context and converts it to the requested PL/SQL type.
PARSE_DEBUG_OUTPUT Function	Given a BLOB containing MLE debug output in the Java Heap Dump format, this function returns a textual representation of debug output.
SET_CTX_STDERR Procedure	This procedure redirects the stderr stream of the MLE context to the given CLOB.
SET_CTX_STDERR_TO_DBMS_OUTPUT Procedure	This procedure redirects the stderr stream of the MLE context to DBMS_OUTPUT.
SET_CTX_STDOUT Procedure	This procedure redirects the stdout stream of the MLE context to the given CLOB.
SET_CTX_STDOUT_TO_DBMS_OUTPUT Procedure	This procedure redirects the stdout stream of the MLE context to DBMS_OUTPUT.
SET_ICS_STDERR Procedure	This procedure redirects the stderr stream of the inlined MLE call specification context to the given CLOB for the calling user in the current session.
SET_ICS_STDERR_TO_DBMS_OUTPUT Procedure	This procedure redirects the stderr stream of the inlined MLE call specification context to DBMS_OUTPUT for the calling user in the current session.
SET_ICS_STDOUT Procedure	This procedure redirects the stdout stream of an inlined MLE call specification context in the current session to the given CLOB.
SET_ICS_STDOUT_TO_DBMS_OUTPUT Procedure	This procedure redirects the stdout stream of the inlined call specification context to DBMS_OUTPUT for the calling user in the current session.
SET_STDERR Procedure	This procedure redirects the stderr stream of MLE contexts to the given CLOB.
SET_STDERR_TO_DBMS_OUTPUT Procedure	This procedure redirects the stderr stream of MLE contexts to DBMS_OUTPUT.
SET_STDOUT Procedure	This procedure redirects the stdout stream of MLE contexts to the given CLOB.
SET_STDOUT_TO_DBMS_OUTPUT Procedure	This procedure redirects the stdout stream of MLE contexts to DBMS_OUTPUT.

121.3.1 CREATE_CONTEXT Function

Creates an MLE context for executing snippets in JavaScript. You need the EXECUTE_DYNAMIC MLE privilege to execute this function.

Syntax

```
DBMS_MLE.CREATE_CONTEXT
    RETURN CONTEXT_HANDLE_T;

DBMS_MLE.CREATE_CONTEXT (
```

```
environment IN VARCHAR2)
RETURN CONTEXT_HANDLE_T;
```

Parameters

Table 121-2 CREATE_CONTEXT Function Parameters

Parameter	Description
environment	The case-sensitive schema name of the MLE environment that configures the context. Optional.

Return Values

This function returns a handle that uniquely identifies a context within a session for use in subsequent operations, such as `EXPORT_TO_MLE` and `EVAL`.

Usage Notes

A context has a lifetime limited to the session in which it was created. When a client session is terminated, all its contexts are dropped. All MLE contexts created in a session are also dropped when the session state is reset, for example, by calling `DBMS_SESSION.RESET_PACKAGE`. JavaScript code is evaluated in the context using the user, roles, and schema that are in effect at the time of context creation.

The function may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04105: if the environment does not exist.

See Also:

Oracle Database JavaScript Developer's Guide for more details about privileges required to execute JavaScript code

121.3.2 DISABLE_CTX_STDERR Procedure

This procedure disables `stderr` stream of the specified MLE context, so that future writes to `stderr` are discarded. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.DISABLE_CTX_STDERR(
    context_handle IN context_handle_t);
```


Parameters

Table 121-3 DISABLE_CTX_STDERR Procedure Parameters

Parameter	Description
<code>context_handle</code>	The handle to an MLE context in the current session.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges

121.3.3 DISABLE_CTX_STDOUT Procedure

This procedure disables `stdout` stream of the specified MLE context, so that future writes to `stdout` are discarded. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.DISABLE_CTX_STDOUT(
    context_handle          IN          context_handle_t);
```

Parameters

Table 121-4 DISABLE_CTX_STDOUT Procedure Parameters

Parameter	Description
<code>context_handle</code>	The handle to an MLE context in the current session.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges

121.3.4 DISABLE_DEBUGGING Procedure

This procedure disables any currently enabled debugpoints for the current session. Post-execution debugging allows you to collect runtime state to be used for analysis after the program has been run. Post-execution debugging can only be applied to MLE code deployed in modules as opposed to code deployed using dynamic execution.

Syntax

```
DBMS_MLE.DISABLE_DEBUGGING();
```

Usage Notes

This procedure has no effect if no debugpoints are currently enabled. Debugging can be enabled again with a subsequent call to `DBMS_MLE.ENABLE_DEBUGGING`.

See Also:

Oracle Database JavaScript Developer's Guide for more information about post-execution debugging with MLE

121.3.5 DISABLE_ICS_STDERR Procedure

This procedure disables the `stderr` stream of the inlined MLE call specification context, so that future writes to `stderr` are discarded for the calling user in the current session. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.DISABLE_ICS_STDERR (
    name          IN          VARCHAR2);
```

Parameters

Table 121-5 DISABLE_ICS_STDERR Procedure Parameters

Parameter	Description
name	The name of the inlined MLE call specification.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04043: if the call specification does not exist.

121.3.6 DISABLE_ICS_STDOUT Procedure

This procedure disables the `stdout` stream of an inlined call specification context, so that future writes to `stdout` are discarded for the calling user in the current session. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.DISABLE_ICS_STDOUT (
    name          IN          VARCHAR2);
```

Parameters

Table 121-6 DISABLE_ICS_STDOUT Procedure Parameters

Parameter	Description
name	The name of the inlined MLE call specification.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04043: if the call specification does not exist.

121.3.7 DISABLE_STDERR Procedure

This procedure disables the `stderr` stream of MLE contexts, so that future writes to `stderr` are discarded. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.DISABLE_STDERR();

DBMS_MLE.DISABLE_STDERR (
    module_name      IN      VARCHAR2);

DBMS_MLE.DISABLE_STDERR (
    module_name      IN      VARCHAR2,
    env_name         IN      VARCHAR2);
```

Parameters

Table 121-7 DISABLE_STDERR Function Parameters

Parameter	Description
module_name	The name of the MLE module.
env_name	The name of the MLE environment.

Usage Notes

When called without parameters, this procedure applies to all existing contexts and contexts created in the future. Otherwise, only the context associated with the given module (or module and environment combination) is affected.

If no environment is specified, the context defined by the given module and the built-in environment is used.

Any output that was buffered so far gets flushed to the pre-existing sink.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges
- ORA-04103: if the module does not exist
- ORA-04105: if the environment does not exist

121.3.8 DISABLE_STDOUT Procedure

This procedure disables the stdout stream of MLE contexts, so that future writes to `stdout` are discarded. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.DISABLE_STDOUT();

DBMS_MLE.DISABLE_STDOUT(
    module_name      IN      VARCHAR2);

DBMS_MLE.DISABLE_STDOUT(
    module_name      IN      VARCHAR2,
    env_name         IN      VARCHAR2);
```

Parameters

Table 121-8 DISABLE_STDOUT Function Parameters

Parameter	Description
<code>module_name</code>	The name of the MLE module.
<code>env_name</code>	The name of the MLE environment.

Usage Notes

When called without parameters, this procedure applies to all existing contexts and contexts created in the future. Otherwise, only the context associated with the given module (or module and environment combination) is affected.

If no environment is specified, the context defined by the given module and the built-in environment is used.

Any output that was buffered so far gets flushed to the pre-existing sink.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges
- ORA-04103: if the module does not exist
- ORA-04105: if the environment does not exist

121.3.9 DROP_CONTEXT Procedure

This procedure is used to drop an MLE context that was previously created using the `CREATE_CONTEXT` function. After the context is dropped, the context handle is no longer

valid and cannot be used anymore. You need the `EXECUTE DYNAMIC MLE` privilege to execute this procedure.

Syntax

```
DBMS_MLE.DROP_CONTEXT (
    context_handle IN    context_handle_t);
```

Parameters

Table 121-9 DROP_CONTEXT Procedure Parameters

Parameter	Description
<code>context_handle</code>	The handle to an MLE context in the current session.

Usage Notes

The procedure may raise `ORA-01031` error if the caller does not have sufficient privileges.

121.3.10 ENABLE_DEBUGGING Procedure

This procedure enables a set of debugpoints for the current session. Post-execution debugging allows you to collect runtime state to be used for analysis after the program has been run. Post-execution debugging can only be applied to MLE code deployed in modules as opposed to code deployed using dynamic execution.

Syntax

```
DBMS_MLE.ENABLE_DEBUGGING (
    debugspec IN    JSON,
    sink      OUT   NOCOPY BLOB);
```

Parameters

Table 121-10 ENABLE_DEBUGGING Procedure Parameters

Parameter	Description
<code>debugspec</code>	The debug specification as a JSON document that identifies the debugging information to be collected.
<code>sink</code>	The sink to log debug output to.

Usage Notes

Calling this procedure multiple times in the same session replaces any existing set of debugpoints.

All enabled debugpoints are automatically disabled once the session ends.

The procedure may raise the following errors:

- `ORA-04103`: if the module does not exist.
- `ORA-04162`: if an attempt is made to debug an MLE built-in module.
- `ORA-04164`: if the caller is missing the `COLLECT DEBUG INFO` privilege on the module.

- ORA-04165: if the provided debug specification is invalid.



See Also:

Oracle Database JavaScript Developer's Guide for more information about post-execution debugging with MLE

121.3.11 EVAL Procedure

This procedure executes the given JavaScript code within the context identified by the context handle.

The evaluated code has access to all previous modifications to the state of the context, including variables defined by code previously evaluated in the context and values exported through `EXPORT_TO_MLE()`. The evaluated code can also import MLE built-in modules such as the MLE SQL driver.

You need the `EXECUTE DYNAMIC MLE` privilege to execute this procedure. It also requires the `EXECUTE ON JAVASCRIPT` privilege.

Syntax

```
DBMS_MLE.EVAL(
    context_handle IN          context_handle_t,
    language_id   IN          language_t,
    source        IN          CLOB,
    result        IN OUT      NOCOPY CLOB CHARACTER SET ANY_CS,
    options       IN          VARCHAR2          DEFAULT NULL,
    source_name   IN          VARCHAR2          DEFAULT NULL);
```

```
DBMS_MLE.EVAL(
    context_handle IN          context_handle_t,
    language_id   IN          language_t,
    source        IN          VARCHAR2,
    result        IN OUT      NOCOPY CLOB CHARACTER SET ANY_CS,
    options       IN          VARCHAR2          DEFAULT NULL,
    source_name   IN          VARCHAR2          DEFAULT NULL);
```

Parameters

Table 121-11 EVAL Procedure Parameters

Parameter	Description
context_handle	The handle to an MLE context.
language_id	The language of the provided source code. The value 'JAVASCRIPT' must be provided as of Oracle 23ai.
source	The source code to be executed.
result	A buffer to which the result of the evaluation of the source code is appended. Optional.
options	Reserved for future use. Optional.

Table 121-11 (Cont.) EVAL Procedure Parameters

Parameter	Description
source_name	A name for the provided source code that is used to identify the snippet in stack traces. Optional.

Usage Notes

When specifying the optional `source_name` parameter, the `options` parameter must be defined as either `NULL` or `""`.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04108: if the current container, the current user, or the currently enabled roles are different from those in effect at the time of context creation.
- ORA-04153: if the context handle is invalid.
- ORA-04161: if the source code being evaluated throws an exception.

121.3.12 EXPORT_TO_MLE Procedure

This procedure allows you to assign the given value, with appropriate conversion, to the named property in the MLE context. The property is created if it is not already present. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    property_value IN    BINARY_INTEGER);
```

```
DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    property_value IN    BINARY_DOUBLE);
```

```
DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    property_value IN    BINARY_FLOAT);
```

```
DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    property_value IN    BLOB);
```

```
DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    property_value IN    BOOLEAN);
```

```

DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN context_handle_t,
    property_name IN VARCHAR2,
    property_value IN CLOB CHARACTER SET ANY_CS);

DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN context_handle_t,
    property_name IN VARCHAR2,
    property_value IN DATE);

DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN context_handle_t,
    property_name IN VARCHAR2,
    property_value IN DSINTERVAL_UNCONSTRAINED);

DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN context_handle_t,
    property_name IN VARCHAR2,
    property_value IN JSON);

DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN context_handle_t,
    property_name IN VARCHAR2,
    property_value IN NUMBER);

DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN context_handle_t,
    property_name IN VARCHAR2,
    property_value IN TIMESTAMP_TZ_UNCONSTRAINED);

DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN context_handle_t,
    property_name IN VARCHAR2,
    property_value IN TIMESTAMP_UNCONSTRAINED);

DBMS_MLE.EXPORT_UROWID (
    context_handle IN context_handle_t,
    property_name IN VARCHAR2,
    property_value IN UROWID);

DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN context_handle_t,
    property_name IN VARCHAR2,
    property_value IN VARCHAR2 CHARACTER SET ANY_CS);

DBMS_MLE.EXPORT_TO_MLE (
    context_handle IN context_handle_t,
    property_name IN VARCHAR2,
    property_value IN YMINTERVAL_UNCONSTRAINED);

DBMS_MLE.EXPORT_CHAR (
    context_handle IN context_handle_t,
    property_name IN VARCHAR2,
    property_value IN CHAR CHARACTER SET ANY_CS);

```



```
DBMS_MLE.EXPORT_RAW (
  context_handle IN      context_handle_t,
  property_name  IN      VARCHAR2,
  property_value IN      RAW);
```

Parameters

Table 121-12 EXPORT_TO_MLE Procedure Parameters

Parameter	Description
context_handle	The handle to an MLE context in the current session.
property_name	The name of the variable to be set. If the <code>property_name</code> value is <code>NULL</code> or an empty string, ORA-04157 error is thrown.
property_value	The value to which the variable should be set.

Usage Notes

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04157: if the value of the passed `property_name` is `NULL` or an empty string.
- ORA-04108: if the current container, the current user, or the currently enabled roles are different from those in effect at the time of context creation.
- ORA-04153: if the context handle is invalid.

121.3.13 GET_AVAILABLE_LANGUAGES Function

This function returns the set of available MLE languages.

Syntax

```
DBMS_MLE.GET_AVAILABLE_LANGUAGES ()
  RETURN languages_t;
```

Return Values

A set of available MLE languages as a table of language identifiers as they can be used as an argument to `DBMS_MLE.EVAL()`.

121.3.14 GET_CTX_ERROR_STACK Function

This function retrieves the JavaScript stack trace for the most recent application error in the given execution context. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.GET_CTX_ERROR_STACK(
  context_handle          IN      context_handle_t)
  RETURN error_frames_t;
```

Parameters

Table 121-13 GET_CTX_ERROR_STACK Function Parameters

Parameter	Description
<code>context_handle</code>	The handle to an MLE context in the current session.

Return Values

A collection of error stack frames, each of type `error_frame_t`. An empty collection is returned if there is no error stack to report.

Usage Notes

The Function may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges
- ORA-04153: if the context handle is invalid.

121.3.15 GET_ERROR_STACK Function

This function retrieves the JavaScript stack trace for the most recent application error in the given module (and optional environment) call. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.GET_ERROR_STACK(
    module_name      IN          VARCHAR2,
    env_name         IN          VARCHAR2 DEFAULT '')
RETURN error_frames_t;
```

Parameters

Table 121-14 GET_ERROR_STACK Function Parameters

Parameter	Description
<code>module_name</code>	The name of the MLE module.
<code>env_name</code>	The name of the MLE environment. Optional.

Return Values

A collection of error stack frames, each of type `error_frame_t`. An empty collection is returned if there is no error stack to report.

Usage Notes

The Function may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges
- ORA-04170: if the module name or environment name is invalid

121.3.16 IMPORT_FROM_MLE Procedure

This procedure retrieves the value of the named property from the MLE context and converts it to the requested PL/SQL type. You need the `EXECUTE DYNAMIC MLE` privilege to execute this procedure.

Syntax

```
DBMS_MLE.IMPORT_FROM_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    target         OUT   NOCOPY BINARY_INTEGER);
```

```
DBMS_MLE.IMPORT_FROM_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    target         OUT   NOCOPY BINARY_DOUBLE);
```

```
DBMS_MLE.IMPORT_FROM_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    target         OUT   NOCOPY BINARY_FLOAT);
```

```
DBMS_MLE.IMPORT_FROM_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    target         OUT   NOCOPY BLOB);
```

```
DBMS_MLE.IMPORT_FROM_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    target         OUT   NOCOPY BOOLEAN);
```

```
DBMS_MLE.IMPORT_FROM_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    target         OUT   NOCOPY CLOB CHARACTER SET ANY_CS);
```

```
DBMS_MLE.IMPORT_FROM_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    target         OUT   NOCOPY DATE);
```

```
DBMS_MLE.IMPORT_FROM_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    target         OUT   NOCOPY DSINTERVAL_UNCONSTRAINED);
```

```
DBMS_MLE.IMPORT_FROM_MLE (
    context_handle IN    context_handle_t,
    property_name  IN    VARCHAR2,
    target         OUT   JSON);
```

```

DBMS_MLE.IMPORT_FROM_MLE (
  context_handle IN      context_handle_t,
  property_name  IN      VARCHAR2,
  target         OUT     NOCOPY NUMBER);

DBMS_MLE.IMPORT_FROM_MLE (
  context_handle IN      context_handle_t,
  property_name  IN      VARCHAR2,
  target         OUT     NOCOPY TIMESTAMP_TZ_UNCONSTRAINED);

DBMS_MLE.IMPORT_FROM_MLE (
  context_handle IN      context_handle_t,
  property_name  IN      VARCHAR2,
  target         OUT     NOCOPY TIMESTAMP_UNCONSTRAINED);

DBMS_MLE.IMPORT_UROWID (
  context_handle IN      context_handle_t,
  property_name  IN      VARCHAR2,
  target         OUT     NOCOPY UROWID);

DBMS_MLE.IMPORT_FROM_MLE (
  context_handle IN      context_handle_t,
  property_name  IN      VARCHAR2,
  target         OUT     NOCOPY VARCHAR2 CHARACTER SET ANY_CS);

DBMS_MLE.IMPORT_FROM_MLE (
  context_handle IN      context_handle_t,
  property_name  IN      VARCHAR2,
  target         OUT     NOCOPY YMININTERVAL_UNCONSTRAINED);

DBMS_MLE.IMPORT_CHAR (
  context_handle IN      context_handle_t,
  property_name  IN      VARCHAR2,
  target         OUT     CHAR CHARACTER SET ANY_CS);

DBMS_MLE.IMPORT_RAW (
  context_handle IN      context_handle_t,
  property_name  IN      VARCHAR2,
  target         OUT     RAW);

```

Parameters

Table 121-15 IMPORT_FROM_MLE Procedure Parameters

Parameter	Description
context_handle	The handle to an MLE context in the current session.
property_name	The name of the property to be retrieved. If the property_name is NULL or an empty string, ORA-04157 error is thrown.
target	A PL/SQL variable into which the retrieved property is stored.

Usage Notes

The IMPORT_FROM_MLE procedure may throw the following exceptions:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04108: if the current container, the current user, or the currently enabled roles are different from those in effect at the time of context creation.
- ORA-04153: if the context handle is invalid.
- ORA-04157: if the value of the passed property_name is NULL or an empty string.
- ORA-04205: the value cannot be converted to the target PL/SQL type.
- ORA-06502: the buffer of the PL/SQL variable is too small to hold the retrieved value.

121.3.17 PARSE_DEBUG_OUTPUT Function

Given a BLOB containing MLE debug output in the Java Heap Dump format, returns a textual representation of debug output.

Syntax

```
DBMS_MLE.PARSE_DEBUG_OUTPUT (  
    debugoutput          IN          BLOB)  
RETURN JSON;
```

Parameters

Table 121-16 PARSE_DEBUG_OUTPUT Function Parameters

Parameter	Description
debugoutput	MLE debug output in the Java Heap Dump format.

Return Values

The function returns a JSON representation of the debug information. The output is an array of `DebugPointData` objects.

Usage Notes

The procedure may raise the following errors:

- ORA-04163: if the input is not in the Java Heap Dump format.
- ORA-04166: if the debug output is invalid.

See Also:

Oracle Database JavaScript Developer's Guide for more information about analyzing debug output

121.3.18 SET_CTX_STDERR Procedure

This procedure redirects the `stderr` stream of the MLE context to the given CLOB. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.SET_CTX_STDERR(
    context_handle IN          context_handle_t,
    sink          IN OUT      NOCOPY CLOB CHARACTER SET ANY_CS);
```

Parameters

Table 121-17 SET_CTX_STDERR Procedure Parameters

Parameter	Description
<code>context_handle</code>	Handle to an MLE context in the current session.
<code>sink</code>	The CLOB sink to redirect <code>stderr</code> to. Providing a <code>NULL</code> value will result in ORA-06530 error.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to the new sink.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04153: if the context handle is invalid.
- ORA-06530: if the sink is `NULL`.

121.3.19 SET_CTX_STDERR_TO_DBMS_OUTPUT Procedure

This procedure redirects the `stderr` stream of the MLE context to `DBMS_OUTPUT`. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.SET_CTX_STDERR_TO_DBMS_OUTPUT(
    context_handle IN          context_handle_t);
```

Parameters

Table 121-18 SET_CTX_STDERR_TO_DBMS_OUTPUT Procedure Parameters

Parameter	Description
<code>context_handle</code>	Handle to an MLE context in the current session.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to `DBMS_OUTPUT`.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04153: if the context handle is invalid.

121.3.20 SET_CTX_STDOUT Procedure

This procedure redirects the `stdout` stream of the MLE context to the given CLOB. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.SET_CTX_STDOUT(
    context_handle     IN context_handle_t,
    sink               IN OUT NOCOPY CLOB CHARACTER SET ANY_CS);
```

Parameters

Table 121-19 SET_CTX_STDOUT Procedure Parameters

Parameter	Description
<code>context_handle</code>	The handle to an MLE context in the current session.
<code>sink</code>	The CLOB sink to redirect <code>stdout</code> to. Providing a <code>NULL</code> value will result in an ORA-06530 error.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to the new sink.

This procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04153: if the context handle is invalid.
- ORA-06530: if the sink is `NULL`.

121.3.21 SET_CTX_STDOUT_TO_DBMS_OUTPUT Procedure

This procedure redirects the `stdout` stream of the MLE context to `DBMS_OUTPUT`. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.SET_CTX_STDOUT_TO_DBMS_OUTPUT(
    context_handle     IN     context_handle_t);
```

Parameters

Table 121-20 SET_CTX_STDOUT_TO_DBMS_OUTPUT Procedure Parameters

Parameter	Description
<code>context_handle</code>	The handle to an MLE context in the current session.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to `DBMS_OUTPUT`.

The procedure may raise the following errors:

- `ORA-01031`: if the caller does not have sufficient privileges.
- `ORA-04153`: if the context handle is invalid.

121.3.22 SET_ICS_STDERR Procedure

This procedure redirects the `stderr` stream of the inlined MLE call specification context to the given `CLOB` for the calling user in the current session. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.SET_ICS_STDERR(
    name          IN          VARCHAR2,
    sink          IN OUT      NOCOPY CLOB CHARACTER SET ANY_CS);
```

Parameters

Table 121-21 SET_ICS_STDERR Procedure Parameters

Parameter	Description
<code>name</code>	The name of the inlined MLE call specification.
<code>sink</code>	The <code>CLOB</code> to redirect <code>stderr</code> to.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to the new sink.

The procedure may raise the following errors:

- `ORA-01031`: if the caller does not have sufficient privileges.
- `ORA-04043`: if the call specification does not exist.
- `ORA-06530`: if the sink is `NULL`.

121.3.23 SET_ICS_STDERR_TO_DBMS_OUTPUT Procedure

This procedure redirects the `stderr` stream of the inlined MLE call specification context to `DBMS_OUTPUT` for the calling user in the current session. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.SET_ICS_STDERR_TO_DBMS_OUTPUT(
    name          IN          VARCHAR2);
```


Parameters

Table 121-22 SET_ICS_STDERR_TO_DBMS_OUTPUT Procedure Parameters

Parameter	Description
name	The name of the inlined MLE call specification.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to DBMS_OUTPUT.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04043: if the call specification does not exist.

121.3.24 SET_ICS_STDOUT Procedure

This procedure redirects the `stdout` stream of an inlined MLE call specification context in the current session to the given CLOB.

Syntax

```
DBMS_MLE.SET_ICS_STDOUT(
    name          IN          VARCHAR2,
    sink          IN          OUT NOCOPY CLOB CHARACTER SET ANY_CS);
```

Parameters

Table 121-23 SET_ICS_STDOUT Procedure Parameters

Parameter	Description
name	The name of the inlined MLE call specification.
sink	The CLOB sink to redirect <code>stdout</code> to. Providing a NULL value will result in an ORA-06530 error.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to the new sink.

This procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04043: if the call specification does not exist.
- ORA-06530: if the sink is NULL.

121.3.25 SET_ICS_STDOUT_TO_DBMS_OUTPUT Procedure

This procedure redirects the `stdout` stream of the inlined call specification context to `DBMS_OUTPUT` for the calling user in the current session. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.SET_ICS_STDOUT_TO_DBMS_OUTPUT (
    name          IN          VARCHAR2);
```

Parameters

Table 121-24 SET_ICS_STDOUT_TO_DBMS_OUTPUT Procedure Parameters

Parameter	Description
name	The name of the inlined call specification.

Usage Notes

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to `DBMS_OUTPUT`.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04043: if the call specification does not exist.

121.3.26 SET_STDERR Procedure

This procedure redirects the `stderr` stream of MLE contexts to the given `CLOB`. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.SET_STDERR (
    sink          IN OUT          NOCOPY CLOB CHARACTER SET ANY_CS);
```

```
DBMS_MLE.SET_STDERR (
    module_name   IN              VARCHAR2,
    sink          IN OUT          NOCOPY CLOB CHARACTER SET ANY_CS);
```

```
DBMS_MLE.SET_STDERR (
    module_name   IN              VARCHAR2,
    env_name      IN              VARCHAR2,
    sink          IN OUT          NOCOPY CLOB CHARACTER SET ANY_CS);
```

Parameters

Table 121-25 SET_STDERR Procedure Parameters

Parameter	Description
<code>module_name</code>	The name of the MLE module.
<code>env_name</code>	The name of the MLE environment.
<code>sink</code>	The CLOB to redirect <code>stdout</code> to.

Usage Notes

When called without parameters, this procedure applies to all existing contexts and contexts created in the future. Otherwise, only the context associated with the given module (or module and environment combination) is affected.

If no environment is specified, the context defined by the given module and the built-in environment is used.

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to the new sink.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges.
- ORA-04103: if the module does not exist.
- ORA-04105: if the environment does not exist.
- ORA-06530: if the sink is `NULL`.

121.3.27 SET_STDERR_TO_DBMS_OUTPUT Procedure

This procedure redirects the `stderr` stream of MLE contexts to `DBMS_OUTPUT`. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.SET_STDERR_TO_DBMS_OUTPUT();
```

```
DBMS_MLE.SET_STDERR_TO_DBMS_OUTPUT(
  module_name      IN          VARCHAR2);
```

```
DBMS_MLE.SET_STDERR_TO_DBMS_OUTPUT(
  module_name      IN          VARCHAR2,
  env_name         IN          VARCHAR2);
```

Parameters

Table 121-26 SET_STDERR_TO_DBMS_OUTPUT Function Parameters

Parameter	Description
<code>module_name</code>	The name of the MLE module.

Table 121-26 (Cont.) SET_STDERR_TO_DBMS_OUTPUT Function Parameters

Parameter	Description
env_name	The name of the MLE environment.

Usage Notes

When called without parameters, this procedure applies to all existing contexts and contexts created in the future. Otherwise, only the context associated with the given module (or module and environment combination) is affected.

If no environment is specified, the context defined by the given module and the built-in environment is used.

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to DBMS_OUTPUT.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges
- ORA-04103: if the module does not exist
- ORA-04105: if the environment does not exist

121.3.28 SET_STDOUT Procedure

This procedure redirects the `stdout` stream of MLE contexts to the given CLOB. You need the EXECUTE DYNAMIC MLE privilege to execute this function.

Syntax

```
DBMS_MLE.SET_STDOUT (
    sink          IN OUT  NOCOPY CLOB CHARACTER SET ANY_CS);
```

```
DBMS_MLE.SET_STDOUT (
    module_name  IN      VARCHAR2,
    sink        IN OUT  NOCOPY CLOB CHARACTER SET ANY_CS);
```

```
DBMS_MLE.SET_STDOUT (
    module_name  IN      VARCHAR2,
    env_name     IN      VARCHAR2,
    sink        IN OUT  NOCOPY CLOB CHARACTER SET ANY_CS);
```

Parameters

Table 121-27 SET_STDOUT Procedure Parameters

Parameter	Description
module_name	The name of the MLE module.
env_name	The name of the MLE environment.
sink	The CLOB to redirect stdout to.

Usage Notes

When called without parameters, this procedure applies to all existing contexts and contexts created in the future. Otherwise, only the context associated with the given module (or module and environment combination) is affected.

If no environment is specified, the context defined by the given module and the built-in environment is used.

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to the new sink.

The procedure may raise the following errors:

- ORA-01031: if the caller does not have sufficient privileges
- ORA-04103: if the module does not exist
- ORA-04105: if the environment does not exist
- ORA-06530: if the sink is NULL.

121.3.29 SET_STDOUT_TO_DBMS_OUTPUT Procedure

This procedure redirects the `stdout` stream of MLE contexts to `DBMS_OUTPUT`. You need the `EXECUTE DYNAMIC MLE` privilege to execute this function.

Syntax

```
DBMS_MLE.SET_STDOUT_TO_DBMS_OUTPUT();

DBMS_MLE.SET_STDOUT_TO_DBMS_OUTPUT(
    module_name    IN    VARCHAR2);

DBMS_MLE.SET_STDOUT_TO_DBMS_OUTPUT(
    module_name    IN    VARCHAR2,
    env_name       IN    VARCHAR2);
```

Parameters

Table 121-28 SET_STDOUT_TO_DBMS_OUTPUT Function Parameters

Parameter	Description
<code>module_name</code>	The name of the MLE module.
<code>env_name</code>	The name of the MLE environment.

Usage Notes

When called without parameters, this procedure applies to all existing contexts and contexts created in the future. Otherwise, only the context associated with the given module (or module and environment combination) is affected.

If no environment is specified, the context defined by the given module and the built-in environment is used.

Any output that was buffered so far gets flushed to the pre-existing sink before redirecting to `DBMS_OUTPUT`.

The procedure may raise the following errors:

- `ORA-01031`: if the caller does not have sufficient privileges
- `ORA-04103`: if the module does not exist
- `ORA-04105`: if the environment does not exist

DBMS_MONITOR

The `DBMS_MONITOR` package enables you to use PL/SQL for controlling additional tracing and statistics gathering.

The chapter contains the following topics:

- [Summary of DBMS_MONITOR Subprograms](#)

122.1 Summary of DBMS_MONITOR Subprograms

This table lists the `DBMS_MONITOR` subprograms and briefly describes them.

Table 122-1 DBMS_MONITOR Package Subprograms

Subprogram	Description
CLIENT_ID_STAT_DISABLE Procedure	Disables statistic gathering previously enabled for a given Client Identifier
CLIENT_ID_STAT_ENABLE Procedure	Enables statistic gathering for a given Client Identifier
CLIENT_ID_TRACE_DISABLE Procedure	Disables the trace previously enabled for a given Client Identifier globally for the database
CLIENT_ID_TRACE_ENABLE Procedure	Enables the trace for a given Client Identifier globally for the database
DATABASE_TRACE_DISABLE Procedure	Disables SQL trace for the whole database or a specific instance
DATABASE_TRACE_ENABLE Procedure	Enables SQL trace for the whole database or a specific instance
SERV_MOD_ACT_STAT_DISABLE Procedure	Disables statistic gathering enabled for a given combination of Service Name, <code>MODULE</code> and <code>ACTION</code>
SERV_MOD_ACT_STAT_ENABLE Procedure	Enables statistic gathering for a given combination of Service Name, <code>MODULE</code> and <code>ACTION</code>
SERV_MOD_ACT_TRACE_DISABLE Procedure	Disables the trace for <code>ALL</code> enabled instances for a or a given combination of Service Name, <code>MODULE</code> and <code>ACTION</code> name globally
SERV_MOD_ACT_TRACE_ENABLE Procedure	Enables SQL tracing for a given combination of Service Name, <code>MODULE</code> and <code>ACTION</code> globally unless an <code>instance_name</code> is specified
SESSION_TRACE_DISABLE Procedure	Disables the previously enabled trace for a given database session identifier (SID) on the local instance
SESSION_TRACE_ENABLE Procedure	Enables the trace for a given database session identifier (SID) on the local instance

122.1.1 CLIENT_ID_STAT_DISABLE Procedure

This procedure will disable statistics accumulation for all instances and remove the accumulated results from V\$CLIENT_STATS view enabled by the CLIENT_ID_STAT_ENABLE Procedure.

Syntax

```
DBMS_MONITOR.CLIENT_ID_STAT_DISABLE(  
    client_id          IN   VARCHAR2);
```

Parameters

Table 122-2 CLIENT_ID_STAT_DISABLE Procedure Parameters

Parameter	Description
client_id	Client Identifier for which statistic aggregation is disabled

Examples

To disable accumulation:

```
EXECUTE DBMS_MONITOR.CLIENT_ID_STAT_DISABLE('janedoe');
```

122.1.2 CLIENT_ID_STAT_ENABLE Procedure

This procedure enables statistic gathering for a given Client Identifier.

Statistics gathering is global for the database and persistent across instance starts and restarts. That is, statistics are enabled for all instances of the same database, including restarts. Statistics are viewable through V\$CLIENT_STATS views.

Syntax

```
DBMS_MONITOR.CLIENT_ID_STAT_ENABLE(  
    client_id          IN   VARCHAR2);
```

Parameters

Table 122-3 CLIENT_ID_STAT_ENABLE Procedure Parameters

Parameter	Description
client_id	Client Identifier for which statistic aggregation is enabled

Examples

To enable statistic accumulation for a client with a given client ID:

```
EXECUTE DBMS_MONITOR.CLIENT_ID_STAT_ENABLE('janedoe');
```


122.1.3 CLIENT_ID_TRACE_DISABLE Procedure

This procedure will disable tracing enabled by the CLIENT_ID_TRACE_ENABLE Procedure.

Syntax

```
DBMS_MONITOR.CLIENT_ID_TRACE_DISABLE(
  client_id  IN  VARCHAR2);
```

Parameters

Table 122-4 CLIENT_ID_TRACE_DISABLE Procedure Parameters

Parameter	Description
client_id	Client Identifier for which SQL tracing is disabled

Examples

```
EXECUTE DBMS_MONITOR.CLIENT_ID_TRACE_DISABLE ('janedoe');
```

122.1.4 CLIENT_ID_TRACE_ENABLE Procedure

This procedure will enable the trace for a given client identifier globally for the database.

Syntax

```
DBMS_MONITOR.CLIENT_ID_TRACE_ENABLE(
  client_id  IN  VARCHAR2,
  waits      IN  BOOLEAN DEFAULT TRUE,
  binds      IN  BOOLEAN DEFAULT FALSE,
  plan_stat  IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 122-5 CLIENT_ID_TRACE_ENABLE Procedure Parameters

Parameter	Description
client_id	Database Session Identifier for which SQL tracing is enabled
waits	If TRUE, wait information is present in the trace
binds	If TRUE, bind information is present in the trace
plan_stat	Frequency at which we dump row source statistics. Value should be 'NEVER', 'FIRST_EXECUTION' (equivalent to NULL) or 'ALL_EXECUTIONS'.

Usage Notes

- The trace will be written to multiple trace files because more than one Oracle shadow process can work on behalf of a given client identifier.
- The tracing is enabled for all instances and persistent across restarts.

Examples

```
EXECUTE DBMS_MONITOR.CLIENT_ID_TRACE_ENABLE('janedoe', TRUE,
FALSE);
```

122.1.5 DATABASE_TRACE_DISABLE Procedure

This procedure disables SQL trace for the whole database or a specific instance.

Syntax

```
DBMS_MONITOR.DATABASE_TRACE_DISABLE (
    instance_name IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 122-6 DATABASE_TRACE_DISABLE Procedure Parameters

Parameter	Description
instance_name	Disables tracing for the named instance

122.1.6 DATABASE_TRACE_ENABLE Procedure

This procedure enables SQL trace for the whole database or a specific instance.

Syntax

```
DBMS_MONITOR.DATABASE_TRACE_ENABLE (
    waits          IN BOOLEAN DEFAULT TRUE,
    binds          IN BOOLEAN DEFAULT FALSE,
    instance_name  IN VARCHAR2 DEFAULT NULL,
    plan_stat      IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 122-7 DATABASE_TRACE_ENABLE Procedure Parameters

Parameter	Description
waits	If TRUE, wait information will be present in the trace
binds	If TRUE, bind information will be present in the trace
instance_name	If set, restricts tracing to the named instance
plan_stat	Frequency at which we dump row source statistics. Value should be 'NEVER', 'FIRST_EXECUTION' (equivalent to NULL) or 'ALL_EXECUTIONS'.

122.1.7 SERV_MOD_ACT_STAT_DISABLE Procedure

This procedure will disable statistics accumulation and remove the accumulated results from V\$SERV_MOD_ACT_STATS view.

Statistics disabling is persistent for the database. That is, service statistics are disabled for instances of the same database (plus dblinks that have been activated as a result of the enable).

Syntax

```
DBMS_MONITOR.SERV_MOD_ACT_STAT_DISABLE (
  service_name  IN VARCHAR2,
  module_name   IN VARCHAR2,
  action_name   IN VARCHAR2 DEFAULT ALL_ACTIONS);
```

Parameters

Table 122-8 SERV_MOD_ACT_STAT_DISABLE Procedure Parameters

Parameter	Description
service_name	Name of the service for which statistic aggregation is disabled
module_name	Name of the MODULE. An additional qualifier for the service. It is a required parameter.
action_name	Name of the ACTION. An additional qualifier for the Service and MODULE name. Omitting the parameter (or supplying ALL_ACTIONS constant) means enabling aggregation for all Actions for a given Service/MODULE combination. In this case, statistics are aggregated on the module level.

Usage Notes

Regarding statistics gathering, when you change the module or action, the change takes effect when the next user call is executed in the session. For example, if a module is set to 'module 1' in a session, and the module is reset to 'module 2' in a user call in the session, then the module remains 'module 1' during this user call. The module is changed to 'module 2' in the next user call in the session.

122.1.8 SERV_MOD_ACT_STAT_ENABLE Procedure

This procedure enables statistic gathering for a given combination of Service Name, MODULE and ACTION.

Calling this procedure enables statistic gathering for a hierarchical combination of Service name, MODULE name, and ACTION name on all instances for the same database. Statistics are accessible by means of the V\$SERV_MOD_ACT_STATS view.

Syntax

```
DBMS_MONITOR.SERV_MOD_ACT_STAT_ENABLE (
  service_name  IN VARCHAR2,
  module_name   IN VARCHAR2,
  action_name   IN VARCHAR2 DEFAULT ALL_ACTIONS);
```

Parameters

Table 122-9 SERV_MOD_ACT_STAT_ENABLE Procedure Parameters

Parameter	Description
<code>service_name</code>	Name of the service for which statistic aggregation is enabled
<code>module_name</code>	Name of the <code>MODULE</code> . An additional qualifier for the service. It is a required parameter.
<code>action_name</code>	Name of the <code>ACTION</code> . An additional qualifier for the Service and <code>MODULE</code> name. Omitting the parameter (or supplying <code>ALL_ACTIONS</code> constant) means enabling aggregation for all Actions for a given Service/ <code>MODULE</code> combination. In this case, statistics are aggregated on the module level.

Usage Notes

Enabling statistic aggregation for the given combination of Service/Module/Action names is slightly complicated by the fact that the Module/Action values can be empty strings which are indistinguishable from NULLs. For this reason, we adopt the following conventions:

A special constant (unlikely to be a real action names) is defined:

```
ALL_ACTIONS constant VARCHAR2 := '###ALL_ACTIONS';
```

Using `ALL_ACTIONS` for an action specification means that aggregation is enabled for all actions with a given module name, while using `NULL` (or empty string) means that aggregation is enabled for an action whose name is an empty string.

Regarding statistics gathering, when you change the module or action, the change takes effect when the next user call is executed in the session. For example, if a module is set to 'module 1' in a session, and the module is reset to 'module 2' in a user call in the session, then the module remains 'module 1' during this user call. The module is changed to 'module 2' in the next user call in the session.

Examples

To enable statistic accumulation for a given combination of Service name and `MODULE`:

```
EXECUTE DBMS_MONITOR.SERV_MOD_ACT_STAT_ENABLE( 'APPS1', 'PAYROLL');
```

To enable statistic accumulation for a given combination of Service name, `MODULE` and `ACTION`:

```
EXECUTE
DBMS_MONITOR.SERV_MOD_ACT_STAT_ENABLE('APPS1', 'GLEDGER', 'DEBIT_ENTRY');
```

If both of the preceding commands are issued, statistics are accumulated as follows:

- For the `APPS1` service, because accumulation for each Service Name is the default.
- For all actions in the `PAYROLL` Module.
- For the `DEBIT_ENTRY` Action within the `GLEDGER` Module.

122.1.9 SERV_MOD_ACT_TRACE_DISABLE Procedure

This procedure will disable the trace at ALL enabled instances for a given combination of Service Name, MODULE, and ACTION name globally.

Syntax

```
DBMS_MONITOR.SERV_MOD_ACT_TRACE_DISABLE (
  service_name  IN  VARCHAR2,
  module_name   IN  VARCHAR2,
  action_name   IN  VARCHAR2 DEFAULT ALL_ACTIONS,
  instance_name IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 122-10 SERV_MOD_ACT_TRACE_DISABLE Procedure Parameters

Parameter	Description
service_name	Name of the service for which tracing is disabled.
module_name	Name of the MODULE. An additional qualifier for the service
action_name	Name of the ACTION. An additional qualifier for the Service and MODULE name.
instance_name	If set, this restricts tracing to the named instance_name

Usage Notes

Specifying NULL for the module_name parameter means that statistics will no longer be accumulated for the sessions which do not set the MODULE attribute.

Examples

To enable tracing for a Service named APPS1:

```
EXECUTE DBMS_MONITOR.SERV_MOD_ACT_TRACE_ENABLE ('APPS1',
  DBMS_MONITOR.ALL_MODULES, DBMS_MONITOR.ALL_ACTIONS, TRUE,
  FALSE, NULL);
```

To disable tracing specified in the previous step:

```
EXECUTE DBMS_MONITOR.SERV_MOD_ACT_TRACE_DISABLE ('APPS1');
```

To enable tracing for a given combination of Service and MODULE (all ACTIONS):

```
EXECUTE DBMS_MONITOR.SERV_MOD_ACT_TRACE_ENABLE ('APPS1', 'PAYROLL',
  DBMS_MONITOR.ALL_ACTIONS, TRUE, FALSE, NULL);
```

To disable tracing specified in the previous step:

```
EXECUTE DBMS_MONITOR.SERV_MOD_ACT_TRACE_DISABLE ('APPS1', 'PAYROLL');
```

122.1.10 SERV_MOD_ACT_TRACE_ENABLE Procedure

This procedure will enable SQL tracing for a given combination of Service Name, MODULE and ACTION globally unless an instance_name is specified.

Syntax

```
DBMS_MONITOR.SERV_MOD_ACT_TRACE_ENABLE (
    service_name      IN VARCHAR2,
    module_name       IN VARCHAR2 DEFAULT ANY_MODULE,
    action_name       IN VARCHAR2 DEFAULT ANY_ACTION,
    waits             IN BOOLEAN DEFAULT TRUE,
    binds             IN BOOLEAN DEFAULT FALSE,
    instance_name     IN VARCHAR2 DEFAULT NULL,
    plan_stat         IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 122-11 SERV_MOD_ACT_TRACE_ENABLE Procedure Parameters

Parameter	Description
service_name	Name of the service for which SQL trace is enabled
module_name	Name of the MODULE for which SQL trace is enabled. An optional additional qualifier for the service. If omitted, SQL trace is enabled for all modules and actions in a given service.
action_name	Name of the ACTION for which SQL trace is enabled. An optional additional qualifier for the Service and MODULE name. If omitted, SQL trace is enabled for all actions in a given module.
waits	If TRUE, wait information is present in the trace
binds	If TRUE, bind information is present in the trace
instance_name	If set, this restricts tracing to the named instance_name
plan_stat	Frequency at which we dump row source statistics. Value should be 'NEVER', 'FIRST_EXECUTION' (equivalent to NULL) or 'ALL_EXECUTIONS'.

Usage Notes

- The procedure enables a trace for a given combination of Service, MODULE and ACTION name. The specification is strictly hierarchical: Service Name or Service Name/MODULE, or Service Name, MODULE, and ACTION name must be specified. Omitting a qualifier behaves like a wild-card, so that not specifying an ACTION means all ACTIONS. Using the ALL_ACTIONS constant achieves the same purpose.
- This tracing is useful when an application MODULE and optionally known ACTION is experiencing poor service levels.
- By default, tracing is enabled globally for the database. The instance_name parameter is provided to restrict tracing to named instances that are known, for example, to exhibit poor service levels.
- Tracing information is present in multiple trace files and you must use the trcsess tool to collect it into a single file.

- Specifying NULL for the `module_name` parameter means that statistics will be accumulated for the sessions which do not set the `MODULE` attribute.

Examples

To enable tracing for a Service named APPS1:

```
EXECUTE DBMS_MONITOR.SERV_MOD_ACT_TRACE_ENABLE('APPS1',
        DBMS_MONITOR.ALL_MODULES, DBMS_MONITOR.ALL_ACTIONS, TRUE,
FALSE, NULL);
```

To enable tracing for a given combination of Service and MODULE (all ACTIONS):

```
EXECUTE DBMS_MONITOR.SERV_MOD_ACT_TRACE_ENABLE('APPS1', 'PAYROLL',
        DBMS_MONITOR.ALL_ACTIONS, TRUE, FALSE, NULL);
```

122.1.11 SESSION_TRACE_DISABLE Procedure

This procedure will disable the trace for a given database session at the local instance.

Syntax

```
DBMS_MONITOR.SESSION_TRACE_DISABLE(
    session_id    IN    BINARY_INTEGER DEFAULT NULL,
    serial_num    IN    BINARY_INTEGER DEFAULT NULL);
```

Parameters

Table 122-12 SESSION_TRACE_DISABLE Procedure Parameters

Parameter	Description
<code>session_id</code>	Database Session Identifier for which SQL trace is disabled
<code>serial_num</code>	Serial number for this session

Usage Notes

If `serial_num` is NULL but `session_id` is specified, a session with a given `session_id` is no longer traced irrespective of its serial number. If both `session_id` and `serial_num` are NULL, the current user session is no longer traced. It is illegal to specify NULL `session_id` and non-NULL `serial_num`. In addition, the NULL values are default and can be omitted.

Examples

To enable tracing for a client with a given client session ID:

```
EXECUTE DBMS_MONITOR.SESSION_TRACE_ENABLE(7,4634, TRUE, FALSE);
```

To disable tracing specified in the previous step:

```
EXECUTE DBMS_MONITOR.SESSION_TRACE_DISABLE(7,4634);;
```

122.1.12 SESSION_TRACE_ENABLE Procedure

This procedure enables a SQL trace for the given Session ID on the local instance

Syntax

```
DBMS_MONITOR.SESSION_TRACE_ENABLE (
    session_id IN BINARY_INTEGER DEFAULT NULL,
    serial_num IN BINARY_INTEGER DEFAULT NULL,
    waits      IN BOOLEAN DEFAULT TRUE,
    binds     IN BOOLEAN DEFAULT FALSE,
    plan_stat  IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 122-13 SESSION_TRACE_ENABLE Procedure Parameters

Parameter	Description
session_id	Client Identifier for which SQL trace is enabled. If omitted (or NULL), the user's own session is assumed.
serial_num	Serial number for this session. If omitted (or NULL), only the session ID is used to determine a session.
waits	If TRUE, wait information is present in the trace
binds	If TRUE, bind information is present in the trace
plan_stat	Frequency at which we dump row source statistics. Value should be 'NEVER', 'FIRST_EXECUTION' (equivalent to NULL) or 'ALL_EXECUTIONS'.

Usage Notes

The procedure enables a trace for a given database session, and is still useful for client/server applications. The trace is enabled only on the instance to which the caller is connected, since database sessions do not span instances. This tracing is strictly local to an instance.

If serial_num is NULL but session_id is specified, a session with a given session_id is traced irrespective of its serial number. If both session_id and serial_num are NULL, the current user session is traced. It is illegal to specify NULL session_id and non-NULL serial_num. In addition, the NULL values are default and can be omitted.

Examples

To enable tracing for a client with a given client session ID:

```
EXECUTE DBMS_MONITOR.SESSION_TRACE_ENABLE(7,4634, TRUE, FALSE);
```

To disable tracing specified in the previous step:

```
EXECUTE DBMS_MONITOR.SESSION_TRACE_DISABLE(7,4634);
```

Either

```
EXECUTE DBMS_MONITOR.SESSION_TRACE_ENABLE(5);
```


or

```
EXECUTE DBMS_MONITOR.SESSION_TRACE_ENABLE(5, NULL);
```

traces the session with session ID of 5, while either

```
EXECUTE DBMS_MONITOR.SESSION_TRACE_ENABLE();
```

or

```
EXECUTE DBMS_MONITOR.SESSION_TRACE_ENABLE(NULL, NULL);
```

traces the current user session. Also,

```
EXECUTE DBMS_MONITOR.SESSION_TRACE_ENABLE(NULL, NULL, TRUE, TRUE);
```

traces the current user session including waits and binds. The same can be also expressed using keyword syntax:

```
EXECUTE DBMS_MONITOR.SESSION_TRACE_ENABLE(binds=>TRUE);
```

DBMS_MVIEW

DBMS_MVIEW enables you to understand capabilities for materialized views and potential materialized views, including their rewrite availability. It also enables you to refresh materialized views that are not part of the same refresh group and purge logs.



Note:

DBMS_MVIEW is a synonym for DBMS_SNAPSHOT.



See Also:

Oracle Database Data Warehousing Guide for more information about using materialized views in a data warehousing environment

This chapter contains the following topics:

- [Operational Notes](#)
- [Security Model](#)
- [Rules and Limits](#)
- [Summary of DBMS_MVIEW Subprograms](#)

123.1 DBMS_MVIEW Operational Notes

If a query is less than 256 characters long, you can invoke `EXPLAIN_REWRITE` using the `EXECUTE` command from SQL*Plus. Otherwise, the recommended method is to use a PL/SQL `BEGIN..END` block, as shown in the examples in `/rdbms/demo/smxrw.sql`.

123.2 DBMS_MVIEW Security Model

The `DBMS_MVIEW` package consists of a number of materialized view-related subprograms, each of which has different functionality and privilege requirements.

The privilege model is generally based on the invoker's right. Each package subprogram is executed by first checking the privileges against the invoker. If all the required privileges are met, the subprogram will be executed. Otherwise, an insufficient privileges error will be thrown.

123.3 DBMS_MVIEW Rules and Limits

The `DBMS_MVIEW.EXPLAIN_REWRITE` procedure cannot accept queries longer than 32627 characters. These restrictions also apply when passing the defining query of a materialized view to the `DBMS_MVIEW.EXPLAIN_MVIEW` procedure.

123.4 Summary of DBMS_MVIEW Subprograms

This table lists the `DBMS_MVIEW` subprograms and briefly describes them.

Table 123-1 DBMS_MVIEW Package Subprograms

Subprogram	Description
<code>BEGIN_TABLE_REORGANIZATION Procedure</code>	Performs a process to preserve materialized view data needed for refresh
<code>END_TABLE_REORGANIZATION Procedure</code>	Ensures that the materialized view data for the master table is valid and that the master table is in the proper state
<code>ESTIMATE_MVIEW_SIZE Procedure</code>	Estimates the size of a materialized view that you might create, in bytes and rows
<code>EXPLAIN_MVIEW Procedure</code>	Explains what is possible with a materialized view or potential materialized view
<code>EXPLAIN_REWRITE Procedure</code>	Explains why a query failed to rewrite or why the optimizer chose to rewrite a query with a particular materialized view or materialized views
<code>I_AM_A_REFRESH Function</code>	Returns the value of the <code>I_AM_REFRESH</code> package state
<code>PMARKER Function</code>	Returns a partition marker from a rowid, and is used for Partition Change Tracking (PCT)
<code>PURGE_DIRECT_LOAD_LOG Procedure</code>	Purges rows from the direct loader log after they are no longer needed by any materialized views (used with data warehousing)
<code>PURGE_LOG Procedure</code>	Purges rows from the materialized view log
<code>PURGE_MVIEW_FROM_LOG Procedure</code>	Purges rows from the materialized view log
<code>REFRESH Procedures</code>	Refreshes one or more materialized views that are not members of the same refresh group
<code>REFRESH_ALL_MVIEWS Procedure</code>	Refreshes all materialized views that do not reflect changes to their master table or master materialized view
<code>REFRESH_DEPENDENT Procedures</code>	Refreshes all table-based materialized views that depend on a specified master table or master materialized view, or list of master tables or master materialized views
<code>REGISTER_MVIEW Procedure</code>	Enables the administration of individual materialized views
<code>UNREGISTER_MVIEW Procedure</code>	Enables the administration of individual materialized views once invoked at a master site or master materialized view site to unregister a materialized view

123.4.1 BEGIN_TABLE_REORGANIZATION Procedure

This procedure performs a process to preserve materialized view data needed for refresh. It must be called before a master table is reorganized.

Syntax

```
DBMS_MVIEW.BEGIN_TABLE_REORGANIZATION (
    tabowner    IN  VARCHAR2,
    tabname     IN  VARCHAR2);
```

Parameters

Table 123-2 BEGIN_TABLE_REORGANIZATION Procedure Parameters

Parameter	Description
tabowner	Owner of the table being reorganized
tabname	Name of the table being reorganized

123.4.2 END_TABLE_REORGANIZATION Procedure

This procedure ensures that the materialized view data for the master table is valid and that the master table is in the proper state. It must be called after a master table is reorganized.

Syntax

```
DBMS_MVIEW.END_TABLE_REORGANIZATION (
    tabowner    IN  VARCHAR2,
    tabname     IN  VARCHAR2);
```

Parameters

Table 123-3 END_TABLE_REORGANIZATION Procedure Parameters

Parameter	Description
tabowner	Owner of the table being reorganized
tabname	Name of the table being reorganized

123.4.3 ESTIMATE_MVIEW_SIZE Procedure

This procedure estimates the size of a materialized view that you might create, in bytes and number of rows.

Syntax

```
DBMS_MVIEW.ESTIMATE_MVIEW_SIZE (
    stmt_id      IN  VARCHAR2,
    select_clause IN  VARCHAR2,
    num_rows     OUT NUMBER,
    num_bytes    OUT NUMBER);
```

Parameters

Table 123-4 ESTIMATE_MVIEW_SIZE Procedure Parameters

Parameter	Description
stmt_id	Arbitrary string used to identify the statement in an EXPLAIN PLAN
select_clause	The SELECT statement to be analyzed
num_rows	Estimated cardinality
num_bytes	Estimated number of bytes

123.4.4 EXPLAIN_MVIEW Procedure

This procedure enables you to learn what is possible with a materialized view or potential materialized view. For example, you can determine if a materialized view is fast refreshable and what types of query rewrite you can perform with a particular materialized view.

Using this procedure is straightforward. You simply call `DBMS_MVIEW.EXPLAIN_MVIEW`, passing in as parameters the schema and materialized view name for an existing materialized view. Alternatively, you can specify the `SELECT` string or `CREATE MATERIALIZED VIEW` statement for a potential materialized view. The materialized view or potential materialized view is then analyzed and the results are written into either a table called `MV_CAPABILITIES_TABLE`, which is the default, or to an array called `MSG_ARRAY`.

The procedure is overloaded:

- The first version is for explaining an existing or potential materialized view with output to `MV_CAPABILITIES_TABLE`.
- The second version is for explaining an existing or potential materialized view with output to a `VARRAY`.

Syntax

```
DBMS_MVIEW.EXPLAIN_MVIEW (
  mv          IN VARCHAR2,
  statement_id IN VARCHAR2:= NULL);

DBMS_MVIEW.EXPLAIN_MVIEW (
  mv          IN VARCHAR2,
  msg_array   OUT SYS.ExplainMVArrayType);
```

Parameters

Table 123-5 EXPLAIN_MVIEW Procedure Parameters

Parameter	Description
mv	The name of an existing materialized view (optionally qualified with the owner name separated by a ".") or a SELECT statement or a CREATE MATERIALIZED VIEW statement for a potential materialized view.

Table 123-5 (Cont.) EXPLAIN_MVIEW Procedure Parameters

Parameter	Description
<code>statement_id</code>	A client-supplied unique identifier to associate output rows with specific invocations of <code>EXPLAIN_MVIEW</code>
<code>msg_array</code>	The PL/SQL <code>VARRAY</code> that receives the output. Use this parameter to direct <code>EXPLAIN_MVIEW</code> 's output to a PL/SQL <code>VARRAY</code> rather than <code>MV_CAPABILITIES_TABLE</code> .

Usage Notes

- You must run the `utlxmlv.sql` script to create `MV_CAPABILITIES_TABLE` in the current schema prior to calling `EXPLAIN_MVIEW` except when you direct output to a `VARRAY`. The script is found in the `ADMIN` directory.
- In Oracle database version 19.18, the following capability is added and is displayed while explaining a materialized view using `dbms_mview.explain_mview`. It indicates that the materialized view is eligible for LPCT fast refresh:

```
REFRESH_FAST_LPT
```

**See Also:**

Oracle Database Data Warehousing Guide for more information about refresh methods for materialized view .

123.4.5 EXPLAIN_REWRITE Procedure

This procedure enables you to learn why a query failed to rewrite, or, if it rewrites, which materialized views will be used.

Using the results from the procedure, you can take the appropriate action needed to make a query rewrite if at all possible. The query specified in the `EXPLAIN_REWRITE` statement is never actually executed.

A demo file, `xrwutl.sql`, is available to help format the output from `EXPLAIN_REWRITE`.

Syntax

You can obtain the output from `DBMS_MVIEW.EXPLAIN_REWRITE` in two ways. The first is to use a table, while the second is to create a `VARRAY`. The following shows the basic syntax for using an output table:

```
DBMS_MVIEW.EXPLAIN_REWRITE (
  query          VARCHAR2,
  mv             VARCHAR2(30),
  statement_id   VARCHAR2(30));
```

You can create an output table called `REWRITE_TABLE` by executing the `utlxrw.sql` script.

The `query` parameter is a text string representing the SQL query. The parameter, `mv`, is a fully qualified materialized view name in the form of `schema.mv`. This is an optional parameter. When it is not specified, `EXPLAIN_REWRITE` returns any relevant messages regarding all the materialized views considered for rewriting the given query. When `schema` is omitted and only `mv` is specified, `EXPLAIN_REWRITE` looks for the materialized view in the current schema.

If you want to direct the output of `EXPLAIN_REWRITE` to a `VARRAY` instead of a table, you should call the procedure as follows:

```
DBMS_MVIEW.EXPLAIN_REWRITE (
    query          [VARCHAR2 | CLOB],
    mv             VARCHAR2(30),
    output_array   SYS.RewriteArrayType);
```

Note that if the query is less than 256 characters long, `EXPLAIN_REWRITE` can be easily invoked with the `EXECUTE` command from SQL*Plus. Otherwise, the recommended method is to use a PL/SQL `BEGIN... END` block, as shown in the examples in `/rdbms/demo/smxrw*`.

You can also use `EXPLAIN_REWRITE` with multiple materialized views, in which case the syntax will be the same as with a single materialized view, except that the materialized views are specified by a comma-delimited string. For example, to find out whether a given set of materialized views `mv1`, `mv2`, and `mv3` could be used to rewrite the query, `query_txt`, and, if not, why not, use `EXPLAIN_REWRITE` as follows:

```
DBMS_MVIEW.EXPLAIN_REWRITE(query_txt, 'mv1, mv2, mv3')
```

See *Oracle Database Data Warehousing Guide* for more information on using the `EXPLAIN_REWRITE` procedure.

Parameters

Table 123-6 EXPLAIN_REWRITE Procedure Parameters

Parameter	Description
<code>query</code>	SQL <code>SELECT</code> statement to be explained
<code>mv</code>	The fully qualified name of an existing materialized view in the form of <code>SCHEMA.MV</code> . For multiple materialized views, you can provide a comma-delimited list of names.
<code>statement_id</code>	A client-supplied unique identifier to distinguish output messages
<code>msg_array</code>	The PL/SQL <code>VARRAY</code> that receives the output. Use this parameter to direct <code>EXPLAIN_REWRITE</code> 's output to a PL/SQL <code>VARRAY</code> .

Usage Notes

To obtain the output into a table, you must run the `utlxrw.sql` script before calling `EXPLAIN_REWRITE`. This script creates a table named `REWRITE_TABLE` in the current schema.

123.4.6 I_AM_A_REFRESH Function

This function returns the value of the I_AM_REFRESH package state.

Syntax

```
DBMS_MVIEW.I_AM_A_REFRESH
    RETURN BOOLEAN;
```

Return Values

A return value of `true` indicates that all local replication triggers for materialized views are effectively disabled in this session because each replication trigger first checks this state. A return value of `false` indicates that these triggers are enabled.

123.4.7 PMARKER Function

This function returns a partition marker from a rowid. It is used for Partition Change Tracking (PCT).

Syntax

```
DBMS_MVIEW.PMARKER (
    rid IN ROWID)
    RETURN NUMBER;
```

Parameters

Table 123-7 PMARKER Function Parameters

Parameter	Description
rid	The rowid of a row entry in a master table

123.4.8 PURGE_DIRECT_LOAD_LOG Procedure

This procedure removes entries from the direct loader log after they are no longer needed for any known materialized view. This procedure usually is used in environments using Oracle's data warehousing technology.

Syntax

```
DBMS_MVIEW.PURGE_DIRECT_LOAD_LOG();
```

123.4.9 PURGE_LOG Procedure

This procedure purges rows from the materialized view log.

Syntax

```
DBMS_MVIEW.PURGE_LOG (
    master      IN   VARCHAR2,
    num         IN   BINARY_INTEGER := 1,
    flag        IN   VARCHAR2      := 'NOP');
```


Parameters

Table 123-8 PURGE_LOG Procedure Parameters

Parameter	Description
master	Name of the master table or master materialized view.
num	<p>Number of least recently refreshed materialized views whose rows you want to remove from materialized view log. For example, the following statement deletes rows needed to refresh the two least recently refreshed materialized views:</p> <pre>DBMS_MVIEW.PURGE_LOG('master_table', 2);</pre> <p>To delete all rows in the materialized view log, indicate a high number of materialized views to disregard, as in this example:</p> <pre>DBMS_MVIEW.PURGE_LOG('master_table', 9999);</pre> <p>This statement completely purges the materialized view log that corresponds to <code>master_table</code> if fewer than 9999 materialized views are based on <code>master_table</code>. A simple materialized view whose rows have been purged from the materialized view log must be completely refreshed the next time it is refreshed.</p>
flag	<p>Specify <code>delete</code> to guarantee that rows are deleted from the materialized view log for at least one materialized view. This parameter can override the setting for the parameter <code>num</code>. For example, the following statement deletes rows from the materialized view log that has dependency rows in the least recently refreshed materialized view:</p> <pre>DBMS_MVIEW.PURGE_LOG('master_table', 1, 'delete');</pre>

123.4.10 PURGE_MVIEW_FROM_LOG Procedure

This procedure is called on the master site or master materialized view site to delete the rows in materialized view refresh related data dictionary tables maintained at the master for the specified materialized view identified by `mview_id` or the combination of `mviewowner`, `mviewname`, and `mviewsite`.

If the materialized view specified is the oldest materialized view to have refreshed from any of the master tables or master materialized views, then the materialized view log is also purged. This procedure does not unregister the materialized view.

Syntax

```
DBMS_MVIEW.PURGE_MVIEW_FROM_LOG (
    mview_id      IN    BINARY_INTEGER);
```

```
DBMS_MVIEW.PURGE_MVIEW_FROM_LOG (
    mviewowner    IN    VARCHAR2,
    mviewname     IN    VARCHAR2,
    mviewsite     IN    VARCHAR2);
```

 **Note:**

This procedure is overloaded. The parameter `mview_id` is mutually exclusive with the three remaining parameters: `mviewowner`, `mviewname`, and `mviewsite`.

Parameters**Table 123-9 PURGE_MVIEW_FROM_LOG Procedure Parameters**

Parameter	Description
<code>mview_id</code>	If you want to execute this procedure based on the identification of the target materialized view, specify the materialized view identification using the <code>mview_id</code> parameter. Query the <code>DBA_BASE_TABLE_MVIEWS</code> view at the materialized view log site for a listing of materialized view IDs. Executing this procedure based on the materialized view identification is useful if the target materialized view is not listed in the list of registered materialized views (<code>DBA_REGISTERED_MVIEWS</code>).
<code>mviewowner</code>	If you do not specify an <code>mview_id</code> , enter the owner of the target materialized view using the <code>mviewowner</code> parameter. Query the <code>DBA_REGISTERED_MVIEWS</code> view at the materialized view log site to view the materialized view owners.
<code>mviewname</code>	If you do not specify an <code>mview_id</code> , enter the name of the target materialized view using the <code>mviewname</code> parameter. Query the <code>DBA_REGISTERED_MVIEWS</code> view at the materialized view log site to view the materialized view names.
<code>mviewsite</code>	If you do not specify an <code>mview_id</code> , enter the site of the target materialized view using the <code>mviewsite</code> parameter. Query the <code>DBA_REGISTERED_MVIEWS</code> view at the materialized view log site to view the materialized view sites.

Usage Notes

If there is an error while purging one of the materialized view logs, the successful purge operations of the previous materialized view logs are not rolled back. This is to minimize the size of the materialized view logs. In case of an error, this procedure can be invoked again until all the materialized view logs are purged.

123.4.11 REFRESH Procedures

This procedure refreshes a list of materialized views.

Syntax

```
DBMS_MVIEW.REFRESH (
  { list          IN      VARCHAR2,
    | tab         IN      DBMS_UTILITY.UNCL_ARRAY, }
  method        IN      VARCHAR2      := NULL,
  rollback_seg  IN      VARCHAR2      := NULL,
  push_deferred_rpc IN    BOOLEAN      := true,
  refresh_after_errors IN    BOOLEAN   := false,
  purge_option   IN      BINARY_INTEGER := 1,
  parallelism    IN      BINARY_INTEGER := 0,
  heap_size      IN      BINARY_INTEGER := 0,
  atomic_refresh IN      BOOLEAN       := true,
```

```
nested          IN      BOOLEAN      := false,
out_of_place    IN      BOOLEAN      := false,
skip_ext_data   IN      BOOLEAN      := false);
```

 **Note:**

This procedure is overloaded. The `list` and `tab` parameters are mutually exclusive.

Parameters

Table 123-10 REFRESH Procedure Parameters

Parameter	Description
<code>list</code> <code>tab</code>	<p>Comma-delimited list of materialized views that you want to refresh. (Synonyms are not supported.) These materialized views can be located in different schemas and have different master tables or master materialized views. However, all of the listed materialized views must be in your local database.</p> <p>Alternatively, you may pass in a PL/SQL index-by table of type <code>DBMS_UTILITY.UNCL_ARRAY</code>, where each element is the name of a materialized view.</p>
<code>method</code>	<p>A string of refresh methods indicating how to refresh the listed materialized views. An <code>f</code> indicates fast refresh, <code>?</code> indicates force refresh, <code>C</code> or <code>c</code> indicates complete refresh, and <code>A</code> or <code>a</code> indicates always refresh. <code>A</code> and <code>C</code> are equivalent. <code>P</code> or <code>p</code> refreshes by recomputing the rows in the materialized view affected by changed partitions in the detail tables. <code>L</code> or <code>l</code> indicates LPCT refresh, that is, recomputing the rows in the materialized view as per the logical partition of the base tables.</p>
<code>rollback_seg</code>	<p>Name of the materialized view site rollback segment to use while refreshing materialized views</p>

 **Note:**

"L" and "?" refreshes attempt a combined PCT and LCPT refresh. (physical and logical partitions).

If a materialized view does not have a corresponding refresh method (that is, if more materialized views are specified than refresh methods), then that materialized view is refreshed according to its default refresh method. For example, consider the following `EXECUTE` statement within `SQL*Plus`:

```
DBMS_MVIEW.REFRESH
('countries_mv,regions_mv,hr.employees_mv','cf');
```

This statement performs a complete refresh of the `countries_mv` materialized view, a fast refresh of the `regions_mv` materialized view, and a default refresh of the `hr.employees` materialized view.

Table 123-10 (Cont.) REFRESH Procedure Parameters

Parameter	Description
<code>push_deferred_rpc</code>	Used by updatable materialized views only. Set this parameter to <code>true</code> if you want to push changes from the materialized view to its associated master tables or master materialized views before refreshing the materialized view. Otherwise, these changes may appear to be temporarily lost.
<code>refresh_after_errors</code>	If this parameter is <code>true</code> , an updatable materialized view continues to refresh even if there are outstanding conflicts logged in the <code>DEFERROR</code> view for the materialized view's master table or master materialized view. If this parameter is <code>true</code> and <code>atomic_refresh</code> is <code>false</code> , this procedure continues to refresh other materialized views if it fails while refreshing a materialized view.
<code>purge_option</code>	If you are using the parallel propagation mechanism (in other words, <code>parallelism</code> is set to 1 or greater), 0 means do not purge, 1 means lazy purge, and 2 means aggressive purge. In most cases, lazy purge is the optimal setting. Set purge to aggressive to trim the queue if multiple master replication groups are pushed to different target sites, and updates to one or more replication groups are infrequent and infrequently pushed. If all replication groups are infrequently updated and pushed, then set this parameter to 0 and occasionally execute <code>PUSH</code> with this parameter set to 2 to reduce the queue.
<code>parallelism</code>	0 specifies serial propagation. $n > 1$ specifies parallel propagation with n parallel processes. 1 specifies parallel propagation using only one parallel process.
<code>heap_size</code>	Maximum number of transactions to be examined simultaneously for parallel propagation scheduling. Oracle automatically calculates the default setting for optimal performance. Note: Do not set this parameter unless directed to do so by Oracle Support Services.
<code>atomic_refresh</code>	If this parameter is set to <code>true</code> , then the list of materialized views is refreshed in a single transaction. All of the refreshed materialized views are updated to a single point in time. If the refresh fails for any of the materialized views, none of the materialized views are updated. If this parameter is set to <code>false</code> , then each of the materialized views is refreshed non-atomically in separate transactions. As part of complete refresh, if <code>truncate</code> is used (non-atomic refresh), unique index rebuild is executed. <code>INDEX REBUILD</code> automatically computes statistics. Thus, statistics are updated for truncated tables.
<code>nested</code>	If <code>true</code> , then perform nested refresh operations for the specified set of materialized views. Nested refresh operations refresh all the depending materialized views and the specified set of materialized views based on a dependency order to ensure the nested materialized views are truly fresh with respect to the underlying base tables.
<code>out_of_place</code>	If <code>true</code> , then it performs an out-of-place refresh. The default is <code>false</code> . This parameter uses the four methods of refresh (F, P, C, ?). So, for example, if you specify <code>F</code> and <code>out_of_place = true</code> , then an out-of-place fast refresh will be attempted. Similarly, if you specify <code>P</code> and <code>out_of_place = true</code> , then out-of-place PCT refresh will be attempted.
<code>skip_ext_data</code>	Provides you an option to skip the MV data refresh corresponding to the external partitions.

Usage Notes

- The preference of LPCT refresh on the materialized view is:
 1. If the materialized view is both PCT and LPCT enabled, a combined LPCT+PCT refresh is performed.
 2. If the materialized view is only LPCT enabled, LPCT refresh is performed.



See Also:

Oracle Database Data Warehousing Guide for more information about refresh methods for materialized view .

123.4.12 REFRESH_ALL_MVIEWS Procedure

This procedure refreshes all materialized views that have certain properties

All materialized views with the following properties are refreshed:

- The materialized view has not been refreshed since the most recent change to a master table or master materialized view on which it depends.
- The materialized view and all of the master tables or master materialized views on which it depends are local.
- The materialized view is in the view `DBA_MVIEWS`.

This procedure is intended for use with data warehouses.

Syntax


```
DBMS_MVIEW.REFRESH_ALL_MVIEWS (
  number_of_failures  OUT  BINARY_INTEGER,
  method              IN   VARCHAR2          := NULL,
  rollback_seg        IN   VARCHAR2          := NULL,
  refresh_after_errors IN  BOOLEAN           := false,
  atomic_refresh       IN  BOOLEAN           := true,
  out_of_place         IN  BOOLEAN           := false);
```

Parameters

Table 123-11 REFRESH_ALL_MVIEWS Procedure Parameters

Parameter	Description
<code>number_of_failures</code>	Returns the number of failures that occurred during processing

Table 123-11 (Cont.) REFRESH_ALL_MVIEWS Procedure Parameters

Parameter	Description
method	A single refresh method indicating the type of refresh to perform for each materialized view that is refreshed. <code>F</code> or <code>f</code> indicates fast refresh, <code>?</code> indicates force refresh, <code>C</code> or <code>c</code> indicates complete refresh, and <code>A</code> or <code>a</code> indicates always refresh. <code>A</code> and <code>C</code> are equivalent. If no method is specified, a materialized view is refreshed according to its default refresh method. <code>P</code> or <code>p</code> refreshes by recomputing the rows in the materialized view affected by changed partitions in the detail tables. <code>L</code> or <code>l</code> indicates LPCT refresh, that is, recomputing the rows in the materialized view as per the logical partition of the base tables.
	<div style="border: 1px solid #0070C0; padding: 10px; background-color: #E6F2FF;"> <p> Note:</p> <p>"L" and "?" refreshes attempt a combined PCT and LCPT refresh. (physical and logical partitions).</p> </div>
rollback_seg	Name of the materialized view site rollback segment to use while refreshing materialized views
refresh_after_errors	If this parameter is <code>true</code> , an updatable materialized view continues to refresh even if there are outstanding conflicts logged in the <code>DEFERROR</code> view for the materialized view's master table or master materialized view. If this parameter is <code>true</code> and <code>atomic_refresh</code> is <code>false</code> , this procedure continues to refresh other materialized views if it fails while refreshing a materialized view.
atomic_refresh	If this parameter is set to <code>true</code> , then the refreshed materialized views are refreshed in a single transaction. All of the refreshed materialized views are updated to a single point in time. If the refresh fails for any of the materialized views, none of the materialized views are updated. If this parameter is set to <code>false</code> , then each of the materialized views is refreshed non-atomically in separate transactions.
out_of_place	If <code>true</code> , then it performs an out-of-place refresh. The default is <code>false</code> . This parameter uses the four methods of refresh (<code>F</code> , <code>P</code> , <code>C</code> , <code>?</code>). So, for example, if you specify <code>F</code> and <code>out_of_place = true</code> , then an out-of-place fast refresh will be attempted. Similarly, if you specify <code>P</code> and <code>out_of_place = true</code> , then out-of-place PCT refresh will be attempted.

123.4.13 REFRESH_DEPENDENT Procedures

This procedure refreshes all materialized views that have certain properties.

Materialized views with the following properties are refreshed:

- The materialized view depends on a master table or master materialized view in the list of specified masters.
- The materialized view has not been refreshed since the most recent change to a master table or master materialized view on which it depends.

- The materialized view and all of the master tables or master materialized views on which it depends are local.
- The materialized view is in the view `DBA_MVIEWS`.

This procedure is intended for use with data warehouses.

Syntax

```
DBMS_MVIEW.REFRESH_DEPENDENT (
  number_of_failures  OUT  BINARY_INTEGER,
  { list              IN   VARCHAR2,
  | tab              IN   DBMS_UTILITY.UNCL_ARRAY, }
  method             IN   VARCHAR2      := NULL,
  rollback_seg       IN   VARCHAR2      := NULL,
  refresh_after_errors IN  BOOLEAN      := false,
  atomic_refresh     IN   BOOLEAN      := true,
  nested             IN   BOOLEAN      := false,
  out_of_place       IN   BOOLEAN      := false);
```



Note:

This procedure is overloaded. The `list` and `tab` parameters are mutually exclusive.

Parameters

Table 123-12 REFRESH_DEPENDENT Procedure Parameters

Parameter	Description
<code>number_of_failures</code>	Returns the number of failures that occurred during processing
<code>list</code> <code>tab</code>	Comma-delimited list of master tables or master materialized views on which materialized views can depend. (Synonyms are not supported.) These tables and the materialized views that depend on them can be located in different schemas. However, all of the tables and materialized views must be in your local database. Alternatively, you may pass in a PL/SQL index-by table of type <code>DBMS_UTILITY.UNCL_ARRAY</code> , where each element is the name of a table.

Table 123-12 (Cont.) REFRESH_DEPENDENT Procedure Parameters


Parameter	Description
method	<p>A string of refresh methods indicating how to refresh the dependent materialized views. All of the materialized views that depend on a particular table are refreshed according to the refresh method associated with that table. F or f indicates fast refresh, ? indicates force refresh, C or c indicates complete refresh, and A or a indicates always refresh. A and C are equivalent. P or p refreshes by recomputing the rows in the materialized view affected by changed partitions in the detail tables. L or l indicates LPCT refresh, that is, recomputing the rows in the materialized view as per the logical partition of the base tables.</p> <div style="border: 1px solid #0070C0; padding: 10px; margin: 10px 0;"> <p> Note:</p> <p>"L" and "?" refreshes attempt a combined PCT and LCPT refresh. (physical and logical partitions).</p> </div> <p>If a table does not have a corresponding refresh method (that is, if more tables are specified than refresh methods), then any materialized view that depends on that table is refreshed according to its default refresh method. For example, the following EXECUTE statement within SQL*Plus:</p> <pre>DBMS_MVIEW.REFRESH_DEPENDENT ('employees,departments,hr.regions','cf');</pre> <p>performs a complete refresh of the materialized views that depend on the employees table, a fast refresh of the materialized views that depend on the departments table, and a default refresh of the materialized views that depend on the hr.regions table.</p>
rollback_seg	Name of the materialized view site rollback segment to use while refreshing materialized views
refresh_after_errors	If this parameter is true, an updatable materialized view continues to refresh even if there are outstanding conflicts logged in the DEFERROR view for the materialized view's master table or master materialized view. If this parameter is true and atomic_refresh is false, this procedure continues to refresh other materialized views if it fails while refreshing a materialized view.
atomic_refresh	<p>If this parameter is set to true, then the refreshed materialized views are refreshed in a single transaction. All of the refreshed materialized views are updated to a single point in time. If the refresh fails for any of the materialized views, none of the materialized views are updated.</p> <p>If this parameter is set to false, then each of the materialized views is refreshed non-atomically in separate transactions.</p>
nested	If true, then perform nested refresh operations for the specified set of tables. Nested refresh operations refresh all the depending materialized views of the specified set of tables based on a dependency order to ensure the nested materialized views are truly fresh with respect to the underlying base tables.

Table 123-12 (Cont.) REFRESH_DEPENDENT Procedure Parameters

Parameter	Description
out_of_place	If true, then it performs an out-of-place refresh. The default is false. This parameter uses the four methods of refresh (F, P, C, ?). So, for example, if you specify F and out_of_place = true, then an out-of-place fast refresh will be attempted. Similarly, if you specify P and out_of_place = true, then out-of-place PCT refresh will be attempted.

123.4.14 REGISTER_MVIEW Procedure

This procedure enables the administration of individual materialized views. It is invoked at a master site or master materialized view site to register a materialized view.

Note that, typically, a materialized view is registered automatically during materialized view creation. You should only run this procedure to manually register a materialized view if the automatic registration failed or if the registration information was deleted.

Syntax

```
DBMS_MVIEW.REGISTER_MVIEW (
  mviewowner IN   VARCHAR2,
  mviewname  IN   VARCHAR2,
  mviewsite  IN   VARCHAR2,
  mview_id   IN   DATE | BINARY_INTEGER,
  flag       IN   BINARY_INTEGER,
  qry_txt    IN   VARCHAR2,
  rep_type   IN   BINARY_INTEGER := DBMS_MVIEW.REG_UNKNOWN);
```

Parameters

Table 123-13 REGISTER_MVIEW Procedure Parameters

Parameter	Description
mviewowner	Owner of the materialized view.
mviewname	Name of the materialized view.
mviewsite	Name of the materialized view site for a materialized view registering at an Oracle database version 8.x and higher master site or master materialized view site. This name should not contain any double quotes.
mview_id	The identification number of the materialized view. Specify an Oracle database version 8.x and higher materialized view as a BINARY_INTEGER. Specify an Oracle database version 7 materialized view registering at an Oracle database version 8.x and higher master sites or master materialized view sites as a DATE.

Table 123-13 (Cont.) REGISTER_MVIEW Procedure Parameters

Parameter	Description
flag	<p>A constant that describes the properties of the materialized view being registered. Valid constants that can be assigned include the following:</p> <p>DBMS_MVIEW.REG_ROWID_MVIEW for a rowid materialized view</p> <p>DBMS_MVIEW.REG_PRIMARY_KEY_MVIEW for a primary key materialized view</p> <p>DBMS_MVIEW.REG_OBJECT_ID_MVIEW for an object id materialized view</p> <p>DBMS_MVIEW.REG_FAST_REFRESHABLE_MVIEW for a materialized view that can be fast refreshed</p> <p>DBMS_MVIEW.REG_UPDATABLE_MVIEW for a materialized view that is updatable</p> <p>A materialized view can have more than one of these properties. In this case, use the plus sign (+) to specify more than one property. For example, if a primary key materialized view can be fast refreshed, you can enter the following for this parameter:</p> <p>DBMS_MVIEW.REG_PRIMARY_KEY_MVIEW + DBMS_MVIEW.REG_FAST_REFRESHABLE_MVIEW</p> <p>You can determine the properties of a materialized view by querying the ALL_MVIEWS data dictionary view.</p>
qry_txt	The first 32,000 bytes of the materialized view definition query.
rep_type	<p>Version of the materialized view. Valid constants that can be assigned include the following:</p> <p>DBMS_MVIEW.REG_V7_SNAPSHOT if the materialized view is at an Oracle database version 7 site</p> <ul style="list-style-type: none"> DBMS_MVIEW.REG_V8_SNAPSHOT <p>reg_repapi_snapshot if the materialized view is at an Oracle database version 8.x or higher site</p> <p>DBMS_MVIEW.REG_UNKNOWN (the default) if you do not know whether the materialized view is at an Oracle database version 7 site or an Oracle database version 8.x (or higher) site</p>

Usage Notes

This procedure is invoked at the master site or master materialized view site by a remote materialized view site using a remote procedure call. If REGISTER_MVIEW is called multiple times with the same mviewowner, mviewname, and mviewsite, then the most recent values for mview_id, flag, and qry_txt are stored. If a query exceeds the maximum VARCHAR2 size, then qry_txt contains the first 32000 characters of the query and the remainder is truncated. When invoked manually, the value of mview_id must be looked up in the materialized view data dictionary views by the person who calls the procedure.

123.4.15 UNREGISTER_MVIEW Procedure

This procedure enables the administration of individual materialized views. It is invoked at a master site or master materialized view site to unregister a materialized view.

Syntax

```
DBMS_MVIEW.UNREGISTER_MVIEW (
    mviewowner      IN   VARCHAR2,
```

```
mviewname      IN  VARCHAR2,  
mviewsite      IN  VARCHAR2);
```

Parameters

Table 123-14 UNREGISTER_MVIEW Procedure Parameters

Parameters	Description
mviewowner	Owner of the materialized view
mviewname	Name of the materialized view
mviewsite	Name of the materialized view site

DBMS_MVIEW_STATS

DBMS_MVIEW_STATS package provides an interface to manage the collection and retention of statistics for materialized view refresh operations.

See Also:

Oracle Database Data Warehousing Guide for information about managing and using materialized view refresh statistics

This chapter contains the following topics:

- [DBMS_MVIEW_STATS Overview](#)
- [DBMS_MVIEW_STATS Security Model](#)
- [Summary of DBMS_MVIEW_STATS Subprograms](#)

124.1 DBMS_MVIEW_STATS Overview

You can use the procedures contained in the DBMS_MVIEW_STATS package to manage the collection and retention of statistics for materialized view refresh operations. This includes the level and granularity at which these statistics are collected and the duration for which they are retained in the database.

You can also set database level system defaults for the parameters that control statistics collection.

124.2 DBMS_MVIEW_STATS Security Model

Refer to the Usage Notes section in each subprogram for information about the privileges required to use the subprogram.

124.3 Summary of DBMS_MVIEW_STATS Subprograms

This table lists the DBMS_MVIEW_STATS subprograms and briefly describes them.

Table 124-1 DBMS_MVIEW_STATS Package Subprograms

Subprogram	Description
PURGE_REFRESH_STATS Procedure	Purges the statistics of materialized view refresh operations that are older than the specified retention period.

Table 124-1 (Cont.) DBMS_MVIEW_STATS Package Subprograms

Subprogram	Description
SET_MVREF_STATS_PARAMS Procedure	Sets the values of parameters that define the collection level and retention period for materialized view refresh statistics. You can set the values either at the database level or for individual materialized views.
SET_SYSTEM_DEFAULT Procedure	Sets the system default value of a refresh statistics parameter. The two refresh statistics parameters are collection level and the retention period.

124.3.1 PURGE_REFRESH_STATS Procedure

This procedure purges refresh statistics that are older than the specified retention period for the specified materialized views.

This procedure forces a purge of refresh statistics without altering the retention period defined for the specified materialized views.

Syntax

```
DBMS_MVIEW_STATS.PURGE_REFRESH_STATS (
    mv_list           IN    VARCHAR2,
    retention_period  IN    NUMBER);
```

Parameters

Table 124-2 PURGE_REFRESH_STATS Procedure Parameters

Parameter	Description
<code>mv_list</code>	The fully-qualified name of an existing materialized view in the form of <code>schema_name.mv_name</code> . Use a comma-separated list to specify multiple materialized views. Specify <code>NULL</code> to purge materialized view refresh statistics for all materialized views in the database.
<code>retention_period</code>	The number of days for which refresh statistics must be preserved in the data dictionary. Statistics for materialized view refresh operations that are older than the retention period are purged from the data dictionary. The retention period specified in this procedure overrides the retention period that may have been set previously either at the database level or for specified materialized views. Specify <code>NULL</code> to use the purging policy defined by the automatic statistics purge. Specify <code>-1</code> to purge all refresh statistics.

Usage Notes

To invoke this procedure, you need either the `SYSDBA` privilege or privileges on every materialized view that is specified in `mv_list`.

124.3.2 SET_MVREF_STATS_PARAMS Procedure

This procedure sets the collection level and retention period for materialized view refresh statistics. You can set these properties either for individual materialized views or for all materialized views in the database.

Syntax

```
DBMS_MVIEW_STATS.SET_MVREF_STATS_PARAMS (
    mv_list           IN    VARCHAR2,
    collection_level IN    VARCHAR2 DEFAULT NULL,
    retention_period  IN    NUMBER DEFAULT NULL);
```

Parameters

Table 124-3 SET_MVREF_STATS_PARAMS Procedure Parameters

Parameter	Description
<code>mv_list</code>	<p>The fully-qualified name of an existing materialized view in the form of <code>schema_name.mv_name</code>. Use a comma-separated list to specify multiple materialized views.</p> <p>Specify <code>NULL</code> to set properties for all existing materialized views in the database.</p>
<code>collection_level</code>	<p>Specifies the level of detail used when collecting refresh statistics for the materialized views specified in <code>mv_list</code>.</p> <p>Set one of the following values for <code>collection_level</code>:</p> <ul style="list-style-type: none"> <code>NONE</code>: No materialized view refresh statistics are collected. <code>TYPICAL</code>: Only basic refresh statistics are collected and stored for the materialized views specified in <code>mv_list</code>. <code>ADVANCED</code>: Detailed refresh statistics are collected and stored for materialized view specified in <code>mv_list</code>. <p>If this parameter is set to <code>NULL</code>, then the system default value for <code>collection_level</code> (set using <code>SET_SYSTEM_DEFAULT</code>) is used.</p>
<code>retention_period</code>	<p>Specifies the retention period, in days, for the refresh statistics of the materialized views specified in <code>mv_list</code>. Statistics that are older than the retention period are automatically purged from the data dictionary.</p> <p>Valid values are between 1 and 1365000.</p> <p>If this parameter is set to <code>NULL</code>, then the system default value for <code>retention_period</code> (set using <code>SET_SYSTEM_DEAFULT</code>) is used.</p> <p>Set <code>retention_period</code> to -1 to specify that refresh statistics for the materialized views in <code>mv_list</code> must never be purged.</p>

Usage Notes

To set the collection level or retention period of one or more materialized views, you must have privileges on those materialized views. To set the collection level or retention period for all materialized views in the database, you must have either the `SYSDBA` privilege or privileges on every materialized view in the database.

To set the system-level default values for statistics collection level and retention period, use the `SET_SYSTEM_DEAFULT` procedure.

Use the `DBA_MVREF_STATS_PARAMS` view to determine the currently-set retention period and collection level for materialized view statistics collection.

To disable refresh statistics collection for all materialized views in the database, use the following:

```
DBMS_MVIEW_STATS.SET_MVREF_STATS_PARAMS (NULL, 'NONE', NULL);
```

Note that the parameters set using `SET_MVREF_STATS_PARAMS` only affect materialized views that exist in the database at the time the procedure is run. Any new materialized views created after this procedure is run will use the system default values for `collection_level` and `retention_period`.

124.3.3 SET_SYSTEM_DEFAULT Procedure

This procedure sets system-wide defaults that manage the collection and retention of materialized view refresh statistics. All newly-created materialized views use these defaults until the parameters are reset explicitly using the `SET_MVREF_STATS_PARAMS` procedure.

Syntax

```
DBMS_MVIEW_STATS.SET_SYSTEM_DEFAULT (
    parameter_name    IN  VARCHAR2,
    value             IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 124-4 SET_SYSTEM_DEFAULT Procedure Parameters

Parameter	Description
<code>parameter_name</code>	<p>The name of the materialized view refresh statistics parameter whose system default value is being set.</p> <p>The parameters that can be set are:</p> <ul style="list-style-type: none"> <code>COLLECTION_LEVEL</code>: Specifies the level of detail for collecting materialized view refresh statistics. <code>RETENTION_PERIOD</code>: Specifies the duration, in days, for which refresh statistics are retained in the data dictionary
<code>value</code>	<p>The value of the materialized view refresh statistics parameter.</p> <p>The valid values for <code>COLLECTION_LEVEL</code> are:</p> <ul style="list-style-type: none"> <code>NONE</code>: No refresh statistics are collected for the refresh operation. This is the default setting. <code>TYPICAL</code>: Only basic refresh statistics are collected for the refresh operation. <code>ADVANCED</code>: Detailed refresh statistics are collected for the refresh operation. <p>The valid values for <code>RETENTION_PERIOD</code> are:</p> <ul style="list-style-type: none"> <code>-1</code> Numbers between 1 and 1365000 <p>The default value for <code>retention_period</code> is 31.</p> <p>If you specify <code>NULL</code> for any of the parameters, then the system default setting for that parameter is used.</p>

Usage Notes

You must have `SYSDBA` privilege to invoke this procedure.

Use the `DBA_MVREF_STATS_SYS_DEFAULTS` view to display the current default settings for materialized view refresh statistics collection.

DBMS_NETWORK_ACL_ADMIN

The `DBMS_NETWORK_ACL_ADMIN` package provides the interface to administer the network Access Control List (ACL).

The chapter contains the following topics:

- [Overview](#)
- [Deprecated Subprograms](#)
- [Security Model](#)
- [Constants](#)
- [Exceptions](#)
- [Examples](#)
- [Summary of DBMS_NETWORK_ACL_ADMIN Subprograms](#)



See Also:

For more information, see "Managing Fine-grained Access to External Network Services" in *Oracle Database Security Guide*

125.1 DBMS_NETWORK_ACL_ADMIN Overview

The `DBMS_NETWORK_ACL_ADMIN` package provides the interface to administer the network access control lists (ACL).

ACLs are used to control access by users to external network services and resources from the database through PL/SQL network utility packages including [UTL_TCP](#) , [UTL_HTTP](#) , [UTL_SMTP](#) and [UTL_INADDR](#) .

125.2 DBMS_NETWORK_ACL_ADMIN Deprecated Subprograms

Oracle recommends that you do not use deprecated subprograms in new applications. Support for deprecated features is for backward compatibility only

The following subprograms are deprecated with release Oracle Database 12c:

- [ADD_PRIVILEGE Procedure](#)
- [ASSIGN_ACL Procedure](#)
- [ASSIGN_WALLET_ACL Procedure](#)
- [CHECK_PRIVILEGE Function](#)

- [CHECK_PRIVILEGE_ACLID Function](#)
- [CREATE_ACL Procedure](#)
- [DELETE_PRIVILEGE Procedure](#)
- [DROP_ACL Procedure](#)
- [UNASSIGN_ACL Procedure](#)
- [UNASSIGN_WALLET_ACL Procedure](#)

125.3 DBMS_NETWORK_ACL_ADMIN Security Model

The EXECUTE privilege on the DBMS_NETWORK_ACL_ADMIN package is granted to the DBA role and to the EXECUTE_CATALOG_ROLE by default.

125.4 DBMS_NETWORK_ACL_ADMIN Constants

The DBMS_NETWORK_ACL_ADMIN package defines constants to use specifying parameter values.

These are shown in the following table.

Table 125-1 DBMS_NETWORK_ACL_ADMIN Constants

Constant	Type	Value	Description
IP_ADDR_MASK	VARCHAR2(80)	'([[:digit:]]+\.) {3} [[:digit:]]+'	IP address mask: xxx.xxx.xxx.xxx
IP_SUBNET_MASK	VARCHAR2(80)	'([[:digit:]]+\.) {0,3}*'	IP subnet mask: xxx.xxx...*
HOSTNAME_MASK	VARCHAR2(80)	'[^\.\.:\/*]+\(\. [^\.\.:\/*]+\)*'	Hostname mask: ???..???.???.???.?? ?
DOMAIN_MASK	VARCHAR2(80)	'*(\.[^\.\:\/*]+)*'	Domain mask: *.???.???.???.???

125.5 DBMS_NETWORK_ACL_ADMIN Exceptions

The following table lists the exceptions raised by the DBMS_NETWORK_ACL_ADMIN package.

Table 125-2 DBMS_NETWORK_ACL_ADMIN Exceptions

Exception	Error Code	Description
ACE_ALREADY_EXISTS	24243	ACE already exists
EMPTY_ACL	24246	Empty ACL
ACL_NOT_FOUND	46114	ACL not found
ACL_ALREADY_EXISTS	46212	ACL already exists
INVALID_ACL_PATH	46059	Invalid ACL path

Table 125-2 (Cont.) DBMS_NETWORK_ACL_ADMIN Exceptions

Exception	Error Code	Description
INVALID_HOST	24244	Invalid host
INVALID_PRIVILEGE	24245	Invalid privilege
INVALID_WALLET_PATH	29248	Invalid wallet path
BAD_ARGUMENT	29261	Bad argument
UNRESOLVED_PRINCIPAL	46238	Unresolved principal
PRIVILEGE_NOT_GRANTED	01927	Privilege not granted

125.6 DBMS_NETWORK_ACL_ADMIN Examples

Grant the `connect` and `resolve` privileges for host `www.us.example.com` to SCOTT.

Example 1

```
DBMS_NETWORK_ACL_ADMIN.APPEND_HOST_ACE(
  host => 'www.us.example.com',
  ace => xs$ace_type(privilege_list => xs$name_list('connect', 'resolve'),
    principal_name => 'scott',
    principal_type => xs_acl.ptype_db));
```

Example 2

Revoke the `resolve` privilege for host `www.us.example.com` from SCOTT.

```
dbms_network_acl_admin.remove_host_ace(
  host => 'www.us.example.com',
  ace => xs$ace_type(privilege_list => xs$name_list('resolve'),
    principal_name => 'scott',
    principal_type => xs_acl.ptype_db));
```

Example 3

Grant the `use_client_certificates` and `use_passwords` privileges for wallet `file:/example/wallets/hr_wallet` to SCOTT.

```
dbms_network_acl_admin.append_wallet_ace(
  wallet_path => 'file:/example/wallets/hr_wallet',
  ace => xs$ace_type(privilege_list =>
  xs$name_list('use_client_certificates', 'use_passwords'),
    principal_name => 'scott',
    principal_type => xs_acl.ptype_db));
```

Example 4

Revoke the `use_passwords` privilege for wallet `file:/example/wallets/hr_wallet` from SCOTT.

```
dbms_network_acl_admin.remove_wallet_ace(
  wallet_path => 'file:/example/wallets/hr_wallet',
  ace => xs$ace_type(privilege_list => xs$name_list('use_passwords'),
    principal_name => 'scott',
    principal_type => xs_acl.ptype_db));
```

Example 5

The `CONTAINS_HOST` in the `DBMS_NETWORK_ACL_UTILITY` package determines if a host is contained in a domain. It can be used in conjunction with the `DBA_HOST_ACE` view to determine the users and their privilege assignments to access a network host. For example, for access to `www.us.example.com`:

```
SELECT HOST, LOWER_PORT, UPPER_PORT,
       ACE_ORDER, PRINCIPAL, PRINCIPAL_TYPE,
       GRANT_TYPE, INVERTED_PRINCIPAL, PRIVILEGE,
       START_DATE, END_DATE
  FROM (SELECT ACES.*,
             DBMS_NETWORK_ACL_UTILITY.CONTAINS_HOST('www.us.example.com',
                                                    HOST) PRECEDENCE
        FROM DBA_HOST_ACES ACES)
 WHERE PRECEDENCE IS NOT NULL
 ORDER BY PRECEDENCE DESC,
          LOWER_PORT NULLS LAST,
          UPPER_PORT NULLS LAST,
          ACE_ORDER;
```

HOST	GRANT_TYPE	INVERTED_PRINCIPAL	LOWER_PORT	UPPER_PORT	PRIVILEGE	ACE_ORDER	PRINCIPAL	PRINCIPAL_TYPE	START_DATE	END_DATE
www.us.example.com	GRANT	NO	80	80	HTTP	1	SCOTT	DATABASE USER		
www.us.example.com	GRANT	NO	80	80	HTTP	2	ADAMS	DATABASE USER		
*	GRANT	NO			CONNECT	1	HQ_DBA	DATABASE USER		
*	GRANT	NO			RESOLVE	1	HQ_DBA	DATABASE USER		

Example 6

For example, for `HQ_DBA`'s own permission to access to `www.us.example.com`:

```
SELECT HOST, LOWER_PORT, UPPER_PORT, PRIVILEGE, STATUS
  FROM (SELECT ACES.*,
             DBMS_NETWORK_ACL_UTILITY.CONTAINS_HOST('www.us.example.com',
                                                    HOST) PRECEDENCE
        FROM USER_HOST_ACES ACES)
 WHERE PRECEDENCE IS NOT NULL
 ORDER BY PRECEDENCE DESC,
          LOWER_PORT NULLS LAST,
          UPPER_PORT NULLS LAST;
```

HOST	LOWER_PORT	UPPER_PORT	PRIVILEGE	STATUS
*			CONNECT	GRANTED
*			RESOLVE	GRANTED

125.7 Summary of DBMS_NETWORK_ACL_ADMIN Subprograms

This table lists and briefly describes the DBMS_NETWORK_ACL_ADMIN package subprograms.

Table 125-3 DBMS_NETWORK_ACL_ADMIN Package Subprograms

Subprogram	Description
ADD_PRIVILEGE Procedure	[DEPRECATED] Adds a privilege to grant or deny the network access to the user in an access control list (ACL)
APPEND_HOST_ACE Procedure	Appends an access control entry (ACE) to the access control list (ACL) of a network host.
APPEND_HOST_ACL Procedure	Appends access control entries (ACE) of an access control list (ACL) to the ACL of a network host
APPEND_WALLET_ACE Procedure	Appends an access control entry (ACE) to the access control list (ACL) of a wallet
APPEND_WALLET_ACL Procedure	Appends access control entries (ACE) of an access control list (ACL) to the ACL of a wallet
ASSIGN_ACL Procedure	[DEPRECATED] Assigns an access control list (ACL) to a host computer, domain, or IP subnet, and if specified, the TCP port range.
ASSIGN_WALLET_ACL Procedure	[DEPRECATED] Assigns an access control list (ACL) to a wallet
CHECK_PRIVILEGE Function	[DEPRECATED] Checks if a privilege is granted or denied the user in an access control list (ACL)
CHECK_PRIVILEGE_ACLID Function	[DEPRECATED] Checks if a privilege is granted to or denied from the user in an ACL by specifying the object ID of the access control list
CREATE_ACL Procedure	[DEPRECATED] Creates an access control list (ACL) with an initial privilege setting
DELETE_PRIVILEGE Procedure	[DEPRECATED] Deletes a privilege in an access control list (ACL)
DROP_ACL Procedure	[DEPRECATED] Drops an access control list (ACL)
REMOVE_HOST_ACE Procedure	Removes privileges from access control entries (ACE) in the access control list (ACL) of a network host matching the given ACE
REMOVE_WALLET_ACE Procedure	Removes privileges from access control entries (ACE) in the access control list (ACL) of a wallet matching the given ACE
SET_HOST_ACL Procedure	Sets the access control list (ACL) of a network host which controls access to the host from the database
SET_WALLET_ACL Procedure	Sets the access control list (ACL) of a wallet which controls access to the wallet from the database
UNASSIGN_ACL Procedure	[DEPRECATED] Unassigns the access control list (ACL) currently assigned to a network host
UNASSIGN_WALLET_ACL Procedure	[DEPRECATED] Unassigns the access control list (ACL) currently assigned to a wallet

125.7.1 ADD_PRIVILEGE Procedure

This procedure adds a privilege to grant or deny the network access to the user. The access control entry (ACE) is created if it does not exist.



Note:

This procedure is deprecated in Oracle Database 12c. While the procedure remains available in the package for reasons of backward compatibility, Oracle recommends using the [APPEND_HOST_ACE Procedure](#) and the [APPEND_WALLET_ACE Procedure](#).

Syntax

```
DBMS_NETWORK_ACL_ADMIN.ADD_PRIVILEGE (
    acl          IN VARCHAR2,
    principal    IN VARCHAR2,
    is_grant     IN BOOLEAN,
    privilege    IN VARCHAR2,
    position     IN PLS_INTEGER DEFAULT NULL,
    start_date   IN TIMESTAMP WITH TIMESTAMP DEFAULT NULL,
    end_date     IN TIMESTAMP WITH TIMESTAMP DEFAULT NULL );
```

Parameters

Table 125-4 ADD_PRIVILEGE Function Parameters

Parameter	Description
acl	Name of the ACL. Relative path will be relative to "/sys/acls"
principal	Principal (database user or role) to whom the privilege is granted or denied. Case sensitive.
is_grant	Privilege is granted or denied.
privilege	Network privilege to be granted or denied
position	Position (1-based) of the ACE. If a non-NULL value is given, the privilege will be added in a new ACE at the given position and there should not be another ACE for the principal with the same <code>is_grant</code> (grant or deny). If a NULL value is given, the privilege will be added to the ACE matching the principal and the <code>is_grant</code> if one exists, or to the end of the ACL if the matching ACE does not exist.
start_date	Start date of the access control entry (ACE). When specified, the ACE will be valid only on and after the specified date. The <code>start_date</code> will be ignored if the privilege is added to an existing ACE.
end_date	End date of the access control entry (ACE). When specified, the ACE expires after the specified date. The <code>end_date</code> must be greater than or equal to the <code>start_date</code> . The <code>end_date</code> will be ignored if the privilege is added to an existing ACE.

Usage Notes

To remove the permission, use the [DELETE_PRIVILEGE Procedure](#).

Examples

```
BEGIN
  DBMS_NETWORK_ACL_ADMIN.ADD_PRIVILEGE(
    acl      => 'us-example-com-permissions.xml',
    principal => 'ST_USERS',
    is_grant => TRUE,
    privilege => 'connect')
END;
```

125.7.2 APPEND_HOST_ACE Procedure

This procedure appends an access control entry (ACE) to the access control list (ACL) of a network host. The ACL controls access to the given host from the database and the ACE specifies the privileges granted to or denied from the specified principal.

Syntax

```
DBMS_NETWORK_ACL_ADMIN.APPEND_HOST_ACE (
  host      IN VARCHAR2,
  lower_port IN PLS_INTEGER DEFAULT NULL,
  upper_port IN PLS_INTEGER DEFAULT NULL,
  ace       IN XS$ACE_TYPE);
```

Parameters

Table 125-5 APPEND_HOST_ACE Function Parameters

Parameter	Description
host	The host, which can be the name or the IP address of the host. You can use a wildcard to specify a domain or a IP subnet. The host or domain name is case-insensitive.
lower_port	Lower bound of an optional TCP port range
upper_port	Upper bound of an optional TCP port range. If NULL, lower_port is assumed.
ace	The ACE

Usage Notes

- Duplicate privileges in the matching ACE in the host ACL will be skipped.
- To remove the ACE, use the [REMOVE_HOST_ACE Procedure](#).
- A host's ACL takes precedence over its domains' ACLs. For a given host, say `www.us.example.com`, the following domains are listed in decreasing precedence:
 - `www.us.example.com`
 - `*.us.example.com`
 - `*.example.com`
 - `*.com`

- *
- An IP address' ACL takes precedence over its subnets' ACLs. For a given IP address, say 192.168.0.100, the following subnets are listed in decreasing precedence:
 - 192.168.0.100
 - 192.168.0.*
 - 192.168.*
 - 192.*
 - *
- An ACE with a "resolve" privilege can be appended only to a host's ACL without a port range.
- When ACEs with "connect" privileges are appended to a host's ACLs with and without a port range, the one appended to the host with a port range takes precedence.
- When specifying a TCP port range of a host, it cannot overlap with other existing port ranges of the host.
- If the ACL is shared with another host or wallet, a copy of the ACL will be made before the ACL is modified.



See Also:

Oracle Database Real Application Security Administrator's and Developer's Guide for more information about the `X$ACE_TYPE` object type

125.7.3 APPEND_HOST_ACL Procedure

This procedure appends access control entries (ACE) of an access control list (ACL) to the ACL of a network host.

Syntax

```
DBMS_NETWORK_ACL_ADMIN.APPEND_HOST_ACL (
    host          IN VARCHAR2,
    lower_port    IN PLS_INTEGER DEFAULT NULL,
    upper_port    IN PLS_INTEGER DEFAULT NULL,
    acl           IN VARCHAR2);
```

Parameters

Table 125-6 APPEND_HOST_ACL Function Parameters

Parameter	Description
host	The host, which can be the name or the IP address of the host. You can use a wildcard to specify a domain or a IP subnet. The host or domain name is case-insensitive.
lower_port	Lower bound of an optional TCP port range

Table 125-6 (Cont.) APPEND_HOST_ACL Function Parameters

Parameter	Description
upper_port	Upper bound of an optional TCP port range. If NULL, lower_port is assumed.
acl	The ACL from which to append

Usage Notes

- Duplicate privileges in the matching ACE in the host ACL will be skipped.
- To remove the ACE, use the [REMOVE_HOST_ACE Procedure](#).
- A host's ACL takes precedence over its domains' ACLs. For a given host, say `www.us.example.com`, the following domains are listed in decreasing precedence:
 - `www.us.example.com`
 - `*.us.example.com`
 - `*.example.com`
 - `*.com`
 - `*`
- An IP address' ACL takes precedence over its subnets' ACLs. For a given IP address, say `192.168.0.100`, the following subnets are listed in decreasing precedence:
 - `192.168.0.100`
 - `192.168.0.*`
 - `192.168.*`
 - `192.*`
 - `*`
- An ACE with a "resolve" privilege can be appended only to a host's ACL without a port range.
- When ACEs with "connect" privileges are appended to a host's ACLs with and without a port range, the one appended to the host with a port range takes precedence.
- When specifying a TCP port range of a host, it cannot overlap with other existing port ranges of the host.- If the ACL is shared with another host or wallet, a copy of the ACL will be made before the ACL is modified.

125.7.4 APPEND_WALLET_ACE Procedure

This procedure appends an access control entry (ACE) to the access control list (ACL) of a wallet. The ACL controls access to the given wallet from the database and the ACE specifies the privileges granted to or denied from the specified principal.

Syntax

```
DBMS_NETWORK_ACL_ADMIN.APPEND_WALLET_ACE (
    wallet_path    IN VARCHAR2,
    ace            IN XS$ACE_TYPE);
```

Parameters

Table 125-7 APPEND_WALLET_ACE Function Parameters

Parameter	Description
wallet_path	Directory path of the wallet. The path is case-sensitive of the format <code>file:directory-path</code> .
ace	The ACE

Usage Notes

- Duplicate privileges in the matching ACE in the host ACL will be skipped.
- To remove the ACE, use the [REMOVE_WALLET_ACE Procedure](#).
- If the ACL is shared with another host or wallet, a copy of the ACL is made before the ACL is modified.

See Also:

Oracle Database Real Application Security Administrator's and Developer's Guide for more information about the `XS$ACE_TYPE` object type

125.7.5 APPEND_WALLET_ACL Procedure

This procedure appends access control entries (ACE) of an access control list (ACL) to the ACL of a wallet.

Syntax

```
DBMS_NETWORK_ACL_ADMIN.APPEND_WALLET_ACL (
    wallet_path  IN VARCHAR2,
    acl          IN VARCHAR2);
```

Parameters

Table 125-8 APPEND_WALLET_ACL Function Parameters

Parameter	Description
wallet_path	Directory path of the wallet. The path is case-sensitive of the format <code>file:directory-path</code> .
ace	The ACL from which to append

Usage Notes

- Duplicate privileges in the matching ACE in the host ACL will be skipped.
- To remove the ACE, use `REMOVE_WALLET_ACE`.
- If the ACL is shared with another host or wallet, a copy of the ACL is made before the ACL is modified.

125.7.6 ASSIGN_ACL Procedure

This procedure assigns an access control list (ACL) to a host computer, domain, or IP subnet, and if specified, the TCP port range.

Note:

This procedure is deprecated in Oracle Database 12c. While the procedure remains available in the package for reasons of backward compatibility, Oracle recommends using the [APPEND_HOST_ACE Procedure](#) and the [APPEND_WALLET_ACE Procedure](#).

Syntax

```
DBMS_NETWORK_ACL_ADMIN.ASSIGN_ACL (
  acl          IN VARCHAR2,
  host         IN VARCHAR2,
  lower_port   IN PLS_INTEGER DEFAULT NULL,
  upper_port   IN PLS_INTEGER DEFAULT NULL);
```

Parameters

Table 125-9 ASSIGN_ACL Function Parameters

Parameter	Description
acl	Name of the ACL. Relative path will be relative to "/sys/acls".
host	Host to which the ACL is to be assigned. The host can be the name or the IP address of the host. A wildcard can be used to specify a domain or a IP subnet. The host or domain name is case-insensitive.
lower_port	Lower bound of a TCP port range if not NULL
upper_port	Upper bound of a TCP port range. If NULL, lower_port is assumed.

Usage Notes

- Only one ACL can be assigned to any host computer, domain, or IP subnet, and if specified, the TCP port range. When you assign a new access control list to a network target, Oracle Database unassigns the previous access control list that was assigned to the same target. However, Oracle Database does not drop the access control list. You can drop the access control list by using the [DROP_ACL Procedure](#). To remove an access control list assignment, use the [UNASSIGN_ACL Procedure](#).
- The ACL assigned to a domain takes a lower precedence than the other ACLs assigned sub-domains, which take a lower precedence than the ACLs assigned to the individual hosts. So for a given host, for example, "www.us.example.com", the following domains are listed in decreasing precedences:
 - www.us.example.com
 - *.us.example.com
 - *.example.com

```
- *.com
- *
```

In the same way, the ACL assigned to a subnet takes a lower precedence than the other ACLs assigned smaller subnets, which take a lower precedence than the ACLs assigned to the individual IP addresses. So for a given IP address, for example, "192.168.0.100", the following subnets are listed in decreasing precedences:

```
- 192.168.0.100
- 192.168.0.*
- 192.168.*
- 192.*
- *
```

- The port range is applicable only to the "connect" privilege assignments in the ACL. The "resolve" privilege assignments in an ACL have effects only when the ACL is assigned to a host without a port range.

For the "connect" privilege assignments, an ACL assigned to the host without a port range takes a lower precedence than other ACLs assigned to the same host with a port range.

- When specifying a TCP port range, both `lower_port` and `upper_port` must not be NULL and `upper_port` must be greater than or equal to `lower_port`. The port range must not overlap with any other port ranges for the same host assigned already.
- To remove the assignment, use [UNASSIGN_ACL Procedure](#).

Examples

```
BEGIN
  DBMS_NETWORK_ACL_ADMIN.ASSIGN_ACL(
    acl          => 'us-example-com-permissions.xml',
    host         => '*.us.example.com',
    lower_port   => 80);
END;
```

125.7.7 ASSIGN_WALLET_ACL Procedure

This procedure assigns an access control list (ACL) to a wallet.



Note:

This procedure is deprecated in Oracle Database 12c. While the procedure remains available in the package for reasons of backward compatibility, Oracle recommends using the [APPEND_HOST_ACE Procedure](#) and the [APPEND_WALLET_ACE Procedure](#).

Syntax

```
UTL_HTTP.ASSIGN_WALLET_ACL (
  acl          IN  VARCHAR2,
  wallet_path  IN  VARCHAR2);
```

Parameters

Table 125-10 ASSIGN_WALLET_ACL Procedure Parameters

Parameter	Description
acl	Name of the ACL. Relative path will be relative to <code>"/sys/acls"</code>
wallet_path	Directory path of the wallet to which the ACL is to be assigned. The path is case-sensitive and of the format <code>file:directory-path</code> .

Usage Notes

To remove the assignment, use the [UNASSIGN_WALLET_ACL Procedure](#).

Examples

```
BEGIN
  DBMS_NETWORK_ACL_ADMIN.CREATE_ACL(
    acl          => 'wallet-acl.xml',
    description => 'Wallet ACL',
    principal   => 'SCOTT',
    is_grant    => TRUE,
    privilege   => 'use-client-certificates');

  DBMS_NETWORK_ACL_ADMIN.ADD_PRIVILEGE(
    acl          => 'wallet-acl.xml',
    principal   => 'SCOTT',
    is_grant    => TRUE,
    privilege   => 'use-passwords');

  DBMS_NETWORK_ACL_ADMIN.ASSIGN_WALLET_ACL(
    acl          => 'wallet-acl.xml',
    wallet_path => 'file:/example/wallets/test_wallet');
END;
```

125.7.8 CHECK_PRIVILEGE Function

This function checks if a privilege is granted or denied the user in an ACL.

**Note:**

This procedure is deprecated in Oracle Database 12c. The procedure remains available in the package only for reasons of backward compatibility.

Syntax

```
DBMS_NETWORK_ACL_ADMIN.CHECK_PRIVILEGE (
  acl          IN VARCHAR2,
  user         IN VARCHAR2,
  privilege    IN VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 125-11 CHECK_PRIVILEGE Function Parameters

Parameter	Description
acl	Name of the ACL. Relative path will be relative to "/sys/acls".
user	User to check against. If the user is NULL, the invoker is assumed. The username is case-sensitive as in the USERNAME column of the ALL_USERS view.
privilege	Network privilege to check

Return Values

Returns 1 when the privilege is granted; 0 when the privilege is denied; NULL when the privilege is neither granted or denied.

Examples

```
SELECT DECODE (
  DBMS_NETWORK_ACL_ADMIN.CHECK_PRIVILEGE (
    'us-example-com-permissions.xml', 'SCOTT', 'resolve'),
  1, 'GRANTED', 0, 'DENIED', NULL) PRIVILEGE
FROM DUAL;
```

125.7.9 CHECK_PRIVILEGE_ACLID Function

This function checks if a privilege is granted to or denied from the user in an ACL by specifying the object ID of the access control list.

Note:

This procedure is deprecated in Oracle Database 12c. The procedure remains available in the package only for reasons of backward compatibility.

Syntax

```
DBMS_NETWORK_ACL_ADMIN.CHECK_PRIVILEGE_ACLID (
  aclid          IN RAW,
  user           IN VARCHAR2 DEFAULT NULL)
  privilege     IN VARCHAR2,
RETURN NUMBER;
```

Parameters

Table 125-12 CHECK_PRIVILEGE_ACLID Function Parameters

Parameter	Description
aclid	Object ID of the ACL

Table 125-12 (Cont.) CHECK_PRIVILEGE_ACLID Function Parameters

Parameter	Description
user	User to check against. If the user is <code>NULL</code> , the invoker is assumed. The username is case-sensitive as in the <code>USERNAME</code> column of the <code>ALL_USERS</code> view.
privilege	Network privilege to check

Return Values

Returns 1 when the privilege is granted; 0 when the privilege is denied; `NULL` when the privilege is neither granted or denied.

125.7.10 CREATE_ACL Procedure

This deprecated procedure creates an access control list (ACL) with an initial privilege setting. An ACL must have at least one privilege setting. The ACL has no access control effect unless it is assigned to the network target.

**Note:**

This procedure is deprecated in Oracle Database 12c. While the procedure remains available in the package for reasons of backward compatibility, Oracle recommends using the [APPEND_HOST_ACE Procedure](#) and the [APPEND_WALLET_ACE Procedure](#).

Syntax

```
DBMS_NETWORK_ACL_ADMIN.CREATE_ACL (
  acl          IN VARCHAR2,
  description  IN VARCHAR2,
  principal   IN VARCHAR2,
  is_grant    IN BOOLEAN,
  privilege    IN VARCHAR2,
  start_date  IN TIMESTAMP WITH TIMEZONE DEFAULT NULL,
  end_date    IN TIMESTAMP WITH TIMEZONE DEFAULT NULL );
```

Parameters**Table 125-13 CREATE_ACL Procedure Parameters**

Parameter	Description
acl	Name of the ACL. Relative path will be relative to <code>"/sys/acls"</code> .
description	Description attribute in the ACL
principal	Principal (database user or role) to whom the privilege is granted or denied. Case sensitive.
is_grant	Privilege is granted or not (denied)

Table 125-13 (Cont.) CREATE_ACL Procedure Parameters

Parameter	Description
privilege	Network privilege to be granted or denied - 'connect resolve' (case sensitive). A database user needs the <code>connect</code> privilege to an external network host computer if he or she is connecting using the <code>UTL_TCP</code> , <code>UTL_HTTP</code> , <code>UTL_SMTP</code> , and <code>UTL_MAIL</code> utility packages. To resolve a host name that was given a host IP address, or the IP address that was given a host name, with the <code>UTL_INADDR</code> package, grant the database user the <code>resolve</code> privilege.
start_date	Start date of the access control entry (ACE). When specified, the ACE is valid only on and after the specified date.
end_date	End date of the access control entry (ACE). When specified, the ACE expires after the specified date. The <code>end_date</code> must be greater than or equal to the <code>start_date</code> .

Usage Notes

To drop the access control list, use the [DROP_ACL Procedure](#).

Examples

```
BEGIN
  DBMS_NETWORK_ACL_ADMIN.CREATE_ACL(
    acl          => 'us-example-com-permissions.xml',
    description  => 'Network permissions for *.us.example.com',
    principal    => 'SCOTT',
    is_grant     => TRUE,
    privilege    => 'connect');
END;
```

125.7.11 DELETE_PRIVILEGE Procedure

This deprecated procedure deletes a privilege in an access control list.

Note:

This procedure is deprecated in Oracle Database 12c. While the procedure remains available in the package for reasons of backward compatibility, Oracle recommends using the [REMOVE_HOST_ACE Procedure](#) and the [REMOVE_WALLET_ACE Procedure](#).

Syntax

```
DBMS_NETWORK_ACL_ADMIN.DELETE_PRIVILEGE (
  acl          IN VARCHAR2,
  principal    IN VARCHAR2,
  is_grant     IN BOOLEAN DEFAULT NULL,
  privilege    IN VARCHAR2 DEFAULT NULL);
```


Parameters

Table 125-14 DELETE_PRIVILEGE Function Parameters

Parameter	Description
acl	Name of the ACL. Relative path will be relative to "/sys/acls".
principal	Principal (database user or role) for whom all the ACE will be deleted
is_grant	Privilege is granted or not (denied). If a NULL value is given, the deletion is applicable to both granted or denied privileges.
privilege	Network privilege to be deleted. If a NULL value is given, the deletion is applicable to all privileges.

Examples

```
BEGIN
  DBMS_NETWORK_ACL_ADMIN.DELETE_PRIVILEGE (
    acl          => 'us-example-com-permissions.xml',
    principal    => 'ST_USERS')
END;
```

125.7.12 DROP_ACL Procedure

This **deprecated procedure** drops an access control list (ACL).



Note:

This procedure is deprecated in Oracle Database 12c. The procedure remains available in the package only for reasons of backward compatibility.

Syntax

```
DBMS_NETWORK_ACL_ADMIN.DROP_ACL (
  acl          IN VARCHAR2);
```

Parameters

Table 125-15 DROP_ACL Procedure Parameters

Parameter	Description
acl	Name of the ACL. Relative path will be relative to "/sys/acls".

Examples

```
BEGIN
  DBMS_NETWORK_ACL_ADMIN.DROP_ACL (
    acl => 'us-example-com-permissions.xml');
END;
```

125.7.13 REMOVE_HOST_ACE Procedure

This procedure removes privileges from access control entries (ACE) in the access control list (ACL) of a network host matching the given ACE.

Syntax

```
DBMS_NETWORK_ACL_ADMIN.REMOVE_HOST_ACE (
  host          IN VARCHAR2,
  lower_port    IN PLS_INTEGER DEFAULT NULL,
  upper_port    IN PLS_INTEGER DEFAULT NULL,
  ace           IN XS$ACE_TYPE,
  remove_empty_acl IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 125-16 REMOVE_HOST_ACE Function Parameters

Parameter	Description
host	The host, which can be the name or the IP address of the host. You can use a wildcard to specify a domain or a IP subnet. The host or domain name is case-insensitive.
lower_port	Lower bound of an optional TCP port range
upper_port	Upper bound of an optional TCP port range. If NULL, lower_port is assumed.
ace	The ACE
remove_empty_acl	Whether to remove the ACL when it becomes empty when the ACE is removed

Usage Notes

If the ACL is shared with another host or wallet, a copy of the ACL is made before the ACL is modified.

125.7.14 REMOVE_WALLET_ACE Procedure

This procedure removes privileges from access control entries (ACE) in the access control list (ACL) of a wallet matching the given ACE.

Syntax

```
DBMS_NETWORK_ACL_ADMIN.REMOVE_WALLET_ACE (
  wallet_path    IN VARCHAR2,
  ace           IN XS$ACE_TYPE,
  remove_empty_acl IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 125-17 REMOVE_WALLET_ACE Function Parameters

Parameter	Description
wallet_path	Directory path of the wallet. The path is case-sensitive of the format <i>file:directory-path</i> .
ace	The ACE
remove_empty_acl	Whether to remove the ACL when it becomes empty when the ACE is removed

Usage Notes

If the ACL is shared with another host or wallet, a copy of the ACL is made before the ACL is modified.

125.7.15 SET_HOST_ACL Procedure

This procedure sets the access control list (ACL) of a network host which controls access to the host from the database.

Syntax

```
DBMS_NETWORK_ACL_ADMIN.SET_HOST_ACL (
  host          IN VARCHAR2,
  lower_port    IN PLS_INTEGER DEFAULT NULL,
  upper_port    IN PLS_INTEGER DEFAULT NULL,
  acl           IN VARCHAR2);
```

Parameters

Table 125-18 SET_HOST_ACL Function Parameters

Parameter	Description
host	The host, which can be the name or the IP address of the host. You can use a wildcard to specify a domain or a IP subnet. The host or domain name is case-insensitive.
lower_port	Lower bound of an optional TCP port range
upper_port	Upper bound of an optional TCP port range. If NULL, lower_port is assumed.
acl	The ACL. NULL to unset the host's ACL.

Usage Notes

A host's ACL is created and set on-demand when an access control entry (ACE) is appended to the host's ACL. Users are discouraged from setting a host's ACL manually.

125.7.16 SET_WALLET_ACL Procedure

This procedure sets the access control list (ACL) of a wallet which controls access to the wallet from the database.

Syntax

```
DBMS_NETWORK_ACL_ADMIN.SET_WALLET_ACL (
    wallet_path  IN VARCHAR2,
    acl          IN VARCHAR2);
```

Parameters

Table 125-19 SET_WALLET_ACL Function Parameters

Parameter	Description
wallet_path	Directory path of the wallet. The path is case-sensitive of the format <code>file:directory-path</code> .
acl	The ACL. NULL to unset the host's ACL.

Usage Notes

A wallet's ACL is created and set on-demand when an access control entry (ACE) is appended to the wallet's ACL. Users are discouraged from setting a wallet's ACL manually.

125.7.17 UNASSIGN_ACL Procedure

This deprecated procedure unassigns the access control list (ACL) currently assigned to a network host.



Note:

This procedure is deprecated in Oracle Database 12c. While the procedure remains available in the package for reasons of backward compatibility, Oracle recommends using the [REMOVE_HOST_ACE Procedure](#) and the [REMOVE_WALLET_ACE Procedure](#).

Syntax

```
DBMS_NETWORK_ACL_ADMIN.UNASSIGN_ACL (
    acl          IN VARCHAR2 DEFAULT NULL,
    host         IN VARCHAR2 DEFAULT NULL,
    lower_port   IN PLS_INTEGER DEFAULT NULL,
    upper_port   IN PLS_INTEGER DEFAULT NULL);
```

Parameters

Table 125-20 UNASSIGN_ACL Function Parameters

Parameter	Description
acl	Name of the ACL. Relative path will be relative to "/sys/acls". If ACL is NULL, any ACL assigned to the host is unassigned.
host	Host from which the ACL is to be removed. The host can be the name or the IP address of the host. A wildcard can be used to specify a domain or a IP subnet. The host or domain name is case-insensitive. If host is NULL, the ACL will be unassigned from any host. If both host and acl are NULL, all ACLs assigned to any hosts are unassigned.
lower_port	Lower bound of a TCP port range if not NULL
upper_port	Upper bound of a TCP port range. If NULL, lower_port is assumed.

Examples

```
BEGIN
  DBMS_NETWORK_ACL_ADMIN.UNASSIGN_ACL(
    host      => '*.us.example.com',
    lower_port => 80);
END;
```

125.7.18 UNASSIGN_WALLET_ACL Procedure

This deprecated procedure unassigns the access control list (ACL) currently assigned to a wallet.



Note:

This procedure is deprecated in Oracle Database 12c. While the procedure remains available in the package for reasons of backward compatibility, Oracle recommends using the [REMOVE_HOST_ACE Procedure](#) and the [REMOVE_WALLET_ACE Procedure](#).

Syntax

```
UTL_HTTP.UNASSIGN_WALLET_ACL (
  acl          IN VARCHAR2 DEFAULT NULL,
  wallet_path  IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 125-21 UNASSIGN_WALLET_ACL Procedure Parameters

Parameter	Description
acl	Name of the ACL. Relative path will be relative to "/sys/acls". If acl is NULL, any ACL assigned to the wallet is unassigned

Table 125-21 (Cont.) UNASSIGN_WALLET_ACL Procedure Parameters

Parameter	Description
wallet_path	Directory path of the wallet to which the ACL is assigned. The path is case-sensitive and of the format <i>file:directory-path</i> . If both <i>acl</i> and <i>wallet_path</i> are NULL, all ACLs assigned to any wallets are unassigned.

Examples

```
BEGIN
  DBMS_NETWORK_ACL_ADMIN.UNASSIGN_WALLET_ACL(
    acl      => 'wallet-acl.xml',
    wallet_path => 'file:/example/wallets/test_wallet');
END;
```

DBMS_NETWORK_ACL_UTILITY

The `DBMS_NETWORK_ACL_UTILITY` package provides the utility functions to facilitate the evaluation of access control list (ACL) assignments governing TCP connections to network hosts.



See Also:

For more information, see ["Managing Fine-grained Access to External Network Services"](#) in *Oracle Database Security Guide*

The chapter contains the following topics:

- [Security Model](#)
- [Examples](#)
- [Summary of DBMS_NETWORK_ACL_UTILITY Subprograms](#)

126.1 DBMS_NETWORK_ACL_UTILITY Security Model

EXECUTE on the `DBMS_NETWORK_ACL_UTILITY` package is granted to PUBLIC.

126.2 DBMS_NETWORK_ACL_UTILITY Examples

The `CONTAINS_HOST` Function in this package indicates if a domain or subnet contains a given host or IP address.

It can be used in conjunction with the [CHECK_PRIVILEGE_ACLID Function](#) in the `DBMS_NETWORK_ACL_ADMIN` package to determine the privilege assignments affecting a user's permission to access a network host. The return value of the `CONTAINS_HOST` Function in can also be used to order the ACL assignments by their precedence.

Example 1

For example, for SCOTT's permission to connect to `www.hr.example.com`:

```
SELECT host, lower_port, upper_port, acl,
       DECODE(
         DBMS_NETWORK_ACL_ADMIN.CHECK_PRIVILEGE_ACLID(aclid, 'SCOTT', 'connect'),
         1, 'GRANTED', 0, 'DENIED', NULL) privilege
FROM (SELECT host, acl, aclid, lower_port, upper_port,
            DBMS_NETWORK_ACL_UTILITY.CONTAINS_HOST('www.hr.example.com', host)
      precedence
      FROM dba_network_acls)
WHERE precedence > 0
ORDER BY precedence DESC, lower_port nulls LAST;
```

HOST	LOWER_PORT	UPPER_PORT	ACL	PRIVILEGE
www.hr.example.com	80	80	/sys/acls/www.xml	GRANTED
www.hr.example.com	3000	3999	/sys/acls/www.xml	GRANTED
www.hr.example.com			/sys/acls/www.xml	GRANTED
*.hr.example.com			/sys/acls/all.xml	
*.example.com			/sys/acls/all.xml	

Example 2

For example, for SCOTT's permission to do domain name resolution for www.hr.example.com:

```
SELECT host, acl,
       DECODE(
         DBMS_NETWORK_ACL_ADMIN.CHECK_PRIVILEGE_ACLID(aclid, 'SCOTT', 'resolve'),
         1, 'GRANTED', 0, 'DENIED', null) privilege
FROM (SELECT host, acl, aclid,
            DBMS_NETWORK_ACL_UTILITY.CONTAINS_HOST('www.hr.example.com', host)
            precedence
      FROM dba_network_acls
      WHERE lower_port IS NULL AND upper_port IS NULL)
WHERE precedence > 0
ORDER BY precedence DESC;
```

HOST	ACL	PRIVILEGE
www.hr.example.com	/sys/acls/hr-www.xml	GRANTED
*.hr.example.com	/sys/acls/hr-domain.xml	
*.example.com	/sys/acls/corp-domain.xml	

Note that the "resolve" privilege takes effect only in ACLs assigned without any port range (when lower_port and upper_port are NULL). For this reason, the example does not include lower_port and upper_port columns in the query.

Related Topics

- [CONTAINS_HOST Function](#)
This function determines if the given host is equal to or contained in the given host, domain, or subnet. It handles different representation of the same IP address or subnet. For example, an IPv4-mapped IPv6 address is considered equal to the IPv4-native address it represents. It does not perform domain name resolution when evaluating the host or domain.

126.3 Summary of DBMS_NETWORK_ACL_UTILITY Subprograms

This table lists and briefly describes the DBMS_NETWORK_ACL_UTILITY package subprograms.

Table 126-1 DBMS_NETWORK_ACL_UTILITY Package Subprograms

Subprogram	Description
CONTAINS_HOST Function	Determines if the given host is equal to or contained in the given host, domain, or subnet

Table 126-1 (Cont.) DBMS_NETWORK_ACL_UTILITY Package Subprograms

Subprogram	Description
DOMAIN_LEVEL Function	Returns the domain level of the given host name, domain, or subnet
DOMAINS Function	For a given host, this function returns the domains whose ACL assigned is used to determine if a user has the privilege to access the given host or not.
EQUALS_HOST Function	Determines if the two given hosts, domains, or subnets are equal

126.3.1 CONTAINS_HOST Function

This function determines if the given host is equal to or contained in the given host, domain, or subnet. It handles different representation of the same IP address or subnet. For example, an IPv4-mapped IPv6 address is considered equal to the IPv4-native address it represents. It does not perform domain name resolution when evaluating the host or domain.

Syntax

```
DBMS_NETWORK_ACL_UTILITY.CONTAINS_HOST (
    host      IN   VARCHAR2,
    domain    IN   VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 126-2 CONTAINS_HOST Function Parameters

Parameter	Description
host	Network host
domain	Network host, domain, or subnet

Return Values

Returns a non-NULL value if the given host is equal to or contained in the related host, domain, or subnet:

- If `domain` is a hostname, returns the level of its domain + 1
- If `domain` is a domain name, returns the domain level
- If `domain` is an IP address or subnet, return the number of significant address bits of the IP address or subnet
- If `domain` is the wildcard "*", returns 0

The non-NULL value returned indicates the precedence of the domain or subnet for ACL assignment. The higher the value, the higher is the precedence. NULL will be returned if the host is not equal to or contained in the given host, domain or subnet.

Examples

```
SELECT host, acl, precedence
   FROM (select host, acl,
                DBMS_NETWORK_ACL_UTILITY.CONTAINS_HOST('192.0.2.3', host)
                precedence
          FROM dba_network_acls)
 WHERE precedence > 0
 ORDER BY precedence DESC;
```

HOST	ACL	PRECEDENCE
192.0.2.3	/sys/acls/hr-www.xml	32
::ffff:192.0.2.0/120	/sys/acls/hr-domain.xml	24
::ffff:192.0.0.0/104	/sys/acls/corp-domain.xml	8

126.3.2 DOMAIN_LEVEL Function

This function returns the domain level of the given host name, domain, or subnet.

Syntax

```
DBMS_NETWORK_ACL_UTILITY.DOMAIN_LEVEL (
    host IN VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 126-3 DOMAIN_LEVEL Function Parameters

Parameter	Description
host	Network host, domain, or subnet

Return Values

The domain level of the given host, domain, or subnet.

Usage Notes

Note that this function cannot handle IPv6 addresses and subnets, and subnets in CIDR notation.

Examples

```
SELECT host, acl, domain_level
   FROM (select host, acl,
                DBMS_NETWORK_ACL_UTILITY.DOMAIN_LEVEL(host) domain_level
          FROM dba_network_acls)
 ORDER BY domain_level desc;
```

HOST	ACL	DOMAIN_LEVEL
www.hr.example.com	/sys/acls/hr-www.xml	4
*.hr.example.com	/sys/acls/hr-domain.xml	3
*.example.com	/sys/acls/corp-domain.xml	2

126.3.3 DOMAINS Function

For a given host, this function returns the domains whose ACL assigned determines if a user has the privilege to access the given host or not. When the IP address of the host is given, return the subnets instead.

Syntax

```
DBMS_NETWORK_ACL_UTILITY.DOMAINS (
    host IN VARCHAR2)
RETURN DOMAIN_TABLE PIPELINED;
```

Parameters

Table 126-4 DOMAINS Function Parameters

Parameter	Description
host	Network host

Return Values

The domains or subnets for the given host.

Usage Notes

Note that this function cannot handle IPv6 addresses. Nor can it generate subnets of arbitrary number of prefix bits for an IPv4 address.

Examples

```
select * from table(dbms_network_acl_utility.domains('www.hr.example.com'));

DOMAINS
-----
www.hr.example.com
*.hr.example.com
*.example.com
*.com
*
```

126.3.4 EQUALS_HOST Function

This function determines if the two given hosts, domains, or subnets are equal. It handles different representation of the same IP address or subnet. For example, an IPv4-mapped IPv6 address is considered equal to the IPv4- native address it represents. It does not perform domain name resolution when comparing the two hosts or domains.

Syntax

```
DBMS_NETWORK_ACL_UTILITY.EQUALS_HOST (
    host1 IN VARCHAR2,
    host2 IN VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 126-5 EQUALS_HOST Function Parameters

Parameter	Description
host1	Network host, domain, or subnet to compare
host2	Network host, domain, or subnet to compare

Return Values

1 if the two hosts, domains, or subnets are equal. 0 otherwise.

Examples

```
SELECT host, acl
   FROM dba_network_acls
  WHERE DBMS_NETWORK_ACL_UTILITY.EQUALS_HOST('192.0.2.*', host) = 1;
```

```
HOST          ACL
-----
::ffff:192.0.2.0/120  /sys/acls/hr-domain.xml
```

DBMS_ODCI

DBMS_ODCI package contains a single user function related to the use of Data Cartridges.

This chapter contains the following topic:

- [Summary of DBMS_ODCI Subprograms](#)



See Also:

- *Oracle Database Data Cartridge Developer's Guide*

127.1 Summary of DBMS_ODCI Subprograms

The DBMS_ODCI package has one subprogram, the ESTIMATE_CPU_UNITS function.

Table 127-1 DBMS_ODCI Package Subprograms

Subprogram	Description
ESTIMATE_CPU_UNITS Function	Returns the approximate number of CPU instructions (in thousands) corresponding to a specified time interval (in seconds)

127.1.1 ESTIMATE_CPU_UNITS Function

This function returns the approximate number of CPU instructions (in thousands) corresponding to a specified time interval (in seconds). This information can be used to associate the CPU cost with a user-defined function for the extensible optimizer.

The function takes as input the elapsed time of the user function, measures CPU units by multiplying the elapsed time by the processor speed of the machine, and returns the approximate number of CPU instructions that should be associated with the user function. For a multiprocessor machine, ESTIMATE_CPU_UNITS considers the speed of a single processor.

Syntax

```
DBMS_ODCI.estimate_cpu_units(
    elapsed_time    NUMBER)
RETURN NUMBER;
```

Parameters

Parameter	Description
elapsed_time	The elapsed time in seconds that it takes to execute a function.

Usage Notes

When associating CPU cost with a user-defined function, use the full number of CPU units rather than the number of *thousands* of CPU units returned by `ESTIMATE_CPU_UNITS`; multiply the number returned by `ESTIMATE_CPU_UNITS` by 1,000.

DBMS_OPTIM_BUNDLE

The `DBMS_OPTIM_BUNDLE` package is used to manage the installed but disabled module bug fixes which cause an execution plan change.

This chapter contains the following topics:

- [DBMS_OPTIM_BUNDLE Security Model](#)
- [Summary of DBMS_OPTIM_BUNDLE Subprograms](#)

128.1 DBMS_OPTIM_BUNDLE Security Model

The `DBMS_OPTIM_BUNDLE` package runs with the privileges of the user starting the package. DBA role is required to run this package.

128.2 Summary of DBMS_OPTIM_BUNDLE Subprograms

This table lists the `DBMS_OPTIM_BUNDLE` subprograms and briefly describes them.

Table 128-1 DBMS_OPTIM_BUNDLE Package Subprograms

Subprogram	Description
ENABLE_OPTIM_FIXES Procedure	This procedure enables or disables fixes with plan changes up to the latest installed release update.
GETBUGSFORBUNDLE Procedure	This procedure displays execution plan bug fixes applied as part of release updates.
LISTBUNDLESWITHFCFIXES Procedure	This procedure lists the release update names and release update IDs of release updates with fix control fixes.
SET_FIX_CONTROLS Procedure	This procedure enables or disables a list of fixes with <code>_fix_controls</code> .

128.2.1 ENABLE_OPTIM_FIXES Procedure

The `DBMS_OPTIM_BUNDLE` subprogram, `ENABLE_OPTIM_FIXES` procedure enables or disables fixes with plan changes up to the latest installed release update.

Syntax

```
DBMS_OPTIM_BUNDLE.ENABLE_OPTIM_FIXES (
  action                IN  VARCHAR2  DEFAULT 'OFF',
  scope                 IN  VARCHAR2  DEFAULT 'MEMORY',
  current_setting_precedence IN  VARCHAR2  DEFAULT 'YES');
```

Parameters

Table 128-2 ENABLE_OPTIM_FIXES Procedure Parameters

Parameter	Description
action	<p>Enables or disables all of the installed but disabled execution plan bug fixes up to and including the current release update.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • ON-enables the bundle fixes. • OFF-disables bundle fixes by setting the <code>_fix_controls</code> to the value 0. It will not remove <code>_fix_control</code> entries from SPFILE. <p>The default value is OFF.</p>
scope	<p>The scope of enabling or disabling the installed but disabled execution plan bug fixes.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • MEMORY • SPFILE • BOTH • INITORA <p>MEMORY/SPFILE/BOTH: These three input values enables or disables the fixes in a given scope.</p> <p>INITORA: This input value will just display manual command syntax that the user needs to manually enter into the database's <code>init.ora</code> file in order to enable or disable execution plan bug fixes. When using <code>SCOPE=INITORA</code> in this way, the <code>current_setting_precedence</code> field has no significance.</p>
current_setting_precedence	<p>Sets the precedence of environment settings or release update settings, where these settings are in conflict.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • YES-the current environment settings take precedence in case of conflict • NO-release update settings take precedence in case of conflict <p>The default value is YES.</p>

Examples

To enable all of the installed but disabled execution plan bug fixes up to and including those from the current release update:

```
SQL> execute dbms_optim_bundle.enable_optim_fixes('ON','BOTH', 'YES');
```

This instruction would enable all fixes, in both `MEMORY` and in the persistent `SPFILE`, with a precedence of current setting.

Exceptions

The following exceptions are raised by the `ENABLE_OPTIM_FIXES` Procedure:

- ORA-20001: Bad input value
- ORA-20002: Internal or other errors

128.2.2 GETBUGSFORBUNDLE Procedure

The `DBMS_OPTIM_BUNDLE.GETBUGSFORBUNDLE` subprogram, `GETBUGSFORBUNDLE` procedure displays execution plan bug fixes applied as part of release updates.

Syntax

```
DBMS_OPTIM_BUNDLE.GETBUGSFORBUNDLE (  
    bundleid          IN NUMBER DEFAULT NULL);
```

Parameters

Table 128-3 GETBUGSFORBUNDLE Procedure Parameters

Parameter	Description
bundleid	The release update ID. If <code>NULL</code> , the execution plan bug fixes from the latest bundle is displayed. If a bundle ID is specified, then the execution plan bug fixes up to the specified bundle is displayed. The default value is <code>NULL</code> .

Examples

To view a listing of the installed but disabled execution plan bug fixes from the most recent release update applied:

```
SQL> set serveroutput on;  
SQL> execute dbms_optim_bundle.getbugsforbundle;  
  
19.8.0.0.200714DBRU:  
  Bug: 29304314, fix_controls: 29304314  
  Bug: 29930457, fix_controls: 29930457
```

The above example lists the installed but disabled execution plan bug fixes from the 19.8.0.0.200714DBRU release.

To view a listing of the installed but disabled execution plan bug fixes from release updates up to and including release update 171017:

```
SQL> execute dbms_optim_bundle.getbugsforbundle(171017);
```

Exceptions

The following exceptions are raised by the `GETBUGSFORBUNDLE` Procedure:

- `ORA-20001: Bad input value`
- `ORA-20002: Internal or other errors`

128.2.3 LISTBUNDLESWITHFCFIXES Procedure

The DBMS_OPTIM_BUNDLE subprogram, LISTBUNDLESWITHFCFIXES procedure lists the release update names and release update IDs of release updates with fix control fixes.

Syntax

```
DBMS_OPTIM_BUNDLE.LISTBUNDLESWITHFCFIXES ( );
```

Examples

To view the release update names and release update IDs:

```
SQL> set serveroutput on
SQL> exec dbms_optim_bundle.listBundlesWithFCFixes;
bundleId: 190719, bundleName: 19.4.0.0.190719DBRU
bundleId: 191015, bundleName: 19.5.0.0.191015DBRU
bundleId: 200414, bundleName: 19.7.0.0.200414DBRU
bundleId: 200714, bundleName: 19.8.0.0.200714DBRU
bundleId: 201020, bundleName: 19.9.0.0.201020DBRU
bundleId: 210119, bundleName: 19.10.0.0.210119DBRU
bundleId: 210420, bundleName: 19.11.0.0.210420DBRU
bundleId: 210720, bundleName: 19.12.0.0.210720DBRU
```

PL/SQL procedure successfully completed.

Exceptions

The following exception is raised by the LISTBUNDLESWITHFCFIXES Procedure:

ORA-20002: Internal or other errors

128.2.4 SET_FIX_CONTROLS Procedure

The DBMS_OPTIM_BUNDLE subprogram, SET_FIX_CONTROLS procedure enables or disables a list of fixes with `_fix_controls`. The fixes can be present in a base version, in a release update, or in a one-off release. This procedure appends the new fix control settings to the existing ones.

Syntax

```
DBMS_OPTIM_BUNDLE.SET_FIX_CONTROLS (
    fix_control_string          IN  VARCHAR2,
    sid                        IN  VARCHAR2  DEFAULT '*',
    scope                      IN  VARCHAR2  DEFAULT 'MEMORY',
    current_setting_precedence IN  VARCHAR2  DEFAULT 'YES');
```

Parameters

Table 128-4 SET_FIX_CONTROLS Procedure Parameters

Parameter	Description
<code>fix_control_string</code>	Comma separated list of <code>fix_control:value</code> pair. For example: <code>'13329748:0,20355502:4, 27060221:1'</code>

Table 128-4 (Cont.) SET_FIX_CONTROLS Procedure Parameters

Parameter	Description
sid	The name of the instance on which <code>fix_control</code> setting need to be made. Acceptable values are * or valid <code>instance_name</code> from <code>sys.gv\$instance</code> . The default value is *.
scope	The scope of enabling or disabling the installed but disabled execution plan bug fixes. The possible values are: <ul style="list-style-type: none">• MEMORY• SPFILE• BOTH The default value is MEMORY.
current_setting_precedence	Precedence of current setting over user supplied setting. The possible values are: <ul style="list-style-type: none">• YES—the current environment settings take precedence in case of conflict• NO—input settings take precedence in case of conflict The default value is YES.

Exceptions

The following exceptions are raised by the `SET_FIX_CONTROLS` Procedure:

- ORA-20001: Bad input value
- ORA-20002: Internal or other errors

DBMS_OUTLN

The `DBMS_OUTLN` package, synonymous with `OUTLN_PKG`, contains the functional interface for subprograms associated with the management of stored outlines.

See Also:

For more information about using the `DBMS_OUTLN` package, see *Oracle Database SQL Tuning Guide*.

Note:

Stored outlines will be desupported in a future release in favor of SQL plan management. In Oracle Database 11g Release 1 (11.1), stored outlines continue to function as in past releases. However, Oracle strongly recommends that you use SQL plan management for new applications. SQL plan management creates SQL plan baselines, which offer superior SQL performance and stability compared with stored outlines. If you have existing stored outlines, please consider migrating them to SQL plan baselines by using the [LOAD_PLANS_FROM_CURSOR_CACHE Functions](#) or [LOAD_PLANS_FROM_SQLSET Function](#) of the `DBMS_SPM` package. When the migration is complete, you should disable or remove the stored outlines.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_OUTLN Subprograms](#)

129.1 DBMS_OUTLN Overview

A stored outline is the stored data that pertains to an execution plan for a given SQL statement. It enables the optimizer to repeatedly re-create execution plans that are equivalent to the plan originally generated along with the outline. The data stored in an outline consists, in part, of a set of hints that are used to achieve plan stability.

Stored outlines will be de-supported in a future release in favor of SQL plan management. As of 11g R1, stored outlines continue to function as in past releases, but Oracle strongly recommends that you use SQL plan management for new applications. SQL plan management creates SQL plan baselines, which offer superior SQL performance and stability compared with stored outlines. If you have existing stored outlines, please consider migrating them to SQL plan baselines by using the [LOAD_PLANS_FROM_CURSOR_CACHE Functions](#) or the [LOAD_PLANS_FROM_SQLSET Function](#) of the `DBMS_SPM` package. When the migration is complete, you should disable or remove the stored outlines.

129.2 DBMS_OUTLN Security Model

DBMS_OUTLN contains management procedures that should be available to appropriate users only. EXECUTE privilege is not extended to the general user community unless the DBA explicitly does so.

PL/SQL functions that are available for outline management purposes can be executed only by users with EXECUTE privilege on the procedure (or package).

129.3 Summary of DBMS_OUTLN Subprograms

This table lists the DBMS_OUTLN subprograms and briefly describes them.

Table 129-1 DBMS_OUTLN Package Subprograms

Subprogram	Description
CLEAR_USED Procedure	Clears the outline 'used' flag
CREATE_OUTLINE Procedure	Generates outlines from the shared cursor identified by hash value and child number
DROP_BY_CAT Procedure	Drops outlines that belong to a specified category
DROP_UNUSED Procedure	Drops outlines that have never been applied in the compilation of a SQL statement
EXACT_TEXT_SIGNATURES Procedure	Updates outline signatures to those that compute based on exact text matching
UPDATE_BY_CAT Procedure	Changes the category of outlines in one category to a new category
UPDATE_SIGNATURES Procedure	Updates outline signatures to the current version's signature

129.3.1 CLEAR_USED Procedure

This procedure clears the outline 'used' flag.

Syntax

```
DBMS_OUTLN.CLEAR_USED (
    name      IN      VARCHAR2);
```

Parameters

Table 129-2 CLEAR_USED Procedure Parameters

Parameter	Description
name	Name of the outline.

129.3.2 CREATE_OUTLINE Procedure

This procedure generates an outline by reparsing the SQL statement from the shared cursor identified by hash value and child number.

Syntax

```
DBMS_OUTLN.CREATE_OUTLINE (  
    hash_value    IN NUMBER,  
    child_number  IN NUMBER,  
    category      IN VARCHAR2 DEFAULT 'DEFAULT');
```

Parameters

Table 129-3 CREATE_OUTLINE Procedure Parameters

Parameter	Description
hash_value	Hash value identifying the target shared cursor.
child_number	Child number of the target shared cursor.
category	Category in which to create outline (optional).

129.3.3 DROP_BY_CAT Procedure

This procedure drops outlines that belong to a particular category. While outlines are put into the `DEFAULT` category unless otherwise specified, users have the option of grouping their outlines into groups called categories.

Syntax

```
DBMS_OUTLN.DROP_BY_CAT (  
    cat VARCHAR2);
```

Parameters

Table 129-4 DROP_BY_CAT Procedure Parameters

Parameter	Description
cat	Category of outlines to drop.

Usage Notes

This procedure purges a category of outlines in a single call.

Examples

This example drops all outlines in the `DEFAULT` category:

```
DBMS_OUTLN.DROP_BY_CAT('DEFAULT');
```

129.3.4 DROP_UNUSED Procedure

This procedure drops outlines that have never been applied in the compilation of a SQL statement.

Syntax

```
DBMS_OUTLN.DROP_UNUSED;
```

Usage Notes

You can use `DROP_UNUSED` for outlines generated by an application for one-time use SQL statements created as a result of dynamic SQL. These outlines are never used and take up valuable disk space.

129.3.5 EXACT_TEXT_SIGNATURES Procedure

This procedure updates outline signatures to those that compute based on exact text matching.

Syntax

```
DBMS_OUTLN.EXACT_TEXT_SIGNATURES;
```

Usage Notes

This procedure is relevant only for downgrading an outline to 8.1.6 or earlier.

129.3.6 UPDATE_BY_CAT Procedure

This procedure changes the category of all outlines in one category to a new category.

Syntax

```
DBMS_OUTLN.UPDATE_BY_CAT (
    oldcat    VARCHAR2 default 'DEFAULT',
    newcat    VARCHAR2 default 'DEFAULT');
```

Parameters

Table 129-5 UPDATE_BY_CAT Procedure Parameters

Parameter	Description
oldcat	The current category of outlines.
newcat	The new category of outlines.

129.3.7 UPDATE_SIGNATURES Procedure

This procedure updates outline signatures to the current version's signature.

Syntax

```
DBMS_OUTLN.UPDATE_SIGNATURES;
```

Usage Notes

You should execute this procedure if you have imported outlines generated in an earlier release to ensure that the signatures are compatible with the current release's computation algorithm.

DBMS_OUTPUT

The `DBMS_OUTPUT` package enables you to send messages from stored procedures, packages, and triggers. The package is especially useful for displaying PL/SQL debugging information.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Operational Notes](#)
- [Exceptions](#)
- [Rules and Limits](#)
- [Examples](#)
- [Data Structures](#)
- [Summary of DBMS_OUTPUT Subprograms](#)

130.1 DBMS_OUTPUT Overview

The package is typically used for debugging, or for displaying messages and reports to SQL*DBA or SQL*Plus (such as are produced by applying the SQL command `DESCRIBE` to procedures).

The [PUT Procedure](#) and [PUT_LINE Procedure](#) in this package enable you to place information in a buffer that can be read by another trigger, procedure, or package. In a separate PL/SQL procedure or anonymous block, you can display the buffered information by calling the [GET_LINE Procedure](#) and [GET_LINES Procedure](#).

If the package is disabled, all calls to subprograms are ignored. In this way, you can design your application so that subprograms are available only when a client is able to process the information.

130.2 DBMS_OUTPUT Security Model

The `dbmsotpt.sql` script must be run as user `SYS`. This creates the public synonym `DBMS_OUTPUT`, and `EXECUTE` permission on this package is granted to `public`.

130.3 DBMS_OUTPUT Operational Notes

The following operational notes apply to `DBMS_OUTPUT`.

- If you do not call `GET_LINE`, or if you do not display the messages on your screen in SQL*Plus, the buffered messages are ignored.
- SQL*Plus calls `GET_LINES` after issuing a SQL statement or anonymous PL/SQL calls.

- Typing `SET SERVEROUTPUT ON` in SQL*Plus has the effect of invoking `DBMS_OUTPUT.ENABLE (buffer_size => NULL);` with no limit on the output.
- You should generally avoid having application code invoke either the [DISABLE Procedure](#) or [ENABLE Procedure](#) because this could subvert the attempt of an external tool like SQL*Plus to control whether or not to display output.

**Note:**

Messages sent using `DBMS_OUTPUT` are not actually sent until the sending subprogram or trigger completes. There is no mechanism to flush output during the execution of a procedure.

130.4 DBMS_OUTPUT Exceptions

`DBMS_OUTPUT` subprograms raise the application error `ORA-20000` and return errors.

The output procedures can return the following errors:

Table 130-1 DBMS_OUTPUT Errors

Error	Description
ORU-10027:	Buffer overflow
ORU-10028:	Line length overflow

130.5 DBMS_OUTPUT Rules and Limits

The following are limits on `DBMS_OUTPUT` line and buffer size.

- The maximum line size is 32767 bytes.
- The default buffer size is 20000 bytes. The minimum size is 2000 bytes and the maximum is unlimited.

130.6 DBMS_OUTPUT Examples

This topic contains three examples of using `DBMS_OUTPUT`.

Example 1: Using a Trigger to Produce Output

You can use a trigger to print out some output from the debugging process. For example, you could code the trigger to invoke:

```
DBMS_OUTPUT.PUT_LINE('I got here:'||:new.col||' is the new value');
```

If you have enabled the `DBMS_OUTPUT` package, then the text produced by this `PUT_LINE` would be buffered, and you could, after executing the statement (presumably

some INSERT, DELETE, or UPDATE that caused the trigger to fire), retrieve the line of information. For example:

```
BEGIN
  DBMS_OUTPUT.GET_LINE(:buffer, :status);
END;
```

You could then optionally display the buffer on the screen. You repeat calls to `GET_LINE` until `status` comes back as nonzero. For better performance, you should use calls to [GET_LINES Procedure](#) which can return an array of lines.

Example 2: Debugging Stored Procedures and Triggers

The `DBMS_OUTPUT` package is commonly used to debug stored procedures and triggers. This package can also be used to enable you to retrieve information about an object and format this output, as shown in ["Example 3: Retrieving Information About an Object"](#).

This function queries the employee table and returns the total salary for a specified department. The function includes several calls to the `PUT_LINE` procedure:

```
CREATE FUNCTION dept_salary (dnum NUMBER) RETURN NUMBER IS
  CURSOR emp_cursor IS
    SELECT sal, comm FROM emp WHERE deptno = dnum;
  total_wages  NUMBER(11, 2) := 0;
  counter      NUMBER(10) := 1;
BEGIN

  FOR emp_record IN emp_cursor LOOP
    emp_record.comm := NVL(emp_record.comm, 0);
    total_wages := total_wages + emp_record.sal
      + emp_record.comm;
    DBMS_OUTPUT.PUT_LINE('Loop number = ' || counter ||
      ' ; Wages = ' || TO_CHAR(total_wages)); /* Debug line */
    counter := counter + 1; /* Increment debug counter */
  END LOOP;
  /* Debug line */
  DBMS_OUTPUT.PUT_LINE('Total wages = ' ||
    TO_CHAR(total_wages));
  RETURN total_wages;

END dept_salary;
```

Assume the `EMP` table contains the following rows:

EMPNO	SAL	COMM	DEPT
1002	1500	500	20
1203	1000		30
1289	1000		10
1347	1000	250	20

Assume the user executes the following statements in `SQL*Plus`:

```
SET SERVEROUTPUT ON
VARIABLE salary NUMBER;
EXECUTE :salary := dept_salary(20);
```

The user would then see the following information displayed in the output pane:

```
Loop number = 1; Wages = 2000
Loop number = 2; Wages = 3250
```

```
Total wages = 3250
```

```
PL/SQL procedure successfully executed.
```

Example 3: Retrieving Information About an Object

In this example, the user has used the `EXPLAIN PLAN` command to retrieve information about the execution plan for a statement and has stored it in `PLAN_TABLE`. The user has also assigned a statement ID to this statement. The example `EXPLAIN_OUT` procedure retrieves the information from this table and formats the output in a nested manner that more closely depicts the order of steps undergone in processing the SQL statement.

```

/*****
/* Create EXPLAIN_OUT procedure. User must pass STATEMENT_ID to */
/* to procedure, to uniquely identify statement.                */
*****/
CREATE OR REPLACE PROCEDURE explain_out
  (statement_id IN VARCHAR2) AS

  -- Retrieve information from PLAN_TABLE into cursor EXPLAIN_ROWS.

  CURSOR explain_rows IS
    SELECT level, id, position, operation, options,
           object_name
    FROM plan_table
    WHERE statement_id = explain_out.statement_id
    CONNECT BY PRIOR id = parent_id
              AND statement_id = explain_out.statement_id
    START WITH id = 0
    ORDER BY id;

BEGIN

  -- Loop through information retrieved from PLAN_TABLE:

  FOR line IN explain_rows LOOP

    -- At start of output, include heading with estimated cost.

    IF line.id = 0 THEN
      DBMS_OUTPUT.PUT_LINE ('Plan for statement '
                            || statement_id
                            || ', estimated cost = ' || line.position);
    END IF;

    -- Output formatted information. LEVEL determines indentation level.

    DBMS_OUTPUT.PUT_LINE (lpad(' ', 2*(line.level-1)) ||
                          line.operation || ' ' || line.options || ' ' ||
                          line.object_name);
  END LOOP;

END;
```

 **See Also:**
[UTL_FILE](#)

130.7 DBMS_OUTPUT Data Structures

The `DBMS_OUTPUT` package declares 2 collection types for use with the `GET_LINES` Procedure.

TABLE Types

[CHARARR Table Type](#)

OBJECT Types

[DBMSOUTPUT_LINESARRAY Object Type](#)

Related Topics

- [GET_LINES Procedure](#)
This procedure retrieves an array of lines from the buffer.

130.7.1 CHARARR Table Type

This package type is to be used with the `GET_LINES` Procedure to obtain text submitted through the `PUT` Procedure and `PUT_LINE` Procedure.

Syntax

```
TYPE CHARARR IS TABLE OF VARCHAR2(32767) INDEX BY BINARY_INTEGER;
```

Related Topics

- [GET_LINES Procedure](#)
This procedure retrieves an array of lines from the buffer.
- [PUT Procedure](#)
This procedure places a partial line in the buffer.
- [PUT_LINE Procedure](#)
This procedure places a line in the buffer.

130.7.2 DBMS_OUTPUT DBMSOUTPUT_LINESARRAY Object Type

This type, defined outside the package, is to be used with the `GET_LINES` Procedure to obtain text submitted through the `PUT` Procedure and `PUT_LINE` Procedure.

Syntax

```
TYPE DBMSOUTPUT_LINESARRAY IS  
  VARRAY(2147483647) OF VARCHAR2(32767);
```

Related Topics

- [GET_LINES Procedure](#)
This procedure retrieves an array of lines from the buffer.

- [PUT Procedure](#)
This procedure places a partial line in the buffer.
- [PUT_LINE Procedure](#)
This procedure places a line in the buffer.

130.8 Summary of DBMS_OUTPUT Subprograms

This table lists the `DBMS_OUTPUT` subprograms and briefly describes them.

Table 130-2 DBMS_OUTPUT Package Subprograms

Subprogram	Description
DISABLE Procedure	Disables message output
ENABLE Procedure	Enables message output
GET_LINE Procedure	Retrieves one line from buffer
GET_LINES Procedure	Retrieves an array of lines from buffer
NEW_LINE Procedure	Terminates a line created with <code>PUT</code>
PUT Procedure	Places a partial line in the buffer
PUT_LINE Procedure	Places line in buffer



Note:

The [PUT Procedure](#) that take a number are obsolete and, while currently supported, are included in this release for legacy reasons only.

130.8.1 DISABLE Procedure

This procedure disables calls to `PUT`, `PUT_LINE`, `NEW_LINE`, `GET_LINE`, and `GET_LINES`, and purges the buffer of any remaining information.

As with the [ENABLE Procedure](#), you do not need to call this procedure if you are using the `SERVEROUTPUT` option of `SQL*Plus`.

Syntax

```
DBMS_OUTPUT.DISABLE;
```

Pragmas

```
pragma restrict_references(disable,WNDS,RNDS);
```

130.8.2 ENABLE Procedure

This procedure enables calls to `PUT`, `PUT_LINE`, `NEW_LINE`, `GET_LINE`, and `GET_LINES`.

Calls to these procedures are ignored if the `DBMS_OUTPUT` package is not activated.

Syntax

```
DBMS_OUTPUT.ENABLE (
    buffer_size IN INTEGER DEFAULT 20000);
```

Pragmas

```
pragma restrict_references(enable,WNDS,RNDS);
```

Parameters**Table 130-3** ENABLE Procedure Parameters

Parameter	Description
buffer_size	Upper limit, in bytes, the amount of buffered information. Setting buffer_size to NULL specifies that there should be no limit.

Usage Notes

- It is not necessary to call this procedure when you use the SET SERVEROUTPUT option of SQL*Plus.
- If there are multiple calls to ENABLE, then buffer_size is the last of the values specified. The maximum size is 1,000,000, and the minimum is 2,000 when the user specifies buffer_size (NOT NULL).
- NULL is expected to be the usual choice. The default is 20,000 for backwards compatibility with earlier database versions that did not support unlimited buffering.

130.8.3 GET_LINE Procedure

This procedure retrieves a single line of buffered information.

Syntax

```
DBMS_OUTPUT.GET_LINE (
    line    OUT VARCHAR2,
    status  OUT INTEGER);
```

Parameters**Table 130-4** GET_LINE Procedure Parameters

Parameter	Description
line	Returns a single line of buffered information, excluding a final newline character. You should declare the actual for this parameter as VARCHAR2 (32767) to avoid the risk of "ORA-06502: PL/SQL: numeric or value error: character string buffer too small".
status	If the call completes successfully, then the status returns as 0. If there are no more lines in the buffer, then the status is 1.

Usage Notes

- You can choose to retrieve from the buffer a single line or an array of lines. Call the `GET_LINE` procedure to retrieve a single line of buffered information. To reduce the number of calls to the server, call the `GET_LINES` procedure to retrieve an array of lines from the buffer.
- You can choose to automatically display this information if you are using SQL*Plus by using the special `SET SERVEROUTPUT ON` command.
- After calling `GET_LINE` or `GET_LINES`, any lines not retrieved before the next call to `PUT`, `PUT_LINE`, or `NEW_LINE` are discarded to avoid confusing them with the next message.

130.8.4 GET_LINES Procedure

This procedure retrieves an array of lines from the buffer.

Syntax

```
DBMS_OUTPUT.GET_LINES (
    lines      OUT   CHARARR,
    numlines   IN OUT INTEGER);

DBMS_OUTPUT.GET_LINES (
    lines      OUT   DBMSOUTPUT_LINESARRAY,
    numlines   IN OUT INTEGER);
```

Parameters

Table 130-5 GET_LINES Procedure Parameters

Parameter	Description
<code>lines</code>	Returns an array of lines of buffered information. The maximum length of each line in the array is 32767 bytes. It is recommended that you use the <code>VARRAY</code> overload version in a 3GL host program to execute the procedure from a PL/SQL anonymous block.
<code>numlines</code>	Number of lines you want to retrieve from the buffer. After retrieving the specified number of lines, the procedure returns the number of lines actually retrieved. If this number is less than the number of lines requested, then there are no more lines in the buffer.

Usage Notes

- You can choose to retrieve from the buffer a single line or an array of lines. Call the `GET_LINE` procedure to retrieve a single line of buffered information. To reduce the number of calls to the server, call the `GET_LINES` procedure to retrieve an array of lines from the buffer.
- You can choose to automatically display this information if you are using SQL*Plus by using the special `SET SERVEROUTPUT ON` command.

- After calling `GET_LINE` or `GET_LINES`, any lines not retrieved before the next call to `PUT`, `PUT_LINE`, or `NEW_LINE` are discarded to avoid confusing them with the next message.

130.8.5 NEW_LINE Procedure

This procedure puts an end-of-line marker.

The [GET_LINE Procedure](#) and the [GET_LINES Procedure](#) return "lines" as delimited by "newlines". Every call to the [PUT_LINE Procedure](#) or [NEW_LINE Procedure](#) generates a line that is returned by `GET_LINE(S)`.

Syntax

```
DBMS_OUTPUT.NEW_LINE;
```

130.8.6 PUT Procedure

This procedure places a partial line in the buffer.



Note:

The `PUT` procedure that takes a `NUMBER` is obsolete and, while currently supported, is included in this release for legacy reasons only.

Syntax

```
DBMS_OUTPUT.PUT (
    item IN VARCHAR2);
```

Parameters

Table 130-6 PUT Procedure Parameters

Parameter	Description
item	Item to buffer.

Exceptions

Table 130-7 PUT Procedure Exceptions

Error	Description
ORA-20000, ORU-10027:	Buffer overflow, limit of <buf_limit> bytes.
ORA-20000, ORU-10028:	Line length overflow, limit of 32767 bytes for each line.

Usage Notes

- You can build a line of information piece by piece by making multiple calls to `PUT`, or place an entire line of information into the buffer by calling `PUT_LINE`.

- When you call `PUT_LINE` the item you specify is automatically followed by an end-of-line marker. If you make calls to `PUT` to build a line, then you must add your own end-of-line marker by calling `NEW_LINE`. `GET_LINE` and `GET_LINES` do not return lines that have not been terminated with a newline character.
- If your lines exceed the line limit, you receive an error message.
- Output that you create using `PUT` or `PUT_LINE` is buffered. The output cannot be retrieved until the PL/SQL program unit from which it was buffered returns to its caller.

For example, SQL*Plus does not display `DBMS_OUTPUT` messages until the PL/SQL program completes. There is no mechanism for flushing the `DBMS_OUTPUT` buffers within the PL/SQL program.

```
SQL> SET SERVEROUTPUT ON
SQL> BEGIN
  2  DBMS_OUTPUT.PUT_LINE ('hello');
  3  DBMS_LOCK.SLEEP (10);
  4  END;
```

130.8.7 PUT_LINE Procedure

This procedure places a line in the buffer.



Note:

The `PUT_LINE` procedure that takes a `NUMBER` is obsolete and, while currently supported, is included in this release for legacy reasons only.

Syntax

```
DBMS_OUTPUT.PUT_LINE (
  item IN VARCHAR2);
```

Parameters

Table 130-8 PUT_LINE Procedure Parameters

Parameter	Description
item	Item to buffer.

Exceptions

Table 130-9 PUT_LINE Procedure Exceptions

Error	Description
ORA-20000, ORU-10027:	Buffer overflow, limit of <buf_limit> bytes.
ORA-20000, ORU-10028:	Line length overflow, limit of 32767 bytes for each line.

Usage Notes

- You can build a line of information piece by piece by making multiple calls to `PUT`, or place an entire line of information into the buffer by calling `PUT_LINE`.
- When you call `PUT_LINE` the item you specify is automatically followed by an end-of-line marker. If you make calls to `PUT` to build a line, then you must add your own end-of-line marker by calling `NEW_LINE`. `GET_LINE` and `GET_LINES` do not return lines that have not been terminated with a newline character.
- If your lines exceeds the line limit, you receive an error message.
- Output that you create using `PUT` or `PUT_LINE` is buffered. The output cannot be retrieved until the PL/SQL program unit from which it was buffered returns to its caller.

For example, SQL*Plus does not display `DBMS_OUTPUT` messages until the PL/SQL program completes. There is no mechanism for flushing the `DBMS_OUTPUT` buffers within the PL/SQL program. For example:

```
SQL> SET SERVEROUTPUT ON
SQL> BEGIN
  2 DBMS_OUTPUT.PUT_LINE ('hello');
  3 DBMS_LOCK.SLEEP (10);
  4 END;
```

DBMS_PARALLEL_EXECUTE

The `DBMS_PARALLEL_EXECUTE` package enables incremental update of table data in parallel.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Views](#)
- [Exceptions](#)
- [Examples](#)
- [Summary of DBMS_PARALLEL_EXECUTE Subprograms](#)



See Also:

- [Oracle Database Development Guide](#)
- [Oracle Database Reference](#)

131.1 DBMS_PARALLEL_EXECUTE Overview

This package lets you incrementally update table data in parallel, in two high-level steps.

1. Group sets of rows in the table into smaller-sized chunks.
2. Run a user-specified statement on these chunks in parallel, and commit when finished processing each chunk.

This package introduces the notion of *parallel execution task*. This task groups the various steps associated with the parallel execution of a PL/SQL block, which is typically updating table data.

All of the package subroutines (except the [GENERATE_TASK_NAME Function](#) and the [TASK_STATUS Procedure](#)) perform a commit.

131.2 DBMS_PARALLEL_EXECUTE Security Model

`DBMS_PARALLEL_EXECUTE` is a SYS-owned package which is granted to PUBLIC.

Users who have the `ADM_PARALLEL_EXECUTE_TASK` role can perform administrative routines (qualified by the prefix `ADM_`) and access the DBA view.

Apart from the administrative routines, all the subprograms refer to tasks owned by the current user.

To execute chunks in parallel, you must have `CREATE JOB` system privilege.

The `CHUNK_BY_SQL`, `RUN_TASK`, and `RESUME_TASK` subprograms require a query, and are executed using `DBMS_SQL`. Invokers of the `DBMS_SQL` interface must ensure that no query contains SQL injection.

131.3 DBMS_PARALLEL_EXECUTE Constants

The `DBMS_PARALLEL_EXECUTE` package uses the constants described in these two tables.

Table 131-1 DBMS_PARALLEL_EXECUTE Constants - Chunk Status Value

Constant	Type	Value	Description
ASSIGNED	NUMBER	1	Chunk has been assigned for processing
PROCESSED	NUMBER	2	Chunk has been processed successfully
PROCESSED_WITH_ERROR	NUMBER	3	Chunk has been processed, but an error occurred during processing
UNASSIGNED	NUMBER	0	Chunk is unassigned

Table 131-2 DBMS_PARALLEL_EXECUTE Constants - Task Status Value

Constant	Type	Value	Description
CHUNKED	NUMBER	5	Table associated with the task has been chunked, but none of the chunk has been assigned for processing
CHUNKING	NUMBER	2	Table associated with the task is being chunked
CHUNKING_FAILED	NUMBER	3	Chunking failed
CRASHED	NUMBER	9	Only applicable if parallel execution is used, this occurs if a job secondary process crashes or if the database crashes during <code>EXECUTE</code> , leaving a chunk in <code>ASSIGNED</code> or <code>UNASSIGNED</code> state.
CREATED	NUMBER	1	The task has been created by the CREATE_TASK Procedure
FINISHED	NUMBER	7	All chunks processed without error
FINISHED_WITH_ERROR	NUMBER	8	All chunks processed, but with errors in some cases
NO_CHUNKS	NUMBER	4	Table associated with the task has no chunks created
PROCESSING	NUMBER	6	Part of the chunk assigned for processing, or which has been processed

**Note:**

Use constants instead of absolute values, because absolute values might change in future.

131.4 DBMS_PARALLEL_EXECUTE Views

The `DBMS_PARALLEL_EXECUTE` package uses the following views.

- `DBA_PARALLEL_EXECUTE_CHUNKS`
- `DBA_PARALLEL_EXECUTE_TASKS`
- `USER_PARALLEL_EXECUTE_CHUNKS`
- `USER_PARALLEL_EXECUTE_TASKS`

131.5 DBMS_PARALLEL_EXECUTE Exceptions

The following table lists the exceptions raised by `DBMS_PARALLEL_EXECUTE`.

Table 131-3 Exceptions Raised by DBMS_PARALLEL_EXECUTE

Exception	Error Code	Description
<code>CHUNK_NOT_FOUND</code>	29499	Specified chunk does not exist
<code>DUPLICATE_TASK_NAME</code>	29497	Same task name has been used by an existing task
<code>INVALID_STATE_FOR_CHUNK</code>	29492	Attempts to chunk a table that is not in <code>CREATED</code> or <code>CHUNKING_FAILED</code> state
<code>INVALID_STATE_FOR_RESUME</code>	29495	Attempts to resume execution, but the task is not in <code>FINISHED_WITH_ERROR</code> or <code>CRASHED</code> state
<code>INVALID_STATE_FOR_RUN</code>	29494	Attempts to execute the task that is not in <code>CHUNKED</code> state
<code>INVALID_STATUS</code>	29493	Attempts to set an invalid value to the chunk status
<code>INVALID_TABLE</code>	29491	Attempts to chunk a table by rowid in cases in which the table is not a physical table, or the table is an IOT
<code>MISSING_ROLE</code>	29490	User does not have the necessary <code>ADM_PARALLEL_EXECUTE</code> role
<code>TASK_NOT_FOUND</code>	29498	Specified <code>task_name</code> does not exist

131.6 DBMS_PARALLEL_EXECUTE Examples

The following examples run on the Human Resources (HR) schema of the Oracle Database Sample Schemas. They require that the HR schema be created with the `JOB SYSTEM` privilege.

Chunk by ROWID

This example shows the most common usage of this package. After calling the [RUN_TASK Procedure](#), it checks for errors and reruns in the case of error.

```

DECLARE
  l_sql_stmt VARCHAR2(1000);
  l_try NUMBER;
  l_status NUMBER;
BEGIN

  -- Create the TASK
  DBMS_PARALLEL_EXECUTE.CREATE_TASK ('mytask');

  -- Chunk the table by ROWID
  DBMS_PARALLEL_EXECUTE.CREATE_CHUNKS_BY_ROWID('mytask', 'HR', 'EMPLOYEES',
true, 100);

  -- Execute the DML in parallel
  l_sql_stmt := 'update EMPLOYEES e
    SET e.salary = e.salary + 10
    WHERE rowid BETWEEN :start_id AND :end_id';
  DBMS_PARALLEL_EXECUTE.RUN_TASK('mytask', l_sql_stmt, DBMS_SQL.NATIVE,
    parallel_level => 10);

  -- If there is an error, RESUME it for at most 2 times.
  L_try := 0;
  L_status := DBMS_PARALLEL_EXECUTE.TASK_STATUS('mytask');
  WHILE (l_try < 2 and L_status != DBMS_PARALLEL_EXECUTE.FINISHED)
  LOOP
    L_try := l_try + 1;
    DBMS_PARALLEL_EXECUTE.RESUME_TASK('mytask');
    L_status := DBMS_PARALLEL_EXECUTE.TASK_STATUS('mytask');
  END LOOP;

  -- Done with processing; drop the task
  DBMS_PARALLEL_EXECUTE.DROP_TASK('mytask');

END;
/

```

Chunk by User-Provided SQL

A user can specify a chunk algorithm by using the [CREATE_CHUNKS_BY_SQL Procedure](#). This example shows that rows with the same `manager_id` are grouped together and processed in one chunk.

```

DECLARE
  l_chunk_sql VARCHAR2(1000);
  l_sql_stmt VARCHAR2(1000);
  l_try NUMBER;
  l_status NUMBER;
BEGIN

  -- Create the TASK
  DBMS_PARALLEL_EXECUTE.CREATE_TASK ('mytask');

  -- Chunk the table by MANAGER_ID
  l_chunk_sql := 'SELECT distinct manager_id, manager_id FROM employees';
  DBMS_PARALLEL_EXECUTE.CREATE_CHUNKS_BY_SQL('mytask', l_chunk_sql, false);

  -- Execute the DML in parallel
  -- the WHERE clause contain a condition on manager_id, which is the chunk
  -- column. In this case, grouping rows is by manager_id.
  l_sql_stmt := 'update EMPLOYEES e
    SET e.salary = e.salary + 10

```

```

        WHERE manager_id between :start_id and :end_id';
DBMS_PARALLEL_EXECUTE.RUN_TASK('mytask', l_sql_stmt, DBMS_SQL.NATIVE,
                               parallel_level => 10);

-- If there is error, RESUME it for at most 2 times.
L_try := 0;
L_status := DBMS_PARALLEL_EXECUTE.TASK_STATUS('mytask');
WHILE(l_try < 2 and L_status != DBMS_PARALLEL_EXECUTE.FINISHED)
Loop
    L_try := l_try + 1;
    DBMS_PARALLEL_EXECUTE.RESUME_TASK('mytask');
    L_status := DBMS_PARALLEL_EXECUTE.TASK_STATUS('mytask');
END LOOP;

-- Done with processing; drop the task
DBMS_PARALLEL_EXECUTE.DROP_TASK('mytask');

end;
/

```

Executing Chunks in an User-defined Framework

You can execute chunks in a self-defined framework without using the [RUN_TASK Procedure](#). This example shows how to use [GET_ROWID_CHUNK Procedure](#), [EXECUTE IMMEDIATE](#), [SET_CHUNK_STATUS Procedure](#) to execute the chunks.

```

DECLARE
    l_sql_stmt varchar2(1000);
    l_try number;
    l_status number;
    l_chunk_id number;
    l_start_rowid rowid;
    l_end_rowid rowid;
    l_any_rows boolean;
    CURSOR c1 IS SELECT chunk_id
                  FROM user_parallel_execute_chunks
                  WHERE task_name = 'mytask'
                     AND STATUS IN (DBMS_PARALLEL_EXECUTE.PROCESSED_WITH_ERROR,
                                     DBMS_PARALLEL_EXECUTE.ASSIGNED);
BEGIN
    -- Create the Objects, task, and chunk by ROWID
    DBMS_PARALLEL_EXECUTE.CREATE_TASK ('mytask');
    DBMS_PARALLEL_EXECUTE.CREATE_CHUNKS_BY_ROWID('mytask', 'HR', 'EMPLOYEES', true, 100);

    l_sql_stmt := 'update EMPLOYEES e
                  SET e.salary = e.salary + 10
                  WHERE rowid BETWEEN :start_id AND :end_id';

    -- Execute the DML in his own framework
    --
    -- Process each chunk and commit.
    -- After processing one chunk, repeat this process until
    -- all the chunks are processed.
    --
    <<main_processing>>
    LOOP
        --
        -- Get a chunk to process; if there is nothing to process, then exit the
        -- loop;
        --
    END LOOP;

```



```

DBMS_PARALLEL_EXECUTE.GET_ROWID_CHUNK('mytask',
                                        l_chunk_id,
                                        l_start_rowid,
                                        l_end_rowid,
                                        l_any_rows);

IF (l_any_rows = false) THEN EXIT; END IF;

--
-- The chunk is specified by start_id and end_id.
-- Bind the start_id and end_id and then execute it
--
-- If no error occurred, set the chunk status to PROCESSED.
--
-- Catch any exception. If an exception occurred, store the error num/msg
-- into the chunk table and then continue to process the next chunk.
--
BEGIN
  EXECUTE IMMEDIATE l_sql_stmt using l_start_rowid, l_end_rowid;
  DBMS_PARALLEL_EXECUTE.SET_CHUNK_STATUS('mytask',l_chunk_id,
    DBMS_PARALLEL_EXECUTE.PROCESSED);
EXCEPTION WHEN OTHERS THEN
  DBMS_PARALLEL_EXECUTE.SET_CHUNK_STATUS('mytask', l_chunk_id,
    DBMS_PARALLEL_EXECUTE.PROCESSED_WITH_ERROR, SQLCODE, SQLERRM);
END;

--
-- Finished processing one chunk; Commit here
--
COMMIT;
END LOOP;

```

131.7 Summary of DBMS_PARALLEL_EXECUTE Subprograms

This table lists the DBMS_PARALLEL_EXECUTE subprograms and briefly describes them.

Table 131-4 DBMS_PARALLEL_EXECUTE Package Subprograms

Subprogram	Description
ADM_DROP_CHUNKS Procedure	Drops all chunks of the specified task owned by the specified owner
ADM_DROP_TASK Procedure	Drops the task of the given user and all related chunks
ADM_TASK_STATUS Function	Returns the task status
ADM_STOP_TASK Procedure	Stops the task of the given owner and related job secondary processes
CREATE_TASK Procedure	Creates a task for the current user
CREATE_CHUNKS_BY_NUMBER_COLUMN Procedure	Chunks the table associated with the given task by the specified column
CREATE_CHUNKS_BY_ROWID Procedure	Chunks the table associated with the given task by ROWID
CREATE_CHUNKS_BY_SQL Procedure	Chunks the table associated with the given task by means of a user-provided SELECT statement
DROP_TASK Procedure	Drops the task and all related chunks

Table 131-4 (Cont.) DBMS_PARALLEL_EXECUTE Package Subprograms

Subprogram	Description
DROP_CHUNKS Procedure	Drops the task's chunks
GENERATE_TASK_NAME Function	Returns a unique name for a task
GET_NUMBER_COL_CHUNK Procedure	Picks an unassigned NUMBER chunk and changes it to ASSIGNED
GET_ROWID_CHUNK Procedure	Picks an unassigned ROWID chunk and changes it to ASSIGNED
PURGE_PROCESSED_CHUNKS Procedure	Deletes all the processed chunks whose status is PROCESSED or PROCESSED_WITH_ERROR
RESUME_TASK Procedures	Retries the given the task if the RUN_TASK Procedure finished with an error, or resumes the task if a crash occurred.
RUN_TASK Procedure	Executes the specified SQL statement on the chunks in parallel
SET_CHUNK_STATUS Procedure	Sets the status of the chunk
STOP_TASK Procedure	Stops the task and related job secondary processes
TASK_STATUS Procedure	Returns the task status

131.7.1 ADM_DROP_CHUNKS Procedure

This procedure drops all chunks of the specified task owned by the specified owner.

Syntax

```
DBMS_PARALLEL_EXECUTE.ADM_DROP_CHUNKS (
    task_owner    IN VARCHAR2,
    task_name     IN VARCHAR2);
```

Parameters

Table 131-5 ADM_DROP_CHUNKS Procedure Parameters

Parameter	Description
task_owner	Owner of the task
task_name	Name of the task

131.7.2 ADM_DROP_TASK Procedure

This procedure drops the task of the specified user and all related chunks.

Syntax

```
DBMS_PARALLEL_EXECUTE.ADM_DROP_TASK (
    task_owner    IN VARCHAR2,
    task_name     IN VARCHAR2);
```

Parameters**Table 131-6 ADM_DROP_TASK Procedure Parameters**

Parameter	Description
task_owner	Owner of the task
task_name	Name of the task

131.7.3 ADM_TASK_STATUS Function

This function returns the task status.

Syntax

```
DBMS_PARALLEL_EXECUTE.ADM_TASK_STATUS (
  task_owner  IN VARCHAR2,
  task_name   IN VARCHAR2)
RETURN NUMBER;
```

Parameters**Table 131-7 ADM_TASK_STATUS Function Parameters**

Parameter	Description
task_owner	Owner of the task
task_name	Name of the task

131.7.4 ADM_STOP_TASK Procedure

This procedure stops the task of the specified owner and related job secondary processes.

Syntax

```
DBMS_PARALLEL_EXECUTE.ADM_STOP_TASK (
  task_owner  IN VARCHAR2,
  task_name   IN VARCHAR2);
```

Parameters**Table 131-8 ADM_STOP_TASK Procedure Parameters**

Parameter	Description
task_owner	Owner of the task
task_name	Name of the task

131.7.5 CREATE_TASK Procedure

This procedure creates a task for the current user. The pairing of `task_name` and `current_user` must be unique.

Syntax

```
DBMS_PARALLEL_EXECUTE.CREATE_TASK (
    task_name      IN  VARCHAR2,
    comment        IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 131-9 CREATE_TASK Procedure Parameters

Parameter	Description
<code>task_name</code>	Name of the task. The <code>task_name</code> can be any string in which related length must be less than or equal to 128 bytes.
<code>comment</code>	Comment field. The comment must be less than 4000 bytes.

131.7.6 CREATE_CHUNKS_BY_NUMBER_COL Procedure

This procedure chunks the table (associated with the specified task) by the specified column. The specified column must be a `NUMBER` column. This procedure takes the `MIN` and `MAX` value of the column, and then divides the range evenly according to `chunk_size`.

The chunks are:

START_ID	END_ID
-----	-----
<code>min_id_val</code>	<code>min_id_val+1*chunk_size-1</code>
<code>min_id_val+1*chunk_size</code>	<code>min_id_val+2*chunk_size-1</code>
...	...
<code>min_id_val+i*chunk_size</code>	<code>max_id_val</code>

Syntax

```
DBMS_PARALLEL_EXECUTE.CREATE_CHUNKS_BY_NUMBER_COL (
    task_name      IN  VARCHAR2,
    table_owner    IN  VARCHAR2,
    table_name     IN  VARCHAR2,
    table_column   IN  VARCHAR2,
    chunk_size     IN  NUMBER);
```

Parameters

Table 131-10 CREATE_CHUNKS_BY_NUMBER_COL Procedure Parameters

Parameter	Description
<code>task_name</code>	Name of the task
<code>table_owner</code>	Owner of the table
<code>table_name</code>	Name of the table

Table 131-10 (Cont.) CREATE_CHUNKS_BY_NUMBER_COL Procedure Parameters

Parameter	Description
table_column	Name of the NUMBER column
chunk_size	Range of each chunk

131.7.7 CREATE_CHUNKS_BY_ROWID Procedure

This procedure chunks the table (associated with the specified task) by ROWID.

num_row and num_block are approximate guidance for the size of each chunk. The table to be chunked must be a physical table with physical ROWID having views and table functions. Index-organized tables are not allowed.

Syntax

```
DBMS_PARALLEL_EXECUTE.CREATE_CHUNKS_BY_ROWID (
    task_name      IN  VARCHAR2,
    table_owner    IN  VARCHAR2,
    table_name     IN  VARCHAR2,
    by_row         IN  BOOLEAN,
    chunk_size     IN  NUMBER);
```

Parameters

Table 131-11 CREATE_CHUNKS_BY_ROWID Procedure Parameters

Parameter	Description
task_name	Name of the task
table_owner	Owner of the table
table_name	Name of the table
by_row	TRUE if chunk_size refers to the number of rows, otherwise, chunk_size refers to the number of blocks
chunk_size	Approximate number of rows/blocks to process for each commit cycle

131.7.8 CREATE_CHUNKS_BY_SQL Procedure

This procedure chunks the table (associated with the specified task) by means of a user-provided SELECT statement.

The SELECT statement that returns the range of each chunk must have two columns: start_id and end_id. If the task is to chunk by ROWID, then the two columns must be of ROWID type. If the task is to chunk the table by NUMBER column, then the two columns must be of NUMBER type. The procedure provides the flexibility to users who want to deploy user-defined chunk algorithms.

Syntax

```
DBMS_PARALLEL_EXECUTE.CREATE_CHUNKS_BY_SQL (
    task_name      IN VARCHAR2,
    sql_stmt       IN CLOB,
    by_rowid       IN BOOLEAN);
```

Parameters

Table 131-12 CREATE_CHUNKS_BY_SQL Procedure Parameters

Parameter	Description
task_name	Name of the task
sql_stmt	SQL that returns the chunk ranges
by_rowid	TRUE if the table is chunked by rowids

131.7.9 DROP_TASK Procedure

This procedure drops the task and all related chunks.

Syntax

```
DBMS_PARALLEL_EXECUTE.DROP_TASK (
    task_name      IN VARCHAR2);
```

Parameters

Table 131-13 DROP_TASK Procedure Parameters

Parameter	Description
task_name	Name of the task

131.7.10 DROP_CHUNKS Procedure

This procedure drops the task's chunks.

Syntax

```
DBMS_PARALLEL_EXECUTE.DROP_CHUNKS (
    task_name      IN VARCHAR2);
```

Parameters

Table 131-14 DROP_CHUNKS Procedure Parameters

Parameter	Description
task_name	Name of the task

131.7.11 GENERATE_TASK_NAME Function

This function returns a unique name for a task.

The name is of the form *prefix*N where N is a number from a sequence. If no prefix is specified, the generated name is, by default, TASK\$_1, TASK\$_2, TASK\$_3, and so on. If 'SCOTT' is specified as the prefix, the name is SCOTT1, SCOTT2, and so on.

Syntax

```
DBMS_PARALLEL_EXECUTE.GENERATE_TASK_NAME (
    prefix      IN      VARCHAR2 DEFAULT 'TASK$_')
RETURN VARCHAR2;
```

Parameters

Table 131-15 GENERATE_TASK_NAME Function Parameters

Parameter	Description
prefix	The prefix to use when generating the task name

131.7.12 GET_NUMBER_COL_CHUNK Procedure

This procedure picks an unassigned NUMBER chunk and changes it to ASSIGNED. If there are no more chunks to assign, any_rows is set to FALSE. Otherwise, the chunk_id, start, and end_id of the chunk are returned as OUT parameters.

The chunk information in DBMS_PARALLEL_EXECUTE_CHUNKS\$ is updated as follows: STATUS becomes ASSIGNED; START_TIMESTAMP records the current time; END_TIMESTAMP is cleared.

 **See Also:**

[Views](#)

Syntax

```
DBMS_PARALLEL_EXECUTE.GET_NUMBER_COL_CHUNK (
    task_name      IN VARCHAR2,
    chunk_id       OUT NUMBER,
    start_id       OUT NUMBER,
    end_id         OUT NUMBER,
    any_rows       OUT BOOLEAN);
```

Parameters

Table 131-16 GET_NUMBER_COL_CHUNK Procedure Parameters

Parameter	Description
task_name	Name of the task

Table 131-16 (Cont.) GET_NUMBER_COL_CHUNK Procedure Parameters

Parameter	Description
chunk_id	Chunk ID of the chunk
start_id	ID of the start row in the returned range
end_id	ID of the end row in the returned range
any_rows	Indicates if there could be any rows to process in the range

Usage Notes

If the task is chunked by ROWID, then use `get_rowid_range`. If the task is chunked by NUMBER column, then use `get_number_col_range`. If you make the wrong function call, the returning `chunk_id` and `any_rows` have valid values but `start_id` and `end_id` are NULL.

131.7.13 GET_ROWID_CHUNK Procedure

This procedure picks an unassigned ROWID chunk and changes it to ASSIGNED.

If there are no more chunks to assign, `any_rows` is set to FALSE. Otherwise, the `chunk_id`, `start`, and `end_rowid` of the chunk are returned as OUT parameters. The chunk info in `DBMS_PARALLEL_EXECUTE_CHUNKS$` is updated as follows: STATUS becomes ASSIGNED; START_TIMESTAMP records the current time; END_TIMESTAMP is cleared.

 **See Also:**
[Views](#)

Syntax

```
DBMS_PARALLEL_EXECUTE.GET_ROWID_CHUNK (
    task_name      IN VARCHAR2,
    chunk_id       OUT NUMBER,
    start_rowid    OUT ROWID,
    end_rowid      OUT ROWID,
    any_rows       OUT BOOLEAN);
```

Parameters

Table 131-17 GET_ROWID_CHUNK Procedure Parameters

Parameter	Description
task_name	Name of the task
chunk_id	Chunk ID of the chunk
start_rowid	Start rowid in the returned range
end_rowid	End rowid in the returned range
any_rows	Indicates that the range could include rows to process

Usage Notes

If the task is chunked by ROWID, then use `get_rowid_range`. If the task is chunked by NUMBER column, then use `get_number_col_range`. If you make the wrong function call, the returning `chunk_id` and `any_rows` will still have valid values but `start_id` and `end_id` are NULL.

131.7.14 PURGE_PROCESSED_CHUNKS Procedure

This procedure deletes all the processed chunks whose status is PROCESSED or PROCESSED_WITH_ERROR.

Syntax

```
DBMS_PARALLEL_EXECUTE.PURGE_PROCESSED_CHUNKS (
    task_name          IN VARCHAR2);
```

Parameters

Table 131-18 PURGE_PROCESSED_CHUNKS Procedure Parameters

Parameter	Description
task_name	Name of the task

131.7.15 RESUME_TASK Procedures

This procedure retries the specified the task if the RUN_TASK Procedure finished with an error, or resumes the task if a crash occurred.

You can only invoke this procedure if the task is in a CRASHED or FINISHED_WITH_ERROR state.

For a crashed serial execution, the state remains in PROCESSING. The FORCE option allows you to resume any task in PROCESSING state. However, it is your responsibility to determine that a crash has occurred.

The procedure resumes processing the chunks which have not been processed. Also, chunks which are in PROCESSED_WITH_ERROR or ASSIGNED (due to crash) state are processed because those chunks did not commit.

This procedure takes the same argument as the [RUN_TASK Procedure](#). The overload which takes `task_name` as the only input argument re-uses the arguments provided in the previous invoking of the [RUN_TASK Procedure](#) or [RESUME_TASK Procedures](#).

**See Also:**

[Table 131-2](#)

Syntax

```
DBMS_PARALLEL_EXECUTE.RESUME_TASK (
    task_name          IN  VARCHAR2,
    sql_stmt           IN  CLOB,
    language_flag      IN  NUMBER,
    edition            IN  VARCHAR2  DEFAULT NULL,
    apply_crossedition_trigger IN  VARCHAR2  DEFAULT NULL,
    fire_apply_trigger IN  BOOLEAN   DEFAULT TRUE,
    parallel_level     IN  NUMBER    DEFAULT 0,
    job_class          IN  VARCHAR2  DEFAULT 'DEFAULT_JOB_CLASS',
    force              IN  BOOLEAN   DEFAULT FALSE);
```

```
DBMS_PARALLEL_EXECUTE.RESUME_TASK (
    task_name          IN  VARCHAR2,
    force              IN  BOOLEAN   DEFAULT FALSE);
```

Parameters

Table 131-19 RESUME_TASK Procedure Parameters

Parameter	Description
task_name	Name of the task
sql_stmt	SQL statement; must have :start_id and :end_id placeholders
language_flag	Determines how Oracle handles the SQL statement. The following options are recognized: <ul style="list-style-type: none"> V6 (or 0) specifies version 6 behavior NATIVE (or 1) specifies normal behavior for the database to which the program is connected V7 (or 2) specifies Oracle database version 7 behavior
edition	Specifies the edition in which to run the statement. Default is the current edition.
apply_crossedition_trigger	Specifies the unqualified name of a forward crossedition trigger that is to be applied to the specified SQL. The name is resolved using the edition and current_schema setting in which the statement is to be executed. The trigger must be owned by the user who executes the statement.
fire_apply_trigger	Indicates whether the specified apply_crossedition_trigger is itself to be executed, or only to be used as a guide in selecting other triggers
parallel_level	Number of parallel jobs; zero if run in serial; NULL uses the default parallelism
job_class	If running in parallel, the jobs all belong to the specified job class
force	If TRUE, do not raise an error if the status is PROCESSING.

Examples

Suppose the chunk table contains the following chunk ranges:

```
START_ID          END_ID
-----          -
1                10
```

```
11                20
21                30
```

And the specified SQL statement is:

```
UPDATE employees
   SET salary = salary + 10
   WHERE e.employee_id BETWEEN :start_id AND :end_id
```

This procedure executes the following statements in parallel:

```
UPDATE employees
   SET salary = .salary + 10 WHERE employee_id BETWEEN 1 and 10;
COMMIT;
```

```
UPDATE employees
   SET salary = .salary + 10 WHERE employee_id between 11 and 20;
COMMIT;
```

```
UPDATE employees
   SET salary = .salary + 10 WHERE employee_id between 21 and 30;
COMMIT;
```

Related Topics

- [RUN_TASK Procedure](#)
This procedure executes the specified statement (`sql_stmt`) on the chunks in parallel.

131.7.16 RUN_TASK Procedure

This procedure executes the specified statement (`sql_stmt`) on the chunks in parallel.

It commits after processing each chunk.

The specified statement must have two placeholders called `start_id` and `end_id`, respectively, which represent the range of the chunk to be processed. The type of each placeholder must be `ROWID` where `ROWID`-based chunking was used, or `NUMBER` where `NUMBER`-based chunking was used.

Syntax

```
DBMS_PARALLEL_EXECUTE.RUN_TASK (
  task_name          IN  VARCHAR2,
  sql_stmt           IN  CLOB,
  language_flag      IN  NUMBER,
  edition            IN  VARCHAR2  DEFAULT NULL,
  apply_crossedition_trigger IN VARCHAR2  DEFAULT NULL,
  fire_apply_trigger IN  BOOLEAN  DEFAULT TRUE,
  parallel_level     IN  NUMBER    DEFAULT 0,
  job_class          IN  VARCHAR2  DEFAULT 'DEFAULT_JOB_CLASS');
```

Parameters

Table 131-20 RUN_TASK Procedure Parameters

Parameter	Description
<code>task_name</code>	Name of the task

Table 131-20 (Cont.) RUN_TASK Procedure Parameters

Parameter	Description
sql_stmt	SQL statement; must have :start_id and :end_id placeholders
language_flag	Determines how Oracle handles the SQL statement. The following options are recognized: <ul style="list-style-type: none"> V6 (or 0) specifies version 6 behavior NATIVE (or 1) specifies normal behavior for the database to which the program is connected V7 (or 2) specifies Oracle database version 7 behavior
edition	Specifies the edition in which to run the statement. Default is the current edition.
apply_crossedition_trigger	Specifies the unqualified name of a forward crossedition trigger that is to be applied to the specified SQL. The name is resolved using the edition and current_schema setting in which the statement is to be executed. The trigger must be owned by the user executes the statement.
fire_apply_trigger	Indicates whether the specified apply_crossedition_trigger is itself to be executed, or only a guide to be used in selecting other triggers.
parallel_level	Number of parallel jobs; zero if run in serial; NULL uses the default parallelism.
job_class	If running in parallel, the jobs belong to the specified job class

Usage Notes

- The SQL statement is executed as the current user.
- Since this subprogram is subject to reexecution on error, you need to take great care in submitting a statement to RUN_TASK that is not idempotent.
- Chunks can be executed in parallel by DBMS_SCHEDULER job secondary processes. Therefore, parallel execution requires the CREATE JOB system privilege. The job secondary processes are created under the current user. The default number of job secondary processes is computed as the product of the Oracle parameters cpu_count and parallel_threads_per_cpu. On a Real Application Clusters installation, the number of job secondary processes is the sum of individual settings on each node in the cluster. This procedure returns only when all the chunks are processed. In parallel cases, this procedure returns only when all the secondary processes are finished.

Examples

Suppose the chunk table contains the following chunk ranges:

START_ID	END_ID
-----	-----
1	10
11	20
21	30

And the specified SQL statement is:

```
UPDATE employees
   SET salary = salary + 10
   WHERE e.employee_id BETWEEN :start_id AND :end_id
```

This procedure executes the following statements in parallel:

```
UPDATE employees
   SET salary =.salary + 10 WHERE employee_id BETWEEN 1 and 10;
COMMIT;
```

```
UPDATE employees
   SET salary =.salary + 10 WHERE employee_id between 11 and 20;
COMMIT;
```

```
UPDATE employees
   SET salary =.salary + 10 WHERE employee_id between 21 and 30;
COMMIT;
```

131.7.17 SET_CHUNK_STATUS Procedure

This procedure sets the status of the chunk.

The `START_TIMESTAMP` and `END_TIMESTAMP` of the chunk is updated according to the new status:

Value of the new Status	Side Effect
UNASSIGNED	<code>START_TIMESTAMP</code> and <code>END_TIMESTAMP</code> will be cleared
ASSIGNED	<code>START_TIMESTAMP</code> will be the current time and <code>END_TIMESTAMP</code> will be cleared.
PROCESSED or PROCESSED_WITH_ERROR	The current time will be recorded in <code>END_TIMESTAMP</code>

 **See Also:**
[Views](#)

Syntax

```
DBMS_PARALLEL_EXECUTE.SET_CHUNK_STATUS (
   task_name      IN VARCHAR2,
   chunk_id       OUT NUMBER,
   status         IN NUMBER,
   err_num        IN NUMBER  DEFAULT NULL,
   err_msg        IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 131-21 SET_CHUNK_STATUS Procedure Parameters

Parameter	Description
<code>task_name</code>	Name of the task
<code>chunk_id</code>	Chunk_id of the chunk

Table 131-21 (Cont.) SET_CHUNK_STATUS Procedure Parameters

Parameter	Description
status	Status of the chunk: UNASSIGNED, ASSIGNED, PROCESSED, PROCESSED_WITH_ERROR
err_num	Error code returned during the processing of the chunk
err_msg	Error message returned during the processing of the chunk

131.7.18 STOP_TASK Procedure

This procedure stops the task and related secondary processes.

Syntax

```
DBMS_PARALLEL_EXECUTE.STOP_TASK (
    task_name          IN VARCHAR2);
```

Parameters

Table 131-22 STOP_TASK Procedure Parameters

Parameter	Description
task_name	Name of the task

131.7.19 TASK_STATUS Procedure

This procedure returns the task status.

Syntax

```
DBMS_PARALLEL_EXECUTE.TASK_STATUS (
    task_name          IN VARCHAR2);
```

Parameters

Table 131-23 TASK_STATUS Procedure Parameters

Parameter	Description
task_name	Name of the task

DBMS_PART

The `DBMS_PART` package provides an interface for maintenance and management operations on partitioned objects.



See Also:

- *Oracle Database Reference* for related views

This chapter contains the following topics:

- [Security Model](#)
- [Operational Notes](#)
- [Summary of DBMS_PART Subprograms](#)

132.1 DBMS_PART Security Model

`DBMS_PART` is an invoker's rights package, running with the privileges of the user.

132.2 DBMS_PART Operational Notes

The following operational notes apply to `DBMS_PART`.

- `DBMS_PART` ignores all the errors that it runs into during the cleanup process.
- To display the message `PL/SQL procedure executed successfully` requires at least one cleanup operation to be successful.

132.3 Summary of DBMS_PART Subprograms

This table briefly describes the subprograms of `DBMS_PART` package.

Table 132-1 DBMS_PART Package Subprograms

Subprogram	Description
CLEANUP_GIDX Procedure	Gathers the list of global indexes where optimized asynchronous index maintenance has taken place to clean up entries pointing to data segments that no longer exist
CLEANUP_GIDX_JOB Procedure	
CLEANUP_ONLINE_OP Procedure	Cleans up failed online move operations

132.3.1 CLEANUP_GIDX Procedure

As a consequence of prior partition maintenance operations with asynchronous global index maintenance, global indexes can contain entries pointing to data segments that no longer exist. These stale index rows will not cause any correctness issues or corruptions during any operation on the table or index, whether these are queries, DMLs, DDLs or analyze. This procedure will identify and cleanup these global indexes to ensure efficiency in terms of storage and performance.

Syntax

```
DBMS_PART.CLEANUP_GIDX (
  schema_name_in  IN  VARCHAR2 DEFAULT NULL,
  table_name_in   IN  VARCHAR2 DEFAULT NULL,
  parallel        IN  VARCHAR2 DEFAULT NULL,
  options         IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 132-2 CLEANUP_GIDX Function Parameters

Parameter	Description
schema_name_in	Non-NULL processes only indexes on tables in the given schema
table_name_in	Non-NULL processes only indexes on the given table in the given schema (schema_name_in must be non-NULL if table_name_in is non-NULL)
parallel	The parallel degree to use for the ALTER INDEX DDLs.
options	The following options are supported: <ul style="list-style-type: none"> CLEANUP_ORPHANS: implies that 'cleanup only' mechanism is used. COALESCE: implies that 'coalesce cleanup' mechanism is used.

132.3.2 CLEANUP_GIDX_JOB Procedure

This procedure will identify and cleanup these global indexes to ensure efficiency in terms of storage and performance.

Syntax

```
DBMS_PART.CLEANUP_GIDX_JOB (
  parallel  IN  VARCHAR2 DEFAULT NULL,
  options   IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 132-3 CLEANUP_GIDX_JOB Function Parameters

Parameter	Description
parallel	The parallel degree to use for the ALTER INDEX DDLs.

Table 132-3 (Cont.) CLEANUP_GIDX_JOB Function Parameters

Parameter	Description
options	The following options are supported: <ul style="list-style-type: none"> CLEANUP_ORPHANS: implies that 'cleanup only' mechanism is used. COALESCE: implies that coalesce cleanup mechanism is used.

132.3.3 CLEANUP_ONLINE_OP Procedure

There are many possible points of failure when performing `ALTER TABLE ... MOVE PARTITION ... ONLINE` operations. This procedure pro-actively cleans up such failed online move operations instead of waiting for the background process (SMON) to do so.

Syntax

```
DBMS_PART.CLEANUP_ONLINE_OP (
  schema_name      IN  VARCHAR2 DEFAULT NULL,
  table_name       IN  VARCHAR2 DEFAULT NULL,
  partition_name   IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 132-4 CLEANUP_ONLINE_OP Function Parameters

Parameter	Description
schema_name	Name of schema
table_name	Name of schema
partition_name	Name of partition

Usage Notes

- If `schema_name`, `table_name` and `partition_name` are specified, this cleans up the failed online move operation for the specified partition.
- If `schema_name` and `table_name` are specified, this cleans up all failed online move operations for all the partitions of the specified table.
- If only `schema_name` is specified, this cleans up all failed online move operations in the schema.
- If no arguments are provided, we cleans up all the failed online move operations in the system.
- All other cases raise `ORA-20000` to inform the user of invalid inputs as arguments.

DBMS_PCLXUTIL

The `DBMS_PCLXUTIL` package provides intra-partition parallelism for creating partition-wise local indexes. `DBMS_PCLXUTIL` circumvents the limitation that, for local index creation, the degree of parallelism is restricted to the number of partitions as only one parallel execution server process for each partition is used.



See Also:

There are several rules concerning partitions and indexes. For more information, see *Oracle Database Concepts* and *Oracle Database Administrator's Guide*.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Operational Notes](#)
- [Rules and Limits](#)
- [Summary of DBMS_PCLXUTIL Subprograms](#)

133.1 DBMS_PCLXUTIL Overview

`DBMS_PCLXUTIL` uses the `DBMS_JOB` package to provide a greater degree of parallelism for creating a local index for a partitioned table. This is achieved by asynchronous inter-partition parallelism using the background processes (with `DBMS_SCHEDULER`), in combination with intra-partition parallelism using the parallel execution server.

`DBMS_PCLXUTIL` works with both range and range-hash composite partitioning.

The `DBMS_PCLXUTIL` package can be used during the following DBA tasks:

1. Local index creation

The procedure `BUILD_PART_INDEX` assumes that the dictionary information for the local index already exists. This can be done by issuing the create index SQL command with the `UNUSABLE` option.

```
CREATE INDEX <idx_name> on <tab_name>(…) local(…) unusable;
```

This causes the dictionary entries to be created without "building" the index itself, the time consuming part of creating an index. Now, invoking the procedure `BUILD_PART_INDEX` causes a concurrent build of local indexes with the specified degree of parallelism.

```
EXECUTE dbms_pclxutil.build_part_index(4,4,<tab_name>,<idx_name>,FALSE);
```

For composite partitions, the procedure automatically builds local indexes for all subpartitions of the composite table.

2. Local index maintenance

By marking desired partitions usable or unusable, the `BUILD_PART_INDEX` procedure also enables selective rebuilding of local indexes. The `force_opt` parameter provides a way to override this and build local indexes for all partitions.

```
ALTER INDEX <idx_name> local(...) unusable;
```

Rebuild only the desired (sub)partitions (that are marked unusable):

```
EXECUTE dbms_pclxutil.build_part_index(4,4,<tab_name>,<idx_name>,FALSE);
```

Rebuild all (sub)partitions using `force_opt = TRUE`:

```
EXECUTE dbms_pclxutil.build_part_index(4,4,<tab_name>,<idx_name>,TRUE);
```

A progress report is produced, and the output appears on screen when the program is ended (because the `DBMS_OUTPUT` package writes messages to a buffer first, and flushes the buffer to the screen only upon termination of the program).

133.2 DBMS_PCLXUTIL Security Model

This utility can be run only as table owner, and not as any other user.

133.3 DBMS_PCLXUTIL Operational Notes

`DBMS_PCLXUTIL` submits a job for each partition. It is the responsibility of the user/dba to control the number of concurrent jobs by setting the `INIT.ORA` parameter `JOB_QUEUE_PROCESSES` correctly. There is minimal error checking for correct syntax. Any errors are reported in the job queue process trace files.

133.4 DBMS_PCLXUTIL Rules and Limits

Because `DBMS_PCLXUTIL` uses the `DBMS_JOB` package, you must be aware of the following limitations pertaining to `DBMS_JOB`:

- You must decide appropriate values for the `job_queue_processes` initialization parameter. Clearly, if the job processes are not started before calling `BUILD_PART_INDEX()`, then the package will not function properly. The background processes are specified by the following `init.ora` parameters:

```
job_queue_processes=n #the number of background processes = n
```
- Failure conditions are reported only in the trace files (a `DBMS_JOB` limitation), making it impossible to give interactive feedback to the user. This package prints a failure message, removes unfinished jobs from the queue, and requests the user to take a look at the `j*.trc` trace files.

**Note:**

For range partitioning, the minimum compatibility mode is 8.0; for range-hash composite partitioning, the minimum compatibility mode is 8*i*.

133.5 Summary of DBMS_PCLXUTIL Subprograms

The DBMS_PCLXUTIL package has one subprogram, the BUILD_PART_INDEX procedure.

Table 133-1 DBMS_PCLXUTIL Package Subprograms

Subprogram	Description
BUILD_PART_INDEX Procedure	Provides intra-partition parallelism for creating partition-wise local indexes

133.5.1 BUILD_PART_INDEX Procedure

This procedure provides intra-partition parallelism for creating partition-wise local indexes.

Syntax

```
DBMS_PCLXUTIL.BUILD_PART_INDEX (
  jobs_per_batch IN NUMBER DEFAULT 1,
  procs_per_job  IN NUMBER DEFAULT 1,
  tab_name       IN VARCHAR2 DEFAULT NULL,
  idx_name       IN VARCHAR2 DEFAULT NULL,
  force_opt      IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 133-2 BUILD_PART_INDEX Procedure Parameters

Parameter	Description
jobs_per_batch	The number of concurrent partition-wise "local index builds".
procs_per_job	The number of parallel execution servers to be utilized for each local index build (1 <= procs_per_job <= max_slaves).
tab_name	The name of the partitioned table (an exception is raised if the table does not exist or not partitioned).
idx_name	The name given to the local index (an exception is raised if a local index is not created on the table tab_name).
force_opt	If TRUE, then force rebuild of all partitioned indexes; otherwise, rebuild only the partitions marked 'UNUSABLE'.

Usage Notes

This utility can be run only as table owner, and not as any other user.

Examples

Suppose a table `PROJECT` is created with two partitions `PROJ001` and `PROJ002`, along with a local index `IDX`.

A call to the procedure `BUILD_PART_INDEX(2,4,'PROJECT','IDX',TRUE)` produces the following output:

```
SQLPLUS> EXECUTE dbms_pclxutil.build_part_index(2,4,'PROJECT','IDX',TRUE);  
Statement processed.  
INFO: Job #21 created for partition PROJ002 with 4 slaves  
INFO: Job #22 created for partition PROJ001 with 4 slaves
```

DBMS_PDB

The `DBMS_PDB` package provides an interface to examine and manipulate data about pluggable databases (PDBs) in a multitenant container database (CDB). It also contains an interface that specifies which database objects are application common objects. You can migrate a PDB from one CDB to another CDB. After the migration is complete, all backups of the PDB before the migration are available and usable in the destination CDB.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

See Also:

- *Oracle Database Administrator's Guide* for information about creating and managing PDBs and CDBs
- *Oracle XML DB Developer's Guide* for information about configuring protocol ports and DNS mappings
- *Oracle Database SQL Language Reference* for information about creating PDBs
- *Oracle Database Security Guide* regarding how to create audit policies in a multitenant environment

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_PDB Subprograms](#)

134.1 DBMS_PDB Overview

A multitenant container database (CDB) is an Oracle database that includes zero, one, or many user-created pluggable databases (PDBs). The `DBMS_PDB` package provides an interface to examine and manipulate data about pluggable databases (PDBs). The subprograms in this package can also set a database object to one of the following types of

application common objects in an application container: data-linked object, extended data-linked object, or metadata-linked object.

A data-linked application common object stores data in the application root that can be accessed and modified by all of the application PDBs in the application container. For an extended data-linked object, each application PDB can create its own specific data while sharing the common data in the application root. Therefore, with an extended data-linked object, only the data stored in the application root is common for all application PDBs. A metadata-linked application common object stores the metadata for the specific object, such as a table, in the application root, so that the containers in the application container have the same structure for the object but different data. This package also contains a procedure that specifies that a database object is not an application common object.

Typically, the subprograms in this package are used in the following cases:

- An application that is installed in a PDB is migrated to an application container. The application can be migrated to the application root or to an application PDB. For example, you can migrate an application installed in a PDB plugged into an Oracle Database 12c Release 1 (12.1) CDB to an application container in an Oracle Database 12c Release 2 (12.2) CDB.
- An application is installed in an application root using an installation program that does not allow setting application common objects.

See Also:

Oracle Database Administrator's Guide for information about migrating an application to an application container

134.2 DBMS_PDB Security Model

Users must have the `EXECUTE` privilege to run the procedures of `DBMS_PDB` package.

134.3 Summary of DBMS_PDB Subprograms

This table lists and describes `DBMS_PDB` package subprograms.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

Table 134-1 DBMS_PDB Package Subprograms

Subprogram	Description
CHECK_PLUG_COMPATIBILITY Function	Uses an XML file describing a pluggable database (PDB) to determine whether it may be plugged into a given multitenant container database (CDB).
DESCRIBE Procedure	Generates an XML file describing the specified pluggable database (PDB).
EXPORTMANBACKUP Procedure	Needs to be called only when a non-CDB is migrated as PDB. This procedure needs to be executed in non-CDB database. For PDB relocation, it is automatically called during unplugin.
RECOVER Procedure	Generates an XML file describing a pluggable database by using data files belonging to the pluggable database (PDB).
REMOVE_LINK Procedure	Specifies that a database object is not an application common object.
SET_DATA_LINKED Procedure	Sets a database object to a data-linked application common object
SET_EXT_DATA_LINKED Procedure	Sets a database object to an extended data-linked application common object.
SET_METADATA_LINKED Procedure	Sets a database object to a metadata-linked application common object.
SET_PROFILE_EXPLICIT Procedure	Sets a profile as an application common profile in an application container.
SET_ROLE_EXPLICIT Procedure	Sets a role as an application common role in an application container.
SET_USER_EXPLICIT Procedure	This procedure sets a local user as an application common user in an application container.

134.3.1 CHECK_PLUG_COMPATIBILITY Function

This function uses an XML file describing a pluggable database (PDB) to determine whether it may be plugged into a given multitenant container database (CDB).

Syntax

```
DBMS_PDB.CHECK_PLUG_COMPATIBILITY (
    pdb_descr_file    IN  VARCHAR2,
    pdb_name          IN  VARCHAR2 DEFAULT NULL)
RETURN BOOLEAN;
```

Parameters

Table 134-2 CHECK_PLUG_COMPATIBILITY Procedure Parameters

Parameter	Description
<code>pdb_descr_file</code>	Path of the XML file that will contain description of a PDB
<code>pdb_name</code>	Name which will be given to the PDB represented by <code>pdb_descr_file</code> when plugged into a given CDB. If not specified, the name will be extracted from <code>pdb_descr_file</code> .

Return Values

TRUE if the PDB described by `pdb_descr_file` is compatible with the given CDB, FALSE otherwise. If this function returns FALSE, then query the `PDB_PLUG_IN_VIOLATIONS` data dictionary view to find information about the errors that are found.



See Also:

Oracle Database Reference for information about the `PDB_PLUG_IN_VIOLATIONS` view

134.3.2 DESCRIBE Procedure

This procedure generates an XML file describing the specified pluggable database (PDB). This file can then be passed to the `CHECK_PLUG_COMPATIBILITY` Function to determine if the PDB described by the XML file may be plugged into a given multitenant container database (CDB).

Syntax

```
DBMS_PDB.DESCRIBE (
  pdb_descr_file  IN  VARCHAR2,
  pdb_name       IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 134-3 DESCRIBE Procedure Parameters

Parameter	Description
<code>pdb_descr_file</code>	Path of the XML file that will contain description of a PDB
<code>pdb_name</code>	Name of a PDB to be described. A remote database is specified by including <code>@dblink</code> .

Usage Notes

- If `pdb_name` is omitted, the PDB to which the session is connected will be described.
- If `pdb_name` is omitted, and the session is connected to the Root, an error will be returned.

Related Topics

- [CHECK_PLUG_COMPATIBILITY Function](#)
This function uses an XML file describing a pluggable database (PDB) to determine whether it may be plugged into a given multitenant container database (CDB).

134.3.3 EXPORTRMANBACKUP Procedure

This procedure exports the RMAN backup information that belongs to a pluggable database to its dictionary before unplug so that pre-plugin backups can be used. This procedure needs to be called only for non-CDB to PDB migration. For PDB relocation, this procedure need not be called.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

Syntax

```
DBMS_PDB.EXPORTRMANBACKUP (
    pdb_name      IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 134-4 EXPORTRMANBACKUP Procedure Parameters

Parameter	Description
<code>pdb_name</code>	Name of a pluggable database whose backup information needs to be exported. Omit this parameter if you are connected to a pluggable database or a non-cdb.

Usage Notes

- The PDB must be opened in `read/write` mode.
- If the database is non-CDB, then `pdb_name` must be omitted.
- If the `pdb_name` is omitted, then the pluggable database to which the session is connected is exported.
- If the `pdb_name` is omitted and the session is connected to the `root`, an error is returned.

134.3.4 RECOVER Procedure

This procedure generates an XML file describing a pluggable database by using data files belonging to the pluggable database. This XML file can then be used to plug the pluggable database into a multitenant container database (CDB) using the `CREATE PLUGGABLE DATABASE` statement.

Use this procedure when an XML file describing a pluggable database is corrupted or lost.

Syntax

```
DBMS_PDB.RECOVER (
  pdb_descr_file  IN  VARCHAR2,
  pdb_name        IN  VARCHAR2,
  filenames       IN  VARCHAR2);
```

Parameters**Table 134-5 RECOVER Procedure Parameters**

Parameter	Description
pdb_descr_file	Path of the XML file that contains description of a pluggable database
pdb_name	Name of a pluggable database
filenames	Comma-separated list of datafile paths and/or directories containing datafiles for the pluggable database

134.3.5 REMOVE_LINK Procedure

This procedure specifies that a database object is not an application common object. In an application container, application common objects are shared between multiple containers.

Syntax

```
DBMS_PDB.REMOVE_LINK (
  schema_name  IN VARCHAR2,
  object_name  IN VARCHAR2,
  namespace    IN NUMBER,
  edition_name IN VARCHAR2 DEFAULT NULL);
```

Parameters**Table 134-6 REMOVE_LINK Procedure Parameters**

Parameter	Description
schema_name	The name of the schema that owns the database object.
object_name	The name of the database object.
namespace	The namespace of the database object. The <code>NAMESPACE</code> column of the <code>DBA_OBJECTS</code> view shows the namespace of an object.
edition_name	The name of the edition for the database object.

 **See Also:**

Oracle Database Administrator's Guide for information about migrating an application to an application container

134.3.6 SET_DATA_LINKED Procedure

This procedure sets a database object to a data-linked application common object. In an application container, data-linked application common objects store data in the application root only, and the data can be accessed by all of the application PDBs in the application container. The data in a data-linked application common object can be modified only in the application root.

You can use this procedure to set data-linked application common objects when you migrate an application that is installed in a PDB to an application container. The application can be migrated to the application root or to an application PDB. For example, you can migrate an application installed in a PDB plugged into an Oracle Database 12c Release 1 (12.1) CDB to an application container in an Oracle Database 12c Release 2 (12.2) CDB.

Syntax

```
DBMS_PDB.SET_DATA_LINKED (
  schema_name  IN VARCHAR2,
  object_name  IN VARCHAR2,
  namespace    IN NUMBER,
  edition_name IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 134-7 SET_DATA_LINKED Procedure Parameters

Parameter	Description
schema_name	The name of the schema that owns the database object.
object_name	The name of the database object.
namespace	The namespace of the database object. The NAMESPACE column of the DBA_OBJECTS view shows the namespace of an object.
edition_name	The name of the edition for the database object.

See Also:

Oracle Database Administrator's Guide for information about migrating an application to an application container

134.3.7 SET_EXT_DATA_LINKED Procedure

This procedure sets a database object to an extended data-linked application common object. In an application container, for an extended data-linked object, each application PDB can create its own specific data while sharing the common data in the application root. Therefore, only the data stored in the application root is common for all application PDBs.

You can use this procedure to set extended data-linked application common objects when you migrate an application that is installed in a PDB to an application container. The application can be migrated to the application root or to an application PDB. For example,

you can migrate an application installed in a PDB plugged into an Oracle Database 12c Release 1 (12.1) CDB to an application container in an Oracle Database 12c Release 2 (12.2) CDB.

Syntax

```
DBMS_PDB.SET_EXT_DATA_LINKED (
  schema_name  IN VARCHAR2,
  object_name  IN VARCHAR2,
  namespace    IN NUMBER,
  edition_name IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 134-8 *SET_EXT_DATA_LINKED Procedure Parameters*

Parameter	Description
schema_name	The name of the schema that owns the database object.
object_name	The name of the database object.
namespace	The namespace of the database object. The <code>NAMESPACE</code> column of the <code>DBA_OBJECTS</code> view shows the namespace of an object.
edition_name	The name of the edition for the database object.

See Also:

Oracle Database Administrator's Guide for information about migrating an application to an application container

134.3.8 SET_METADATA_LINKED Procedure

This procedure sets a database object to a metadata-linked application common object. In an application container, metadata-linked application common objects store the metadata for specific objects, such as tables, so that the containers that share the application common object have the same structure but different data.

You can use this procedure to set metadata-linked application common objects when you migrate an application that is installed in a PDB to an application container. The application can be migrated to the application root or to an application PDB. For example, you can migrate an application installed in a PDB plugged into an Oracle Database 12c Release 1 (12.1) CDB to an application container in an Oracle Database 12c Release 2 (12.2) CDB.

Syntax

```
DBMS_PDB.SET_METADATA_LINKED (
  schema_name  IN VARCHAR2,
  object_name  IN VARCHAR2,
  namespace    IN NUMBER,
  edition_name IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 134-9 *SET_METADATA_LINKED Procedure Parameters*

Parameter	Description
schema_name	The name of the schema that owns the database object.
object_name	The name of the database object.
namespace	The namespace of the database object. The NAMESPACE column of the DBA_OBJECTS view shows the namespace of an object.
edition_name	The name of the edition for the database object.

 **See Also:**

Oracle Database Administrator's Guide for information about migrating an application to an application container

134.3.9 SET_PROFILE_EXPLICIT Procedure

This procedure sets a profile as an application common profile in an application container. This procedure is intended for migrating a profile from a previous release to an application container in the current release.

This procedure must be invoked in an application install, patch, upgrade, or uninstall operation in an application root.

Syntax

```
DBMS_PDB.SET_PROFILE_EXPLICIT (
    profile_name IN VARCHAR2);
```

Parameters

Table 134-10 *SET_PROFILE_EXPLICIT Procedure Parameters*

Parameter	Description
profile_name	The name of the profile.

 **See Also:**

Oracle Database Administrator's Guide for information about migrating an application to an application container.

134.3.10 SET_ROLE_EXPLICIT Procedure

This procedure sets a role as an application common role in an application container. This procedure is intended for migrating a role from a previous release to an application container in the current release.

This procedure must be invoked in an application install, patch, upgrade, or uninstall operation in an application root.

Syntax

```
DBMS_PDB.SET_ROLE_EXPLICIT (  
    role_name IN VARCHAR2);
```

Parameters

Table 134-11 SET_ROLE_EXPLICIT Procedure Parameters

Parameter	Description
role_name	The name of the role.



See Also:

Oracle Database Administrator's Guide for information about migrating an application to an application container.

134.3.11 SET_USER_EXPLICIT Procedure

This procedure sets a local user as an application common user in an application container.

This procedure must be invoked in an application install, patch, upgrade, or uninstall operation in an application root.

Syntax

```
DBMS_PDB.SET_USER_EXPLICIT (  
    user_name IN VARCHAR2);
```

Parameters

Table 134-12 SET_USER_EXPLICIT Procedure Parameters

Parameter	Description
user_name	The name of the user.

 **See Also:**

Oracle Database Administrator's Guide for information about migrating an application to an application container.

DBMS_PDB_ALTER_SHARING

In an application container with a pre-installed application, the `DBMS_PDB_ALTER_SHARING` package provides an interface to set database objects as application common objects or to specify that a database object is not an application common object.

Note:

This package provides a subset of the subprograms in the `DBMS_PDB` package. Users who do not have `EXECUTE` privilege on the `DBMS_PDB` package can be granted `EXECUTE` privilege on this package to run these subprograms.

See Also:

- *Oracle Database Administrator's Guide* for information about migrating an application to an application container
- *Oracle XML DB Developer's Guide* for information about configuring protocol ports and DNS mappings
- *Oracle Database SQL Language Reference* for information about creating PDBs
- *Oracle Database Security Guide* regarding how to create audit policies in a multitenant environment

This chapter contains the following topics:

- [DBMS_PDB_ALTER_SHARING Overview](#)
- [DBMS_PDB_ALTER_SHARING Security Model](#)
- [Summary of DBMS_PDB_ALTER_SHARING Subprograms](#)

135.1 DBMS_PDB_ALTER_SHARING Overview

The subprograms in this package can set a database object to one of the following types of application common objects in an application container: data-linked object, extended data-linked object, or metadata-linked object.

A data-linked application common object stores data in the application root that can be accessed and modified by all of the application PDBs in the application container. For an extended data-linked object, each application PDB can create its own specific data while sharing the common data in the application root. Therefore, with an extended data-linked object, only the data stored in the application root is common for all application PDBs. A metadata-linked application common object stores the metadata for the specific object, such as a table, in the application root, so that the containers in the application container have the

same structure for the object but different data. This package also contains a procedure that specifies that a database object is not an application common object.

You can use the subprograms in this package when you

Typically, the subprograms in this package are used in the following cases:

- An application that is installed in a PDB is migrated to an application container. The application can be migrated to the application root or to an application PDB. For example, you can migrate an application installed in a PDB plugged into an Oracle Database 12c Release 1 (12.1) CDB to an application container in an Oracle Database 12c Release 2 (12.2) CDB.
- An application is installed in an application root using an installation program that does not allow setting application common objects.



See Also:

Oracle Database Administrator's Guide for information about migrating an application to an application container

135.2 DBMS_PDB_ALTER_SHARING Security Model

This package provides a subset of the subprograms in the `DBMS_PDB` package. User who do not have `EXECUTE` privilege on the `DBMS_PDB` package can be granted `EXECUTE` privilege on this package to run these subprograms.

Security on this package can be controlled in either of the following ways:

- Granting `EXECUTE` on this package to selected users or roles.
- Granting `EXECUTE_CATALOG_ROLE` to selected users or roles.

If subprograms in the package are run from within a stored procedure, then the user who runs the subprograms must be granted `EXECUTE` privilege on the package directly. It cannot be granted through a role.

135.3 Summary of DBMS_PDB_ALTER_SHARING Subprograms

This table lists and briefly describes `DBMS_PDB_ALTER_SHARING` package subprograms.

Table 135-1 DBMS_PDB_ALTER_SHARING Subprograms

Subprogram	Description
REMOVE_LINK Procedure	Specifies that a database object is not an application common object
SET_DATA_LINKED Procedure	Sets a database object to a data-linked application common object
SET_EXT_DATA_LINKED Procedure	Sets a database object to an extended data-linked application common object

Table 135-1 (Cont.) DBMS_PDB_ALTER_SHARING Subprograms

Subprogram	Description
SET_METADATA_LINKED Procedure	Sets a database object to a metadata-linked application common object
SET_PROFILE_EXPLICIT Procedure	Sets a profile as an application common profile in an application container.
SET_ROLE_EXPLICIT Procedure	Sets a role as an application common role in an application container.
SET_USER_EXPLICIT Procedure	Sets a local user as an application common user in an application container.

135.3.1 REMOVE_LINK Procedure

This procedure specifies that a database object is not an application common object. In an application container, application common objects are shared between multiple containers.

Syntax

```
DBMS_PDB_ALTER_SHARING.REMOVE_LINK (
  schema_name IN VARCHAR2,
  object_name IN VARCHAR2,
  namespace   IN NUMBER,
  edition_name IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 135-2 REMOVE_LINK Procedure Parameters

Parameter	Description
schema_name	The name of the schema that owns the database object.
object_name	The name of the database object.
namespace	The namespace of the database object. The NAMESPACE column of the DBA_OBJECTS view shows the namespace of an object.
edition_name	The name of the edition for the database object.



See Also:

Oracle Database Administrator's Guide for information about migrating an application to an application container

135.3.2 SET_DATA_LINKED Procedure

This procedure sets a database object to a data-linked application common object. In an application container, data-linked application common objects store data in the application root only, and the data can be accessed by all of the application PDBs in the application

container. The data in a data-linked application common object can be modified only in the application root.

You can use this procedure to set data-linked application common objects when you migrate an application that is installed in a PDB to an application container. The application can be migrated to the application root or to an application PDB. For example, you can migrate an application installed in a PDB plugged into an Oracle Database 12c Release 1 (12.1) CDB to an application container in an Oracle Database 12c Release 2 (12.2) CDB.

Syntax

```
DBMS_PDB_ALTER_SHARING.SET_DATA_LINKED (
  schema_name IN VARCHAR2,
  object_name IN VARCHAR2,
  namespace   IN NUMBER,
  edition_name IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 135-3 *SET_DATA_LINKED Procedure Parameters*

Parameter	Description
schema_name	The name of the schema that owns the database object.
object_name	The name of the database object.
namespace	The namespace of the database object. The NAMESPACE column of the DBA_OBJECTS view shows the namespace of an object.
edition_name	The name of the edition for the database object.

See Also:

Oracle Database Administrator's Guide for information about migrating an application to an application container

135.3.3 SET_EXT_DATA_LINKED Procedure

This procedure sets a database object to an extended data-linked application common object. In an application container, for an extended data-linked object, each application PDB can create its own specific data while sharing the common data in the application root. Therefore, only the data stored in the application root is common for all application PDBs.

You can use this procedure to set extended data-linked application common objects when you migrate an application that is installed in a PDB to an application container. The application can be migrated to the application root or to an application PDB. For example, you can migrate an application installed in a PDB plugged into an Oracle Database 12c Release 1 (12.1) CDB to an application container in an Oracle Database 12c Release 2 (12.2) CDB.

Syntax

```
DBMS_PDB_ALTER_SHARING.SET_EXT_DATA_LINKED (
  schema_name  IN VARCHAR2,
  object_name  IN VARCHAR2,
  namespace    IN NUMBER,
  edition_name IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 135-4 *SET_EXT_DATA_LINKED Procedure Parameters*

Parameter	Description
schema_name	The name of the schema that owns the database object.
object_name	The name of the database object.
namespace	The namespace of the database object. The <code>NAMESPACE</code> column of the <code>DBA_OBJECTS</code> view shows the namespace of an object.
edition_name	The name of the edition for the database object.



See Also:

Oracle Database Administrator's Guide for information about migrating an application to an application container

135.3.4 SET_METADATA_LINKED Procedure

This procedure sets a database object to a metadata-linked application common object. In an application container, metadata-linked application common objects store the metadata for specific objects, such as tables, so that the containers that share the application common object have the same structure but different data.

You can use this procedure to set metadata-linked application common objects when you migrate an application that is installed in a PDB to an application container. The application can be migrated to the application root or to an application PDB. For example, you can migrate an application installed in a PDB plugged into an Oracle Database 12c Release 1 (12.1) CDB to an application container in an Oracle Database 12c Release 2 (12.2) CDB.

Syntax

```
DBMS_PDB_ALTER_SHARING.SET_METADATA_LINKED (
  schema_name  IN VARCHAR2,
  object_name  IN VARCHAR2,
  namespace    IN NUMBER,
  edition_name IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 135-5 *SET_METADATA_LINKED Procedure Parameters*

Parameter	Description
schema_name	The name of the schema that owns the database object.
object_name	The name of the database object.
namespace	The namespace of the database object. The <code>NAMESPACE</code> column of the <code>DBA_OBJECTS</code> view shows the namespace of an object.
edition_name	The name of the edition for the database object.

 **See Also:**

Oracle Database Administrator's Guide for information about migrating an application to an application container

135.3.5 SET_PROFILE_EXPLICIT Procedure

This procedure sets a profile as an application common profile in an application container. This procedure is intended for migrating a profile from a previous release to an application container in the current release.

This procedure must be invoked in an application install, patch, upgrade, or uninstall operation in an application root.

Syntax

```
DBMS_PDB_ALTER_SHARING.SET_PROFILE_EXPLICIT (
    profile_name IN VARCHAR2);
```

Parameters

Table 135-6 *SET_PROFILE_EXPLICIT Procedure Parameters*

Parameter	Description
profile_name	The name of the profile.

 **See Also:**

Oracle Database Administrator's Guide for information about migrating an application to an application container.

135.3.6 SET_ROLE_EXPLICIT Procedure

This procedure sets a role as an application common role in an application container. This procedure is intended for migrating a role from a previous release to an application container in the current release.

This procedure must be invoked in an application install, patch, upgrade, or uninstall operation in an application root.

Syntax

```
DBMS_PDB_ALTER_SHARING.SET_ROLE_EXPLICIT (
    role_name IN VARCHAR2);
```

Parameters

Table 135-7 *SET_ROLE_EXPLICIT Procedure Parameters*

Parameter	Description
role_name	The name of the role.



See Also:

Oracle Database Administrator's Guide for information about migrating an application to an application container.

135.3.7 SET_USER_EXPLICIT Procedure

This procedure sets a local user as an application common user in an application container.

This procedure must be invoked in an application install, patch, upgrade, or uninstall operation in an application root.

Syntax

```
DBMS_PDB_ALTER_SHARING.SET_USER_EXPLICIT (
    user_name IN VARCHAR2);
```

Parameters

Table 135-8 *SET_USER_EXPLICIT Procedure Parameters*

Parameter	Description
user_name	The name of the user.

 **See Also:**

Oracle Database Administrator's Guide for information about migrating an application to an application container.

DBMS_PERF

The DBMS_PERF package provides an interface to generate active reports for monitoring database performance.



See Also:

Oracle Database PL/SQL Language Reference for more information about "Avoiding SQL Injection in PL/SQL"

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_PERF Subprograms](#)

136.1 DBMS_PERF Overview

The DBMS_PERF package provides an interface for generating database performance reports. All subprograms return an active report and these reports can be generated at the system level, session level or at SQL level.

136.2 DBMS_PERF Security Model

The DBMS_PERF package requires the DBA role.

136.3 Summary of DBMS_PERF Subprograms

This table lists the DBMS_PERF subprograms and briefly describes them.

Table 136-1 DBMS_PERF Package Subprograms

Subprogram	Description
REPORT_PERFHUB Function	Generates a composite active performance report of the entire database system for a specified time period.
REPORT_SESSION Function	Generates a performance report for a specific database session where a session is identified by <code>inst_id</code> , <code>sid</code> , and <code>serial_num</code> .
REPORT_SQL Function	Generates an active performance report for a particular SQL statement identified by its <code>sql_id</code> .

136.3.1 REPORT_PERFHUB Function

This function generates a composite active performance report of the entire database system for a specified time period.

Syntax

```
DBMS_PERF.REPORT_PERFHUB (
  is_realtime          IN NUMBER    DEFAULT NULL,
  outer_start_time     IN DATE      DEFAULT NULL,
  outer_end_time       IN DATE      DEFAULT NULL,
  selected_start_time  IN DATE      DEFAULT NULL,
  selected_end_time    IN DATE      DEFAULT NULL,
  inst_id              IN NUMBER    DEFAULT NULL,
  dbid                 IN NUMBER    DEFAULT NULL,
  monitor_list_detail  IN NUMBER    DEFAULT NULL,
  workload_sql_detail  IN NUMBER    DEFAULT NULL,
  admn_task_detail     IN NUMBER    DEFAULT NULL,
  report_reference     IN VARCHAR2  DEFAULT NULL,
  report_level         IN VARCHAR2  DEFAULT NULL,
  type                 IN VARCHAR2  DEFAULT 'ACTIVE',
  base_path            IN VARCHAR2  DEFAULT NULL);
RETURN CLOB;
```

Parameters

Table 136-2 *REPORT_PERFHUB Function Parameters*

Parameter	Description
is_realtime	If 1, then real-time. If NULL (default) or 0, then historical mode.
outer_start_time	Start time of outer period shown in the time selector. If NULL (default): <ul style="list-style-type: none"> If is_realtime=0 (historical), then 24 hours before outer_end_time. If is_realtime=1 (realtime mode), then 1 hour before outer_end_time.
outer_end_time	End time of outer period shown in the time selector. If NULL (default), then latest AWR snapshot. <ul style="list-style-type: none"> If is_realtime=0 (historical), then the latest AWR snapshot If is_realtime=1 (realtime mode), this is the current time (and any input is ignored)
selected_start_time	Start time period of selection. If NULL (default) <ul style="list-style-type: none"> If is_realtime=0, then 1 hour before selected_end_time If is_realtime=1, then 5 minutes before selected_end_time
selected_end_time	End time period of selection. If NULL (default) <ul style="list-style-type: none"> If is_realtime=0, then latest AWR snapshot If is_realtime=1, then current time

Table 136-2 (Cont.) REPORT_PERFHUB Function Parameters

Parameter	Description
inst_id	Instance ID to for which to retrieve data <ul style="list-style-type: none"> If -1, then current instance If number is specified, then for that instance If NULL (default), then all instances
dbid	DBID to query. <ul style="list-style-type: none"> If NULL, then current DBID. If is_realtime=1, then DBID must be the local DBID.
monitor_list_detail	Top N in SQL monitor list for which to retrieve SQL monitor details. <ul style="list-style-type: none"> If NULL (default), then retrieves top 10 If 0, then retrieves no monitor list details
workload_sql_detail	Top N in Workload Top SQL list to retrieve monitor details, <ul style="list-style-type: none"> If NULL (default), then retrieves top 10 If 0, then retrieves no monitor list details
addm_task_detail	Maximum N latest ADDM tasks to retrieve <ul style="list-style-type: none"> If NULL (default), retrieves available data but no more than N If 0, then retrieves no ADDM task details
report_reference	Must be NULL when used from SQL*Plus.
report_level	'typical' will get all tabs in performance hub
type	Report type: <ul style="list-style-type: none"> 'ACTIVE' (default) 'xml' returns XML
base_path	URL path for HTML resources since flex HTML requires access to external files. This is only valid for type='ACTIVE' and is typically not used. Default value will retrieve the required files from OTN.

Usage Notes

- Once a time period is selected, the performance information is collected and presented based on performance subject areas.
- The time period can be real-time or historical.
- When real-time data is selected, more granular data is presented because data points are available every minute.
- When historical data is selected, more detailed data (broken down by different metrics) is presented, but the data points are averaged out to the Automatic Workload Repository (AWR) interval (usually an hour).
- Different tabs are available in the Performance Hub, depending on whether is_real-time is 1 for real time mode or 0 for historical mode.

136.3.2 REPORT_SESSION Function

This function produces a performance report for a specific database session where a session is identified by `inst_id`, `sid`, and `serial_num`.

If any of those parameters are missing, then the report is for the current session.

The session-level performance report contains the following tabs:

- **Summary** - This tab contains key identifiers and attributes of the session along with a summary of its activity data. It also contains a list of SQLs, PLSQL blocks and Database Operations (DBOP) executed by that session that were monitored by Real-time SQL Monitoring.
- **Activity** - This tab shows activity broken down by wait classes for this session. The data used for this chart is fetched from Active Session History (ASH).
- **Metrics** - This tab shows charts for certain key metrics for the selected session over time and is only available in historical mode. Some of the metrics shown are CPU usage, PGA usage, IO Throughput and IO Requests.

Syntax

```
DBMS_PERF.REPORT_SESSION (
  inst_id          IN NUMBER    DEFAULT NULL,
  sid              IN NUMBER    DEFAULT NULL,
  serial           IN NUMBER    DEFAULT NULL,
  is_realtime      IN NUMBER    DEFAULT NULL,
  outer_start_time IN DATE      DEFAULT NULL,
  outer_end_time   IN DATE      DEFAULT NULL,
  selected_start_time IN DATE    DEFAULT NULL,
  selected_end_time IN DATE    DEFAULT NULL,
  dbid             IN NUMBER    DEFAULT NULL,
  monitor_list_detail IN NUMBER  DEFAULT NULL,
  report_reference IN VARCHAR2  DEFAULT NULL,
  report_level     IN VARCHAR2  DEFAULT NULL,
  type             IN VARCHAR2  DEFAULT 'ACTIVE',
  base_path        IN VARCHAR2  DEFAULT NULL)
RETURN CLOB;
```

Parameters

Table 136-3 *REPORT_SESSION Function Parameters*

Parameter	Description
<code>inst_id</code>	Instance ID to for which to retrieve data. If <code>NULL</code> (default), then instance of current session.
<code>sid</code>	Session ID for which to retrieve performance. If <code>NULL</code> , uses current session.
<code>serial</code>	Serial# of session. If <code>NULL</code> , then the serial# of the specified <code>sid</code> is used provided the session is connected.
<code>is_realtime</code>	If 1, then real-time. If <code>NULL</code> (default) or 0, then historical mode.

Table 136-3 (Cont.) REPORT_SESSION Function Parameters

Parameter	Description
outer_start_time	Start time of outer period shown in the time selector. If NULL (default): <ul style="list-style-type: none"> If is_realtime=0 (historical), then 24 hours before outer_end_time. If is_realtime=1 (realtime mode), then 1 hour before outer_end_time.
outer_end_time	End time of outer period shown in the time selector. If NULL (default), then latest AWR snapshot. <ul style="list-style-type: none"> If is_realtime=0 (historical), then the latest AWR snapshot If is_realtime=1 (realtime mode), this is the current time (and any input is ignored)
selected_start_time	Start time period of selection. If NULL (default) <ul style="list-style-type: none"> If is_realtime=0, then 1 hour before selected_end_time If is_realtime=1, then 5 minutes before selected_end_time
selected_end_time	End time period of selection. If NULL (default) <ul style="list-style-type: none"> If is_realtime=0, then latest AWR snapshot If is_realtime=1, then current time
dbid	DBID to query. <ul style="list-style-type: none"> If NULL, then current DBID. If is_realtime=1, then DBID must be the local DBID.\
monitor_list_detail	Top N in SQL monitor list for which to retrieve SQL monitor details. <ul style="list-style-type: none"> If NULL (default), then retrieves top 10 If 0, then retrieves no monitor list details
report_reference	Must be NULL when used from SQL*Plus.
report_level	'typical' will get all tabs in the session hub (or session details)
type	Report type: <ul style="list-style-type: none"> 'ACTIVE' (default) 'xml' returns XML
base_path	URL path for HTML resources since flex HTML requires access to external files

136.3.3 REPORT_SQL Function

This function generates an active performance report for a particular SQL statement identified by its `sql_id`.

The SQL-level performance report contains the following tabs:

- Summary - This tab contains an overview of the SQL statement with key attributes like the SQL text, user name, sessions executing it, and related information. It also contains a

Plans tab which shows statistics and activity for each distinct plan for this SQL statement found in memory and in the AWR.

- Activity - This tab shows activity broken down by wait classes for this SQL statement. The data used for this chart is fetched from Active Session History (ASH).
- Execution Statistics - This tab shows statistics and activity for each distinct plan for this statement along with a graphical and tabular representation of the plan.
- Monitored SQL - All executions of this SQL statement that were monitored by Real-time SQL Monitoring are listed in this tab.
- Plan Control - This tab shows information about SQL Profiles and SQL Plan Baselines if they exist for this SQL statement.
- Historical Statistics - This tab is available only in Historical mode. It contains statistics, such as number of executions, number of I/Os, rows processed, and other information produced over time for different execution plans. This information is retrieved from AWR.

Syntax

```
DBMS_PERF.REPORT_SQL (
    sql_id          IN varchar2 default null,
    is_realtime     IN number   default null,
    outer_start_time IN date     default null,
    outer_end_time  IN date     default null,
    selected_start_time IN date   default null,
    selected_end_time IN date   default null,
    inst_id         IN number   default null,
    dbid            IN number   default null,
    monitor_list_detail IN number default null,
    report_reference IN varchar2 default null,
    report_level     IN varchar2 default null,      type          IN
    varchar2 default 'ACTIVE',
    base_path        IN varchar2 default null);
RETURN CLOB;
```

Parameters

Table 136-4 *REPORT_SQL Function Parameters*

Parameter	Description
sql_id	SQL_ID for which to retrieve performance. If NULL, gets SQL details for the last executed SQL statement.
is_realtime	If 1, then real-time. If NULL (default) or 0, then historical mode.
outer_start_time	Start time of outer period shown in the time selector. If NULL (default): <ul style="list-style-type: none"> • If is_realtime=0 (historical), then 24 hours before outer_end_time. • If is_realtime=1 (realtime mode), then 1 hour before outer_end_time.

Table 136-4 (Cont.) REPORT_SQL Function Parameters

Parameter	Description
outer_end_time	End time of outer period shown in the time selector. If NULL (default), then latest AWR snapshot. <ul style="list-style-type: none"> If is_realtime=0 (historical), then the latest AWR snapshot If is_realtime=1 (realtime mode), this is the current time (and any input is ignored)
selected_start_time	Start time period of selection. If NULL (default) <ul style="list-style-type: none"> If is_realtime=0, then 1 hour before selected_end_time If is_realtime=1, then 5 minutes before selected_end_time
selected_end_time	End time period of selection. If NULL (default) <ul style="list-style-type: none"> If is_realtime=0, then latest AWR snapshot If is_realtime=1, then current time
inst_id	Instance ID to for which to retrieve data. If NULL (default), then instance of current session.
dbid	DBID to query. <ul style="list-style-type: none"> If NULL, then current DBID. If is_realtime=1, then DBID must be the local DBID.\
monitor_list_detail	Top N in SQL monitor list for which to retrieve SQL monitor details. <ul style="list-style-type: none"> If NULL (default), then retrieves top 10 If 0, then retrieves no monitor list details
report_reference	Must be NULL when used from SQL*Plus.
report_level	'typical' will get all tabs in performance hub
type	Report type: <ul style="list-style-type: none"> 'ACTIVE' (default) 'xml' returns XML
base_path	URL path for HTML resources since flex HTML requires access to external files

DBMS_PIPE

The `DBMS_PIPE` package lets two or more sessions in the same instance communicate. Oracle pipes are similar in concept to the pipes used in UNIX, but Oracle pipes are not implemented using the operating system pipe mechanisms.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Operational Notes](#)
- [Exceptions](#)
- [Examples](#)
- [Summary of DBMS_PIPE Subprograms](#)

137.1 DBMS_PIPE Overview

Pipe functionality has several potential applications: external service interface, independent transactions, alerters (non-transactional), debugging, and concentrator.

- **External service interface:** You can communicate with user-written services that are external to the RDBMS. This can be done effectively in a shared server process, so that several instances of the service are executing simultaneously. Additionally, the services are available asynchronously. The requestor of the service does not need to block a waiting reply. The requestor can check (with or without time out) at a later time. The service can be written in any of the 3GL languages that Oracle supports.
- **Independent transactions:** The pipe can communicate to a separate session which can perform an operation in an independent transaction (such as logging an attempted security violation detected by a trigger).
- **Alerters (non-transactional):** You can post another process without requiring the waiting process to poll. If an "after-row" or "after-statement" trigger were to alert an application, then the application would treat this alert as an indication that the data probably changed. The application would then read the data to get the current value. Because this is an "after" trigger, the application would want to do a "SELECT FOR UPDATE" to make sure it read the correct data.
- **Debugging:** Triggers and stored procedures can send debugging information to a pipe. Another session can keep reading out of the pipe and display it on the screen or write it to a file.
- **Concentrator:** This is useful for multiplexing large numbers of users over a fewer number of network connections, or improving performance by concentrating several user-transactions into one DBMS transaction.

137.2 DBMS_PIPE Security Model

To use `DBMS_PIPE` and its subprograms, you must be granted the `EXECUTE` privilege on the package. Security can further be achieved by creating pipes using the `private` parameter in the `CREATE_PIPE` function and by writing common packages that only expose particular features or pipenames to particular users or roles.

Depending upon your security requirements, you may choose to use either public pipes or private pipes, which are described in [DBMS_PIPE Operational Notes](#).

The `DBMS_PIPE` package uses invoker's rights, meaning the operations of sending and receiving messages run in the invoker's schema.

In order to use `DBMS_PIPE` messages with Cloud Object stores, you must have the `EXECUTE` privilege on the `DBMS_PIPE` package, the `DBMS_CLOUD` package, and on the Credential Object for accessing the object store URI.

See Also:

- [DBMS_CLOUD](#) for information about that package and about working with cloud service credentials

137.3 DBMS_PIPE Constants

This is the maximum time to wait attempting to send or receive a message.

```
maxwait    constant integer := 86400000; /* 1000 days */
```

137.4 DBMS_PIPE Operational Notes

Except for persistent pipes, information sent through Oracle pipes is buffered in the system global area (SGA). All information in pipes is lost when the instance is shut down.

WARNING:

Pipes are independent of transactions. Be careful using pipes when transaction control can be affected.

The operation of `DBMS_PIPE` is considered with regard to the following topics:

- Public Pipes
- Writing and Reading Pipes
- Private Pipes
- Singleton Pipes

- Persistent Pipes

Public Pipes

You may create a public pipe either implicitly or explicitly. For *implicit* public pipes, the pipe is automatically created when it is referenced for the first time, and it disappears when it no longer contains data. Because the pipe descriptor is stored in the SGA, there is some space usage overhead until the empty pipe is aged out of the cache.

You create an *explicit* public pipe by calling the `CREATE_PIPE` function with the `private` flag set to `FALSE`. You must deallocate explicitly-created pipes by calling the `REMOVE_PIPE` function.

The domain of a public pipe is the schema in which it was created, either explicitly or implicitly.

Reading and Writing Pipes

Each public pipe works asynchronously. Any number of schema users can write to a public pipe, as long as they have `EXECUTE` permission on the `DBMS_PIPE` package, and they know the name of the public pipe. However, once buffered information is read by one user, it is emptied from the buffer, and is not available for other readers of the same pipe.

The sending session builds a message using one or more calls to the `PACK_MESSAGE` procedure. This procedure adds the message to the session's local message buffer. The information in this buffer is sent by calling the `SEND_MESSAGE` function, designating the pipe name to be used to send the message. When `SEND_MESSAGE` is called, all messages that have been stacked in the local buffer are sent.

A process that wants to receive a message calls the `RECEIVE_MESSAGE` function, designating the pipe name from which to receive the message. The process then calls the `UNPACK_MESSAGE` procedure to access each of the items in the message.

Private Pipes

You explicitly create a private pipe by calling the `CREATE_PIPE` function. Once created, the private pipe persists in shared memory until you explicitly deallocate it by calling the `REMOVE_PIPE` function. A private pipe is also deallocated when the database instance is shut down.

You cannot create a private pipe if an implicit pipe exists in memory and has the same name as the private pipe you are trying to create. In this case, `CREATE_PIPE` returns an error.

Access to a private pipe is restricted to:

- Sessions running under the same userid as the creator of the pipe
- Stored subprograms executing in the same userid privilege domain as the pipe creator
- Users connected as `SYSDBA`

An attempt by any other user to send or receive messages on the pipe, or to remove the pipe, results in an immediate error. Any attempt by another user to create a pipe with the same name also causes an error.

As with public pipes, you must first build your message using calls to `PACK_MESSAGE` before calling `SEND_MESSAGE`. Similarly, you must call `RECEIVE_MESSAGE` to retrieve the message before accessing the items in the message by calling `UNPACK_MESSAGE`.

Singleton Pipes

Singleton pipes provide the ability to cache a single message in the shared memory of the current database instance, allowing high throughput concurrent reads of a message across database sessions. In a RAC database, pipes are not synchronized across database instances. Each database instance has its own pipe, private to the memory of the database instance.

A single message can be cached in a singleton pipe, which can be comprised of multiple fields up to a total message size of 32,767 bytes. `DBMS_PIPE` supports the ability to pack multiple attributes in a message using the `PACK_MESSAGE` procedure.

Singleton pipes can be public or private and implicit or explicit. Using a private singleton pipe, the message can only be received by sessions with the same user as the creator of the pipe. The message in a public singleton pipe can be received by any database session with `EXECUTE` privilege on the `DBMS_PIPE` package.

Singleton pipes cache the message in the pipe until it is invalidated or purged. Explicit invalidation by purging the pipe is accomplished by using the `PURGE` procedure or by overwriting the message using the `SEND_MESSAGE` function. Automatic invalidation happens once the shelflife time has elapsed, which is specified as part of the `CREATE_PIPE` function and the `SEND_MESSAGE` function.

A user-defined cache function can be used to automatically populate the message in a singleton pipe and can be specified when reading a message using the `RECEIVE_MESSAGE` function. If the message is not in cache or the message shelflife time has elapsed, the singleton pipe automatically populates a new message in the pipe. The cache function simplifies the use of a pipe by avoiding condition logic on failure to receive a message from an empty pipe. It also ensures there is no cache miss when reading messages from a singleton pipe.

Note:

When using a cache function with `RECEIVE_MESSAGE`, the time spent executing the cache function is not included towards the overall timeout specified for receiving messages.

Singleton pipes do not get evicted from Oracle Database memory, ensuring maximum cache hits. An explicit singleton pipe exists in database memory until it is removed using the `REMOVE_PIPE` procedure or the database restarts. An implicit singleton pipe exists in database memory until there is one cached message in the pipe.

Persistent Pipes

You can optionally use Cloud Object stores for persistent message storage. The process for sending and receiving messages from a pipe is largely the same whether you use local or cloud storage, the difference being with cloud storage, a credential object and associated cloud URI must be provided. `DBMS_PIPE` uses the `DBMS_CLOUD` package to integrate with object storage, meaning `DBMS_PIPE` supports all object stores and credential types that are allowed with `DBMS_CLOUD`.

Storing pipe messages in object storage allows two or more databases in the same or different regions to communicate using `DBMS_PIPE` messages and removes the max number of messages that can be stored in a pipe. This means that a database

instance open on one Real Application Cluster (RAC) instance can reliably use `DBMS_PIPE` for communicating between processes running on different cluster instances.

A locking mechanism is implemented to allow only one sending or receiving operation to be working in the cloud object store at a time. A lock file is created when a process begins using the cloud store and then is deleted once the operation is complete. Only when there is no lock present is a process able to begin working in the cloud store. Processes will retry until the given max wait time is reached. If a lock has been left behind by an unknown process that is no longer operating, the lock will be deleted and remade by the current process trying to access the cloud store after 15 minutes.

 **Note:**

When accessing `DBMS_PIPE` across different databases using Cloud Object stores, Oracle recommends using the `CREATE_PIPE` function before sending or receiving a message to ensure that the pipe is created with the required access permissions of a private or public pipe.

 **See Also:**

- *Using Oracle Autonomous Database Serverless* for supported URI formats
- *Using Oracle Autonomous Database Serverless* for `DBMS_CLOUD` subprograms and REST APIs
- *Using Oracle Autonomous Database Serverless* for information about supported credential types

137.5 DBMS_PIPE Exceptions

`DBMS_PIPE` package subprograms can return the errors listed in the following table.

Table 137-1 DBMS_PIPE Errors

Error	Description
ORA-23321:	Pipename may not be null. This can be returned by the <code>CREATE_PIPE</code> function, or any subprogram that takes a pipe name as a parameter.
ORA-23322:	Insufficient privilege to access pipe. This can be returned by any subprogram that references a private pipe in its parameter list.

137.6 DBMS_PIPE Examples

These examples show use of DBMS_PIPE in debugging PL/SQL, debugging Pro*C, executing system commands, and an external service interface.

Example 1: Debugging - PL/SQL

This example shows the procedure that a PL/SQL program can call to place debugging information in a pipe.

```
CREATE OR REPLACE PROCEDURE debug (msg VARCHAR2) AS
    status NUMBER;
BEGIN
    DBMS_PIPE.PACK_MESSAGE(LENGTH(msg));
    DBMS_PIPE.PACK_MESSAGE(msg);
    status := DBMS_PIPE.SEND_MESSAGE('plsql_debug');
    IF status != 0 THEN
        raise_application_error(-20099, 'Debug error');
    END IF;
END debug;
```

Example 2: Debugging - Pro*C

The following Pro*C code receives messages from the PLSQL_DEBUG pipe in the previous example, and displays the messages. If the Pro*C session is run in a separate window, then it can be used to display any messages that are sent to the debug procedure from a PL/SQL program executing in a separate session.

```
#include <stdio.h>
#include <string.h>

EXEC SQL BEGIN DECLARE SECTION;
    VARCHAR username[20];
    int status;
    int msg_length;
    char retval[2000];
EXEC SQL END DECLARE SECTION;

EXEC SQL INCLUDE SQLCA;

void sql_error();

main()
{
    -- Prepare username:
    strcpy(username.arr, "HR/<password>");
    username.len = strlen(username.arr);

    EXEC SQL WHENEVER SQLERROR DO sql_error();
    EXEC SQL CONNECT :username;

    printf("connected\n");

    -- Start an endless loop to look for and print messages on the pipe:
    FOR (;;)
    {
        EXEC SQL EXECUTE
            DECLARE
```

```

        len INTEGER;
        typ INTEGER;
        sta INTEGER;
        chr VARCHAR2(2000);
BEGIN
    chr := '';
    sta := dbms_pipe.receive_message('plsql_debug');
    IF sta = 0 THEN
        DBMS_PIPE.UNPACK_MESSAGE(len);
        DBMS_PIPE.UNPACK_MESSAGE(chr);
    END IF;
    :status := sta;
    :retval := chr;
    IF len IS NOT NULL THEN
        :msg_length := len;
    ELSE
        :msg_length := 2000;
    END IF;
END;
END-EXEC;
IF (status == 0)
    printf("\n%.*s\n", msg_length, retval);
ELSE
    printf("abnormal status, value is %d\n", status);
}
}

void sql_error()
{
    char msg[1024];
    int rlen, len;
    len = sizeof(msg);
    sqlglm(msg, &len, &rlen);
    printf("ORACLE ERROR\n");
    printf("%.*s\n", rlen, msg);
    exit(1);
}

```

Example 3: Execute System Commands

This example shows PL/SQL and Pro*C code let a PL/SQL stored procedure (or anonymous block) call PL/SQL procedures to send commands over a pipe to a Pro*C program that is listening for them.

The Pro*C program sleeps and waits for a message to arrive on the named pipe. When a message arrives, the Pro*C program processes it, carrying out the required action, such as executing a UNIX command through the *system()* call or executing a SQL command using embedded SQL.

DAEMON.SQL is the source code for the PL/SQL package. This package contains procedures that use the DBMS_PIPE package to send and receive message to and from the Pro*C daemon. Note that full handshaking is used. The daemon always sends a message back to the package (except in the case of the STOP command). This is valuable, because it allows the PL/SQL procedures to be sure that the Pro*C daemon is running.

You can call the DAEMON packaged procedures from an anonymous PL/SQL block using SQL*Plus or Enterprise Manager. For example:

```

SQLPLUS> variable rv number
SQLPLUS> execute :rv := DAEMON.EXECUTE_SYSTEM('ls -la');

```

On a UNIX system, this causes the Pro*C daemon to execute the command `system("ls -la")`.

Remember that the daemon needs to be running first. You might want to run it in the background, or in another window beside the SQL*Plus or Enterprise Manager session from which you call it.

The `DAEMON.SQL` also uses the `DBMS_OUTPUT` package to display the results. For this example to work, you must have execute privileges on this package.

DAEMON.SQL Example. This is the code for the PL/SQL `DAEMON` package:

```
CREATE OR REPLACE PACKAGE daemon AS
  FUNCTION execute_sql(command VARCHAR2,
                      timeout NUMBER DEFAULT 10)
    RETURN NUMBER;

  FUNCTION execute_system(command VARCHAR2,
                          timeout NUMBER DEFAULT 10)
    RETURN NUMBER;

  PROCEDURE stop(timeout NUMBER DEFAULT 10);
END daemon;
/
CREATE OR REPLACE PACKAGE BODY daemon AS

  FUNCTION execute_system(command VARCHAR2,
                          timeout NUMBER DEFAULT 10)
  RETURN NUMBER IS

    status      NUMBER;
    result      VARCHAR2(20);
    command_code NUMBER;
    pipe_name   VARCHAR2(30);
  BEGIN
    pipe_name := DBMS_PIPE.UNIQUE_SESSION_NAME;

    DBMS_PIPE.PACK_MESSAGE('SYSTEM');
    DBMS_PIPE.PACK_MESSAGE(pipe_name);
    DBMS_PIPE.PACK_MESSAGE(command);
    status := DBMS_PIPE.SEND_MESSAGE('daemon', timeout);
    IF status <> 0 THEN
      RAISE_APPLICATION_ERROR(-20010,
        'Execute_system: Error while sending. Status = ' ||
        status);
    END IF;

    status := DBMS_PIPE.RECEIVE_MESSAGE(pipe_name, timeout);
    IF status <> 0 THEN
      RAISE_APPLICATION_ERROR(-20011,
        'Execute_system: Error while receiving.
        Status = ' || status);
    END IF;

    DBMS_PIPE.UNPACK_MESSAGE(result);
    IF result <> 'done' THEN
      RAISE_APPLICATION_ERROR(-20012,
        'Execute_system: Done not received.');
```

```
END IF;
```

```
DBMS_PIPE.UNPACK_MESSAGE(command_code);
```

```

        DBMS_OUTPUT.PUT_LINE('System command executed.  result = ' ||
                               command_code);
    RETURN command_code;
END execute_system;

FUNCTION execute_sql(command VARCHAR2,
                    timeout NUMBER DEFAULT 10)
RETURN NUMBER IS

    status      NUMBER;
    result      VARCHAR2(20);
    command_code NUMBER;
    pipe_name   VARCHAR2(30);

BEGIN
    pipe_name := DBMS_PIPE.UNIQUE_SESSION_NAME;

    DBMS_PIPE.PACK_MESSAGE('SQL');
    DBMS_PIPE.PACK_MESSAGE(pipe_name);
    DBMS_PIPE.PACK_MESSAGE(command);
    status := DBMS_PIPE.SEND_MESSAGE('daemon', timeout);
    IF status <> 0 THEN
        RAISE_APPLICATION_ERROR(-20020,
            'Execute_sql: Error while sending.  Status = ' || status);
    END IF;

    status := DBMS_PIPE.RECEIVE_MESSAGE(pipe_name, timeout);

    IF status <> 0 THEN
        RAISE_APPLICATION_ERROR(-20021,
            'execute_sql: Error while receiving.
            Status = ' || status);
    END IF;

    DBMS_PIPE.UNPACK_MESSAGE(result);
    IF result <> 'done' THEN
        RAISE_APPLICATION_ERROR(-20022,
            'execute_sql: done not received. ');
    END IF;

    DBMS_PIPE.UNPACK_MESSAGE(command_code);
    DBMS_OUTPUT.PUT_LINE
        ('SQL command executed.  sqlcode = ' || command_code);
    RETURN command_code;
END execute_sql;

PROCEDURE stop(timeout NUMBER DEFAULT 10) IS
    status NUMBER;
BEGIN
    DBMS_PIPE.PACK_MESSAGE('STOP');
    status := DBMS_PIPE.SEND_MESSAGE('daemon', timeout);
    IF status <> 0 THEN
        RAISE_APPLICATION_ERROR(-20030,
            'stop: error while sending.  status = ' || status);
    END IF;
END stop;
END daemon;

```

daemon.pc Example. This is the code for the Pro*C daemon. You must precompile this using the Pro*C Precompiler, Version 1.5.x or later. You must also specify the `USERID` and `SQLCHECK` options, as the example contains embedded PL/SQL code.

 **Note:**

To use a VARCHAR output host variable in a PL/SQL block, you must initialize the length component before entering the block.

```
proc iname=daemon userid=HR/<password> sqlcheck=semantics
```

Then C-compile and link in the normal way.

```
#include <stdio.h>
#include <string.h>

EXEC SQL INCLUDE SQLCA;

EXEC SQL BEGIN DECLARE SECTION;
  char *uid = "HR/<password>";
  int status;
  VARCHAR command[20];
  VARCHAR value[2000];
  VARCHAR return_name[30];
EXEC SQL END DECLARE SECTION;

void
connect_error()
{
  char msg_buffer[512];
  int msg_length;
  int buffer_size = 512;

  EXEC SQL WHENEVER SQLERROR CONTINUE;
  sqlglm(msg_buffer, &buffer_size, &msg_length);
  printf("Daemon error while connecting:\n");
  printf("%.*s\n", msg_length, msg_buffer);
  printf("Daemon quitting.\n");
  exit(1);
}

void
sql_error()
{
  char msg_buffer[512];
  int msg_length;
  int buffer_size = 512;

  EXEC SQL WHENEVER SQLERROR CONTINUE;
  sqlglm(msg_buffer, &buffer_size, &msg_length);
  printf("Daemon error while executing:\n");
  printf("%.*s\n", msg_length, msg_buffer);
  printf("Daemon continuing.\n");
}

main()
{
  command.len = 20; /*initialize length components*/
  value.len = 2000;
  return_name.len = 30;
  EXEC SQL WHENEVER SQLERROR DO connect_error();
  EXEC SQL CONNECT :uid;
  printf("Daemon connected.\n");
}
```

```
EXEC SQL WHENEVER SQLERROR DO sql_error();
printf("Daemon waiting...\n");
while (1) {
    EXEC SQL EXECUTE
        BEGIN
            :status := DBMS_PIPE.RECEIVE_MESSAGE('daemon');
            IF :status = 0 THEN
                DBMS_PIPE.UNPACK_MESSAGE(:command);
            END IF;
        END;
    END-EXEC;
    IF (status == 0)
    {
        command.arr[command.len] = '\0';
        IF (!strcmp((char *) command.arr, "STOP"))
        {
            printf("Daemon exiting.\n");
            break;
        }

        ELSE IF (!strcmp((char *) command.arr, "SYSTEM"))
        {
            EXEC SQL EXECUTE
                BEGIN
                    DBMS_PIPE.UNPACK_MESSAGE(:return_name);
                    DBMS_PIPE.UNPACK_MESSAGE(:value);
                END;
            END-EXEC;
            value.arr[value.len] = '\0';
            printf("Will execute system command '%s'\n", value.arr);

            status = system(value.arr);
            EXEC SQL EXECUTE
                BEGIN
                    DBMS_PIPE.PACK_MESSAGE('done');
                    DBMS_PIPE.PACK_MESSAGE(:status);
                    :status := DBMS_PIPE.SEND_MESSAGE(:return_name);
                END;
            END-EXEC;

            IF (status)
            {
                printf
                    ("Daemon error while responding to system command.");
                printf(" status: %d\n", status);
            }
        }
        ELSE IF (!strcmp((char *) command.arr, "SQL")) {
            EXEC SQL EXECUTE
                BEGIN
                    DBMS_PIPE.UNPACK_MESSAGE(:return_name);
                    DBMS_PIPE.UNPACK_MESSAGE(:value);
                END;
            END-EXEC;
            value.arr[value.len] = '\0';
            printf("Will execute sql command '%s'\n", value.arr);

            EXEC SQL WHENEVER SQLERROR CONTINUE;
            EXEC SQL EXECUTE IMMEDIATE :value;
            status = sqlca.sqlcode;
        }
    }
}
```

```

EXEC SQL WHENEVER SQLERROR DO sql_error();
EXEC SQL EXECUTE
  BEGIN
    DBMS_PIPE.PACK_MESSAGE('done');
    DBMS_PIPE.PACK_MESSAGE(:status);
    :status := DBMS_PIPE.SEND_MESSAGE(:return_name);
  END;
END-EXEC;

IF (status)
{
  printf("Daemon error while responding to sql command.");
  printf("  status: %d\n", status);
}
}
ELSE
{
  printf
    ("Daemon error: invalid command '%s' received.\n",
     command.arr);
}
}
ELSE
{
  printf("Daemon error while waiting for signal.");
  printf("  status = %d\n", status);
}
}
EXEC SQL COMMIT WORK RELEASE;
exit(0);

```

Example 4: External Service Interface

Put the user-written 3GL code into an OCI or Precompiler program. The program connects to the database and executes PL/SQL code to read its request from the pipe, computes the result, and then executes PL/SQL code to send the result on a pipe back to the requestor.

Below is an example of a stock service request. The recommended sequence for the arguments to pass on the pipe for all service requests is:

protocol_version	VARCHAR2	- '1', 10 bytes or less
returnpipe	VARCHAR2	- 30 bytes or less
service	VARCHAR2	- 30 bytes or less
arg1	VARCHAR2/NUMBER/DATE	
...		
argn	VARCHAR2/NUMBER/DATE	

The recommended format for returning the result is:

success	VARCHAR2	- 'SUCCESS' if OK, otherwise error message
arg1	VARCHAR2/NUMBER/DATE	
...		
argn	VARCHAR2/NUMBER/DATE	

The "stock price request server" would do, using OCI or PRO* (in pseudo-code):

```

<loop forever>
  BEGIN dbms_stock_server.get_request(:stocksymbol); END;

```

```

<figure out price based on stocksymbol (probably from some radio
    signal), set error if can't find such a stock>
BEGIN dbms_stock_server.return_price(:error, :price); END;

```

A client would do:

```
BEGIN :price := stock_request('YOURCOMPANY'); end;
```

The stored procedure, `dbms_stock_server`, which is called by the preceding "stock price request server" is:

```

CREATE OR REPLACE PACKAGE dbms_stock_server IS
  PROCEDURE get_request(symbol OUT VARCHAR2);
  PROCEDURE return_price(errormsg IN VARCHAR2, price IN VARCHAR2);
END;

CREATE OR REPLACE PACKAGE BODY dbms_stock_server IS
  returnpipe  VARCHAR2(30);

  PROCEDURE returnerror(reason VARCHAR2) IS
    s INTEGER;
  BEGIN
    dbms_pipe.pack_message(reason);
    s := dbms_pipe.send_message(returnpipe);
    IF s <> 0 THEN
      raise_application_error(-20000, 'Error: ' || to_char(s) ||
        ' sending on pipe');
    END IF;
  END;

  PROCEDURE get_request(symbol OUT VARCHAR2) IS
    protocol_version VARCHAR2(10);
    s                 INTEGER;
    service           VARCHAR2(30);
  BEGIN
    s := dbms_pipe.receive_message('stock_service');
    IF s <> 0 THEN
      raise_application_error(-20000, 'Error: ' || to_char(s) ||
        ' reading pipe');
    END IF;
    dbms_pipe.unpack_message(protocol_version);
    IF protocol_version <> '1' THEN
      raise_application_error(-20000, 'Bad protocol: ' ||
        protocol_version);
    END IF;
    dbms_pipe.unpack_message(returnpipe);
    dbms_pipe.unpack_message(service);
    IF service != 'getprice' THEN
      returnerror('Service ' || service || ' not supported');
    END IF;
    dbms_pipe.unpack_message(symbol);
  END;

  PROCEDURE return_price(errormsg in VARCHAR2, price in VARCHAR2) IS
    s INTEGER;
  BEGIN
    IF errormsg is NULL THEN
      dbms_pipe.pack_message('SUCCESS');
      dbms_pipe.pack_message(price);
    ELSE
      dbms_pipe.pack_message(errormsg);
    END IF;
  END;

```

```

END IF;
s := dbms_pipe.send_message(returnpipe);
IF s <> 0 THEN
    raise_application_error(-20000, 'Error:'||to_char(s)||
        ' sending on pipe');
END IF;
END;
END;

```

The procedure called by the client is:

```

CREATE OR REPLACE FUNCTION stock_request (symbol VARCHAR2)
RETURN VARCHAR2 IS
s      INTEGER;
price  VARCHAR2(20);
errmsg VARCHAR2(512);
BEGIN
dbms_pipe.pack_message('1'); -- protocol version
dbms_pipe.pack_message(dbms_pipe.unique_session_name); -- return pipe
dbms_pipe.pack_message('getprice');
dbms_pipe.pack_message(symbol);
s := dbms_pipe.send_message('stock_service');
IF s <> 0 THEN
    raise_application_error(-20000, 'Error:'||to_char(s)||
        ' sending on pipe');
END IF;
s := dbms_pipe.receive_message(dbms_pipe.unique_session_name);
IF s <> 0 THEN
    raise_application_error(-20000, 'Error:'||to_char(s)||
        ' receiving on pipe');
END IF;
dbms_pipe.unpack_message(errormsg);
IF errormsg <> 'SUCCESS' THEN
    raise_application_error(-20000, errormsg);
END IF;
dbms_pipe.unpack_message(price);
RETURN price;
END;

```

You would typically only **GRANT EXECUTE** on **DBMS_STOCK_SERVICE** to the stock service application server, and would only **GRANT EXECUTE** on **stock_request** to those users allowed to use the service.



See Also:

[DBMS_ALERT](#)

137.7 Summary of DBMS_PIPE Subprograms

This table lists the **DBMS_PIPE** subprograms and briefly describes them.

Table 137-2 DBMS_PIPE Package Subprograms

Subprogram	Description
CREATE_PIPE Function	Creates a pipe (necessary for private pipes)
GET_CREDENTIAL_NAME Function	Returns the globally set <code>credential_name</code> variable
GET_LOCATION_URI Function	Returns the globally set <code>location_uri</code> variable
NEXT_ITEM_TYPE Function	Returns datatype of next item in buffer
PACK_MESSAGE Procedures	Builds message in local buffer
PURGE Procedure	Purges contents of named pipe
RECEIVE_MESSAGE Function	Copies message from named pipe into local buffer
REMOVE_PIPE Function	Removes the named pipe
RESET_BUFFER Procedure	Purges contents of local buffer
SEND_MESSAGE Function	Sends message on named pipe: This implicitly creates a public pipe if the named pipe does not exist
SET_CREDENTIAL_NAME Procedure	Sets the global <code>credential_name</code> variable
SET_LOCATION_URI Procedure	Sets the global <code>location_uri</code> variable
UNIQUE_SESSION_NAME Function	Returns unique session name
UNPACK_MESSAGE Procedures	Accesses next item in buffer

137.7.1 CREATE_PIPE Function

This function explicitly creates a public or private pipe. If the `private` flag is `TRUE`, then the pipe creator is assigned as the owner of the private pipe.

Explicitly-created pipes can only be removed by calling `REMOVE_PIPE`, or by shutting down the instance.

Syntax

```
DBMS_PIPE.CREATE_PIPE (
    pipename      IN VARCHAR2,
    maxpipesize  IN INTEGER DEFAULT 65536,
    private       IN BOOLEAN DEFAULT TRUE,
    singleton     IN BOOLEAN DEFAULT FALSE,
    shelflife    IN INTEGER DEFAULT 0)
RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(create_pipe,WNDS,RNDS);
```

Parameters

Table 137-3 CREATE_PIPE Function Parameters

Parameter	Description
pipename	<p>Name of the pipe you are creating.</p> <p>You must use this name when you call <code>SEND_MESSAGE</code> and <code>RECEIVE_MESSAGE</code>. This name must be unique across the instance.</p> <p>Caution: Do not use pipe names beginning with <code>ORA\$</code>. These are reserved for use by procedures provided by Oracle. Pipename should not be longer than 128 bytes, and is case insensitive. At this time, the name cannot contain Globalization Support characters.</p>
maxpipesize	<p>The maximum size allowed for the pipe, in bytes.</p> <p>The total size of all of the messages on the pipe cannot exceed this amount. The message is blocked if it exceeds this maximum. The default <code>maxpipesize</code> is 65536 bytes.</p> <p>The <code>maxpipesize</code> for a pipe becomes a part of the characteristics of the pipe and persists for the life of the pipe. Callers of <code>SEND_MESSAGE</code> with larger values cause the <code>maxpipesize</code> to be increased. Callers with a smaller value use the existing, larger value.</p>
private	<p>Uses the default, <code>TRUE</code>, to create a private pipe.</p> <p>Public pipes can be implicitly created when you call <code>SEND_MESSAGE</code>.</p>
singleton	<p>Use the value <code>TRUE</code> to indicate that the pipe should be created as a singleton pipe. Singleton pipes cannot be persistent pipes.</p> <p>The default value of <code>singleton</code> is <code>FALSE</code>.</p>
shelflife	<p>Only applicable to singleton pipes, this parameter is optionally used to set the expiration time in seconds of a message cached in a singleton pipe. Once the <code>shelflife</code> time is exceeded, the message is no longer accessible from the pipe. The <code>shelflife</code> can be used for implicit invalidation of the message in a singleton pipe.</p> <p>The default value of 0 indicates that the message will not expire.</p> <p>The <code>shelflife</code> of a message in a singleton pipe can also be specified when sending a message. See SEND_MESSAGE Function.</p>

Return Values

Table 137-4 CREATE_PIPE Function Return Values

Return	Description
0	Successful. If the pipe already exists and the user attempting to create it is authorized to use it, then Oracle returns 0, indicating success, and any data already in the pipe remains. If a user connected as SYSDBA/SYSOPER re-creates a pipe, then Oracle returns status 0, but the ownership of the pipe remains unchanged.
6	Failed to convert existing pipe to a singleton pipe. An implicit pipe with more than one existing message cannot be converted to a singleton pipe. For an explicit pipe that is not a singleton pipe, SEND_MESSAGE cannot send a message with the singleton parameter set to TRUE.
7	A non-zero value was given for shelflife and the pipe is not a singleton pipe.
ORA-23322	Failure due to naming conflict. If a pipe with the same name exists and was created by a different user, then Oracle signals error ORA-23322, indicating the naming conflict.

Exceptions

Table 137-5 CREATE_PIPE Function Exception

Exception	Description
Null pipe name	Permission error: Pipe with the same name already exists, and you are not allowed to use it.

137.7.2 GET_CREDENTIAL_NAME Function

This function retrieves the global `credential_name` variable to be used as the default credential with the cloud. The `GET_CREDENTIAL_NAME` function is only applicable to persistent pipes with messages stored in Cloud Object Storage.

Syntax

```
DBMS_PIPE.GET_CREDENTIAL_NAME ()
RETURN VARCHAR2;
```

Return Values

This function returns the globally set `credential_name` variable. The variable is set to `NULL` by default.

137.7.3 GET_LOCATION_URI Function

This function retrieves the global `location_uri` variable to be used as the default location URI with the cloud. The `GET_LOCATION_URI` function is only applicable to persistent pipes with messages stored in Cloud Object Storage.

Syntax

```
DBMS_PIPE.GET_LOCATION_URI ()
RETURN VARCHAR2;
```

Return Values

This function returns the globally set `location_uri` variable. The variable is set to `NULL` by default.

137.7.4 NEXT_ITEM_TYPE Function

This function determines the datatype of the next item in the local message buffer.

After you have called `RECEIVE_MESSAGE` to place pipe information in a local buffer, call `NEXT_ITEM_TYPE`.

Syntax

```
DBMS_PIPE.NEXT_ITEM_TYPE
RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(next_item_type,WNDS,RNDS);
```

Return Values

Table 137-6 NEXT_ITEM_TYPE Function Return Values

Return	Description
0	No more items
6	NUMBER
9	VARCHAR2
11	ROWID
12	DATE
23	RAW

137.7.5 PACK_MESSAGE Procedures

This procedure builds your message in the local message buffer.

To send a message, first make one or more calls to `PACK_MESSAGE`. Then, call `SEND_MESSAGE` to send the message in the local buffer on the named pipe.

The procedure is overloaded to accept items of type `VARCHAR2`, `NCHAR`, `NUMBER`, `DATE`, `RAW` and `ROWID` items. In addition to the data bytes, each item in the buffer requires one byte to indicate its type, and two bytes to store its length. One additional byte is needed to terminate the message. The overhead for all types other than `VARCHAR` is 4 bytes.

Syntax

```
DBMS_PIPE.PACK_MESSAGE (
    item IN VARCHAR2);

DBMS_PIPE.PACK_MESSAGE (
    item IN NCHAR);

DBMS_PIPE.PACK_MESSAGE (
    item IN NUMBER);

DBMS_PIPE.PACK_MESSAGE (
    item IN DATE);

DBMS_PIPE.PACK_MESSAGE_RAW (
    item IN RAW);

DBMS_PIPE.PACK_MESSAGE_ROWID (
    item IN ROWID);
```

Pragmas

```
pragma restrict_references(pack_message,WNDS,RNDS);
pragma restrict_references(pack_message_raw,WNDS,RNDS);
pragma restrict_references(pack_message_rowid,WNDS,RNDS);
```

Parameters

Table 137-7 PACK_MESSAGE Procedure Parameters

Parameter	Description
item	Item to pack into the local message buffer.

Usage Notes

In Oracle database version 8.x, the char-set-id (2 bytes) and the char-set-form (1 byte) are stored with each data item. Therefore, the overhead when using Oracle database version 8.x is 7 bytes.

When you call `SEND_MESSAGE` to send this message, you must indicate the name of the pipe on which you want to send the message. If this pipe already exists, then you must have sufficient privileges to access this pipe. If the pipe does not already exist, then it is created automatically.

Exceptions

`ORA-06558` is raised if the message buffer overflows (currently 4096 bytes). Each item in the buffer takes one byte for the type, two bytes for the length, plus the actual data. There is also one byte needed to terminate the message.

137.7.6 PURGE Procedure

This procedure empties the contents of the named pipe.

An empty implicitly-created pipe is aged out of the shared global area according to the least-recently-used algorithm. Thus, calling `PURGE` lets you free the memory associated with an implicitly-created pipe.

Syntax

```
DBMS_PIPE.PURGE (
    pipename IN VARCHAR2);
```

Pragmas

```
pragma restrict_references (purge, WNDS, RNDS);
```

Parameters

Table 137-8 PURGE Procedure Parameters

Parameter	Description
pipename	Name of pipe from which to remove all messages. The local buffer may be overwritten with messages as they are discarded. Pipename should not be longer than 128 bytes, and is case-insensitive.

Usage Notes

Because `PURGE` calls `RECEIVE_MESSAGE`, the local buffer might be overwritten with messages as they are purged from the pipe. Also, you can receive an `ORA-23322` (insufficient privileges) error if you attempt to purge a pipe with which you have insufficient access rights.

Exceptions

Permission error if pipe belongs to another user.

137.7.7 RECEIVE_MESSAGE Function

This function copies the message into the local message buffer.

Syntax

```
DBMS_PIPE.RECEIVE_MESSAGE (
    pipename      IN VARCHAR2,
    timeout       IN INTEGER      DEFAULT maxwait,
    cache_func    IN VARCHAR2    DEFAULT NULL)
RETURN INTEGER;
```

```
DBMS_PIPE.RECEIVE_MESSAGE (
    pipename      IN VARCHAR2,
    timeout       IN INTEGER      DEFAULT maxwait,
```

```

    credential_name    IN VARCHAR2    DEFAULT NULL,
    location_uri       IN VARCHAR2    DEFAULT NULL)
RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(receive_message,WNDS,RNDS);
```

Parameters

Table 137-9 RECEIVE_MESSAGE Function Parameters

Parameter	Description
pipename	Name of the pipe on which you want to receive a message. Names beginning with ORA\$ are reserved for use by Oracle.
timeout	Time to wait for a message, in seconds. The default value is the constant MAXWAIT, which is defined as 86400000 (1000 days). A timeout of 0 lets you read without blocking.
cache_func	Only applicable to singleton pipes, cache_func is the cache function name used to automatically cache a message in a singleton pipe and can be created as either a PL/SQL function or an embedded function in a PL/SQL package. If specified, the cache function is invoked as the current session user invoking the RECEIVE_MESSAGE function so the current user must have privilege on the function. The name of the function must be fully qualified with the owner schema: <ul style="list-style-type: none"> OWNER.FUNCTION_NAME OWNER.PACKAGE.FUNCTION_NAME Note that the time spent executing the cache function is not included towards the overall timeout specified for receiving messages.
credential_name	The credential name for the cloud store used to store messages. This parameter is only applicable to persistent pipes. The default value is NULL. A passed parameter takes precedence over the package argument's value. Credentials require EXECUTE and READ/WRITE privileges.
location_uri	The location URL for the cloud store being used to store messages. This parameter is only applicable to persistent pipes. The location_uri parameter is a global variable that has a value of NULL by default. A passed parameter takes precedence over the global variable's value. If a credential name is specified, a location_uri must also be provided.

Return Values

Table 137-10 RECEIVE_MESSAGE Function Return Values

Return	Description
0	Success

Table 137-10 (Cont.) RECEIVE_MESSAGE Function Return Values

Return	Description
1	Timed out. If the pipe was implicitly-created and is empty, then it is removed.
2	Record in the pipe is too large for the buffer. (This should not happen.)
3	An interrupt occurred.
8	The cache function was specified on a non-singleton pipe.
ORA-23322	User has insufficient privileges to read from the pipe.

Usage Notes

To receive a message from a pipe, first call `RECEIVE_MESSAGE`. When you receive a message, it is removed from the pipe; hence, a message can only be received once (unless using a singleton pipe). For implicitly-created pipes, the pipe is removed after the last record is removed from the pipe. An implicit singleton pipe exists in database memory until there is one cached message in the pipe.

If the pipe that you specify when you call `RECEIVE_MESSAGE` does not already exist, then Oracle implicitly creates the pipe and waits to receive the message. If the message does not arrive within a designated timeout interval, then the call returns and the pipe is removed.

After receiving the message, you must make one or more calls to `UNPACK_MESSAGE` to access the individual items in the message. The `UNPACK_MESSAGE` procedure is overloaded to unpack items of type `DATE`, `NUMBER`, `VARCHAR2`, and there are two additional procedures to unpack `RAW` and `ROWID` items. If you do not know the type of data that you are attempting to unpack, then call `NEXT_ITEM_TYPE` to determine the type of the next item in the buffer.

Note:

If performing cross-database messaging, the `CREATE_PIPE` function must be called before the first time you attempt to receive a message in the new database. The name of this pipe and its properties must be the same as the pipe the message was sent on in the other database.

Persistent messages are guaranteed to either be written or read by exactly one process. This prevents message content inconsistency due to concurrent writes and reads. Using a persistent messaging pipe, `DBMS_PIPE` allows only one operation, sending a message or receiving a message to be active at a given time. However, if an operation is not possible due to an ongoing operation, the process retries periodically until the `timeout` value is reached.

If you use Oracle Cloud Infrastructure Object Storage to store messages, you can use Oracle Cloud Infrastructure Native URIs or Swift URIs. However, the location URI and the credential must match in type as follows:

- If you use a native URI format to access Oracle Cloud Infrastructure Object Storage, you must use Native Oracle Cloud Infrastructure Signing Keys authentication in the credential object.

- If you use Swift URI format to access Oracle Cloud Infrastructure Object Storage, you must use an auth token authentication in the credential object.

Cache Function Parameter

Singleton pipes support the cache function to automatically cache a message in the pipe in case of the following two scenarios:

- The singleton pipe is empty
- The message in the singleton pipe is invalid because the `shelflife` time has elapsed

The cache function simplifies the use of singleton pipes by avoiding condition logic on failure to receive a message from an empty pipe and ensures there is no cache miss.

The name of the function should be fully qualified with the owner schema:

- `OWNER.FUNCTION_NAME`
- `OWNER.PACKAGE.FUNCTION_NAME`

To use a cache function, the current session user that invokes `DBMS_PIPE.RECEIVE_MESSAGE` must have required privileges to execute the cache function.

Cache Function Syntax

```
CREATE OR REPLACE FUNCTION cache_function_name(
    pipename IN VARCHAR2
) RETURN INTEGER;
```

Cache Function Parameters

Parameter	Data Type	Description
<code>pipename</code>	<code>VARCHAR2</code>	Name of the singleton pipe

Cache Function Return Values

Return	Description
0	Success
Non-zero	Failure value returned from <code>DBMS_PIPE.RECEIVE_MESSAGE</code>

Define a cache function to provide encapsulation and abstraction of complexity from the reader sessions of a singleton pipe. The typical operations within a cache function would be:

- Create a singleton pipe for an explicit pipe using `DBMS_PIPE.CREATE_PIPE`
- Create the message to cache in the singleton pipe
- Send the message to the singleton pipe, optionally specifying a `shelflife` for the implicit message

Exceptions

Table 137-11 RECEIVE_MESSAGE Function Exceptions

Exception	Description
Null pipe name	Permission error. Insufficient privilege to remove the record from the pipe. The pipe is owned by someone else.

Example

```

DECLARE
    l_status INTEGER;
BEGIN
    l_status := DBMS_PIPE.RECEIVE_MESSAGE(pipe_name => 'MY_PIPE1',
                                         timeout   => 1,
                                         cache_func =>
'MY_USER.MY_CACHE_FUNC');
END;
/

```

137.7.8 RESET_BUFFER Procedure

This procedure resets the `PACK_MESSAGE` and `UNPACK_MESSAGE` positioning indicators to 0.

Because all pipes share a single buffer, you may find it useful to reset the buffer before using a new pipe. This ensures that the first time you attempt to send a message to your pipe, you do not inadvertently send an expired message remaining in the buffer.

Syntax

```
DBMS_PIPE.RESET_BUFFER;
```

Pragmas

```
pragma restrict_references(reset_buffer,WNDS,RNDS);
```

137.7.9 REMOVE_PIPE Function

This function removes explicitly-created pipes.

Pipes created implicitly by `SEND_MESSAGE` are automatically removed when empty. However, pipes created explicitly by `CREATE_PIPE` are removed only by calling `REMOVE_PIPE`, or by shutting down the instance. All unconsumed records in the pipe are removed before the pipe is deleted.

This is similar to calling `PURGE` on an implicitly-created pipe.

Syntax

```

DBMS_PIPE.REMOVE_PIPE (
    pipe_name IN VARCHAR2)
RETURN INTEGER;

```

Pragmas

```
pragma restrict_references(remove_pipe,WNDS,RNDS);
```

Parameters

Table 137-12 REMOVE_PIPE Function Parameters

Parameter	Description
pipename	Name of pipe that you want to remove.

Return Values

Table 137-13 REMOVE_PIPE Function Return Values

Return	Description
0	Success If the pipe does not exist, or if the pipe already exists and the user attempting to remove it is authorized to do so, then Oracle returns 0, indicating success, and any data remaining in the pipe is removed.
ORA-23322	Insufficient privileges. If the pipe exists, but the user is not authorized to access the pipe, then Oracle signals error ORA-23322, indicating insufficient privileges.

Exceptions

Table 137-14 REMOVE_PIPE Function Exception

Exception	Description
Null pipe name	Permission error: Insufficient privilege to remove pipe. The pipe was created and is owned by someone else.

137.7.10 SEND_MESSAGE Function

This function sends a message on the named pipe.

The message is contained in the local message buffer, which was filled with calls to `PACK_MESSAGE`. You can create a pipe explicitly using `CREATE_PIPE`, otherwise, it is created implicitly.

To create an implicit singleton pipe, set the `singleton` parameter to `TRUE`. The following arguments are applicable to singleton pipes:

- `singleton`: Indicates that the pipe should be created as a singleton pipe (default: `FALSE`).
- `shelflife`: Optionally specify a `shelflife` expiration of a cached message in the singleton pipe. It can be used for implicit invalidation of the message in a singleton pipe. This argument is applicable for implicit as well as explicit singleton pipes. A `shelflife` value specified in the [SEND_MESSAGE Function](#) overwrites the `shelflife` specified for the explicit singleton pipe in the [CREATE_PIPE Function](#) and will be the default for any new messages cached in the singleton pipe.

Syntax

```
DBMS_PIPE.SEND_MESSAGE (
    pipename      IN VARCHAR2,
    timeout       IN INTEGER DEFAULT MAXWAIT,
    maxpipesize   IN INTEGER DEFAULT 65536,
    singleton     IN BOOLEAN DEFAULT FALSE,
    shelflife     IN INTEGER DEFAULT 0)
RETURN INTEGER;
```

```
DBMS_PIPE.SEND_MESSAGE (
    pipename      IN VARCHAR2,
    timeout       IN INTEGER DEFAULT MAXWAIT,
    credential_name IN VARCHAR2 DEFAULT NULL,
    location_uri  IN VARCHAR2 DEFAULT NULL)
RETURN INTEGER;
```

Pragmas

```
pragma restrict_references (send_message,WNDS,RNDS);
```

Parameters

Table 137-15 SEND_MESSAGE Function Parameters

Parameter	Description
pipename	<p>Name of the pipe on which you want to place the message.</p> <p>If you are using an explicit pipe, then this is the name that you specified when you called <code>CREATE_PIPE</code>.</p> <p>Caution: Do not use pipe names beginning with 'ORA\$'. These names are reserved for use by procedures provided by Oracle. Pipename should not be longer than 128 bytes, and is case-insensitive. At this time, the name cannot contain Globalization Support characters.</p>
timeout	<p>Time to wait while attempting to place a message on a pipe, in seconds.</p> <p>The default value is the constant <code>MAXWAIT</code>, which is defined as 86400000 (1000 days).</p>

Table 137-15 (Cont.) SEND_MESSAGE Function Parameters

Parameter	Description
maxpipesize	<p>Maximum size allowed for the pipe, in bytes.</p> <p>The total size of all the messages on the pipe cannot exceed this amount. The message is blocked if it exceeds this maximum. The default is 65536 bytes.</p> <p>The maxpipesize for a pipe becomes a part of the characteristics of the pipe and persists for the life of the pipe. Callers of SEND_MESSAGE with larger values cause the maxpipesize to be increased. Callers with a smaller value simply use the existing, larger value.</p> <p>Specifying maxpipesize as part of the SEND_MESSAGE procedure eliminates the need for a separate call to open the pipe. If you created the pipe explicitly, then you can use the optional maxpipesize parameter to override the creation pipe size specifications.</p>
singleton	<p>Specifying singleton as TRUE indicates that the implicit pipe should be created as a singleton pipe. This argument is not required if the pipe is explicitly created as a singleton pipe using the CREATE_PIPE function.</p> <p>The default value of singleton is FALSE.</p>
shelflife	<p>Only applicable to singleton pipes, this parameter is optionally used to set the expiration time in seconds of a message cached in an implicit or explicit singleton pipe. Once the shelflife time is exceeded, the message is no longer accessible from the pipe. The shelflife can be used for implicit invalidation of the message in a singleton pipe.</p> <p>The default value of 0 indicates that the message will not expire.</p> <p>Specifying shelflife as part of the SEND_MESSAGE procedure overwrites the shelflife value specified for an explicit singleton pipe using CREATE_PIPE and will be the default for any new messages cached in the singleton pipe.</p>
credential_name	<p>The credential name for the cloud store used to store messages. This parameter is only applicable to persistent pipes.</p> <p>The default value is NULL. A passed parameter takes precedence over the package argument's value. Credentials require the EXECUTE and READ/WRITE privileges.</p>
location_uri	<p>The location URL for the cloud store being used to store messages. This parameter is only applicable to persistent pipes.</p> <p>The location_uri parameter is a global variable that has a value of NULL by default. A passed parameter takes precedence over the global variable's value.</p> <p>If a credential name is specified, a location_uri must also be provided.</p>

Return Values

Table 137-16 SEND_MESSAGE Function Return Values

Return	Description
0	<p>Success.</p> <p>If the pipe already exists and the user attempting to create it is authorized to use it, then Oracle returns 0, indicating success, and any data already in the pipe remains.</p> <p>If a user connected as SYSDBS/SYSOPER re-creates a pipe, then Oracle returns status 0, but the ownership of the pipe remains unchanged.</p>
1	<p>Timed out.</p> <p>This procedure can timeout either because it cannot get a lock on the pipe, or because the pipe remains too full to be used. If the pipe was implicitly-created and is empty, then it is removed.</p>
3	<p>An interrupt occurred.</p> <p>If the pipe was implicitly created and is empty, then it is removed.</p>
6	<p>Failed to convert existing pipe to a singleton pipe.</p> <p>An implicit pipe with more than one existing message cannot be converted to a singleton pipe.</p> <p>For explicit pipe that is not a singleton pipe, SEND_MESSAGE cannot send a message with the singleton parameter set to TRUE.</p>
7	<p>A non-zero value was given for shelveLife and the pipe is not a singleton pipe.</p>
ORA-23322	<p>Insufficient privileges.</p> <p>If a pipe with the same name exists and was created by a different user, then Oracle signals error ORA-23322, indicating the naming conflict.</p>

Usage Notes

Persistent messages are guaranteed to either be written or read by exactly one process. This prevents message content inconsistency due to concurrent writes and reads. Using a persistent messaging pipe, DBMS_PIPE allows only one operation, sending a message or receiving a message to be active at a given time. However, if an operation is not possible due to an ongoing operation, the process retries periodically until the timeout value is reached.

If you use Oracle Cloud Infrastructure Object Storage to store messages, you can use Oracle Cloud Infrastructure Native URIs or Swift URIs. However, the location URI and the credential must match in type as follows:

- If you use a native URI format to access Oracle Cloud Infrastructure Object Storage, you must use Native Oracle Cloud Infrastructure Signing Keys authentication in the credential object.
- If you use Swift URI format to access Oracle Cloud Infrastructure Object Storage, you must use an auth token authentication in the credential object.

Exceptions

Table 137-17 SEND_MESSAGE Function Exception

Exception	Description
Null pipe name	Permission error. Insufficient privilege to write to the pipe. The pipe is private and owned by someone else.

137.7.11 SET_CREDENTIAL_NAME Procedure

This procedure sets the global `credential_name` variable to be used as the default credential with the cloud. The `SET_CREDENTIAL_NAME` procedure is only applicable to persistent pipes with messages stored in Cloud Object Storage.

Syntax

```
DBMS_PIPE.SET_CREDENTIAL_NAME (
    credential_name IN VARCHAR2);
```

Parameters

Table 137-18 SET_CREDENTIAL_NAME Procedure Parameters

Parameter	Description
<code>credential_name</code>	The credential name for the cloud store used to store messages.

137.7.12 SET_LOCATION_URI Procedure

This procedure sets the global `set_location_uri` variable to be used as the default location URI with the cloud. The `SET_LOCATION_URI` procedure is only applicable to persistent pipes with messages stored in Cloud Object Storage.

Syntax

```
DBMS_PIPE.SET_LOCATION_URI (
    location_uri IN VARCHAR2);
```

Parameters

Table 137-19 SET_LOCATION_URI Procedure

Parameter	Description
<code>location_uri</code>	The location URI for the cloud store used to store messages.

137.7.13 UNIQUE_SESSION_NAME Function

This function receives a name that is unique among all of the sessions that are currently connected to a database.

Multiple calls to this function from the same session always return the same value. You might find it useful to use this function to supply the PIPENAME parameter for your SEND_MESSAGE and RECEIVE_MESSAGE calls.

Syntax

```
DBMS_PIPE.UNIQUE_SESSION_NAME  
RETURN VARCHAR2;
```

Pragmas

```
pragma restrict_references(unique_session_name,WNDS,RNDS,WNPS);
```

Return Values

This function returns a unique name. The returned name can be up to 30 bytes.

137.7.14 UNPACK_MESSAGE Procedures

This procedure retrieves items from the buffer.

After you have called RECEIVE_MESSAGE to place pipe information in a local buffer, call UNPACK_MESSAGE.



Note:

The UNPACK_MESSAGE procedure is overloaded to return items of type VARCHAR2, NCHAR, NUMBER, or DATE. There are two additional procedures to unpack RAW and ROWID items.

Syntax

```
DBMS_PIPE.UNPACK_MESSAGE (  
    item OUT VARCHAR2);  
  
DBMS_PIPE.UNPACK_MESSAGE (  
    item OUT NCHAR);  
  
DBMS_PIPE.UNPACK_MESSAGE (  
    item OUT NUMBER);  
  
DBMS_PIPE.UNPACK_MESSAGE (  
    item OUT DATE);  
  
DBMS_PIPE.UNPACK_MESSAGE_RAW (  
    item OUT RAW);  
  
DBMS_PIPE.UNPACK_MESSAGE_ROWID (  
    item OUT ROWID);
```

Pragmas

```
pragma restrict_references(unpack_message,WNDS,RNDS);  
pragma restrict_references(unpack_message_raw,WNDS,RNDS);  
pragma restrict_references(unpack_message_rowid,WNDS,RNDS);
```

Parameters

Table 137-20 UNPACK_MESSAGE Procedure Parameters

Parameter	Description
item	Argument to receive the next unpacked item from the local message buffer.

Exceptions

ORA-06556 or 06559 are generated if the buffer contains no more items, or if the item is not of the same type as that requested.

DBMS_PLSQL_CODE_COVERAGE

The `DBMS_PLSQL_CODE_COVERAGE` package provides an interface for the collection of code coverage data of PL/SQL applications at the basic block level.

This chapter contains the following topics:

- [DBMS_PLSQL_CODE_COVERAGE Overview](#)
- [DBMS_PLSQL_CODE_COVERAGE Security Model](#)
- [DBMS_PLSQL_CODE_COVERAGE Data Structures](#)
- [Summary of DBMS_PLSQL_CODE_COVERAGE Subprograms](#)

138.1 DBMS_PLSQL_CODE_COVERAGE Overview

The `DBMS_PLSQL_CODE_COVERAGE` package provides an interface for collecting code coverage information at the basic block level of PL/SQL applications. A basic block refers to a single entry single exit block of PL/SQL code. PL/SQL developers want to know how well their test infrastructure exercised their code. The coverage tables are created using the `CREATE_COVERAGE_TABLES` procedure.

A typical code coverage run in a session involves calls to :

- `START_COVERAGE`
- Run PL/SQL code
- `STOP_COVERAGE`

The `GET_BLOCK_MAP` function helps you calculate your total coverage.

See Also:

- *Oracle Database Development Guide* for more information about using PL/SQL basic block coverage to maintain quality
- *Oracle Database PL/SQL Language Reference* for the `COVERAGE PRAGMA` syntax and semantics
- *Oracle Database PL/SQL Language Reference* for more information about the `PLSQL_OPTIMIZE_LEVEL` compilation parameter

138.2 DBMS_PLSQL_CODE_COVERAGE Security Model

The user must have `EXECUTE` privilege on the `DBMS_PLSQL_CODE_COVERAGE` package.

The user must have `CREATE` privilege on the unit to collect coverage information about this unit.

PL/SQL basic block coverage data is collected when program units use `INTERPRETED` compilation (parameter set `PLSQL_CODE_TYPE = INTERPRETED`). PL/SQL basic block coverage data is not collected when program units use `NATIVE` compilation. You can disable the `NATIVE` compiler by setting the parameter `PLSQL_OPTIMIZE_LEVEL <= 1`. Regardless of the compilation mode, coverage data for wrapped units is not collected.

138.3 DBMS_PLSQL_CODE_COVERAGE Constants

The `DBMS_PLSQL_CODE_COVERAGE` package provides constants that are used with the `namespace` parameter of the `GET_BLOCK_MAP` function.

These constants are described in the following table.

Table 138-1 DBMS_PLSQL_CODE_COVERAGE Constants

Name	Type	Value	Description
<code>function_namespace</code>	NUMBER	1	Specifies the function namespace
<code>package_spec_namespace</code>	NUMBER	1	Specifies the package specification namespace
<code>package_body_namespace</code>	NUMBER	2	Specifies the package definition (body) namespace
<code>procedure_namespace</code>	NUMBER	1	Specifies the procedure namespace
<code>trigger_namespace</code>	NUMBER	3	Specifies the trigger namespace
<code>type_spec_namespace</code>	NUMBER	1	Specifies the type specification namespace
<code>type_body_namespace</code>	NUMBER	2	Specifies the type definition (body) namespace

138.4 DBMS_PLSQL_CODE_COVERAGE Data Structures

Record Types

- [MAP_REC Record Type](#)

Table Types

- [T_MAP_REC Table Type](#)

138.4.1 MAP_REC Record Type

The MAP_REC record type defines the PL/SQL basic block location in the source code.

Syntax

```
TYPE map_rec IS RECORD (  
  procedure_name VARCHAR2(32767),  
  block_num      NUMBER,  
  line           NUMBER,  
  col            NUMBER,  
  not_feasible  NUMBER);
```

Fields

Table 138-2 MAP_REC Fields

Field	Description
procedure_name	The name of the procedure containing the basic block
block_num	Identifies the basic block
line	Starting line of the basic block
col	Starting column of the basic block
not_feasible	Not_feasible marking of the basic block

138.4.2 T_MAP_REC Table Type

The T_MAP_REC table type specifies the collection of PL/SQL basic blocks in a unit.

Syntax

```
TYPE t_map_rec IS TABLE OF map_rec;
```

138.5 Summary of DBMS_PLSQL_CODE_COVERAGE Subprograms

This table lists the DBMS_PLSQL_CODE_COVERAGE subprograms and briefly describes them.

Table 138-3 DBMS_PLSQL_CODE_COVERAGE Package Subprograms

Subprogram	Description
CREATE_COVERAGE_TABLES Procedure	Creates coverage tables
GET_BLOCK_MAP Function	Gets the mapping of basic blocks to PL/SQL source
START_COVERAGE Function	Starts the coverage data collection in the user's session and returns the RUN_ID
STOP_COVERAGE Procedure	Ends the current coverage run

138.5.1 CREATE_COVERAGE_TABLES Procedure

This procedure creates the tables used for coverage data collection.

Syntax

```
DBMS_PLSQL_CODE_COVERAGE.CREATE_COVERAGE_TABLES (
    FORCE_IT      IN BOOLEAN DEFAULT FALSE);
```

Parameters

Parameter	Description
FORCE_IT	The default is to raise an error if the coverage tables already exists. If set to TRUE, the tables are dropped silently if the tables already exist, and new tables are created.

Exceptions

Table 138-4 CREATE_COVERAGE_TABLES Exceptions

Exception	Description
COVERAGE_ERROR	The FORCE_IT parameter is FALSE and the tables already exist.

138.5.2 GET_BLOCK_MAP Function

This function gets the mapping of basic blocks to PL/SQL source.

Syntax

```
DBMS_PLSQL_CODE_COVERAGE.GET_BLOCK_MAP(
    unit_owner IN VARCHAR2,
    unit_name  IN VARCHAR2,
    namespace  IN POSITIVE)
RETURN T_MAP_REC;
```

Table 138-5 Parameters

Parameter	Description
unit_owner	The owner of the unit. The unit owner is case insensitive. If the unit_owner is empty or NULL, then it defaults to the current schema.
unit_name	The unit whose mapping is to be gotten. The unit_name is case insensitive.
namespace	Namespace to which this unit_name gets resolved. See DBMS_PLSQL_CODE_COVERAGE Constants for a list of valid namespace values.

138.5.3 START_COVERAGE Function

This function starts the coverage data collection in the user's session and returns a unique identifier `RUN_ID` for the run.

Syntax

```
DBMS_PLSQL_CODE_COVERAGE.START_COVERAGE (  
    run_comment    IN VARCHAR2)  
    RETURN NUMBER;
```

Parameters

Parameter	Description
<code>run_comment</code>	Allows the user to name a run and identify the test.

138.5.4 STOP_COVERAGE Procedure

This procedure ends the current coverage run.

Syntax

```
DBMS_PLSQL_CODE_COVERAGE.STOP_COVERAGE;
```

Exceptions

Table 138-6 STOP_COVERAGE Exceptions

Exception	Description
<code>COVERAGE_ERROR</code>	An error is raised if the coverage tables do not exist.

DBMS_PREDICTIVE_ANALYTICS

Machine learning can discover useful information buried in vast amounts of data. However, both the programming interfaces and the machine learning expertise required to obtain these results are too complex for use by the wide audiences that can obtain benefits from using Oracle Machine Learning for SQL.

The `DBMS_PREDICTIVE_ANALYTICS` package addresses both of these complexities by automating the entire machine learning process from data preprocessing through model building to scoring new data. This package provides an important tool that makes machine learning possible for a broad audience of users, in particular, business analysts.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_PREDICTIVE_ANALYTICS Subprograms](#)

139.1 DBMS_PREDICTIVE_ANALYTICS Overview

`DBMS_PREDICTIVE_ANALYTICS` automates parts of the machine learning process.

Machine learning, according to a commonly used process model, requires the following steps:

1. Understand the business problem.
2. Understand the data.
3. Prepare the data for mining.
4. Create models using the prepared data.
5. Evaluate the models.
6. Deploy and use the model to score new data.

`DBMS_PREDICTIVE_ANALYTICS` automates parts of step 3 — 5 of this process.

Predictive analytics procedures analyze and prepare the input data, create and test machine learning models using the input data, and then use the input data for scoring. The results of scoring are returned to the user. The models and supporting objects are not preserved after the operation completes.

139.2 DBMS_PREDICTIVE_ANALYTICS Security Model

The `DBMS_PREDICTIVE_ANALYTICS` package is owned by user `SYS` and is installed as part of database installation. Execution privilege on the package is granted to `public`. The routines in the package are run with invokers' rights (run with the privileges of the current user).

The `DBMS_PREDICTIVE_ANALYTICS` package exposes APIs which are leveraged by the Oracle Machine Learning for SQL option. Users who wish to invoke procedures in this package

require the `CREATE MINING MODEL` system privilege (as well as the `CREATE TABLE` and `CREATE VIEW` system privilege).

139.3 Summary of DBMS_PREDICTIVE_ANALYTICS Subprograms

This table lists and briefly describes the `DBMS_PREDICTIVE_ANALYTICS` package subprograms.

Table 139-1 DBMS_PREDICTIVE_ANALYTICS Package Subprograms

Subprogram	Purpose
EXPLAIN Procedure	Ranks attributes in order of influence in explaining a target column.
PREDICT Procedure	Predicts the value of a target column based on values in the input data.
PROFILE Procedure	Generates rules that identify the records that have the same target value.

139.3.1 EXPLAIN Procedure

The `EXPLAIN` procedure identifies the attributes that are important in explaining the variation in values of a target column.

The input data must contain some records where the target value is known (not `NULL`). These records are used by the procedure to train a model that calculates the attribute importance.

Note:

`EXPLAIN` supports `DATE` and `TIMESTAMP` datatypes in addition to the numeric, character, and nested datatypes supported by Oracle Machine Learning for SQL models.

Data requirements for Oracle Machine Learning for SQL are described in *Oracle Machine Learning for SQL User's Guide*

The `EXPLAIN` procedure creates a result table that lists the attributes in order of their explanatory power. The result table is described in the Usage Notes.

Syntax

```
DBMS_PREDICTIVE_ANALYTICS.EXPLAIN (
  data_table_name      IN VARCHAR2,
  explain_column_name  IN VARCHAR2,
  result_table_name    IN VARCHAR2,
  data_schema_name     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 139-2 EXPLAIN Procedure Parameters

Parameter	Description
<code>data_table_name</code>	Name of input table or view
<code>explain_column_name</code>	Name of the column to be explained
<code>result_table_name</code>	Name of the table where results are saved
<code>data_schema_name</code>	Name of the schema where the input table or view resides and where the result table is created. Default: the current schema.

Usage Notes

The `EXPLAIN` procedure creates a result table with the columns described in [Table 139-3](#).

Table 139-3 EXPLAIN Procedure Result Table

Column Name	Datatype	Description
<code>ATTRIBUTE_NAME</code>	<code>VARCHAR2(30)</code>	Name of a column in the input data; all columns except the explained column are listed in the result table.
<code>EXPLANATORY_VALUE</code>	<code>NUMBER</code>	Value indicating how useful the column is for determining the value of the explained column. Higher values indicate greater explanatory power. Value can range from 0 to 1. An individual column's explanatory value is independent of other columns in the input table. The values are based on how strong each individual column correlates with the explained column. The value is affected by the number of records in the input table, and the relations of the values of the column to the values of the explain column. An explanatory power value of 0 implies there is no useful correlation between the column's values and the explain column's values. An explanatory power of 1 implies perfect correlation; such columns should be eliminated from consideration for <code>PREDICT</code> . In practice, an explanatory power equal to 1 is rarely returned.
<code>RANK</code>	<code>NUMBER</code>	Ranking of explanatory power. Rows with equal values for <code>explanatory_value</code> have the same rank. Rank values are not skipped in the event of ties.

Example

The following example performs an `EXPLAIN` operation on the `SUPPLEMENTARY_DEMOGRAPHICS` table of Sales History.

```
--Perform EXPLAIN operation
BEGIN
  DBMS_PREDICTIVE_ANALYTICS.EXPLAIN(
    data_table_name      => 'supplementary_demographics',
    explain_column_name => 'home_theater_package',
    result_table_name   => 'demographics_explain_result');
END;
/
--Display results
SELECT * FROM demographics_explain_result;
```

ATTRIBUTE_NAME	EXPLANATORY_VALUE	RANK
Y_BOX_GAMES	.524311073	1
YRS_RESIDENCE	.495987246	2
HOUSEHOLD_SIZE	.146208506	3
AFFINITY_CARD	.0598227	4
EDUCATION	.018462703	5
OCCUPATION	.009721543	6
FLAT_PANEL_MONITOR	.00013733	7
PRINTER_SUPPLIES	0	8
OS_DOC_SET_KANJI	0	8
BULK_PACK_DISKETTES	0	8
BOOKKEEPING_APPLICATION	0	8
COMMENTS	0	8
CUST_ID	0	8

The results show that Y_BOX_GAMES, YRS_RESIDENCE, and HOUSEHOLD_SIZE are the best predictors of HOME_THEATER_PACKAGE.

139.3.2 PREDICT Procedure

The PREDICT procedure predicts the values of a target column.

The input data must contain some records where the target value is known (not NULL). These records are used by the procedure to train and test a model that makes the predictions.



Note:

PREDICT supports DATE and TIMESTAMP datatypes in addition to the numeric, character, and nested datatypes supported by Oracle Machine Learning for SQL models.

Data requirements for Oracle Machine Learning for SQL are described in *Oracle Machine Learning for SQL User's Guide*

The PREDICT procedure creates a result table that contains a predicted target value for every record. The result table is described in the Usage Notes.

Syntax

```
DBMS_PREDICTIVE_ANALYTICS.PREDICT (
    accuracy                OUT NUMBER,
    data_table_name         IN VARCHAR2,
    case_id_column_name     IN VARCHAR2,
    target_column_name      IN VARCHAR2,
    result_table_name       IN VARCHAR2,
    data_schema_name        IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 139-4 PREDICT Procedure Parameters

Parameter	Description
accuracy	Output parameter that returns the predictive confidence, a measure of the accuracy of the predicted values. The predictive confidence for a categorical target is the most common target value; the predictive confidence for a numerical target is the mean.
data_table_name	Name of the input table or view.
case_id_column_name	Name of the column that uniquely identifies each case (record) in the input data.
target_column_name	Name of the column to predict.
result_table_name	Name of the table where results will be saved.
data_schema_name	Name of the schema where the input table or view resides and where the result table is created. Default: the current schema.

Usage Notes

The `PREDICT` procedure creates a result table with the columns described in [Table 139-5](#).

Table 139-5 PREDICT Procedure Result Table

Column Name	Datatype	Description
Case ID column name	VARCHAR2 or NUMBER	The name of the case ID column in the input data.
PREDICTION	VARCHAR2 or NUMBER	The predicted value of the target column for the given case.
PROBABILITY	NUMBER	For classification (categorical target), the probability of the prediction. For regression problems (numerical target), this column contains <code>NULL</code> .



Note:

Make sure that the name of the case ID column is not 'PREDICTION' or 'PROBABILITY'.

Predictions are returned for all cases whether or not they contained target values in the input.

Predicted values for known cases may be interesting in some situations. For example, you could perform deviation analysis to compare predicted values and actual values.

Example

The following example performs a `PREDICT` operation and displays the first 10 predictions. The results show an accuracy of 79% in predicting whether each customer has an affinity card.


```

--Perform PREDICT operation
DECLARE
    v_accuracy NUMBER(10,9);
BEGIN
    DBMS_PREDICTIVE_ANALYTICS.PREDICT(
        accuracy          => v_accuracy,
        data_table_name   => 'supplementary_demographics',
        case_id_column_name => 'cust_id',
        target_column_name => 'affinity_card',
        result_table_name => 'pa_demographics_predict_result');
    DBMS_OUTPUT.PUT_LINE('Accuracy = ' || v_accuracy);
END;
/

Accuracy = .788696903

--Display results
SELECT * FROM pa_demographics_predict_result WHERE rownum < 10;

   CUST_ID PREDICTION PROBABILITY
-----
101501          1   .834069848
101502          0   .991269965
101503          0   .99978311
101504          1   .971643388
101505          1   .541754127
101506          0   .803719133
101507          0   .999999303
101508          0   .999999987
101509          0   .999953074

```

139.3.3 PROFILE Procedure

The `PROFILE` procedure generates rules that describe the cases (records) from the input data.

For example, if a target column `CHURN` has values 'Yes' and 'No', `PROFILE` generates a set of rules describing the expected outcomes. Each profile includes a rule, record count, and a score distribution.

The input data must contain some cases where the target value is known (not `NULL`). These cases are used by the procedure to build a model that calculates the rules.

Note:

`PROFILE` does not support nested types or dates.

Data requirements for Oracle Machine Learning for SQL are described in *Oracle Machine Learning for SQL User's Guide*

The `PROFILE` procedure creates a result table that specifies rules (profiles) and their corresponding target values. The result table is described in the Usage Notes.

Syntax

```
DBMS_PREDICTIVE_ANALYTICS.PROFILE (
    data_table_name          IN VARCHAR2,
    target_column_name       IN VARCHAR2,
    result_table_name        IN VARCHAR2,
    data_schema_name         IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 139-6 PROFILE Procedure Parameters

Parameter	Description
data_table_name	Name of the table containing the data to be analyzed.
target_column_name	Name of the target column.
result_table_name	Name of the table where the results will be saved.
data_schema_name	Name of the schema where the input table or view resides and where the result table is created. Default: the current schema.

Usage Notes

The `PROFILE` procedure creates a result table with the columns described in [Table 139-7](#).

Table 139-7 PROFILE Procedure Result Table

Column Name	Datatype	Description
PROFILE_ID	NUMBER	A unique identifier for this profile (rule).
RECORD_COUNT	NUMBER	The number of records described by the profile.
DESCRIPTION	SYS.XMLTYPE	The profile rule. See " XML Schema for Profile Rules ".

XML Schema for Profile Rules

The `DESCRIPTION` column of the result table contains XML that conforms to the following XSD:

```
<xs:element name="SimpleRule">
  <xs:complexType>
    <xs:sequence>
      <xs:group ref="PREDICATE"/>
      <xs:element ref="ScoreDistribution" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="id" type="xs:string" use="optional"/>
    <xs:attribute name="score" type="xs:string" use="required"/>
    <xs:attribute name="recordCount" type="NUMBER" use="optional"/>
  </xs:complexType>
</xs:element>
```

Example

This example generates a rule describing customers who are likely to use an affinity card (target value is 1) and a set of rules describing customers who are not likely to use an affinity card (target value is 0). The rules are based on only two predictors: education and occupation.

```

SET serveroutput ON
SET trimspool ON
SET pages 10000
SET long 10000
SET pagesize 10000
SET linesize 150
CREATE VIEW cust_edu_occ_view AS
    SELECT cust_id, education, occupation, affinity_card
    FROM sh.supplementary_demographics;
BEGIN
    DBMS_PREDICTIVE_ANALYTICS.PROFILE(
        DATA_TABLE_NAME => 'cust_edu_occ_view',
        TARGET_COLUMN_NAME => 'affinity_card',
        RESULT_TABLE_NAME => 'profile_result');
END;
/

```

This example generates eight rules in the result table `profile_result`. Seven of the rules suggest a target value of 0; one rule suggests a target value of 1. The `score` attribute on a rule identifies the target value.

This `SELECT` statement returns all the rules in the result table.

```

SELECT a.profile_id, a.record_count, a.description.getstringval()
FROM profile_result a;

```

This `SELECT` statement returns the rules for a target value of 0.

```

SELECT *
FROM profile_result t
WHERE extractvalue(t.description, '/SimpleRule/@score') = 0;

```

The eight rules generated by this example are displayed as follows.

```

<SimpleRule id="1" score="0" recordCount="443">
  <CompoundPredicate booleanOperator="and">
    <SimpleSetPredicate field="OCCUPATION" booleanOperator="isIn">
      <Array type="string">"Armed-F" "Exec." "Prof." "Protec."
    </Array>
    </SimpleSetPredicate>
    <SimpleSetPredicate field="EDUCATION" booleanOperator="isIn">
      <Array type="string">"< Bach." "Assoc-V" "HS-grad"
    </Array>
    </SimpleSetPredicate>
  </CompoundPredicate>
  <ScoreDistribution value="0" recordCount="297" />
  <ScoreDistribution value="1" recordCount="146" />
</SimpleRule>

<SimpleRule id="2" score="0" recordCount="18">
  <CompoundPredicate booleanOperator="and">
    <SimpleSetPredicate field="OCCUPATION" booleanOperator="isIn">
      <Array type="string">"Armed-F" "Exec." "Prof." "Protec."
    </Array>
    </SimpleSetPredicate>
    <SimpleSetPredicate field="EDUCATION" booleanOperator="isIn">
      <Array type="string">"10th" "11th" "12th" "1st-4th" "5th-6th" "7th-8th" "9th" "Presch."
    </Array>
    </SimpleSetPredicate>
  </CompoundPredicate>
  <ScoreDistribution value="0" recordCount="18" />

```

```

</SimpleRule>

<SimpleRule id="3" score="0" recordCount="458">
  <CompoundPredicate booleanOperator="and">
    <SimpleSetPredicate field="OCCUPATION" booleanOperator="isIn">
      <Array type="string">"Armed-F" "Exec." "Prof." "Protec."
    </Array>
    </SimpleSetPredicate>
    <SimpleSetPredicate field="EDUCATION" booleanOperator="isIn">
      <Array type="string">"Assoc-A" "Bach."
    </Array>
    </SimpleSetPredicate>
  </CompoundPredicate>
  <ScoreDistribution value="0" recordCount="248" />
  <ScoreDistribution value="1" recordCount="210" />
</SimpleRule>

<SimpleRule id="4" score="1" recordCount="276">
  <CompoundPredicate booleanOperator="and">
    <SimpleSetPredicate field="OCCUPATION" booleanOperator="isIn">
      <Array type="string">"Armed-F" "Exec." "Prof." "Protec."
    </Array>
    </SimpleSetPredicate>
    <SimpleSetPredicate field="EDUCATION" booleanOperator="isIn">
      <Array type="string">"Masters" "PhD" "Profsc"
    </Array>
    </SimpleSetPredicate>
  </CompoundPredicate>
  <ScoreDistribution value="1" recordCount="183" />
  <ScoreDistribution value="0" recordCount="93" />
</SimpleRule>

<SimpleRule id="5" score="0" recordCount="307">
  <CompoundPredicate booleanOperator="and">
    <SimpleSetPredicate field="EDUCATION" booleanOperator="isIn">
      <Array type="string">"Assoc-A" "Bach." "Masters" "PhD" "Profsc"
    </Array>
    </SimpleSetPredicate>
    <SimpleSetPredicate field="OCCUPATION" booleanOperator="isIn">
      <Array type="string">"Crafts" "Sales" "TechSup" "Transp."
    </Array>
    </SimpleSetPredicate>
  </CompoundPredicate>
  <ScoreDistribution value="0" recordCount="184" />
  <ScoreDistribution value="1" recordCount="123" />
</SimpleRule>

<SimpleRule id="6" score="0" recordCount="243">
  <CompoundPredicate booleanOperator="and">
    <SimpleSetPredicate field="EDUCATION" booleanOperator="isIn">
      <Array type="string">"Assoc-A" "Bach." "Masters" "PhD" "Profsc"
    </Array>
    </SimpleSetPredicate>
    <SimpleSetPredicate field="OCCUPATION" booleanOperator="isIn">
      <Array type="string">"?" "Cleric." "Farming" "Handler" "House-s" "Machine" "Other"
    </Array>
    </SimpleSetPredicate>
  </CompoundPredicate>
  <ScoreDistribution value="0" recordCount="197" />
  <ScoreDistribution value="1" recordCount="46" />
</SimpleRule>

```

```

<SimpleRule id="7" score="0" recordCount="2158">
  <CompoundPredicate booleanOperator="and">
    <SimpleSetPredicate field="EDUCATION" booleanOperator="isIn">
      <Array type="string">
        "10th" "11th" "12th" "1st-4th" "5th-6th" "7th-8th" "9th" "< Bach." "Assoc-V" "HS-grad"
        "Presch."
      </Array>
    </SimpleSetPredicate>
    <SimpleSetPredicate field="OCCUPATION" booleanOperator="isIn">
      <Array type="string">"?" "Cleric." "Crafts" "Farming" "Machine" "Sales" "TechSup" "
Transp."
      </Array>
    </SimpleSetPredicate>
  </CompoundPredicate>
  <ScoreDistribution value="0" recordCount="1819"/>
  <ScoreDistribution value="1" recordCount="339"/>
</SimpleRule>

<SimpleRule id="8" score="0" recordCount="597">
  <CompoundPredicate booleanOperator="and">
    <SimpleSetPredicate field="EDUCATION" booleanOperator="isIn">
      <Array type="string">
        "10th" "11th" "12th" "1st-4th" "5th-6th" "7th-8th" "9th" "< Bach." "Assoc-V" "HS-grad"
        "Presch."
      </Array>
    </SimpleSetPredicate>
    <SimpleSetPredicate field="OCCUPATION" booleanOperator="isIn">
      <Array type="string">"Handler" "House-s" "Other"
      </Array>
    </SimpleSetPredicate>
  </CompoundPredicate>
  <ScoreDistribution value="0" recordCount="572"/>
  <ScoreDistribution value="1" recordCount="25"/>
</SimpleRule>

```

DBMS_PREPROCESSOR

The DBMS_PREPROCESSOR package provides an interface to print or retrieve the source text of a PL/SQL unit in its post-processed form.

This package contains the following topics:

- [Overview](#)
- [Operating Notes](#)
- [Data Structures](#)
- [Summary of DBMS_PREPROCESSOR Subprograms](#)

140.1 DBMS_PREPROCESSOR Overview

It is necessary to first understand the three styles of subprograms, in order to understand how DBMS_PREPROCESSOR works.

The following are the three styles of subprograms:

1. Subprograms that take a schema name, a unit type name, and the unit name.
2. Subprograms that take a VARCHAR2 string which contains the source text of an arbitrary PL/SQL compilation unit.
3. Subprograms that take a VARCHAR2 index-by table which contains the segmented source text of an arbitrary PL/SQL compilation unit.

Subprograms of the first style are used to print or retrieve the post-processed source text of a stored PL/SQL unit. The user must have the privileges necessary to view the original source text of this unit. The user must also specify the schema in which the unit is defined, the type of the unit, and the name of the unit. If the schema is null, then the current user schema is used. If the status of the stored unit is VALID and the user has the required privilege, then the post-processed source text is guaranteed to be the same as that of the unit the last time it was compiled.

Subprograms of the second or third style are used to generate post-processed source text in the current user schema. The source text is passed in as a single VARCHAR2 string in the second style, or as a VARCHAR2 index-by table in the third style. The source text can represent an arbitrary PL/SQL compilation unit. A typical usage is to pass the source text of an anonymous block and generate its post-processed source text in the current user schema. The third style can be useful when the source text exceeds the VARCHAR2 length limit.

140.2 DBMS_PREPROCESSOR Operating Notes

These notes explain how DBMS_PREPROCESSOR works with the three subprogram styles.

- For subprograms of the first style, the status of the stored PL/SQL unit does not need to be VALID. Likewise, the source text passed in as a VARCHAR2 string or a VARCHAR2 index-by table may contain compile time errors. If errors are found when generating the post-

processed source, the error message text will also appear at the end of the post-processed source text. In some cases, the preprocessing can be aborted because of errors. When this happens, the post-processed source text will appear to be incomplete and the associated error message can help to indicate that an error has occurred during preprocessing.

- For subprograms of the second or third style, the source text can represent any arbitrary PL/SQL compilation unit. However, the source text of a valid PL/SQL compilation unit cannot include commonly used prefixes such as `CREATE OR REPLACE`. In general, the input source should be syntactically prepared in a way as if it were obtained from the `ALL_SOURCE` view. The following list gives some examples of valid initial syntax for some PL/SQL compilation units.

anonymous block	(BEGIN DECLARE) ...
package	PACKAGE <name> ...
package body	PACKAGE BODY <name> ...
procedure	PROCEDURE <name> ...
function	FUNCTION <name> ...
type	TYPE <name> ...
type body	TYPE BODY <name> ...
trigger	(BEGIN DECLARE) ...

If the source text represents a named PL/SQL unit that is valid, that unit will not be created after its post-processed source text is generated.

- If the text of a wrapped PL/SQL unit is obtained from the `ALL_SOURCE` view, the keyword `WRAPPED` always immediately follows the name of the unit, as in this example:

```
PROCEDURE "some proc" WRAPPED
a000000
b2
...
```

If such source text is presented to one of the [GET_POST_PROCESSED_SOURCE Functions](#) or to one of the [PRINT_POST_PROCESSED_SOURCE Procedures](#), the exception `DBMS_PREPROCESSOR.WRAPPED_INPUT` is raised.

140.3 DBMS_PREPROCESSOR Data Structures

The `DBMS_PREPROCESSOR` package defines a `TABLE` type.

Table Types

[SOURCE_LINES_T Table Type](#)

140.3.1 DBMS_PREPROCESSOR SOURCE_LINES_T Table Type

This table type stores lines of post-processed source text. It is used to hold PL/SQL source text both before and after it is processed. It is especially useful in cases in which the amount of text exceeds 32K.

Syntax

```
TYPE source_lines_t IS
TABLE OF VARCHAR2(32767) INDEX BY BINARY_INTEGER;
```

140.4 Summary of DBMS_PREPROCESSOR Subprograms

This table lists the DBMS_PREPROCESSOR subprograms and briefly describes them.

Table 140-1 DBMS_PREPROCESSOR Package Subprograms

Subprogram	Description
GET_POST_PROCESSED_SOURCE Functions	Returns the post-processed source text
PRINT_POST_PROCESSED_SOURCE Procedures	Prints post-processed source text

140.4.1 GET_POST_PROCESSED_SOURCE Functions

This overloaded function returns the post-processed source text. The different functionality of each form of syntax is presented along with the definition.

Syntax

Returns post-processed source text of a stored PL/SQL unit:

```
DBMS_PREPROCESSOR.GET_POST_PROCESSED_SOURCE (
    object_type    IN VARCHAR2,
    schema_name    IN VARCHAR2,
    object_name    IN VARCHAR2)
RETURN source_lines_t;
```

Returns post-processed source text of a compilation unit:

```
DBMS_PREPROCESSOR.GET_POST_PROCESSED_SOURCE (
    source         IN VARCHAR2)
RETURN source_lines_t;
```

Returns post-processed source text of an INDEX-BY table containing the source text of the compilation unit:

```
DBMS_PREPROCESSOR.GET_POST_PROCESSED_SOURCE (
    source         IN source_lines_t)
RETURN source_lines_t;
```

Parameters

Table 140-2 GET_POST_PROCESSED_SOURCE Function Parameters

Parameter	Description
object_type	Must be one of PACKAGE, PACKAGE BODY, PROCEDURE, FUNCTION, TYPE, TYPE, BODY or TRIGGER. Case sensitive.
schema_name	The schema name. Case insensitive unless a quoted identifier is used. If NULL, use current schema.
object_name	The name of the object. The object_type is always case insensitive. Case insensitive unless a quoted identifier is used.
source	The source text of the compilation unit

Table 140-2 (Cont.) GET_POST_PROCESSED_SOURCE Function Parameters

Parameter	Description
source_lines_t	INDEX-BY table containing the source text of the compilation unit. The source text is a concatenation of all the non-NULL INDEX-BY table elements in ascending index order.

Return Values

The function returns an INDEX-BY table containing the lines of the post-processed source text starting from index 1.

Usage Notes

- Newline characters are not removed.
- Each line in the post-processed source text is mapped to a row in the INDEX-BY table.
- In the post-processed source, unselected text will have blank lines.

Exceptions

Table 140-3 GET_POST_PROCESSED_SOURCE Function Exceptions

Exception	Description
ORA-24234	Insufficient privileges or object does not exist
ORA-24235	Bad value for object type. Should be one of PACKAGE, PACKAGE BODY, PROCEDURE, FUNCTION, TYPE, TYPE, BODY or TRIGGER.
ORA-24236	The source text is empty
ORA-00931	Missing identifier. The object_name should not be NULL.
ORA-06502	Numeric or value error: <ul style="list-style-type: none"> • Character string buffer too small • A line is too long (> 32767 bytes)

140.4.2 PRINT_POST_PROCESSED_SOURCE Procedures

This overloaded procedure calls DBMS_OUTPUT.PUT_LINE to let you view post-processed source text. The different functionality of each form of syntax is presented along with the definition.

Syntax

Prints post-processed source text of a stored PL/SQL unit:

```
DBMS_PREPROCESSOR.PRINT_POST_PROCESSED_SOURCE (
    object_type  IN VARCHAR2,
    schema_name  IN VARCHAR2,
    object_name  IN VARCHAR2);
```

Prints post-processed source text of a compilation unit:

```
DBMS_PREPROCESSOR.PRINT_POST_PROCESSED_SOURCE (
    source          IN VARCHAR2);
```

Prints post-processed source text of an INDEX-BY table containing the source text of the compilation unit:

```
DBMS_PREPROCESSOR.PRINT_POST_PROCESSED_SOURCE (
    source          IN source_lines_t);
```

Parameters

Table 140-4 PRINT_POST_PROCESSED_SOURCE Procedure Parameters

Parameter	Description
object_type	Must be one of PACKAGE, PACKAGE BODY, PROCEDURE, FUNCTION, TYPE, TYPE, BODY or TRIGGER. Case sensitive.
schema_name	The schema name. Case insensitive unless a quoted identifier is used. If NULL, use current schema.
object_name	The name of the object. The object_type is always case insensitive. Case insensitive unless a quoted identifier is used.
source	The source text of the compilation unit
source_lines_t	INDEX-BY table containing the source text of the compilation unit. The source text is a concatenation of all the non-NULL INDEX-BY table elements in ascending index order.

Exceptions

Table 140-5 PRINT_POST_PROCESSED_SOURCE Procedure Exceptions

Exception	Description
ORA-24234	Insufficient privileges or object does not exist
ORA-24235	Bad value for object type. Should be one of PACKAGE, PACKAGE BODY, PROCEDURE, FUNCTION, TYPE, TYPE, BODY or TRIGGER.
ORA-24236	The source text is empty
ORA-00931	Missing identifier. The object_name should not be NULL.
ORA-06502	Numeric or value error: <ul style="list-style-type: none"> Character string buffer too small A line is too long (> 32767 bytes)

Usage Notes

The index-by table may contain holes. NULL elements are ignored when doing the concatenation.

DBMS_PRIVILEGE_CAPTURE

The `DBMS_PRIVILEGE_CAPTURE` package provides an interface to database privilege analysis.



See Also:

Oracle® Database Security Guide regarding on how to analyze the use of privilege grants

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Examples](#)
- [Summary of DBMS_PRIVILEGE_CAPTURE Subprograms](#)

141.1 DBMS_PRIVILEGE_CAPTURE Overview

Database privilege analysis enables you to create a policy that records the usage of system and object privileges that have been granted to users. You then can determine the privileges that your users are using and not using. From there, you can revoke any unused privileges, thereby reducing the number of excess privilege grants for users.

By analyzing the privileges that users must have to perform specific tasks, privilege analysis policies help you to achieve a least privilege model for your users.

141.2 DBMS_PRIVILEGE_CAPTURE Security Model

The privilege analysis administrator role, `CAPTURE_ADMIN`, is granted `EXECUTE` permission on the `DBMS_PRIVILEGE_CAPTURE` package by default.

The `CAPTURE_ADMIN` role is granted to the `DBA` role during database installation.

141.3 DBMS_PRIVILEGE_CAPTURE Constants

The `DBMS_PRIVILEGE_CAPTURE` package defines several enumerated constants for specifying parameter values.

Table 141-1 DBMS_PRIVILEGE_CAPTURE Constants

Constant	Value	Type	Description
G_DATABASE	1	NUMBER	Analyzes all privilege use, except privileges used by the SYS user.
G_ROLE	2	NUMBER	Analyzes privilege use for the specified roles.
G_CONTEXT	3	NUMBER	Analyzes privilege use when the condition parameter evaluates to true.
G_ROLE_AND_CONTEXT	4	NUMBER	Analyzes privilege use for the specified roles when the condition parameter evaluates to true.

141.4 DBMS_PRIVILEGE_CAPTURE Examples

These examples illustrate using the `DBMS_PRIVILEGE_CAPTURE.CREATE_CAPTURE` procedure to create various types of privilege analysis, like database analysis, role analysis, and context-specific analysis. The examples also illustrate combining different conditions in context-specific analysis.

```
--Create a database privilege analysis policy
BEGIN
DBMS_PRIVILEGE_CAPTURE.CREATE_CAPTURE(
    name          => 'all_priv_analysis_pol',
    description   => 'database-wide policy to analyze all privileges',
    type         => DBMS_PRIVILEGE_CAPTURE.G_DATABASE);
END;

--Create a privilege analysis policy to analyze privileges from the role PUBLIC
BEGIN
DBMS_PRIVILEGE_CAPTURE.CREATE_CAPTURE(
    name          => 'pub_analysis_pol',
    description   => 'Policy to record privilege use by PUBLIC',
    type         => DBMS_PRIVILEGE_CAPTURE.G_ROLE,
    roles        => role_name_list('PUBLIC'));
END;

-- Create a policy to analyze privileges from the application module, "Account
-- Payable"
BEGIN
DBMS_PRIVILEGE_CAPTURE.CREATE_CAPTURE(
    name          => 'acc_pay_analysis_pol',
    type         => DBMS_PRIVILEGE_CAPTURE.G_CONTEXT,
    condition     => 'SYS_CONTEXT(''USERENV'', ''MODULE'') = ''Account Payable''');
END;

-- Create a policy that records privileges for session user APPS when running the
-- application module "Account Payable"
BEGIN
DBMS_PRIVILEGE_CAPTURE.CREATE_CAPTURE(
    name          => 'acc_pay_analysis_pol',
    type         => DBMS_PRIVILEGE_CAPTURE.G_CONTEXT,
    condition     => 'SYS_CONTEXT(''USERENV'', ''MODULE'') = ''Account Payable'' AND
                    SYS_CONTEXT(''USERENV'', ''SESSION_USER'') = ''APPS''');
END;
```

141.5 Summary of DBMS_PRIVILEGE_CAPTURE Subprograms

This table lists and briefly describes the DBMS_PRIVILEGE_CAPTURE package subprograms.

Table 141-2 DBMS_PRIVILEGE_CAPTURE Package Subprograms

Subprogram	Description
CAPTURE_DEPENDENCY_PRIVS Procedure	Captures the privileges that are used by definer's rights and invoker's rights PL/SQL program units for compilation.
CREATE_CAPTURE Procedure	Creates a policy that specifies the conditions for analyzing privilege use.
DELETE_RUN Procedure	Deletes a privilege analysis capture run
DISABLE_CAPTURE Procedure	Stops the recording of privilege use for a specified privilege analysis policy
DROP_CAPTURE Procedure	Removes a privilege analysis policy together with the data recorded
ENABLE_CAPTURE Procedure	Starts the recording of privilege analysis for a specified privilege analysis policy
GENERATE_RESULT Procedure	Populates the privilege analysis data dictionary views with data

141.5.1 CAPTURE_DEPENDENCY_PRIVS Procedure

This procedure captures the privileges that are used by definer's rights and invoker's rights PL/SQL program units for compilation.

Syntax

```
DBMS_PRIVILEGE_CAPTURE.CAPTURE_DEPENDENCY_PRIVS ();
```

Parameters

This procedure has no parameters.

Usage Notes

Every rerun of the DBMS_PRIVILEGE_CAPTURE.CAPTURE_DEPENDENCY_PRIVS procedure deletes any existing records from the privilege analysis data dictionary views. It then recaptures records based on the existing PL/SQL program units.

141.5.2 CREATE_CAPTURE Procedure

This procedure creates a privilege analysis policy that specifies the conditions for analyzing privilege use. It also optionally specifies the roles for which privilege use is to be analyzed, and the conditions under which privilege use is to be analyzed.

Syntax

```
DBMS_PRIVILEGE_CAPTURE.CREATE_CAPTURE (
    name          IN VARCHAR2,
    description   IN VARCHAR2 DEFAULT NULL,
    type          IN NUMBER DEFAULT G_DATABASE,
    roles         IN ROLE_NAME_LIST DEFAULT ROLE_NAME_LIST(),
    condition     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 141-3 CREATE_CAPTURE Procedure Parameters

Parameter	Description
name	Name of the privilege analysis policy. A string of size up to 30 characters.
description	Description of the policy (up to 1024 characters)
type	Type of the privilege analysis policy. Possible values are: <ul style="list-style-type: none"> G_DATABASE: Captures all privilege use in the database, except privileges used by the SYS user. G_ROLE: Captures the use of a privilege if the privilege is part of a specified role or list of roles. G_CONTEXT: Captures the use of a privilege if the context specified by the <code>condition</code> parameter evaluates to true. G_ROLE_AND_CONTEXT: Captures the use of a privilege if the privilege is part of the specified list of roles and when the condition specified by the <code>condition</code> parameter is true.
roles	The roles whose privileges are to be analyzed. Required if the type is G_ROLE or G_ROLE_AND_CONTEXT.
condition	PL/SQL boolean expression containing up to 4000 characters. Required if type is G_CONTEXT or G_ROLE_AND_CONTEXT. Note that the boolean expression can only contain SYS_CONTEXT, but not other functions.

Usage Notes

- When using role-based analysis for the `CREATE_CAPTURE` procedure, privilege use is analyzed even if the privilege is indirectly granted to the specified role.

For example, say role R2 contains role R1, and R1 contains privilege P1. If the privilege policy includes only role R2, any use of the P1 privilege is still analyzed, as privilege P1 is an indirect part of role R2.

- When using the `condition` parameter, use the following syntax for the PL/SQL expression:

```
condition ::= predicate | (predicate1) AND (predicate2)
            | (predicate1) OR (predicate2)
```

Where,

```
predicate ::= sys_context(namespace, attribute) relop constant_value |
sys_context(namespace, attribute) between constant_value and
constant_value | sys_context(namespace, attribute) in {constant_value
(,constant_value)* }
```

Where,

```
relop ::= = | < | <= | > | >= | <>
```

- A privilege analysis policy cannot analyze the use of SYS user privileges.

141.5.3 DELETE_RUN Procedure

This procedure deletes a privilege analysis capture run.

Syntax

```
DBMS_PRIVILEGE_CAPTURE.DELETE_RUN (
    name          IN VARCHAR2,
    run_name      IN VARCHAR2);
```

Parameters

Table 141-4 *DELETE_RUN Procedure Parameters*

Parameter	Description
name	Name of the privilege analysis policy with which the capture run is associated
run_name	Name of the capture run

Usage Notes

- You can find the names of existing privilege capture policies by querying the DBA_PRIV_CAPTURES data dictionary view.
- Another way to delete a capture run is to drop the policy with which the capture run is associated. Dropping the policy automatically drops its associated capture runs.
- When you drop a capture run it is no longer accessible through the privilege capture data dictionary views.

141.5.4 DISABLE_CAPTURE Procedure

This procedure stops the recording of privilege use for a specified privilege analysis policy. When a policy is disabled, privilege use meeting the policy condition is no longer recorded.

Syntax

```
DBMS_PRIVILEGE_CAPTURE.DISABLE_CAPTURE (
    name          IN VARCHAR2);
```

Parameters

Table 141-5 DISABLE_CAPTURE Procedure Parameters

Parameter	Description
name	Name of the privilege analysis policy to be disabled

Usage Notes

When a privilege analysis policy is first created, it is disabled by default.

141.5.5 DROP_CAPTURE Procedure

This procedure removes a privilege analysis policy together with the data recorded. When a policy is removed, all previously recorded privilege use data associated with the policy is deleted.

Syntax

```
DBMS_PRIVILEGE_CAPTURE.DROP_CAPTURE (
    name          IN VARCHAR2);
```

Parameters

Table 141-6 DROP_CAPTURE Procedure Parameters

Parameter	Description
name	Name of the privilege analysis policy to be removed

Usage Notes

- You must disable a privilege analysis policy before removing it. An enabled policy cannot be removed.
- If there are capture runs associated with this policy, then they are automatically dropped when you drop the policy.

141.5.6 ENABLE_CAPTURE Procedure

This procedure starts the recording of privilege analysis for a specified privilege analysis policy and optionally provides a capture run for this policy. After a policy is enabled, all privilege use under the policy condition is recorded.

Syntax

```
DBMS_PRIVILEGE_CAPTURE.ENABLE_CAPTURE (
    name          IN VARCHAR2,
    run_name      IN VARCHAR2 DEFAULT NULL);
```


Parameters

Table 141-7 *ENABLE_CAPTURE Procedure Parameters*

Parameter	Description
name	Name of the privilege analysis policy to be enabled
run_name	Name of the capture run to associate with this policy, less than 128 characters. Enclose exotic characters in double quotation marks.

Usage Notes

The following usage notes apply:

- When a privilege analysis policy is first created, it is disabled by default. You must run `ENABLE_CAPTURE` to enable the privilege analysis policy.
- You can enable only one privilege analysis policy at a time. However, a database-wide privilege analysis of the `G_DATABASE` type can be enabled together with another non `G_DATABASE` privilege analysis.
- You cannot enable the same run multiple times. For example, `run_01` cannot be used again if you want to re-enable the capture for `run_01`. Instead, create a new run.

141.5.7 GENERATE_RESULT Procedure

This procedure populates the privilege analysis data dictionary views with data.

 **See Also:**

Oracle® Database Security Guide for more information about privilege analysis views.

Syntax

```
DBMS_PRIVILEGE_CAPTURE.GENERATE_RESULT (
  name          IN VARCHAR2,
  run_name      IN VARCHAR2 DEFAULT NULL,
  DEPENDENCY   IN BOOLEAN DEFAULT NULL);
```

Parameters

Table 141-8 *GENERATE_RESULT Procedure Parameters*

Parameter	Description
name	Name of the privilege analysis policy for which views are populated
run_name	Name of the capture run that is associated with the privilege analysis policy. If you omit this parameter, then the records of all created runs will be analyzed. When you specify the <code>run_name</code> parameter, only the records of that run are analyzed and all other runs are unaffected.

Table 141-8 (Cont.) *GENERATE_RESULT* Procedure Parameters

Parameter	Description
dependency	Enter Y (yes) or N (no) to indicate if PL/SQL compilation privileges, set by the <code>DBMS_PRIVILEGE_CAPTURE.CAPTURE_DEPENDENCY_PRIVS</code> procedure, should be included in the report.

Usage Notes

You must disable a privilege analysis policy before populating the privilege analysis views for the policy. You cannot invoke this subprogram on an enabled privilege analysis policy.

DBMS_PROCESS

The `DBMS_PROCESS` package provides an interface to manage the prespawmed servers.

This chapter contains the following topics:

- [DBMS_PROCESS Overview](#)
- [DBMS_PROCESS Security Model](#)
- [Summary of DBMS_PROCESS Subprograms](#)

142.1 DBMS_PROCESS Overview

By default, Oracle Database can prespawn foreground processes to improve the performance of client connections.

A prespawmed process refers to a process that has been spawned but does not have a session yet. When a user connects to the database or a service process is needed, the process performs further initialization as needed.

To manage foreground processes, use the `DBMS_PROCESS` package. The procedures in this package configure the number of foreground processes for a connection pool, start a connection pool, and stop a connection pool.

See Also:

- *Oracle Database Administrator's Guide* for a detailed description of managing a pre-created processes
- *Oracle Database Reference* for information about the `USE_DEDICATED_BROKER` parameter, which determines how dedicated servers are spawned. `TRUE` enables the listener to send the connection to a dedicated connection broker that spawns the dedicated server. `FALSE` sets the listener to spawn a dedicated server directly.

142.2 DBMS_PROCESS Security Model

You must be granted the `SYSDBA` administrative privilege to use the `DBMS_PROCESS` package.

142.3 Summary of DBMS_PROCESS Subprograms

This table lists the DBMS_PROCESS subprograms and briefly describes them.

Table 142-1 DBMS_PROCESS Package Subprograms

Subprogram	Description
CONFIGURE_POOL Procedure	Configures the minimum number of prespawnd processes, the number of prespawnd processes in a batch, and the initial number of pre-spawnd processes for a foreground connection pool
START_POOL Procedure	Starts a prespawnd foreground process pool.
STOP_POOL Procedure	Stops a prespawnd foreground process pool.

142.3.1 CONFIGURE_POOL Procedure

This procedure configures the minimum number of prespawnd processes, the number of prespawnd processes in a batch, and the initial number of pre-spawnd processes for a foreground connection pool.

Syntax

```
DBMS_PROCESS.CONFIGURE_POOL(
    pool_name      IN  VARCHAR2 DEFAULT "SYS_DEFAULT_FOREGROUND_POOL",
    min_count      IN  NUMBER  DEFAULT 10,
    batch_count    IN  NUMBER  DEFAULT 20,
    init_count     IN  NUMBER  DEFAULT 0);
```

Parameters

Table 142-2 CONFIGURE_POOL Procedure Parameters

Parameter	Description
pool_name	Name of the foreground pool
min_count	Count after which a batch of prespawnd processes will be spawned in the pool (default 10; maximum number of processes 64,000)
batch_count	Batch of prespawnd servers to be spawned in the pool (default 20). The total value of the min_count and batch_count values cannot exceed the PROCESSES parameter value.
init_count	Set of prespawnd servers to be spawned in startup, or before a storm of connections, spawned in batches (default 0). Do not exceed the PROCESSES parameter value.

Exceptions

Table 142-3 CONFIGURE_POOL Procedure Exceptions

Error	Description
ORA-456	Prespawn not enabled
ORA-457	Prespawn pool not found
ORA-458	Prespawn pool already started
ORA-459	Prespawn pool not started
ORA-460	Process pool invalid configuration value(s)

Usage Notes

- To find information about foreground processes, query the V\$PROCESS_POOL dynamic view.

Example

```
BEGIN
  DBMS_PROCESS.CONFIGURE_POOL (
    pool_name => 'hrdb_pool',
    min_count => 40,
    batch_count => 20,
    init_count => 10);
END;
/
```

142.3.2 START_POOL Procedure

This procedure starts a prespawnd foreground process pool.

Syntax

```
DBMS_PROCESS.START_POOL(
  pool_name          IN  VARCHAR2 DEFAULT "SYS_DEFAULT_FOREGROUND_POOL");
```

Parameters

Table 142-4 START_POOL Procedure Parameters

Parameter	Description
pool_name	Name of prespawnd foreground process pool. To find existing pools, query the V\$PROCESS_POOL dynamic view.

Exceptions

Table 142-5 START_POOL Procedure Exceptions

Error	Description
ORA-457	Prespawn pool not found
ORA-458	Prespawn pool already started
ORA-459	Prespawn pool not started

Example

```
BEGIN
  DBMS_PROCESS.START_POOL (
    pool_name => 'hrdb_pool',
  );
END;
```

142.3.3 STOP_POOL Procedure

This procedure stops a prespawnd foreground process pool.

Syntax

```
DBMS_PROCESS.STOP_POOL(
  pool_name          IN  VARCHAR2 DEFAULT "SYS_DEFAULT_FOREGROUND_POOL");
```

Parameters

Table 142-6 STOP_POOL Procedure Parameters

Parameter	Description
pool_name	Name of the prespawnd foreground process pool. To find existing pools, query the V\$PROCESS_POOL dynamic view.

Exceptions

Table 142-7 STOP_POOL Procedure Exceptions

Error	Description
ORA-457	Prespawn pool not found
ORA-458	Prespawn pool already started
ORA-459	Prespawn pool not started

Example

```
BEGIN
  DBMS_PROCESS.STOP_POOL (
    pool_name => 'hrdb_pool',
  );
END;
```

DBMS_PROFILER

The package provides an interface to profile existing PL/SQL applications and identify performance bottlenecks. You can then collect and persistently store the PL/SQL profiler data.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Operational Notes](#)
- [Exceptions](#)
- [Summary of DBMS_PROFILER Subprograms](#)

143.1 DBMS_PROFILER Overview

This package enables the collection of profiler (performance) data for performance improvement or for determining code coverage for PL/SQL applications. Application developers can use code coverage data to focus their incremental testing efforts.

With this interface, you can generate profiling information for all named library units that are executed in a session. The profiler gathers information at the PL/SQL virtual machine level. This information includes the total number of times each line has been executed, the total amount of time that has been spent executing that line, and the minimum and maximum times that have been spent on a particular execution of that line.



Note:

It is possible to infer the code coverage figures for PL/SQL units for which data has been collected.

The profiling information is stored in database tables. This enables querying on the data: you can build customizable reports (summary reports, hottest lines, code coverage data, and so on. And you can analyze the data.

The `PROFTAB.SQL` script creates tables with the columns, datatypes, and definitions as shown in the following tables.

Table 143-1 Columns in Table PLSQL_PROFILER_RUNS

Column	Datatype	Definition
runid	NUMBER PRIMARY KEY	Unique run identifier from plsql_profiler_runnumber
related_run	NUMBER	Runid of related run (for client/server correlation)

Table 143-1 (Cont.) Columns in Table PLSQL_PROFILER_RUNS

Column	Datatype	Definition
run_owner	VARCHAR2 (128)	User who started run
run_date	DATE	Start time of run
run_comment	VARCHAR2 (2047)	User provided comment for this run
run_total_time	NUMBER	Elapsed time for this run in nanoseconds
run_system_info	VARCHAR2 (2047)	Currently unused
run_comment1	VARCHAR2 (2047)	Additional comment
spare1	VARCHAR2 (256)	Unused

Table 143-2 Columns in Table PLSQL_PROFILER_UNITS

Column	Datatype	Definition
runid	NUMBER	Primary key, references plsql_profiler_runs,
unit_number	NUMBER	Primary key, internally generated library unit #
unit_type	VARCHAR2 (128)	Library unit type
unit_owner	VARCHAR2 (128)	Library unit owner name
unit_name	VARCHAR2 (128)	Library unit name timestamp on library unit
unit_timestamp	DATE	In the future will be used to detect changes to unit between runs
total_time	NUMBER	Total time spent in this unit in nanoseconds. The profiler does not set this field, but it is provided for the convenience of analysis tools.
spare1	NUMBER	Unused
spare2	NUMBER	Unused

Table 143-3 Columns in Table PLSQL_PROFILER_DATA

Column	Datatype	Definition
runid	NUMBER	Primary key, unique (generated) run identifier
unit_number	NUMBER	Primary key, internally generated library unit number
line#	NUMBER	Primary key, not null, line number in unit
total_occur	NUMBER	Number of times line was executed
total_time	NUMBER	Total time spent executing line in nanoseconds
min_time	NUMBER	Minimum execution time for this line in nanoseconds
max_time	NUMBER	Maximum execution time for this line in nanoseconds
spare1	NUMBER	Unused
spare2	NUMBER	Unused
spare3	NUMBER	Unused
spare4	NUMBER	Unused

With Oracle database version 8.x, a sample textual report writer(`profrep.sql`) is provided with the PL/SQL demo scripts.

Note that prior to Oracle Database 10g, the `DBMS_PROFILER` package was not automatically loaded when the database was created, and the Oracle-supplied `PROFLOAD.SQL` script was used to create it. In 10g and beyond, the `DBMS_PROFILER` package is loaded automatically when the database is created, and `PROFLOAD.SQL` is no longer needed.

143.2 DBMS_PROFILER Security Model

The profiler only gathers data for units for which a user has `CREATE` privilege; you cannot use the package to profile units for which `EXECUTE ONLY` access has been granted. In general, if a user can debug a unit, the same user can profile it. However, a unit can be profiled whether or not it has been compiled `DEBUG`. Oracle advises that modules that are being profiled should be compiled `DEBUG`, since this provides additional information about the unit in the database.



Note:

`DBMS_PROFILER` treats any program unit that is compiled in `NATIVE` mode as if you do not have `CREATE` privilege, that is, you will not get any output.

143.3 DBMS_PROFILER Operational Notes

These notes describe a typical run, how to interpret output, and two methods of exception generation.

Typical Run

Improving application performance is an iterative process. Each iteration involves the following steps:

1. Running the application with one or more benchmark tests with profiler data collection enabled.
2. Analyzing the profiler data and identifying performance problems.
3. Fixing the problems.

The PL/SQL profiler supports this process using the concept of a "run". A run involves running the application through benchmark tests with profiler data collection enabled. You can control the beginning and the ending of a run by calling the `START_PROFILER` and `STOP_PROFILER` functions.

The user must first create database tables in the profiler user's schema to collect the data. The `PROFTAB.SQL` script creates the tables and other data structures required for persistently storing the profiler data.

Note that running `PROFTAB.SQL` drops the current tables. The `PROFTAB.SQL` script is in the `RDBMS/ADMIN` directory. Some PL/SQL operations, such as the first execution of a PL/SQL unit, may involve I/O to catalog tables to load the byte code for the PL/SQL unit being executed. Also, it may take some time executing package initialization code the first time a package procedure or function is called.

To avoid timing this overhead, "*warm up*" the database before collecting profile data. To do this, run the application once without gathering profiler data.

You can allow profiling across all users of a system, for example, to profile all users of a package, independent of who is using it. In such cases, the `SYSADMIN` should use a modified `PROFTAB.SQL` script which:

- Creates the profiler tables and sequence
- Grants `SELECT/INSERT/UPDATE` on those tables and sequence to all users
- Defines public synonyms for the tables and sequence

 **Note:**

Do not alter the actual fields of the tables.

A typical run then involves:

- Starting profiler data collection in the run.
- Executing PL/SQL code for which profiler and code coverage data is required.
- Stopping profiler data collection, which writes the collected data for the run into database tables

 **Note:**

The collected profiler data is not automatically stored when the user disconnects. You must issue an explicit call to the `FLUSH_DATA` or the `STOP_PROFILER` function to store the data at the end of the session. Stopping data collection stores the collected data.

As the application executes, profiler data is collected in memory data structures that last for the duration of the run. You can call the `FLUSH_DATA` function at intermediate points during the run to get incremental data and to free memory for allocated profiler data structures. Flushing the collected data involves storing collected data in the database tables created earlier.

 **See Also:**

"[FLUSH_DATA Function and Procedure](#)".

Interpreting Output

The table `plsql_profiler_data` contains one row for each line of the source unit for which code was generated. The `line#` value specifies which source line. If the row exists, and the `total_occur` value in that row is > 0 , some code associated with that line was executed. If the row exists, and `total_occur` value is 0, no code associated with that line was executed. If the row doesn't exist in the table, no code was generated for that line, and therefore it should not be mentioned in reports

If the source of a single statement is on a single line, any code generated for that statement will be attributed to that line number. (In some cases, such as a simple declaration, or because of optimization, no code will be needed). To get coverage information, units should be compiled with `PLSQL_OPTIMIZE_LEVEL=1`.

If a statement spans multiple lines, any code generated for that statement will be attributed to some line in the range, but it is not guaranteed that every line in the range will have code attributed to it. In such a case there will be gaps in the set of line# values. In particular, multi-line SQL-related statements may appear to be on a single line (usually the first). This is because PL/SQL passes the processed text of the cursor to the SQL engine; therefore, as far as PL/SQL is concerned, the entire SQL statement is a single indivisible operation.

When multiple statements are on the same line, the profiler will combine the occurrences for each statement. This may be confusing if a line has embedded control flow. For example, if 'then ...' and 'else ...' are on the same line, it will not be possible to determine whether the 'then' or the 'else' was taken.

In general, profiler and coverage reports are most easily interpreted if each statement is on its own line.

Two Methods of Exception Generation

Each routine in this package has two versions that allow you to determine how errors are reported.

- A function that returns success/failure as a status value and will never raise an exception
- A procedure that returns normally if it succeeds and raises an exception if it fails

In each case, the parameters of the function and procedure are identical. Only the method by which errors are reported differs. If there is an error, there is a correspondence between the error codes that the functions return, and the exceptions that the procedures raise.

To avoid redundancy, the following section only provides details about the functional form.

143.4 DBMS_PROFILER Exceptions

DBMS_PROFILER throws the exceptions described in this topic.

Table 143-4 DBMS_PROFILER Exceptions

Exception	Description
<code>version_mismatch</code>	Corresponds to <code>error_version</code> .
<code>profiler_error</code>	Corresponds to either "error_param" or "error_io".

A 0 return value from any function denotes successful completion; a nonzero return value denotes an error condition. The possible errors are as follows:

- 'A subprogram was called with an incorrect parameter.'

```
error_param constant binary_integer := 1;
```
- 'Data flush operation failed. Check whether the profiler tables have been created, are accessible, and that there is adequate space.'

```
error_io    constant binary_integer := 2;
```

- There is a mismatch between package and database implementation. Oracle returns this error if an incorrect version of the `DBMS_PROFILER` package is installed, and if the version of the profiler package cannot work with this database version. The only recovery is to install the correct version of the package.

```
error_version constant binary_integer := -1;
```

143.5 Summary of DBMS_PROFILER Subprograms

This table lists the `DBMS_PROFILER` subprograms and briefly describes them.

Table 143-5 DBMS_PROFILER Package Subprograms

Subprogram	Description
FLUSH_DATA Function and Procedure	Flushes profiler data collected in the user's session
GET_VERSION Procedure	Gets the version of this API
INTERNAL_VERSION_CHECK Function	Verifies that this version of the <code>DBMS_PROFILER</code> package can work with the implementation in the database
PAUSE_PROFILER Function and Procedure	Pauses profiler data collection
RESUME_PROFILER Function and Procedure	Resumes profiler data collection
START_PROFILER Functions and Procedures	Starts profiler data collection in the user's session
STOP_PROFILER Function and Procedure	Stops profiler data collection in the user's session

143.5.1 FLUSH_DATA Function and Procedure

This function flushes profiler data collected in the user's session. The data is flushed to database tables, which are expected to preexist.



Note:

Use the `PROFTAB.SQL` script to create the tables and other data structures required for persistently storing the profiler data.

Syntax

```
DBMS_PROFILER.FLUSH_DATA
    RETURN BINARY_INTEGER;

DBMS_PROFILER.FLUSH_DATA;
```

143.5.2 GET_VERSION Procedure

This procedure gets the version of this API.

Syntax

```
DBMS_PROFILER.GET_VERSION (  
    major OUT BINARY_INTEGER,  
    minor OUT BINARY_INTEGER);
```

Parameters

Table 143-6 GET_VERSION Procedure Parameters

Parameter	Description
major	Major version of DBMS_PROFILER.
minor	Minor version of DBMS_PROFILER.

143.5.3 INTERNAL_VERSION_CHECK Function

This function verifies that this version of the DBMS_PROFILER package can work with the implementation in the database.

Syntax

```
DBMS_PROFILER.INTERNAL_VERSION_CHECK  
    RETURN BINARY_INTEGER;
```

143.5.4 PAUSE_PROFILER Function and Procedure

This function pauses profiler data collection.

Syntax

```
DBMS_PROFILER.PAUSE_PROFILER  
    RETURN BINARY_INTEGER;  
  
DBMS_PROFILER.PAUSE_PROFILER;
```

143.5.5 RESUME_PROFILER Function and Procedure

This function resumes profiler data collection.

Syntax

```
DBMS_PROFILER.RESUME_PROFILER  
    RETURN BINARY_INTEGER;  
  
DBMS_PROFILER.RESUME_PROFILER;
```

143.5.6 START_PROFILER Functions and Procedures

This function starts profiler data collection in the user's session.

There are two overloaded forms of the `START_PROFILER` function; one returns the run number of the started run, as well as the result of the call. The other does not return the run number. The first form is intended for use with GUI-based tools controlling the profiler.

Syntax

```
DBMS_PROFILER.START_PROFILER(
  run_comment   IN VARCHAR2 := sysdate,
  run_comment1  IN VARCHAR2 := '',
  run_number    OUT BINARY_INTEGER)
RETURN BINARY_INTEGER;
```

```
DBMS_PROFILER.START_PROFILER(
  run_comment IN VARCHAR2 := sysdate,
  run_comment1 IN VARCHAR2 := '')
RETURN BINARY_INTEGER;
```

```
DBMS_PROFILER.START_PROFILER(
  run_comment   IN VARCHAR2 := sysdate,
  run_comment1  IN VARCHAR2 := '',
  run_number    OUT BINARY_INTEGER);
```

```
DBMS_PROFILER.START_PROFILER(
  run_comment IN VARCHAR2 := sysdate,
  run_comment1 IN VARCHAR2 := '');
```

Parameters

Table 143-7 START_PROFILER Function Parameters

Parameter	Description
<code>run_comment</code>	Each profiler run can be associated with a comment. For example, the comment could provide the name and version of the benchmark test that was used to collect data.
<code>run_number</code>	Stores the number of the run so you can store and later recall the run's data.
<code>run_comment1</code>	Allows you to make interesting comments about the run.

143.5.7 STOP_PROFILER Function and Procedure

This function stops profiler data collection in the user's session.

This function has the side effect of flushing data collected so far in the session, and it signals the end of a run.

Syntax

```
DBMS_PROFILER.STOP_PROFILER
RETURN BINARY_INTEGER;
```

```
DBMS_PROFILER.STOP_PROFILER;
```

DBMS_PROPAGATION_ADM

The `DBMS_PROPAGATION_ADM` package, one of a set of Oracle Replication packages, provides administrative interfaces for configuring a propagation from a source queue to a destination queue.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_PROPAGATION_ADM Subprograms](#)

144.1 DBMS_PROPAGATION_ADM Overview

This package provides interfaces to start, stop, and configure a propagation.

144.2 DBMS_PROPAGATION_ADM Security Model

Security on this package can be controlled by granting `EXECUTE` on this package to selected users or roles, or by granting `EXECUTE_CATALOG_ROLE` to selected users or roles.

If subprograms in the package are run from within a stored procedure, then the user who runs the subprograms must be granted `EXECUTE` privilege on the package directly. It cannot be granted through a role.

When the `DBMS_PROPAGATION_ADM` package is used to manage an Oracle Replication configuration, it requires that the user is granted the privileges of an Oracle Replication administrator.

144.3 Summary of DBMS_PROPAGATION_ADM Subprograms

This table lists the `DBMS_PROPAGATION_ADM` subprograms and briefly describes them.

Table 144-1 DBMS_PROPAGATION_ADM Package Subprograms

Subprogram	Description
ALTER_PROPAGATION Procedure	Adds, alters, or removes a rule set for a propagation
CREATE_PROPAGATION Procedure	Creates a propagation and specifies the source queue, destination queue, and rule set for the propagation
DROP_PROPAGATION Procedure	Drops a propagation
START_PROPAGATION Procedure	Starts a propagation
STOP_PROPAGATION Procedure	Stops a propagation

**Note:**

All subprograms commit unless specified otherwise.

144.3.1 ALTER_PROPAGATION Procedure

This procedure adds, alters, or removes a rule set for a propagation.

Syntax

```
DBMS_PROPAGATION_ADM.ALTER_PROPAGATION (
  propagation_name      IN  VARCHAR2,
  rule_set_name         IN  VARCHAR2  DEFAULT NULL,
  remove_rule_set      IN  BOOLEAN   DEFAULT FALSE,
  negative_rule_set_name IN  VARCHAR2  DEFAULT NULL,
  remove_negative_rule_set IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 144-2 ALTER_PROPAGATION Procedure Parameters

Parameter	Description
propagation_name	The name of the propagation you are altering. You must specify an existing propagation name. Do not specify an owner.
rule_set_name	<p>The name of the positive rule set for the propagation. The positive rule set contains the rules that instruct the propagation to propagate messages.</p> <p>If you want to use a positive rule set for the propagation, then you must specify an existing rule set in the form <code>[schema_name.]rule_set_name</code>. For example, to specify a positive rule set in the <code>hr</code> schema named <code>prop_rules</code>, enter <code>hr.prop_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>An error is returned if the specified rule set does not exist. You can create a rule set and add rules to it using the <code>DBMS_RULE_ADM</code> package.</p> <p>If you specify <code>NULL</code> and the <code>remove_rule_set</code> parameter is set to <code>FALSE</code>, then the procedure retains any existing positive rule set. If you specify <code>NULL</code> and the <code>remove_rule_set</code> parameter is set to <code>TRUE</code>, then the procedure removes any existing positive rule set.</p>

Table 144-2 (Cont.) ALTER_PROPAGATION Procedure Parameters

Parameter	Description
<code>remove_rule_set</code>	<p>If <code>TRUE</code>, then the procedure removes the positive rule set for the specified propagation. If you remove a positive rule set for a propagation, and the propagation does not have a negative rule set, then the propagation propagates all messages.</p> <p>If you remove a positive rule set for a propagation, and a negative rule set exists for the propagation, then the propagation propagates all messages in its queue that are not discarded by the negative rule set.</p> <p>If <code>FALSE</code>, then the procedure retains the positive rule set for the specified propagation.</p> <p>If the <code>rule_set_name</code> parameter is non-NULL, then this parameter should be set to <code>FALSE</code>.</p>
<code>negative_rule_set_name</code>	<p>The name of the negative rule set for the propagation. The negative rule set contains the rules that instruct the propagation to discard messages.</p> <p>If you want to use a negative rule set for the propagation, then you must specify an existing rule set in the form <code>[schema_name.]rule_set_name</code>. For example, to specify a negative rule set in the <code>hr</code> schema named <code>neg_rules</code>, enter <code>hr.neg_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>An error is returned if the specified rule set does not exist. You can create a rule set and add rules to it using the <code>DBMS_RULE_ADM</code> package.</p> <p>If you specify <code>NULL</code> and the <code>remove_negative_rule_set</code> parameter is set to <code>FALSE</code>, then the procedure retains any existing negative rule set. If you specify <code>NULL</code> and the <code>remove_negative_rule_set</code> parameter is set to <code>TRUE</code>, then the procedure removes any existing negative rule set.</p> <p>If you specify both a positive and a negative rule set for a propagation, then the negative rule set is always evaluated first.</p>
<code>remove_negative_rule_set</code>	<p>If <code>TRUE</code>, then the procedure removes the negative rule set for the specified propagation. If you remove a negative rule set for a propagation, and the propagation does not have a positive rule set, then the propagation propagates all messages.</p> <p>If you remove a negative rule set for a propagation, and a positive rule set exists for the propagation, then the propagation propagates all messages in its queue that are not discarded by the positive rule set.</p> <p>If <code>FALSE</code>, then the procedure retains the negative rule set for the specified propagation.</p> <p>If the <code>negative_rule_set_name</code> parameter is non-NULL, then this parameter should be set to <code>FALSE</code>.</p>

144.3.2 CREATE_PROPAGATION Procedure

This procedure creates a propagation and specifies the source queue, destination queue, and any rule set for the propagation. A propagation propagates messages in a local source queue to a destination queue. The destination queue might or might not be in the same database as the source queue.

Syntax

```
DBMS_PROPAGATION_ADM.CREATE_PROPAGATION (
    propagation_name      IN  VARCHAR2,
    source_queue          IN  VARCHAR2,
    destination_queue     IN  VARCHAR2,
    destination_dblink   IN  VARCHAR2  DEFAULT NULL,
    rule_set_name        IN  VARCHAR2  DEFAULT NULL,
    negative_rule_set_name IN  VARCHAR2  DEFAULT NULL,
    queue_to_queue       IN  BOOLEAN   DEFAULT NULL,
    original_propagation_name IN  VARCHAR2  DEFAULT NULL,
    auto_merge_threshold IN  NUMBER    DEFAULT NULL);
```

Parameters

Table 144-3 CREATE_PROPAGATION Procedure Parameters

Parameter	Description
propagation_name	The name of the propagation you are creating. A NULL setting is not allowed. Do not specify an owner. Note: The propagation_name setting cannot be altered after the propagation is created.
source_queue	The name of the source queue, specified as [schema_name.]queue_name. The current database must contain the source queue. For example, to specify a source queue named streams_queue in the strmadmin schema, enter strmadmin.streams_queue for this parameter. If the schema is not specified, then the current user is the default.
destination_queue	The name of the destination queue, specified as [schema_name.]queue_name. For example, to specify a destination queue named streams_queue in the strmadmin schema, enter strmadmin.streams_queue for this parameter. If the schema is not specified, then the current user is the default.
destination_dblink	The name of the database link that will be used by the propagation. The database link is from the database that contains the source queue to the database that contains the destination queue. If NULL, then the source queue and destination queue must be in the same database. Note: Connection qualifiers are not allowed.

Table 144-3 (Cont.) CREATE_PROPAGATION Procedure Parameters

Parameter	Description
<code>rule_set_name</code>	<p>The name of the positive rule set for the propagation. The positive rule set contains the rules that instruct the propagation to propagate messages.</p> <p>If you want to use a positive rule set for the propagation, then you must specify an existing rule set in the form <code>[schema_name.]rule_set_name</code>. For example, to specify a positive rule set in the <code>hr</code> schema named <code>prop_rules</code>, enter <code>hr.prop_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>An error is returned if the specified rule set does not exist. You can create a rule set and add rules to it using the <code>DBMS_RULE_ADM</code> package.</p> <p>If you specify <code>NULL</code>, and no negative rule set exists for the propagation, then the propagation propagates all messages in its queue.</p> <p>If you specify <code>NULL</code>, and a negative rule set exists for the propagation, then the propagation propagates all messages in its queue that are not discarded by the negative rule set.</p>
<code>negative_rule_set_name</code>	<p>The name of the negative rule set for the propagation. The negative rule set contains the rules that instruct the propagation to discard messages.</p> <p>If you want to use a negative rule set for the propagation, then you must specify an existing rule set in the form <code>[schema_name.]rule_set_name</code>. For example, to specify a negative rule set in the <code>hr</code> schema named <code>neg_rules</code>, enter <code>hr.neg_rules</code>. If the schema is not specified, then the current user is the default.</p> <p>An error is returned if the specified rule set does not exist. You can create a rule set and add rules to it using the <code>DBMS_RULE_ADM</code> package.</p> <p>If you specify <code>NULL</code>, and no positive rule set exists for the propagation, then the propagation propagates all messages in its queue.</p> <p>If you specify <code>NULL</code>, and a positive rule set exists for the propagation, then the propagation propagates all messages in its queue that are not discarded by the positive rule set.</p> <p>If you specify both a positive and a negative rule set for a propagation, then the negative rule set is always evaluated first.</p>

Table 144-3 (Cont.) CREATE_PROPAGATION Procedure Parameters

Parameter	Description
<code>queue_to_queue</code>	<p>If <code>TRUE</code> or <code>NULL</code>, then the propagation is a queue to queue propagation. A queue-to-queue propagation always has its own propagation job and uses a service for automatic failover when the destination queue is a buffered queue in an Oracle Real Application Clusters (Oracle RAC) database.</p> <p>If <code>FALSE</code>, then the propagation is a queue-to-dblink propagation. A queue-to-dblink propagation can share a propagation job with other propagations that use the same database link and does not support automatic failover in an Oracle RAC environment.</p>
<code>original_propagation_name</code>	<p>Specify the original propagation name if the propagation being created is part of a split and merge operation. The split operation clones the original propagation under a new name. The name of the original propagation is important when the cloned propagation is copied back to the original stream.</p> <p>Specify <code>NULL</code> if the propagation being created is not part of a split and merge operation.</p>
<code>auto_merge_theshold</code>	<p>Specify a positive number if both of the following conditions are met:</p> <ul style="list-style-type: none"> The propagation being created is part of a split and merge operation. The stream will be merged back to the original stream automatically. <p>Specify <code>NULL</code> if either of the following conditions are met:</p> <ul style="list-style-type: none"> The propagation being created is not part of a split and merge operation. The propagation being created is part of a split and merge operation, but the stream being split off will not be merged back to the original stream automatically.

Usage Notes

This procedure starts propagation and might create a propagation job. If this procedure creates a propagation job, then it establishes a default schedule for the propagation job. Each propagation job is an Oracle Scheduler job. You can adjust the schedule of a propagation job using Oracle Scheduler.

The user who owns the source queue is the user who propagates messages. This user must have the necessary privileges to propagate messages.



See Also:

[DBMS_RULE_ADM](#)

144.3.3 DROP_PROPAGATION Procedure

This procedure drops a propagation and deletes all messages for the destination queue in the source queue. This procedure also removes the schedule for propagation from the source queue to the destination queue.

Syntax

```
DBMS_PROPAGATION_ADM.DROP_PROPAGATION(
    propagation_name      IN  VARCHAR2,
    drop_unused_rule_sets IN  BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 144-4 DROP_PROPAGATION Procedure Parameters

Parameter	Description
propagation_name	The name of the propagation you are dropping. You must specify an existing propagation name. Do not specify an owner.
drop_unused_rule_sets	If TRUE, then the procedure drops any rule sets, positive and negative, used by the specified propagation if these rule sets are not used by any other Oracle Replication client, which includes capture processes, propagations, apply processes, and messaging clients. If this procedure drops a rule set, then this procedure also drops any rules in the rule set that are not in another rule set. If FALSE, then the procedure does not drop the rule sets used by the specified propagation, and the rule sets retain their rules.

Usage Notes

When you use this procedure to drop a propagation, information about rules created for the propagation is removed from the data dictionary views for Oracle Replication rules. Information about such a rule is removed even if the rule is not in either rule set for the propagation.

The following are the data dictionary views for Oracle Replication rules:

- ALL_STREAMS_GLOBAL_RULES
- DBA_STREAMS_GLOBAL_RULES
- ALL_STREAMS_SCHEMA_RULES
- DBA_STREAMS_SCHEMA_RULES
- ALL_STREAMS_TABLE_RULES
- DBA_STREAMS_TABLE_RULES

Note:

When you drop a propagation, the propagation job used by the propagation is dropped automatically, if no other propagations are using the propagation job.

144.3.4 START_PROPAGATION Procedure

This procedure starts a propagation.

Syntax

```
DBMS_PROPAGATION_ADM.START_PROPAGATION(
    propagation_name IN VARCHAR2);
```

Parameter

Table 144-5 START_PROPAGATION Procedure Parameter

Parameter	Description
propagation_name	The name of the propagation you are starting. You must specify an existing propagation name. Do not specify an owner.

Usage Notes

The propagation status is persistently recorded. Hence, if the status is `ENABLED`, then the propagation is started upon database instance startup.

144.3.5 STOP_PROPAGATION Procedure

This procedure stops a propagation.

Syntax

```
DBMS_PROPAGATION_ADM.STOP_PROPAGATION(
    propagation_name IN VARCHAR2,
    force             IN BOOLEAN DEFAULT FALSE);
```

Parameter

Table 144-6 STOP_PROPAGATION Procedure Parameter

Parameter	Description
propagation_name	The name of the propagation you are stopping. You must specify an existing propagation name. Do not specify an owner.
force	If <code>TRUE</code> , then the procedure stops the propagation and clears the statistics for the propagation. If <code>FALSE</code> , then the procedure stops the propagation without clearing the statistics for the propagation.

Usage Notes

The propagation status is persistently recorded. Hence, if the status is `DISABLED` or `ABORTED`, then the propagation is not started upon database instance startup.

DBMS_QOPATCH

The `DBMS_QOPATCH` package provides an interface to view the installed database patches.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Operational Notes](#)
- [Error Messages](#)
- [Summary of DBMS_QOPATCH Subprograms](#)

145.1 DBMS_QOPATCH Overview

The `DBMS_QOPATCH` package provides a PLSQL/SQL interface to view the installed database patches. The interface provides all the patch information available as part of the `OPATCH LSINVENTORY -XML` command. The package accesses the OUI patch inventory in real time to provide patch and meta-information.

145.2 DBMS_QOPATCH Security Model

The `DBMS_QOPATCH` package is created as part of SYS schema and SYS is the only user who can execute these subprograms.

145.3 DBMS_QOPATCH Operational Notes

The following operational notes apply to `DBMS_QOPATCH`.

- The package will work only if the database is `OPEN`.
- In an Oracle Real Application Clusters (RAC) environment, if the subprogram requires to fetch data from other RAC nodes it spawns a job in the other node(s) to get the data. In this case `JOB_QUEUE_PROCESSES` needs to be `>0` for the package to fetch the data from other RAC nodes.
- If there is a delay in the job execution, the package returns `ORA-20008` error.

145.4 DBMS_QOPATCH Exceptions

This table lists the exceptions raised by the `DBMS_QOPATCH` package.

Table 145-1 DBMS_QOPATCH Error Messages

Error Code	Description
ORA-20001	Latest XML inventory is not loaded into table.

Table 145-1 (Cont.) DBMS_QOPATCH Error Messages

Error Code	Description
ORA-20002	Directory creation failed.
ORA-20003	Configuration of a job on a node failed.
ORA-20004	Job configuration failed as node is inactive.
ORA-20005	Job is not configured with given node, instance name.
ORA-20006	Number of RAC active instances and opatch jobs configured are not same.
ORA-20007	Job configuration failed as node or instance is not active.
ORA-20008	Timed out - job execution time is more than 120Secs.
ORA-20009	Job execution failed.
ORA-20010	Node is inactive and job cannot be executed.
ORA-20011	Job name is NULL and inventory cannot be loaded.
ORA-20012	JOB_QUEUE_PROCESSES is set to zero and the inventory cannot be loaded.
ORA-20013	DBMS_QOPATCH ran mostly in non-install area.
ORA-20014	Database is not opened.
ORA-20015	Database opened as read-only.

145.5 Summary of DBMS_QOPATCH Subprograms

This table lists and briefly describes the DBMS_QOPATCH package subprograms.

Table 145-2 DBMS_QOPATCH Package Subprograms

Subprogram	Description
CHECK_PATCH_INSTALLED Function	Checks if a patch is installed.
GET_OPATCH_BUGS Function	Provides a bugs list for a patch in XML format if the patch number is given. If patch is not given then it lists all the bugs installed in all the patches in XML format.
GET_OPATCH_COUNT Function	Provides the total number of installed patches in XML format
GET_OPATCH_DATA Function	Provides top level patch information for the patch (such as Patch ID, patch creation time) in the XML element
GET_OPATCH_FILES Function	Provides the list of files modified in the given patch number in XML format
GET_OPATCH_INSTALL_INFO Function	Returns the XML element containing the ORACLE_HOME details such as patch and inventory location
GET_OPATCH_LIST Function	Provides list of patches installed as an XML element from the XML inventory
GET_OPATCH_LSINVENTORY	Returns whole opatch inventory as XML instance document.
GET_OPATCH_OLAYS Function	Provides overlay patches for a given patch as XML element

Table 145-2 (Cont.) DBMS_QOPATCH Package Subprograms

Subprogram	Description
GET_OPATCH_PREQS Function	Provides prerequisite patches for a given patch as XML element
GET_OPATCH_XSLT	Returns the style-sheet for the opatch XML inventory presentation
GET_PATCH_DETAILS Function	Displays the detailed patch information from <code>opatch lsinventory</code> .
GET_SQLPATCH_STATU S Procedure	Displays the SQL patch status by querying from SQL patch registry to produce complete patch level information
IS_PATCH_INSTALLED Function	Provides information (such as patchID, application date, and SQL patch information) on the installed patch as XML node by querying the XML inventory
OPATCH_COMPARE_CU RRENT Function	Compares the current database with a list of bugs.
OPATCH_COMPARE_NO DES Function	Compares the given RAC node(s) with the instance to the present connected node with current node. The return value indicates whether the data was refreshed or not.
SET_CURRENT_OPINST Procedure	Sets the node name and instance to get the inventory details specific to it in an Oracle Real Application Clusters (RAC) environment

145.5.1 CHECK_PATCH_INSTALLED Function

Checks if the patch is installed.

Syntax

```
DBMS_QOPATCH.CHECK_PATCH_INSTALLED (
    bugs      IN QOPATCH_LIST);
RETURN VARCHAR2;
```

Parameters

Table 145-3 CHECK_PATCH_INSTALLED Parameters

Parameter	Description
<code>bugs</code>	List of patches to be checked.

145.5.2 GET_OPATCH_BUGS Function

This function provides a bugs list in a patch if the patch number is given. If a patch number is not given, it lists all the bugs in the specified XML format.

Syntax

```
DBMS_QOPATCH.GET_OPATCH_BUGS (
    patchnum IN VARCHAR2 DEFAULT NULL);
RETURN XMLTYPE;
```

Parameters

Table 145-4 GET_OPATCH_BUGS Function Parameters

Parameter	Description
patchnum	Patch number

145.5.3 GET_OPATCH_COUNT Function

This function provides the total number of installed patches in XML format.

Syntax

```
DBMS_QOPATCH.GET_OPATCH_COUNT (
    patchnum IN VARCHAR2);
RETURN XMLTYPE;
```

Parameters

Table 145-5 GET_OPATCH_COUNT Function Parameters

Parameter	Description
patchnum	Patch number

145.5.4 GET_OPATCH_DATA Function

This function provides top level patch information for the patch (such as Patch ID, patch creation time) in the XML element.

Syntax

```
DBMS_QOPATCH.GET_OPATCH_DATA (
    patchnum IN VARCHAR2);
RETURN XMLTYPE;
```

Parameters

Table 145-6 GET_OPATCH_DATA Function Parameters

Parameter	Description
patchnum	Patch number

145.5.5 GET_OPATCH_FILES Function

This function provides the list of files modified in the given patch number in XML format.

Syntax

```
DBMS_QOPATCH.GET_OPATCH_FILES (  
    patchnum IN VARCHAR2);  
RETURN XMLTYPE;
```

Parameters

Table 145-7 GET_OPATCH_FILES Function Parameters

Parameter	Description
patchnum	Patch number

145.5.6 GET_OPATCH_INSTALL_INFO Function

This function returns the XML element containing the ORACLE_HOME details such as patch and inventory location.

Syntax

```
DBMS_QOPATCH.GET_OPATCH_INSTALL_INFO  
RETURNS XMLTYPE;
```

145.5.7 GET_OPATCH_LIST Function

This function provides list of patches installed as an XML element from the XML inventory.

Syntax

```
DBMS_QOPATCH.GET_OPATCH_LIST  
RETURN XMLTYPE;
```

145.5.8 GET_OPATCH_LSINVENTORY

This function returns whole opatch inventory as XML instance document.

Syntax

```
DBMS_QOPATCH.GET_OPATCH_LSINVENTORY  
RETURN XMLTYPE;
```

145.5.9 GET_OPATCH_OLAYS Function

This function provides overlay patches for a given patch as XML element.

Syntax

```
DBMS_QOPATCH.GET_OPATCH_OLAYS (  
    patchnum IN VARCHAR2);  
RETURN XMLTYPE;
```

Parameters

Table 145-8 GET_OPATCH_OLAYS Function Parameters

Parameter	Description
patchnum	Patch number

145.5.10 GET_OPATCH_PREQS Function

This function provides prerequisite patches for a given patch as XML element.

Syntax

```
DBMS_QOPATCH.GET_OPATCH_PREQS (  
    patchnum IN VARCHAR2);  
RETURN XMLTYPE;
```

Parameters

Table 145-9 GET_OPATCH_PREQS Function Parameters

Parameter	Description
patchnum	Patch number

145.5.11 GET_OPATCH_XSLT

This function returns the style-sheet for the opatch XML inventory presentation. You can use the return type of this subprogram to perform XMLTRANSFORM and the transformed result has the same appearance as opatch text output.

Syntax

```
DBMS_QOPATCH.GET_OPATCH_XSLT  
RETURN XMLTYPE;
```

145.5.12 GET_PATCH_DETAILS Function

Displays the detailed patch information from `opatch lsinventory`.

Syntax

```
DBMS_QOPATCH.GET_PATCH_DETAILS (
    patch    IN VARCHAR2);
RETURN XMLTYPE;
```

Parameters**Table 145-10** GET_PATCH_DETAILS Function Parameters

Parameter	Description
patch	The patch number.

145.5.13 GET_SQLPATCH_STATUS Procedure

This procedure displays the SQL patch status by querying from SQL patch registry to produce complete patch level information. If the patch number is given, it displays the information specific to the given SQL patch, otherwise information for all SQL patches.

Syntax

```
DBMS_QOPATCH.GET_SQLPATCH_STATUS (
    patchnum IN VARCHAR2 DEFAULT NULL);
```

Parameters**Table 145-11** GET_SQLPATCH_STATUS Procedure Parameters

Parameter	Description
patchnum	Patch number

145.5.14 IS_PATCH_INSTALLED Function

This function provides information (such as patchID, application date, and SQL patch information) on the installed patch as XML node by querying the XML inventory.

Syntax

```
DBMS_QOPATCH.IS_PATCH_INSTALLED (
    patchnum IN VARCHAR2);
RETURN XMLTYPE;
```

Parameters**Table 145-12** IS_PATCH_INSTALLED Function Parameters

Parameter	Description
patchnum	Patch number

145.5.15 OPATCH_COMPARE_CURRENT Function

Compares the current database with a list of bugs.

Syntax

```
DBMS_QOPATCH.OPATCH_COMPARE_CURRENT Function (  
    bugs      IN QOPATCH_LIST);  
RETURN VARCHAR2;
```

Parameters

Table 145-13 OPATCH_COMPARE_CURRENT Function Parameters

Parameter	Description
bugs	List of bugs to compare with the current database.

145.5.16 OPATCH_COMPARE_NODES Function

Compares the given RAC node(s) with the instance to the present connected node with current node. The return value indicates whether the data was refreshed or not.

Syntax

```
DBMS_QOPATCH.OPATCH_COMPARE_NODES (  
    node      IN VARCHAR2 DEFAULT NULL,  
    inst      IN VARCHAR2 DEFAULT NULL);  
RETURN VARCHAR2;
```

Parameters

Table 145-14 OPATCH_COMPARE_NODES Function Parameters

Parameter	Description
node	Node name
inst	Instance name

145.5.17 SET_CURRENT_OPINST Procedure

This procedure sets the node name and instance to get the inventory details specific to it in an Oracle Real Application Clusters (RAC) environment.

Syntax

```
DBMS_QOPATCH.SET_CURRENT_OPINST (  
    node_name  IN VARCHAR2 DEFAULT NULL,  
    inst_name  IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 145-15 SET_CURRENT_OPINST Procedure Parameters

Parameter	Description
node_name	Name of node
inst_name	Name of instance

DBMS_RANDOM

The `DBMS_RANDOM` package provides a built-in random number generator. `DBMS_RANDOM` is not intended for cryptography.

This chapter contains the following topics:

- [Deprecated Subprograms](#)
- [Security Model](#)
- [Operational Notes](#)
- [Summary of DBMS_RANDOM Subprograms](#)

146.1 DBMS_RANDOM Deprecated Subprograms

These subprograms are deprecated with Oracle Database 11g. Oracle recommends that you do not use deprecated procedures in new applications. Support for deprecated features is for backward compatibility only.

- [INITIALIZE Procedure](#)
- [RANDOM Function](#)
- [TERMINATE Procedure](#)

146.2 DBMS_RANDOM Security Model

This package should be installed as `SYS`. By default, the package is initialized with the current user name, current time down to the second, and the current session. Oracle recommends that users who need to execute this package should be given `EXECUTE` privilege explicitly and should not rely on `PUBLIC EXECUTE` privilege.

146.3 DBMS_RANDOM Operational Notes

These operational notes apply to `DBMS_RANDOM`.

- `DBMS_RANDOM.RANDOM` produces integers in $[-2^{31}, 2^{31})$.
- `DBMS_RANDOM.VALUE` produces numbers in $[0,1)$ with 38 digits of precision.

`DBMS_RANDOM` can be explicitly initialized, but does not need to be initialized before calling the random number generator. It will automatically initialize with the date, user ID, and process ID if no explicit initialization is performed.

If this package is seeded twice with the same seed, then accessed in the same way, it will produce the same results in both cases.

In some cases, such as when testing, you may want the sequence of random numbers to be the same on every run. In that case, you seed the generator with a constant value by calling

one of the overloads of `DBMS_RANDOM.SEED`. To produce different output for every run, simply to omit the call to "Seed" and the system will choose a suitable seed for you.

146.4 Summary of DBMS_RANDOM Subprograms

This table lists the `DBMS_RANDOM` subprograms and briefly describes them.

Table 146-1 *DBMS_RANDOM Package Subprograms*

Subprogram	Description
INITIALIZE Procedure	Initializes the package with a seed value
NORMAL Function	Returns random numbers in a normal distribution
RANDOM Function	Generates a random number
SEED Procedures	Resets the seed
STRING Function	Gets a random string
TERMINATE Procedure	Terminates package
VALUE Functions	Gets a random number, greater than or equal to 0 and less than 1, with 38 digits to the right of the decimal (38-digit precision), while the overloaded function gets a random Oracle number <i>x</i> , where <i>x</i> is greater than or equal to <i>low</i> and less than <i>high</i>

146.4.1 INITIALIZE Procedure

This deprecated procedure initializes the generator.



Note:

This procedure is deprecated with Release 11gR1 and, although currently supported, it should not be used.

Syntax

```
DBMS_RANDOM.INITIALIZE (
    val IN BINARY_INTEGER);
```

Pragmas

```
PRAGMA restrict_references (initialize, WNDS);
```

Parameters

Table 146-2 *INITIALIZE Procedure Parameters*

Parameter	Description
<code>val</code>	Seed number used to generate a random number

Usage Notes

This procedure is obsolete as it simply calls the [SEED Procedures](#).

146.4.2 NORMAL Function

This function returns random numbers in a standard normal distribution.

Syntax

```
DBMS_RANDOM.NORMAL  
RETURN NUMBER;
```

Pragmas

```
PRAGMA restrict_references (normal, WNDS);
```

Return Values

Table 146-3 NORMAL Function Parameters

Parameter	Description
number	Returns a random number

146.4.3 RANDOM Function

This deprecated procedure generates a random number.



Note:

This function is deprecated with Release 11gR1 and, although currently supported, it should not be used.

Syntax

```
DBMS_RANDOM.RANDOM  
RETURN binary_integer;
```

Pragmas

```
PRAGMA restrict_references (random, WNDS);
```

Return Values

Table 146-4 RANDOM Function Parameters

Parameter	Description
binary_integer	Returns a random integer greater or equal to $-power(2,31)$ and less than $power(2,31)$

146.4.4 SEED Procedures

This procedure resets the seed.

Syntax

```
DBMS_RANDOM.SEED (  
    val IN BINARY_INTEGER);
```

```
DBMS_RANDOM.SEED (  
    val IN VARCHAR2);
```

Pragmas

```
PRAGMA restrict_references (seed, WNDS);
```

Parameters

Table 146-5 SEED Procedure Parameters

Parameter	Description
val	Seed number or string used to generate a random number

Usage Notes

The seed can be a string up to length 2000.

146.4.5 STRING Function

This function gets a random string.

Syntax

```
DBMS_RANDOM.STRING  
    opt IN CHAR,  
    len IN NUMBER)  
RETURN VARCHAR2;
```

Pragmas

```
PRAGMA restrict_references (string, WNDS);
```

Parameters

Table 146-6 STRING Function Parameters

Parameter	Description
opt	Specifies what the returning string looks like: <ul style="list-style-type: none"> 'u', 'U' - returning string in uppercase alpha characters 'l', 'L' - returning string in lowercase alpha characters 'a', 'A' - returning string in mixed case alpha characters 'x', 'X' - returning string in uppercase alpha-numeric characters 'p', 'P' - returning string in any printable characters. Otherwise the returning string is in uppercase alpha characters.
len	Length of the returning string

Return Values

Table 146-7 STRING Function Return Values

Parameter	Description
VARCHAR2	Returns a VARCHAR2

146.4.6 TERMINATE Procedure

When you are finished with the package, call the `TERMINATE` procedure.

**Note:**

This procedure is deprecated with Release 11gR1 and, although currently supported, it should not be used.

Syntax

```
DBMS_RANDOM.TERMINATE;
```

146.4.7 VALUE Functions

The basic function gets a random number, greater than or equal to 0 and less than 1, with 38 digits to the right of the decimal (38-digit precision). Alternatively, you can get a random Oracle number *x*, where *x* is greater than or equal to *low* and less than *high*.

Syntax

```
DBMS_RANDOM.VALUE
  RETURN NUMBER;

DBMS_RANDOM.VALUE (
  low IN NUMBER,
  high IN NUMBER)
  RETURN NUMBER;
```

Parameters

Table 146-8 VALUE Function Parameters

Parameter	Description
low	Lowest number in a range from which to generate a random number. The number generated may be equal to low
high	Highest number below which to generate a random number. The number generated will be less than high

Return Values

Table 146-9 VALUE Function Return Values

Parameter	Description
NUMBER	Returns an Oracle Number

DBMS_REDACT

The `DBMS_REDACT` package provides an interface to Oracle Data Redaction, which enables you to redact data that is returned from queries issued by low-privileged users or an application.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Operating Procedures](#)
- [Summary of DBMS_REDACT Subprograms](#)



See Also:

- *Oracle Database Advanced Security Guide* regarding using Data Redaction to protect sensitive data

147.1 DBMS_REDACT Overview

Data redaction provides a way to define redaction policies for an application. Oracle Data Redaction provides functionality to redact data that is returned from user `SELECT` queries in an application. The redaction takes place in real time. The Data Redaction policy applies to the querying user, depending on this user's `SYS_CONTEXT` or `XS_SYS_CONTEXT` values. This redaction process does not require that the queried data be static or unchanging, or for the entire data set to be redacted at one time in an off-line manner. Oracle Database redacts the data only for the rows specified by the user's query, not the data for the entire column. The redaction takes place immediately before the data is returned to the querying user or application.

147.2 DBMS_REDACT Security Model

If the querying user has the `EXEMPT REDACTION POLICY` system privilege, redaction will not be performed. If the user does not have the `EXEMPT REDACTION POLICY` system privilege, the policy expression will be evaluated in the current user's environment. If the policy expression evaluates to `TRUE`, then redaction will be performed, otherwise no redaction will be performed.

You must have the `EXECUTE` privilege on the `DBMS_REDACT` package, as well as the `ADMINISTER REDACTION POLICY` system or schema privilege, to execute its subprograms. Procedures in the interface are executed with privileges of the current user.

In addition to the `EXECUTE` privilege on the `DBMS_REDACT` package to execute its subprograms, you must have the following privileges:

- The `CREATE TABLE` or `CREATE ANY TABLE` privilege when the data redaction policy is on an object in your own schema. This requirement applies to the following procedures:
 - `DBMS_REDACT.ADD_POLICY`
 - `DBMS_REDACT.DROP_POLICY`
 - `DBMS_REDACT.ALTER_POLICY`
 - `DBMS_REDACT.DISABLE_POLICY`
 - `DBMS_REDACT.ENABLE_POLICY`
 - `DBMS_REDACT.APPLY_POLICY_EXPR_TO_COL`
- The `CREATE ANY TABLE` privilege when the data redaction policy is on an object in another user's schema. This requirement applies to the following procedures:
 - `DBMS_REDACT.UPDATE_FULL_REDACTION_VALUES`
 - `DBMS_REDACT.CREATE_POLICY_EXPRESSION`
 - `DBMS_REDACT.DROP_POLICY_EXPRESSION`
 - `DBMS_REDACT.UPDATE_POLICY_EXPRESSION`

147.3 DBMS_REDACT Constants

The `DBMS_REDACT` package defines several constants for specifying parameter values.

Table 147-1 Values for function_type Parameter of DBMS_REDACT.ADD_POLICY

Constant	Value	Type	Description
NONE	0	BINARY_INTEGER	No redaction
FULL	1	BINARY_INTEGER	Redact to fixed values
NULLIFY	6	BINARY_INTEGER	Returns a null value as a redacted value
PARTIAL	2	BINARY_INTEGER	Partial redaction, redact a portion of the column data
RANDOM	4	BINARY_INTEGER	Random redaction, each query results in a different random value
REGEXP	5	BINARY_INTEGER	Regular expression based redaction
REGEXP_WIDTH	7	BINARY_INTEGER	Regular expression based redaction that preserves the width of a column that uses a regular expression; designed for applications that use the <code>OCI_ATTR_CHAR_SIZE</code> attribute of the Oracle OLE DB Provider interface

Table 147-2 Values for action Parameter of DBMS_REDACT.ALTER_POLICY

Constant	Value	Type	Description
ADD_COLUMN	1	BINARY_INTEGER	Add a column to the redaction policy
DROP_COLUMN	2	BINARY_INTEGER	Drop a column from the redaction policy
MODIFY_EXPRESSION	3	BINARY_INTEGER	Modify the expression of a redaction policy (the expression evaluates to a BOOLEAN value: if TRUE then redaction is applied, otherwise not)
MODIFY_COLUMN	4	BINARY_INTEGER	Modify a column in the redaction policy to change the redaction function_type or the function_parameters
SET_POLICY_DESCRIPTION	5	BINARY_INTEGER	Set a description for the redaction policy
SET_COLUMN_DESCRIPTION	6	BINARY_INTEGER	Set a description for the redaction performed on the column

147.4 DBMS_REDACT Operating Procedures

The following table presents the relationship between the type of redaction function and its parameters, based on the datatype of the column being redacted. Examples of the various format strings are provided, showing how to perform some commonplace redaction for a string datatype (in this case, a Social Security Number (SSN)), a DATE datatype, and various examples of redaction for the number datatype.

Table 147-3 Data Redaction Function Types

function_type	function_parameters	Examples
DBMS_REDACT.NONE	-	-
DBMS_REDACT.FULL	-	-
DBMS_REDACT.NULLIFY	-	-
DBMS_REDACT.PARTIAL (for character types)	<p>A comma-separated list, containing the following five fields (with no spaces after the commas delimiting the fields):</p> <ul style="list-style-type: none"> REDACT_PARTIAL_INPUT_FORMAT REDACT_PARTIAL_OUTPUT_FORMAT REDACT_PARTIAL_MASKCHAR REDACT_PARTIAL_MASKFROM REDACT_PARTIAL_MASKTO <p>See Table 147-4.</p>	<p>'VVVFVVVFVVVV, VVV-VV-VVVV, X, 1, 5' for redacting the first 5 digits of SSN strings like 123-45-6789, adding dashes back to format it, resulting in strings like XXX-XX-6789</p> <p>'VVVFVVVFVVVV, VVV VV VVVV, X, 1, 5' for redacting the first 5 digits of SSN strings like 123-45-6789, adding spaces to format it, resulting in strings like XXX XX 6789</p>

Table 147-3 (Cont.) Data Redaction Function Types

function_type	function_parameters	Examples
DBMS_REDACT.PARTIAL (for character types), continued	REDACT_PARTIAL_INPUT_FORMAT - the input format: V for value to be possibly redacted, F for formatting character to be ignored	The REDACT_PARTIAL_INPUT_FORMAT field value VVVFVVVFVVV for matching SSN strings like 123-45-6789
DBMS_REDACT.PARTIAL (for character types), continued	REDACT_PARTIAL_OUTPUT_FORMAT - the output format: V for output of redaction. Any other character will be treated as a formatting character and output literally.	The REDACT_PARTIAL_OUTPUT_FORMAT field value VVV-VV-VVVV can be used to redact SSN strings into XXX-XX-6789 (X comes from REDACT_PARTIAL_MASKCHAR field).
DBMS_REDACT.PARTIAL (for character types), continued	REDACT_PARTIAL_MASKCHAR - the character used to redact the input	The value X for redacting SSN strings into XXX-XX-6789.
DBMS_REDACT.PARTIAL (for character types), continued	REDACT_PARTIAL_MASKFROM - specifies which V within the REDACT_PARTIAL_INPUT_FORMAT from which to start the redaction (see explanation following the next entry, REDACT_PARTIAL_MASKTO)	The value 1 for redacting SSN strings starting at the first V of REDACT_PARTIAL_INPUT_FORMAT of VVVFVVVFVVV into strings like XXX-XX-6789
DBMS_REDACT.PARTIAL (for character types), continued	REDACT_PARTIAL_MASKTO - specifies which V within the REDACT_PARTIAL_INPUT_FORMAT at which to end the redaction	The value 5 for redacting SSN strings up to and including the fifth V within REDACT_PARTIAL_INPUT_FORMAT of VVVFVVVFVVV into strings like XXX-XX-6789. Note how the format character '-' (corresponding to the first F within REDACT_PARTIAL_INPUT_FORMAT) is ignored as far as redaction is concerned, so the value here is 5 as opposed to 6.

Table 147-3 (Cont.) Data Redaction Function Types

function_type	function_parameters	Examples
DBMS_REDACT.PARTIAL (for character types), continued	<p>The REDACT_PARTIAL_MASKFROM and REDACT_PARTIAL_MASKTO field values are specified as counts of the number of V characters in the REDACT_PARTIAL_INPUT_FORMAT field, up to and including the intended position, starting from the leftmost V. This way, REDACT_PARTIAL_MASKFROM and REDACT_PARTIAL_MASKTO are independent of the specific formatting of the data. For example, in the common use case of redacting an SSN to show only the last four digits, data like 123456789 (with REDACT_PARTIAL_INPUT_FORMAT of VVVVVVVVV) and data like 123-45-6789 (with REDACT_PARTIAL_INPUT_FORMAT of VVVFVVFVVVV), would both use REDACT_PARTIAL_MASKFROM of 1 and REDACT_PARTIAL_MASKTO of 5.</p>	-
DBMS_REDACT.PARTIAL (for number types)	<p>A comma-separated list, containing the following three fields (with no spaces after the commas delimiting the fields):</p> <ul style="list-style-type: none"> • REDACT_PARTIAL_MASKCHAR • REDACT_PARTIAL_MASKFROM • REDACT_PARTIAL_MASKTO <p>See Table 147-4.</p>	'9, 1, 5' for redacting the first 5 digits of an SSN number 123456789 into 999996789; or '0, 1, 2' for redacting a number 1.23 to 0.03.
DBMS_REDACT.PARTIAL (for number types), continued	<p>REDACT_PARTIAL_MASKCHAR - the character used to redact the input, in the range between 0 and 9</p> <p>REDACT_PARTIAL_MASKFROM - the position, starting from 1, from which to start the redaction. The position does not include the decimal point if it is present.</p> <p>REDACT_PARTIAL_MASKTO - the position at which to end the redaction</p>	-

Table 147-3 (Cont.) Data Redaction Function Types

function_type	function_parameters	Examples
DBMS_REDACT.PARTIAL (for datetime datatypes)	<p>A list, containing the following five fields (concatenated so that there is no space between the fields):</p> <ul style="list-style-type: none"> • REDACT_PARTIAL_DATE_MONTH • REDACT_PARTIAL_DATE_DAY • REDACT_PARTIAL_DATE_YEAR • REDACT_PARTIAL_DATE_HOUR • REDACT_PARTIAL_DATE_MINUTE • REDACT_PARTIAL_DATE_SECOND <p>See Table 147-4.</p>	'm12DYHMS', which changes 01-May-01 01:01:01 to 01-Dec-01 01:01:01.
DBMS_REDACT.PARTIAL (for datetime datatypes), continued	<p>REDACT_PARTIAL_DATE_MONTH: - 'M' (no redacting of month) or 'm#' (redact month to a specific month, if possible), where # (the month specified by its number) is between 1 and 12</p> <p>REDACT_PARTIAL_DATE_DAY: 'D' (no redacting of date) or 'd#' (redact day to #, if possible), # between 1 and 31</p> <p>REDACT_PARTIAL_DATE_YEAR: 'Y' (no redacting of year) or 'y#' (redact year to #, if possible), # between 1 and 9999</p> <p>REDACT_PARTIAL_DATE_HOUR: 'H' (no redacting of hour) or 'h#' (redact hour to #, if possible), # between 0 and 23</p> <p>REDACT_PARTIAL_DATE_MINUTE: 'M' (no redacting of minute) or 'm#' (redact minute to #, if possible), # between 0 and 59</p> <p>REDACT_PARTIAL_DATE_SECOND: 'S' (no redacting of second) or 's#' (redact second to #, if possible), # between 0 and 59</p>	
DBMS_REDACT.REGEXP	-	-
DBMS_REDACT.REGEXP_WITH	-	-
DBMS_REDACT.RANDOM	-	-

Table 147-4 Format Descriptors with Component Field Names and Delimiters

Datatype	Format Descriptor for Partial redaction
Character	REDACT_PARTIAL_INPUT_FORMAT ', ' REDACT_PARTIAL_OUTPUT_FORMAT ', ' REDACT_PARTIAL_MASKCHAR ', ' REDACT_PARTIAL_MASKFROM ', ' REDACT_PARTIAL_MASKTO
Number	REDACT_PARTIAL_MASKCHAR ', ' REDACT_PARTIAL_MASKFROM ', ' REDACT_PARTIAL_MASKTO
Datetime	REDACT_PARTIAL_DATE_MONTH REDACT_PARTIAL_DATE_DAY REDACT_PARTIAL_DATE_YEAR REDACT_PARTIAL_DATE_HOUR REDACT_PARTIAL_DATE_MINUTE REDACT_PARTIAL_DATE_SECOND

147.5 Summary of DBMS_REDACT Subprograms

This table lists and briefly describes the DBMS_REDACT package subprograms.

Table 147-5 DBMS_REDACT Package Subprograms

Subprogram	Description
ADD_POLICY Procedure	Defines a Data Redaction policy for a table or view
ALTER_POLICY Procedure	Alters a Data Redaction policy for a table or view
APPLY_POLICY_EXPR_TO_COL Procedure	Applies a named Data Redaction policy expression to a redacted column
CREATE_POLICY_EXPRESSION Procedure	Creates a named Data Redaction policy expression
DISABLE_POLICY Procedure	Disables a Data Redaction policy
DROP_POLICY Procedure	Drops a Data Redaction policy
DROP_POLICY_EXPRESSION Procedure	Drops a named Data Redaction policy expression
ENABLE_POLICY Procedure	Enables a Data Redaction policy
UPDATE_FULL_REDACTION_VALUES Procedure	Modifies the default displayed values for a Data Redaction policy for full redaction
UPDATE_POLICY_EXPRESSION Procedure	Updates a named Data Redaction policy expression

147.5.1 ADD_POLICY Procedure

This procedure defines a Data Redaction policy for a table or view.

Syntax

```
DBMS_REDACT.ADD_POLICY (
    object_schema          IN    VARCHAR2 := NULL,
```

```

object_name          IN    VARCHAR2,
policy_name          IN    VARCHAR2,
column_name          IN    VARCHAR2 := NULL,
function_type        IN    BINARY_INTEGER := DBMS_REDACT.FULL,
function_parameters  IN    VARCHAR2 := NULL,
expression           IN    VARCHAR2,
enable               IN    BOOLEAN := TRUE,
regexp_pattern       IN    VARCHAR2 := NULL,
regexp_replace_string IN  VARCHAR2 := NULL,
regexp_position      IN    BINARY_INTEGER := 1,
regexp_occurrence    IN    BINARY_INTEGER := 0,
regexp_match_parameter IN  VARCHAR2 := NULL,
policy_description   IN    VARCHAR2 := NULL,
column_description   IN    VARCHAR2 := NULL);

```

Parameters

Table 147-6 *ADD_POLICY Procedure Parameters*

Parameter	Description
object_schema	Schema owning the table or view, current user if NULL
object_name	Name of table or view on which to add a Data Redaction policy
policy_name	Name of policy
column_name	[Optional] Name of one column to which the redaction policy applies. If you must redact more than one column, use the ALTER_POLICY Procedure to add the additional columns.
function_type	Type of redaction function to use. Possible values are: <ul style="list-style-type: none"> - DBMS_REDACT.NONE - DBMS_REDACT.FULL (default) - DBMS_REDACT.NULLIFY - DBMS_REDACT.PARTIAL - DBMS_REDACT.RANDOM - DBMS_REDACT.REGEXP - DBMS_REDACT.REGEXP_WIDTH <p>If the function_type is DBMS_REDACT.REGEXP or DBMS_REDACT.REGEXP_WIDTH, then you must omit the function_parameters parameter, and use the regexp_* parameters to define the Data Redaction policy.</p> <p>See Table 147-1 for an overview of the meanings of these values, and for some examples of their use.</p>

Table 147-6 (Cont.) ADD_POLICY Procedure Parameters

Parameter	Description
function_parameters	<p>Parameters to the redaction function. The possible values depend on the value of the <code>function_type</code> provided.</p> <p>If the <code>function_type</code> is <code>DBMS_REDACT.REGEXP</code> or <code>DBMS_REDACT.REGEXP_WIDTH</code>, then you must omit the <code>function_parameters</code> parameter, and use the <code>regexp_*</code> parameters to define the Data Redaction policy.</p> <ul style="list-style-type: none"> - <code>DBMS_REDACT.NONE</code>: Can be omitted entirely and defaults to <code>NULL</code> - <code>DBMS_REDACT.FULL</code>: Can be omitted entirely and defaults to <code>NULL</code> - Redacting parameters for partial character redacting. For character datatypes, a comma-separated list containing these fields: <ul style="list-style-type: none"> • Input format: 'V' for value to be possibly redacted, 'F' for formatting character to be ignored • Output format: 'V' for output of redacting, any other characters will be treated as formatting characters. • Redact character: a character that will be used to replace the actual values. Examples are '*' and 'x'. • Starting digit position: specifies the starting (character) position to begin replacing actual values with the redacting character. The beginning of the string is position 1. Positions do not include formatting characters. • Ending digit position: specifies the ending (character) position to end redacting. An example is 'VVVFVVFVVVV,VVV-VV-VVVV,X,1,5' for redacting the first 5 digits of SSN string 123-45-6789, and adding dashes back to format it like an SSN, resulting in XXX-XX-6789. <p>For number datatypes, a comma-separated list containing these fields:</p> <ul style="list-style-type: none"> • Redact character: this is a character between '0' to '9' that will be used to replace the actual values. • Starting digit position: specifies the starting (digit) position to begin replacing actual values with the redacting character. The beginning of the string is position 1. Positions do not include the decimal point. • Ending digit position: this specifies the ending digit position to end redacting. An example is '9,1,5' for redacting the first 5 digits of a Social Security number 123456789, resulting in 999996789. <p>For datetime datatypes, the format is a packed string (no spaces or commas) containing the following sequence of fields. Please note that each field can consist of one or more characters, and the field length depends on whether redacting is required. The one-character fields are used to specify that no redaction of that component of the datetime value is to take place. The longer fields indicate a specific time or date to use as the redacted value of that component of the datetime value.</p>

Table 147-6 (Cont.) ADD_POLICY Procedure Parameters

Parameter	Description
	<ul style="list-style-type: none"> Month: 'M' (no redacting of month) or 'm#' (redact month to a specific month, if possible), where # (the month specified by its number) is between 1 and 12 Day: 'D' (no redacting of day) or 'd#' (redact day to #, if possible), # between 1 and 31 Year: 'Y' (no redacting of year) or 'y#' (redact year to #, if possible), # between 1 and 9999 Hour: 'H' (no redacting of hour) or 'h#' (redact hour to #, if possible), # between 0 and 23 Minute: 'M' (no redacting of minute) or 'm#' (redact minute to #, if possible), # between 0 and 59 Second: 'S' (no redacting of second) or 's#' (redact second to #, if possible), # between 0 and 59 <p>An example is 'm12d1y2001h1m1s1', which changes 02-May-13 12:30:23 to 01-Dec-01 01:01:01.</p> <p>For partial character and number-redacting shortcuts, see <i>Oracle Database Advanced Security Guide</i>.</p>
expression	<p>Default boolean expression for the table or view. If this expression is used, then redaction takes place only if this policy expression evaluates to TRUE.</p> <p>The following functions are supported:</p> <ul style="list-style-type: none"> SYS_CONTEXT XS_SYS_CONTEXT SUBSTR functions (includes SUBSTRB, SUBSTRC, SUBSTR2, SUBSTR4) LENGTH functions (includes LENGTHB, LENGTHC, LENGTH2, LENGTH4) V (APEX_UTIL.GET_SESSION_STATE) NV (APEX_UTIL.GET_NUMERIC_SESSION_STATE) OLS_LABEL_DOMINATES DOMINATES OLS_DOMINATES OLS_DOM DOM OLS_STRICTLY_DOMINATES STRICTLY_DOMINATES S_DOM SA_UTL.DOMINATES SA_UTL.CHECK_READ SA_UTL.NUMERIC_LABEL CHAR_TO_LABEL SA_SESSION.LABEL <p>See <i>Oracle Database Advanced Security Guide</i> for more information about these supported functions</p>

Table 147-6 (Cont.) ADD_POLICY Procedure Parameters

Parameter	Description
enable	<p>Boolean value that determines whether the Data Redaction policy is enabled on creation.</p> <p>The default value is <code>TRUE</code>, which means that the policy is automatically enabled upon creation. If the <code>enable</code> parameter is set to <code>FALSE</code>, the policy takes effect only when it is subsequently enabled by calling the <code>DBMS_REDACT.ENABLE_POLICY</code> procedure.</p>
regexp_pattern	<p>Regular expression pattern up to 512 bytes.</p> <p>Use only if the <code>function_type</code> parameter is <code>DBMS_REDACT.REGEXP</code>. Also, do not specify the <code>function_parameters</code> parameter when <code>function_type</code> is <code>DBMS_REDACT.REGEXP</code>.</p> <p>See <i>Oracle Database SQL Language Reference</i> for more information and examples on using regular expression patterns.</p>
regexp_replace_string	<p>Replacement string (up to 4000 characters in length) with up to 500 back-references to subexpressions in the form <code>\n</code>, where <code>n</code> is a number between 1 and 9.</p> <p>Use only if the <code>function_type</code> parameter is <code>DBMS_REDACT.REGEXP</code>.</p>
regexp_position	<p>Integer counting from 1, specifies the position where the search must begin. The default is 1.</p> <p>Use only if the <code>function_type</code> parameter is <code>DBMS_REDACT.REGEXP</code>.</p>
regexp_occurrence	<ul style="list-style-type: none"> Use 0 to replace all occurrences of the match. The default is 0. Use positive integer <code>n</code> to replace the <code>n</code>-th occurrence of the match. <p>Use only if the <code>function_type</code> parameter is <code>DBMS_REDACT.REGEXP</code>.</p>
regexp_match_parameter	<p>Changes the default matching behavior, possible values are a combination of 'i', 'c', 'n', 'm', 'x'</p> <p>Use only if the <code>function_type</code> parameter is <code>DBMS_REDACT.REGEXP</code>.</p> <p>See <i>Oracle Database SQL Language Reference</i> for more information and examples on using regular expression match parameters.</p>
policy_description	Description of redaction policy
column_description	Description of the column being redacted

Exceptions

- ORA-28060 - A Data Redaction policy already exists on this column.
- ORA-28061 - This object cannot have a Data Redaction policy defined on it.
- ORA-28062 - The policy expression is too long.
- ORA-28063 - The policy expression is empty.

- ORA-28064 - The redaction function is not valid.
- ORA-28066 - Invalid column *column*.
- ORA-28067 - Missing or invalid column name.
- ORA-28069 - A Data Redaction policy already exists on this object.
- ORA-28073 - The column *column_name* has an unsupported datatype or attribute.
- ORA-28074 - The *field_name* field of the redaction parameters is not valid.

The field can be any of the following:

- REDACT_PARTIAL_INPUT_FORMAT
- REDACT_PARTIAL_OUTPUT_FORMAT
- REDACT_PARTIAL_MASKCHAR
- REDACT_PARTIAL_MASKFROM
- REDACT_PARTIAL_MASKTO
- REDACT_PARTIAL_DATE_MONTH
- REDACT_PARTIAL_DATE_DAY
- REDACT_PARTIAL_DATE_YEAR
- REDACT_PARTIAL_DATE_HOUR
- REDACT_PARTIAL_DATE_MINUTE
- REDACT_PARTIAL_DATE_SECOND

See [Table 147-3](#) and [Table 147-4](#) for examples of the field contents and field ordering.

- ORA-28075 - The data redaction policy expression has an error.
- ORA-28076 - Empty role name specified as SYS_SESSION_ROLES attribute.
- ORA-28077 - The specified role name *role_name* for SYS_SESSION_ROLES exceeds the maximum length.
- ORA-28078 - A regular expression parameter is missing or invalid.
- ORA-28082 - The parameter *parameter* is invalid (where the possible values are *function_parameters*, *column_description*, *policy_name* and *policy_description*).
- ORA-28085 - The input and output lengths of the redaction do not match.
- ORA-28092 - The parameter *param_name* with value *value* has an error.
- ORA-28097 - A data redaction policy cannot be applied to an object owned by SYS.
- ORA-28104 - Input value for *parameter* is not valid.

Usage Notes

See [DBMS_REDACT Security Model](#) for a list of the required privileges for this procedure.

See [Operating Procedures](#) for more information regarding function types and function parameters with related examples.

A named Data Redaction policy expression that has been applied to a redacted column takes precedence over the expression defined in the `expression` parameter. To find redacted columns that are affected by named policy expressions, query the `REDACTION_EXPRESSIONS` data dictionary view.

Example

Partial redaction policy:

```
BEGIN
  DBMS_REDACT.ADD_POLICY (
    object_schema      => 'hr',
    object_name        => 'employees',
    column_name        => 'employee_id',
    policy_name        => 'redact_emp_id_nums',
    function_type      => DBMS_REDACT.PARTIAL,
    function_parameters => '7,1,5',
    expression         => '1=1');
END;
```

Full redaction policy:

```
BEGIN
  DBMS_REDACT.ADD_POLICY (
    object_schema      => 'hr',
    object_name        => 'employees',
    column_name        => 'employee_id',
    policy_name        => 'redact_emp_ids',
    function_type      => DBMS_REDACT.FULL,
    expression         => 'SYS_CONTEXT(''SYS_SESSION_ROLES'', 'CLERK')
                        = 'FALSE');
END;
```

147.5.2 ALTER_POLICY Procedure

This procedure alters an existing Data Redaction policy for a table or view.

It alters a the policy in one or more of the following ways:

- By changing the policy expression
- By changing the type of redaction for a specified column
- By changing the parameters to the redaction function for a specified column
- By adding a column to the redaction policy (the redaction type and any parameters must be specified).
- By removing a column from the redaction policy
- By changing the description of the policy
- By changing the description of the column

Syntax

```
DBMS_REDACT.ALTER_POLICY (
  object_schema      IN    VARCHAR2 := NULL,
  object_name        IN    VARCHAR2,
  policy_name        IN    VARCHAR2,
  action             IN    BINARY_INTEGER := DBMS_REDACT.ADD_COLUMN,
  column_name        IN    VARCHAR2 := NULL,
```

```

function_type          IN    BINARY_INTEGER := DBMS_REDACT.FULL,
function_parameters    IN    VARCHAR2 := NULL,
expression             IN    VARCHAR2,
regexp_pattern         IN    VARCHAR2 := NULL,
regexp_replace_string  IN    VARCHAR2 := NULL,
regexp_position        IN    BINARY_INTEGER := 1,
regexp_occurrence      IN    BINARY_INTEGER := 0,
regexp_match_parameter IN    VARCHAR2 := NULL,
policy_description     IN    VARCHAR2 := NULL,
column_description     IN    VARCHAR2 := NULL);

```

Parameters

Table 147-7 ALTER_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema owning the table or view, current user if NULL
object_name	Name of table or view on which to alter a Data Redaction policy
policy_name	Name of policy limited to 30 bytes
action	Action to take. For more information see Table 147-2 .
column_name	(Optional) Name of one column to which the redaction policy applies. Required for the following actions: <ul style="list-style-type: none"> • add_column • drop_column • modify_column • set_column_description
function_type	Type of redaction function to use. Possible values are: <ul style="list-style-type: none"> - DBMS_REDACT.NONE - DBMS_REDACT.FULL (default) - DBMS_REDACT.NULLIY - DBMS_REDACT.PARTIAL - DBMS_REDACT.RANDOM - DBMS_REDACT.REGEXP - DBMS_REDACT.REGEXP_WIDTH <p>If the function_type is DBMS_REDACT.REGEXP or DBMS_REDACT.REGEXP_WIDTH, then you must omit the function_parameters parameter, and use the regexp_pattern, regexp_replace_string, regexp_position, regexp_occurrence, and regexp_match_parameter to define the Data Redaction policy.</p> <p>See Table 147-1 for an overview of the meanings of these values, and for some examples of their use.</p>

Table 147-7 (Cont.) ALTER_POLICY Procedure Parameters

Parameter	Description
function_parameters	<p>Parameters to the redaction function. Use only if function_type is DBMS_REDACT.PARTIAL.</p> <p>If the function_type is DBMS_REDACT.REGEXP or DBMS_REDACT.REGEXP_WIDTH, then you must omit the function_parameters parameter, and use the regexp_pattern, regexp_replace_string, regexp_position, regexp_occurrence, and regexp_match_parameter to define the Data Redaction policy.</p> <ul style="list-style-type: none"> - If the function_type is DBMS_REDACT.NONE or DBMS_REDACT.NULLIFY, the function_parameters parameter must be omitted. - If the function_type is DBMS_REDACT.FULL, the function_parameters parameter must be omitted. - If the function_type is DBMS_REDACT.PARTIAL, the function_parameters parameter represents the redacting parameters for partial redacting. <ul style="list-style-type: none"> • Input format: 'V' for value to be possibly redacted, 'F' for formatting character to be ignored • Output format: 'V' for output of redacting, any other characters will be treated as formatting characters • Redact character: a character that will be used to replace the actual values. Examples are '*' and 'x' • Starting digit position: specifies the starting (character) position to begin replacing actual values with the redacting character. The beginning of the string is position 1. Positions do not include formatting characters. • Ending digit position: specifies the ending (character) position to end redacting. An example is 'VVVFVVVFVVVV, VVV-VV-VVVV, X, 1, 5' for redacting the first 5 digits of SSN string 123-45-6789, and adding dashes back to format it like an SSN, resulting in XXX-XX-6789. <p>For number datatypes, a comma-separated list containing these fields:</p> <ul style="list-style-type: none"> • Redact character: this is a character between '0' to '9' that will be used to replace the actual values. • Starting digit position: specifies the starting (digit) position to begin replacing actual values with the redacting character. The beginning of the string is position 1. Positions do not include the decimal point. • Ending digit position: this specifies the ending digit position to end redacting. An example is '9, 1, 5' for redacting the first 5 digits of a Social Security number number 123456789, resulting in 999996789. <p>For datetime datatypes, the format is a packed string (no spaces or commas) containing the following sequence of fields. Please note that each field can consist of one or more characters, and the field length depends on whether redacting is required. The one-character fields are used to specify that no redaction of that component of the datetime value is to take</p>

Table 147-7 (Cont.) ALTER_POLICY Procedure Parameters

Parameter	Description
	<p>place. The longer fields indicate a specific time or date to use as the redacted value of that component of the datetime value.</p> <ul style="list-style-type: none"> • Month: 'M' (no redacting of month) or 'm#' (redact month to a specific month, if possible), where # (the month specified by its number) is between 1 and 12. • Day: 'D' (no redacting of date) or 'd#' (redact day to #, if possible), # between 1 and 31. • Year: 'Y' (no redacting of year) or 'y#' (redact year to #, if possible), # between 1 and 9999. • Hour: 'H' (no redacting of hour) or 'h#' (redact hour to #, if possible), # between 0 and 23. • Minute: 'M' (no redacting of minute) or 'm#' (redact minute to #, if possible), # between 0 and 59. • Second: 'S' (no redacting of second) or 's#' (redact second to #, if possible), # between 0 and 59. <p>An example is 'm12DYHMS', which changes 01-May-01 01:01:01 to 01-Dec-01 01:01:01</p> <p>For partial character and number-redacting shortcuts, see <i>Oracle Database Advanced Security Guide</i>.</p>
expression	<p>Default boolean expression for the table or view. If this expression is used, then redaction takes place only if this policy expression evaluates to TRUE.</p> <p>The following functions are supported:</p> <ul style="list-style-type: none"> • SYS_CONTEXT • XS_SYS_CONTEXT (See <i>Oracle Database Advanced Security Guide</i>) • NV (APEX_UTIL.GET_NUMERIC_SESSION_STATE) • V (APEX_UTIL.GET_SESSION_STATE) • OLS_LABEL_DOMINATES • DOMINATES • OLS_DOMINATES • OLS_DOM • DOM • OLS_STRICTLY_DOMINATES • STRICTLY_DOMINATES • S_DOM • SA_UTL.DOMINATES • SA_UTL.CHECK_READ • SA_UTL.NUMERIC_LABEL • CHAR_TO_LABEL • SA_SESSION.LABEL

Table 147-7 (Cont.) ALTER_POLICY Procedure Parameters

Parameter	Description
regexp_pattern	Regular expression pattern up to 512 bytes. Use only if the function_type parameter is DBMS_REDACT.REGEXP. Also, do not specify the function_parameters parameter when function_type is DBMS_REDACT.REGEXP. See <i>Oracle Database SQL Language Reference</i> for more information and examples on using regular expression patterns.
regexp_replace_string	Replacement string (up to 4000 characters in length) with up to 500 back-references to subexpressions in the form \n, where n is a number between 1 and 9. Use only if the function_type parameter is DBMS_REDACT.REGEXP
regexp_position	Integer counting from 1, specifies the position where the search must begin. Use only if the function_type parameter is DBMS_REDACT.REGEXP. The default is 1.
regexp_occurrence	<ul style="list-style-type: none"> Use 0 to replace all occurrences of the match. 0 is the default. Use positive integer <i>n</i> to replace the <i>n</i>-th occurrence of the match. Use only if the function_type parameter is DBMS_REDACT.REGEXP.
regexp_match_parameter	Changes the default matching behavior, possible values are a combination of 'i', 'c', 'ic', 'iq', 'n', 'm', 'x' Use only if the function_type parameter is DBMS_REDACT.REGEXP. See <i>Oracle Database SQL Language Reference</i> for more information and examples on using regular expression match parameters.
policy_description	Description of redaction policy
column_description	Description of the column being redacted

Exceptions

- ORA-28060 - A data redaction policy already exists on this column.
- ORA-28061 - This object cannot have a data redaction policy defined on it.
- ORA-28062 - The policy expression is too long.
- ORA-28063 - The policy expression is empty.
- ORA-28064 - The redaction function is not valid.
- ORA-28066 - Invalid column *column*.
- ORA-28067 - Missing or invalid column name.
- ORA-28068 - The object *object* does not have a Data Redaction policy.
- ORA-28069 - A Data Redaction policy already exists on this object.

- ORA-28070 - The column *column* does not have a Data Redaction policy.
- ORA-28071 - The action is not valid.
- ORA-28072 - The specified policy name is incorrect.
- ORA-28073 - The column *column_name* has an unsupported datatype or attribute.
- ORA-28074 - The *field_name* field of the redaction parameters is not valid.

The field can be any of the following:

- REDACT_PARTIAL_INPUT_FORMAT
- REDACT_PARTIAL_OUTPUT_FORMAT
- REDACT_PARTIAL_MASKCHAR
- REDACT_PARTIAL_MASKFROM
- REDACT_PARTIAL_MASKTO
- REDACT_PARTIAL_DATE_MONTH
- REDACT_PARTIAL_DATE_DAY
- REDACT_PARTIAL_DATE_YEAR
- REDACT_PARTIAL_DATE_HOUR
- REDACT_PARTIAL_DATE_MINUTE
- REDACT_PARTIAL_DATE_SECOND

See [Table 147-3](#) and [Table 147-4](#) for examples of the field contents and field ordering.

- ORA-28075 - The data redaction policy expression has an error.
- ORA-28076 - Empty role name specified as SYS_SESSION_ROLES attribute.
- ORA-28077 - The specified role name *role_name* for SYS_SESSION_ROLES exceeds the maximum length.
- ORA-28078 - A regular expression parameter is missing or invalid.
- ORA-28082 - The parameter *parameter* is invalid (where the possible values are *function_parameters*, *column_description*, *policy_name* and *policy_description*).
- ORA-28085 - The input and output lengths of the redaction do not match.
- ORA-28092 - The parameter *param_name* with value *value* has an error.
- ORA-28097 - A data redaction policy cannot be applied to an object owned by SYS.
- ORA-28104 - Input value for *parameter* is not valid.

Usage Notes

See [DBMS_REDACT Security Model](#) for a list of the required privileges for this procedure.

See [Operating Procedures](#) for more information regarding Function Types and Function Parameters with related examples.

A named Data Redaction policy expression that has been applied to a redacted column takes precedence over the expression defined in the `expression` parameter. To find redacted columns that are affected by named policy expressions, query the `REDACTION_EXPRESSIONS` data dictionary view.

Examples

```
BEGIN
  DBMS_REDACT.ALTER_POLICY (
    object_schema      => 'HR',
    object_name        => 'EMPLOYEES',
    policy_name        => 'redact_emp_id_nums',
    action              => DBMS_REDACT.DROP_COLUMN,
    column_name        => 'EMAIL');
END;
```

147.5.3 APPLY_POLICY_EXPR_TO_COL Procedure

This procedure associates a named Oracle Data Redaction policy expression with a redacted column from a table or view.

Syntax

```
DBMS_REDACT.APPLY_POLICY_EXPR_TO_COL (
  object_schema      IN VARCHAR2 := NULL,
  object_name        IN VARCHAR2,
  column_name        IN VARCHAR2,
  policy_expression_name IN VARCHAR2 := NULL);
```

Parameters

Table 147-8 *APPLY_POLICY_EXPR_TO_COL Procedure Parameters*

Parameter	Description
<code>object_schema</code>	Name of the schema that contains the redacted column. If omitted, then the current schema is used.
<code>object_name</code>	Name of the object (table or view) that contains the redacted column
<code>column_name</code>	Name of the redacted column to which the policy expression is applied
<code>policy_expression_name</code>	If NULL, then the named policy expression associated with the redacted column <code>column_name</code> is removed.

Exceptions

- ORA-28068 - The object *object* does not have a Data Redaction policy.
- ORA-28082 - The parameter *parameter* is invalid.
- ORA-28092 - The parameter *parameter* with value *value* has an error.

Usage Notes

See [DBMS_REDACT Security Model](#) for a list of the required privileges for this procedure.

You can find existing Data Redaction policy expressions by querying the REDACTION_EXPRESSIONS data dictionary view. To find columns that have been redacted, query the REDACTION_COLUMNS data dictionary view.

Example

```
BEGIN
  DBMS_REDACT.APPLY_POLICY_EXPR_TO_COL(
    object_schema      => 'OE',
    object_name        => 'CUSTOMERS',
    column_name        => 'INCOME_LEVEL',
    policy_expression_name => 'oe_redact_pol');
END;
```

147.5.4 CREATE_POLICY_EXPRESSION Procedure

This procedure creates a named Oracle Data Redaction policy expression.

Syntax

```
DBMS_REDACT.CREATE_POLICY_EXPRESSION (
  policy_expression_name  IN  VARCHAR2,
  expression              IN  VARCHAR2,
  policy_expression_description IN VARCHAR2 := NULL);
```

Parameters

Table 147-9 CREATE_POLICY_EXPRESSION Procedure Parameters

Parameter	Description
policy_expression_name	Name of the policy expression
expression	Definition of the policy expression
policy_expression_description	Description of the policy expression

Exceptions

- ORA-28082 - The parameter *parameter* is invalid.
- ORA-28092 - The parameter *parameter* with value *value* has an error.

Usage Notes

See [DBMS_REDACT Security Model](#) for a list of the required privileges for this procedure.

See [APPLY_POLICY_EXPR_TO_COL Procedure](#) for how to apply policy expressions to table columns.

After you create a policy expression, you can associate it with a redacted table or view column by running the DBMS_REDACT.APPLY_POLICY_EXPR_TO_COL procedure. To find existing redacted columns, query the REDACTION_COLUMNS data dictionary view.

Example

```

BEGIN
  DBMS_REDACT.CREATE_POLICY_EXPRESSION(
    policy_expression_name => 'oe_redact_pol',
    expression              => 'SYS_CONTEXT(''USERENV'', ''SESSION_USER'') =
''OE''',
    policy_expression_description => 'Enables policy for user OE ');
END;

```

147.5.5 DISABLE_POLICY Procedure

This procedure disables a Data Redaction policy.

Syntax

```

DBMS_REDACT.DISABLE_POLICY (
  object_schema IN VARCHAR2 := NULL,
  object_name   IN VARCHAR2,
  policy_name   IN VARCHAR2);

```

Parameters**Table 147-10** *DISABLE_POLICY Procedure Parameters*

Parameter	Description
object_schema	Schema owning the table or view, current user if NULL
object_name	Name of table or view for which to disable a Data Redaction policy
policy_name	Name of policy to be disabled

Exceptions

- ORA-28068 - The object *object* does not have a Data Redaction policy.
- ORA-28072 - The specified policy name is incorrect.
- ORA-28080 - The policy was already disabled.

Usage Notes

See [DBMS_REDACT Security Model](#) for a list of the required privileges for this procedure.

Examples

```

BEGIN
  DBMS_REDACT.DISABLE_POLICY (
    object_schema => 'hr',
    object_name   => 'employees',
    policy_name   => 'redact_emp_ids');
END;

```

147.5.6 DROP_POLICY Procedure

This procedure drops a Data Redaction policy by removing a redaction policy from the table or view.

Syntax

```
DBMS_REDACT.DROP_POLICY (
  object_schema      IN    VARCHAR2 := NULL,
  object_name        IN    VARCHAR2,
  policy_name        IN    VARCHAR2);
```

Parameters

Table 147-11 *DROP_POLICY Procedure Parameters*

Parameter	Description
object_schema	Schema owning the table or view, current user if NULL
object_name	Name of table or view from which to drop a Data Redaction policy
policy_name	Name of policy to be dropped

Exceptions

- ORA-28068 - The object *object* does not have a Data Redaction policy.
- ORA-28072 - The specified policy name is incorrect.

Usage Notes

See [DBMS_REDACT Security Model](#) for a list of the required privileges for this procedure.

Examples

```
BEGIN
  DBMS_REDACT.DROP_POLICY (
    object_schema => 'hr',
    object_name   => 'employees',
    policy_name   => 'redact_emp_ids');
END;
```

147.5.7 DROP_POLICY_EXPRESSION Procedure

This procedure drops a named policy expression.

Syntax

```
DBMS_REDACT.DROP_POLICY_EXPRESSION (
  policy_expression_name IN    VARCHAR2);
```

Parameters

Table 147-12 *DROP_POLICY_EXPRESSION Procedure Parameters*

Parameter	Description
<code>policy_expression_name</code>	Name of the policy expression

Exceptions

- ORA-28082 - The parameter *parameter* is invalid.
- ORA-28092 - The parameter *parameter* with value *value* has an error.

Usage Notes

See [DBMS_REDACT Security Model](#) for a list of the required privileges for this procedure.

You can find existing Data Redaction policy expressions by querying the `REDACTION_EXPRESSIONS` data dictionary view.

Example

```
BEGIN
  DBMS_REDACT.DROP_POLICY_EXPRESSION(
    policy_expression_name => 'oe_redact_pol');
END;
```

147.5.8 ENABLE_POLICY Procedure

This procedure re-enables a Data Redaction policy.

Syntax

```
DBMS_REDACT.ENABLE_POLICY (
  object_schema          IN   VARCHAR2 := NULL,
  object_name            IN   VARCHAR2,
  policy_name            IN   VARCHAR2);
```

Parameters

Table 147-13 *ENABLE_POLICY Procedure Parameters*

Parameter	Description
<code>object_schema</code>	Schema owning the table or view, current user if <code>NULL</code>
<code>object_name</code>	Name of table or view on which to enable a Data Redaction policy
<code>policy_name</code>	Name of policy to be enabled

Exceptions

- ORA-28068 - The object *object* does not have a Data Redaction policy.
- ORA-28071 - The action is not valid.
- ORA-28072 - The specified policy name is incorrect.

- ORA-28079 - The policy was already enabled.

Usage Notes

See [DBMS_REDACT Security Model](#) for a list of the required privileges for this procedure.

Examples

```
BEGIN
  DBMS_REDACT.ENABLE_POLICY (
    object_schema => 'hr',
    object_name   => 'employees',
    policy_name   => 'redact_emp_ids');
END;
```

147.5.9 UPDATE_FULL_REDACTION_VALUES Procedure

This procedure modifies the default displayed values for a Data Redaction policy for full redaction.

Syntax

```
DBMS_REDACT.UPDATE_FULL_REDACTION_VALUES (
  number_val      IN NUMBER           := NULL,
  binfloat_val    IN BINARY_FLOAT     := NULL,
  bindouble_val   IN BINARY_DOUBLE    := NULL,
  char_val        IN CHAR              := NULL,
  varchar_val     IN VARCHAR2         := NULL,
  nchar_val       IN NCHAR             := NULL,
  nvarchar_val    IN NVARCHAR2        := NULL,
  date_val        IN DATE              := NULL,
  ts_val          IN TIMESTAMP         := NULL,
  tswtz_val       IN TIMESTAMP WITH TIME ZONE := NULL,
  blob_val        IN BLOB              := NULL,
  clob_val        IN CLOB              := NULL,
  nclob_val       IN NCLOB             := NULL,
  boolean_val     IN BOOLEAN          := NULL);
```

Parameters

Table 147-14 *UPDATE_FULL_REDACTION_VALUES Procedure Parameters*

Parameter	Description
number_val	Modifies the default value for columns of the NUMBER datatype
binfloat_val	Modifies the default value for columns of the BINARY_FLOAT datatype
bindouble_val	Modifies the default value for columns of the BINARY_DOUBLE datatype
char_val	Modifies the default value for columns of the CHAR datatype
varchar_val	Modifies the default value for columns of the VARCHAR2 datatype
nchar_val	Modifies the default value for columns of the NCHAR datatype
nvarchar_val	Modifies the default value for columns of the NVARCHAR2 datatype
date	Modifies the default value for columns of the DATE datatype

Table 147-14 (Cont.) UPDATE_FULL_REDACTION_VALUES Procedure Parameters

Parameter	Description
ts_val	Modifies the default value for columns of the <code>TIMESTAMP</code> datatype
tswtz_val	Modifies the default value for columns of the <code>TIMESTAMP WITH TIME ZONE</code> datatype
blob_val	Modifies the default value for columns of the <code>BLOB</code> datatype
clob_val	Modifies the default value for columns of the <code>CLOB</code> datatype
nclob_val	Modifies the default value for columns of the <code>NCLOB</code> datatype
boolean_val	Modifies the default value for columns of the <code>BOOLEAN</code> datatype

Usage Notes

See [DBMS_REDACT Security Model](#) for a list of the required privileges for this procedure.

147.5.10 UPDATE_POLICY_EXPRESSION Procedure

This procedure updates a named Oracle Data Redaction policy expression.

Syntax

```
DBMS_REDACT.UPDATE_POLICY_EXPRESSION (
  policy_expression_name      IN   VARCHAR2,
  expression                  IN   VARCHAR2,
  policy_expression_description IN   VARCHAR2 := NULL);
```

Parameters**Table 147-15 UPDATE_POLICY_EXPRESSION Procedure Parameters**

Parameter	Description
policy_expression_name	Name of the policy expression
expression	Definition of the policy expression
policy_expression_description	Description of the policy expression

Exceptions

- ORA-28082 - The parameter *parameter* is invalid.
- ORA-28092 - The parameter *parameter* with value *value* has an error.

Usage Notes

See [DBMS_REDACT Security Model](#) for a list of the required privileges for this procedure.

You can find existing policy expressions by querying the `REDACTION_EXPRESSIONS` data dictionary view.

Example

```
BEGIN
  DBMS_REDACT.UPDATE_POLICY_EXPRESSION(
    policy_expression_name => 'oe_redact_pol',
    expression             =>
'SYS_CONTEXT(''USERENV'', ''SESSION_USER'') != ''OE'',
    policy_expression_description => 'Updates policy expression for
oe_redact_pol');
END;
```


DBMS_REDEFINITION

The `DBMS_REDEFINITION` package provides an interface to perform an online redefinition of tables.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Operational Notes](#)
- [Rules and Limits](#)
- [Examples](#)
- [Summary of DBMS_REDEFINITION Subprograms](#)



See Also:

Oracle Database Administrator's Guide for more information about online redefinition of tables

148.1 DBMS_REDEFINITION Overview

To achieve online redefinition, incrementally maintainable local materialized views are used. These logs keep track of the changes to the master tables and are used by the materialized views during refresh synchronization.

148.2 DBMS_REDEFINITION Security Model

Subprograms in the `DBMS_REDEFINITION` package are run with invokers' rights (with the privileges of the current user).

There are two modes:

- In `USER` mode, the user who has the `CREATE TABLE` and `CREATE MVIEW` privileges may redefine a table residing in his own schema.
- In `FULL` mode, the user who has the `ANY` privilege may redefine tables in any schema.

148.3 DBMS_REDEFINITION Constants

The `DBMS_REDEFINITION` package defines several constants for specifying parameter values.

Table 148-1 DBMS_REDEFINITION Constants

Constant	Type	Value	Description
CONS_CONSTRAINT	PLS_INTEGER	3	Used to specify that dependent object type is a constraint
CONS_INDEX	PLS_INTEGER	2	Used to specify that dependent object type is a index
CONS_MVLOG	PLS_INTEGER	10	Used to (un)register a materialized view log, as a dependent object of the table, through the REGISTER_DEPENDENT_OBJECT Procedure and the UNREGISTER_DEPENDENT_OBJECT Procedure .
CONS_ORIG_PARAMS	PLS_INTEGER	1	Used to specify that indexes should be cloned with their original storage parameters
CONS_TRIGGER	PLS_INTEGER	4	Used to specify that dependent object type is a trigger
CONS_USE_PK	BINARY_INTEGER	1	Used to indicate that the redefinition should be done using primary keys or pseudo-primary keys (unique keys with all component columns having not-NULL constraints)
CONS_USE_ROWID	BINARY_INTEGER	2	Used to indicate that the redefinition should be done using rowids
CONS_VPD_AUTO	BINARY_INTEGER	2	Used to indicate to copy VPD policies automatically
CONS_VPD_MANUAL	BINARY_INTEGER	4	Used to indicate to copy VPD policies manually
CONS_VPD_NONE	BINARY_INTEGER	1	Used to indicate that there are no VPD policies on the original table

148.4 DBMS_REDEFINITION Operational Notes

The following operational notes apply to DBMS_REDEFINITION.

- `CONS_USE_PK` and `CONS_USE_ROWID` are constants used as input to the "options_flag" parameter in both the [START_REDEF_TABLE Procedure](#) and [CAN_REDEF_TABLE Procedure](#). `CONS_USE_ROWID` is used to indicate that the redefinition should be done using rowids while `CONS_USE_PK` implies that the redefinition should be done using primary keys or pseudo-primary keys (which are unique keys with all component columns having NOT NULL constraints).
- `CONS_INDEX`, `CONS_MVLOG`, `CONS_TRIGGER` and `CONS_CONSTRAINT` are used to specify the type of the dependent object being (un)registered in [REGISTER_DEPENDENT_OBJECT Procedure](#) and [UNREGISTER_DEPENDENT_OBJECT Procedure](#) (parameter "dep_type").

`CONS_INDEX` ==> dependent object is of type INDEX

`CONS_TRIGGER` ==> dependent object is of type TRIGGER

CONS_CONSTRAINT==> dependent object type is of type CONSTRAINT

CONS_MVLOG ==> dependent object is of type MATERIALIZED VIEW LOG

- CONS_ORIG_PARAMS as used as input to the "copy_indexes" parameter in [COPY_TABLE_DEPENDENTS Procedure](#). Using this parameter implies that the indexes on the original table be copied onto the interim table using the same storage parameters as that of the original index.

148.5 DBMS_REDEFINITION Rules and Limits

Various rules and limits apply to implementation of the DBMS_REDEFINITION package.

For more information about these, see the *Oracle Database Administrator's Guide*.

148.6 DBMS_REDEFINITION Examples

The following examples demonstrate DBMS_REDEFINITION functionality.

We create two tables EMP and EMP_INT as the original and the interim tables, respectively:

```
CREATE TABLE "EMP"
( "EMPNO" NUMBER(4,0) PRIMARY KEY,
  "ENAME" VARCHAR2(10),
  "JOB" VARCHAR2(9),
  "MGR" NUMBER(4,0),
  "HIREDATE" DATE,
  "SAL" NUMBER(7,2),
  "COMM" NUMBER(7,2),
  "DEPTNO" NUMBER(2,0))
```

```
TABLESPACE myts;
```

```
CREATE TABLE "EMP_INT"
( "EMPNO" NUMBER(4,0) PRIMARY KEY,
  "ENAME" VARCHAR2(10),
  "JOB" VARCHAR2(9),
  "MGR" NUMBER(4,0),
  "HIREDATE" DATE,
  "SAL" NUMBER(7,2),
  "COMM" NUMBER(7,2),
  "DEPTNO" NUMBER(2,0))
```

```
TABLESPACE compressed_ts;
```

Regular Multi-Step Redefinition

```
DBMS_REDEFINITION.START_REDEF_TABLE('SCOTT', 'EMP', 'EMP_INT',
  ENABLE_ROLLBACK => TRUE);
DBMS_REDEFINITION.FINISH_REDEF_TABLE('SCOTT', 'EMP', 'EMP_INT');
```

Assume the DBA wants to evaluate the performance of the application for 2 days, after moving the table EMP from tablespace myts to compressed_ts. One can run

sync_interim_table [SYNC_INTERIM_TABLE Procedure](#) to keep both the tables in sync (say, every hour).

```
DBMS_REDEFINITION.SYNC_INTERIM_TABLE('SCOTT', 'EMP', 'EMP_INT');
```

Case 1 — DBA is not happy with the performance, so decides to rollback.

```
DBMS_REDEFINITION.ROLLBACK('SCOTT', 'EMP', 'EMP_INT');
```

Case 2 — DBA is happy with the performance, so decides not to rollback.

```
DBMS_REDEFINITION.ABORT_ROLLBACK('SCOTT', 'EMP', 'EMP_INT');
```

This terminates the possibility of rollback.

Single-Step Redefinition

```
DBMS_REDEFINITION.REDEF_TABLE('SCOTT','EMP','ROW STORE COMPRESS  
ADVANCED', enable_rollback => TRUE);
```



Note:

Online table redefinition rollback is not supported when the `REDEF_TABLE` procedure is used to redefine a table.

148.7 Summary of DBMS_REDEFINITION Subprograms

This table lists the `DBMS_REDEFINITION` subprograms and briefly describes them.

Table 148-2 DBMS_REDEFINITION Package Subprograms

Subprogram	Description
ABORT_REDEF_TABLE Procedure	Cleans up errors that occur during the redefinition process and removes all temporary objects created by the reorganization process
ABORT_ROLLBACK Procedure	Aborts rollback
ABORT_UPDATE Procedure	Aborts an update started with the <code>EXECUTE_UPDATE</code> procedure
CAN_REDEF_TABLE Procedure	Determines if a given table can be redefined online
COPY_TABLE_DEPENDENTS Procedure	Copies the dependent objects of the original table onto the interim table
EXECUTE_UPDATE Procedure	Optimizes the performance of bulk updates to a table
FINISH_REDEF_TABLE Procedure	Completes the redefinition process

Table 148-2 (Cont.) DBMS_REDEFINITION Package Subprograms

Subprogram	Description
REDEF_TABLE Procedure	Provides a single push-button interface that integrates several redefinition steps
REGISTER_DEPENDENT_OBJECT Procedure	Registers a dependent object (index, trigger, constraint or materialized view log) on the table being redefined and the corresponding dependent object on the interim table
ROLLBACK Procedure	Performs rollback
SET_PARAM Procedure	Sets a new value for a specified parameter used by the redefinition process identified by a redefinition ID
START_REDEF_TABLE Procedure	Initiates the redefinition process
SYNC_INTERIM_TABLE Procedure	Keeps the interim table synchronized with the original table
UNREGISTER_DEPENDENT_OBJECT Procedure	Unregisters a dependent object (index, trigger, constraint or materialized view log) on the table being redefined and the corresponding dependent object on the interim table

148.7.1 ABORT_REDEF_TABLE Procedure

This procedure cleans up errors that occur during the redefinition process.

This procedure can also be used to terminate the redefinition process any time after the [START_REDEF_TABLE Procedure](#) has been called and before the [FINISH_REDEF_TABLE Procedure](#) is called. This process will remove the temporary objects that are created by the redefinition process such as materialized view logs.

Syntax

```
DBMS_REDEFINITION.ABORT_REDEF_TABLE (
  uname          IN VARCHAR2,
  orig_table     IN VARCHAR2,
  int_table      IN VARCHAR2,
  part_name      IN VARCHAR2 := NULL);
```

Parameters

Table 148-3 ABORT_REDEF_TABLE Procedure Parameters

Parameter	Description
uname	Schema name of the tables
orig_table	Name of the table to be redefined
int_table	Name of the interim table. Can take a comma-delimited list of interim table names.
part_name	Name of the partition being redefined. If redefining only a single partition of a table, specify the partition name in this parameter. <code>NULL</code> implies the entire table is being redefined. Can take a comma-delimited list of partition names to be redefined.

148.7.2 ABORT_ROLLBACK Procedure

This procedure aborts rollback for a table that was redefined.

When online redefinition of a table is started with the `START_REDEF_TABLE` procedure, rollback can be enabled for the changes performed by online redefinition of a table by setting the `enable_rollback` parameter to `TRUE`. If you want to retain the changes made by online redefinition, you can abort the rollback to clean up the database objects that enable rollback.

Syntax

```
DBMS_REDEFINITION.ABORT_ROLLBACK (
  uname          IN VARCHAR2,
  orig_table     IN VARCHAR2,
  int_table      IN VARCHAR2 := NULL,
  part_name      IN VARCHAR2 := NULL);
```

Parameters

Table 148-4 ABORT_ROLLBACK Procedure Parameters

Parameter	Description
<code>uname</code>	Schema name of the tables
<code>orig_table</code>	Name of the table to be redefined
<code>int_table</code>	Name of the interim table
<code>part_name</code>	Name of the partition being redefined

148.7.3 ABORT_UPDATE Procedure

This procedure can aborts an update started with the `EXECUTE_UPDATE` procedure in the `RDBMS_REDEFINITION` package.

Syntax

```
DBMS_REDEFINITION.ABORT_UPDATE (
  update_stmt IN CLOB);
```

Parameters

Table 148-5 ABORT_UPDATE Procedure Parameters

Parameter	Description
<code>update_stmt</code>	The SQL <code>UPDATE</code> statement to be aborted The SQL statement must exactly match the SQL statement in the <code>EXECUTE_UPDATE</code> procedure.

**See Also:***Oracle Database Administrator's Guide*

148.7.4 CAN_REDEF_TABLE Procedure

This procedure determines if a given table can be redefined online. This is the first step of the online redefinition process. If the table is not a candidate for online redefinition, an error message is raised.

Syntax

```
DBMS_REDEFINITION.CAN_REDEF_TABLE (
  uname          IN VARCHAR2,
  tname          IN VARCHAR2,
  options_flag   IN PLS_INTEGER := 1,
  part_name      IN VARCHAR2 := NULL);
```

Parameters

Table 148-6 CAN_REDEF_TABLE Procedure Parameters

Parameter	Description
uname	Schema name of the table
tname	Name of the table to be re-organized
options_flag	Indicates the type of redefinition method to use. <ul style="list-style-type: none"> If <code>dbms_redefinition.cons_use_pk</code>, the redefinition is done using primary keys or pseudo-primary keys (unique keys with all component columns having <code>NOT NULL</code> constraints). The default method of redefinition is using primary keys. If <code>dbms_redefinition.cons_use_rowid</code>, the redefinition is done using rowids.
part_name	Name of the partition being redefined. If redefining only a single partition of a table, specify the partition name in this parameter. <code>NULL</code> implies the entire table is being redefined.

Exceptions

If the table is not a candidate for online redefinition, an error message is raised.

148.7.5 COPY_TABLE_DEPENDENTS Procedure

This procedure clones the dependent objects of the table being redefined onto the interim table and registers the dependent objects. This procedure does not clone the already registered dependent objects.

This subprogram is used to clone the dependent objects like grants, triggers, constraints and privileges from the table being redefined to the interim table (which represents the post-redefinition table).

Syntax

```

DBMS_REDEFINITION.COPY_TABLE_DEPENDENTS (
  uname           IN  VARCHAR2,
  orig_table      IN  VARCHAR2,
  int_table       IN  VARCHAR2,
  copy_indexes    IN  PLS_INTEGER := 1,
  copy_triggers   IN  BOOLEAN     := TRUE,
  copy_constraints IN  BOOLEAN     := TRUE,
  copy_privileges IN  BOOLEAN     := TRUE,
  ignore_errors   IN  BOOLEAN     := FALSE,
  num_errors      OUT PLS_INTEGER,
  copy_statistics IN  BOOLEAN     := FALSE,
  copy_mvlog      IN  BOOLEAN     := FALSE);

```

Parameters

Table 148-7 COPY_TABLE_DEPENDENTS Procedure Parameters

Parameter	Description
uname	Schema name of the tables
orig_table	Name of the table being redefined
int_table	Name of the interim table
copy_indexes	Flag indicating whether to copy the indexes <ul style="list-style-type: none"> 0 - do not copy any index dbms_redefinition.cons_orig_params – copy the indexes using the physical parameters of the source indexes
copy_triggers	TRUE = clone triggers, FALSE = do nothing
copy_constraints	TRUE = clone constraints, FALSE = do nothing. If compatibility setting is 10.2 or higher, then clone CHECK and NOT NULL constraints
copy_privileges	TRUE = clone privileges, FALSE = do nothing
ignore_errors	TRUE = if an error occurs while cloning a particular dependent object, then skip that object and continue cloning other dependent objects. FALSE = that the cloning process should stop upon encountering an error.
num_errors	Number of errors that occurred while cloning dependent objects
copy_statistics	TRUE = copy statistics, FALSE = do nothing
copy_mvlog	TRUE = copy materialized view log, FALSE = do nothing

Usage Notes

- The user must check the column `num_errors` before proceeding to ensure that no errors occurred during the cloning of the objects.
- In case of an error, the user should fix the cause of the error and call the [COPY_TABLE_DEPENDENTS Procedure](#) again to clone the dependent object. Alternatively the user can manually clone the dependent object and then register the manually cloned dependent object using the [REGISTER_DEPENDENT_OBJECT Procedure](#).

- All cloned referential constraints involving the interim tables will be created disabled (they will be automatically enabled after the redefinition) and all triggers on interim tables will not fire till the redefinition is completed. After the redefinition is complete, the cloned objects will be renamed to the corresponding pre-redefinition names of the objects (from which they were cloned from).
- It is the user's responsibility that the cloned dependent objects are unaffected by the redefinition. All the triggers will be cloned and it is the user's responsibility that the cloned triggers are unaffected by the redefinition.

148.7.6 EXECUTE_UPDATE Procedure

This procedure can optimize the performance of bulk updates to a table. Performance is optimized because the updates are not logged in the redo log.

The `EXECUTE_UPDATE` procedure automatically uses the components of online table redefinition, such as an interim table, a materialized view, and a materialized view log, to enable optimized bulk updates to a table. The `EXECUTE_UPDATE` procedure also removes fragmentation of the affected rows and ensures that the update is atomic. If the bulk updates raise any errors, then you can use the `ABORT_UPDATE` procedure to undo the changes made by the `EXECUTE_UPDATE` procedure.

Syntax

```
DBMS_REDEFINITION.EXECUTE_UPDATE (
    update_stmt IN CLOB);
```

Parameters

Table 148-8 EXECUTE_UPDATE Procedure Parameters

Parameter	Description
update_stmt	The SQL UPDATE statement



See Also:

Oracle Database Administrator's Guide

148.7.7 FINISH_REDEF_TABLE Procedure

This procedure completes the redefinition process.

Before this step, you can create new indexes, triggers, grants, and constraints on the interim table. The referential constraints involving the interim table must be disabled. After completing this step, the original table is redefined with the attributes and data of the interim table. The original table is locked briefly during this procedure.

Syntax

```
DBMS_REDEFINITION.FINISH_REDEF_TABLE (
    uname          IN VARCHAR2,
    orig_table     IN  VARCHAR2,
```

```

int_table          IN  VARCHAR2,
part_name          IN  VARCHAR2 := NULL,
dml_lock_timeout  IN  PLS_INTEGER := NULL,
continue_after_errors IN  BOOLEAN := FALSE,
disable_rollback  IN  PLS_INTEGER := FALSE);

```

Parameters

Table 148-9 FINISH_REDEF_TABLE Procedure Parameters

Parameters	Description
uname	Schema name of the tables
orig_table	Name of the table to be redefined
int_table	Name of the interim table. Can take a comma-delimited list of interim table names.
part_name	Name of the partition being redefined. If redefining only a single partition of a table, specify the partition name in this parameter. NULL implies the entire table is being redefined. Can take a comma-delimited list of partition names to be redefined.
dml_lock_timeout	Specifies the number of seconds the procedure waits for its required locks before failing. The permissible range of values for timeout is 0 to 1,000,000. The default is NULL (wait mode).
continue_after_errors	When redefining multiple partitions allows operation execution to continue on the next partition (applies only to batched partition redefinition).
disable_rollback	When set to TRUE, disables the rollback option if it was enabled in the START_REDEF_TABLE procedure. Specifying TRUE cleans up the database objects that enable rollback.

Examples

Wait up to 600 seconds for required locks on SH.SALES:

```

EXECUTE DBMS_REDEFINITION.FINISH_REDEF_TABLE (
  'SH', 'SALES', 'INT_SALES', 600);

```

148.7.8 REDEF_TABLE Procedure

This procedure provides a single interface that integrates several redefinition steps including the CAN_REDEF_TABLE Procedure, the START_REDEF_TABLE Procedure, the COPY_TABLE_DEPENDENTS Procedure and the FINISH_REDEF_TABLE Procedure.

This procedure can change data storage properties including tablespaces (for table, partition, subpartition, index, LOB column), compress type (for table, partition, subpartition, index, LOB column) and STORE_AS clause for the LOB column.

Syntax

```

DBMS_REDEFINITION.REDEF_TABLE (
  uname          IN  VARCHAR2,
  tname          IN  VARCHAR2,
  table_compression_type  IN  VARCHAR2 := NULL,
  table_part_tablespace  IN  VARCHAR2 := NULL,
  index_key_compression_type  IN  VARCHAR2 := NULL,

```

```

index_tablespace      IN VARCHAR2 := NULL,
lob_compression_type  IN VARCHAR2 := NULL,
lob_tablespace       IN VARCHAR2 := NULL,
lob_store_as         IN VARCHAR2 := NULL,
refresh_dep_mviews   IN VARCHAR2 := 'N',
dml_lock_timeout     IN PLS_INTEGER := NULL);

```

Parameters

Table 148-10 REDEF_TABLE Procedure Parameters

Parameter	Description
uname	Schema name of the table
tname	Name of the table to be redefined
table_compression_type	Text string of the table compression clause. NULL means there is no change.
table_part_tablespace	Tablespace name for the entire table or partitions. NULL means there is no change.
index_key_compression_type	Text string of the compression clause for all indexes on the table. NULL means there is no change.
index_tablespace	Tablespace name for all indexes on the table. NULL means there is no change.
lob_compression_type	Text string of the compression clause for all LOBs in the entire table. NULL means there is no change.
lob_tablespace	Tablespace name for all LOBs in the table. NULL means there is no change.
lob_store_as	Specifies LOB store as 'SECUREFILE' or 'BASICFILE'. NULL means there is no change.
refresh_dep_mviews	When set to 'Y', fast refresh of dependent materialized views is performed once at the end of the redefinition operation.
dml_lock_timeout	Specifies the number of seconds the procedure waits for its required locks before failing. The permissible range of values for timeout is 0 to 1,000,000. The default is NULL (wait mode).

Examples

```

BEGIN
  DBMS_REDEFINITION.REDEF_TABLE (
    uname           => 'TABOWNER2',
    tname          => 'EMP2',
    table_compression_type => 'ROW STORE COMPRESS ADVANCED',
    table_part_tablespace => 'NEWTBS',
    index_key_compression_type => 'COMPRESS 1',
    index_tablespace   => 'NEWIDXTBS',
    lob_compression_type   => 'COMPRESS HIGH',
    lob_tablespace     => 'SLOBTBS',
    lob_store_as      => 'SECUREFILE');
END;

```

Related Topics

- [CAN_REDEF_TABLE Procedure](#)
This procedure determines if a given table can be redefined online. This is the first step of the online redefinition process. If the table is not a candidate for online redefinition, an error message is raised.
- [START_REDEF_TABLE Procedure](#)
This procedure starts a table redefinition.
- [COPY_TABLE_DEPENDENTS Procedure](#)
This procedure clones the dependent objects of the table being redefined onto the interim table and registers the dependent objects. This procedure does not clone the already registered dependent objects.
- [FINISH_REDEF_TABLE Procedure](#)
This procedure completes the redefinition process.



See Also:

Oracle Database Administrator's Guide regarding "Performing Online Redefinition with the REDEF_TABLE Procedure"

148.7.9 REGISTER_DEPENDENT_OBJECT Procedure

This procedure registers a dependent object (index, trigger, constraint or materialized view log) on the table being redefined and the corresponding dependent object on the interim table.

This can be used to have the same object on each table but with different attributes. For example: for an index, the storage and tablespace attributes could be different but the columns indexed remain the same

Syntax

```
DBMS_REDEFINITION.REGISTER_DEPENDENT_OBJECT(
  uname          IN   VARCHAR2,
  orig_table     IN   VARCHAR2,
  int_table      IN   VARCHAR2,
  dep_type       IN   PLS_INTEGER,
  dep_owner      IN   VARCHAR2,
  dep_orig_name  IN   VARCHAR2,
  dep_int_name   IN   VARCHAR2);
```

Parameters

Table 148-11 REGISTER_DEPENDENT_OBJECT Procedure Parameters

Parameters	Description
uname	Schema name of the tables
orig_table	Name of the table to be redefined
int_table	Name of the interim table

Table 148-11 (Cont.) REGISTER_DEPENDENT_OBJECT Procedure Parameters

Parameters	Description
dep_type	Type of the dependent object (see Constants and Operational Notes)
dep_owner	Owner of the dependent object
dep_orig_name	Name of the original dependent object
dep_int_name	Name of the interim dependent object

Usage Notes

- Attempting to register an already registered object will raise an error.
- Registering a dependent object will automatically remove that object from `DBA_REDEFINITION_ERRORS` if an entry exists for that object.

148.7.10 ROLLBACK Procedure

This procedure rolls back changes to a table after online table redefinition to return the table to its original definition and preserve DML changes made to the table.

Syntax

```
DBMS_REDEFINITION.ROLLBACK (
  uname           IN VARCHAR2,
  orig_table      IN VARCHAR2,
  int_table       IN VARCHAR2 := NULL,
  part_name       IN VARCHAR2 := NULL,
  dml_lock_timeout IN PLS_INTEGER := NULL,
  continue_after_errors IN BOOLEAN := FALSE);
```

Parameters**Table 148-12 ROLLBACK Procedure Parameters**

Parameter	Description
uname	Schema name of the table to be redefined
orig_table	Name of the table to be redefined
int_table	Name of the interim table.
part_name	Name of the partition being redefined.
dml_lock_timeout	Specifies the number of seconds the procedure waits for its required locks before failing. The permissible range of values for timeout is 0 to 1,000,000. The default is NULL (wait mode).
continue_after_errors	When rolling back redefinition changes on multiple partitions, allows operation execution to continue on the next partition (applies only to batched partition redefinition).

148.7.11 SET_PARAM Procedure

This procedure sets a new value for a specified parameter used by the redefinition process identified by a redefinition ID.

Note:

Currently, the only value that can be changed by this procedure is the value for the `refresh_dep_mviews` parameter that is specified in the `REDEF_TABLE` procedure or the `START_REDEF_TABLE` procedure. You can determine the redefinition ID and check the value of the `refresh_dep_mviews` parameter for an online table redefinition operation by querying the `DBA_REDEFINITION_STATUS` view.

Syntax

```
DBMS_REDEFINITION.SET_PARAM (
    redefinition_id IN VARCHAR2,
    param_name      IN VARCHAR2,
    param_value     IN VARCHAR2);
```

Parameters

Table 148-13 SET_PARAM Procedure Parameters

Parameter	Description
<code>redefinition_id</code>	The redefinition ID that identifies the redefinition process
<code>param_name</code>	The parameter name
<code>param_value</code>	The new parameter value

See Also:

Oracle Database Administrator's Guide

148.7.12 START_REDEF_TABLE Procedure

This procedure starts a table redefinition.

Prior to calling this procedure, you must manually create an empty interim table (in the same schema as the table to be redefined) with the desired attributes of the post-redefinition table, and then call this procedure to initiate the redefinition.

Syntax

```
DBMS_REDEFINITION.START_REDEF_TABLE (
    uname          IN VARCHAR2,
    orig_table     IN VARCHAR2,
```

```

int_table          IN VARCHAR2,
col_mapping        IN VARCHAR2 := NULL,
options_flag       IN BINARY_INTEGER := 1,
orderby_cols       IN VARCHAR2 := NULL,
part_name          IN VARCHAR2 := NULL,
continue_after_errors IN BOOLEAN := FALSE,
copy_vpd_opt       IN BINARY_INTEGER := CONS_VPD_NONE,
refresh_dep_mviews IN VARCHAR2 := 'N',
enable_rollback    IN BOOLEAN := FALSE);

```

Parameters

Table 148-14 START_REDEF_TABLE Procedure Parameters

Parameter	Description
uname	Schema name of the tables
orig_table	Name of the table to be redefined
int_table	Name of the interim table. Can take a comma-delimited list of interim table names.
col_mapping	Mapping information from the columns in the original table to the columns in the interim table. (This is similar to the column list on the SELECT clause of a query.) If NULL, all the columns in the original table are selected and have the same name after redefinition.
options_flag	Indicates the type of redefinition method to use: <ul style="list-style-type: none"> If dbms_redefinition.cons_use_pk, the redefinition is done using primary keys or pseudo-primary keys (unique keys with all component columns having NOT NULL constraints). The default method of redefinition is using primary keys. If dbms_redefinition.cons_use_rowid, the redefinition is done using rowids.
orderby_cols	This optional parameter accepts the list of columns (along with the optional keyword(s) ascending/descending) with which to order by the rows during the initial instantiation of the interim table (the order by is only done for the initial instantiation and not for subsequent synchronizations)
part_name	Name of the partition being redefined. If redefining only a single partition of a table, specify the partition name in this parameter. NULL implies the entire table is being redefined. Can take a comma-delimited list of partition names to be redefined.
continue_after_errors	When redefining multiple partitions allows operation execution to continue on the next partition (applies only to batched partition redefinition)
copy_vpd_opt	Specifies how VPD policies are handled in online redefinition
refresh_dep_mviews	When set to 'Y', fast refresh of dependent materialized views is performed when the START_REDEF_TABLE procedure is run, each time the SYNC_INTERIM_TABLE procedure is run, and when the FINISH_REDEF_TABLE procedure is run.

Table 148-14 (Cont.) START_REDEF_TABLE Procedure Parameters

Parameter	Description
enable_rollback	When set to TRUE, enables the rollback option. When this parameter is set to true, Oracle Database maintains the interim table created during redefinition after redefinition is complete. You can run the SYNC_INTERIM_TABLE procedure to synchronize the interim table periodically to apply DML changes made to the redefined table to the interim table. An internal materialized view and materialized view log enables maintenance of the interim table. If you decide to roll back the online table redefinition with the ROLLBACK procedure, then the interim table is synchronized, and Oracle Database switches back to it so that the table has its original definition.

Examples

Start redefinition of three partitions (sal03q1, sal03q2, sal03q3) in table 'STEVE.salestable' using three interim tables of int_salestable1, int_salestable2 and int_salestable3, respectively. The operation will continue on sal03q3 even if it fails on sal03q1.

```
DBMS_REDEFINITION.START_REDEF_TABLE (
  uname           => 'STEVE',
  orig_table      => 'salestable',
  int_table       => 'int_salestable1, int_salestable2, int_salestable3',
  col_mapping     => NULL,
  options_flag    => DBMS_REDEFINITION.CONST_USE_ROWID,
  part_name       => 'sal03q1,sal03q2,sal03q3',
  continue_after_errors => TRUE);
```

Specify to copy VPD policies automatically:

```
EXECUTE DBMS_REDEFINITION.START_REDEF_TABLE (
  uname           => 'SCOTT',
  orig_table      => 'T',
  int_table       => 'INT_T',
  copy_vpd_opt   => DBMS_REDEFINITION.CONST_VPD_AUTO);
```

148.7.13 SYNC_INTERIM_TABLE Procedure

This procedure keeps the interim table synchronized with the original table.

Syntax

```
DBMS_REDEFINITION.SYNC_INTERIM_TABLE (
  uname           IN  VARCHAR2,
  orig_table      IN  VARCHAR2,
  int_table       IN  VARCHAR2,
  part_name       IN  VARCHAR2 := NULL,
  continue_after_errors IN  BOOLEAN := FALSE);
```


Parameters

Table 148-15 SYNC_INTERIM_TABLE Procedure Parameters

Parameter	Description
uname	Schema name of the table
orig_table	Name of the table to be redefined
int_table	Name of the interim table. Can take a comma-delimited list of interim table names.
part_name	Name of the partition being redefined. If redefining only a single partition of a table, specify the partition name in this parameter. <code>NULL</code> implies the entire table is being redefined. Can take a comma-delimited list of partition names to be redefined.
continue_after_errors	When redefining multiple partitions allows operation execution to continue on the next partition (applies only to batched partition redefinition)

Usage Notes

- This step is useful in minimizing the amount of synchronization needed to be done by the [FINISH_REDEF_TABLE Procedure](#) before completing the online redefinition.
- This procedure can be called between long running operations (such as `CREATE INDEX`) on the interim table to sync it up with the data in the original table and speed up subsequent operations.

148.7.14 UNREGISTER_DEPENDENT_OBJECT Procedure

This procedure unregisters a dependent object (index, trigger, constraint or materialized view log) on the table being redefined and the corresponding dependent object on the interim table.

Syntax

```
DBMS_REDEFINITION.UNREGISTER_DEPENDENT_OBJECT (
  uname          IN VARCHAR2,
  orig_table     IN VARCHAR2,
  int_table      IN VARCHAR2,
  dep_type       IN PLS_INTEGER,
  dep_owner      IN VARCHAR2,
  dep_orig_name  IN VARCHAR2,
  dep_int_name   IN VARCHAR2);
```

Parameters

Table 148-16 UNREGISTER_DEPENDENT_OBJECT Procedure Parameters

Parameters	Description
uname	Schema name of the tables
orig_table	Name of the table to be redefined
int_table	Name of the interim table

Table 148-16 (Cont.) UNREGISTER_DEPENDENT_OBJECT Procedure Parameters

Parameters	Description
dep_type	Type of the dependent object
dep_owner	Owner of the dependent object
dep_orig_name	Name of the original dependent object
dep_int_name	Name of the interim dependent object

DBMS_REFRESH

The `DBMS_REFRESH` package enables you to create groups of materialized views that can be refreshed together to a transactionally consistent point in time. These groups are called refresh groups.

This chapter contains the following topics:

- [DBMS_REFRESH Overview](#)
- [DBMS_REFRESH Security Model](#)

149.1 DBMS_REFRESH Overview

When it is important for materialized views to be transactionally consistent with each other, you can organize them into refresh groups.

By refreshing the refresh group, you can ensure that the data in all of the materialized views in the refresh group correspond to the same transactionally consistent point in time. A materialized view in a refresh group still can be refreshed individually, but doing so nullifies the benefits of the refresh group because refreshing the materialized view individually does not refresh the other materialized views in the refresh group.

149.2 DBMS_REFRESH Security Model

Users must have the `EXECUTE` privilege to run the procedures of `DBMS_REFRESH` package.

149.3 Summary of DBMS_REFRESH Subprograms

This table lists the `DBMS_REFRESH` subprograms and briefly describes them.

Table 149-1 DBMS_REFRESH Package Subprograms

Subprogram	Description
ADD Procedure	Adds materialized views to a refresh group
CHANGE Procedure	Changes the refresh interval for a refresh group
DESTROY Procedure	Removes all of the materialized views from a refresh group and deletes the refresh group
MAKE Procedure	Specifies the members of a refresh group and the time interval used to determine when to refresh the members of this group
REFRESH Procedure	Manually refreshes a refresh group
SUBTRACT Procedure	Removes materialized views from a refresh group

149.3.1 ADD Procedure

This procedure adds materialized views to a refresh group.

Syntax

```
DBMS_REFRESH.ADD (
    name      IN VARCHAR2,
    { list    IN VARCHAR2,
      | tab    IN DBMS_UTILITY.UNCL_ARRAY, }
    lax       IN BOOLEAN := FALSE);
```



Note:

This procedure is overloaded. The `list` and `tab` parameters are mutually exclusive.

Parameters

Table 149-2 ADD Procedure Parameters

Parameter	Description
<code>name</code>	Name of the refresh group to which you want to add members, specified as <code>[schema_name.]refresh_group_name</code> . If the schema is not specified, then the current user is the default.
<code>list</code>	Comma-delimited list of materialized views that you want to add to the refresh group. Synonyms are not supported. Each materialized view is specified as <code>[schema_name.]materialized_view_name</code> . If the schema is not specified, then the refresh group owner is the default.
<code>tab</code>	Instead of a comma-delimited list, you can supply a PL/SQL associative array of type <code>DBMS_UTILITY.UNCL_ARRAY</code> , where each element is the name of a materialized view. The first materialized view should be in position 1. The last position must be <code>NULL</code> . Each materialized view is specified as <code>[schema_name.]materialized_view_name</code> . If the schema is not specified, then the refresh group owner is the default.
<code>lax</code>	A materialized view can belong to only one refresh group at a time. If you are moving a materialized view from one group to another, then you must set the <code>lax</code> flag to <code>TRUE</code> to succeed. Oracle then automatically removes the materialized view from the other refresh group and updates its refresh interval to be that of its new group. Otherwise, the call to <code>ADD</code> generates an error message.

149.3.2 CHANGE Procedure

This procedure changes the refresh interval for a refresh group.

Syntax

```
DBMS_REFRESH.CHANGE (
    name                IN VARCHAR2,
    next_date           IN DATE           := NULL,
    interval            IN VARCHAR2      := NULL,
    implicit_destroy    IN BOOLEAN       := NULL,
    rollback_seg        IN VARCHAR2      := NULL,
    push_deferred_rpc   IN BOOLEAN       := NULL,
    refresh_after_errors IN BOOLEAN      := NULL,
    purge_option        IN BINARY_INTEGER := NULL,
    parallelism         IN BINARY_INTEGER := NULL,
    heap_size           IN BINARY_INTEGER := NULL);
```

Parameters

Table 149-3 CHANGE Procedure Parameters

Parameter	Description
name	Name of the refresh group for which you want to alter the refresh interval.
next_date	Next date that you want a refresh to occur. By default, this date remains unchanged.
interval	Function used to calculate the next time to refresh the materialized views in the refresh group. This interval is evaluated immediately before the refresh. Thus, select an interval that is greater than the time it takes to perform a refresh. By default, the interval remains unchanged.
implicit_destroy	Allows you to reset the value of the <code>implicit_destroy</code> flag. If this flag is set, then Oracle automatically deletes the group if it no longer contains any members. By default, this flag remains unchanged.
rollback_seg	Allows you to change the rollback segment used. By default, the rollback segment remains unchanged. To reset this parameter to use the default rollback segment, specify <code>NULL</code> , including the quotes. Specifying <code>NULL</code> without quotes indicates that you do not want to change the rollback segment currently being used.
push_deferred_rpc	Starting with Oracle Database 12c Release 2 (12.2), this parameter is ignored.
refresh_after_err ors	Starting with Oracle Database 12c Release 2 (12.2), this parameter is ignored.
purge_option	Starting with Oracle Database 12c Release 2 (12.2), this parameter is ignored.
parallelism	<ul style="list-style-type: none"> 0 specifies serial propagation. $n > 1$ specifies parallel propagation with n parallel processes. 1 specifies parallel propagation using only one parallel process.

Table 149-3 (Cont.) CHANGE Procedure Parameters

Parameter	Description
heap_size	Maximum number of transactions to be examined simultaneously for parallel propagation scheduling. Oracle automatically calculates the default setting for optimal performance.

 **Note:**

Do not set this parameter unless directed to do so by Oracle Support Services.

149.3.3 DESTROY Procedure

This procedure removes all of the materialized views from a refresh group and delete the refresh group.

Syntax

```
DBMS_REFRESH.DESTROY (
    name IN VARCHAR2);
```

Parameters

Table 149-4 DESTROY Procedure Parameters

Parameter	Description
name	Name of the refresh group that you want to destroy.

149.3.4 MAKE Procedure

This procedure specifies the members of a refresh group and the time interval used to determine when to refresh the members of this group.

Syntax

```
DBMS_REFRESH.MAKE (
    name                IN    VARCHAR2
    { list              IN    VARCHAR2,
      | tab             IN    DBMS_UTILITY.UNCL_ARRAY, }
    next_date          IN    DATE,
    interval            IN    VARCHAR2,
    implicit_destroy   IN    BOOLEAN      := FALSE,
    lax                 IN    BOOLEAN      := FALSE,
    job                 IN    BINARY_INTEGER := 0,
    rollback_seg       IN    VARCHAR2     := NULL,
    push_deferred_rpc  IN    BOOLEAN      := TRUE,
    refresh_after_errors IN    BOOLEAN      := FALSE
    purge_option        IN    BINARY_INTEGER := NULL,
    parallelism         IN    BINARY_INTEGER := NULL,
    heap_size           IN    BINARY_INTEGER := NULL
```

```

job_name          IN    VARCHAR2          := NULL,
auto_commit       IN    BOOLEAN           := NULL);

```

 **Note:**

This procedure is overloaded. The `list` and `tab` parameters are mutually exclusive.


Parameters

Table 149-5 MAKE Procedure Parameters

Parameter	Description
<code>name</code>	Unique name used to identify the refresh group, specified as <code>[schema_name.]refresh_group_name</code> . If the schema is not specified, then the current user is the default. Refresh groups must follow the same naming conventions as tables.
<code>list</code>	Comma-delimited list of materialized views that you want to refresh. Synonyms are not supported. These materialized views can be located in different schemas and have different master tables or master materialized views. However, all of the listed materialized views must be in your current database. Each materialized view is specified as <code>[schema_name.]materialized_view_name</code> . If the schema is not specified, then the refresh group owner is the default.
<code>tab</code>	Instead of a comma-delimited list, you can supply a PL/SQL associative array of names of materialized views that you want to refresh using the data type <code>DBMS_UTILITY.UNCL_ARRAY</code> . If the table contains the names of <code>n</code> materialized views, then the first materialized view should be in position 1 and the <code>n + 1</code> position should be set to <code>NULL</code> . Each materialized view is specified as <code>[schema_name.]materialized_view_name</code> . If the schema is not specified, then the refresh group owner is the default.
<code>next_date</code>	Next date that you want a refresh to occur.
<code>interval</code>	Function used to calculate the next time to refresh the materialized views in the group. This field is used with the <code>next_date</code> value. For example, if you specify <code>NEXT_DAY(SYSDATE+1, "MONDAY")</code> as your interval, and if your <code>next_date</code> evaluates to Monday, then Oracle refreshes the materialized views every Monday. This interval is evaluated immediately before the refresh. Thus, select an interval that is greater than the time it takes to perform a refresh.
<code>implicit_destroy</code>	Set this to <code>TRUE</code> to delete the refresh group automatically when it no longer contains any members. Oracle checks this flag only when you call the <code>SUBTRACT</code> procedure. That is, setting this flag still enables you to create an empty refresh group.
<code>lax</code>	A materialized view can belong to only one refresh group at a time. If you are moving a materialized view from an existing group to a new refresh group, then you must set this to <code>TRUE</code> to succeed. Oracle then automatically removes the materialized view from the other refresh group and updates its refresh interval to be that of its new group. Otherwise, the call to <code>MAKE</code> generates an error message.
<code>job</code>	Needed by the Import utility. Use the default value, 0.

Table 149-5 (Cont.) MAKE Procedure Parameters

Parameter	Description
rollback_seg	Name of the rollback segment to use while refreshing materialized views. The default, NULL, uses the default rollback segment.
push_deferred_rpc	Starting with Oracle Database 12c Release 2 (12.2), this parameter is ignored.
refresh_after_errors	Starting with Oracle Database 12c Release 2 (12.2), this parameter is ignored.
purge_option	Starting with Oracle Database 12c Release 2 (12.2), this parameter is ignored.
parallelism	<ul style="list-style-type: none"> 0 specifies serial propagation. $n > 1$ specifies parallel propagation with n parallel processes. 1 specifies parallel propagation using only one parallel process.
heap_size	Maximum number of transactions to be examined simultaneously for parallel propagation scheduling. Oracle automatically calculates the default setting for optimal performance.

 **Note:**
Do not set this parameter unless directed to do so by Oracle Support Services.

job_name	This parameter is needed by the import utility. User should use the default value, NULL.
auto_commit	<p>Supported values are NULL, TRUE, and FALSE.</p> <ul style="list-style-type: none"> NULL—allows the user to continue using DBMS_JOB. TRUE—commit statement will be automatically issued after the job of the refresh group are created by DBMS_REFRESH.MAKE. FALSE—user must issue a commit statement to finish the transaction after calling DBMS_REFRESH.MAKE. <p>The default value is NULL.</p>

Usage Notes

Import utility and export utility need CREATE JOB privilege if DBMS_SCHEDULER jobs are used.

149.3.5 REFRESH Procedure

This procedure manually refreshes a refresh group.

Syntax

```
DBMS_REFRESH.REFRESH (
    name IN VARCHAR2);
```


Parameters

Table 149-6 REFRESH Procedure Parameters

Parameter	Description
name	Name of the refresh group that you want to refresh manually.

149.3.6 SUBTRACT Procedure

This procedure removes materialized views from a refresh group.

Syntax

```
DBMS_REFRESH.SUBTRACT (
  name      IN      VARCHAR2,
  { list    IN      VARCHAR2,
    | tab    IN      DBMS_UTILITY.UNCL_ARRAY, }
  lax       IN      BOOLEAN := FALSE);
```

**Note:**

This procedure is overloaded. The `list` and `tab` parameters are mutually exclusive.

Parameters

Table 149-7 SUBTRACT Procedure Parameters

Parameter	Description
name	Name of the refresh group from which you want to remove members, specified as <code>[schema_name.]refresh_group_name</code> . If the schema is not specified, then the current user is the default.
list	Comma-delimited list of materialized views that you want to remove from the refresh group. (Synonyms are not supported.) These materialized views can be located in different schemas and have different master tables or master materialized views. However, all of the listed materialized views must be in your current database. Each materialized view is specified as <code>[schema_name.]materialized_view_name</code> . If the schema is not specified, then the refresh group owner is the default.
tab	Instead of a comma-delimited list, you can supply a PL/SQL associative array of type <code>DBMS_UTILITY.UNCL_ARRAY</code> , where each element is the name of a materialized view. The first materialized view should be in position 1. The last position must be <code>NULL</code> . Each materialized view is specified as <code>[schema_name.]materialized_view_name</code> . If the schema is not specified, then the refresh group owner is the default.
lax	Set this to <code>FALSE</code> if you want Oracle to generate an error message if the materialized view you are attempting to remove is not a member of the refresh group.

DBMS_REPAIR

The `DBMS_REPAIR` package contains data corruption repair procedures that enable you to detect and repair corrupt blocks in tables and indexes. You can address corruptions where possible and continue to use objects while you attempt to rebuild or repair them.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Operating Notes](#)
- [Exceptions](#)
- [Examples](#)
- [Summary of DBMS_REPAIR Subprograms](#)



See Also:

For detailed information about using the `DBMS_REPAIR` package, see *Oracle Database Administrator's Guide*

150.1 DBMS_REPAIR Overview

The `DBMS_REPAIR` package is intended for use by database administrators only. It is not intended for use by application developers.

150.2 DBMS_REPAIR Security Model

The package is owned by `SYS`. Execution privilege is not granted to other users.

150.3 DBMS_REPAIR Constants

The `DBMS_REPAIR` package defines several enumerated constants that should be used for specifying parameter values. Enumerated constants must be prefixed with the package name. For example, `DBMS_REPAIR.TABLE_OBJECT`.

The following table lists the parameters and the enumerated constants.

Table 150-1 DBMS_REPAIR Parameters with Enumerated Constants

Parameter	Option	Type	Description
object_type	• TABLE_OBJECT	BINARY_INTEGE	-
	• INDEX_OBJECT	R	
	• CLUSTER_OBJECT		
action	• CREATE_ACTION	BINARY_INTEGE	-
	• DROP_ACTION	R	
	• PURGE_ACTION		
table_type	• REPAIR_TABLE	BINARY_INTEGE	-
	• ORPHAN_TABLE	R	
flags	• SKIP_FLAG	BINARY_INTEGE	-
	• NOSKIP_FLAG	R	
object_id	• ALL_INDEX_ID := 0	BINARY_INTEGE R	Clean up all objects that qualify
wait_for_lock	• LOCK_WAIT := 1	BINARY_INTEGE	Specifies whether to try getting DML locks on underlying table [[sub]partition] object
	• LOCK_NOWAIT := 0	R	

**Note:**

The default table_name will be REPAIR_TABLE when table_type is REPAIR_TABLE, and will be ORPHAN_KEY_TABLE when table_type is ORPHAN_TABLE.

150.4 DBMS_REPAIR Operating Notes

The procedure to create the ORPHAN_KEYS_TABLE is similar to the one used to create the REPAIR_TABLE.

```
CONNECT / AS SYSDBA;
EXEC DBMS_REPAIR.ADMIN_TABLES('ORPHAN_KEYS_TABLE', DBMS_REPAIR.ORPHAN_TABLE,
                              DBMS_REPAIR.CREATE_ACTION);
EXEC DBMS_REPAIR.ADMIN_TABLES('REPAIR_TABLE', DBMS_REPAIR.REPAIR_TABLE,
                              DBMS_REPAIR.CREATE_ACTION);

DESCRIBE ORPHAN_KEYS_TABLE;
DESCRIBE REPAIR_TABLE;
SELECT * FROM ORPHAN_KEYS_TABLE;
SELECT * FROM REPAIR_TABLE;
```

The DBA would create the repair and orphan keys tables once. Subsequent executions of the [CHECK_OBJECT Procedure](#) would add rows into the appropriate table indicating the types of errors found.

The name of the repair and orphan keys tables can be chosen by the user, with the following restriction: the name of the repair table must begin with the 'REPAIR_' prefix, and the name of the orphan keys table must begin with the 'ORPHAN_' prefix. The following code is also legal:

```

CONNECT / AS SYSDBA;
EXEC DBMS_REPAIR.ADMIN_TABLES('ORPHAN_FOOBAR', DBMS_REPAIR.ORPHAN_TABLE,
                             DBMS_REPAIR.CREATE_ACTION);
EXEC DBMS_REPAIR.ADMIN_TABLES('REPAIR_ABCD', DBMS_REPAIR.REPAIR_TABLE,
                             DBMS_REPAIR.CREATE_ACTION);

DESCRIBE ORPHAN_FOOBAR;
DESCRIBE REPAIR_ABCD;
SELECT * FROM ORPHAN_FOOBAR;
SELECT * FROM REPAIR_ABCD;

```

When invoking the [CHECK_OBJECT Procedure](#) the name of the repair and orphan keys tables that were created should be specified correctly, especially if the default values were not used in the [ADMIN_TABLES Procedure](#) or `CREATE_ACTION`.

Other actions in the [ADMIN_TABLES Procedure](#) can be used to purge/delete the `REPAIR_TABLE` and the `ORPHAN_KEYS_TABLE`.

150.5 DBMS_REPAIR Exceptions

The table in this topic describes the exceptions raised by the `DDBMS_REPAIR` subprograms.

Table 150-2 DBMS_REPAIR Exceptions

Exception	Description	Action
942	Reported by <code>DBMS_REPAIR.ADMIN_TABLES</code> during a <code>DROP_ACTION</code> when the specified table doesn't exist.	-
955	Reported by <code>DBMS_REPAIR.CREATE_ACTION</code> when the specified table already exists.	-
24120	An invalid parameter was passed to the specified <code>DBMS_REPAIR</code> procedure.	Specify a valid parameter value or use the parameter's default.
24122	An incorrect block range was specified.	Specify correct values for the <code>BLOCK_START</code> and <code>BLOCK_END</code> parameters.
24123	An attempt was made to use the specified feature, but the feature is not yet implemented.	Do not attempt to use the feature.
24124	An invalid <code>ACTION</code> parameter was specified.	Specify <code>CREATE_ACTION</code> , <code>PURGE_ACTION</code> or <code>DROP_ACTION</code> for the <code>ACTION</code> parameter.
24125	An attempt was made to fix corrupt blocks on an object that has been dropped or truncated since <code>DBMS_REPAIR.CHECK_OBJECT</code> was run.	Use <code>DBMS_REPAIR.ADMIN_TABLES</code> to purge the repair table and run <code>DBMS_REPAIR.CHECK_OBJECT</code> to determine whether there are any corrupt blocks to be fixed.
24127	<code>TABLESPACE</code> parameter specified with an <code>ACTION</code> other than <code>CREATE_ACTION</code> .	Do not specify <code>TABLESPACE</code> when performing actions other than <code>CREATE_ACTION</code> .
24128	A partition name was specified for an object that is not partitioned.	Specify a partition name only if the object is partitioned.

Table 150-2 (Cont.) DBMS_REPAIR Exceptions

Exception	Description	Action
24129	An attempt was made to pass a table name parameter without the specified prefix.	Pass a valid table name parameter.
24130	An attempt was made to specify a repair or orphan table that does not exist.	Specify a valid table name parameter.
24131	An attempt was made to specify a repair or orphan table that does not have a correct definition.	Specify a table name that refers to a properly created table.
24132	An attempt was made to specify a table name is greater than 30 characters long.	Specify a valid table name parameter.

150.6 DBMS_REPAIR Examples

This topic shows examples of DBMS_REPAIR usage.

```
/* Fix the bitmap status for all the blocks in table mytab in schema sys */
EXECUTE DBMS_REPAIR.SEGMENT_FIX_STATUS('SYS', 'MYTAB');

/* Mark block number 45, filenumber 1 for table mytab in sys schema as FULL.*/
EXECUTE DBMS_REPAIR.SEGMENT_FIX_STATUS('SYS', 'MYTAB', TABLE_OBJECT,1, 45, 1);
```

150.7 Summary of DBMS_REPAIR Subprograms

This table lists the DBMS_REPAIR subprograms and briefly describes them.

Table 150-3 DBMS_REPAIR Package Subprograms

Subprogram	Description
ADMIN_TABLES Procedure	Provides administrative functions for the DBMS_REPAIR package repair and orphan key tables, including create, purge, and drop functions
CHECK_OBJECT Procedure	Detects and reports corruptions in a table or index
DUMP_ORPHAN_KEYS Procedure	Reports on index entries that point to rows in corrupt data blocks
FIX_CORRUPT_BLOCKS Procedure	Marks blocks software corrupt that have been previously detected as corrupt by CHECK_OBJECT
ONLINE_INDEX_CLEAN Function	Performs a manual cleanup of failed or interrupted online index builds or rebuilds
REBUILD_FREELISTS Procedure	Rebuilds an object's freelists
SEGMENT_FIX_STATUS Procedure	Fixes the corrupted state of a bitmap entry

Table 150-3 (Cont.) DBMS_REPAIR Package Subprograms

Subprogram	Description
SKIP_CORRUPT_BLOCKS Procedure	Sets whether to ignore blocks marked corrupt during table and index scans or to report ORA-1578 when blocks marked corrupt are encountered

150.7.1 ADMIN_TABLES Procedure

This procedure provides administrative functions for the DBMS_REPAIR package repair and orphan key tables.

Syntax

```
DBMS_REPAIR.ADMIN_TABLES (
  table_name IN VARCHAR2,
  table_type IN BINARY_INTEGER,
  action IN BINARY_INTEGER,
  tablespace IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 150-4 ADMIN_TABLES Procedure Parameters

Parameter	Description
table_name	Name of the table to be processed. Defaults to ORPHAN_KEY_TABLE or REPAIR_TABLE based on the specified table_type. When specified, the table name must have the appropriate prefix: ORPHAN_ or REPAIR_.
table_type	Type of table; must be either ORPHAN_TABLE or REPAIR_TABLE. See " Constants ".
action	Indicates what administrative action to perform. Must be either CREATE_ACTION, PURGE_ACTION, or DROP_ACTION. If the table already exists, and if CREATE_ACTION is specified, then an error is returned. PURGE_ACTION indicates to delete all rows in the table that are associated with non-existent objects. If the table does not exist, and if DROP_ACTION is specified, then an error is returned. When CREATE_ACTION and DROP_ACTION are specified, an associated view named DBA_<table_name> is created and dropped respectively. The view is defined so that rows associated with non-existent objects are eliminated. Created in the SYS schema. See " Constants ".
tablespace	Indicates the tablespace to use when creating a table. By default, the SYS default tablespace is used. An error is returned if the tablespace is specified and if the action is not CREATE_ACTION.

150.7.2 CHECK_OBJECT Procedure

This procedure checks the specified objects and populates the repair table with information about corruptions and repair directives.

Validation consists of block checking all blocks in the object.

Syntax

```
DBMS_REPAIR.CHECK_OBJECT (
  schema_name      IN VARCHAR2,
  object_name      IN VARCHAR2,
  partition_name   IN VARCHAR2      DEFAULT NULL,
  object_type      IN BINARY_INTEGER DEFAULT TABLE_OBJECT,
  repair_table_name IN VARCHAR2      DEFAULT 'REPAIR_TABLE',
  flags           IN BINARY_INTEGER DEFAULT NULL,
  relative_fno    IN BINARY_INTEGER DEFAULT NULL,
  block_start     IN BINARY_INTEGER DEFAULT NULL,
  block_end       IN BINARY_INTEGER DEFAULT NULL,
  corrupt_count   OUT BINARY_INTEGER);
```

Parameters

Table 150-5 CHECK_OBJECT Procedure Parameters

Parameter	Description
schema_name	Schema name of the object to be checked.
object_name	Name of the table or index to be checked.
partition_name	Partition or subpartition name to be checked. If this is a partitioned object, and if <code>partition_name</code> is not specified, then all partitions and subpartitions are checked. If this is a partitioned object, and if the specified partition contains subpartitions, then all subpartitions are checked.
object_type	Type of the object to be processed. This must be either <code>TABLE_OBJECT</code> (default) or <code>INDEX_OBJECT</code> . See " Constants ".
repair_table_name	Name of the repair table to be populated. The table must exist in the <code>SYS</code> schema. Use the <code>ADMIN_TABLES</code> Procedure to create a repair table. The default name is <code>REPAIR_TABLE</code> .
flags	Reserved for future use.
relative_fno	Relative file number: Used when specifying a block range.
block_start	First block to process if specifying a block range. May be specified only if the object is a single table, partition, or subpartition.
block_end	Last block to process if specifying a block range. May be specified only if the object is a single table, partition, or subpartition. If only one of <code>block_start</code> or <code>block_end</code> is specified, then the other defaults to the first or last block in the file respectively.
corrupt_count	Number of corruptions reported.

Usage Notes

You may optionally specify a DBA range, partition name, or subpartition name when you want to check a portion of an object.

150.7.3 DUMP_ORPHAN_KEYS Procedure

This procedure reports on index entries that point to rows in corrupt data blocks. For each such index entry encountered, a row is inserted into the specified orphan table.

If the repair table is specified, then any corrupt blocks associated with the base table are handled in addition to all data blocks that are marked software corrupt. Otherwise, only blocks that are marked corrupt are handled.

This information may be useful for rebuilding lost rows in the table and for diagnostic purposes.

Syntax

```
DBMS_REPAIR.DUMP_ORPHAN_KEYS (
  schema_name      IN VARCHAR2,
  object_name      IN VARCHAR2,
  partition_name   IN VARCHAR2      DEFAULT NULL,
  object_type      IN BINARY_INTEGER DEFAULT INDEX_OBJECT,
  repair_table_name IN VARCHAR2      DEFAULT 'REPAIR_TABLE',
  orphan_table_name IN VARCHAR2      DEFAULT 'ORPHAN_KEYS_TABLE',
  flags           IN BINARY_INTEGER DEFAULT NULL,
  key_count       OUT BINARY_INTEGER);
```

Parameters

Table 150-6 DUMP_ORPHAN_KEYS Procedure Parameters

Parameter	Description
schema_name	Schema name.
object_name	Object name.
partition_name	Partition or subpartition name to be processed. If this is a partitioned object, and if <code>partition_name</code> is not specified, then all partitions and subpartitions are processed. If this is a partitioned object, and if the specified partition contains subpartitions, then all subpartitions are processed.
object_type	Type of the object to be processed. The default is <code>INDEX_OBJECT</code> . See " Constants ".
repair_table_name	Name of the repair table that has information regarding corrupt blocks in the base table. The specified table must exist in the <code>SYS</code> schema. The <code>ADMIN_TABLES</code> Procedure is used to create the table.
orphan_table_name	Name of the orphan key table to populate with information regarding each index entry that refers to a row in a corrupt data block. The specified table must exist in the <code>SYS</code> schema. The <code>ADMIN_TABLES</code> Procedure is used to create the table.
flags	Reserved for future use.

Table 150-6 (Cont.) DUMP_ORPHAN_KEYS Procedure Parameters

Parameter	Description
key_count	Number of index entries processed.

150.7.4 FIX_CORRUPT_BLOCKS Procedure

This procedure fixes the corrupt blocks in specified objects based on information in the repair table that was previously generated by the CHECK_OBJECT Procedure.

Prior to effecting any change to a block, the block is checked to ensure the block is still corrupt. Corrupt blocks are repaired by marking the block software corrupt. When a repair is effected, the associated row in the repair table is updated with a fix timestamp.

Syntax

```
DBMS_REPAIR.FIX_CORRUPT_BLOCKS (
  schema_name      IN  VARCHAR2,
  object_name      IN  VARCHAR2,
  partition_name   IN  VARCHAR2      DEFAULT NULL,
  object_type      IN  BINARY_INTEGER DEFAULT TABLE_OBJECT,
  repair_table_name IN  VARCHAR2      DEFAULT 'REPAIR_TABLE',
  flags           IN  BINARY_INTEGER DEFAULT NULL,
  fix_count       OUT BINARY_INTEGER);
```

Parameters

Table 150-7 FIX_CORRUPT_BLOCKS Procedure Parameters

Parameter	Description
schema_name	Schema name.
object_name	Name of the object with corrupt blocks to be fixed.
partition_name	Partition or subpartition name to be processed. If this is a partitioned object, and if partition_name is not specified, then all partitions and subpartitions are processed. If this is a partitioned object, and if the specified partition contains subpartitions, then all subpartitions are processed.
object_type	Type of the object to be processed. This must be either TABLE_OBJECT (default) or INDEX_OBJECT. See " Constants ".
repair_table_name	Name of the repair table with the repair directives. Must exist in the SYS schema.
flags	Reserved for future use.
fix_count	Number of blocks fixed.

Related Topics

- [CHECK_OBJECT Procedure](#)
This procedure checks the specified objects and populates the repair table with information about corruptions and repair directives.

150.7.5 ONLINE_INDEX_CLEAN Function

This function performs a manual cleanup of failed or interrupted online index builds or rebuilds.

This action is also performed periodically by SMON, regardless of user-initiated cleanup.

This function returns `TRUE` if all indexes specified were cleaned up and `FALSE` if one or more indexes could not be cleaned up.

Syntax

```
DBMS_REPAIR.ONLINE_INDEX_CLEAN (
    object_id      IN BINARY_INTEGER DEFAULT ALL_INDEX_ID,
    wait_for_lock  IN BINARY_INTEGER DEFAULT LOCK_WAIT)
RETURN BOOLEAN;
```

Parameters

Table 150-8 ONLINE_INDEX_CLEAN Function Parameters

Parameter	Description
<code>object_id</code>	Object id of index to be cleaned up. The default cleans up all object ids that qualify.
<code>wait_for_lock</code>	This parameter specifies whether to try getting DML locks on underlying table [[sub]partition] object. The default retries up to an internal retry limit, after which the lock get will give up. If <code>LOCK_NOWAIT</code> is specified, then the lock get does not retry.

150.7.6 REBUILD_FREELISTS Procedure

This procedure rebuilds the freelists for the specified object.

All free blocks are placed on the master freelist. All other freelists are zeroed.

If the object has multiple freelist groups, then the free blocks are distributed among all freelists, allocating to the different groups in round-robin fashion.

Syntax

```
DBMS_REPAIR.REBUILD_FREELISTS (
    schema_name    IN VARCHAR2,
    object_name    IN VARCHAR2,
    partition_name IN VARCHAR2 DEFAULT NULL,
    object_type    IN BINARY_INTEGER DEFAULT TABLE_OBJECT);
```

Parameters

Table 150-9 REBUILD_FREELISTS Procedure Parameters

Parameter	Description
<code>schema_name</code>	Schema name.
<code>object_name</code>	Name of the object whose freelists are to be rebuilt.

Table 150-9 (Cont.) REBUILD_FREELISTS Procedure Parameters

Parameter	Description
partition_name	Partition or subpartition name whose freelists are to be rebuilt. If this is a partitioned object, and partition_name is not specified, then all partitions and subpartitions are processed. If this is a partitioned object, and the specified partition contains subpartitions, then all subpartitions are processed.
object_type	Type of the object to be processed. This must be either TABLE_OBJECT (default) or INDEX_OBJECT. See " Constants ".

150.7.7 SEGMENT_FIX_STATUS Procedure

With this procedure you can fix the corrupted state of a bitmap entry. The procedure either recalculates the state based on the current contents of the corresponding block or sets the state to a specific value.

Syntax

```
DBMS_REPAIR.SEGMENT_FIX_STATUS (
    segment_owner  IN VARCHAR2,
    segment_name   IN VARCHAR2,
    segment_type   IN BINARY_INTEGER DEFAULT TABLE_OBJECT,
    file_number    IN BINARY_INTEGER DEFAULT NULL,
    block_number   IN BINARY_INTEGER DEFAULT NULL,
    status_value   IN BINARY_INTEGER DEFAULT NULL,
    partition_name IN VARCHAR2 DEFAULT NULL,);
```

Parameters

Table 150-10 SEGMENT_FIX_STATUS Procedure Parameters

Parameter	Description
schema_owner	Schema name of the segment.
segment_name	Segment name.
partition_name	Optional. Name of an individual partition. NULL for nonpartitioned objects. Default is NULL.
segment_type	Optional Type of the segment (for example, TABLE_OBJECT or INDEX_OBJECT). Default is NULL.
file_number	(optional) The tablespace-relative file number of the data block whose status has to be fixed. If omitted, all the blocks in the segment will be checked for state correctness and fixed.
block_number	(optional) The file-relative block number of the data block whose status has to be fixed. If omitted, all the blocks in the segment will be checked for state correctness and fixed.

Table 150-10 (Cont.) SEGMENT_FIX_STATUS Procedure Parameters

Parameter	Description
status_value	<p>(optional) The value to which the block status described by the <code>file_number</code> and <code>block_number</code> will be set. If omitted, the status will be set based on the current state of the block. This is almost always the case, but if there is a bug in the calculation algorithm, the value can be set manually. Status values:</p> <ul style="list-style-type: none"> • 1 = block is full • 2 = block is 0-25% free • 3 = block is 25-50% free • 4 = block is 50-75% free • 5 = block is 75-100% free <p>The status for bitmap blocks, segment headers, and extent map blocks cannot be altered. The status for blocks in a fixed hash area cannot be altered. For index blocks, there are only two possible states: 1 = block is full and 3 = block has free space.</p>

150.7.8 SKIP_CORRUPT_BLOCKS Procedure

This procedure enables or disables the skipping of corrupt blocks during index and table scans of the specified object.

When the object is a table, skip applies to the table and its indexes. When the object is a cluster, it applies to all of the tables in the cluster, and their respective indexes.



Note:

When Oracle performs an index range scan on a corrupt index after DBMS_REPAIR.SKIP_CORRUPT_BLOCKS has been set for the base table, corrupt branch blocks and root blocks are not skipped. Only corrupt non-root leaf blocks are skipped.

Syntax

```
DBMS_REPAIR.SKIP_CORRUPT_BLOCKS (
  schema_name  IN VARCHAR2,
  object_name  IN VARCHAR2,
  object_type  IN BINARY_INTEGER DEFAULT TABLE_OBJECT,
  flags        IN BINARY_INTEGER DEFAULT SKIP_FLAG);
```

Parameters

Table 150-11 SKIP_CORRUPT_BLOCKS Procedure Parameters

Parameter	Description
schema_name	Schema name of the object to be processed.
object_name	Name of the object.

Table 150-11 (Cont.) SKIP_CORRUPT_BLOCKS Procedure Parameters

Parameter	Description
object_type	Type of the object to be processed. This must be either TABLE_OBJECT (default) or CLUSTER_OBJECT. See "Constants".
flags	If SKIP_FLAG is specified, then it turns on the skip of software corrupt blocks for the object during index and table scans. If NOSKIP_FLAG is specified, then scans that encounter software corrupt blocks return an ORA-1578. See "Constants".

151

DBMS_RESCONFIG

The `DBMS_RESCONFIG` package provides an interface to operate on the resource configuration list, and to retrieve listener information for a resource.

This chapter contains the following topics:

- [Overview](#)
- [Summary of DBMS_RESCONFIG Subprograms](#)



See Also:

Oracle XML DB Developer's Guide for more information about "Resource Configuration".

151.1 DBMS_RESCONFIG Overview

The `DBMS_RESCONFIG` package contains functions and procedures to manage the resource configuration lists of individual resources and the repository.

151.2 Summary of DBMS_RESCONFIG Subprograms

This table lists and briefly describes the `DBMS_RESCONFIG` package subprograms.

Table 151-1 DBMS_RESCONFIG Package Subprograms

Subprogram	Description
ADDREPOSITORYRESCONFIG Procedure	Inserts the resource configuration specified by absolute path at the given position of the repository's configuration list
ADDRESCONFIG Procedure	Inserts the resource configuration specified by the absolute path at the given position in the target resource's configuration list
APPENDRESCONFIG Procedure	Appends the resource configuration specified by rcpath to the target resource's configuration list if it is not already included in the list
DELETEREPOSITORYRESCONFIG Procedure	Removes the configuration at the given position in the repository's configuration list.
DELETERESCONFIG Procedures	Removes the configuration at the given position in the target resource's configuration list.
GETLISTENERS Function	Returns the list of listeners applicable for a given resource
GETREPOSITORYRESCONFIG Function	Returns the resource configuration at the specified position of the repository's configuration list

Table 151-1 (Cont.) DBMS_RESCONFIG Package Subprograms

Subprogram	Description
GETREPOSITORYRESCONFIGPATHS Function	Returns a list of resource configuration paths defined for the repository
GETRESCONFIG Function	Returns the resource configuration at the specified position of the target resource's configuration list
GETRESCONFIGPATHS Function	Returns a list of resource configuration paths defined in the target resource's configuration list
PATCHREPOSITORYRESCONFIGLIST Procedure	Removes invalid references from the repository resource configuration list, and makes the repository available

151.2.1 ADDREPOSITORYRESCONFIG Procedure

This procedure inserts the resource configuration specified by absolute path of the resource configuration at the specified position of the repository's configuration list. It shifts the element currently at that position (if any) and any subsequent elements to the right.

Syntax

```
DBMS_RESCONFIG.ADDREPOSITORYRESCONFIG (
    rcpath    IN    VARCHAR2,
    pos       IN    PLS_INTEGER := NULL);
```

Parameters

Table 151-2 ADDREPOSITORYRESCONFIG Function Parameters

Parameter	Description
rcpath	Absolute path of the resource configuration to be inserted. An exception is raised if <code>rcpath</code> already exists in the target's configuration list.
pos	Index at which the new configuration is to be inserted. If this parameter is not specified then the new configuration is appended to the end of the list. An exception is raised if the index is out of range (<code>pos < 0</code> or <code>pos ></code> the size of the target resource's configuration list).

Usage Notes

- An error is raised if the document referenced by `rcpath` is not based on `XDBResConfig.xsd` schema.
- Users must have `XDBADMIN` role and `READ` privilege on the resource configuration to be inserted; otherwise, an error is returned.

151.2.2 ADDRESCONFIG Procedure

This procedure inserts the resource configuration specified by the absolute path of the resource configuration at the given position in the target resource's configuration list. It

shifts the element currently at that position (if any) and any subsequent elements to the right.

Syntax

```
DBMS_RESCONFIG.ADDRESCONFIG (
    respath    IN    VARCHAR2,
    rcpath     IN    VARCHAR2,
    pos        IN    PLS_INTEGER := NULL);
```

Parameters

Table 151-3 ADDRESCONFIG Function Parameters

Parameter	Description
respath	Absolute path of the target resource
rcpath	Absolute path of the resource configuration to be inserted. An exception is raised if rcpath already exists in the target's configuration list.
pos	Index at which the new configuration is to be inserted. If this parameter is not specified then the new configuration is appended to the end of the list. An exception is raised if the index is out of range ($pos < 0$ or $pos >$ the size of the target resource's configuration list).

Usage Notes

- An error is raised if the document referenced by rcpath is not based on XDBResConfig.xsd schema.
- Users must have WRITE-CONFIG privilege on the target resource and read privilege on the resource configuration to be inserted; otherwise, an error is returned.

151.2.3 APPENDRESCONFIG Procedure

This procedure appends the resource configuration specified by rcpath to the target resource's configuration list if it is not already included in the list.

Syntax

```
DBMS_RESCONFIG.ADDRESCONFIG (
    respath      IN    VARCHAR2,
    rcpath       IN    VARCHAR2,
    appendOption IN    PLS_INTEGER);
```

Parameters

Table 151-4 ADDRESCONFIG Function Parameters

Parameter	Description
respath	Absolute path of the target resource
rcpath	Absolute path of the resource configuration to be appended at the end of the target's configuration list. If rcpath already exists in the list then nothing is appended.

Table 151-4 (Cont.) ADDRESCONFIG Function Parameters

Parameter	Description
appendOption	Either APPEND_RESOURCE or APPEND_RECURSIVE. If APPEND_RESOURCE is specified then only the target resource is affected. If APPEND_RECURSIVE is specified then the target resource and all its descendents will be affected.

Usage Notes

- An error is raised if the document referenced by rcpath is not based on XDBResConfig.xsd schema.
- Users must have WRITE-CONFIG privilege on all affected resources and required read privilege on the resource configuration to be inserted; otherwise, an error is returned.

151.2.4 DELETEREPOSITORYRESCONFIG Procedure

This procedure removes the configuration at the given position in the repository's configuration list. It shifts any subsequent elements to the left.

Syntax

```
DBMS_RESCONFIG.DELETEREPOSITORYRESCONFIG (
    pos          IN    PLS_INTEGER);
```

Parameters

Table 151-5 DELETEREPOSITORYRESCONFIG Function Parameters

Parameter	Description
pos	The index of the configuration to be removed. An exception is raised if the index is out of range (pos < 0 or pos >= the size of the target resource's configuration list).

Usage Notes

- Users must have XDBADMIN role to execute this.
- This statement is treated as if it is a DDL statement. This means the system will implicitly commit before and after this statement.

151.2.5 DELETERESCONFIG Procedures

This procedure removes the configuration at the given position in the target resource's configuration list. It shifts any subsequent elements to the left. Users can use the overloaded for recursive deletion.

Syntax

```
DBMS_RESCONFIG.DELETERESCONFIG (
    respath      IN  VARCHAR2,
    pos          IN  PLS_INTEGER);
```

```
DBMS_RESCONFIG.DELETERESCONFIG (
    respath      IN  VARCHAR2,
    rcpath       IN  VARCHAR2,
    deleteOption IN  PLS_INTEGER);
```

Parameters

Table 151-6 DELETERESCONFIG Procedure Parameters

Parameter	Description
respath	Absolute path of the target resource
pos	The index of the configuration to be removed. An exception is raised if the index is out of range ($pos < 0$ or $pos \geq$ the size of the target resource's configuration list).
rcpath	Absolute path of the resource configuration to be deleted if found in list.
deleteOption	Either <code>DELETE_RESOURCE</code> or <code>DELETE_RECURSIVE</code> . If <code>DELETE_RESOURCE</code> is specified then only the configuration list of the target resource is affected. If <code>DELETE_RECURSIVE</code> is specified then the configuration list of the target resource and all its descendents will be affected.

Usage Notes

Users must have `WRITE-CONFIG` privilege on the target resource to execute this.

151.2.6 GETLISTENERS Function

This function returns the list of listeners applicable for a given resource.

The value returned by this function is an XML document containing the `<event-listeners>` element of the `XDBResconfig.xsd` schema. It contains all the listeners applicable to the target resource, including repository-level listeners. From the returned XML document users can use the `EXTRACT` operator to retrieve the listeners defined for a specific event.

Syntax

```
DBMS_RESCONFIG.GETLISTENERS (
    path  IN  VARCHAR2)
RETURN XMLTYPE;
```

Parameters

Table 151-7 GETLISTENERS Function Parameters

Parameter	Description
path	Absolute path of the target resource

Usage Notes

Users must have the required access privilege on all resource configurations referenced by the repository and the target resource; otherwise, an error is returned.

151.2.7 GETREPOSITORYRESCONFIG Function

This function returns the resource configuration at the specified position of the repository's configuration list.

Syntax

```
DBMS_RESCONFIG.GETREPOSITORYRESCONFIG (
    pos    IN    PLS_INTEGER)
RETURN XMLTYPE;
```

Parameters

Table 151-8 GETREPOSITORYRESCONFIG Function Parameters

Parameter	Description
pos	Index of element to return. An exception is raised if the index is out of range ($pos < 0$ or $pos \geq$ the size of the repository's configuration list).

Usage Notes

Users must have the required read privilege on the requested resource configuration; otherwise, an error is returned.

151.2.8 GETREPOSITORYRESCONFIGPATHS Function

This function returns a list of resource configuration paths defined for the repository.

Syntax

```
DBMS_RESCONFIG.GETREPOSITORYRESCONFIGPATHS
RETURN XDB$STRING_LIST_T;
```

Usage Notes

Users must be able to access all the referenced resource configurations; otherwise, an error is returned.

151.2.9 GETRESCONFIG Function

This function returns the resource configuration at the specified position of the target resource's configuration list.

Syntax

```
DBMS_RESCONFIG.GETRESCONFIG(  
    respath IN VARCHAR2,  
    pos IN PLS_INTEGER)  
RETURN XMLTYPE;
```

Parameters

Table 151-9 GETRESCONFIG Function Parameters

Parameter	Description
respath	Absolute path of the target resource
pos	Index of element to return. An exception is raised if the index is out of range ($pos < 0$ or $pos \geq$ the size of the target resource's configuration list).

Usage Notes

Users must have the required read privilege on the requested resource configuration; otherwise, an error is returned.

151.2.10 GETRESCONFIGPATHS Function

This function returns a list of resource configuration paths defined in the target resource's configuration list.

Syntax

```
DBMS_RESCONFIG.GETRESCONFIGPATHS(  
    respath IN VARCHAR2)  
RETURN XDB$STRING_LIST_T;
```

Parameters

Table 151-10 GETRESCONFIGPATHS Function Parameters

Parameter	Description
respath	Absolute path of the target resource

Usage Notes

Users must be able to access all the referenced resource configurations; otherwise, an error is returned.

151.2.11 PATCHREPOSITORYRESCONFIGLIST Procedure

This procedure removes invalid references from the repository resource configuration list, and makes the repository available.

Under normal circumstances, deletion of a resource configuration resource cannot be performed if it is part of the repository resource configuration list. If, for some reason, the deletion of a resource configuration resource that is part of the repository resource configuration list succeeds, then any repository operation results in a 'dangling reference' error. This procedure removes those invalid references.

This procedure must be run as `SYS`.

Syntax

```
DBMS_RESCONFIG.PATCHREPOSITORYRESCONFIGLIST;
```

DBMS_RESOURCE_MANAGER

The `DBMS_RESOURCE_MANAGER` package maintains plans, consumer groups, and plan directives. It also provides semantics so that you may group together changes to the plan schema.

This chapter contains the following topics:

- [Deprecated Subprograms](#)
- [Security Model](#)
- [Constants](#)
- [Summary of DBMS_RESOURCE_MANAGER Subprograms](#)

See Also:

For more information on using the Database Resource Manager, see *Oracle Database Administrator's Guide*

152.1 DBMS_RESOURCE_MANAGER Deprecated Subprograms

The `SET_INITIAL_CONSUMER_GROUP` Procedure has been deprecated with Oracle Database 11g.

- [SET_INITIAL_CONSUMER_GROUP Procedure](#)

Note:

Oracle recommends that you do not use deprecated procedures in new applications. Support for deprecated features is for backward compatibility only.

152.2 DBMS_RESOURCE_MANAGER Security Model

The invoker must have the `ADMINISTER_RESOURCE_MANAGER` system privilege to execute these procedures.

The procedures to grant and revoke this privilege are in the package [DBMS_RESOURCE_MANAGER_PRIVS](#).

152.3 DBMS_RESOURCE_MANAGER Constants

The `DBMS_RESOURCE_MANAGER` package defines several constants for specifying parameter values.

These are shown in the following table.

Table 152-1 DBMS_RESOURCE_MANAGER Constants

Constant	Type	Value	Description
<code>CLIENT_ID</code>	<code>VARCHAR2 (30)</code>	<code>CLIENT_ID</code>	Client identifier of the session
<code>CLIENT_MACHINE</code>	<code>VARCHAR2 (30)</code>	<code>CLIENT_MACHINE</code>	Name of the computer from which the client is making the connection
<code>CLIENT_OS_USER</code>	<code>VARCHAR2 (30)</code>	<code>CLIENT_OS_USER</code>	Operating system user name of the client that is logging in
<code>CLIENT_PROGRAM</code>	<code>VARCHAR2 (30)</code>	<code>CLIENT_PROGRAM</code>	Name of the client program used to log in to the server
<code>MODULE_NAME</code>	<code>VARCHAR2 (30)</code>	<code>MODULE_NAME</code>	Module name in the currently running application as set by the SET_MODULE Procedure in the DBMS_APPLICATION_INFO package, or the equivalent OCI attribute setting
<code>MODULE_NAME_ACTION</code>	<code>VARCHAR2 (30)</code>	<code>MODULE_NAME_ACTION</code>	A combination of the current module and the action being performed as set by either of the following procedures in the DBMS_APPLICATION_INFO package, or their equivalent OCI attribute setting: <ul style="list-style-type: none"> SET_MODULE Procedure SET_ACTION Procedure The attribute is specified as the module name followed by a period (<code>.</code>), followed by the action name (<code>module_name.action_name</code>).
<code>ORACLE_FUNCTION</code>	<code>VARCHAR2 (30)</code>	<code>ORACLE_FUNCTION</code>	Function the session is currently executing. Valid functions are the <code>BACKUP</code> , <code>COPY</code> , <code>DATALOAD</code> , and <code>INMEMORY</code> . <code>BACKUP</code> is set for sessions that are doing backup operations using <code>RMAN</code> . <code>COPY</code> is set for sessions that are doing image copies using <code>RMAN</code> . <code>DATALOAD</code> is set for sessions that are loading data using Oracle Data Pump.
<code>ORACLE_USER</code>	<code>VARCHAR2 (30)</code>	<code>ORACLE_USER</code>	Oracle Database user name

Table 152-1 (Cont.) DBMS_RESOURCE_MANAGER Constants

Constant	Type	Value	Description
SERVICE_MODULE	VARCHAR2 (30)	SERVICE_MODULE	Combination of service and module names in this form: <i>service_name.module_name</i>
SERVICE_MODULE_ACTION	VARCHAR2 (30)	SERVICE_MODULE_ACTION	Combination of service name, module name, and action name, in this form: <i>service_name.module_name.action_name</i>
SERVICE_NAME	VARCHAR2 (30)	SERVICE_NAME	Service name used by the client to establish a connection

152.4 Summary of DBMS_RESOURCE_MANAGER Subprograms

This table lists the DBMS_RESOURCE_MANAGER subprograms and briefly describes them.

Table 152-2 DBMS_RESOURCE_MANAGER Package Subprograms

Subprogram	Description
BEGIN_SQL_BLOCK Procedure	Indicates the start of a block of SQL statements to be treated as a group by resource manager
CALIBRATE_IO Procedure	Calibrates the I/O capabilities of storage
CLEAR_PENDING_AREA Procedure	Clears the work area for the resource manager
CREATE_CATEGORY Procedure	Creates a new resource consumer group category
CREATE_CDB_PLAN Procedure	Creates entries which define consolidation resource plans.
CREATE_CDB_PLAN_DIRECTIVE Procedure	Creates the plan directives of the consolidation resource plan
CREATE_CDB_PROFILE_DIRECTIVE Procedure	Creates the performance profile directives of the consolidation resource plan
CREATE_CONSUMER_GROUP Procedure	Creates entries which define resource consumer groups
CREATE_PENDING_AREA Procedure	Creates a work area for changes to resource manager objects
CREATE_PLAN Procedure	Creates entries which define resource plans
CREATE_PLAN_DIRECTIVE Procedure	Creates resource plan directives
CREATE_SIMPLE_PLAN Procedure	Creates a single-level resource plan containing up to eight consumer groups in one step
DELETE_CATEGORY Procedure	Deletes an existing resource consumer group category
DELETE_CDB_PLAN Procedure	Deletes the consolidation resource plan
DELETE_CDB_PLAN_DIRECTIVE Procedure	Deletes the plan directive of the consolidation resource plan

Table 152-2 (Cont.) DBMS_RESOURCE_MANAGER Package Subprograms

Subprogram	Description
DELETE_CDB_PROFILE_DIRECTIVE Procedure	Deletes the performance profile directive of the consolidation resource plan
DELETE_CONSUMER_GROUP Procedure	Deletes entries which define resource consumer groups
DELETE_PLAN Procedure	Deletes the specified plan as well as all the plan directives it refers to
DELETE_PLAN_CASCADE Procedure	Deletes the specified plan as well as all its descendants (plan directives, subplans, consumer groups)
DELETE_PLAN_DIRECTIVE Procedure	Deletes resource plan directives
DEQUEUE_PARALLEL_STATEMENT Procedure	Dequeues a parallel statement from the parallel statement queue
END_SQL_BLOCK Procedure	Indicates the end of a block of SQL statements that should be treated as a group by resource manager
SET_CONSUMER_GROUP_MAPPING Procedure	Adds, deletes, or modifies entries for the login and run-time attribute mappings
SET_CONSUMER_GROUP_MAPPING_PRI Procedure	Creates the session attribute mapping priority list
SET_INITIAL_CONSUMER_GROUP Procedure	Assigns the initial resource consumer group for a user (Caution: Deprecated Subprogram)
SUBMIT_PENDING_AREA Procedure	Submits pending changes for the resource manager
SWITCH_CONSUMER_GROUP_FOR_SESS Procedure	Changes the resource consumer group of a specific session
SWITCH_CONSUMER_GROUP_FOR_USER Procedure	Changes the resource consumer group for all sessions with a given user name
SWITCH_PLAN Procedure	Sets the current resource manager plan
UPDATE_CATEGORY Procedure	Updates an existing resource consumer group category
UPDATE_CDB_AUTOTASK_DIRECTIVE Procedure	Updates the plan directives with regard to automated maintenance tasks
UPDATE_CDB_DEFAULT_DIRECTIVE Procedure	Updates the default values for a consolidation plan
UPDATE_CDB_PLAN Procedure	Updates the consolidation resource plan
UPDATE_CDB_PLAN_DIRECTIVE Procedure	Updates the plan directives for a consolidation resource plan
UPDATE_CDB_PROFILE_DIRECTIVE Procedure	Updates the performance profile directives of the consolidation resource plan
UPDATE_CONSUMER_GROUP Procedure	Updates entries which define resource consumer groups
UPDATE_PLAN Procedure	Updates entries which define resource plans
UPDATE_PLAN_DIRECTIVE Procedure	Updates resource plan directives
VALIDATE_PENDING_AREA Procedure	Validates pending changes for the resource manager

152.4.1 BEGIN_SQL_BLOCK Procedure

This procedure, to be used with parallel statement queuing, indicates the start of a block of SQL statements that should be treated as a group by resource manager.

Syntax

```
DBMS_RESOURCE_MANAGER.BEGIN_SQL_BLOCK;
```

Usage Notes

For more information, see "Parallel Statement Queuing" and "Managing Parallel Statement Queuing with Resource Manager" in *Oracle Database VLDB and Partitioning Guide*.

152.4.2 CALIBRATE_IO Procedure

This procedure calibrates the I/O capabilities of storage. Calibration status is available from the `V$IO_CALIBRATION_STATUS` view and results for a successful calibration run are located in `DBA_RSRC_IO_CALIBRATE` table.

Syntax

```
DBMS_RESOURCE_MANAGER.CALIBRATE_IO (
  num_physical_disks    IN PLS_INTEGER DEFAULT 1,
  max_latency           IN PLS_INTEGER DEFAULT 20,
  max_iops              OUT PLS_INTEGER,
  max_mbps              OUT PLS_INTEGER,
  actual_latency        OUT PLS_INTEGER);
```

Parameters

Table 152-3 CALIBRATE_IO Procedure Parameters

Parameter	Description
<code>num_physical_disks</code>	Approximate number of physical disks in the database storage. This parameter is used to determine the initial I/O load for the calibration run.
<code>max_latency</code>	Maximum tolerable latency in milliseconds for database-block-sized IO requests
<code>max_iops</code>	Maximum number of I/O requests per second that can be sustained. The I/O requests are randomly-distributed, database-block-sized reads.
<code>max_mbps</code>	Maximum throughput of I/O that can be sustained, expressed in megabytes per second. The I/O requests are randomly-distributed, 1 megabyte reads.
<code>actual_latency</code>	Average latency of database-block-sized I/O requests at <code>max_iops</code> rate, expressed in milliseconds

Usage Notes

- Only users with the `SYSDBA` privilege can run this procedure. Qualified users must also turn on `timed_statistics`, and ensure `asynch_io` is enabled for datafiles. This can be

achieved by setting `filesystemio_options` to either `ASYNCH` or `SETALL`. One can also query the `asynch_io` status by means of the following SQL statement:

```
col name format a50
SELECT name, asynch_io FROM v$datafile f,v$iostat_file i
  WHERE f.file#      = i.file_no
  AND  filetype_name = 'Data File'
/
```

- Only one calibration can be run at a time. If another calibration is initiated at the same time, it will fail.
- For an Oracle Real Application Clusters (Oracle RAC) database, the workload is simultaneously generated from all instances.
- In a multitenant container database (CDB), calibration can only be run from the CDB root (`CDB$ROOT`).
- Calibration is extremely disruptive to the database performance. It is strongly recommended to run calibration only when database users can tolerate severe deterioration to database performance.
- For optimal calibration results, no other database workloads should be running.



See Also:

Oracle Database Performance Tuning Guide for more information about calibration

Examples

Example of using I/O Calibration procedure

```
SET SERVEROUTPUT ON
DECLARE
  lat NUMBER;
  iops INTEGER;
  mbps INTEGER;
BEGIN
  -- DBMS_RESOURCE_MANAGER.CALIBRATE_IO (<DISKS>, <MAX_LATENCY>, iops, mbps, lat);
  DBMS_RESOURCE_MANAGER.CALIBRATE_IO (2, 10, iops, mbps, lat);

end;
/
```

View for I/O calibration results

```
SQL> desc v$io_calibration_status
Name                                                    Null?    Type
-----
STATUS                                                  VARCHAR2(13)
CALIBRATION_TIME                                       TIMESTAMP(3)

SQL> desc gv$io_calibration_status
Name                                                    Null?    Type
-----
INST_ID                                                NUMBER
STATUS                                                  VARCHAR2(13)
CALIBRATION_TIME                                       TIMESTAMP(3)
```

Column explanation:

STATUS:

IN PROGRESS : Calibration in Progress (Results from previous calibration
run displayed, if available)
READY : Results ready and available from earlier run
NOT AVAILABLE : Calibration results not available.

CALIBRATION_TIME: End time of the last calibration run

DBA table that stores I/O Calibration results

SQL> desc DBA_RSRC_IO_CALIBRATE

Name	Null?	Type
START_TIME		TIMESTAMP(6)
END_TIME		TIMESTAMP(6)
MAX_IOPS		NUMBER
MAX_MBPS		NUMBER
MAX_PMBPS		NUMBER
LATENCY		NUMBER
NUM_PHYSICAL_DISKS		NUMBER

```
comment on table DBA_RSRC_IO_CALIBRATE is
'Results of the most recent I/O calibration'
/
comment on column DBA_RSRC_IO_CALIBRATE.START_TIME is
'start time of the most recent I/O calibration'
/
comment on column DBA_RSRC_IO_CALIBRATE.END_TIME is
'end time of the most recent I/O calibration'
/
comment on column DBA_RSRC_IO_CALIBRATE.MAX_IOPS is
'maximum number of data-block read requests that can be sustained per second'
/
comment on column DBA_RSRC_IO_CALIBRATE.MAX_MBPS is
'maximum megabytes per second of maximum-sized read requests that can be
sustained'
/
comment on column DBA_RSRC_IO_CALIBRATE.MAX_PMBPS is
'maximum megabytes per second of large I/O requests that
can be sustained by a single process'
/
comment on column DBA_RSRC_IO_CALIBRATE.LATENCY is
'latency for data-block read requests'
/
comment on column DBA_RSRC_IO_CALIBRATE.NUM_PHYSICAL_DISKS is
'number of physical disks in the storage subsystem (as specified by user)'
/
```

152.4.3 CLEAR_PENDING_AREA Procedure

This procedure clears pending changes for the resource manager.

Syntax

```
DBMS_RESOURCE_MANAGER.CLEAR_PENDING_AREA;
```

152.4.4 CREATE_CATEGORY Procedure

This procedure creates a new consumer group category. The primary purpose of this attribute is to support Exadata I/O Resource Manager category plans.

The view `DBA_RSRC_CATEGORIES` defines the currently defined categories. The `ADMINISTRATIVE`, `INTERACTIVE`, `BATCH`, `MAINTENANCE`, and `OTHER` categories are available.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_CATEGORY (
  category IN VARCHAR2,
  comment  IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 152-4 CREATE_CATEGORY Procedure Parameters

Parameter	Description
category	Name of consumer group category
comment	User comment

152.4.5 CREATE_CDB_PLAN Procedure

Creates entries which define consolidation resource plans.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_CDB_PLAN (
  plan          IN VARCHAR2(32),
  comment      IN VARCHAR2(2000) DEFAULT NULL);
```

Parameters

Table 152-5 CREATE_CDB_PLAN Procedure Parameters

Parameter	Description
plan	Name of the consolidation plan
comment	User comment

Usage Notes

This procedure can be run only from the CDB root (`CDB$ROOT`).

152.4.6 CREATE_CDB_PLAN_DIRECTIVE Procedure

This procedure creates the plan directives of the consolidation resource plan. Plan directives specify the resource allocation policy for pluggable databases (PDBs).

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_CDB_PLAN_DIRECTIVE (
  plan                IN    VARCHAR2,
  pluggable_database IN    VARCHAR2,
  comment             IN    VARCHAR2 (2000) DEFAULT '',
  shares              IN    NUMBER           DEFAULT NULL,
  utilization_limit   IN    NUMBER           DEFAULT NULL,
  parallel_server_limit IN NUMBER           DEFAULT NULL,
  memory_limit        IN    NUMBER           DEFAULT 100,
  memory_min         IN    NUMBER           DEFAULT 0);
```

Parameters

Table 152-6 CREATE_CDB_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
plan	Name of the consolidation plan
pluggable_database	Name of the PDB
comment	User comment
shares	Specifies the share of resource allocation for the PDB. CPU Resource Manager and Exadata I/O Resource Manager are enabled by specifying shares for each PDB. The <code>shares</code> parameter is also used for Parallel Statement Queuing. If no share is specified, the default is obtained from the default directive, specified through UPDATE_CDB_DEFAULT_DIRECTIVE Procedure .
utilization_limit	Specifies the maximum percentage of the CDB's CPU and Exadata I/O resources that the PDB can utilize. CPU Resource Manager and Exadata I/O Resource Manager can also be limited by setting the <code>CPU_COUNT</code> parameter for the PDB.

Table 152-6 (Cont.) CREATE_CDB_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
<code>parallel_server_limit</code>	<p>Parallel servers that the PDB can use after which parallel statements are queued. Alternatively, you can set the <code>parallel_servers_target</code> at the PDB level.</p> <p>A PDB can set a lower limit for parallel execution servers than the limit specified in the CDB resource plan. When the <code>PARALLEL_SERVERS_TARGET</code> initialization parameter is set in a PDB, and parallel execution server limit is specified for a PDB in the CDB resource plan, then the lower limit is used.</p> <p>For example, assume that the <code>parallel_servers_target</code> initialization parameter is set to 100 in the CDB root and <code>parallel_server_limit</code> is set to 70 for <code>hrpdb</code> in the CDB resource plan. Also, assume that <code>hrpdb</code> has its <code>parallel_servers_target</code> initialization parameter set to 50. In this case, the limit for parallel execution servers for <code>hrpdb</code> is 50, because 50 is lower than the CDB resource plan limit of 70 for <code>hrpdb</code>.</p>
<code>memory_limit</code>	<p>This parameter is only applicable to Oracle Exadata storage for configuring the Exadata Smart Flash Cache and Exadata PMEM Cache.</p>
<code>memory_min</code>	<p>This parameter is only applicable to Oracle Exadata storage for configuring the Exadata Smart Flash Cache and Exadata PMEM Cache.</p>



Note:

Oracle recommends, that you use `parallel_servers_target` parameter instead of `parallel_servers_limit` in a CDB resource plan.

Usage Notes

- The default value for `shares`, `utilization_limit`, and `parallel_server_limit` is NULL. When a user specifies NULL, or does not specify a value, this indicates that the default value should be used.
- This procedure can be run only from the CDB root (`CDB$ROOT`).

152.4.7 CREATE_CDB_PROFILE_DIRECTIVE Procedure

This procedure creates the performance profile directives of the consolidation resource plan. The directives specify the resource allocation policy for pluggable databases (PDBs) that use the performance profile.

For a PDB to use the new performance profile, the PDB must have the `DB_PERFORMANCE_PROFILE` initialization parameter set to the profile name.

This procedure provides an easy way to specify the directive for a large number of PDBs with the same resource requirements. Each PDB with a `DB_PERFORMANCE_PROFILE` initialization parameter set to the performance profile name inherits the settings specified by this directive, including the shares, utilization limit, and so on.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_CDB_PROFILE_DIRECTIVE (
  plan                IN    VARCHAR2,
  profile             IN    VARCHAR2,
  comment            IN    VARCHAR2 (2000) DEFAULT '',
  shares             IN    NUMBER           DEFAULT NULL,
  utilization_limit  IN    NUMBER           DEFAULT NULL,
  parallel_server_limit IN NUMBER           DEFAULT NULL,
  memory_limit       IN    NUMBER           DEFAULT 100,
  memory_min        IN    NUMBER           DEFAULT 0);
```

Parameters

Table 152-7 CREATE_CDB_PROFILE_DIRECTIVE Procedure Parameters

Parameter	Description
plan	Name of the consolidation plan
profile	Name of the performance profile
comment	User comment
shares	Specifies the share of resource allocation for PDBs that use the performance profile. CPU Resource Manager and Exadata I/O Resource Manager are enabled by specifying shares for each PDB. The <code>shares</code> parameter is also used for Parallel Statement Queuing. If no share is specified, the default is obtained from the default directive, specified through UPDATE_CDB_DEFAULT_DIRECTIVE Procedure .
utilization_limit	Specifies the maximum percentage of CPU Resource Manager and Exadata I/O Resource Manager that PDBs that use the performance profile can utilize.
parallel_server_limit	Specifies the maximum percentage of <code>parallel_servers_target</code> parallel servers that PDBs that use the performance profile can use.
memory_limit	This parameter is only applicable to Oracle Exadata storage for configuring the Exadata Smart Flash Cache and Exadata PMEM Cache.
memory_min	This parameter is only applicable to Oracle Exadata storage for configuring the Exadata Smart Flash Cache and Exadata PMEM Cache.

152.4.8 CREATE_CONSUMER_GROUP Procedure

This procedure creates entries which define resource consumer groups.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_CONSUMER_GROUP (
  consumer_group IN VARCHAR2,
  comment        IN VARCHAR2 DEFAULT NULL,
```



```

cpu_mth          IN VARCHAR2 DEFAULT NULL,
mgmt_mth        IN VARCHAR2 DEFAULT 'ROUND-ROBIN',
category        IN VARCHAR2 DEFAULT 'OTHER');

```

Parameters

Table 152-8 CREATE_CONSUMER_GROUP Procedure Parameters

Parameter	Description
consumer_group	Name of the consumer group
comment	User comment
cpu_mth	Name of CPU resource allocation method (deprecated)
mgmt_mth	Name of CPU resource allocation method
category	Describes the category of the consumer group. The primary purpose of this attribute is to support Exadata I/O Resource Manager category plans. The view <code>DBA_RSRC_CATEGORIES</code> defines the currently defined categories. Categories can be modified, using the CREATE_CATEGORY Procedure , UPDATE_CATEGORY Procedure , and DELETE_CATEGORY Procedure .

152.4.9 CREATE_PENDING_AREA Procedure

This procedure makes changes to resource manager objects.

All changes to the plan schema must be done within a pending area. The pending area can be thought of as a "scratch" area for plan schema changes. The administrator creates this pending area, makes changes as necessary, possibly validates these changes, and only when the submit is completed do these changes become active.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_PENDING_AREA;
```

Usage Notes

You may, at any time while the pending area is active, view the current plan schema with your changes by selecting from the appropriate user views.

At any time, you may clear the pending area if you want to stop the current changes. You may also call the `VALIDATE` procedure to confirm whether the changes you have made are valid. You do not have to perform your changes in a given order to maintain a consistent group of entries. These checks are also implicitly done when the pending area is submitted.

Note:

Oracle allows "orphan" consumer groups (in other words, consumer groups that have no plan directives that refer to them). This is in anticipation that an administrator may want to create a consumer group that is not currently being used, but will be used in the future.

For resource plans, the following rules must be adhered to, and they are checked whenever the `validate` or `submit` procedures are executed:

- No plan schema may contain any loops.
- All plans and consumer groups referred to by plan directives must exist.
- All plans must have plan directives that refer to either plans or consumer groups.
- All percentages in any given level must not add up to greater than 100 for the emphasis resource allocation method.
- No plan may be deleted that is currently being used as a top plan by an active instance.
- The plan directive parameter, `parallel_degree_limit_p1`, may only appear in plan directives that refer to consumer groups (that is, not at subplans).
- There cannot be more than 28 plan directives coming from any given plan (that is, no plan can have more than 28 children).
- There cannot be more than 28 consumer groups in any active plan schema.
- Plans and consumer groups use the same namespace; therefore, no plan can have the same name as any consumer group.
- There must be a plan directive for `OTHER_GROUPS` somewhere in any active plan schema. This ensures that a session not covered by the currently active plan is allocated resources as specified by the `OTHER_GROUPS` directive.

 **Note:**

These rules are not applicable for CDB resource plans.

If any of the preceding rules are broken when checked by the `VALIDATE` or `SUBMIT` procedures, then an informative error message is returned. You may then make changes to fix one or more problems and reissue the `validate` or `submit` procedures.

152.4.10 CREATE_PLAN Procedure

This procedure creates entries which define resource plans.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_PLAN (
  plan                IN  VARCHAR2,
  comment             IN  VARCHAR2 DEFAULT NULL,
  cpu_mth             IN  VARCHAR2 DEFAULT NULL, -- deprecated
  active_sess_pool_mth IN  VARCHAR2 DEFAULT 'ACTIVE_SESS_POOL_ABSOLUTE',
  parallel_degree_limit_mth IN  VARCHAR2 DEFAULT
    'PARALLEL_DEGREE_LIMIT_ABSOLUTE',
  queueing_mth       IN  VARCHAR2 DEFAULT 'FIFO_TIMEOUT',
  mgmt_mth           IN  VARCHAR2 DEFAULT 'EMPHASIS',
  sub_plan           IN  BOOLEAN DEFAULT FALSE,
  max_iops           IN  NUMBER DEFAULT NULL,
  max_mbps           IN  NUMBER DEFAULT NULL);
```

Parameters

Table 152-9 CREATE_PLAN Procedure Parameters

Parameter	Description
plan	Name of the resource plan
comment	User comment
cpu_mth	Allocation method for CPU resources (deprecated)
active_sess_pool_mth	Active session pool resource allocation method. Limits the number of active sessions. All other sessions are inactive and wait in a queue to be activated. ACTIVE_SESS_POOL_ABSOLUTE is the default and only method available.
parallel_degree_limit_mth	Resource allocation method for specifying a limit on the degree of parallelism of any operation. PARALLEL_DEGREE_LIMIT_ABSOLUTE is the default and only method available.
queueing_mth	Queuing resource allocation method. Controls order in which queued inactive sessions will execute. FIFO_TIMEOUT is the default and only method available
mgmt_mth	Resource allocation method for specifying how much resources (for example, CPU or I/O) each consumer group or sub-plan gets <ul style="list-style-type: none"> EMPHASIS - for multilevel plans that use percentages to specify how I/O resources are distributed among consumer groups RATIO - for single-level plans that use ratios to specify how I/O resources are distributed
sub_plan	If TRUE, indicates that this plan is only intended for use as a sub-plan. Sub-plans are not required to have an OTHER_GROUPS directive. Default is FALSE.
max_iops	Nonoperative
max_mbps	Nonoperative

Usage Notes

If you want to use any default resource allocation method, then you do not need to specify it when creating or updating a plan.

152.4.11 CREATE_PLAN_DIRECTIVE Procedure

This procedure creates resource plan directives.

Note:

The parameters `max_utilization_limit` and `parallel_target_percentage` are deprecated with Oracle Database 11g Release 1 (11.1.0.1), and are replaced by `utilization_limit` and `parallel_server_limit`.

Syntax

```

DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE (
  plan                IN VARCHAR2,
  group_or_subplan    IN VARCHAR2,
  comment             IN VARCHAR2 DEFAULT NULL,
  cpu_p1              IN NUMBER   DEFAULT NULL, -- deprecated
  cpu_p2              IN NUMBER   DEFAULT NULL, -- deprecated
  cpu_p3              IN NUMBER   DEFAULT NULL, -- deprecated
  cpu_p4              IN NUMBER   DEFAULT NULL, -- deprecated
  cpu_p5              IN NUMBER   DEFAULT NULL, -- deprecated
  cpu_p6              IN NUMBER   DEFAULT NULL, -- deprecated
  cpu_p7              IN NUMBER   DEFAULT NULL, -- deprecated
  cpu_p8              IN NUMBER   DEFAULT NULL, -- deprecated
  active_sess_pool_p1 IN NUMBER   DEFAULT NULL,
  queueing_p1         IN NUMBER   DEFAULT NULL,
  parallel_degree_limit_p1 IN NUMBER DEFAULT NULL,
  switch_group        IN VARCHAR2 DEFAULT NULL,
  switch_time         IN NUMBER   DEFAULT NULL,
  switch_estimate     IN BOOLEAN  DEFAULT FALSE,
  max_est_exec_time   IN NUMBER   DEFAULT NULL,
  undo_pool           IN NUMBER   DEFAULT NULL,
  max_idle_time       IN NUMBER   DEFAULT NULL,
  max_idle_blocker_time IN NUMBER DEFAULT NULL,
  switch_time_in_call IN NUMBER   DEFAULT NULL, -- deprecated
  mgmt_p1             IN NUMBER   DEFAULT NULL,
  mgmt_p2             IN NUMBER   DEFAULT NULL,
  mgmt_p3             IN NUMBER   DEFAULT NULL,
  mgmt_p4             IN NUMBER   DEFAULT NULL,
  mgmt_p5             IN NUMBER   DEFAULT NULL,
  mgmt_p6             IN NUMBER   DEFAULT NULL,
  mgmt_p7             IN NUMBER   DEFAULT NULL,
  mgmt_p8             IN NUMBER   DEFAULT NULL,
  switch_io_megabytes IN NUMBER   DEFAULT NULL,
  switch_io_reqs      IN NUMBER   DEFAULT NULL,
  switch_for_call     IN BOOLEAN  DEFAULT NULL,
  max_utilization_limit IN NUMBER DEFAULT NULL, -- deprecated
  parallel_target_percentage IN NUMBER DEFAULT NULL, -- deprecated
  parallel_server_limit IN NUMBER DEFAULT NULL,
  utilization_limit   IN NUMBER   DEFAULT NULL,
  switch_io_logical   IN NUMBER   DEFAULT NULL,
  switch_elapsed_time IN NUMBER   DEFAULT NULL,
  shares              IN NUMBER   DEFAULT NULL,
  parallel_stmt_critical IN VARCHAR2 DEFAULT NULL,
  session_pga_limit   IN NUMBER   DEFAULT NULL,
  pq_timeout_action   IN NUMBER   DEFAULT NULL,
  parallel_queue_timeout IN NUMBER DEFAULT NULL,);

```

**Note:**

Oracle recommends that you use shares instead of mgmt_p*.

Parameters

Table 152-10 CREATE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
plan	Name of the resource plan
group_or_subplan	Name of the consumer group or subplan
comment	Comment for the plan directive
cpu_p1	-- deprecated: use mgmt_p1 or, even better, shares instead
cpu_p2	-- deprecated: use mgmt_p2 or, even better, shares instead
cpu_p3	-- deprecated: use mgmt_p3 or, even better, shares instead
cpu_p4	-- deprecated: use mgmt_p4 or, even better, shares instead
cpu_p5	-- deprecated: use mgmt_p5 or, even better, shares instead
cpu_p6	-- deprecated: use mgmt_p6 or, even better, shares instead
cpu_p7	-- deprecated: use mgmt_p7 or, even better, shares instead
cpu_p8	-- deprecated: use mgmt_p8 or, even better, shares instead
active_sess_pool_p1	Specifies maximum number of sessions that can currently have an active call
queueing_p1	Specified time (in seconds) after which a call in the inactive session queue (waiting for execution) will time out. Default is NULL, which means unlimited.
parallel_degree_limit_p1	Specifies a limit on the degree of parallelism for any operation. Default is NULL, which means unlimited. If the value is 0, then all operations will be serial.
switch_group	Specifies consumer group to switch to, once a switch condition is met. If the group name is CANCEL_SQL, then the current call is canceled when the switch condition is met. If the group name is KILL_SESSION, then the session is killed when the switch condition is met. If the group name is LOG_ONLY, then no action is taken other than recording this event via SQL monitor. Default is NULL.
switch_time	Specifies the time on CPU (not elapsed time) that a session can execute before an action is taken. Default is NULL, which means unlimited. As with other switch directives, if switch_for_call is TRUE, the number of CPUs is accumulated from the start of a call. Otherwise, the number of CPUs is accumulated for the length of the session.
switch_estimate	If TRUE, tells Oracle to use its execution time estimate to automatically switch the consumer group of an operation before beginning its execution. This is used in conjunction with the switch_time directive. Default value is FALSE.
max_est_exec_time	Specifies the maximum execution time (in CPU seconds) allowed for a session. If the optimizer estimates that an operation will take longer than MAX_EST_EXEC_TIME, the operation is not started and ORA-07455 is issued. If the optimizer does not provide an estimate, this directive has no effect. Default is NULL, which means unlimited.

Table 152-10 (Cont.) CREATE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
undo_pool	Limits the size in kilobytes of the undo records corresponding to uncommitted transactions by this consumer group
max_idle_time	Indicates the maximum session idle time. Default is NULL, which means unlimited.
max_idle_blocker_time	Maximum amount of time in seconds that a session can be idle while blocking another session's acquisition of a resource
switch_time_in_call	Deprecated. If this parameter is specified, <code>switch_time</code> is set to <code>switch_time_in_call</code> (in seconds) and <code>switch_for_call</code> is effectively set to TRUE. It is better to use <code>switch_time</code> and <code>switch_for_call</code> .
mgmt_p1	Resource allocation value for level 1 (replaces <code>cpu_p1</code>): <ul style="list-style-type: none"> EMPHASIS - specifies the resource percentage at the first level RATIO - specifies the weight of resource usage
mgmt_p2	Resource allocation value for level 2 (replaces <code>cpu_p2</code>): <ul style="list-style-type: none"> EMPHASIS - specifies the resource percentage at the second level RATIO - non-applicable
mgmt_p3	Resource allocation value for level 3 (replaces <code>cpu_p3</code>): <ul style="list-style-type: none"> EMPHASIS - specifies the resource percentage at the third level RATIO - non-applicable
mgmt_p4	Resource allocation value for level 4 (replaces <code>cpu_p4</code>): <ul style="list-style-type: none"> EMPHASIS - specifies the resource percentage at the fourth level RATIO - non-applicable
mgmt_p5	Resource allocation value for level 5 (replaces <code>cpu_p5</code>): <ul style="list-style-type: none"> EMPHASIS - specifies the resource percentage at the fifth level RATIO - non-applicable
mgmt_p6	Resource allocation value for level 6 (replaces <code>cpu_p6</code>): <ul style="list-style-type: none"> EMPHASIS - specifies the resource percentage at the sixth level RATIO - non-applicable
mgmt_p7	Resource allocation value for level 7 (replaces <code>cpu_p7</code>): <ul style="list-style-type: none"> EMPHASIS - specifies the resource percentage at the seventh level RATIO - non-applicable
mgmt_p8	Resource allocation value for level 8 (replaces <code>cpu_p8</code>): <ul style="list-style-type: none"> EMPHASIS - specifies the resource percentage at the eighth level RATIO - non-applicable

Table 152-10 (Cont.) CREATE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
<code>switch_io_megabytes</code>	Specifies the amount of I/O (in MB) that a session can issue before an action is taken. Default is <code>NULL</code> , which means unlimited. As with other switch directives, if <code>switch_for_call</code> is <code>TRUE</code> , the number of CPUs is accumulated from the start of a call. Otherwise, the number of CPUs is accumulated for the length of the session.
<code>switch_io_reqs</code>	Specifies the number of I/O requests that a session can issue before an action is taken. Default is <code>NULL</code> , which means unlimited. As with other switch directives, if <code>switch_for_call</code> is <code>TRUE</code> , the number of CPUs is accumulated from the start of a call. Otherwise, the number of CPUs is accumulated for the length of the session.
<code>switch_for_call</code>	Specifies that if an action is taken because of the <code>switch_time</code> , <code>switch_io_megabytes</code> , <code>switch_io_reqs</code> , <code>switch_io_logical</code> or <code>switch_elapsed_time</code> parameters, the consumer group is restored to its original consumer group at the end of the top call. Default is <code>NULL</code> , which means that the original consumer group is not restored at the end of the top call.
<code>max_utilization_limit</code>	-- deprecated: use <code>utilization_limit</code> instead
<code>parallel_target_percentage</code>	-- deprecated: use <code>parallel_sever_limit</code> instead
<code>parallel_queue_timeout</code>	Specifies the time (in seconds) that a parallel statement may remain in its Consumer Group's parallel statement queue before it is removed and terminated with an error (ORA- 07454).

 **Note:**

You can use the `pq_timeout_action` parameter to specify the action to be taken when a parallel statement is removed from the queue.

`parallel_sever_limit` Specifies the maximum percentage of `parallel_servers_target` parallel servers that the Consumer Group can use, after which parallel statements are queued.

`utilization_limit` Resource limit. Currently it includes CPU and I/O for Exadata. For CPU, this limits the CPU utilization for the consumer group. For Exadata I/O, this limits the disk utilization for the consumer group. This does not apply to parallel servers.

`switch_io_logical` Number of logical IOs that will trigger the action specified by `switch_group`. As with other switch directives, if `switch_for_call` is `TRUE`, the number of logical IOs is accumulated from the start of a call. Otherwise, the number of logical IOs is accumulated for the length of the session.

Table 152-10 (Cont.) CREATE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
<code>switch_elapsed_time</code>	Elapsed time that will trigger the action specified by <code>switch_group</code> . As with other switch directives, if <code>switch_for_call</code> is <code>TRUE</code> , the elapsed time is accumulated from the start of a call. Otherwise, the elapsed time is accumulated for the length of the session.
<code>shares</code>	Specifies the share of resource allocation for the consumer group. CPU Resource Manager and Exadata I/O Resource Manager are enabled by specifying shares for each consumer group. The <code>shares</code> parameter is also used for Parallel Statement Queuing. If CPU Resource Manager and Exadata I/O Resource Manager are enabled, then the default value is 1.
<code>parallel_stmt_critical</code>	<p>If set to <code>BYPASS_QUEUE</code>, parallel statements from the Consumer Group are not queued, regardless of the <code>PARALLEL_DEGREE_POLICY</code> parameter value.</p> <p>If set to <code>QUEUE</code>, all the parallel statements from the consumer group, irrespective of the <code>parallel_degree_policy</code> parameter value, are eligible for queuing.</p> <p>Default is <code>FALSE</code>, which means that parallel statements are eligible for queuing, based on the <code>parallel_degree_policy</code> parameter value.</p>
<code>session_pga_limit</code>	<p>Maximum amount of untunable PGA (in MB) that a session in this consumer group can allocate before being terminated. <code>NULL</code> (default) indicates no limit.</p> <p>SQL operations that allocate tunable PGA (operations that can opt to use temp space) are not controlled by this limit.</p>
<code>pq_timeout_action</code>	<p>Specifies the action to be taken when a parallel statement is removed from the queue due to <code>parallel_queue_timeout</code>.</p> <p>The values are:</p> <ul style="list-style-type: none"> <code>CANCEL</code> — The parallel statement is terminated with error <code>ORA-7454</code> <code>RUN</code> — The SQL statement runs immediately, and might get downgraded if parallel servers are unavailable <p>The default action of this parameter is <code>CANCEL</code>.</p>

Usage Notes

- All parameters default to `NULL`.
- For `max_idle_time` and `max_idle_blocker_time`, PMON will check these limits once a minute. If it finds a session that has exceeded one of the limits, it will forcibly kill the session and clean up all its state.
- The parameter `switch_for_call` is mostly useful for three-tier applications where the mid-tier server is implementing session pooling. By using `switch_for_call`, the resource usage of one client will not affect a future client that happens to be executed on the same session.
- An error is thrown if `PQ_TIMEOUT_ACTION` is specified, but `PARALLEL_QUEUE_TIMEOUT` is not specified.
- Specifies the action to be taken when a parallel statement is removed from the queue.

152.4.12 CREATE_SIMPLE_PLAN Procedure

This procedure creates a single-level resource plan containing up to eight consumer groups in one step. You do not need to create a pending area manually before creating a resource plan, or use the `CREATE_CONSUMER_GROUP` and `CREATE_RESOURCE_PLAN_DIRECTIVES` procedures separately.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_SIMPLE_PLAN (
  simple_plan      IN VARCHAR2 DEFAULT NULL,
  consumer_group1 IN VARCHAR2 DEFAULT NULL,
  group1_cpu       IN NUMBER   DEFAULT NULL,    -- deprecated
  consumer_group2 IN VARCHAR2 DEFAULT NULL,
  group2_cpu       IN NUMBER   DEFAULT NULL,    -- deprecated
  consumer_group3 IN VARCHAR2 DEFAULT NULL,
  group3_cpu       IN NUMBER   DEFAULT NULL,    -- deprecated
  consumer_group4 IN VARCHAR2 DEFAULT NULL,
  group4_cpu       IN NUMBER   DEFAULT NULL,    -- deprecated
  consumer_group5 IN VARCHAR2 DEFAULT NULL,
  group5_cpu       IN NUMBER   DEFAULT NULL,    -- deprecated
  consumer_group6 IN VARCHAR2 DEFAULT NULL,
  group6_cpu       IN NUMBER   DEFAULT NULL,    -- deprecated
  consumer_group7 IN VARCHAR2 DEFAULT NULL,
  group7_cpu       IN NUMBER   DEFAULT NULL,    -- deprecated
  consumer_group8 IN VARCHAR2 DEFAULT NULL,
  group8_cpu       IN NUMBER   DEFAULT NULL,    -- deprecated
  group1_percent  IN NUMBER   DEFAULT NULL,
  group2_percent  IN NUMBER   DEFAULT NULL,
  group3_percent  IN NUMBER   DEFAULT NULL,
  group4_percent  IN NUMBER   DEFAULT NULL,
  group5_percent  IN NUMBER   DEFAULT NULL,
  group6_percent  IN NUMBER   DEFAULT NULL,
  group7_percent  IN NUMBER   DEFAULT NULL,
  group8_percent  IN NUMBER   DEFAULT NULL);
```

Parameters

Table 152-11 CREATE_SIMPLE_PLAN Procedure Parameters

Parameter	Description
<code>simple_plan</code>	Name of the resource plan
<code>consumer_group1</code>	Name of the consumer group
<code>group1_cpu</code>	Percentage for group (deprecated)
<code>consumer_group2</code>	Name of the consumer group
<code>group2_cpu</code>	Percentage for group (deprecated)
<code>consumer_group3</code>	Name of the consumer group
<code>group3_cpu</code>	Percentage for group (deprecated)
<code>consumer_group4</code>	Name of the consumer group
<code>group4_cpu</code>	Percentage for group (deprecated)
<code>consumer_group5</code>	Name of the consumer group

Table 152-11 (Cont.) CREATE_SIMPLE_PLAN Procedure Parameters

Parameter	Description
group5_cpu	Percentage for group (deprecated)
consumer_group6	Name of the consumer group
group6_cpu	Percentage for group (deprecated)
consumer_group7	Name of the consumer group
group7_cpu	Percentage for group (deprecated)
consumer_group8	OTHER_GROUPS - all sessions that aren't mapped to a consumer group.
group8_cpu	Percentage for group (deprecated)
group1_percent	Percentage of resources allocated for this consumer group
group2_percent	Percentage of resources allocated for this consumer group
group3_percent	Percentage of resources allocated for this consumer group
group4_percent	Percentage of resources allocated for this consumer group
group5_percent	Percentage of resources allocated for this consumer group
group6_percent	Percentage of resources allocated for this consumer group
group7_percent	Percentage of resources allocated for this consumer group
group8_percent	Percentage of resources allocated to other groups

152.4.13 DELETE_CATEGORY Procedure

This procedure deletes an existing resource consumer group category.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_CATEGORY (
    category      IN    VARCHAR2);
```

Parameters

Table 152-12 DELETE_CATEGORY Procedure Parameters

Parameter	Description
category	Name of consumer group category

152.4.14 DELETE_CDB_PLAN Procedure

This procedure deletes the consolidation resource plan.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_CDB_PLAN (
    plan      IN    VARCHAR2(32)  DEFAULT NULL);
```

Parameters

Table 152-13 DELETE_CDB_PLAN Procedure Parameters

Parameter	Description
plan	Name of the consolidation plan

Usage Notes

This procedure can be run only from the CDB root (CDB\$ROOT).

152.4.15 DELETE_CDB_PLAN_DIRECTIVE Procedure

This procedure deletes the plan directives of the consolidation resource plan. Once the plan directive is deleted, the pluggable database will get the default resource allocation.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_CDB_PLAN_DIRECTIVE (
    plan                IN    VARCHAR2 (32)  DEFAULT NULL,
    pluggable_database  IN    VARCHAR2 (32)  DEFAULT NULL);
```

Parameters

Table 152-14 DELETE_CDB_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
plan	Name of the consolidation plan
pluggable_database	Name of the pluggable database in which the plan directive is to be deleted

Usage Notes

This procedure can be run only from the CDB root (CDB\$ROOT).

152.4.16 DELETE_CDB_PROFILE_DIRECTIVE Procedure

This procedure deletes the performance profile directive of the consolidation resource plan. Once the directive is deleted, the pluggable databases (PDBs) that use the performance profile use the default resource allocation.

For a PDB to use a performance profile, the PDB must have the DB_PERFORMANCE_PROFILE initialization parameter set to the performance profile name.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_CDB_PROFILE_DIRECTIVE (
    plan                IN    VARCHAR2 (32)  DEFAULT NULL,
    profile             IN    VARCHAR2 (32)  DEFAULT NULL);
```

Parameters**Table 152-15 DELETE_CDB_PROFILE_DIRECTIVE Procedure Parameters**

Parameter	Description
plan	Name of the consolidation plan
profile	Name of the performance profile directive to be deleted

Usage Notes

This procedure can be run only from the CDB root (CDB\$ROOT).

152.4.17 DELETE_CONSUMER_GROUP Procedure

This procedure deletes entries which define resource consumer groups.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_CONSUMER_GROUP (
    consumer_group IN VARCHAR2);
```

Parameters**Table 152-16 DELETE_CONSUMER_GROUP Procedure Parameters**

Parameters	Description
consumer_group	Name of the consumer group to be deleted

152.4.18 DELETE_PLAN Procedure

This procedure deletes the specified plan as well as all the plan directives to which it refers.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_PLAN (
    plan IN VARCHAR2);
```

Parameters**Table 152-17 DELETE_PLAN Procedure Parameters**

Parameter	Description
plan	Name of the resource plan to delete

152.4.19 DELETE_PLAN_CASCADE Procedure

This procedure deletes the specified plan and all of its descendants (plan directives, subplans, consumer groups). Mandatory objects and directives are not deleted.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_PLAN_CASCADE (
    plan IN VARCHAR2);
```

Parameters

Table 152-18 DELETE_PLAN_CASCADE Procedure Parameters

Parameters	Description
plan	Name of the plan

Usage Notes

If DELETE_PLAN_CASCADE encounters any error, then it rolls back the operation, and nothing is deleted.

152.4.20 DELETE_PLAN_DIRECTIVE Procedure

This procedure deletes resource plan directives.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_PLAN_DIRECTIVE (
    plan          IN VARCHAR2,
    group_or_subplan IN VARCHAR2);
```

Parameters

Table 152-19 DELETE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
plan	Name of the resource plan
group_or_subplan	Name of the group or subplan

152.4.21 DEQUEUE_PARALLEL_STATEMENT Procedure

This procedure dequeues a parallel statement from the parallel statement queue.

If the PARALLEL_DEGREE_POLICY initialization parameter is set to AUTO or ADAPTIVE, then parallel statement queuing is enabled. If a parallel statement is in the parallel statement queue, then you can use this procedure to dequeue the parallel statement so that it runs immediately.

Syntax

```
DBMS_RESOURCE_MANAGER.DEQUEUE_PARALLEL_STATEMENT (
  session_id      IN PLS_INTEGER,
  session_serial  IN PLS_INTEGER,
  inst_id         IN PLS_INTEGER DEFAULT NULL,
  sql_id          IN VARCHAR2 DEFAULT NULL);
```

Parameters**Table 152-20 DEQUEUE_PARALLEL_STATEMENT Procedure Parameters**

Parameter	Description
session_id	The session id of the session running the parallel statement to be dequeued.
session_serial	The serial number of the session.
inst_id	Instance ID where the session is running. If NULL, then the current instance is used.
sql_id	The SQL ID of the session's statement to dequeue. If the session is running SQL with a different SQL ID, then the statement is not dequeued.

152.4.22 END_SQL_BLOCK Procedure

This procedure, to be used with parallel statement queuing, indicates the end of a block of SQL statements that should be treated as a group by resource manager.

Syntax

```
DBMS_RESOURCE_MANAGER.END_SQL_BLOCK;
```

Usage Notes

For more information, see "Parallel Statement Queuing" and "Managing Parallel Statement Queuing with Resource Manager" in *Oracle Database VLDB and Partitioning Guide*.

152.4.23 SET_CONSUMER_GROUP_MAPPING Procedure

This procedure adds, deletes, or modifies entries that map sessions to consumer groups, based on the session's login and runtime attributes.

Syntax

```
DBMS_RESOURCE_MANAGER.SET_CONSUMER_GROUP_MAPPING (
  attribute      IN VARCHAR2,
  value          IN VARCHAR2,
  consumer_group IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 152-21 SET_CONSUMER_GROUP_MAPPING Procedure Parameters

Parameters	Description
attribute	Mapping attribute to add or modify. It can be one of the Constants listed.
value	Attribute value to match. This includes both absolute mapping and regular expressions.
consumer_group	Name of the mapped consumer group, or NULL to delete a mapping

Usage Notes

- If no mapping exists for the given attribute and value, a mapping to the given consumer group will be created. If a mapping already exists for the given attribute and value, the mapped consumer group will be updated to the one given. If the `consumer_group` argument is NULL, then any mapping from the given attribute and value will be deleted.
- The subprogram supports simple regex expressions for the `value` parameter. It implements the same semantics as the SQL 'LIKE' operator. Specifically, it uses '%' as a multicharacter wildcard and '_' as a single character wildcard. The '\' character can be used to escape the wildcards. Note that wildcards can only be used if the attribute is one of the following:

- CLIENT_OS_USER
- CLIENT_PROGRAM
- CLIENT_MACHINE
- MODULE_NAME
- MODULE_NAME_ACTION
- SERVICE_MODULE
- SERVICE_MODULE_ACTION

- Consumer group mapping comparisons for `DBMS_RESOURCE_MANAGER.CLIENT_PROGRAM` are performed by stripping the @ sign and following characters from `V$SESSION.PROGRAM` before comparing it to the `CLIENT_PROGRAM` value supplied.

152.4.24 SET_CONSUMER_GROUP_MAPPING_PRI Procedure

Multiple attributes of a session can be used to map the session to a consumer group. This procedure prioritizes the attribute mappings.

Syntax

```
DBMS_RESOURCE_MANAGER.SET_CONSUMER_GROUP_MAPPING_PRI (
    explicit          IN NUMBER,
    oracle_user       IN NUMBER,
    service_name      IN NUMBER,
    client_os_user    IN NUMBER,
```

```

client_program      IN NUMBER,
client_machine     IN NUMBER,
module_name        IN NUMBER,
module_name_action IN NUMBER,
service_module     IN NUMBER,
service_module_action IN NUMBER,
client_id          IN NUMBER DEFAULT 11);

```

Parameters

Table 152-22 SET_CONSUMER_GROUP_MAPPING_PRI Procedure Parameters

Parameters	Description
explicit	Priority of the explicit mapping
oracle_user	Priority of the Oracle user name mapping
service_name	Priority of the client service name mapping
client_os_user	Priority of the client operating system user name mapping
client_program	Priority of the client program mapping
client_machine	Priority of the client machine mapping
module_name	Priority of the application module name mapping
module_name_action	Priority of the application module name and action mapping
service_module	Priority of the service name and application module name mapping
module_name_action	Priority of the service name, application module name, and application action mapping
client_id	Client identifier

Usage Notes

- This procedure requires that you include the pseudo-attribute `explicit` as an argument. It must be set to 1. It indicates that explicit consumer group switches have the highest priority. You explicitly switch consumer groups with these package procedures:
 - `DBMS_SESSION.SWITCH_CURRENT_CONSUMER_GROUP`
 - `DBMS_RESOURCE_MANAGER.SWITCH_CONSUMER_GROUP_FOR_SESS`
 - `DBMS_RESOURCE_MANAGER.SWITCH_CONSUMER_GROUP_FOR_USER`
- Each priority value must be a unique integer from 1 to 11. Together, they establish an ordering where 1 is the highest priority and 11 is the lowest.

152.4.25 SET_INITIAL_CONSUMER_GROUP Procedure

This deprecated procedure sets the initial resource consumer group for a user.

The initial consumer group of a user is the consumer group to which any session created by that user initially belongs.

 **Note:**

This procedure is deprecated in Release 11gR1. While the procedure remains available in the package, Initial Consumer Group is set by the session-to-consumer group mapping rules.

Syntax

```
DBMS_RESOURCE_MANAGER.SET_INITIAL_CONSUMER_GROUP (
    user          IN  VARCHAR2,
    consumer_group IN  VARCHAR2);
```

Parameters

Table 152-23 SET_INITIAL_CONSUMER_GROUP Procedure Parameters

Parameters	Description
user	Name of the user
consumer_group	User's initial consumer group

Usage Notes

- The ADMINISTER_RESOURCE_MANAGER or the ALTER USER system privilege are required to be able to execute this procedure. The user, or PUBLIC, must be directly granted switch privilege to a consumer group before it can be set to be the user's initial consumer group. Switch privilege for the initial consumer group cannot come from a role granted to that user.

 **Note:**

These semantics are similar to those for ALTER USER DEFAULT ROLE.

- If the initial consumer group for a user has never been set, then the user's initial consumer group is automatically the consumer group: DEFAULT_CONSUMER_GROUP.
- DEFAULT_CONSUMER_GROUP has switch privileges granted to PUBLIC; therefore, all users are automatically granted switch privilege for this consumer group. Upon deletion of a consumer group, all users having the deleted group as their initial consumer group now have DEFAULT_CONSUMER_GROUP as their initial consumer group. All currently active sessions belonging to a deleted consumer group are switched to DEFAULT_CONSUMER_GROUP.

152.4.26 SUBMIT_PENDING_AREA Procedure

This procedure submits pending changes for the resource manager. It clears the pending area after validating and committing the changes (if valid).



Note:

A call to `SUBMIT_PENDING_AREA` may fail even if `VALIDATE_PENDING_AREA` succeeds. This may happen if a plan being deleted is loaded by an instance after a call to `VALIDATE_PENDING_AREA`, but before a call to `SUBMIT_PENDING_AREA`.

Syntax

```
DBMS_RESOURCE_MANAGER.SUBMIT_PENDING_AREA;
```

152.4.27 SWITCH_CONSUMER_GROUP_FOR_SESS Procedure

This procedure changes the resource consumer group of a specific session. It also changes the consumer group of any parallel execution servers that are related to the top user session. This procedure is RAC instance specific. You need to connect to the PDB in same RAC instance where the session to be switched is running, and then run this procedure.

Syntax

```
DBMS_RESOURCE_MANAGER.SWITCH_CONSUMER_GROUP_FOR_SESS (
    session_id      IN NUMBER,
    session_serial  IN NUMBER,
    consumer_group  IN VARCHAR2);
```

Parameters

Table 152-24 SWITCH_CONSUMER_GROUP_FOR_SESS Procedure Parameters

Parameter	Description
<code>session_id</code>	SID column from the view <code>V\$SESSION</code>
<code>session_serial</code>	SERIAL# column from view <code>V\$SESSION</code> .
<code>consumer_group</code>	Name of the consumer group to which to switch

152.4.28 SWITCH_CONSUMER_GROUP_FOR_USER Procedure

This procedure changes the resource consumer group for all sessions with a given user ID. It also changes the consumer group of any parallel execution servers that are related to the top user session.

Syntax

```
DBMS_RESOURCE_MANAGER.SWITCH_CONSUMER_GROUP_FOR_USER (
    user            IN VARCHAR2,
    consumer_group  IN VARCHAR2);
```

Parameters

Table 152-25 SWITCH_CONSUMER_GROUP_FOR_USER Procedure Parameters

Parameter	Description
user	Name of the user
consumer_group	Name of the consumer group to which to switch

Usage Notes

- The [SWITCH_CONSUMER_GROUP_FOR_SESS Procedure](#) and the SWITCH_CONSUMER_GROUP_FOR_USER procedures let you raise or lower the allocation of CPU resources of certain sessions or users. This provides a functionality similar to the nice command on UNIX.
- These procedures cause the session to be moved into the newly specified consumer group immediately.

152.4.29 SWITCH_PLAN Procedure

This procedure sets the current resource manager plan.

Syntax

```
DBMS_RESOURCE_MANAGER.SWITCH_PLAN(
    plan_name          IN   VARCHAR2,
    sid                IN   VARCHAR2 DEFAULT '*',
    allow_scheduler_plan_switches IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 152-26 SWITCH_PLAN Procedure Parameters

Parameter	Description
plan_name	Name of the plan to which to switch. Passing in an empty string ("") for the plan_name, disables the resource manager
sid	The sid parameter is relevant only in an Oracle Real Application Clusters environment. This parameter lets you change the plan for a particular instance. Specify the sid of the instance where you want to change the plan. Or specify '*' if you want Oracle to change the plan for all instances.
allow_scheduler_plan_switches	FALSE - disables automated plan switches by the job scheduler at window boundaries. To reenale automated plan switches, switch_plan must be called again by the administrator with allow_scheduler_plan_switches set to TRUE. By default automated plan switches by the job scheduler are enabled.

152.4.30 UPDATE_CATEGORY Procedure

This procedure updates an existing resource consumer group category.

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_CATEGORY (
    category      IN    VARCHAR2,
    new_comment   IN    VARCHAR2  DEFAULT NULL);
```

Parameters

Table 152-27 UPDATE_CATEGORY Procedure Parameters

Parameter	Description
category	Name of consumer group category
new_comment	User comment

Usage Notes

To clear (reset to the directive's default value), use the value -1.

152.4.31 UPDATE_CDB_AUTOTASK_DIRECTIVE Procedure

This procedure updates the plan directives with regard to automated maintenance tasks in the CDB root (CDB\$ROOT).

By default, all maintenance tasks occur directly in the PDBs themselves.

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_CDB_AUTOTASK_DIRECTIVE (
    plan                IN    VARCHAR2,
    new_comment         IN    VARCHAR2  DEFAULT NULL,
    new_shares          IN    NUMBER    DEFAULT NULL,
    new_utilization_limit IN    NUMBER    DEFAULT NULL,
    new_parallel_server_limit IN    NUMBER    DEFAULT NULL,
    new_memory_limit    IN    NUMBER    DEFAULT NULL,
    new_memory_min      IN    NUMBER    DEFAULT NULL);
```

Parameters

Table 152-28 UPDATE_CDB_AUTOTASK_DIRECTIVE Procedure Parameters

Parameter	Description
plan	Name of the consolidation plan
new_comment	New user comment
new_shares	Specifies the new share of resource allocation for CDB root's automated maintenance tasks
new_utilization_limit	Specifies the new maximum percentage of CPU that automated maintenance tasks in the CDB root can utilize

Table 152-28 (Cont.) UPDATE_CDB_AUTOTASK_DIRECTIVE Procedure Parameters

Parameter	Description
<code>new_parallel_server_limit</code>	Specifies the new maximum percentage of <code>parallel_servers_target</code> parallel servers that automated maintenance tasks in the CDB root are allowed to use
<code>new_memory_limit</code>	This parameter is only applicable to Oracle Exadata storage for configuring the Database Smart Flash Cache and PMEM Cache.
<code>new_memory_min</code>	This parameter is only applicable to Oracle Exadata storage for configuring the Database Smart Flash Cache and PMEM Cache.

Usage Notes

- By default for automated maintenance tasks, the values are
 - `shares`: -1
 - `utilization_limit`: 90
 - `parallel_server_limit`: 100
- The `shares = -1` means that the automated maintenance tasks get an allocation of 20% of the system. If the user specifies the `shares`, it behaves the same properties as the other CDB plan directive functions. If the user does not change the `shares` or later changes it back to -1, autotask will get 20% of the system.
- This procedure can be run only from the CDB root.
- To clear (reset to the directive's default value), use the value -1.

152.4.32 UPDATE_CDB_DEFAULT_DIRECTIVE Procedure

This procedure updates the plan directives of the consolidation resource plan.

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_CDB_DEFAULT_DIRECTIVE (
    plan                IN    VARCHAR2    DEFAULT NULL,
    new_comment         IN    VARCHAR2    DEFAULT NULL,
    new_shares          IN    NUMBER      DEFAULT NULL,
    new_utilization_limit IN    NUMBER      DEFAULT NULL,
    new_parallel_server_limit IN    NUMBER      DEFAULT NULL,
    new_memory_limit    IN    NUMBER      DEFAULT NULL,
    new_memory_min      IN    NUMBER      DEFAULT NULL);
```

Parameters

Table 152-29 UPDATE_CDB_DEFAULT_DIRECTIVE Procedure Parameters

Parameter	Description
<code>plan</code>	Name of the consolidation plan
<code>new_comment</code>	New user comment

Table 152-29 (Cont.) UPDATE_CDB_DEFAULT_DIRECTIVE Procedure Parameters

Parameter	Description
<code>new_shares</code>	Specifies the share of resource allocation for the pluggable database. CPU Resource Manager and Exadata I/O Resource Manager are enabled by specifying shares for each PDB. The <code>new_shares</code> parameter is also used for Parallel Statement Queuing.
<code>new_utilization_limit</code>	Specifies the maximum percentage of CPU that the pluggable database can utilize.
<code>new_parallel_server_limit</code>	Specifies the maximum percentage of <code>parallel_servers_target</code> parallel servers that the pluggable database can use.
<code>new_memory_limit</code>	This parameter is only applicable to Oracle Exadata storage for configuring the Database Smart Flash Cache and PMEM Cache.
<code>new_memory_min</code>	This parameter is only applicable to Oracle Exadata storage for configuring the Database Smart Flash Cache and PMEM Cache.

Usage Notes

- By default, the default values are
 - `new_shares: 1`
 - `utilization_limit: 100`
 - `parallel_server_limit: 100`
- Note that the default values are `NULL`. This has the same meaning as in [UPDATE_CDB_PLAN_DIRECTIVE Procedure](#). If the user does not specify a value, the value will not be modified.
- This procedure can be run only from the CDB root (`CDB$ROOT`).
- To clear (reset to the directive's default value), use the value `-1`.

152.4.33 UPDATE_CDB_PLAN Procedure

This procedure updates the consolidation resource plan.

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_CDB_PLAN (
  plan           IN    VARCHAR2(32),
  new_comment    IN    VARCHAR2(2000) DEFAULT NULL);
```

Parameters

Table 152-30 UPDATE_CDB_PLAN Procedure Parameters

Parameter	Description
plan	Name of the consolidation plan
new_comment	User comment

Usage Notes

- This procedure can be run only from the CDB root (CDB\$ROOT).
- To clear (reset to the directive's default value), use the value -1.

152.4.34 UPDATE_CDB_PLAN_DIRECTIVE Procedure

Updates the plan directives for a consolidation resource plan. Plan directives specify the resource allocation policy for pluggable databases (PDBs).

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_CDB_PLAN_DIRECTIVE (
    plan                IN    VARCHAR2 (30),
    pluggable_database  IN    VARCHAR2 (30)
    new_comment         IN    VARCHAR2 (200) DEFAULT NULL,
    new_shares          IN    NUMBER          DEFAULT NULL,
    new_utilization_limit IN    NUMBER          DEFAULT NULL,
    new_parallel_server_limit IN    NUMBER          DEFAULT NULL,
    new_memory_limit    IN    NUMBER          DEFAULT NULL,
    new_memory_min      IN    NUMBER          DEFAULT NULL);
```

Parameters

Table 152-31 UPDATE_CDB_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
plan	Name of the consolidation plan
pluggable_database	Name of the pluggable database
new_comment	New user comment
new_shares	The share of resource allocation for the pluggable database CPU Resource Manager is enabled by specifying shares for each PDB. The <code>shares</code> parameter is also used for Parallel Statement Queuing. If no share is specified, the default is obtained from the default directive, specified through the UPDATE_CDB_DEFAULT_DIRECTIVE Procedure .
new_utilization_limit	The new maximum percentage of CPU that the pluggable database can utilize

Table 152-31 (Cont.) UPDATE_CDB_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
<code>new_parallel_server_limit</code>	The new maximum percentage of <code>parallel_servers_target</code> parallel servers that the pluggable database can use
<code>new_memory_limit</code>	This parameter is only applicable to Oracle Exadata storage for configuring the Database Smart Flash Cache and PMEM Cache.
<code>new_memory_min</code>	This parameter is only applicable to Oracle Exadata storage for configuring the Database Smart Flash Cache and PMEM Cache.

Usage Notes

- The default value for the `new_*` parameters is `NULL` which indicates that the existing value is left unchanged. If the user does not specify one of the arguments when calling this function, the value is not modified.
- This procedure can be run only from the CDB root (`CDB$ROOT`).
- To clear (reset to the directive's default value), use the value `-1`.

152.4.35 UPDATE_CDB_PROFILE_DIRECTIVE Procedure

This procedure updates the performance profile directives of the consolidation resource plan. The directives specify the resource allocation policy for pluggable databases (PDBs) that use the performance profile.

For a PDB to use a performance profile, the PDB must have the `DB_PERFORMANCE_PROFILE` initialization parameter set to the performance profile name.

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_CDB_PROFILE_DIRECTIVE (
  plan          IN    VARCHAR2,
  profile       IN    VARCHAR2,
  new_comment   IN    VARCHAR2 (2000) DEFAULT '',
  new_shares    IN    NUMBER          DEFAULT NULL,
  new_utilization_limit IN    NUMBER          DEFAULT NULL,
  new_parallel_server_limit IN    NUMBER          DEFAULT NULL,
  new_memory_limit IN    NUMBER          DEFAULT 100,
  new_memory_min IN    NUMBER          DEFAULT 0);
```

Parameters**Table 152-32 UPDATE_CDB_PROFILE_DIRECTIVE Procedure Parameters**

Parameter	Description
<code>plan</code>	Name of the consolidation plan
<code>profile</code>	Name of the performance profile
<code>new_comment</code>	New user comment

Table 152-32 (Cont.) UPDATE_CDB_PROFILE_DIRECTIVE Procedure Parameters

Parameter	Description
<code>new_shares</code>	The share of resource allocation for the PDBs that use the performance profile
<code>new_utilization_limit</code>	The new maximum percentage of CPU that PDBs that use the performance profile can use
<code>new_parallel_server_limit</code>	The new maximum percentage of <code>parallel_servers_target</code> parallel servers that PDBs that use the performance profile can use
<code>new_memory_limit</code>	This parameter is only applicable to Oracle Exadata storage for configuring the Database Smart Flash Cache and PMEM Cache.
<code>new_memory_min</code>	This parameter is only applicable to Oracle Exadata storage for configuring the Database Smart Flash Cache and PMEM Cache.

Usage Notes

- This procedure can be run only from the CDB root (CDB\$ROOT).
- To clear (reset to the directive's default value), use the value `-1`.

152.4.36 UPDATE_CONSUMER_GROUP Procedure

This procedure updates entries which define resource consumer groups.

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_CONSUMER_GROUP (
    consumer_group IN VARCHAR2,
    new_comment    IN VARCHAR2 DEFAULT NULL,
    new_cpu_mth    IN VARCHAR2 DEFAULT NULL,
    new_mgmt_mth   IN VARCHAR2 DEFAULT NULL,
    new_category   IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 152-33 UPDATE_CONSUMER_GROUP Procedure Parameter

Parameter	Description
<code>consumer_group</code>	Name of consumer group
<code>new_comment</code>	New user comment
<code>new_cpu_mth</code>	Name of new method for CPU resource allocation (deprecated)
<code>new_mgmt_mth</code>	Name of new method for CPU resource allocation
<code>new_category</code>	New consumer group category

Usage Notes

- If the parameters to the `UPDATE_CONSUMER_GROUP` procedure are not specified, then they remain unchanged in the data dictionary.

- To clear (reset to the directive's default value), use the value -1.

152.4.37 UPDATE_PLAN Procedure

This procedure updates entries which define resource plans.

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_PLAN (
    plan                IN VARCHAR2,
    new_comment         IN VARCHAR2 DEFAULT NULL,
    new_cpu_mth         IN VARCHAR2 DEFAULT NULL, -- deprecated
    new_active_sess_pool_mth IN VARCHAR2 DEFAULT NULL,
    new_parallel_degree_limit_mth IN VARCHAR2 DEFAULT NULL,
    new_queueing_mth    IN VARCHAR2 DEFAULT NULL,
    new_mgmt_mth        IN VARCHAR2 DEFAULT NULL,
    new_sub_plan        IN BOOLEAN DEFAULT FALSE,
    new_max_iops         IN NUMBER DEFAULT NULL,
    new_max_mbps        IN NUMBER DEFAULT NULL);
```

Parameters

Table 152-34 UPDATE_PLAN Procedure Parameters

Parameter	Description
plan	Name of resource plan
new_comment	New user comment
new_cpu_mth	Name of new allocation method for CPU resources (deprecated)
new_active_sess_pool_mth	Name of new method for maximum active sessions
new_parallel_degree_limit_mth	Name of new method for degree of parallelism
new_queueing_mth	Specifies type of queuing policy to use with active session pool feature
new_mgmt_mth	Resource allocation method for specifying how much resources (for example, CPU or I/O) each consumer group or sub-plan gets <ul style="list-style-type: none"> • EMPHASIS - for multilevel plans that use percentages to specify how I/O resources are distributed among consumer groups. • RATIO - for single-level plans that use ratios to specify how I/O resources are distributed.
new_sub_plan	New setting for whether the plan is only intended for use as a sub-plan
new_max_iops	Nonoperative
new_max_mbps	Nonoperative

Usage Notes

- If the parameters to [UPDATE_PLAN Procedure](#) are not specified, then they remain unchanged in the data dictionary.
- If you want to use any default resource allocation method, then you do not need to specify it when creating or updating a plan.
- To clear (reset to the directive's default value), use the value -1.

152.4.38 UPDATE_PLAN_DIRECTIVE Procedure

This procedure updates resource plan directives.

Note:

The parameters `new_max_utilization_limit` and `new_parallel_target_percentage` are deprecated with Oracle Database 11g Release 1 (12.1.0.1), and are replaced by `new_utilization_limit` and `new_parallel_server_limit`.

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_PLAN_DIRECTIVE (
  plan                               IN VARCHAR2,
  group_or_subplan                    IN VARCHAR2,
  new_comment                          IN VARCHAR2 DEFAULT NULL,
  new_cpu_p1                           IN NUMBER  DEFAULT NULL, -- deprecated
  new_cpu_p2                           IN NUMBER  DEFAULT NULL, -- deprecated
  new_cpu_p3                           IN NUMBER  DEFAULT NULL, -- deprecated
  new_cpu_p4                           IN NUMBER  DEFAULT NULL, -- deprecated
  new_cpu_p5                           IN NUMBER  DEFAULT NULL, -- deprecated
  new_cpu_p6                           IN NUMBER  DEFAULT NULL, -- deprecated
  new_cpu_p7                           IN NUMBER  DEFAULT NULL, -- deprecated
  new_cpu_p8                           IN NUMBER  DEFAULT NULL, -- deprecated
  new_active_sess_pool_p1              IN NUMBER  DEFAULT NULL,
  new_queueing_p1                      IN NUMBER  DEFAULT NULL,
  new_parallel_degree_limit_p1         IN NUMBER  DEFAULT NULL,
  new_switch_group                     IN VARCHAR2 DEFAULT NULL,
  new_switch_time                      IN NUMBER  DEFAULT NULL,
  new_switch_estimate                  IN BOOLEAN DEFAULT FALSE,
  new_max_est_exec_time                IN NUMBER  DEFAULT NULL,
  new_undo_pool                        IN NUMBER  DEFAULT NULL,
  new_max_idle_time                    IN NUMBER  DEFAULT NULL,
  new_max_idle_blocker_time           IN NUMBER  DEFAULT NULL,
  switch_time_in_call                  IN NUMBER  DEFAULT NULL, -- deprecated
  new_mgmt_p1                          IN NUMBER  DEFAULT NULL,
  new_mgmt_p2                          IN NUMBER  DEFAULT NULL,
  new_mgmt_p3                          IN NUMBER  DEFAULT NULL,
  new_mgmt_p4                          IN NUMBER  DEFAULT NULL,
  new_mgmt_p5                          IN NUMBER  DEFAULT NULL,
  new_mgmt_p6                          IN NUMBER  DEFAULT NULL,
  new_mgmt_p7                          IN NUMBER  DEFAULT NULL,
  new_mgmt_p8                          IN NUMBER  DEFAULT NULL,
  new_switch_io_megabytes              IN NUMBER  DEFAULT NULL,
  new_switch_io_reqs                  IN NUMBER  DEFAULT NULL,
  new_switch_for_call                  IN BOOLEAN DEFAULT NULL,
  new_max_utilization_limit            IN NUMBER  DEFAULT NULL,
  new_parallel_target_percentage       IN NUMBER  DEFAULT NULL,
  new_parallel_queue_timeout           IN NUMBER  DEFAULT NULL,
  new_parallel_server_limit            IN NUMBER  DEFAULT NULL,
  new_utilization_limit                IN NUMBER  DEFAULT NULL,
  new_switch_io_logical                IN NUMBER  DEFAULT NULL,
  new_switch_elapsed_time              IN NUMBER  DEFAULT NULL,
  new_shares                           IN NUMBER  DEFAULT NULL,
```

```

new_parallel_stmt_critical    IN VARCHAR2 DEFAULT NULL,
new_session_pga_limit        IN NUMBER   DEFAULT NULL,
new_pq_timeout_action        IN NUMBER   DEFAULT NULL);

```

Parameters

Table 152-35 UPDATE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
plan	Name of the resource plan
group_or_subplan	Name of the consumer group or subplan
new_comment	Comment for the plan directive
new_cpu_p1	Deprecated - use new_mgmt_p1 instead
new_cpu_p2	Deprecated - use new_mgmt_p2 instead
new_cpu_p3	Deprecated - use new_mgmt_p3 instead
new_cpu_p4	Deprecated- use new_mgmt_p4 instead
new_cpu_p5	Deprecated - use new_mgmt_p5 instead
new_cpu_p6	Deprecated- use new_mgmt_p6 instead
new_cpu_p7	Deprecated- use new_mgmt_p7 instead
new_cpu_p8	Deprecated- use new_mgmt_p8 instead
new_active_sess_pool_p1	Specifies maximum number of concurrently active sessions for a consumer group. Default is NULL, which means unlimited.
new_queueing_p1	Specified time (in seconds) after which a job in the inactive session queue (waiting for execution) will time out. Default is NULL, which means unlimited.
new_parallel_degree_limit_p1	Specifies a limit on the degree of parallelism for any operation. Default is NULL, which means unlimited.
new_switch_group	Specifies consumer group to which this session is switched if other switch criteria are met. Default is NULL. If the group name is 'CANCEL_SQL', the current call will be canceled when other switch criteria are met. If the group name is 'KILL_SESSION', the session will be killed when other switch criteria are met.
new_switch_time	Specifies time (in CPU seconds) that a session can execute before an action is taken. Default is NULL, which means unlimited.
new_switch_estimate	If TRUE, tells Oracle to use its execution time estimate to automatically switch the consumer group of an operation before beginning its execution. Default is FALSE.
new_max_est_exec_time	Specifies the maximum execution time (in CPU seconds) allowed for a session. If the optimizer estimates that an operation will take longer than MAX_EST_EXEC_TIME, the operation is not started and ORA-07455 is issued. If the optimizer does not provide an estimate, this directive has no effect. Default is NULL, which means unlimited.
new_undo_pool	Limits the size in kilobytes of the undo records corresponding to uncommitted transactions by this consumer group
new_max_idle_time	Indicates the maximum session idle time. Default is NULL, which means unlimited.
new_max_idle_blocker_time	Maximum amount of time in seconds that a session can be idle while blocking another session's acquisition of a resource

Table 152-35 (Cont.) UPDATE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
<code>new_switch_time_in_call</code>	Deprecated. If this parameter is specified, <code>new_switch_time</code> will be effectively set to <code>new_switch_time_in_call</code> and <code>new_switch_for_call</code> will be effectively set to <code>TRUE</code> .
<code>new_mgmt_p1</code>	Resource allocation value for level 1 (replaces <code>new_cpu_p1</code>): <ul style="list-style-type: none"> • EMPHASIS - specifies the resource percentage at the first level • RATIO - specifies the weight of resource usage
<code>new_mgmt_p2</code>	Resource allocation value for level 2 (replaces <code>new_cpu_p2</code>) <ul style="list-style-type: none"> • EMPHASIS - specifies the resource percentage at the second level • RATIO - non-applicable
<code>new_mgmt_p3</code>	Resource allocation value for level 3 (replaces <code>new_cpu_p3</code>) <ul style="list-style-type: none"> • EMPHASIS - specifies the resource percentage at the third level • RATIO - non-applicable
<code>new_mgmt_p4</code>	Resource allocation value for level 4 (replaces <code>new_cpu_p4</code>) <ul style="list-style-type: none"> • EMPHASIS - specifies the resource percentage at the fourth level • RATIO - non-applicable
<code>new_mgmt_p5</code>	Resource allocation value for level 5 (replaces <code>new_cpu_p5</code>) <ul style="list-style-type: none"> • EMPHASIS - specifies the resource percentage at the fifth level • RATIO - non-applicable
<code>new_mgmt_p6</code>	Resource allocation value for level 6 (replaces <code>new_cpu_p6</code>) <ul style="list-style-type: none"> • EMPHASIS - specifies the resource percentage at the sixth level • RATIO - non-applicable
<code>new_mgmt_p7</code>	Resource allocation value for level 7 (replaces <code>new_cpu_p7</code>) <ul style="list-style-type: none"> • EMPHASIS - specifies the resource percentage at the seventh level • RATIO - non-applicable
<code>new_mgmt_p8</code>	Resource allocation value for level 8 (replaces <code>new_cpu_p8</code>) <ul style="list-style-type: none"> • EMPHASIS - specifies the resource percentage at the eighth level • RATIO - non-applicable
<code>new_switch_io_megabytes</code>	Specifies the amount of I/O (in MB) that a session can issue before an action is taken. Default is <code>NULL</code> , which means unlimited.
<code>new_switch_io_reqs</code>	Specifies the number of I/O requests that a session can issue before an action is taken. Default is <code>NULL</code> , which means unlimited.
<code>new_switch_for_call</code>	Specifies that if an action is taken because of the <code>new_switch_time</code> , <code>new_switch_io_megabytes</code> , or <code>new_switch_io_reqs</code> parameters, the consumer group is restored to its original consumer group at the end of the top call. Default is <code>FALSE</code> , which means that the original consumer group is not restored at the end of the top call.
<code>new_max_utilization_limit</code>	Deprecated - use <code>new_utilization_limit</code> instead
<code>new_parallel_target_percentage</code>	Deprecated - use <code>new_parallel_server_limit</code> instead
<code>new_parallel_server_limit</code>	Parallel server limit. Setting this overwrites the limit for parallel server set by <code>utilization_limit</code> .

Table 152-35 (Cont.) UPDATE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
<code>new_utilization_limit</code>	Resource limit. For CPU, this limits the CPU utilization for the consumer group. For parallel servers, this limits the parallel servers used as a percentage of <code>parallel_servers_target</code> .
<code>new_switch_elapsed_time</code>	Elapsed time that will trigger the action specified by <code>switch_group</code> . As with other switch directives, if <code>new_switch_for_call</code> is TRUE, the elapsed time is accumulated from the start of a call. Otherwise, the elapsed time is accumulated for the length of the session.
<code>new_shares</code>	Specifies the share of resource allocation for the pluggable database. CPU Resource Manager and Exadata I/O Resource Manager are enabled by specifying shares for each PDB. The <code>shares</code> parameter is also used for Parallel Statement Queuing. If CPU Resource Manager and Exadata I/O Resource Manager are enabled, then the default value is 1.
<code>new_parallel_stmt_critical</code>	If set to <code>BYPASS_QUEUE</code> , parallel statements from this consumer group are not queued. If set to <code>QUEUE</code> , all the parallel statements, irrespective of the <code>parallel_degree_policy</code> parameter value, from the consumer group get queued. Default is <code>FALSE</code> , which means that certain parallel statements are eligible for queuing depending upon the <code>parallel_degree_policy</code> parameter value.
<code>new_session_pga_limit</code>	Maximum amount of PGA in MB that sessions in this consumer group can allocate before being terminated. <code>NULL</code> (default) indicates no change.
<code>new_parallel_queue_timeout</code>	Specifies the time (in seconds) that a parallel statement may remain in its Consumer Group's parallel statement queue before it is removed. The default action of this parameter is <code>ERROR</code> . This action can be altered using the <code>new_pq_timeout_action</code> parameter.
<code>new_pq_timeout_action</code>	Specifies the action to be taken when a parallel statement is removed from the queue due to <code>new_parallel_queue_timeout</code> . The values are: <ul style="list-style-type: none"> • <code>CANCEL</code> — The SQL statement is terminated with error <code>ORA-7454</code> • <code>RUN</code> — The SQL statement runs immediately, and might get downgraded if parallel servers are unavailable

Usage Notes

- If the parameters for `UPDATE_PLAN_DIRECTIVE` are left unspecified, then they remain unchanged in the data dictionary.
- For `new_max_idle_time` and `new_max_idle_blocker_time`, PMON will check these limits once a minute. If it finds a session that has exceeded one of the limits, it will forcibly kill the session and clean up all its state.
- The parameter `new_switch_time_in_call` is mostly useful for three-tier applications where the mid-tier server is implementing session pooling. By turning on `new_switch_time_in_call`, the resource usage of one client will not affect the consumer group of a future client that happens to be executed on the same session.
- To clear (reset to the directive's default value), use the value `-1`.

152.4.39 VALIDATE_PENDING_AREA Procedure

This procedure validates pending changes for the resource manager.

Syntax

```
DBMS_RESOURCE_MANAGER.VALIDATE_PENDING_AREA;
```

DBMS_RESOURCE_MANAGER_PRIVS

The `DBMS_RESOURCE_MANAGER_PRIVS` package maintains privileges associated with the Resource Manager.

This chapter contains the following topics:

- [Summary of DBMS_RESOURCE_MANAGER_PRIVS Subprograms](#)



See Also:

For more information on using the Database Resource Manager, see *Oracle Database Administrator's Guide*

153.1 Summary of DBMS_RESOURCE_MANAGER_PRIVS Subprograms

This table lists the `DBMS_RESOURCE_MANAGER_PRIVS` subprograms and briefly describes them.

Table 153-1 DBMS_RESOURCE_MANAGER_PRIVS Package Subprograms

Subprogram	Description
GRANT_SWITCH_CONSUMER_GRP OUP Procedure	Grants the privilege to switch to resource consumer groups
GRANT_SYSTEM_PRIVILEGE Procedure	Performs a grant of a system privilege
REVOKE_SWITCH_CONSUMER_GRP OUP Procedure	Revokes the privilege to switch to resource consumer groups.
REVOKE_SYSTEM_PRIVILEGE Procedure	Performs a revoke of a system privilege

153.1.1 GRANT_SWITCH_CONSUMER_GROUP Procedure

This procedure grants the privilege to switch to a resource consumer group.

Syntax

```
DBMS_RESOURCE_MANAGER_PRIVS.GRANT_SWITCH_CONSUMER_GROUP (
    grantee_name    IN VARCHAR2,
    consumer_group  IN VARCHAR2,
    grant_option    IN BOOLEAN);
```


Parameters

Table 153-2 GRANT_SWITCH_CONSUMER_GROUP Procedure Parameters

Parameter	Description
grantee_name	Name of the user or role to whom privilege is to be granted.
consumer_group	Name of consumer group.
grant_option	TRUE if grantee should be allowed to grant access, FALSE otherwise.

Usage Notes

If you grant permission to switch to a particular consumer group to a user, then that user can immediately switch their current consumer group to the new consumer group.

If you grant permission to switch to a particular consumer group to a role, then any users who have been granted that role and have enabled that role can immediately switch their current consumer group to the new consumer group.

If you grant permission to switch to a particular consumer group to PUBLIC, then any user can switch to that consumer group.

If the `grant_option` parameter is TRUE, then users granted switch privilege for the consumer group may also grant switch privileges for that consumer group to others.

In order to set the initial consumer group of a user, you must grant the switch privilege for that group to the user.



See Also:

[DBMS_RESOURCE_MANAGER](#)

Examples

```
BEGIN
DBMS_RESOURCE_MANAGER_PRIVS.GRANT_SWITCH_CONSUMER_GROUP (
  'scott', 'mail_maintenance_group', true);
DBMS_RESOURCE_MANAGER.CREATE_PENDING_AREA();
DBMS_RESOURCE_MANAGER.set_consumer_group_mapping(
  dbms_resource_manager.oracle_user, 'scott', 'mail_maintenance_group');
DBMS_RESOURCE_MANAGER.SUBMIT_PENDING_AREA();
END;
/
```

153.1.2 GRANT_SYSTEM_PRIVILEGE Procedure

This procedure performs a grant of a system privilege to a user or role.

Syntax

```
DBMS_RESOURCE_MANAGER_PRIVS.GRANT_SYSTEM_PRIVILEGE (
  grantee_name    IN VARCHAR2,
```

```

privilege_name IN VARCHAR2 DEFAULT 'ADMINISTER_RESOURCE_MANAGER',
admin_option   IN BOOLEAN);

```

Parameters

Table 153-3 GRANT_SYSTEM_PRIVILEGE Procedure Parameters

Parameter	Description
grantee_name	Name of the user or role to whom privilege is to be granted.
privilege_name	Name of the privilege to be granted.
admin_option	TRUE if the grant is with admin_option, FALSE otherwise.

Usage Notes

Currently, Oracle provides only one system privilege for the Resource Manager: `ADMINISTER_RESOURCE_MANAGER`. Database administrators have this system privilege with the `ADMIN` option. The grantee and the revokee can either be a user or a role. Users that have been granted the system privilege with the `ADMIN` option can also grant this privilege to others.

Examples

The following call grants this privilege to a user called `scott` without the `ADMIN` option:

```

BEGIN
DBMS_RESOURCE_MANAGER_PRIVS.GRANT_SYSTEM_PRIVILEGE (
  grantee_name => 'scott',
  privilege_name => 'ADMINISTER_RESOURCE_MANAGER',
  admin_option => FALSE);
END;
/

```

153.1.3 REVOKE_SWITCH_CONSUMER_GROUP Procedure

This procedure revokes the privilege to switch to a resource consumer group.

Syntax

```

DBMS_RESOURCE_MANAGER_PRIVS.REVOKE_SWITCH_CONSUMER_GROUP (
  revokee_name IN VARCHAR2,
  consumer_group IN VARCHAR2);

```

Parameters

Table 153-4 REVOKE_SWITCH_CONSUMER_GROUP Procedure Parameter

Parameter	Description
revokee_name	Name of user/role from which to revoke access.
consumer_group	Name of consumer group.

Usage Notes

If you revoke a user's switch privilege for a particular consumer group, then any subsequent attempts by that user to switch to that consumer group will fail.

If you revoke the initial consumer group from a user, then that user will automatically be part of the `DEFAULT_CONSUMER_GROUP` consumer group when logging in.

If you revoke the switch privilege for a consumer group from a role, then any users who only had switch privilege for the consumer group through that role will not be able to switch to that consumer group.

If you revoke the switch privilege for a consumer group from `PUBLIC`, then any users who could previously only use the consumer group through `PUBLIC` will not be able to switch to that consumer group.

Examples

The following example revokes the privileges to switch to `mail_maintenance_group` from Scott:

```
BEGIN
DBMS_RESOURCE_MANAGER_PRIVS.REVOKE_SWITCH_CONSUMER_GROUP (
  'scott', 'mail_maintenance_group');
END;
/
```

153.1.4 REVOKE_SYSTEM_PRIVILEGE Procedure

This procedure performs a revoke of a system privilege from a user or role.

Syntax

```
DBMS_RESOURCE_MANAGER_PRIVS.REVOKE_SYSTEM_PRIVILEGE (
  revokee_name   IN VARCHAR2,
  privilege_name IN VARCHAR2 DEFAULT 'ADMINISTER_RESOURCE_MANAGER');
```

Parameters

Table 153-5 REVOKE_SYSTEM_PRIVILEGE Procedure Parameters

Parameter	Description
<code>revokee_name</code>	Name of the user or role from whom privilege is to be revoked.
<code>privilege_name</code>	Name of the privilege to be revoked.

Examples

The following call revokes the `ADMINISTER_RESOURCE_MANAGER` from user `scott`:

```
BEGIN
DBMS_RESOURCE_MANAGER_PRIVS.REVOKE_SYSTEM_PRIVILEGE ('scott');
END;
/
```

DBMS_RESULT_CACHE

The `DBMS_RESULT_CACHE` package provides an interface to allow the DBA to administer that part of the shared pool that is used by the SQL result cache and the PL/SQL function result cache.

Both these caches use the same infrastructure. Therefore, for example, `DBMS_RESULT_CACHE.BYPASS` determines whether both caches are bypassed or both caches are used, and `DBMS_RESULT_CACHE.FLUSH` flushes both all the cached results for SQL queries and all the cached results for PL/SQL functions.

This chapter contains the following topics:

- [Security Model](#)
- [Constants](#)
- [Summary of DBMS_RESULT_CACHE Subprograms](#)

See Also:

- *Oracle Database Performance Tuning Guide*, for more information about "Result Cache Concepts"
- *Oracle Database PL/SQL Language Reference*, for more information about PL/SQL function Result Cache "Using the Cross-Session PL/SQL Function Result Cache"
- *Database PL/SQL Language Reference*, for more information about Result Cache Management.

154.1 DBMS_RESULT_CACHE Security Model

Only database administrators should be granted the `EXECUTE` privilege for this package.

154.2 DBMS_RESULT_CACHE Constants

The `DBMS_RESULT_CACHE` package defines several constants for specifying parameter values.

The following table describes these constants.

Table 154-1 DBMS_RESULT_CACHE Constants

Constant	Definition	Description
<code>STATUS_BYPS</code>	<code>CONSTANT VARCHAR2(10) := 'BYPASS';</code>	Cache has been made temporarilyunavailable.

Table 154-1 (Cont.) DBMS_RESULT_CACHE Constants

Constant	Definition	Description
STATUS_CORR	CONSTANT VARCHAR2(10) := 'CORRUPT';	The result cache is in an unusable state.
STATUS_DISA	CONSTANT VARCHAR2(10) := 'DISABLED';	Cache is not available.
STATUS_ENAB	CONSTANT VARCHAR2(10) := 'ENABLED';	Cache is available.
STATUS_SYNC	CONSTANT VARCHAR2(10) := 'SYNC';	Cache is available, but synchronizing with Oracle RAC nodes.

154.3 Summary of DBMS_RESULT_CACHE Subprograms

This table lists the DBMS_RESULT_CACHE subprograms and briefly describes them.

Table 154-2 DBMS_RESULT_CACHE Package Subprograms

Subprogram	Description
BLOCK_LIST Function	Returns all the block listed cache ids of a local instance.
BLOCK_LIST_ADD Procedure	Adds a <code>cache_id</code> to the block list.
BLOCK_LIST_CLEAR Procedure	Removes all <code>cache_ids</code> from the block list.
BLOCK_LIST_REMOVE Procedure	Removes the <code>cache_id</code> from the block list.
BYPASS Procedure	Sets the bypass mode for the result cache.
FLUSH Function & Procedure	Attempts to remove all the objects from the result cache, and depending on the arguments retains or releases the memory and retains or clears the statistics.
IGNORE_LIST Function	This table function returns a row for each entry that's been added into the ignore list.
IGNORE_LIST_ADD Procedure	This procedure adds to the ignore list a table specified by object number or by owner and table name.
IGNORE_LIST_CLEAR Procedure	This procedure drops the entire ignore list.
IGNORE_LIST_REMOVE Procedure	This procedure removes a table specified by object number or by owner and table name.
INVALIDATE Functions & Procedures	Invalidates all the result-set objects that are dependent upon the specified dependency object.
INVALIDATE_OBJECT Functions & Procedures	Invalidates the specified result-set object(s)
MEMORY_REPORT Procedure	Produces the memory usage report for the result cache.
OBJECT_BLOCK_LIST Function	Returns all the object numbers currently in the block list
OBJECT_BLOCK_LIST_ADD Procedure	Adds objects to the object block list

Table 154-2 (Cont.) DBMS_RESULT_CACHE Package Subprograms

Subprogram	Description
OBJECT_BLOCK_LIST_CLEAR Procedure	Clears the entire block list
OBJECT_BLOCK_LIST_REMOVE Procedure	Removes objects from the object block list.
STATUS Function	Checks the status of the result cache.

154.3.1 BLACK_LIST Function

This procedure is deprecated with Oracle Database 23ai. Use the [BLOCK_LIST Function](#) instead.

154.3.2 BLACK_LIST_ADD Procedure

This procedure is deprecated with Oracle Database 23ai. Use the [BLOCK_LIST_ADD Procedure](#) instead.

154.3.3 BLACK_LIST_CLEAR Procedure

This procedure is deprecated with Oracle Database 23ai. Use the [BLOCK_LIST_CLEAR Procedure](#) instead.

154.3.4 BLACK_LIST_REMOVE Procedure

This procedure is deprecated with Oracle Database 23ai. Use the [BLOCK_LIST_REMOVE Procedure](#) instead.

154.3.5 BYPASS Procedure

This procedure sets the bypass mode for the Result Cache.

It sets one of the following bypass modes:

- When bypass mode is turned on, it implies that cached results are no longer used and that no new results are saved in the cache.
- When bypass mode is turned off, the cache resumes normal operation.

Syntax

```
DBMS_RESULT_CACHE.BYPASS (  
  bypass_mode IN BOOLEAN,  
  session     IN  BOOLEAN);
```

Parameters

Table 154-3 BYPASS Procedure Parameters

Parameter	Description
bypass_mode	<ul style="list-style-type: none"> TRUE => Result Cache usage is bypassed FALSE => Result Cache usage is turned on
session	<ul style="list-style-type: none"> TRUE => Applies to current session FALSE (default) => Applies to all sessions

Usage Notes

This operation is database instance specific.

Examples

This operation can be used when there is a need to hot patch PL/SQL code in a running system. If a code-patch is applied to a PL/SQL module on which a result cached function directly or transitively depends, then the cached results associated with the result cache function are not automatically flushed (if the instance is not restarted/bounced). This must be manually achieved.

To ensure correctness during the patching process follow these steps:

1. Place the result cache in bypass mode, and flush existing result.

```
BEGIN
  DBMS_RESULT_CACHE.BYPASS (TRUE);
  DBMS_RESULT_CACHE.FLUSH;
END;
/
```

This step must be performed on each instance if in a Oracle Real Application Clusters environment.

2. Apply the PL/SQL code patches.
3. Resume use of the result cache, by turning off the cache bypass mode.

```
BEGIN
  DBMS_RESULT_CACHE.BYPASS (FALSE);
END;
/
```

This step must be performed on each instance if in a Oracle Real Application Clusters environment.

154.3.6 FLUSH Function & Procedure

This function and procedure attempts to remove all the objects from the Result Cache, and depending on the arguments retains or releases the memory and retains or clears the statistics.

Syntax

```
DBMS_RESULT_CACHE.FLUSH (
  retainMem IN BOOLEAN DEFAULT FALSE,
```

```

    retainSta IN BOOLEAN DEFAULT FALSE)
RETURN BOOLEAN;

DBMS_RESULT_CACHE.FLUSH (
    retainMem IN BOOLEAN DEFAULT FALSE,
    retainSta IN BOOLEAN DEFAULT FALSE);

```

Parameters

Table 154-4 FLUSH Function & Procedure Parameters

Parameter	Description
retainMem	<ul style="list-style-type: none"> TRUE => retains the free memory in the cache FALSE (default) => releases the free memory to the system
retainSta	<ul style="list-style-type: none"> TRUE => retains the existing cache statistics FALSE (default) => clears the existing cache statistics

Return Values

TRUE if successful in removing all the objects.

154.3.7 IGNORE_LIST Function

This table function returns a row for each entry that's been added into the ignore list.

Objects in the ignore list are never considered for auto block listing. This allows users to override auto block listing.

Syntax

```

type ign_recT is record( objNo NUMBER);
type ign_tabT is table of ign_recT;
DBMS_RESULT_CACHE.IGNORE_LIST (
    RETURN ign_tabT pipelined;

```

154.3.8 IGNORE_LIST_ADD Procedure

This procedure adds to the ignore list a table specified by object number or by owner and table name.

Objects in the ignore list are never considered for auto block listing. This allows users to override auto block listing.

Syntax

```

DBMS_RESULT_CACHE.IGNORE_LIST_ADD (
    objNo IN NATURALN);

```


Syntax

```
DBMS_RESULT_CACHE.IGNORE_LIST_ADD (  
  owner   IN  VARCHAR2,  
  name    IN  VARCHAR2);
```

Parameters**Table 154-5 IGNORE_LIST_ADD Procedure Parameters**

Parameter	Description
objNo	The objNo is added to the ignore list.
name	The table specified by owner and name are added to the ignore list.
owner	The table specified by owner and name are added to the ignore list.

154.3.9 IGNORE_LIST_CLEAR Procedure

This procedure drops the entire ignore list.

Objects in the ignore list are never considered for auto block listing. This allows users to override auto block listing.

Syntax

```
DBMS_RESULT_CACHE.IGNORE_LIST_CLEAR;
```

154.3.10 IGNORE_LIST_REMOVE Procedure

This procedure removes a table specified by object number or by owner and table name.

Syntax

```
DBMS_RESULT_CACHE.IGNORE_LIST_REMOVE (  
  objNo   IN  NATURALN);
```

Syntax

```
DBMS_RESULT_CACHE.IGNORE_LIST_REMOVE (  
  owner   IN  VARCHAR2,  
  name    IN  VARCHAR2);
```

Parameters

Table 154-6 IGNORE_LIST_REMOVE Procedure Parameters

Parameter	Description
objNo	The objNo is removed from the ignore list.
name	The table specified by owner and name is removed to the ignore list.
owner	The table specified by owner and name is removed to the ignore list.

154.3.11 INVALIDATE Functions & Procedures

This function and procedure invalidates all the result-set objects that dependent upon the specified dependency object.

Syntax

```
DBMS_RESULT_CACHE.INVALIDATE (
    owner      IN VARCHAR2,
    name       IN VARCHAR2)
RETURN NUMBER;

DBMS_RESULT_CACHE.INVALIDATE (
    owner      IN VARCHAR2,
    name       IN VARCHAR2);

DBMS_RESULT_CACHE.INVALIDATE (
    object_id  IN BINARY_INTEGER)
RETURN NUMBER;

DBMS_RESULT_CACHE.INVALIDATE (
    object_id  IN BINARY_INTEGER);
```

Parameters

Table 154-7 INVALIDATE Function & Procedure Parameters

Parameter	Description
owner	Schema name
name	Object name
object_id	Dictionary object number

Return Values

The number of objects invalidated.

154.3.12 INVALIDATE_OBJECT Functions & Procedures

This function and procedure invalidates the specified result-set object(s).

Syntax

```
DBMS_RESULT_CACHE.INVALIDATE_OBJECT (
    id          IN BINARY_INTEGER)
RETURN NUMBER;
```

```
DBMS_RESULT_CACHE.INVALIDATE_OBJECT (
    id          IN BINARY_INTEGER);
```

```
DBMS_RESULT_CACHE.INVALIDATE_OBJECT (
    cache_id    IN VARCHAR2)
RETURN NUMBER;
```

```
DBMS_RESULT_CACHE.INVALIDATE_OBJECT (
    cache_id    IN VARCHAR2);
```

Parameters

Table 154-8 INVALIDATE_OBJECT Function & Procedure Parameters

Parameter	Description
id	Address of the cache object in the Result Cache
cache_id	Result cache identifier of a SQL cursor or PL/SQL function.

Return Values

The number of objects invalidated.

154.3.13 MEMORY_REPORT Procedure

This procedure produces the memory usage report for the Result Cache.

Syntax

```
DBMS_RESULT_CACHE.MEMORY_REPORT (
    detailed    IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 154-9 MEMORY_REPORT Procedure Parameters

Parameter	Description
detailed	<ul style="list-style-type: none"> TRUE => produces a more detailed report FALSE (default) => produces the standard report

Usage Notes

Invoking this procedure from SQL*Plus requires that the serveroutput be turned on.

Examples

```
SET SERVEROUTPUT ON

EXECUTE DBMS_RESULT_CACHE.MEMORY_REPORT;
```

154.3.14 OBJECT_BLACK_LIST Function

This function is deprecated with Oracle Database 23ai. Use the [OBJECT_BLOCK_LIST Function](#) instead.

154.3.15 OBJECT_BLACK_LIST_ADD Procedure

This procedure is deprecated with Oracle Database 23ai. Use the [OBJECT_BLOCK_LIST_ADD Procedure](#) instead.

154.3.16 OBJECT_BLACK_LIST_CLEAR Procedure

This procedure is deprecated with Oracle Database 23ai. Use the [OBJECT_BLOCK_LIST_CLEAR Procedure](#) instead.

154.3.17 OBJECT_BLACK_LIST_REMOVE Procedure

This procedure is removed with Oracle Database 23ai. Use [OBJECT_BLOCK_LIST_REMOVE Procedure](#) instead.

154.3.18 STATUS Function

This function checks the status of the Result Cache.

Syntax

```
DBMS_RESULT_CACHE.STATUS
RETURN VARCHAR2;
```



Note:

For more information on the constants, see [DBMS_RESULT_CACHE Constants](#).

154.3.19 BLOCK_LIST Function

This table function returns all the block-listed cache ids of a local instance.

Syntax

```
DBMS_RESULT_CACHE.BLOCK_LIST
RETURN BL_TABT;
```

154.3.20 BLOCK_LIST_ADD Procedure

This procedure adds a `cache_id` to the block list.

Syntax

```
DBMS_RESULT_CACHE.BLOCK_LIST_ADD (
  cache_id  IN VARCHAR2,
  global    IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 154-10 BLOCK_LIST_ADD Procedure Parameters

Parameter	Description
<code>cache_id</code>	The <code>cache_id</code> is added to the block list.
<code>global</code>	TRUE — applies to all caches in a RAC cluster. FALSE (default) — applies only to the local instance cache.

154.3.21 BLOCK_LIST_CLEAR Procedure

This procedure removes all `cache_ids` from the block list.

Syntax

```
DBMS_RESULT_CACHE.BLOCK_LIST_CLEAR (
  global  IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 154-11 BLOCK_LIST_CLEAR Procedure Parameters

Parameter	Description
<code>global</code>	TRUE — applies to all caches in a RAC cluster. FALSE (default) — applies only to the local instance cache.

154.3.22 BLOCK_LIST_REMOVE Procedure

This procedure removes the `cache_id` from the block list.

Syntax

```
DBMS_RESULT_CACHE.BLOCK_LIST_REMOVE (
  cache_id  IN VARCHAR2,
  global    IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 154-12 BLOCK_LIST_REMOVE Procedure Parameters

Parameter	Description
cache_id	The cache_id is removed from the block list.
global	TRUE — applies to all caches in a RAC cluster. FALSE (default) — applies only to the local instance cache.

154.3.23 OBJECT_BLOCK_LIST Function

This table function returns all the object numbers currently in the block list.

Syntax

```
DBMS_RESULT_CACHE.OBJECT_BLOCK_LIST ()
RETURN NATURALN;
```

154.3.24 OBJECT_BLOCK_LIST_ADD Procedure

This procedure adds objects to the object block list. These procedures only have to be run once in the cluster as they take effect everywhere at once. However, they do not persist between cluster shutdowns and startups.

Syntax

```
DBMS_RESULT_CACHE.OBJECT_BLOCK_LIST_ADD (
  objNo      IN BINARY_INTEGER);

DBMS_RESULT_CACHE.OBJECT_BLOCK_LIST_ADD (
  owner      IN VARCHAR2,
  name       IN VARCHAR2);
```

Parameters

Table 154-13 OBJECT_BLOCK_LIST_ADD Procedure Parameters

Parameter	Description
objNo	The object number.
owner	The owner of the object.
name	The name of the table.

154.3.25 OBJECT_BLOCK_LIST_CLEAR Procedure

This procedure clears the entire block list.

Syntax

```
DBMS_RESULT_CACHE.OBJECT_BLOCK_LIST_CLEAR ();
```

154.3.26 OBJECT_BLOCK_LIST_REMOVE Procedure

This procedure removes objects from the object block list.

Syntax

```
DBMS_RESULT_CACHE.OBJECT_BLOCK_LIST_REMOVE (  
    objNo          IN BINARY_INTEGER);
```

```
DBMS_RESULT_CACHE.OBJECT_BLOCK_LIST_REMOVE (  
    owner          IN VARCHAR2,  
    name           IN VARCHAR2);
```

Parameters

Table 154-14 OBJECT_BLOCK_LIST_REMOVE Procedure Parameters

Parameter	Description
objNo	The object number.
owner	The owner of the object.
name	The name of the table.

DBMS_RESUMABLE

With the `DBMS_RESUMABLE` package, you can suspend large operations that run out of space or reach space limits after executing for a long time, fix the problem, and make the statement resume execution. In this way you can write applications without worrying about running into space-related errors.

This chapter contains the following topics:

- [Operational Notes](#)
- [Summary of DBMS_RESUMABLE Subprograms](#)

155.1 DBMS_RESUMABLE Operational Notes

When you suspend a statement, you should log the suspension in the alert log. You should also register a procedure to be executed when the statement is suspended. Using a view, you can monitor the progress of the statement and indicate whether the statement is currently executing or suspended.

Suspending a statement automatically results in suspending the transaction. Thus all transactional resources are held during a statement suspend and resume. When the error condition disappears, the suspended statement automatically resumes execution. A resumable space allocation can be suspended and resumed multiple times during execution.

A suspension timeout interval is associated with resumable space allocations. A resumable space allocation that is suspended for the timeout interval (the default is two hours) wakes up and returns an exception to the user. A suspended statement may be forced to throw an exception using the `DBMS_RESUMABLE.ABORT()` procedure.

155.2 Summary of DBMS_RESUMABLE Subprograms

This table lists the `DBMS_RESUMABLE` subprograms and briefly describes them.

Table 155-1 *DBMS_RESUMABLE Package Subprograms*

Subprogram	Description
ABORT Procedure	Aborts a suspended resumable space allocation
GET_SESSION_TIMEOUT Function	Returns the current timeout value of the resumable space allocations for a session with <code>session_id</code>
GET_TIMEOUT Function	Returns the current timeout value of resumable space allocations for the current session
SET_SESSION_TIMEOUT Procedure	Sets the timeout of resumable space allocations for a session with <code>session_id</code>
SET_TIMEOUT Procedure	Sets the timeout of resumable space allocations for the current session

Table 155-1 (Cont.) DBMS_RESUMABLE Package Subprograms

Subprogram	Description
SPACE_ERROR_INFO Function	Looks for space-related errors in the error stack, otherwise returning FALSE

155.2.1 ABORT Procedure

This procedure aborts a suspended resumable space allocation.

The parameter `session_id` is the session ID in which the statement is executed. For a parallel DML/DDL, `session_id` is any session ID that participates in the parallel DML/DDL. This operation is guaranteed to succeed. The procedure can be called either inside or outside of the `AFTER SUSPEND` trigger.

Syntax

```
DBMS_RESUMABLE.ABORT (
    session_id IN NUMBER);
```

Parameters

Table 155-2 ABORT Procedure Parameters

Parameter	Description
<code>session_id</code>	The session identifier of the resumable space allocation.

Usage Notes

To call an `ABORT` procedure, you must be the owner of the session with `session_id`, have `ALTER SYSTEM` privileges, or be a DBA.

155.2.2 GET_SESSION_TIMEOUT Function

This function returns the current timeout value of resumable space allocations for a session with `session_id`.

Syntax

```
DBMS_RESUMABLE.GET_SESSION_TIMEOUT (
    session_id IN NUMBER)
RETURN NUMBER;
```

Parameters

Table 155-3 GET_SESSION_TIMEOUT Function Parameters

Parameter	Description
<code>session_id</code>	The session identifier of the resumable space allocation.

Return Values

Table 155-4 GET_SESSION_TIMEOUT Function Return Values

Return Value	Description
NUMBER	The current timeout value of resumable space allocations for a session with <code>session_id</code> . The timeout is returned in seconds.

Usage Notes

If `session_id` does not exist, the `GET_SESSION_TIMEOUT` function returns -1.

155.2.3 GET_TIMEOUT Function

This function returns the current timeout value of resumable space allocations for the current session.

Syntax

```
DBMS_RESUMABLE.GET_TIMEOUT  
RETURN NUMBER;
```

Return Values

Table 155-5 GET_TIMEOUT Function Return Values

Return Value	Description
NUMBER	The current timeout value of resumable space allocations for the current session. The returned value is in seconds.

Usage Notes

If the current session is not resumable enabled, the `GET_TIMEOUT` function returns -1.

155.2.4 SET_SESSION_TIMEOUT Procedure

This procedure sets the timeout of resumable space allocations for a session with `session_id`.

The new timeout setting applies to the session immediately. If `session_id` does not exist, no operation occurs.

Syntax

```
DBMS_RESUMABLE.SET_SESSION_TIMEOUT (  
    session_id IN NUMBER,  
    timeout    IN NUMBER);
```

Parameters

Table 155-6 SET_SESSION_TIMEOUT Procedure Parameters

Parameter	Description
session_id	The session identifier of the resumable space allocation.
timeout	The timeout of the resumable space allocation.

155.2.5 SET_TIMEOUT Procedure

This procedure sets the timeout of resumable space allocations for the current session. The new timeout setting applies to the session immediately.

Syntax

```
DBMS_RESUMABLE.SET_TIMEOUT (
    timeout IN NUMBER);
```

Parameters

Table 155-7 SET_TIMEOUT Procedure Parameters

Parameter	Description
timeout	The timeout of the resumable space allocation.

155.2.6 SPACE_ERROR_INFO Function

This function looks for space-related errors in the error stack.

If it cannot find a space related error, it will return `FALSE`. Otherwise, `TRUE` is returned and information about the particular object that causes the space error is returned.

Syntax

```
DBMS_RESUMABLE.SPACE_ERROR_INFO
    error_type      OUT VARCHAR2,
    object_type     OUT VARCHAR2,
    object_owner    OUT VARCHAR2,
    table_space_name OUT VARCHAR2,
    object_name     OUT VARCHAR2,
    sub_object_name OUT VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 155-8 SPACE_ERROR_INFO Function Parameters

Parameter	Description
error_type	The space error type. It will be one of the following: <ul style="list-style-type: none">• NO MORE SPACE• MAX EXTENTS REACHED• SPACE QUOTA EXCEEDED
object_type	The object type. It will be one of the following: <ul style="list-style-type: none">• TABLE• INDEX• CLUSTER• TABLE SPACE• ROLLBACK SEGMENT• UNDO SEGMENT• LOB SEGMENT• TEMP SEGMENT• INDEX PARTITION• TABLE PARTITION• LOB PARTITION• TABLE SUBPARTITION• INDEX SUBPARTITION• LOB SUBPARTITION The type can also be <code>NULL</code> if it does not apply.
object_owner	The owner of the object. <code>NULL</code> if it cannot be determined.
table_space_name	The table space where the object resides. <code>NULL</code> if it cannot be determined.
object_name	The name of rollback segment, temp segment, table, index, or cluster.
sub_object_name	The partition name or sub-partition name of <code>LOB</code> , <code>TABLE</code> , or <code>INDEX</code> . <code>NULL</code> if it cannot be determined.

DBMS_RLS

The `DBMS_RLS` package contains the fine-grained access control administrative interface, which is used to implement Virtual Private Database (VPD).

`DBMS_RLS` is available with the Enterprise Edition only.



See Also:

Oracle Database Security Guide for usage information about `DBMS_RLS`

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Operational Notes](#)
- [Rules and Limits](#)
- [Summary of DBMS_RLS Subprograms](#)

156.1 DBMS_RLS Overview

The functionality to support fine-grained access control is based on dynamic predicates, where security rules are not embedded in views, but are acquired at the statement parse time, when the base table or view is referenced in a DML statement.

A dynamic predicate for a table, view, or synonym is generated by a PL/SQL function, which is associated with a security policy through a PL/SQL interface. For example:

```
DBMS_RLS.ADD_POLICY (  
    'hr', 'employees', 'emp_policy', 'hr', 'emp_sec', 'select', 'user_ctx', 'time');
```

Whenever the `EMPLOYEES` table, under the `HR` schema, is referenced in a query or subquery (`SELECT`), the server calls the `EMP_SEC` function (under the `HR` schema). This function returns a predicate specific to the current schema for the `EMP_POLICY` policy. The policy function may generate the predicates based on the session environment variables available during the function call. These variables usually appear in the form of application contexts. The policy can specify any combination of security-relevant columns and of these statement types: `INDEX`, `SELECT`, `INSERT`, `UPDATE`, or `DELETE`.

The server then produces a transient view with the text:

```
SELECT * FROM hr.employees WHERE P1
```

Here, `P1` (for example, where `SAL > 10000`, or even a subquery) is the predicate returned from the `EMP_SEC` function. The server treats the `EMPLOYEES` table as a view and does the view expansion just like the ordinary view, except that the view text is taken from the transient view instead of the data dictionary.

If the predicate contains subqueries, then the owner (definer) of the policy function is used to resolve objects within the subqueries and checks security for those objects. In other words, users who have access privilege to the policy-protected objects do not need to know anything about the policy. They do not need to be granted object privileges for any underlying security policy. Furthermore, the users do not require `EXECUTE` privilege on the policy function, because the server makes the call with the function definer's right.

 **Note:**

The transient view can preserve the updatability of the parent object because it is derived from a single table or view with predicate only; that is, no `JOIN`, `ORDER BY`, `GROUP BY`, and so on.

`DBMS_RLS` also provides the interface to drop or enable security policies. For example, you can drop or enable the `EMP_POLICY` with the following PL/SQL statements:

```
DBMS_RLS.DROP_POLICY('hr', 'employees', 'emp_policy');
DBMS_RLS.ENABLE_POLICY('hr', 'employees', 'emp_policy', TRUE);
```

156.2 DBMS_RLS Security Model

A security check is performed when the transient view is created with a subquery. The schema owning the policy function, which generates the dynamic predicate, is the transient view's definer for security check and object lookup.

156.3 DBMS_RLS Constants

The `DBMS_RLS` package includes constants that can be used for specifying parameter values.

Table 156-1 DBMS_RLS Constants

Constant	Type	Value	Description
<code>ADD_ATTRIBUTE_ASSOCIATION</code>	<code>BINARY_INTEGER</code>	1	Used with <code>DBMS_RLS.ALTER_POLICY</code> and <code>DBMS_RLS.ALTER_GROUPED_POLICY</code> : adds the specified namespace and attribute to the policy or grouped policy

Table 156-1 (Cont.) DBMS_RLS Constants

Constant	Type	Value	Description
REMOVE_ATTRIBUTE_ASSOCIATION	BINARY_INTEGER	2	Used with <code>DBMS_RLS.ALTER_POLICY</code> and <code>DBMS_RLS.ALTER_GROUPED_POLICY</code> : removes the specified namespace and attribute to the policy or grouped policy.

156.4 DBMS_RLS Operational Notes

The `DBMS_RLS` procedures cause current DML transactions, if any, to commit before the operation. However, the procedures do not cause a commit first if they are inside a DDL event trigger. With DDL transactions, the `DBMS_RLS` procedures are part of the DDL transaction.

For example, you may create a trigger for `CREATE TABLE`. Inside the trigger, you may add a column through `ALTER TABLE`, and you can add a policy through `DBMS_RLS`. All these operations are in the same transaction as `CREATE TABLE`, even though each one is a DDL statement. The `CREATE TABLE` succeeds only if the trigger is completed successfully.

Views of current cursors and corresponding predicates are available from `V$VPD_POLICIES`.

A synonym can reference only a view or a table.

156.5 DBMS_RLS Rules and Limits

Using long identifiers is supported for VPD. The maximum length for arguments such as `object_schema`, `object_name`, and `policy_name`, which apply to objects (table names, policy names, and subprogram names) and views is 128 bytes.

156.6 Summary of DBMS_RLS Subprograms

This table lists and briefly describes the subprograms available in `DBMS_RLS`.

Table 156-2 DBMS_RLS Package Subprograms

Subprogram	Description
ADD_GROUPED_POLICY Procedure	Adds a policy associated with a policy group
ADD_POLICY Procedure	Adds a fine-grained access control policy to a table, view, or synonym
ADD_POLICY_CONTEXT Procedure	Adds the context for the active application
ALTER_POLICY Procedure	Associates an application context attribute with VPD policies
ALTER_GROUPED_POLICY Procedure	Adds application context related changes
CREATE_POLICY_GROUP Procedure	Creates a policy group
DELETE_POLICY_GROUP Procedure	Deletes a policy group

Table 156-2 (Cont.) DBMS_RLS Package Subprograms

Subprogram	Description
DISABLE_GROUPED_POLICY Procedure	Disables a row-level group security policy
DROP_GROUPED_POLICY Procedure	Drops a policy associated with a policy group
DROP_POLICY Procedure	Drops a fine-grained access control policy from a table, view, or synonym
DROP_POLICY_CONTEXT Procedure	Drops a driving context from the object so that it will have one less driving context
ENABLE_GROUPED_POLICY Procedure	Enables or disables a row-level group security policy
ENABLE_POLICY Procedure	Enables or disables a fine-grained access control policy
REFRESH_GROUPED_POLICY Procedure	Reparses the SQL statements associated with a refreshed policy
REFRESH_POLICY Procedure	Causes all the cached statements associated with the policy to be reparsed

156.6.1 ADD_GROUPED_POLICY Procedure

This procedure adds a policy associated with a policy group.

Syntax

```
DBMS_RLS.ADD_GROUPED_POLICY (
  object_schema      IN  VARCHAR2      DEFAULT NULL,
  object_name        IN  VARCHAR2,
  policy_group       IN  VARCHAR2      DEFAULT 'SYS_DEFAULT',
  policy_name        IN  VARCHAR2,
  function_schema    IN  VARCHAR2      DEFAULT NULL,
  policy_function     IN  VARCHAR2,
  statement_types    IN  VARCHAR2      DEFAULT NULL,
  update_check       IN  BOOLEAN        DEFAULT FALSE,
  enable             IN  BOOLEAN        DEFAULT TRUE,
  static_policy      IN  BOOLEAN        DEFAULT FALSE,
  policy_type        IN  BINARY_INTEGER DEFAULT NULL,
  long_predicate     IN  BOOLEAN        DEFAULT FALSE,
  sec_relevant_cols  IN  VARCHAR2,
  sec_relevant_cols_opt IN BINARY_INTEGER DEFAULT NULL,
  namespace         IN  VARCHAR2      DEFAULT NULL,
  attribute          IN  VARCHAR2      DEFAULT NULL);
```

Parameters

Table 156-3 ADD_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view, or synonym. If no object_schema is specified or is NULL, then the current schema is used.
object_name	Name of the table, view, or synonym to which the policy is added
policy_group	Name of the policy group to which the policy belongs
policy_name	Name of the policy; must be unique for the same table or view

Table 156-3 (Cont.) ADD_GROUPED_POLICY Procedure Parameters

Parameter	Description
<code>function_schema</code>	Schema owning the policy function. If no <code>function_schema</code> is specified or is NULL, then the current schema is used.
<code>policy_function</code>	Name of the function that generates a predicate for the policy. If the function is defined within a package, the name of the package must be present.
<code>statement_types</code>	Statement types to which the policy applies. It can be any combination of INDEX, SELECT, UPDATE, or DELETE. The default is to apply to all of these types except INSERT and INDEX.
<code>update_check</code>	For INSERT and UPDATE statements only, setting <code>update_check</code> to TRUE causes the server to check the policy against the value after INSERT or UPDATE. The check applies only to the security relevant columns that are included in the policy definition. In other words, the INSERT or UPDATE operation will fail only if the security relevant column that is defined in the policy is added or updated in the INSERT or UPDATE statement.
<code>enable</code>	Indicates if the policy is enable when it is added. The default is TRUE.
<code>static_policy</code>	Default is FALSE. If it is set to TRUE, the server assumes that the policy function for the static policy produces the same predicate string for anyone accessing the object, except for SYS or the privilege user who has the EXEMPT ACCESS POLICY privilege.
<code>policy_type</code>	Default is NULL, which means <code>policy_type</code> is decided by the value of <code>static_policy</code> . The available policy types are listed in Table 156-5 . Specifying any of these policy types overrides the value of <code>static_policy</code> .
<code>long_predicate</code>	Default is FALSE, which means the policy function can return a predicate with a length of up to 4000 bytes. TRUE means the predicate text string length can be up to 32K bytes. Policies existing prior to the availability of this parameter retain a 32K limit.
<code>sec_relevant_cols</code>	Enables column-level Virtual Private Database (VPD), which enforces security policies when a column containing sensitive information is referenced in a query. Applies to tables and views, but not to synonyms. Specify a list of comma- or space-separated valid column names of the policy-protected object. The policy is enforced only if a specified column is referenced (or, for an abstract datatype column, its attributes are referenced) in the user SQL statement or its underlying view definition. Default is all the user-defined columns for the object.
<code>namespace</code>	Name which determines the application context namespace
<code>attribute</code>	Attribute which determines the application context attribute name

Usage Notes

- This procedure adds a policy to the specified table, view, or synonym and associates the policy with the specified policy group.
- The policy group must have been created by using the [CREATE_POLICY_GROUP Procedure](#).
- The policy name must be unique within a policy group for a specific object.

- Policies from the default policy group, `SYS_DEFAULT`, are always executed regardless of the active policy group; however, fine-grained access control policies do not apply to users with `EXEMPT ACCESS POLICY` system privilege.

156.6.2 ADD_POLICY Procedure

This procedure adds a fine-grained access control policy to a table, view, or synonym.

The procedure causes the current transaction, if any, to commit before the operation is carried out. However, this does not cause a commit first if it is inside a DDL event trigger.

 **See Also:**
[Operational Notes](#)

A `COMMIT` is also performed at the end of the operation.

Syntax

```
DBMS_RLS.ADD_POLICY (
  object_schema          IN  VARCHAR2          DEFAULT NULL,
  object_name            IN  VARCHAR2,
  policy_name            IN  VARCHAR2,
  function_schema        IN  VARCHAR2          DEFAULT NULL,
  policy_function        IN  VARCHAR2,
  statement_types        IN  VARCHAR2          DEFAULT NULL,
  update_check           IN  BOOLEAN           DEFAULT FALSE,
  enable                 IN  BOOLEAN           DEFAULT TRUE,
  static_policy          IN  BOOLEAN           DEFAULT FALSE,
  policy_type            IN  BINARY_INTEGER   DEFAULT NULL,
  long_predicate         IN  BOOLEAN           DEFAULT FALSE,
  sec_relevant_cols      IN  VARCHAR2          DEFAULT NULL,
  sec_relevant_cols_opt IN  BINARY_INTEGER   DEFAULT NULL,
  namespace              IN  VARCHAR2          DEFAULT NULL,
  attribute              IN  VARCHAR2          DEFAULT NULL);
```

Parameters

Table 156-4 ADD_POLICY Procedure Parameters

Parameter	Description
<code>object_schema</code>	Schema containing the table, view, or synonym. If no <code>object_schema</code> is specified or is <code>NULL</code> , then the current schema is used.
<code>object_name</code>	Name of table, view, or synonym to which the policy is added.
<code>policy_name</code>	Name of policy to be added. It must be unique for the same table or view. Do not enter special characters such as spaces or commas. If you want to use special characters for the policy name, then enclose the name in quotation marks.
<code>function_schema</code>	Schema owning the policy function. If no <code>function_schema</code> is specified or is <code>NULL</code> , then the current schema is used.

Table 156-4 (Cont.) ADD_POLICY Procedure Parameters

Parameter	Description
<code>policy_function</code>	Name of a function which generates a predicate for the policy. If the function is defined within a package, then the name of the package must be present.
<code>statement_types</code>	Statement types to which the policy applies. It can be any combination of <code>INDEX</code> , <code>SELECT</code> , <code>UPDATE</code> , or <code>DELETE</code> . The default is to apply to all of these types except <code>INSERT</code> and <code>INDEX</code> .
<code>update_check</code>	Optional argument for the <code>INSERT</code> or <code>UPDATE</code> statement type. The default is <code>FALSE</code> . If you plan to use the <code>INSERT</code> statement type, then you must set <code>update_check</code> to <code>TRUE</code> . Otherwise, an <code>ORA-28104 input value for string is not valid error</code> is generated. The check applies only to the security relevant columns that are included in the policy definition. In other words, the <code>INSERT</code> or <code>UPDATE</code> operation will fail only if the security relevant column that is defined in the policy is added or updated in the <code>INSERT</code> or <code>UPDATE</code> statement.
<code>enable</code>	Indicates if the policy is enabled when it is added. The default is <code>TRUE</code> .
<code>static_policy</code>	The default is <code>FALSE</code> . If it is set to <code>TRUE</code> , the server assumes that the policy function for the static policy produces the same predicate string for anyone accessing the object, except for <code>SYS</code> or the privileged user who has the <code>EXEMPT ACCESS POLICY</code> privilege.
<code>policy_type</code>	Default is <code>NULL</code> , which means <code>policy_type</code> is decided by the value of <code>static_policy</code> . The available policy types are listed in Table 156-5 . Specifying any of these policy types overrides the value of <code>static_policy</code> .
<code>long_predicate</code>	Default is <code>FALSE</code> , which means the policy function can return a predicate with a length of up to 4000 bytes. <code>TRUE</code> means the predicate text string length can be up to 32K bytes. Policies existing prior to the availability of this parameter retain a 32K limit.
<code>sec_relevant_cols</code>	Enables column-level Virtual Private Database (VPD), which enforces security policies when a column containing sensitive information is referenced in a query. Applies to tables and views, but not to synonyms. Specify a list of comma- or space-separated valid column names of the policy-protected object. The policy is enforced only if a specified column is referenced (or, for an abstract datatype column, its attributes are referenced) in the user SQL statement or its underlying view definition. Default is all the user-defined columns for the object.
<code>sec_relevant_cols_opt</code>	Use with <code>sec_relevant_cols</code> to display all rows for column-level VPD filtered queries (<code>SELECT</code> only), but where sensitive columns appear as <code>NULL</code> . Default is set to <code>NULL</code> , which allows the filtering defined with <code>sec_relevant_cols</code> to take effect. Set to <code>dbms_ols.ALL_ROWS</code> to display all rows, but with sensitive column values, which are filtered by <code>sec_relevant_cols</code> , displayed as <code>NULL</code> . See Usage Notes for restrictions and additional information about this option.
<code>namespace</code>	Name which determines the application context namespace
<code>attribute</code>	Attribute which determines the application context attribute name

Table 156-5 DBMS_RLS.ADD_POLICY Policy Types

Policy Type	Description
STATIC	Predicate is assumed to be the same regardless of the runtime environment. Static policy functions are executed once and then cached in SGA. Statements accessing the same object do not reexecute the policy function. However, each execution of the same cursor could produce a different row set even for the same predicate because the predicate may filter the data differently based on attributes such as SYS_CONTEXT or SYSDATE. Applies to only one object.
SHARED_STATIC	Same as STATIC except that the server first looks for a cached predicate generated by the same policy function of the same policy type. Shared across multiple objects.
CONTEXT_SENSITIVE	Server re-evaluates the policy function at statement execution time if it detects context changes since the last use of the cursor. For session pooling where multiple clients share a database session, the middle tier must reset context during client switches. Note that the server does not cache the value returned by the function for this policy type; it always executes the policy function on statement parsing. Applies to only one object.
SHARED_CONTEXT_SENSITIVE	Same as CONTEXT_SENSITIVE except that the server first looks for a cached predicate generated by the same policy function of the same policy type within the same database session. If the predicate is found in the session memory, the policy function is not reexecuted and the cached value is valid until session private application context changes occur. Shared across multiple objects.
DYNAMIC	The default policy type. Server assumes the predicate may be affected by any system or session environment at any time, and so always reexecutes the policy function upon each statement parsing and execution. Applies to only one object.

Usage Notes

- SYS is free of any security policy.
- The policy functions are called by the server. Following is the interface for the function:


```
FUNCTION policy_function (object_schema IN VARCHAR2, object_name VARCHAR2)
    RETURN VARCHAR2
--- object_schema is the schema owning the table or view.
--- object_name is the name of table, view, or synonym to which the policy
applies.
```
- The policy functions must have the purity level of WNDS (write no database state).

See Also:

The *Oracle Database Development Guide* has more details about the RESTRICT_REFERENCES pragma.

- Predicates generated from different VPD policies for the same object have the combined effect of a conjunction (ANDed) of all the predicates.

- The security check and object lookup are performed against the owner of the policy function for objects in the subqueries of the dynamic predicates.
- If the function returns a zero length predicate, then it is interpreted as no restriction being applied to the current user for the policy.
- When a table alias is required (for example, parent object is a type table) in the predicate, the name of the table or view itself must be used as the name of the alias. The server constructs the transient view as something like

```
"select c1, c2, ... from tab tab where <predicate>"
```

- Validity of the function is checked at runtime for ease of installation and other dependency issues during import and export.
- Column-level VPD column masking behavior (specified with `sec_relevant_cols_opt => dbms_ols.ALL_ROWS`) is fundamentally different from all other VPD policies, which return only a subset of rows. Instead the column masking behavior returns all rows specified by the user's query, but the sensitive column values display as `NULL`. The restrictions for this option are as follows:
 - Only applies to `SELECT` statements
 - Unlike regular VPD predicates, the masking condition that is generated by the policy function must be a simple boolean expression.
 - If your application performs calculations, or does not expect `NULL` values, then you should use the default behavior of column-level VPD, which is specified with the `sec_relevant_cols` parameter.
 - If you use `UPDATE AS SELECT` with this option, then only the values in the columns you are allowed to see will be updated.
 - This option may prevent some rows from displaying. For example:

```
SELECT * FROM employees
WHERE salary = 10
```

This query may not return rows if the `salary` column returns a `NULL` value because the column masking option has been set.

- When you add a VPD policy to a synonym, it causes all the dependent objects of the synonym, including policy functions that reference the synonym, to be marked `INVALID`.
- You cannot associate a global application context with a context sensitive policy or a context shared sensitive policy.
- The maximum number of policies that can be created for a single object is 255.

Examples

As the first of two examples, the following creates a policy that applies to the `hr.employee` table. This is a column-level VPD policy that will be enforced only if a `SELECT` or an `INDEX` statement refers to the `salary`, `birthdate`, or `SSN` columns of the table explicitly, or implicitly through a view. It is also a `CONTEXT_SENSITIVE` policy, so the server will invoke the policy function `hr.hrfun` at parse time. The namespace and attribute application context parameters restrict the policy evaluation only when the application context values change. During execution, it will only invoke the function if there has been any session private context change since the last use of the statement cursor. The predicate generated by the policy function must not exceed 4000 bytes, the default length limit, since the `long_predicate` parameter is omitted from the call.

```

BEGIN
  DBMS_RLS.ADD_POLICY(
    object_schema => 'hr',
    object_name   => 'employee',
    policy_name   => 'hr_policy',
    function_schema => 'hr',
    policy_function => 'hrfun',
    statement_types => 'select,index',
    policy_type    => DBMS_RLS.CONTEXT_SENSITIVE,
    sec_relevant_cols => 'salary,birthdate,ssn',
    namespace     => 'empno_ctx',
    attribute     => 'emp_id');
END;

```

As the second example, the following command creates another policy that applies to the same object for hosting, so users can access only data based on their subscriber ID. Since it is defined as a `SHARED_STATIC` policy type, the server will first try to find the predicate in the SGA cache. The server will only invoke the policy function, `subfun`, if that search fails.

```

BEGIN
  DBMS_RLS.ADD_POLICY(
    object_schema => 'hr',
    object_name   => 'employee',
    policy_name   => 'hosting_policy',
    function_schema => 'hr',
    policy_function => 'subfun',
    policy_type    => dbms_rls.SHARED_STATIC);
END;

```

156.6.3 ADD_POLICY_CONTEXT Procedure

This procedure adds the context for the active application.

Syntax

```

DBMS_RLS.ADD_POLICY_CONTEXT (
  object_schema  IN VARCHAR2 NULL,
  object_name    IN VARCHAR2,
  namespace      IN VARCHAR2,
  attribute      IN VARCHAR2);

```

Parameters

Table 156-6 ADD_POLICY_CONTEXT Procedure Parameters

Parameter	Description
<code>object_schema</code>	Schema containing the table, view, or synonym. If no <code>object_schema</code> is specified or is <code>NULL</code> , then the current schema is used.
<code>object_name</code>	Name of the table, view, or synonym to which the policy is added.
<code>namespace</code>	Name which determines the application context namespace
<code>attribute</code>	Attribute which determines the application context attribute name

Usage Notes

Note the following:

- This procedure indicates the application context that drives the enforcement of policies; this is the context that determines which application is running.
- The driving context can be session or global.
- At execution time, the server retrieves the name of the active policy group from the value of this context.
- There must be at least one driving context defined for each object that has fine-grained access control policies; otherwise, all policies for the object will be executed.
- Adding multiple context to the same object will cause policies from multiple policy groups to be enforced.
- If the driving context is `NULL`, policies from all policy groups are used.
- If the driving context is a policy group with policies, all enabled policies from that policy group will be applied, along with all policies from the `SYS_DEFAULT` policy group.
- To add a policy to table `HR.EMPLOYEES` in group `access_control_group`, the following command is issued:

```
DBMS_RLS.ADD_GROUPED_POLICY('hr','employees','access_control_group','policy1','SYS',
 'HR.ACCESS');
```

156.6.4 ALTER_POLICY Procedure

This procedure associates an application context attribute with VPD policies.

Syntax

```
DBMS_RLS.ALTER_POLICY (
  object_schema  IN VARCHAR2 DEFAULT NULL,
  object_name    IN VARCHAR2,
  policy_name    IN VARCHAR2,
  alter_option   IN NUMBER,
  namespace     IN VARCHAR2 DEFAULT NULL,
  attribute      IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 156-7 ALTER_POLICY Procedure Parameters

Parameter	Description
<code>object_schema</code>	Schema containing the table, view, or synonym. If no <code>object_schema</code> is specified or is <code>NULL</code> , then the current schema is used.
<code>object_name</code>	Name of the table, view, or synonym to which the policy is added
<code>policy_name</code>	Name of the policy, unique for the same table or view
<code>alter_option</code>	Used to determine whether the application context is being added or removed from an Oracle Virtual Private Database policy
<code>namespace</code>	Name which determines the application context namespace
<code>attribute</code>	Attribute which determines the application context attribute name

Usage Notes

Note the following:

- This procedure associates an application context namespace and application context attribute to context sensitive and shared context sensitive policies only. Specifying application context namespace and application context attribute for DYNAMIC, STATIC or SHARED_STATIC policies will result in an error. If namespace is specified, attribute should also be specified for the procedure call.
- You cannot associate a global application context with a context sensitive policy or a context shared sensitive policy.
- Invocations of ALTER_POLICY which modify a shared context sensitive VPD policy have an effect on all shared context sensitive VPD policies that have the same VPD policy function.
- The driving context can be session or global.
- At execution time, the server retrieves the name of the active policy group from the value of this context.
- There must be at least one driving context defined for each object that has fine-grained access control policies; otherwise, all policies for the object will be executed.
- Adding multiple context to the same object will cause policies from multiple policy groups to be enforced.
- If the driving context is NULL, policies from all policy groups are used.
- If the driving context is a policy group with policies, all enabled policies from that policy group will be applied, along with all policies from the SYS_DEFAULT policy group.
- To add a policy to table hr.employees in group access_control_group, the following command is issued:

```
DBMS_RLS.ADD_GROUPED_POLICY(
    'hr','employees','access_control_group','policy1','SYS','HR.ACCESS');
```

156.6.5 ALTER_GROUPED_POLICY Procedure

This procedure adds application context related changes.

Syntax

```
DBMS_RLS.ALTER_GROUPED_POLICY (
    object_schema    IN VARCHAR2 DEFAULT NULL,
    object_name      IN VARCHAR2,
    policy_group     IN VARCHAR2 DEFAULT SYS_DEFAULT,
    policy_name      IN VARCHAR2,
    alter_option     IN NUMBER,
    namespace        IN VARCHAR2 DEFAULT NULL,
    attribute        IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 156-8 ALTER_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view, or synonym. If no object_schema is specified or is NULL, then the current schema is used.

Table 156-8 (Cont.) ALTER_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_name	Name of the table, view, or synonym to which the policy is added
policy_group	Name of the policy group to which this policy belongs; must be unique for the same table or view
policy_name	Name of the policy, unique for the same table or view
alter_option	Used to determine whether the application context is being added or removed from the Oracle Virtual Private Database policy
namespace	Name that determines the application context namespace
attribute	Attribute determines the application context attribute name

Usage Notes

Note the following:

- This procedure will associate an application context namespace and application context attribute to context sensitive and shared context sensitive policies only. Specifying application context namespace and application context attribute for DYNAMIC, STATIC or SHARED_STATIC policies will result in an error. If namespace is specified, attribute should also be specified for the procedure call.
- You cannot associate a global application context with a context sensitive policy or a context shared sensitive policy.
- Invocations of ALTER_GROUPED_POLICY which modify a shared context sensitive VPD policy have an effect on all shared context sensitive VPD policies that have the same VPD policy function.
- The driving context can be session or global.
- At execution time, the server retrieves the name of the active policy group from the value of this context.
- There must be at least one driving context defined for each object that has fine-grained access control policies; otherwise, all policies for the object will be executed.
- Adding multiple context to the same object will cause policies from multiple policy groups to be enforced.
- If the driving context is NULL, policies from all policy groups are used.
- If the driving context is a policy group with policies, all enabled policies from that policy group will be applied, along with all policies from the SYS_DEFAULT policy group.
- To add a policy to table hr.employees in group access_control_group, the following command is issued:

```
DBMS_RLS.ADD_GROUPED_POLICY (
    'hr', 'employees', 'access_control_group', 'policy1', 'SYS', 'HR.ACCESS');
```

156.6.6 CREATE_POLICY_GROUP Procedure

This procedure creates a policy group.

Syntax

```
DBMS_RLS.CREATE_POLICY_GROUP (  
    object_schema IN VARCHAR2 NULL,  
    object_name   IN VARCHAR2,  
    policy_group  IN VARCHAR2);
```

Parameters

Table 156-9 CREATE_POLICY_GROUP Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view, or synonym. If no <code>object_schema</code> is specified or is <code>NULL</code> , then the current schema is used.
object_name	Name of the table, view, or synonym to which the policy is added
policy_group	Name of the policy group that the policy belongs to

Usage Notes

The group must be unique for each table or view.

156.6.7 DELETE_POLICY_GROUP Procedure

This procedure deletes a policy group.

Syntax

```
DBMS_RLS.DELETE_POLICY_GROUP (  
    object_schema IN VARCHAR2 NULL,  
    object_name   IN VARCHAR2,  
    policy_group  IN VARCHAR2);
```

Parameters

Table 156-10 DELETE_POLICY_GROUP Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view, or synonym. If no <code>object_schema</code> is specified or is <code>NULL</code> , then the current schema is used.
object_name	Name of the table, view, or synonym to which the policy is added
policy_group	Name of the policy group that the policy belongs to

Usage Notes

Note the following:

- This procedure deletes a policy group for the specified table, view, or synonym.
- No policy can be in the policy group.

156.6.8 DISABLE_GROUPED_POLICY Procedure

This procedure disables a row-level group security policy.

Syntax

```
DBMS_RLS.DISABLE_GROUPED_POLICY (
  object_schema  IN VARCHAR2 NULL,
  object_name    IN VARCHAR2,
  group_name     IN VARCHAR2,
  policy_name    IN VARCHAR2);
```

Parameters

Table 156-11 DISABLE_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view, or synonym
object_name	Name of the table, view, or synonym with which the policy is associated
group_name	Name of the group of the policy
policy_name	Name of the policy to be enabled or disabled

Usage Notes

- The procedure causes the current transaction, if any, to commit before the operation is carried out.
- A commit is performed at the end of the operation.
- A policy is disabled when this procedure is executed or when the ENABLE_GROUPED_POLICY procedure is executed with "enable" set to FALSE.

156.6.9 DROP_GROUPED_POLICY Procedure

This procedure drops a policy associated with a policy group.

Syntax

```
DBMS_RLS.DROP_GROUPED_POLICY (
  object_schema  IN VARCHAR2 NULL,
  object_name    IN VARCHAR2,
  policy_group   IN VARCHAR2 'SYS_DEFAULT',
  policy_name    IN VARCHAR2);
```

Parameters

Table 156-12 DROP_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view, or synonym. If no object_schema is specified or is NULL, then the current schema is used.
object_name	Name of the table, view, or synonym to which the policy is dropped
policy_group	Name of the policy group to which the policy belongs
policy_name	Name of the policy

156.6.10 DROP_POLICY Procedure

This procedure drops a fine-grained access control policy from a table, view, or synonym.

The procedure causes the current transaction, if any, to commit before the operation is carried out. However, this does not cause a commit first if it is inside a DDL event trigger.



See Also:

[Operational Notes](#)

A COMMIT is also performed at the end of the operation.

Syntax

```
DBMS_RLS.DROP_POLICY (
  object_schema  IN VARCHAR2 NULL,
  object_name    IN VARCHAR2,
  policy_name    IN VARCHAR2);
```

Parameters

Table 156-13 DROP_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view or synonym. If no object_schema is specified, or NULL is provided, then the current user's schema is assumed.
object_name	Name of the table, view, or synonym for which the policy is dropped
policy_name	Name of policy to be dropped from table, view, or synonym

Usage Notes

- When you drop a VPD policy from a synonym, it causes all the dependent objects of the synonym, including policy functions that reference the synonym, to be marked `INVALID`.

156.6.11 DROP_POLICY_CONTEXT Procedure

This procedure drops a driving context from the object so that it will have one less driving context.

Syntax

```
DBMS_RLS.DROP_POLICY_CONTEXT (
  object_schema  IN VARCHAR2 NULL,
  object_name    IN VARCHAR2,
  namespace     IN VARCHAR2,
  attribute      IN VARCHAR2);
```

Parameters**Table 156-14** DROP_POLICY_CONTEXT Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view, or synonym. If no object_schema is specified or is NULL, then the current schema is used.
object_name	Name of the table, view, or synonym to which the policy is dropped
namespace	Namespace of the driving context
attribute	Attribute of the driving context

156.6.12 ENABLE_GROUPED_POLICY Procedure

This procedure enables or disables a row-level group security policy.

Syntax

```
DBMS_RLS.ENABLE_GROUPED_POLICY (
  object_schema  IN VARCHAR2 NULL,
  object_name    IN VARCHAR2,
  group_name     IN VARCHAR2,
  policy_name    IN VARCHAR2,
  enable        IN BOOLEAN TRUE);
```

Parameters**Table 156-15** ENABLE_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view, or synonym. If no object_schema is specified or is NULL, then the current schema is used.
object_name	Name of the table, view, or synonym with which the policy is associated
group_name	Name of the group of the policy

Table 156-15 (Cont.) ENABLE_GROUPED_POLICY Procedure Parameters

Parameter	Description
policy_name	Name of the policy to be enabled or disabled
enable	TRUE enables the policy; FALSE disables the policy

Usage Notes

- The procedure causes the current transaction, if any, to commit before the operation is carried out.
- A commit is performed at the end of the operation.
- A policy is enabled when it is created.

156.6.13 ENABLE_POLICY Procedure

This procedure enables or disables a fine-grained access control policy. A policy is enabled when it is created.

The procedure causes the current transaction, if any, to commit before the operation is carried out. However, this does not cause a commit first if it is inside a DDL event trigger.

 **See Also:**
[Operational Notes](#)

A COMMIT is also performed at the end of the operation.

Syntax

```
DBMS_RLS.ENABLE_POLICY (
    object_schema IN VARCHAR2 NULL,
    object_name   IN VARCHAR2,
    policy_name   IN VARCHAR2,
    enable        IN BOOLEAN TRUE);
```

Parameters

Table 156-16 ENABLE_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view, or synonym. If no object_schema is specified or is NULL, then the current schema is used.
object_name	Name of table, view, or synonym with which the policy is associated
policy_name	Name of policy to be enabled or disabled
enable	TRUE to enable the policy, FALSE to disable the policy

156.6.14 REFRESH_GROUPED_POLICY Procedure

This procedure reparses the SQL statements associated with a refreshed policy.

Syntax

```
DBMS_RLS.REFRESH_GROUPED_POLICY (  
    object_schema IN VARCHAR2 NULL,  
    object_name   IN VARCHAR2 NULL,  
    group_name    IN VARCHAR2 NULL,  
    policy_name   IN VARCHAR2 NULL);
```

Parameters

Table 156-17 REFRESH_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view, or synonym. If no <code>object_schema</code> is specified or is <code>NULL</code> , then the current schema is used.
object_name	Name of the table, view, or synonym with which the policy is associated
group_name	Name of the group of the policy
policy_name	Name of the policy

Usage Notes

- This procedure causes all the cached statements associated with the policy to be reparsed. This guarantees that the latest change to the policy has immediate effect after the procedure is executed.
- The procedure causes the current transaction, if any, to commit before the operation is carried out.
- A commit is performed at the end of the operation.
- The procedure returns an error if it tries to refresh a disabled policy.
- The procedure removes the cached results of context and shared sensitive VPD policies.

156.6.15 REFRESH_POLICY Procedure

This procedure causes all the cached statements associated with the policy to be reparsed. This guarantees that the latest change to this policy will have immediate effect after the procedure is executed.

The procedure causes the current transaction, if any, to commit before the operation is carried out. However, this does not cause a commit first if it is inside a DDL event trigger.



See Also:

[Operational Notes](#)

A COMMIT is also performed at the end of the operation.

Syntax

```
DBMS_RLS.REFRESH_POLICY (  
    object_schema IN VARCHAR2 NULL,  
    object_name   IN VARCHAR2 NULL,  
    policy_name   IN VARCHAR2 NULL);
```

Parameters

Table 156-18 REFRESH_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table, view, or synonym. If no object_schema is specified or is NULL, then the current schema is used.
object_name	Name of table, view, or synonym with which the policy is associated
policy_name	Name of policy to be refreshed

Usage Notes

- The procedure returns an error if it tries to refresh a disabled policy.
- The procedure removes the cached results of context and shared sensitive VPD policies.

DBMS_ROLLING

The `DBMS_ROLLING` PL/SQL package is used to implement the Rolling Upgrade Using Active Data Guard feature.

The Active Data Guard feature of Oracle Data Guard streamlines the process of upgrading Oracle Database software in a Data Guard configuration in a rolling fashion. The Rolling Upgrade Using Active Data Guard feature requires a license for the Oracle Active Data Guard option. You can use this feature for database release upgrades starting with the first patchset of Oracle Database 12c.

Starting with Oracle Database 23ai, Transaction Guard works during `DBMS_ROLLING` operations to ensure continuous application functions during switchover, issued by `DBMS_ROLLING` to Transient Logical Standby. Transaction Guard returns the commit outcome of the current in-flight transaction when an error or outage occurs. Applications embed the Transaction Guard APIs in their error handling procedures to ensure that work continues without any in-flight work lost or duplicate submissions after an outage.

Additionally, you can use this feature immediately for other database maintenance tasks. The database where maintenance is performed must be operating at a minimum of Oracle Database 12c Release 1 (12.1). Such maintenance tasks include:

- Adding partitioning to non-partitioned tables
- Changing BasicFiles LOBs to SecureFiles LOBs
- Changing `XMLType` stored as `CLOB` to `XMLType` stored as binary XML
- Altering tables to be OLTP-compressed

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of `DBMS_ROLLING` Subprograms](#)



See Also:

Oracle Data Guard Concepts and Administration for information about using `DBMS_ROLLING` to perform a rolling upgrade

157.1 `DBMS_ROLLING` Overview

The `DBMS_ROLLING` PL/SQL package provides procedures that you can use to perform any change throughout a Data Guard configuration in a rolling fashion.

These procedures include a rolling upgrade of the Oracle Database software. Although the focus of this document is rolling upgrade operations, the content is applicable to the deployment of any rolling changes.

Starting with Oracle Database 23ai, Transaction Guard works during `DBMS_ROLLING` operations to ensure continuous application functions during switchover, issued by `DBMS_ROLLING` to Transient Logical Standby.

All the procedures are executed at the current primary database, which eliminates the potential confusion of moving between remote databases to perform various operations related to the rolling upgrade. If necessary, all the procedures can be called again to resume the rolling upgrade after an error or interruption. (The upgrade script must still be run at the standby.)

The package also provides a procedure that allows you to return a Data Guard configuration back to its original, pre-upgrade state in the event users wish to abandon the rolling upgrade.

The actual execution of a rolling upgrade has been reduced to three steps (excluding the upgrade of the Oracle Database software itself and the on-disk setup of the new Oracle Database software). The number of steps remains the same regardless of the size of the Data Guard configuration.

Conceptually, for the purposes of the `DBMS_ROLLING` package, you divide your Data Guard configuration into two groups: the leading group and the trailing group. The databases in the leading group undergo the upgrade operation (or any other change that you are deploying) first. The databases in the trailing group undergo the upgrade of the Oracle Database software (or any other change that you are deploying) only after the switchover operation. This insulates them from the upgrade and gives you time to evaluate the effect of the change in the leading group databases.

Each group has a master database: the future primary database as specified in the `DBMS_ROLLING.INIT_PLAN` procedure is the master of the leading group, called Leading Group Master (LGM), while the original primary database is the master of the trailing group called Trailing Group Master (TGM). You can configure databases to protect the LGM and the TGM. Standbys designated to protect the LGM are referred to as Leading Group Standbys (LGS). Standbys designated to protect the TGM are referred to as Trailing Group Standbys (TGS). These terms are used throughout this documentation.

If you perform a rolling upgrade using a transient logical standby database (including using `DBMS_ROLLING`), then you must manually load audit records from the operating system spillover location before the switchover. Before you run `DBMS_ROLLING.SWITCHOVER`, run `DBMS_AUDIT_MGMT.LOAD_UNIFIED_AUDIT_FILES` on the trailing group master (current primary database).

157.2 DBMS_ROLLING Security Model

The `DBMS_ROLLING` package is available to users who have been granted the DBA role.

157.3 Summary of DBMS_ROLLING Subprograms

This table lists and briefly describes the `DBMS_ROLLING` package subprograms.

Table 157-1 DBMS_ROLLING Package Subprograms

Subprogram	Description
INIT_PLAN Procedure	Initializes a rolling operation plan with system-generated default values.
DESTROY_PLAN Procedure	Destroys any existing rolling operation plan, its parameters, and all resources associated with the rolling operation.
BUILD_PLAN Procedure	Validates plan parameters and creates or modifies a rolling operation plan.
SET_PARAMETER Procedure	Modifies a rolling operation parameter.
START_PLAN Procedure	Starts the rolling operation.
SWITCHOVER Procedure	Performs a switchover between the current primary database and the transient logical standby database.
FINISH_PLAN Procedure	Finalizes the rolling operation.
ROLLBACK_PLAN Procedure	Completely rolls back the rolling operation.

157.3.1 INIT_PLAN Procedure

This procedure initializes a rolling operation plan with system-generated default values.

Syntax

```
DBMS_ROLLING.INIT_PLAN (
    future_primary IN VARCHAR2);
```

Parameters

Table 157-2 INIT_PLAN Procedure Parameters

Parameter	Description
future_primary	DB_UNIQUE_NAME of the future primary (also known as the Leading Group Master (LGM))

Exceptions

- ORA-45400: operation not permitted on current database
- ORA-45401: upgrade plan is already active
- ORA-45402: LOG_ARCHIVE_CONFIG must contain the DG_CONFIG attribute
- ORA-45403: database %s must be specified in DG_CONFIG
- ORA-45411: operation requires additional arguments
- ORA-65040: operation not allowed from within a pluggable database

Usage Notes

- This procedure communicates with all databases defined in the log_archive_config init.ora parameter and validates that each database is a valid participant in the rolling

upgrade. Valid participants other than the primary database must have a database role of either physical standby, DG, or logical standby.

- The designated future primary must be a physical standby or ADG.

157.3.2 DESTROY_PLAN Procedure

This procedure destroys any existing upgrade plan, its parameters, and all resources associated with a rolling operation.

Syntax

```
DBMS_ROLLING.DESTROY_PLAN ();
```

Parameters

This procedure has no parameters.

Exceptions

- ORA-45422: operation requires existing plan
- ORA-65040: operation not allowed from within a pluggable database

Usage Notes

- When a rolling operation is complete, this procedure can be called to completely purge all states related to a rolling operation.
- This procedure must also be called after a `ROLLBACK_PLAN` to purge the metadata.

157.3.3 BUILD_PLAN Procedure

This procedure validates plan parameters and creates or modifies a rolling operation plan.

A successfully constructed plan is required in order to perform a rolling operation. This procedure must return successfully before the `START_PLAN` procedure can be called to start the rolling operation. Parameter changes made after a plan has been created may require calling the `BUILD_PLAN` procedure to modify the existing plan. The `DBA_ROLLING_EVENTS` view will indicate if any invocation of the `SET_PARAMETER` procedure requires a plan rebuild. Failure to rebuild the plan will result in an ORA-45416 error when attempting to resume the rolling operation.

Syntax

```
DBMS_ROLLING.BUILD_PLAN ();
```

Parameters

This procedure has no parameters.

Exceptions

- ORA-45400: operation not permitted on current database
- ORA-45403: database %s must be specified in the `DG_CONFIG`
- ORA-45414: could not connect to a remote database

- ORA-45419: `DB_UNIQUE_NAME` parameter must be specified
- ORA-45433: failover was detected on an unsupported database
- ORA-45434: multiple failovers of the same type detected
- ORA-65040: operation not allowed from within a pluggable database

Usage Notes

- This procedure connects to databases specified as plan parameters. These instances must be mounted or open, and must be reachable via the network.

157.3.4 SET_PARAMETER Procedure

This procedure modifies a rolling operation parameter.

Starting with Oracle Database 20c, a new parameter called `BLOCK_UNSUPPORTED` is added to the `DBMS_ROLLING.SET_PARAMETER` procedure. By default, `BLOCK_UNSUPPORTED` is set to 1, indicating that operations performed on tables that are unsupported by Transient Logical Standby will be blocked on the primary database. If set to 0, then the `DBMS_ROLLING` package does not block operations on unsupported tables. Those tables will not be maintained by Transient Logical Standby, and will diverge from the primary database.

Syntax

```
DBMS_ROLLING.SET_PARAMETER (
  scope          IN VARCHAR2 DEFAULT NULL,
  name           IN NUMBER,
  value          IN VARCHAR2);
```

Parameters

Table 157-3 *SET_PARAMETER Procedure Parameters*

Parameter	Description
scope	Parameter scope. It can either be NULL for global parameters, or the <code>DB_UNIQUE_NAME</code> of a specific database for local parameters.
name	The <code>DBMS_ROLLING</code> constant for a given parameter.
value	New value for the parameter or NULL to revert to a default value.

Exceptions

- ORA-45400: operation not permitted on current database
- ORA-45408: parameter name is unknown
- ORA-45409: parameter value is invalid or out of bounds
- ORA-45410: parameter may not be modified
- ORA-45411: operation requires additional arguments
- ORA-45412: parameter scope argument is unknown
- ORA-45413: parameter has no default value
- ORA-45414: could not connect to a remote database

- ORA-65040: operation not allowed from within a pluggable database

Usage Notes

- Changes to a parameter value may require a call to the `DBMS_ROLLING.BUILD_PLAN` procedure to modify the existing plan. Users should check the `DBA_ROLLING_EVENTS` view after setting a parameter to determine if a rebuild is necessary.
- [Table 157-4](#) lists all the available parameters and their descriptions. The parameter names and values described in the table are all of type `VARCHAR2`.
- The `MINVAL` and `MAXVAL` columns in the `DBA_ROLLING_PARAMETERS` view identify the valid range of values for a parameter. The view does not contain any parameters until the `DBMS_ROLLING.INIT_PLAN` procedure has been successfully invoked.

Table 157-4 Valid Values for DBMS_ROLLING.SET_PARAMETER Procedure

Parameter Name	Global?	Description	Default
<code>ACTIVE_SESSIONS_TIMEOUT</code>	Yes	The maximum amount of time in seconds to enforce <code>ACTIVE_SESSIONS_WAIT</code> before halting the rolling upgrade. This parameter is only valid if <code>ACTIVE_SESSIONS_WAIT</code> is set to 1.	3600
<code>ACTIVE_SESSIONS_WAIT</code>	Yes	Whether the switchover operation will wait for active sessions to finish. If set to 1, the <code>SWITCHOVER</code> procedure waits for active sessions to complete. If set to 0, the <code>SWITCHOVER</code> procedure kills active sessions to expedite the switchover.	0
<code>BACKUP_CONTROLFILE</code>	Yes	File name of the backup control file that is created during a rolling upgrade.	<code>rolling_change_backup.f</code>
<code>BLOCK_UNSUPPORTED</code>	Yes	This parameter can be set for Rolling Upgrade to Block Unsupported Operations on the source database. Possible values are 0 and 1. <ul style="list-style-type: none"> 1: Turns blocking on. This is the default value. 0: Turns blocking off. Scope is not considered for this parameter. 	1
<code>DGBROKER</code>	Yes	Use Data Guard broker for managing apply, recovery, and log archive destinations.	1 if broker is enabled, 0 otherwise.
<code>DICTIONARY_LOAD_TIMEOUT</code>	Yes	The maximum amount of time in seconds to enforce <code>DICTIONARY_LOAD_WAIT</code> before halting the rolling upgrade. This parameter is only valid if <code>DICTIONARY_LOAD_WAIT</code> is set to 1.	3600
<code>DICTIONARY_LOAD_WAIT</code>	Yes	Whether the instantiation of the transient logical standby will include a wait for the complete loading of the data dictionary snapshot in redo. If set to 1, then the <code>START_PLAN</code> procedure will not return until the dictionary has been completely loaded. If set to 0, then the <code>START_PLAN</code> procedure will only verify that the loading of the dictionary has started.	0
<code>DICTIONARY_PLS_WAIT_INTERVAL</code>	Yes	The time in seconds to wait in between attempts to quiesce PL/SQL activity in order to write the data dictionary to redo.	300

Table 157-4 (Cont.) Valid Values for DBMS_ROLLING.SET_PARAMETER Procedure

Parameter Name	Global?	Description	Default
DICTIONARY_PLS_WAIT_TIMEOUT	Yes	The maximum amount of time in seconds to attempt to quiesce PL/SQL activity in order to write the data dictionary to redo.	3600
EVENT_RECORDS	Yes	The maximum number of records to permit in DBA_ROLLING_EVENTS	10000
FAILOVER	Yes	Automatically attempt to adjust the upgrade plan as a result of a failover event. This parameter resets its value to 0 upon completion of a subsequent call to BUILD_PLAN.	0
GRP_PREFIX	Yes	Execution of procedures in DBMS_ROLLING results in a number of Guaranteed Restore Points (GRP) taken in various databases participating in the Data Guard configuration. All such GRPs have the same prefix in their names. You can use this parameter to override the default prefix.	DBMSRU
IGNORE_BUILD_WARNINGS	Yes	Ignore warnings which would otherwise raise exceptions during execution of the BUILD_PLAN procedure.	1
IGNORE_LAST_ERROR	Yes	Ignore last encountered error upon startup of next rolling operation. This parameter resets its value to 0 upon invocation of a procedure call which resumes the rolling upgrade.	0
LAD_ENABLED_TIMEOUT	Yes	The maximum time in seconds to wait for a recently enabled log archive destination to reach a VALID state.	600
LOG_LEVEL	Yes	Logging level for the DBS_ROLLING PL/SQL package. A value of INFO results in the logging of errors and relevant non-fatal warnings. A value of FULL results in the logging of all events.	INFO
MEMBER	No	The upgrade group in which the specified database is a member. A value of LEADING indicates that the standby is a member of the leading upgrade group. As such, it is a standby of the Leading Group Master (LGM). The LGM is the database which is converted into the transient logical standby, and which becomes the new primary after the switchover. A value of TRAILING indicates that the standby is a member of the trailing upgrade group. As such, it is a standby of the Trailing Group Master (TGM). The TGM is the original primary database.	LEADING
READY_LGM_LAG_TIME	Yes	The apply lag time in seconds associated with the READY_LGM_LAG_WAIT parameter.	600
READY_LGM_LAG_TIMEOUT	Yes	The maximum amount of time in seconds to enforce READY_LGM_LAG_WAIT before halting the rolling upgrade. This parameter is only valid if READY_LGM_LAG_WAIT is set to 1.	60

Table 157-4 (Cont.) Valid Values for DBMS_ROLLING.SET_PARAMETER Procedure

Parameter Name	Global?	Description	Default
READY_LGM_LAG_WAIT	Yes	Whether the START_PLAN procedure will wait for the apply lag on the leading group master to fall below READY_LGM_LAG_TIME seconds before returning control back to the user. If set to 1, the wait is performed. If set to 0, the wait is not performed.	0
SWITCH_LGM_LAG_TIME	Yes	The apply lag time in seconds associated with the SWITCH_LGM_LAG_WAIT parameter.	600
SWITCH_LGM_LAG_TIMEOU T	Yes	The maximum amount of time in seconds to enforce SWITCH_LGM_LAG_WAIT before halting the rolling upgrade. This parameter is only valid if SWITCH_LGM_LAG_WAIT is set to 1.	60
SWITCH_LGM_LAG_WAIT	Yes	Whether the SWITCHOVER procedure will wait for the apply lag on the leading group master to fall below SWITCH_LGM_LAG_TIME seconds before initiating the switchover. If set to 1, the wait is performed. If set to 0, the wait is not performed.	1
SWITCH_LGS_LAG_TIME	Yes	The apply lag time in seconds associated with the SWITCH_LGS_LAG_WAIT parameter.	60
SWITCH_LGS_LAG_TIMEOU T	Yes	The maximum amount of time in seconds to enforce SWITCH_LGS_LAG_WAIT before halting the rolling upgrade. This parameter is only valid if SWITCH_LGS_LAG_WAIT is set to 1.	60
SWITCH_LGS_LAG_WAIT	Yes	Whether the SWITCHOVER procedure will wait for the apply lag on the leading group standbys to fall below SWITCH_LGS_LAG_TIME seconds before initiating the switchover. If set to 1, the wait is performed. If set to 0, the wait is not performed.	0
UPDATED_LGS_TIMEOUT	Yes	The maximum amount of time in seconds to enforce UPDATED_LGS_WAIT before halting the rolling upgrade. This parameter is only valid if UPDATED_LGS_WAIT is set to 1.	10800
UPDATED_LGS_WAIT	Yes	Whether the SWITCHOVER procedure will wait for the leading group standbys to complete recovery of all upgrade redo before initiating the switchover. If set to 1, the wait is performed. If set to 0, the wait is not performed	1
UPDATED_TGS_TIMEOUT	Yes	The maximum amount of time in seconds to enforce UPDATED_TGS_WAIT before halting the rolling upgrade. This parameter is only valid if UPDATED_TGS_WAIT is set to 1.	10800
UPDATED_TGS_WAIT	Yes	Whether the FINISH_PLAN procedure will wait for the trailing group standbys to complete recovery of all upgrade redo before returning control to the user. If set to 1, the wait is performed. If set to 0, the wait is not performed.	1

157.3.5 START_PLAN Procedure

This procedure starts the rolling operation. This procedure must be executed on the primary database to formally start the rolling operation.

When the `START_PLAN` procedure is complete, the `future_primary` parameter in the `INIT_PLAN` procedure will be converted into a fully configured transient logical standby database.

Syntax

```
DBMS_ROLLING.START_PLAN ();
```

Parameters

This procedure has no parameters.

Exceptions

- ORA-45400: operation not permitted on current database
- ORA-45414: could not connect to a remote database
- ORA-45415: instruction execution failure
- ORA-45416: operation cannot start until plan rebuild
- ORA-45417: operation not permitted since current phase was not %s
- ORA-45422: operation requires existing plan
- ORA-45426: managed recovery process was not running
- ORA-45427: logical standby Redo Apply process was not running
- ORA-45428: database was not in expected database role
- ORA-45435: managed recovery process was running
- ORA-45436: logical standby Redo Apply process was running
- ORA-45438: database is not in mounted mode
- ORA-45439: database is not in open read/write mode
- ORA-45486: database update progress is inconsistent
- ORA-65040: operation not allowed from within a pluggable database

Usage Notes

- A rolling operation plan must have previously been generated through the `BUILD_PLAN` procedure.

157.3.6 SWITCHOVER Procedure

This procedure performs a switchover between the current primary database and the transient logical standby database.

At the successful completion of the procedure, the LGM assumes the primary role for the Data Guard configuration.

Syntax

```
DBMS_ROLLING.SWITCHOVER ();
```

Parameters

This procedure has no parameters.

Exceptions

- ORA-16224: database guard is enabled
- ORA-45400: operation not permitted on current database
- ORA-45414: could not connect to a remote database
- ORA-45415: instruction execution failure
- ORA-45416: operation cannot start until plan rebuild
- ORA-45417: operation not permitted since current phase was not %s
- ORA-45422: operation requires existing plan
- ORA-45426: managed recovery process was not running
- ORA-45427: logical standby Redo Apply process was not running
- ORA-45428: database was not in expected database role
- ORA-45435: managed recovery process was running
- ORA-45436: logical standby Redo Apply process was running
- ORA-45438: database is not in mounted mode
- ORA-45439: database is not in open read/write mode
- ORA-45486: database update progress is inconsistent
- ORA-65040: operation not allowed from within a pluggable database

Usage Notes

- This procedure can only be called after you have manually upgraded the transient logical standby and opened it on the higher Oracle Database version.
- Once the future primary has been upgraded, logical apply should be restarted and allowed to catch up with the primary since the primary will have been open for business and generating redo which the standby must now apply. Failing to do so will cause the switchover to take a long time since it will have to apply all of that redo.

157.3.7 FINISH_PLAN Procedure

This procedure finalizes the rolling operation.

It configures the former primary as a physical standby of the new primary by flashing it back to an earlier taken GRP (guaranteed restore point), converting its role to physical standby, and then starting managed recovery which will recover all redo generated by the new primary including upgrade redo and any other redo generated before or after the upgrade.

Syntax

```
DBMS_ROLLING.FINISH_PLAN ();
```

Parameters

This procedure has no parameters.

Exceptions

- ORA-45400: operation not permitted on current database
- ORA-45414: could not connect to a remote database
- ORA-45415: instruction execution failure
- ORA-45416: operation cannot start until plan rebuild
- ORA-45417: operation not permitted since current phase was not %s
- ORA-45422: operation requires existing plan
- ORA-45426: managed recovery process was not running
- ORA-45427: logical standby Redo Apply process was not running
- ORA-45428: database was not in expected database role
- ORA-45435: managed recovery process was running
- ORA-45436: logical standby Redo Apply process was running
- ORA-45438: database is not in mounted mode
- ORA-45439: database is not in open read/write mode
- ORA-45486: database update progress is inconsistent
- ORA-65040: operation not allowed from within a pluggable database

Usage Notes

- This procedure can only be called after you have remounted the former primary and remaining physical standbys on the higher Oracle Database version.

157.3.8 ROLLBACK_PLAN Procedure

This procedure rolls back the configuration-wide rolling operation.

Once completed, all of the databases in the leading group become physical standbys of the original primary database. This procedure can only be called if the configuration has not yet gone through a switchover operation since the `START_PLAN` procedure was invoked.

Syntax

```
DBMS_ROLLING.ROLLBACK_PLAN;
```

Parameters

This procedure has no parameters.

Exceptions

- ORA-45400: operation not permitted on current database
- ORA-45414: could not connect to a remote database
- ORA-45415: instruction execution failure
- ORA-45441: no databases eligible for rollback
- ORA-45442: rollback is not permitted after a role change
- ORA-65040: operation not allowed from within a pluggable database

Usage Notes

- You must manually restart media recovery on the lower Oracle Database version if the upgrade of the transient logical standby has already been performed.

DBMS_ROWID

The `DBMS_ROWID` package lets you create `ROWIDs` and obtain information about `ROWIDs` from PL/SQL programs and SQL statements. You can find the data block number, the object number, and other `ROWID` components without writing code to interpret the base-64 character external `ROWID`. `DBMS_ROWID` is intended for upgrading from Oracle database version 7 to Oracle database version 8.X.

**Note:**

`DBMS_ROWID` is not to be used with universal `ROWIDs` (`UROWIDs`).

This chapter contains the following topics:

- [Security Model](#)
- [Types](#)
- [Exceptions](#)
- [Operational Notes](#)
- [Examples](#)
- [Summary of DBMS_ROWID Subprograms](#)

158.1 DBMS_ROWID Security Model

This package runs with the privileges of calling user, rather than the package owner `SYS`.

158.2 DBMS_ROWID Types

There are four `DBMS_ROWID` types.

These are:

- Extension and restriction types
- Verification types
- Object types
- Conversion types

Extension and Restriction Type

The types are as follows:

- `RESTRICTED`—restricted `ROWID`
- `EXTENDED`—extended `ROWID`

For example:

```
rowid_type_restricted constant integer := 0;
rowid_type_extended   constant integer := 1;
```



Note:

Extended ROWIDs are only used in Oracle database version 8.Xi and higher.

Verification Types

Table 158-1 Verification Types

Result	Description
VALID	Valid ROWID
INVALID	Invalid ROWID

For example:

```
rowid_is_valid   constant integer := 0;
rowid_is_invalid constant integer := 1;
```

Object Types

Table 158-2 Object Types

Result	Description
UNDEFINED	Object Number not defined (for restricted ROWIDs)

For example:

```
rowid_object_undefined constant integer := 0;
```

Conversion Types

Table 158-3 Conversion Types

Result	Description
INTERNAL	Convert to/from column of ROWID type
EXTERNAL	Convert to/from string format

For example:

```
rowid_convert_internal constant integer := 0;
rowid_convert_external constant integer := 1;
```

158.3 DBMS_ROWID Exceptions

This table describes the Exceptions raised by DBMS_ROWID subprograms.

Table 158-4 Exceptions

Exception	Description
ROWID_INVALID	Invalid rowid format
ROWID_BAD_BLOCK	Block is beyond end of file

For example:

```
ROWID_INVALID exception;
  pragma exception_init(ROWID_INVALID, -1410);

ROWID_BAD_BLOCK exception;
  pragma exception_init(ROWID_BAD_BLOCK, -28516);
```

158.4 DBMS_ROWID Operational Notes

These operation notes apply to DBMS_ROWID.

- Some of the functions in this package take a single parameter, such as a ROWID. This can be a character or a PL/SQL ROWID, either restricted or extended, as required.
- You can call the DBMS_ROWID functions and procedures from PL/SQL code, and you can also use the functions in SQL statements.

Note:

ROWID_INFO is a procedure. It can only be used in PL/SQL code.

- You can use functions from the DBMS_ROWID package just like built-in SQL functions; in other words, you can use them wherever you can use an expression. In this example, the ROWID_BLOCK_NUMBER function is used to return just the block number of a single row in the EMP table:

```
SELECT DBMS_ROWID.ROWID_BLOCK_NUMBER(rowid)
       FROM emp
       WHERE ename = 'KING';
```

- If Oracle returns the error "ORA:452, 0, 'Subprogram '%s' violates its associated pragma' for pragma restrict_references, it could mean the violation is due to:
 - A problem with the current procedure or function
 - Calling a procedure or function without a pragma or due to calling one with a less restrictive pragma
 - Calling a package procedure or function that touches the initialization code in a package or that sets the default values

158.5 DBMS_ROWID Examples

This example returns the ROWID for a row in the EMP table, extracts the data object number from the ROWID, using the ROWID_OBJECT function in the DBMS_ROWID package, then displays the object number:

```
DECLARE
  object_no  INTEGER;
  row_id     ROWID;
  ...
BEGIN
  SELECT ROWID INTO row_id FROM emp
     WHERE empno = 7499;
  object_no := DBMS_ROWID.ROWID_OBJECT(row_id);
  DBMS_OUTPUT.PUT_LINE('The obj. # is '|| object_no);
  ...

```

158.6 Summary of DBMS_ROWID Subprograms

This table lists the DBMS_ROWID subprograms and briefly describes them.

Table 158-5 DBMS_ROWID Package Subprograms

Subprogram	Description
ROWID_BLOCK_NUMBER Function	Returns the block number of a ROWID
ROWID_CREATE Function	Creates a ROWID, for testing only
ROWID_INFO Procedure	Returns the type and components of a ROWID
ROWID_OBJECT Function	Returns the object number of the extended ROWID
ROWID_RELATIVE_FNO Function	Returns the file number of a ROWID
ROWID_ROW_NUMBER Function	Returns the row number
ROWID_TO_ABSOLUTE_FNO Function	Returns the absolute file number associated with the ROWID for a row in a specific table
ROWID_TO_EXTENDED Function	Converts a ROWID from restricted format to extended
ROWID_TO_RESTRICTED Function	Converts an extended ROWID to restricted format
ROWID_TYPE Function	Returns the ROWID type: 0 is restricted, 1 is extended
ROWID_VERIFY Function	Checks if a ROWID can be correctly extended by the ROWID_TO_EXTENDED function

158.6.1 ROWID_BLOCK_NUMBER Function

This function returns the database block number for the input ROWID.

Syntax

```
DBMS_ROWID.ROWID_BLOCK_NUMBER (  
    row_id      IN  ROWID,  
    ts_type_in  IN  VARCHAR2 DEFAULT 'SMALLFILE')  
RETURN NUMBER;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_block_number,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 158-6 ROWID_BLOCK_NUMBER Function Parameters

Parameter	Description
row_id	ROWID to be interpreted
ts_type_in	The type of the tablespace (bigfile/smallfile) to which the row belongs

Examples

The example SQL statement selects the block number from a ROWID and inserts it into another table:

```
INSERT INTO T2 (SELECT dbms_rowid.rowid_block_number(ROWID, 'BIGFILE')  
FROM some_table  
WHERE key_value = 42);
```

158.6.2 ROWID_CREATE Function

This function lets you create a ROWID, given the component parts as parameters.

This is useful for testing ROWID operations, because only the Oracle Server can create a valid ROWID that points to data in a database.

Syntax

```
DBMS_ROWID.ROWID_CREATE (  
    rowid_type  IN NUMBER,  
    object_number IN NUMBER,  
    relative_fno IN NUMBER,  
    block_number IN NUMBER,  
    row_number  IN NUMBER)  
RETURN ROWID;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_create,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 158-7 ROWID_CREATE Function Parameters

Parameter	Description
rowid_type	Type (restricted or extended) Set the rowid_type parameter to 0 for a restricted ROWID. Set it to 1 to create an extended ROWID. If you specify rowid_type as 0, then the required object_number parameter is ignored, and ROWID_CREATE returns a restricted ROWID.
object_number	Data object number (rowid_object_undefined for restricted)
relative_fno	Relative file number
block_number	Block number in this file
row_number	Returns row number in this block

Examples

Create a dummy extended ROWID:

```
my_rowid := DBMS_ROWID.ROWID_CREATE(1, 9999, 12, 1000, 13);
```

Find out what the rowid_object function returns:

```
obj_number := DBMS_ROWID.ROWID_OBJECT(my_rowid);
```

The variable obj_number now contains 9999.

158.6.3 ROWID_INFO Procedure

This procedure returns information about a ROWID, including its type (restricted or extended), and the components of the ROWID.

This is a procedure, and it cannot be used in a SQL statement.

Syntax

```
DBMS_ROWID.ROWID_INFO (
  rowid_in      IN  ROWID,
  rowid_type    OUT NUMBER,
  object_number OUT NUMBER,
  relative_fno  OUT NUMBER,
  block_number  OUT NUMBER,
  row_number    OUT NUMBER);
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_info,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 158-8 ROWID_INFO Procedure Parameters

Parameter	Description
rowid_in	ROWID to be interpreted. This determines if the ROWID is a restricted (0) or extended (1) ROWID.
rowid_type	Returns type (restricted/extended)
object_number	Returns data object number (rowid_object_undefined for restricted)
relative_fno	Returns relative file number
block_number	Returns block number in this file
row_number	Returns row number in this block



See Also:

"ROWID_TYPE Function"

Examples

This example reads back the values for the ROWID that you created in the ROWID_CREATE:

```
DBMS_ROWID.ROWID_INFO (
  my_rowid, rid_type, obj_num, file_num, block_num, row_num, 'BIGFILE');
```

158.6.4 ROWID_OBJECT Function

This function returns the data object number for an extended ROWID.

The function returns zero if the input ROWID is a restricted ROWID.

Syntax

```
DBMS_ROWID.ROWID_OBJECT (
  rowid_id IN ROWID)
RETURN NUMBER;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_object,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 158-9 ROWID_OBJECT Function Parameters

Parameter	Description
row_id	ROWID to be interpreted

**Note:**

The `ROWID_OBJECT_UNDEFINED` constant is returned for restricted ROWIDs.

Examples

```
SELECT dbms_rowid.rowid_object (ROWID)
FROM emp
WHERE empno = 7499;
```

158.6.5 ROWID_RELATIVE_FNO Function

This function returns the relative file number of the ROWID specified as the `IN` parameter. (The file number is relative to the tablespace.)

Syntax

```
DBMS_ROWID.ROWID_RELATIVE_FNO (
    rowid_id      IN   ROWID,
    ts_type_in    IN   VARCHAR2 DEFAULT 'SMALLFILE')
RETURN NUMBER;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_relative_fno,WNDS,RNDS,WNPS,RNPS);
```

Parameters**Table 158-10 ROWID_RELATIVE_FNO Function Parameters**

Parameter	Description
<code>row_id</code>	ROWID to be interpreted
<code>ts_type_in</code>	Type of the tablespace (bigfile/smallfile) to which the row belongs

Examples

The example PL/SQL code fragment returns the relative file number:

```
DECLARE
    file_number    INTEGER;
    rowid_val      ROWID;
BEGIN
    SELECT ROWID INTO rowid_val
    FROM dept
    WHERE loc = 'Boston';
    file_number :=
        dbms_rowid.rowid_relative_fno(rowid_val, 'SMALLFILE');
    ...
```

158.6.6 ROWID_ROW_NUMBER Function

This function extracts the row number from the ROWID IN parameter.

Syntax

```
DBMS_ROWID.ROWID_ROW_NUMBER (  
    row_id IN ROWID)  
    RETURN NUMBER;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES(rowid_row_number,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 158-11 ROWID_ROW_NUMBER Function Parameters

Parameter	Description
row_id	ROWID to be interpreted.

Examples

Select a row number:

```
SELECT dbms_rowid.rowid_row_number(ROWID)  
    FROM emp  
    WHERE ename = 'ALLEN';
```

158.6.7 ROWID_TO_ABSOLUTE_FNO Function

This function extracts the absolute file number from a ROWID, where the file number is absolute for a row in a given schema and table.

The schema name and the name of the schema object (such as a table name) are provided as IN parameters for this function.

Syntax

```
DBMS_ROWID.ROWID_TO_ABSOLUTE_FNO (  
    row_id      IN ROWID,  
    schema_name IN VARCHAR2,  
    object_name IN VARCHAR2)  
    RETURN NUMBER;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_to_absolute_fno,WNDS,WNPS,RNPS);
```

Parameters

Table 158-12 ROWID_TO_ABSOLUTE_FNO Function Parameters

Parameter	Description
row_id	ROWID to be interpreted
schema_name	Name of the schema which contains the table
object_name	Table name

Examples

```
DECLARE
  abs_fno      INTEGER;
  rowid_val    CHAR(18);
  object_name  VARCHAR2(20) := 'EMP';
BEGIN
  SELECT ROWID INTO rowid_val
  FROM emp
  WHERE empno = 9999;
  abs_fno := dbms_rowid.rowid_to_absolute_fno(
  rowid_val, 'SCOTT', object_name);
```



Note:

For partitioned objects, the name must be a table name, not a partition or a sub/partition name.

158.6.8 ROWID_TO_EXTENDED Function

This function translates a restricted ROWID that addresses a row in a schema and table that you specify to the extended ROWID format.

Later, it may be removed from this package into a different place.

Syntax

```
DBMS_ROWID.ROWID_TO_EXTENDED (
  old_rowid      IN ROWID,
  schema_name    IN VARCHAR2,
  object_name    IN VARCHAR2,
  conversion_type IN INTEGER)
RETURN ROWID;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_to_extended,WNDS,WNPS,RNPS);
```

Parameters

Table 158-13 ROWID_TO_EXTENDED Function Parameters

Parameter	Description
old_rowid	ROWID to be converted
schema_name	Name of the schema which contains the table (optional)
object_name	Table name (optional).
conversion_type	The following constants are defined: ROWID_CONVERT_INTERNAL (:=0) ROWID_CONVERT_EXTERNAL (:=1)

Return Values

ROWID_TO_EXTENDED returns the ROWID in the extended character format. If the input ROWID is NULL, then the function returns NULL. If a zero-valued ROWID is supplied (00000000.0000.0000), then a zero-valued restricted ROWID is returned.

Examples

Assume that there is a table called RIDS in the schema SCOTT, and that the table contains a column ROWID_COL that holds ROWIDs (restricted), and a column TABLE_COL that point to other tables in the SCOTT schema. You can convert the ROWIDs to extended format with the statement:

```
UPDATE SCOTT.RIDS
   SET rowid_col =
      dbms_rowid.rowid_to_extended (
         rowid_col, 'SCOTT', TABLE_COL, 0);
```

Usage Notes

- If the schema and object names are provided as IN parameters, then this function verifies SELECT authority on the table named, and converts the restricted ROWID provided to an extended ROWID, using the data object number of the table. That ROWID_TO_EXTENDED returns a value, however, does not guarantee that the converted ROWID actually references a valid row in the table, either at the time that the function is called, or when the extended ROWID is actually used.
- If the schema and object name are not provided (are passed as NULL), then this function attempts to fetch the page specified by the restricted ROWID provided. It treats the file number stored in this ROWID as the absolute file number. This can cause problems if the file has been dropped, and its number has been reused prior to the migration. If the fetched page belongs to a valid table, then the data object number of this table is used in converting to an extended ROWID value. This is very inefficient, and Oracle recommends doing this only as a last resort, when the target table is not known. The user must still know the correct table name at the time of using the converted value.
- If an extended ROWID value is supplied, the data object number in the input extended ROWID is verified against the data object number computed from the table name parameter. If the two numbers do not match, the INVALID_ROWID exception is raised. If they do match, the input ROWID is returned.

- ROWID_TO_EXTENDED cannot be used with partition tables.



See Also:

The [ROWID_VERIFY Function](#) has a method to determine if a given ROWID can be converted to the extended format.

158.6.9 ROWID_TO_RESTRICTED Function

This function converts an extended ROWID into restricted ROWID format.

Syntax

```
DBMS_ROWID.ROWID_TO_RESTRICTED (
    old_rowid      IN ROWID,
    conversion_type IN INTEGER)
RETURN ROWID;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_to_restricted,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 158-14 ROWID_TO_RESTRICTED Function Parameters

Parameter	Description
old_rowid	ROWID to be converted
conversion_type	The following constants are defined: ROWID_CONVERT_INTERNAL (:=0) ROWID_CONVERT_EXTERNAL (:=1)

158.6.10 ROWID_TYPE Function

This function returns 0 if the ROWID is a restricted ROWID, and 1 if it is extended.

Syntax

```
DBMS_ROWID.ROWID_TYPE (
    rowid_id IN ROWID)
RETURN NUMBER;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_type,WNDS,RNDS,WNPS,RNPS);
```


Parameters

Table 158-15 ROWID_TYPE Function Parameters

Parameter	Description
row_id	ROWID to be interpreted

Examples

```
IF DBMS_ROWID.ROWID_TYPE(my_rowid) = 1 THEN
    my_obj_num := DBMS_ROWID.ROWID_OBJECT(my_rowid);
```

158.6.11 ROWID_VERIFY Function

This function verifies the ROWID.

It returns 0 if the input restricted ROWID can be converted to extended format, given the input schema name and table name, and it returns 1 if the conversion is not possible.



Note:

You can use this function in a WHERE clause of a SQL statement, as shown in the example.

Syntax

```
DBMS_ROWID.ROWID_VERIFY (
    rowid_in      IN ROWID,
    schema_name   IN VARCHAR2,
    object_name   IN VARCHAR2,
    conversion_type IN INTEGER
) RETURN NUMBER;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_verify,WNDS,WNPS,RNPS);
```

Parameters

Table 158-16 ROWID_VERIFY Function Parameters

Parameter	Description
rowid_in	ROWID to be verified
schema_name	Name of the schema which contains the table
object_name	Table name
conversion_type	The following constants are defined: ROWID_CONVERT_INTERNAL (:=0) ROWID_CONVERT_EXTERNAL (:=1)

Examples

Considering the schema in the example for the `ROWID_TO_EXTENDED` function, you can use the following statement to find bad ROWIDs prior to conversion. This enables you to fix them beforehand.

```
SELECT ROWID, rowid_col
FROM SCOTT.RIDS
WHERE dbms_rowid.rowid_verify(rowid_col, NULL, NULL, 0) =1;
```



See Also:

[UTL_RAW](#) , [UTL_REF](#)

DBMS_RULE

The `DBMS_RULE` package contains subprograms that enable the evaluation of a rule set for a specified event.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_RULE Subprograms](#)

159.1 DBMS_RULE Overview

This package contains subprograms that enable the evaluation of a rule set for a specified event.

See Also:

- [Rule TYPES](#) for more information about the types used with the `DBMS_RULE` package
- [DBMS_RULE_ADM](#)

159.2 DBMS_RULE Security Model

`PUBLIC` is granted `EXECUTE` privilege on this package.

See Also:

Oracle Database Security Guide for more information about user group `PUBLIC`

159.3 Summary of DBMS_RULE Subprograms

This table lists the `DBMS_RULE` subprograms and briefly describes them.

Table 159-1 `DBMS_RULE` Package Subprograms

Subprogram	Description
CLOSE_ITERATOR Procedure	Closes an open iterator

Table 159-1 (Cont.) DBMS_RULE Package Subprograms

Subprogram	Description
EVALUATE Procedure	Evaluates the rules in the specified rule set that use the evaluation context specified
EVALUATE_EXPRESSION Procedure	Evaluates an expression under the logged in user in a session
EVALUATE_EXPRESSION_ITERATOR Procedure	Finds the relevant datapoints and pass <code>re\$value_list</code> into evaluation interface
EVALUATE_RULE Procedure	Evaluates the condition defined in the Rule
EVALUATE_RULE_ITERATOR Procedure	Finds the relevant datapoints and pass <code>re\$value_list</code> into evaluation interface
GET_NEXT_HIT Function	Returns the next rule that evaluated to <code>TRUE</code> from a true rules iterator, or returns the next rule that evaluated to <code>MAYBE</code> from a maybe rules iterator; returns <code>NULL</code> if there are no more rules that evaluated to <code>TRUE</code> or <code>MAYBE</code> .
IS_FAST Procedure	Returns <code>TRUE</code> if the expression can be evaluated fast. An expression can be evaluated fast if the engine does not need to run any internal SQL and does not need to go to PL/SQL layer in case there are any PL/SQL functions referred.
GET_NEXT_RESULT Function	Iterates over result from the expression given <code>result_val_iterator</code> .

159.3.1 CLOSE_ITERATOR Procedure

This procedure closes an open iterator.

Syntax

```
DBMS_RULE.CLOSE_ITERATOR(
    iterator IN BINARY_INTEGER);
```

Parameter

Table 159-2 CLOSE_ITERATOR Procedure Parameter

Parameter	Description
<code>iterator</code>	Iterator to be closed

Usage Notes

This procedure requires an open iterator that was returned by an earlier call to `DBMS_RULE.EVALUATE` in the same session. The user who runs this procedure does not require any privileges on the rule set being evaluated.

Closing an iterator frees resources, such as memory, associated with the iterator. Therefore, Oracle recommends that you close an iterator when it is no longer needed.

**See Also:**[EVALUATE Procedure](#)

159.3.2 EVALUATE Procedure

This procedure evaluates the rules in the specified rule set that use the evaluation context specified for a specified event.

This procedure is overloaded. The `true_rules` and `maybe_rules` parameters are mutually exclusive with the `true_rules_iterator` and `maybe_rules_iterator` parameters. In addition, the procedure with the `true_rules` and `maybe_rules` parameters includes the `stop_on_first_hit` parameter, but the other procedure does not.

Syntax

```

DBMS_RULE.EVALUATE (
    rule_set_name          IN      VARCHAR2,
    evaluation_context     IN      VARCHAR2,
    event_context         IN      SYS.RE$NV_LIST          DEFAULT NULL,
    table_values          IN      SYS.RE$TABLE_VALUE_LIST  DEFAULT NULL,
    column_values         IN      SYS.RE$COLUMN_VALUE_LIST  DEFAULT NULL,
    variable_values       IN      SYS.RE$VARIABLE_VALUE_LIST  DEFAULT NULL,
    attribute_values      IN      SYS.RE$ATTRIBUTE_VALUE_LIST  DEFAULT NULL,

    skip_rules            IN      SYS.RE$RULE_NAME_LIST      DEFAULT NULL,

    dop                   IN      NUMBER,

    result_cache         IN      BOOLEAN                  DEFAULT FALSE,
    stop_on_first_hit    IN      BOOLEAN                  DEFAULT FALSE,
    simple_rules_only    IN      BOOLEAN                  DEFAULT FALSE,
    true_rules           OUT     SYS.RE$RULE_HIT_LIST,
    maybe_rules          OUT     SYS.RE$RULE_HIT_LIST);

DBMS_RULE.EVALUATE (
    rule_set_name          IN      VARCHAR2,
    evaluation_context     IN      VARCHAR2,
    event_context         IN      SYS.RE$NV_LIST          DEFAULT NULL,
    table_values          IN      SYS.RE$TABLE_VALUE_LIST  DEFAULT NULL,
    column_values         IN      SYS.RE$COLUMN_VALUE_LIST  DEFAULT NULL,
    variable_values       IN      SYS.RE$VARIABLE_VALUE_LIST  DEFAULT NULL,
    attribute_values      IN      SYS.RE$ATTRIBUTE_VALUE_LIST  DEFAULT NULL,

    skip_rules            IN      SYS.RE$RULE_NAME_LIST      DEFAULT NULL,

    dop                   IN      NUMBER,

    simple_rules_only    IN      BOOLEAN                  DEFAULT FALSE,
    true_rules_iterator  OUT     BINARY_INTEGER,
    maybe_rules_iterator OUT     BINARY_INTEGER);

```

Parameters

Table 159-3 EVALUATE Procedure Parameters

Parameter	Description
<code>rule_set_name</code>	Name of the rule set in the form <code>[schema_name.]rule_set_name</code> . For example, to evaluate all of the rules in a rule set named <code>hr_rules</code> in the <code>hr</code> schema, enter <code>hr.hr_rules</code> for this parameter. If the schema is not specified, then the schema of the current user is used.
<code>evaluation_context</code>	An evaluation context name in the form <code>[schema_name.]evaluation_context_name</code> . If the schema is not specified, then the name of the current user is used. Only rules that use the specified evaluation context are evaluated.
<code>event_context</code>	A list of name-value pairs that identify events that cause evaluation
<code>table_values</code>	Contains the data for table rows using the table aliases specified when the evaluation context was created. Each table alias in the list must be unique.
<code>column_values</code>	Contains the partial data for table rows. It must not contain column values for tables, whose values are already specified in <code>table_values</code> .
<code>variable_values</code>	A list containing the data for variables. The only way for an explicit variable value to be known is to specify its value in this list. If an implicit variable value is not specified in the list, then the function used to obtain the value of the implicit variable is invoked. If an implicit variable value is specified in the list, then this value is used and the function is not invoked.
<code>attribute_values</code>	Contains the partial data for variables. It must not contain attribute values for variables whose values are already specified in <code>variable_values</code> .
<code>stop_on_first_hit</code>	If <code>TRUE</code> , then the rules engine stops evaluation as soon as it finds a <code>TRUE</code> rule. If <code>TRUE</code> and there are no <code>TRUE</code> rules, then the rules engine stops evaluation as soon as it finds a rule that may evaluate to <code>TRUE</code> given more data. If <code>FALSE</code> , then the rules engine continues to evaluate rules even after it finds a <code>TRUE</code> rule.
<code>simple_rules_only</code>	If <code>TRUE</code> , then only those rules that are simple enough to be evaluated fast (without issuing SQL) are considered for evaluation. If <code>FALSE</code> , then evaluates all rules.

Table 159-3 (Cont.) EVALUATE Procedure Parameters

Parameter	Description
<code>true_rules</code>	<p>Receives the output of the <code>EVALUATE</code> procedure into a varray of <code>RE\$RULE_HIT_LIST</code> type.</p> <p>If no rules evaluate to <code>TRUE</code>, then <code>true_rules</code> is empty.</p> <p>If at least one rule evaluates to <code>TRUE</code> and <code>stop_on_first_hit</code> is <code>TRUE</code>, then <code>true_rules</code> contains one rule that evaluates to <code>TRUE</code>.</p> <p>If <code>stop_on_first_hit</code> is <code>FALSE</code>, then <code>true_rules</code> contains all rules that evaluate to <code>TRUE</code>.</p>
<code>maybe_rules</code>	<p>If all rules can be evaluated completely, without requiring any additional data, then <code>maybe_rules</code> is empty.</p> <p>If <code>stop_on_first_hit</code> is <code>TRUE</code>, then if there is at least one rule that may evaluate to <code>TRUE</code> given more data, and no rules evaluate to <code>TRUE</code>, then <code>maybe_rules</code> contains one rule that may evaluate to <code>TRUE</code>.</p> <p>If <code>stop_on_first_hit</code> is <code>FALSE</code>, then <code>maybe_rules</code> contains all rules that may evaluate to <code>TRUE</code> given more data.</p>
<code>true_rules_iterator</code>	Contains the iterator for accessing rules that are <code>TRUE</code>
<code>maybe_rules_iterator</code>	Contains the iterator for accessing rules that may be <code>TRUE</code> given additional data or the ability to issue SQL
<code>skip_rules</code>	List of rules to skip within this evaluation.
<code>dop</code>	Degree of parallelism
<code>result_cache</code>	If <code>TRUE</code> , Result Cache will be created. If evaluate procedure is called with either <code>true_rules_iterator</code> or <code>maybe_rules_iterator</code> , then <code>result_cache</code> is not enabled.

Usage Notes



Note:

Rules in the rule set that use an evaluation context different from the one specified are not considered for evaluation.

The rules in the rule set are evaluated using the data specified for `table_values`, `column_values`, `variable_values`, and `attribute_values`. These values must refer to tables and variables in the specified evaluation context. Otherwise, an error is raised.

The caller may specify, using `stop_on_first_hit`, if evaluation must stop as soon as the first `TRUE` rule or the first `MAYBE` rule (if there are no `TRUE` rules) is found.

The caller may also specify, using `simple_rules_only`, if only rules that are simple enough to be evaluated fast (which means without SQL) should be considered for evaluation. This makes evaluation faster, but causes rules that cannot be evaluated without SQL to be returned as `MAYBE` rules.

Partial evaluation is supported. The `EVALUATE` procedure can be called with data for only some of the tables, columns, variables, or attributes. In such a case, rules that cannot be evaluated because of a lack of data are returned as `MAYBE` rules, unless they can be determined to be `TRUE` or `FALSE` based on the values of one or more simple expressions within the rule. For example, given a value of 1 for attribute "a.b" of variable "x", a rule with the following rule condition can be returned as `TRUE`, without a value for table "tab":

```
(:x.a.b = 1) or (tab.c > 10)
```

The results of an evaluation are the following:

- `TRUE` rules, which is the list of rules that evaluate to `TRUE` based on the given data. These rules are returned either in the `OUT` parameter `true_rules`, which returns all of the rules that evaluate to `TRUE`, or in the `OUT` parameter `true_rules_iterator`, which returns each rule that evaluates to `TRUE` one at a time.
- `MAYBE` rules, which is the list of rules that could not be evaluated for one of the following reasons:
 - The rule refers to data that was unavailable. For example, a variable attribute "x.a.b" is specified, but no value is specified for the variable "x", the attribute "a", or the attribute "a.b".
 - The rule is not simple enough to be evaluated fast (without SQL) and `simple_rules_only` is specified as `TRUE`, or partial data is available.

Maybe rules are returned either in the `OUT` parameter `maybe_rules`, which returns all of the rules that evaluate to `MAYBE`, or in the `OUT` parameter `maybe_rules_iterator`, which returns each rule that evaluates to `MAYBE` one at a time.

The caller may specify whether the procedure returns all of the rules that evaluate to `TRUE` and `MAYBE` for the event or an iterator for rules that evaluate to `TRUE` and `MAYBE`. A true rules iterator enables the client to fetch each rule that evaluates to `TRUE` one at a time, and a maybe rules iterator enables the client to fetch each rule that evaluates to `MAYBE` one at a time.

If you use an iterator, then you use the `GET_NEXT_HIT` function in the `DBMS_RULE` package to retrieve the next rule that evaluates to `TRUE` or `MAYBE` from an iterator. Oracle recommends that you close an iterator if it is no longer needed to free resources, such as memory, used by the iterator. An iterator can be closed in the following ways:

- The `CLOSE_ITERATOR` procedure in the `DBMS_RULE` package is run with the iterator specified.
- The iterator returns `NULL` because no more rules evaluate to `TRUE` or `MAYBE`.
- The session in which the iterator is running ends.

To run the `DBMS_RULE.EVALUATE` procedure, a user must meet at least one of the following requirements:

- Have `EXECUTE_ON_RULE_SET` privilege on the rule set
- Have `EXECUTE_ANY_RULE_SET` system privilege
- Be the rule set owner

 **Note:**

The rules engine does not invoke any actions. An action context can be returned with each returned rule, but the client of the rules engine must invoke any necessary actions.

 **See Also:**

- [Rule TYPES](#) for more information about the types used with the DBMS_RULE package
- [GET_NEXT_HIT](#) Function
- [CLOSE_ITERATOR](#) Procedure

159.3.3 EVALUATE_EXPRESSION Procedure

This procedure allows user to evaluate an expression under the logged in user in a session.

Any re-execute of the same expression with same table alias and variable type will result in reusing the same compiled context. With fixed compile cache size, its possible of aging....

Syntax

```
DBMS_RULE.EVALUATE_EXPRESSION(
  rule_expression          IN          VARCHAR2,
  table_aliases            IN          SYS.RE$TABLE_ALIAS_LIST:= NULL,
  variable_types          IN          SYS.RE$VARIABLE_TYPE_LIST:= NULL,
  table_values             IN          SYS.RE$TABLE_VALUE_LIST:= NULL,
  column_values           IN          SYS.RE$COLUMN_VALUE_LIST:=NULL,
  variable_values         IN          SYS.RE$VARIABLE_VALUE_LIST:=NULL,
  attribute_values        IN          SYS.RE$ATTRIBUTE_VALUE_LIST:=NULL,
  cache                   IN          BOOLEAN DEFAULT FALSE,
  result_val              OUT         BOOLEAN);
```

Parameters

Table 159-4 EVALUATE_EXPRESSION Procedure Parameters

Parameter	Description
rule_expression	Contains an expression string.
table_alias	Contains alias of tables referred in the expression string.
variable_types	Contains type definitions of variables used in expression.
table_values	Contains ROWID of table row for expression evaluation.
column_values	Contains values of columns referred in the expression.
variable_values	Contains values of variables referred in the expression.
attribute_values	Contains values of attributes referred in the expression.
cache	If TRUE, Result Cache will be created.

Table 159-4 (Cont.) EVALUATE_EXPRESSION Procedure Parameters

Parameter	Description
result_val	Result of the evaluation.

159.3.4 EVALUATE_EXPRESSION_ITERATOR Procedure

This is a user visible interface. Because PL/SQL based callbacks can be expensive, we provide an array based approach. The client program is assumed to find the relevant datapoints and pass `re$value_list` into evaluation interface. The expression evaluation engine is expected to walk through this list and evaluate expression for each datapoint (`re$value_list`) element.

Syntax

```
DBMS_RULE.EVALUATE_EXPRESSION_ITERATOR(
    rule_expression      IN          varchar2,
    table_aliases        IN          sys.re$table_alias_list:= NULL,
    variable_types       IN          sys.re$variable_type_list:= NULL,
    values               IN          sys.re$value_list,
    cache                IN          boolean DEFAULT FALSE,
    result_val_iter_id   OUT         BINARY_INTEGER)
```

Parameters

Table 159-5 EVALUATE_EXPRESSION_ITERATOR Procedure Parameter

Parameter	Description
rule_expression	Contains an expression string.
table_alias	Alias of tables referred in the above expression string.
variable_types	Type definitions of variables used in expression.
values	List of datapoint values for evaluation.
cache	If TRUE, Result Cache will be created.
result_val_iter_id	Contains iterator for result of array of values sent using value.

159.3.5 EVALUATE_RULE Procedure

The Rule Evaluation API expects that `CREATE_RULE` procedure has been called with an legitimate `EVALUATION_CONTEXT` prior. This API will evaluate the condition defined in the Rule.

Syntax

```
DBMS_RULE.EVALUATE_RULE(
    rule_name           IN          VARCHAR2,
    event_context       IN          SYS.RE$NV_LIST           DEFAULT NULL,
    table_values        IN          SYS.RE$table_value_list  DEFAULT NULL,
    column_values       IN          SYS.RE$column_value_list DEFAULT NULL,
    variable_values     IN          SYS.RE$variable_value_list DEFAULT NULL,
    attribute_values    IN          SYS.RE$attribute_value_list DEFAULT NULL,
```

```

cache          IN  BOOLEAN DEFAULT FALSE,
result_val     OUT BOOLEAN);

```

Parameters

Table 159-6 EVALUATE_RULE Procedure Parameter

Parameter	Description
rule_name	Name of the rule previously create using CREATE_RULE procedure.
event_context	A list of name-value pairs that identify events that cause evaluation.
table_values	ROWID of table row for expression evaluation.
column_values	Values of columns referred in the expression
variable_values	Values of variables referred in expression
attribute_values	Values of attributes referred in expression
cache	If TRUE, Result Cache will be created.
result_val	Result of the evaluation

159.3.6 EVALUATE_RULE_ITERATOR Procedure

This is an iterative interface. The client program is assumed to find the relevant datapoints and pass re\$value_list into evaluation interface.

Evaluation engine is expected to walk through this list and evaluate expression for each datapoint (re\$value_list) element. User can use DBMS_RULE.GET_NEXT_RESULT procedure to iterate through the result list.

Syntax

```

DBMS_RULE.EVALUATE_RULE_ITERATOR(
rule_name      IN      VARCHAR2,
event_context  IN      SYS.RE$NV_LIST DEFAULT NULL,
values         IN      SYS.RE$VALUE_LIST,
cache         IN      BOOLEAN DEFAULT FALSE,
result_val_iter_id OUT  BINARY_INTEGER);

```

Parameters

Table 159-7 EVALUATE_RULE_ITERATOR Procedure Parameter

Parameter	Description
rule_name	Name of the rule previously create using CREATE_RULE procedure.
event_context	A list of name-value pairs that identify events that cause evaluation
values	List of datapoint values for evaluation.
cache	If TRUE, Result Cache will be created.
result_val_iter_id	Contains iterator for result of array of values sent using values

159.3.7 GET_NEXT_HIT Function

This function returns the next rule that evaluated to `TRUE` from a true rules iterator, or returns the next rule that evaluated to `MAYBE` from a maybe rules iterator. The function returns `NULL` if there are no more rules that evaluated to `TRUE` or `MAYBE`.

Syntax

```
DBMS_RULE.GET_NEXT_HIT(  
    iterator IN BINARY_INTEGER)  
RETURN SYS.RE$RULE_HIT;
```

Parameter

Table 159-8 GET_NEXT_HIT Function Parameter

Parameter	Description
<code>iterator</code>	The iterator from which the rule that evaluated to <code>TRUE</code> or <code>MAYBE</code> is retrieved

Usage Notes

This procedure requires an open iterator that was returned by an earlier call to `DBMS_RULE.EVALUATE` in the same session. The user who runs this procedure does not require any privileges on the rule set being evaluated.

When an iterator returns `NULL`, it is closed automatically. If an open iterator is no longer needed, then use the `CLOSE_ITERATOR` procedure in the `DBMS_RULE` package to close it.

Note:

This function raises an error if the rule set being evaluated was modified after the call to the `DBMS_RULE.EVALUATE` procedure that returned the iterator. Modifications to a rule set include added rules to the rule set, changing existing rules in the rule set, dropping rules from the rule set, and dropping the rule set.

See Also:

- [Rule TYPES](#) for more information about the types used with the `DBMS_RULE` package
- [EVALUATE Procedure](#)
- [CLOSE_ITERATOR Procedure](#)

159.3.8 GET_NEXT_RESULT Function

This function iterates over result from the expression given in `RESULT_VAL_ITERATOR`. It returns the expression at iterator evaluated to `TRUE` or `FALSE`.

Syntax

```
DBMS_RULE.GET_NEXT_RESULT (
  result_val_iterator_id  IN  BINARY_INTEGER)
RETURN  BOOLEAN;
```

Parameter

Table 159-9 GET_NEXT_RESULT Function Parameter

Parameter	Description
<code>result_val_iterator_id</code>	Iterator returned from <code>EVALUATE_EXPRESSION_ITERATOR</code>

159.3.9 IS_FAST Procedure

Given an expression, of either rule or Independent Expression, this procedure will return `TRUE` if the expression can be evaluated as fast. An expression can be evaluated as fast if the engine does not need to run any internal SQL and does not need to go to PL/SQL layer in case there are any PL/SQL functions referred.

Syntax

```
DBMS_RULE.IS_FAST(
  expression          IN          VARCHAR2,
  table_aliases       IN          SYS.RE$TABLE_ALIAS_LIST:= NULL,
  variable_types      IN          SYS.RE$VARIABLE_TYPE_LIST:= NULL,
  result_val          OUT         BOOLEAN);
```

Parameter

Table 159-10 IS_FAST Procedure Parameter

Parameter	Description
<code>expression</code>	Expression to check
<code>table_aliases</code>	Alias of tables referred in the above expression string
<code>variable_types</code>	Type definitions of variables used in expression
<code>result_val</code>	If the expression can be evaluated as fast

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DBMS_RULE_ADM

The `DBMS_RULE_ADM` package provides the subprograms for creating and managing rules, rule sets, and rule evaluation contexts.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_RULE_ADM Subprograms](#)

160.1 DBMS_RULE_ADM Overview

This package provides the subprograms for creating and managing rules, rule sets, and rule evaluation contexts.

See Also:

- [Rule TYPES](#) for more information about the types used with the `DBMS_RULE_ADM` package
- [DBMS_RULE](#)

160.2 DBMS_RULE_ADM Security Model

`PUBLIC` is granted `EXECUTE` privilege on this package.

See Also:

Oracle Database Security Guide for more information about user group `PUBLIC`

160.3 Summary of DBMS_RULE_ADM Subprograms

This table lists the `DBMS_RULE_ADM` subprograms and briefly describes them.

Table 160-1 `DBMS_RULE_ADM` Package Subprograms

Subprogram	Description
ADD_RULE Procedure	Adds the specified rule to the specified rule set

Table 160-1 (Cont.) DBMS_RULE_ADM Package Subprograms

Subprogram	Description
ALTER_EVALUATION_CONTEXT Procedure	Alters a rule evaluation context
ALTER_RULE Procedure	Changes one or more aspects of the specified rule
CREATE_EVALUATION_CONTEXT Procedure	Creates a rule evaluation context
CREATE_RULE Procedure	Creates a rule with the specified name
CREATE_RULE_SET Procedure	Creates a rule set with the specified name
DROP_EVALUATION_CONTEXT Procedure	Drops the rule evaluation context with the specified name
DROP_RULE Procedure	Drops the rule with the specified name
DROP_RULE_SET Procedure	Drops the rule set with the specified name
GRANT_OBJECT_PRIVILEGE Procedure	Grants the specified object privilege on the specified object to the specified user or role
GRANT_SCHEMA_PRIVILEGE Procedure	Grants the specified schema privilege on the specified schema to the specified user or role.
GRANT_SYSTEM_PRIVILEGE Procedure	Grants the specified system privilege to the specified user or role
REMOVE_RULE Procedure	Removes the specified rule from the specified rule set
REVOKE_OBJECT_PRIVILEGE Procedure	Revokes the specified object privilege on the specified object from the specified user or role
REVOKE_SCHEMA_PRIVILEGE Procedure	Revokes the specified schema privilege on the specified schema from the specified user or role.
REVOKE_SYSTEM_PRIVILEGE Procedure	Revokes the specified system privilege from the specified user or role

**Note:**

All subprograms commit unless specified otherwise.

160.3.1 ADD_RULE Procedure

This procedure adds the specified rule to the specified rule set.

Syntax

```
DBMS_RULE_ADM.ADD_RULE(
  rule_name          IN  VARCHAR2,
  rule_set_name      IN  VARCHAR2,
  evaluation_context IN  VARCHAR2  DEFAULT NULL,
  rule_comment       IN  VARCHAR2  DEFAULT NULL);
```

Parameters

Table 160-2 ADD_RULE Procedure Parameters

Parameter	Description
<code>rule_name</code>	The name of the rule you are adding to the rule set, specified as <code>[schema_name.]rule_name</code> . For example, to add a rule named <code>all_a</code> in the <code>hr</code> schema, enter <code>hr.all_a</code> for this parameter. If the schema is not specified, then the current user is the default.
<code>rule_set_name</code>	The name of the rule set to which you are adding the rule, specified as <code>[schema_name.]rule_set_name</code> . For example, to add the rule to a rule set named <code>apply_rules</code> in the <code>hr</code> schema, enter <code>hr.apply_rules</code> for this parameter. If the schema is not specified, then the current user is the default.
<code>evaluation_context</code>	An evaluation context name in the form <code>[schema_name.]evaluation_context_name</code> . If the schema is not specified, then the current user is the default. Only specify an evaluation context if the rule itself does not have an evaluation context and you do not want to use the rule set's evaluation context for the rule.
<code>rule_comment</code>	Optional description, which can contain the reason for adding the rule to the rule set

Usage Notes

To run this procedure, a user must meet at least one of the following requirements:

- Have `ALTER_ON_RULE_SET` privilege on the rule set
- Have `ALTER_ANY_RULE_SET` system privilege
- Be the owner of the rule set

Also, the rule set owner must meet at least one of the following requirements:

- Have `EXECUTE_ON_RULE` privilege on the rule
- Have `EXECUTE_ANY_RULE` system privilege
- Be the rule owner

If the rule has no evaluation context and no evaluation context is specified when you run this procedure, then the rule uses the evaluation context associated with the rule set. In such a case, the rule owner must have the necessary privileges on all the base objects accessed by the rule using the evaluation context.

If an evaluation context is specified, then the rule set owner must meet at least one of the following requirements:

- Have `EXECUTE_ON_EVALUATION_CONTEXT` privilege on the evaluation context
- Have `EXECUTE_ANY_EVALUATION_CONTEXT` system privilege, and the owner of the evaluation context must not be `SYS`
- Be the evaluation context owner

Also, the rule owner must have the necessary privileges on all the base objects accessed by the rule using the evaluation context.

160.3.2 ALTER_EVALUATION_CONTEXT Procedure

This procedure alters a rule evaluation context. A rule evaluation context defines external data that can be referenced in rule conditions. The external data can either exist as variables or as table data.

Syntax

```
DBMS_RULE_ADM.ALTER_EVALUATION_CONTEXT(
  evaluation_context_name      IN  VARCHAR2,
  table_aliases                IN  SYS.RE$TABLE_ALIAS_LIST  DEFAULT NULL,
  remove_table_aliases         IN  BOOLEAN                  DEFAULT FALSE,
  variable_types               IN  SYS.RE$VARIABLE_TYPE_LIST DEFAULT NULL,
  remove_variable_types        IN  BOOLEAN                  DEFAULT FALSE,
  evaluation_function           IN  VARCHAR2                DEFAULT NULL,
  remove_evaluation_function    IN  BOOLEAN                  DEFAULT FALSE,
  evaluation_context_comment    IN  VARCHAR2                DEFAULT NULL,
  remove_eval_context_comment  IN  BOOLEAN                  DEFAULT FALSE);
```

Parameters

Table 160-3 ALTER_EVALUATION_CONTEXT Procedure Parameters

Parameter	Description
evaluation_context_name	The name of the evaluation context you are altering, specified as <code>[schema_name.]evaluation_context_name</code> . For example, to alter an evaluation context named <code>dept_eval_context</code> in the <code>hr</code> schema, enter <code>hr.dept_eval_context</code> for this parameter. If the schema is not specified, then the current user is the default.
table_aliases	If <code>NULL</code> and <code>remove_table_aliases</code> is <code>FALSE</code> , then the procedure retains the existing table aliases. If <code>NULL</code> and <code>remove_table_aliases</code> is <code>TRUE</code> , then the procedure removes the existing table aliases. If non- <code>NULL</code> , then the procedure replaces the existing table aliases for the evaluation context with the specified table aliases. Table aliases specify the tables in an evaluation context. The table aliases can be used to reference tables in rule conditions.
remove_table_aliases	If <code>TRUE</code> and <code>table_aliases</code> is <code>NULL</code> , then the procedure removes the existing table aliases for the evaluation context. If <code>TRUE</code> and <code>table_aliases</code> is non- <code>NULL</code> , then the procedure raises an error. If <code>FALSE</code> , then the procedure does not remove table aliases.

Table 160-3 (Cont.) ALTER_EVALUATION_CONTEXT Procedure Parameters

Parameter	Description
variable_types	<p>If NULL and <code>remove_variable_types</code> is FALSE, then the procedure retains the variable types. If NULL and <code>remove_variable_types</code> is TRUE, then the procedure removes the existing variable types.</p> <p>If non-NULL, then the procedure replaces the existing variable types for the evaluation context with the specified variable types.</p>
remove_variable_types	<p>If TRUE and <code>variable_types</code> is NULL, then the procedure removes the existing variable types for the evaluation context. If TRUE and <code>variable_types</code> is non-NULL, then the procedure raises an error.</p> <p>If FALSE, then the procedure does not remove the variable types.</p>
evaluation_function	<p>If NULL and <code>remove_evaluation_function</code> is FALSE, then the procedure retains the existing evaluation function. If NULL and <code>remove_evaluation_function</code> is TRUE, then the procedure removes the existing evaluation function.</p> <p>If non-NULL, then the procedure replaces the existing evaluation function for the evaluation context with the specified evaluation function.</p> <p>An evaluation function is an optional function that will be called to evaluate rules that use the evaluation context. It must have the same form as the <code>DBMS_RULE.EVALUATE</code> procedure. If the schema is not specified, then the current user is the default.</p> <p>See CREATE_EVALUATION_CONTEXT Procedure for more information about evaluation functions.</p>
remove_evaluation_function	<p>If TRUE and <code>evaluation_function</code> is NULL, then the procedure removes the existing evaluation function for the evaluation context. If TRUE and <code>evaluation_function</code> is non-NULL, then the procedure raises an error.</p> <p>If FALSE, then the procedure does not remove the evaluation function.</p>
evaluation_context_comment	<p>If NULL and <code>remove_eval_context_comment</code> is FALSE, then the procedure retains the existing evaluation context comment. If NULL and <code>remove_evaluation_function</code> is TRUE, then the procedure removes the existing evaluation context comment.</p> <p>If non-NULL, then the procedure replaces the existing comment for the evaluation context with the specified comment.</p> <p>An evaluation context comment is an optional description of the rule evaluation context.</p>

Table 160-3 (Cont.) ALTER_EVALUATION_CONTEXT Procedure Parameters

Parameter	Description
remove_eval_context_comment	If TRUE and evaluation_context_comment is NULL, then the procedure removes the existing comment for the evaluation context. If TRUE and evaluation_context_comment is non-NULL, then the procedure raises an error. If FALSE, then the procedure does not remove the evaluation context comment.

Usage Notes

To run this procedure, a user must meet at least one of the following requirements:

- Be the owner of the evaluation context being altered
- Have ALL_ON_EVALUATION_CONTEXT or ALTER_ON_EVALUATION_CONTEXT object privilege on an evaluation context owned by another user
- Have ALTER_ANY_EVALUATION_CONTEXT system privilege



See Also:

[Rule TYPES](#) for more information about the types used with the DBMS_RULE_ADM package

160.3.3 ALTER_RULE Procedure

This procedure changes one or more aspects of the specified rule.

Syntax

```
DBMS_RULE_ADM.ALTER_RULE(
    rule_name           IN  VARCHAR2,
    condition           IN  VARCHAR2           DEFAULT NULL,
    evaluation_context  IN  VARCHAR2           DEFAULT NULL,
    remove_evaluation_context IN  BOOLEAN       DEFAULT FALSE,
    action_context     IN  SYS.RE$NV_LIST     DEFAULT NULL,
    remove_action_context IN  BOOLEAN       DEFAULT FALSE,
    rule_comment       IN  VARCHAR2           DEFAULT NULL,
    remove_rule_comment IN  BOOLEAN       DEFAULT FALSE);
```

Parameters

Table 160-4 ALTER_RULE Procedure Parameters

Parameter	Description
<code>rule_name</code>	The name of the rule you are altering, specified as <code>[schema_name.]rule_name</code> . For example, to alter a rule named <code>all_a</code> in the <code>hr</code> schema, enter <code>hr.all_a</code> for this parameter. If the schema is not specified, then the current user is the default.
<code>condition</code>	The condition to be associated with the rule. If non-NULL, then the procedure replaces the existing condition of the rule with the specified condition.
<code>evaluation_context</code>	An evaluation context name in the form <code>[schema_name.]evaluation_context_name</code> . If the schema is not specified, then the current user is the default. If non-NULL, then the procedure replaces the existing evaluation context of the rule with the specified evaluation context.
<code>remove_evaluation_context</code>	If TRUE, then the procedure sets the evaluation context for the rule to NULL, which effectively removes the evaluation context from the rule. If FALSE, then the procedure retains any evaluation context for the specified rule. If the <code>evaluation_context</code> parameter is non-NULL, then this parameter should be set to FALSE.
<code>action_context</code>	If non-NULL, then the procedure changes the action context associated with the rule. A rule action context is information associated with a rule that is interpreted by the client of the rules engine when the rule is evaluated.
<code>remove_action_context</code>	If TRUE, then the procedure sets the action context for the rule to NULL, which effectively removes the action context from the rule. If FALSE, then the procedure retains any action context for the specified rule. If the <code>action_context</code> parameter is non-NULL, then this parameter should be set to FALSE.
<code>rule_comment</code>	If non-NULL, then the existing comment of the rule is replaced by the specified comment.
<code>remove_rule_comment</code>	If TRUE, then the procedure sets the comment for the rule to NULL, which effectively removes the comment from the rule. If FALSE, then the procedure retains any comment for the specified rule. If the <code>rule_comment</code> parameter is non-NULL, then this parameter should be set to FALSE.

Usage Notes

To run this procedure, a user must meet at least one of the following requirements:

- Have ALTER_ON_RULE privilege on the rule

- Have ALTER_ANY_RULE system privilege
- Be the owner of the rule being altered

If an evaluation context is specified, then the rule owner must meet at least one of the following requirements:

- Have EXECUTE_ON_EVALUATION_CONTEXT privilege on the evaluation context
- Have EXECUTE_ANY_EVALUATION_CONTEXT system privilege, and the owner of the evaluation context must not be SYS
- Be the evaluation context owner

Also, the rule owner must have the necessary privileges on all the base objects accessed by the rule using the evaluation context.



See Also:

[Rule TYPEs](#) for more information about the types used with the DBMS_RULE_ADM package

160.3.4 CREATE_EVALUATION_CONTEXT Procedure

This procedure creates a rule evaluation context. A rule evaluation context defines external data that can be referenced in rule conditions. The external data can either exist as variables or as table data.

Syntax

```
DBMS_RULE_ADM.CREATE_EVALUATION_CONTEXT (
  evaluation_context_name      IN  VARCHAR2,
  table_aliases                IN  SYS.RE$TABLE_ALIAS_LIST   DEFAULT NULL,
  variable_types               IN  SYS.RE$VARIABLE_TYPE_LIST  DEFAULT NULL,
  evaluation_function          IN  VARCHAR2                  DEFAULT NULL,
  evaluation_context_comment   IN  VARCHAR2                  DEFAULT NULL);
```

Parameters

Table 160-5 CREATE_EVALUATION_CONTEXT Procedure Parameters

Parameter	Description
evaluation_context_name	The name of the evaluation context you are creating, specified as <i>[schema_name.]evaluation_context_name</i> . For example, to create an evaluation context named dept_eval_context in the hr schema, enter hr.dept_eval_context for this parameter. If the schema is not specified, then the current user is the default.
table_aliases	Table aliases that specify the tables in an evaluation context. The table aliases can be used to reference tables in rule conditions.
variable_types	A list of variables for the evaluation context

Table 160-5 (Cont.) CREATE_EVALUATION_CONTEXT Procedure Parameters

Parameter	Description
<code>evaluation_function</code>	An optional function that will be called to evaluate rules using the evaluation context. It must have the same form as the <code>DBMS_RULE.EVALUATE</code> procedure. If the schema is not specified, then the current user is the default. See " Usage Notes " for more information about the evaluation function.
<code>evaluation_context_comment</code>	An optional description of the rule evaluation context.

Usage Notes

To run this procedure, a user must meet at least one of the following requirements:

- Be the owner of the evaluation context being created and have `CREATE_EVALUATION_CONTEXT_OBJ` system privilege
- Have `CREATE_ANY_EVALUATION_CONTEXT` system privilege



See Also:

[Rule TYPEs](#) for more information about the types used with the `DBMS_RULE_ADM` package

The evaluation function must have the following signature:

```
FUNCTION evaluation_function_name(
  rule_set_name      IN  VARCHAR2,
  evaluation_context IN  VARCHAR2,
  event_context      IN  SYS.RE$NV_LIST           DEFAULT NULL,
  table_values       IN  SYS.RE$TABLE_VALUE_LIST  DEFAULT NULL,
  column_values      IN  SYS.RE$COLUMN_VALUE_LIST DEFAULT NULL,
  variable_values    IN  SYS.RE$VARIABLE_VALUE_LIST DEFAULT NULL,
  attribute_values   IN  SYS.RE$ATTRIBUTE_VALUE_LIST DEFAULT NULL,
  stop_on_first_hit  IN  BOOLEAN                 DEFAULT FALSE,
  simple_rules_only  IN  BOOLEAN                 DEFAULT FALSE,
  true_rules         OUT SYS.RE$RULE_HIT_LIST,
  maybe_rules        OUT SYS.RE$RULE_HIT_LIST);
RETURN BINARY_INTEGER;
```



Note:

Each parameter is required and must have the specified datatype. However, you can change the names of the parameters.

The return value of the function must be one of the following:

- `DBMS_RULE_ADM.EVALUATION_SUCCESS`: The user specified evaluation function completed the rule set evaluation successfully. The rules engine returns the results of the evaluation

obtained by the evaluation function to the rules engine client using the `DBMS_RULE.EVALUATE` procedure.

- `DBMS_RULE_ADM.EVALUATION_CONTINUE`: The rules engine evaluates the rule set as if there were no evaluation function. The evaluation function is not used, and any results returned by the evaluation function are ignored.
- `DBMS_RULE_ADM.EVALUATION_FAILURE`: The user specified evaluation function failed. Rule set evaluation stops, and an error is raised.

160.3.5 CREATE_RULE Procedure

This procedure creates a rule.

Syntax

```
DBMS_RULE_ADM.CREATE_RULE (
  rule_name          IN  VARCHAR2,
  condition          IN  VARCHAR2,
  evaluation_context IN  VARCHAR2          DEFAULT NULL,
  action_context     IN  SYS.RE$NV_LIST   DEFAULT NULL,
  rule_comment       IN  VARCHAR2          DEFAULT NULL);
```

Parameters

Table 160-6 CREATE_RULE Procedure Parameters

Parameter	Description
<code>rule_name</code>	The name of the rule you are creating, specified as <code>[schema_name.]rule_name</code> . For example, to create a rule named <code>all_a</code> in the <code>hr</code> schema, enter <code>hr.all_a</code> for this parameter. If the schema is not specified, then the current user is the default.
<code>condition</code>	The condition to be associated with the rule. A condition evaluates to <code>TRUE</code> or <code>FALSE</code> and can be any condition allowed in the <code>WHERE</code> clause of a <code>SELECT</code> statement. For example, the following is a valid rule condition: <code>department_id = 30</code> Ensure that the proper case is used for text in rule conditions. Note: Do not include the word "WHERE" in the condition.
<code>evaluation_context</code>	An optional evaluation context name in the form <code>[schema_name.]evaluation_context_name</code> , which is associated with the rule. If the schema is not specified, then the current user is the default. If <code>evaluation_context</code> is not specified, then the rule inherits the evaluation context from its rule set.
<code>action_context</code>	The action context associated with the rule. A rule action context is information associated with a rule that is interpreted by the client of the rules engine when the rule is evaluated.
<code>rule_comment</code>	An optional description of the rule

Usage Notes

To run this procedure, a user must meet at least one of the following requirements:

- Be the owner of the rule being created and have the `CREATE_RULE_OBJ` system privilege
- Have `CREATE_ANY_RULE` system privilege

If an evaluation context is specified, then the rule owner must meet at least one of the following requirements:

- Have `EXECUTE_ON_EVALUATION_CONTEXT` privilege on the evaluation context
- Have `EXECUTE_ANY_EVALUATION_CONTEXT` system privilege, and the owner of the evaluation context must not be `SYS`.
- Be the evaluation context owner

Also, the rule owner must have the necessary privileges on all the base objects accessed by the rule using the evaluation context.



See Also:

[Rule TYPES](#) for more information about the types used with the `DBMS_RULE_ADM` package

160.3.6 CREATE_RULE_SET Procedure

This procedure creates a rule set.

Syntax

```
DBMS_RULE_ADM.CREATE_RULE_SET(
    rule_set_name      IN  VARCHAR2,
    evaluation_context IN  VARCHAR2 DEFAULT NULL,
    rule_set_comment   IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 160-7 CREATE_RULE_SET Procedure Parameters

Parameter	Description
<code>rule_set_name</code>	The name of the rule set you are creating, specified as <code>[schema_name.]rule_set_name</code> . For example, to create a rule set named <code>apply_rules</code> in the <code>hr</code> schema, enter <code>hr.apply_rules</code> for this parameter. If the schema is not specified, then the current user is the default.
<code>evaluation_context</code>	An optional evaluation context name in the form <code>[schema_name.]evaluation_context_name</code> , which applies to all rules in the rule set that are not associated with an evaluation context explicitly. If the schema is not specified, then the current user is the default.
<code>rule_set_comment</code>	An optional description of the rule set

Usage Notes

To run this procedure, a user must meet at least one of the following requirements:

- Be the owner of the rule set being created and have `CREATE_RULE_SET_OBJ` system privilege
- Have `CREATE_ANY_RULE_SET` system privilege

If an evaluation context is specified, then the rule set owner must meet at least one of the following requirements:

- Have `EXECUTE_ON_EVALUATION_CONTEXT` privilege on the evaluation context
- Have `EXECUTE_ANY_EVALUATION_CONTEXT` system privilege, and the owner of the evaluation context must not be `SYS`
- Be the evaluation context owner

160.3.7 DROP_EVALUATION_CONTEXT Procedure

This procedure drops a rule evaluation context.

Syntax

```
DBMS_RULE_ADM.DROP_EVALUATION_CONTEXT (
    evaluation_context_name IN VARCHAR2,
    force                    IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 160-8 DROP_EVALUATION_CONTEXT Procedure Parameters

Parameter	Description
<code>evaluation_context_name</code>	The name of the evaluation context you are dropping, specified as <code>[schema_name.]evaluation_context_name</code> . For example, to drop an evaluation context named <code>dept_eval_context</code> in the <code>hr</code> schema, enter <code>hr.dept_eval_context</code> for this parameter. If the schema is not specified, then the current user is the default.
<code>force</code>	If <code>TRUE</code> , then the procedure removes the rule evaluation context from all rules and rule sets that use it. If <code>FALSE</code> and no rules or rule sets use the rule evaluation context, then the procedure drops the rule evaluation context. If <code>FALSE</code> and one or more rules or rule sets use the rule evaluation context, then the procedure raises an exception. Caution: Setting <code>force</code> to <code>TRUE</code> can result in rules and rule sets that do not have an evaluation context. If neither a rule nor the rule set it is in has an evaluation context, and no evaluation context was specified for the rule by the <code>ADD_RULE</code> procedure, then the rule cannot be evaluated.

Usage Notes

To run this procedure, a user must meet at least one of the following requirements:

- Be the owner of the evaluation context
- Have `DROP_ANY_EVALUATION_CONTEXT` system privilege

160.3.8 DROP_RULE Procedure

This procedure drops a rule.

Syntax

```
DBMS_RULE_ADM.DROP_RULE (
    rule_name IN VARCHAR2,
    force     IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 160-9 DROP_RULE Procedure Parameters

Parameter	Description
<code>rule_name</code>	The name of the rule you are dropping, specified as <code>[schema_name.]rule_name</code> . For example, to drop a rule named <code>all_a</code> in the <code>hr</code> schema, enter <code>hr.all_a</code> for this parameter. If the schema is not specified, then the current user is the default.
<code>force</code>	<p>If <code>TRUE</code>, then the procedure removes the rule from all rule sets that contain it.</p> <p>If <code>FALSE</code> and no rule sets contain the rule, then the procedure drops the rule.</p> <p>If <code>FALSE</code> and one or more rule sets contain the rule, then the procedure raises an exception.</p>

Usage Notes

To run this procedure, a user must meet at least one of the following requirements:

- Be the owner of the rule
- Have `DROP_ANY_RULE` system privilege

Note:

- To remove a rule from a rule set without dropping the rule from the database, use the `REMOVE_RULE` procedure.
- The rule evaluation context associated with the rule, if any, is not dropped when you run this procedure.

160.3.9 DROP_RULE_SET Procedure

This procedure drops a rule set.

Syntax

```
DBMS_RULE_ADM.DROP_RULE_SET(
  rule_set_name IN VARCHAR2,
  delete_rules  IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 160-10 DROP_RULE_SET Procedure Parameters

Parameter	Description
rule_set_name	The name of the rule set you are dropping, specified as [<i>schema_name</i> .] <i>rule_set_name</i> . For example, to drop a rule set named <i>apply_rules</i> in the <i>hr</i> schema, enter <i>hr.apply_rules</i> for this parameter. If the schema is not specified, then the current user is the default.
delete_rules	If TRUE , then the procedure drops any rules that are in the rule set. If any of the rules in the rule set are also in another rule set, then these rules are not dropped. If FALSE , then the procedure does not drop the rules in the rule set.

Usage Notes

To run this procedure, a user must meet at least one of the following requirements:

- Have **DROP_ANY_RULE_SET** system privilege
- Be the owner of the rule set

Note:

The rule evaluation context associated with the rule set, if any, is not dropped when you run this procedure.

160.3.10 GRANT_OBJECT_PRIVILEGE Procedure

This procedure grants the specified object privilege on the specified object to the specified user or role. If a user owns the object, then the user automatically is granted all privileges on the object, with grant option.

Syntax

```
DBMS_RULE_ADM.GRANT_OBJECT_PRIVILEGE(
  privilege      IN BINARY_INTEGER,
  object_name    IN VARCHAR2,
  grantee        IN VARCHAR2,
  grant_option   IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 160-11 GRANT_OBJECT_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The name of the object privilege to grant to the grantee on the object. See " Usage Notes " for the available object privileges.
object_name	The name of the object for which you are granting the privilege to the grantee, specified as [<i>schema_name</i> .] <i>object_name</i> . For example, to grant the privilege on a rule set named <i>apply_rules</i> in the <i>hr</i> schema, enter <i>hr.apply_rules</i> for this parameter. If the schema is not specified, then the current user is the default. The object must be an existing rule, rule set, or evaluation context.
grantee	The name of the user or role for which the privilege is granted. The specified user cannot be the owner of the object.
grant_option	If TRUE, then the specified user or users granted the specified privilege can grant this privilege to others. If FALSE, then the specified user or users granted the specified privilege cannot grant this privilege to others.

Usage Notes

To run this procedure, a user must meet at least one of the following requirements:

- Be the owner of the object on which the privilege is granted
- Have the same privilege as the privilege being granted with the grant option

In addition, if the object is a rule set, then the user must have `EXECUTE` privilege on all the rules in the rule set with grant option or must own the rules in the rule set.

[Table 160-12](#) lists the object privileges.

Table 160-12 Object Privileges for Evaluation Contexts, Rules, and Rule Sets

Privilege	Description
<code>SYS.DBMS_RULE_ADM.ALL_ON_EVALUATION_CONTEXT</code>	Alter and execute a particular evaluation context in another user's schema
<code>SYS.DBMS_RULE_ADM.ALL_ON_RULE</code>	Alter and execute a particular rule in another user's schema
<code>SYS.DBMS_RULE_ADM.ALL_ON_RULE_SET</code>	Alter and execute a particular rule set in another user's schema
<code>SYS.DBMS_RULE_ADM.ALTER_ON_EVALUATION_CONTEXT</code>	Alter a particular evaluation context in another user's schema
<code>SYS.DBMS_RULE_ADM.ALTER_ON_RULE</code>	Alter a particular rule in another user's schema
<code>SYS.DBMS_RULE_ADM.ALTER_ON_RULE_SET</code>	Alter a particular rule set in another user's schema
<code>SYS.DBMS_RULE_ADM.EXECUTE_ON_EVALUATION_CONTEXT</code>	Execute a particular evaluation context in another user's schema
<code>SYS.DBMS_RULE_ADM.EXECUTE_ON_RULE</code>	Execute a particular rule in another user's schema

Table 160-12 (Cont.) Object Privileges for Evaluation Contexts, Rules, and Rule Sets

Privilege	Description
SYS.DBMS_RULE_ADM.EXECUTE_ON_RULE_SET	Execute a particular rule set in another user's schema

Examples

For example, to grant the HR user the privilege to alter a rule named hr_dml in the strmadmin schema, enter the following:

```
BEGIN
  DBMS_RULE_ADM.GRANT_OBJECT_PRIVILEGE(
    privilege   => SYS.DBMS_RULE_ADM.ALTER_ON_RULE,
    object_name => 'strmadmin.hr_dml',
    grantee     => 'hr',
    grant_option => FALSE);
END;
/
```

160.3.11 GRANT_SCHEMA_PRIVILEGE Procedure

This procedure grants the specified schema privilege on the specified schema to the specified user or role.

Syntax

```
DBMS_RULE_ADM.GRANT_SCHEMA_PRIVILEGE(
  privilege   IN  BINARY_INTEGER,
  schema      IN  VARCHAR2,
  grantee     IN  VARCHAR2,
  grant_option IN  BOOLEAN   DEFAULT FALSE);
```

Parameters

Table 160-13 GRANT_SCHEMA_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The name of the schema privilege to grant to the grantee.
schema	The name of the schema on which schema privilege is to be granted.
grantee	The name of the user or role to which the schema privilege is to be granted.
grant_option	If TRUE, then the specified user or users granted the specified privilege can grant the system privilege to others. If FALSE, then the specified user or users granted the specified privilege cannot grant the system privilege to others.

Usage Notes

[Table 160-16](#) lists the system privileges.

Table 160-14 System Privileges for Evaluation Contexts, Rules, and Rule Sets

Privilege	Description
SYS.DBMS_RULE_ADM.ALTER_ANY_EVALUATION_CONTEXT	Alter any evaluation context owned by any user
SYS.DBMS_RULE_ADM.ALTER_ANY_RULE	Alter any rule owned by any user
SYS.DBMS_RULE_ADM.ALTER_ANY_RULE_SET	Alter any rule set owned by any user
SYS.DBMS_RULE_ADM.CREATE_ANY_EVALUATION_CONTEXT	Create a new evaluation context in any schema
SYS.DBMS_RULE_ADM.CREATE_EVALUATION_CONTEXT_OBJ	Create a new evaluation context in the grantee's schema
SYS.DBMS_RULE_ADM.CREATE_ANY_RULE	Create a new rule in any schema
SYS.DBMS_RULE_ADM.CREATE_RULE_OBJ	Create a new rule in the grantee's schema
SYS.DBMS_RULE_ADM.CREATE_ANY_RULE_SET	Create a new rule set in any schema
SYS.DBMS_RULE_ADM.CREATE_RULE_SET_OBJ	Create a new rule set in the grantee's schema
SYS.DBMS_RULE_ADM.DROP_ANY_EVALUATION_CONTEXT	Drop any evaluation context in any schema
SYS.DBMS_RULE_ADM.DROP_ANY_RULE	Drop any rule in any schema
SYS.DBMS_RULE_ADM.DROP_ANY_RULE_SET	Drop any rule set in any schema
SYS.DBMS_RULE_ADM.EXECUTE_ANY_EVALUATION_CONTEXT	Execute any evaluation context owned by any user
SYS.DBMS_RULE_ADM.EXECUTE_ANY_RULE	Execute any rule owned by any user
SYS.DBMS_RULE_ADM.EXECUTE_ANY_RULE_SET	Execute any rule set owned by any user

160.3.12 GRANT_SYSTEM_PRIVILEGE Procedure

This procedure grant the specified system privilege to the specified user or role.

Syntax

```
DBMS_RULE_ADM.GRANT_SYSTEM_PRIVILEGE (
  privilege      IN  BINARY_INTEGER,
  grantee        IN  VARCHAR2,
  grant_option   IN  BOOLEAN    DEFAULT FALSE);
```

Parameters

Table 160-15 GRANT_SYSTEM_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The name of the system privilege to grant to the grantee.
grantee	The name of the user or role for which the privilege is granted
grant_option	If TRUE, then the specified user or users granted the specified privilege can grant the system privilege to others. If FALSE, then the specified user or users granted the specified privilege cannot grant the system privilege to others.

Usage Notes

Table 160-16 lists the system privileges.

Table 160-16 System Privileges for Evaluation Contexts, Rules, and Rule Sets

Privilege	Description
SYS.DBMS_RULE_ADM.ALTER_ANY_EVALUATION_CONTEXT	Alter any evaluation context owned by any user
SYS.DBMS_RULE_ADM.ALTER_ANY_RULE	Alter any rule owned by any user
SYS.DBMS_RULE_ADM.ALTER_ANY_RULE_SET	Alter any rule set owned by any user
SYS.DBMS_RULE_ADM.CREATE_ANY_EVALUATION_CONTEXT	Create a new evaluation context in any schema
SYS.DBMS_RULE_ADM.CREATE_EVALUATION_CONTEXT_OBJ	Create a new evaluation context in the grantee's schema
SYS.DBMS_RULE_ADM.CREATE_ANY_RULE	Create a new rule in any schema
SYS.DBMS_RULE_ADM.CREATE_RULE_OBJ	Create a new rule in the grantee's schema
SYS.DBMS_RULE_ADM.CREATE_ANY_RULE_SET	Create a new rule set in any schema
SYS.DBMS_RULE_ADM.CREATE_RULE_SET_OBJ	Create a new rule set in the grantee's schema
SYS.DBMS_RULE_ADM.DROP_ANY_EVALUATION_CONTEXT	Drop any evaluation context in any schema
SYS.DBMS_RULE_ADM.DROP_ANY_RULE	Drop any rule in any schema
SYS.DBMS_RULE_ADM.DROP_ANY_RULE_SET	Drop any rule set in any schema
SYS.DBMS_RULE_ADM.EXECUTE_ANY_EVALUATION_CONTEXT	Execute any evaluation context owned by any user
SYS.DBMS_RULE_ADM.EXECUTE_ANY_RULE	Execute any rule owned by any user
SYS.DBMS_RULE_ADM.EXECUTE_ANY_RULE_SET	Execute any rule set owned by any user

For example, to grant the `strmadmin` user the privilege to create a rule set in any schema, enter the following:

```
BEGIN
  DBMS_RULE_ADM.GRANT_SYSTEM_PRIVILEGE(
    privilege   => SYS.DBMS_RULE_ADM.CREATE_ANY_RULE_SET,
    grantee     => 'strmadmin',
    grant_option => FALSE);
END;
/
```

160.3.13 REMOVE_RULE Procedure

This procedure removes the specified rule from the specified rule set.

Syntax

```
DBMS_RULE_ADM.REMOVE_RULE(
  rule_name           IN  VARCHAR2,
  rule_set_name       IN  VARCHAR2,
  evaluation_context  IN  VARCHAR2  DEFAULT NULL,
  all_evaluation_contexts IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 160-17 REMOVE_RULE Procedure Parameters

Parameter	Description
<code>rule_name</code>	The name of the rule you are removing from the rule set, specified as <code>[schema_name.]rule_name</code> . For example, to remove a rule named <code>all_a</code> in the <code>hr</code> schema, enter <code>hr.all_a</code> for this parameter. If the schema is not specified, then the current user is the default.
<code>rule_set_name</code>	The name of the rule set from which you are removing the rule, specified as <code>[schema_name.]rule_set_name</code> . For example, to remove the rule from a rule set named <code>apply_rules</code> in the <code>hr</code> schema, enter <code>hr.apply_rules</code> for this parameter. If the schema is not specified, then the current user is the default.
<code>evaluation_context_name</code>	The name of the evaluation context associated with the rule you are removing, specified as <code>[schema_name.]evaluation_context_name</code> . For example, to specify an evaluation context named <code>dept_eval_context</code> in the <code>hr</code> schema, enter <code>hr.dept_eval_context</code> for this parameter. If the schema is not specified, then the current user is the default. If an evaluation context was specified for the rule you are removing when you added the rule to the rule set using the <code>ADD_RULE</code> procedure, then specify the same evaluation context. If you added the same rule more than once with different evaluation contexts, then specify the rule with the evaluation context you want to remove. If you specify an evaluation context that is not associated with the rule, then the procedure raises an error. Specify <code>NULL</code> if you did not specify an evaluation context when you added the rule to the rule set. If you specify <code>NULL</code> and there are one or more evaluation contexts associated with the rule, then the procedure raises an error.
<code>all_evaluation_contexts</code>	If <code>TRUE</code> , then the procedure removes the rule from the rule set with all of its associated evaluation contexts. If <code>FALSE</code> , then the procedure only removes the rule with the specified evaluation context. This parameter is relevant only if the same rule is added more than once to the rule set with different evaluation contexts.

Usage Notes

To run this procedure, a user must meet at least one of the following requirements:

- Have `ALTER_ON_RULE_SET` privilege on the rule set
- Have `ALTER_ANY_RULE_SET` system privilege
- Be the owner of the rule set

 **Note:**

This procedure does not drop a rule from the database. To drop a rule from the database, use the `DROP_RULE` procedure.

160.3.14 REVOKE_OBJECT_PRIVILEGE Procedure

This procedure revokes the specified object privilege on the specified object from the specified user or role.

Syntax

```
DBMS_RULE_ADM.REVOKE_OBJECT_PRIVILEGE (
  privilege   IN  BINARY_INTEGER,
  object_name IN  VARCHAR2,
  revokee     IN  VARCHAR2);
```

Parameters

Table 160-18 REVOKE_OBJECT_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The name of the object privilege on the object to revoke from the revokee. See GRANT_OBJECT_PRIVILEGE Procedure for a list of the object privileges.
object_name	The name of the object for which you are revoking the privilege from the revokee, specified as <code>[schema_name.]object_name</code> . For example, to revoke an object privilege on a rule set named <code>apply_rules</code> in the <code>hr</code> schema, enter <code>hr.apply_rules</code> for this parameter. If the schema is not specified, then the current user is the default. The object must be an existing rule, rule set, or evaluation context.
revokee	The name of the user or role from which the privilege is revoked. The user who owns the object cannot be specified.

160.3.15 REVOKE_SCHEMA_PRIVILEGE Procedure

This procedure revokes the specified schema privilege on the specified schema from the specified user or role.

Syntax

```
DBMS_RULE_ADM.REVOKE_SCHEMA_PRIVILEGE (
  privilege IN  BINARY_INTEGER,
  schema    IN  VARCHAR2,
  revokee   IN  VARCHAR2);
```

Parameters

Table 160-19 REVOKE_SCHEMA_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The name of the schema privilege to revoke from the revokee. See GRANT_SCHEMA_PRIVILEGE Procedure for a list of the schema privileges.
schema	The name of the schema from which the schema privilege is to be revoked.
revokee	The name of the user or role from which the schema privilege is to be revoked.

160.3.16 REVOKE_SYSTEM_PRIVILEGE Procedure

This procedure revokes the specified system privilege from the specified user or role.

Syntax

```
DBMS_RULE_ADM.REVOKE_SYSTEM_PRIVILEGE(  
    privilege IN BINARY_INTEGER,  
    revokee   IN VARCHAR2);
```

Parameters

Table 160-20 REVOKE_SYSTEM_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The name of the system privilege to revoke from the revokee. See GRANT_SYSTEM_PRIVILEGE Procedure for a list of the system privileges.
revokee	The name of the user or role from which the privilege is revoked

DBMS_SAGA_ADM

The `DBMS_SAGA_ADM` package provides a collection of saga administration functions and procedures to define and manage saga participants, coordinators and brokers.

This chapter contains the following topics:

- [DBMS_SAGA_ADM Overview](#)
- [DBMS_SAGA_ADM Security Model](#)
- [Summary of DBMS_SAGA_ADM Subprograms](#)

161.1 DBMS_SAGA_ADM Overview

The `SYS.DBMS_SAGA_ADM` package provides the saga administration APIs to manage sagas.

The saga administration APIs implemented using the `DBMS_SAGA_ADM` package enables the administrators to define and manage saga participants, coordinators and brokers. The package APIs are described here for your reference.

161.2 DBMS_SAGA_ADM Security Model

A participant must invoke the procedures in `DBMS_SAGA_ADM` package from inside its schema and PDB. Invocation of APIs in the `DBMS_SAGA_ADM` package requires the `SAGA_ADM_ROLE` role.

161.3 Summary of DBMS_SAGA_ADM Subprograms

This table lists and briefly describes the `DBMS_SAGA_ADM` package subprograms.

Table 161-1 DBMS_SAGA_ADM Package Subprograms

Subprogram	Description
ADD_COORDINATOR Procedure	Adds a saga coordinator to the saga framework
DROP_COORDINATOR Procedure	Drops the given coordinator from the saga framework.
ADD_PARTICIPANT Procedure	Adds a participant to the local PDB and the broker
DROP_PARTICIPANT Procedure	Drops the given participant on the local PDB and the broker if there are no pending sagas and pending saga messages for the participant.
ADD_BROKER Procedure	Adds a broker to the saga framework and creates a JMS topic for the broker.
DROP_BROKER Procedure	Drops a broker and the associated JMS topic.
REGISTER_SAGA_CALLBACK Procedure	Allows users to create or modify a callback package if created using <code>add_participant</code> procedure.

161.3.1 ADD_BROKER Procedure

This procedure adds a broker to the saga framework.

As a part of adding a broker, a JMS topic is created for the broker. Both incoming and outgoing message propagation channels from participants to the broker use the broker's JMS topic.

Syntax

```
add_broker(
  broker_name          IN varchar2,
  broker_schema        IN varchar2 default sys_context('userenv',
'CURRENT_USER'),
  storage_clause        IN varchar2 default NULL,
  queue_partitions     IN number DEFAULT 1,
  version              IN number default 1
);
```

Parameters

Table 161-2 ADD_BROKER Procedure Parameters

Parameter	Description
broker_name	A unique broker name.
broker_schema	The schema for the microservice participant being added. If no value is provided, CURRENT_USER is used.
storage_clause	The storage parameter is included in the CREATE_TRANSACTIONAL_EVENT_QUEUE statement when the inbound and outbound JMS topics are created. The storage_clause argument can take any text that you can use in a standard DBMS_AQADM.CREATE_TRANSACTIONAL_EVENT_QUEUE storage_clause argument.
queue_partitions	The number of partitions for the Saga entity IN/OUT queues. This allows for higher parallelism and throughput for the Saga entity. DEFAULT is 1.
version	Saga version

161.3.2 DROP_BROKER Procedure

This procedure drops a broker and the associated JMS topic.

A broker can only be dropped if there are no registered participants and pending messages for the broker.

Syntax

```
drop_broker(broker_name IN varchar2)
```

Parameters

Table 161-3 DROP_BROKER Procedure Parameters

Parameter	Description
broker_name	The broker name to be dropped.

161.3.3 ADD_COORDINATOR Procedure

This procedure adds a Saga coordinator to the Saga framework. A Saga coordinator acts as a transaction manager for Sagas. The Saga coordinator maintains the state of a Saga across various participants.

Syntax

```
add_coordinator(
  coordinator_name      IN varchar2,
  coordinator_schema    IN varchar2 DEFAULT sys_context('USERENV', 'CURRENT_USER'),
  storage_clause        IN varchar2 DEFAULT NULL,
  dblink_to_broker     IN varchar2 DEFAULT NULL,
  mailbox_schema       IN varchar2,
  broker_name          IN varchar2,
  dblink_to_coordinator IN varchar2 DEFAULT NULL,
  queue_partitions      IN number DEFAULT 1,
  listener_count       IN number DEFAULT -1,
  version              IN number default 1);
```

Parameters

Table 161-4 ADD_COORDINATOR Procedure Parameters

Parameter	Description
coordinator_name	A unique name for the Saga coordinator.
coordinator_schema	The schema for the Saga coordinator being added. The parameter uses CURRENT_USER if no value is specified.
storage_clause	The storage parameter is included in the CREATE_TRANSACTIONAL_EVENT_QUEUE statement when the inbound and outbound JMS topics are created. The storage_clause argument can take any text that you can use in a standard DBMS_AQADM.CREATE_TRANSACTIONAL_EVENT_QUEUE storage_clause argument.
dblink_to_broker	Pre-created database link to connect from the coordinator PDB to the broker PDB.
mailbox_schema	The schema for the mailbox owner at the broker.
broker_name	The name of the broker.
dblink_to_coordinator	Pre-created database link to connect from the broker PDB to the coordinator PDB.

Table 161-4 (Cont.) ADD_COORDINATOR Procedure Parameters

Parameter	Description
queue_partitions	The number of partitions for the Saga entity IN/OUT queues. This allows for higher parallelism and throughput for the Saga entity. DEFAULT is 1.
listener_count	The number of concurrent Saga listener processes consuming inbound messages for the Saga coordinator. listener_count can have one of the following values: <ul style="list-style-type: none"> DBMS_SAGA_ADM.AQ_NTFN, which is also the DEFAULT. In this case, the Saga coordinator processes messages using the AQ notification mechanism. DBMS_SAGA_ADM.AUTO_NTFN- In this case, the Saga coordinator processes messages using job queue processes that dequeue from the coordinator queue. The job automatically adds and removes jobs depending on the queue depth. If any positive number (N) is specified, then N number of fixed jobs are created to process the messages for the Saga coordinator.
version	Saga version

 **Note:**

The number of queue partitions should be equal to the partition count specified while performing the add_broker() operation.

161.3.4 DROP_COORDINATOR Procedure

This procedure drops the given coordinator and disables message propagation between the coordinator and the broker. A coordinator can only be dropped if there are no participants associated with the coordinator.

Syntax

```
drop_coordinator(coordinator_name IN varchar2)
```

Parameters

Table 161-5 DROP_COORDINATOR Procedure Parameters

Parameter	Description
coordinator_name	The name of the saga coordinator that is being dropped.

161.3.5 ADD_PARTICIPANT Procedure

This procedure adds a Saga participant to the database and the broker.

A participant name is unique to the broker where the participant is added. The ADD_PARTICIPANT procedure creates system-defined inbound and outbound JMS

topics for the participant. A JMS topic is also created at the broker's side if the topic does not exist. Message propagation relationships are set up from:

- The outbound JMS topic of the participant to the JMS topic of the broker.
- The JMS topic of the broker to the inbound JMS topic of the participant.

Syntax

```
add_participant(
  participant_name          IN varchar2,
  participant_schema       IN varchar2 DEFAULT sys_context('USERENV',
'CURRENT_USER'),
  storage_clause           IN varchar2 DEFAULT NULL,
  coordinator_name        IN varchar2 DEFAULT NULL,
  dblink_to_broker        IN varchar2,
  mailbox_schema          IN varchar2,
  broker_name             IN varchar2,
  callback_schema         IN varchar2 DEFAULT sys_context('USERENV','CURRENT_USER'),
  callback_package        IN varchar2,
  dblink_to_participant   IN varchar2,
  queue_partitions        IN number DEFAULT 1,
  version                 IN number DEFAULT 1
);
```

Parameters

Table 161-6 ADD_PARTICIPANT Procedure Parameters

Parameter	Description
participant_name	A unique name for the saga participant.
participant_schema	The schema for the saga participant being added. The parameter uses CURRENT_USER if no value is specified.
storage_clause	The storage parameter is included in the CREATE_TRANSACTIONAL_EVENT_QUEUE statement when the inbound and outbound JMS topics are created. The storage_clause argument can take any text that you can use in a standard DBMS_AQADM.CREATE_TRANSACTIONAL_EVENT_QUEUE storage_clause argument.
coordinator_name	The name of the saga coordinator. If no value is provided and create_coordinator is TRUE, a system generated name is assumed.
dblink_to_broker	The pre-created database link to connect from the participant PDB to broker PDB.
mailbox_schema	The schema for the mailbox owner at the broker's side.
broker_name	The name of the broker. If no value is provided, the mailbox_schema name is assumed.
callback_schema	The schema of the user-defined callback package. If no value is provided, CURRENT_USER is used.
callback_package	The name of the user-defined callback package. The callback package isolates application developers from the internal details of the saga infrastructure, and enables the developers to focus on business logic.
dblink_to_participa nt	The pre-created database link to connect from broker PDB to the participant PDB.

Table 161-6 (Cont.) ADD_PARTICIPANT Procedure Parameters

Parameter	Description
queue_partitions	The number of partitions for the Saga entity IN/OUT queues. This allows for higher parallelism and throughput for the Saga entity. DEFAULT is 1.
version	Saga version



Note:

The number of queue partitions should be equal to the partition count specified while performing the `add_broker()` operation.

Usage Notes

The `ADD_PARTICIPANT` procedure needs coordinator name as an argument, hence the `ADD_COORDINATOR` procedure must be used before the `ADD_PARTICIPANT` procedure.

161.3.6 DROP_PARTICIPANT Procedure

This procedure drops the given participant on the local PDB and the broker.

The `DROP_PARTICIPANT` procedure drops the given participant on the local PDB and the broker if there are no pending sagas and pending saga messages for the participant. The `DROP_PARTICIPANT` procedure also disables message propagation between the participant and the broker.

Syntax

```
drop_participant(participant_name IN varchar2)
```

Parameters

Table 161-7 DROP_PARTICIPANT Procedure Parameters

Parameter	Description
participant_name	The name of the participant microservice that is being dropped.

161.3.7 REGISTER_SAGA_CALLBACK Procedure

This procedure enables users to create or modify a callback package if the package is created using `ADD_PARTICIPANT` procedure.

If the callback package was not added before, the `REGISTER_SAGA_CALLBACK` procedure sets up the required subscribers and the notification callback. While doing an add participant the user has the option of specifying the callback package. If they want to defer specifying the callback package or if they want to change the callback package they can use the `REGISTER_SAGA_CALLBACK` procedure. If the callback already exists for a participant, then it is simply replaced. The

REGISTER_SAGA_CALLBACK procedure is useful in cases where the user is not sure about whether to implement PL/SQL or Java, and wants to decide about it later, or the user wants to switch implementations (for example, from a Java client to a PL/SQL based client).

Syntax

```
register_saga_callback(participant_name IN varchar2,  
  callback_schema      IN varchar2 default sys_context('USERENV','CURRENT_USER'),  
  callback_package     IN varchar2);
```

Parameters

Table 161-8 REGISTER_SAGA_CALLBACK Procedure Parameters

Parameter	Description
participant_name	The name of the participant already created.
callback_schema	The schema for the user-defined callback package. If no value is provided, CURRENT_USER is used.
callback_package	The name of the user-defined callback package. The callback package isolates application developers from the internal details of the saga infrastructure, and enables them to focus on business logic.

DBMS_SAGA

The `DBMS_SAGA` package provides a collection of saga functions and procedures to initiate and finalize sagas.

This chapter contains the following topics:

- [DBMS_SAGA Overview](#)
- [DBMS_SAGA Security Model](#)
- [Summary of DBMS_SAGA Subprograms](#)

162.1 DBMS_SAGA Overview

The `DBMS_SAGA` package enables you (developers) to use PL/SQL and develop packaged microservices applications in the database without requiring a mid-tier.

The `DBMS_SAGA` package provides the PL/SQL interfaces to allow client programs to interact with database sagas.

If you want to implement microservices using a mid-tier to communicate with a database, it is recommended that you use the AQJMS extensions to implement the saga functionality.



See Also:

Managing a Saga Using JMS Interface for more information about the AQJMS extensions.

162.2 DBMS_SAGA Security Model

The `DBMS_SAGA` package requires the `SAGA_PARTICIPANT` role to participate in sagas.

162.3 Summary of DBMS_SAGA Subprograms

This table lists and briefly describes the `DBMS_SAGA` package subprograms.

Table 162-1 DBMS_SAGA Package Subprograms

Subprogram	Description
BEGIN_SAGA Function	Creates and returns a new <code>saga_id_t</code> (GUID). The new Saga ID is inserted into the <code>Saga\$</code> dictionary table.
GET_SAGA_ID Function	Gets the Saga ID for a Saga associated with a database session.
SET_SAGA_ID Procedure	Sets the Saga ID for a database session to the <code>saga_id</code> provided.
COMMIT_SAGA Procedure	Commits the Saga identified by the <code>saga_id</code> parameter.

Table 162-1 (Cont.) DBMS_SAGA Package Subprograms

Subprogram	Description
ROLLBACK_SAGA Procedure	Rolls back the Saga identified by the <code>saga_id</code> parameter.
IS_INCOMPLETE Function	Returns <code>TRUE</code> if the Saga corresponding to the provided <code>saga_id</code> is considered incomplete.
SET_INCOMPLETE Procedure	Marks the Saga identified by the provided <code>saga_id</code> as incomplete.
SEND_REQUEST Procedure	Enrolls a participant to an initiated Saga.

162.3.1 BEGIN_SAGA Function

This function creates and returns a new saga GUID: `saga_id_t`. The new saga ID is inserted into the `saga$` dictionary table.

Syntax

```
function begin_saga(initiator_name IN varchar2,
                  timeout    IN number default NULL,
                  version    IN number default 1)
return saga_id_t;
```

Parameters

Table 162-2 BEGIN_SAGA Procedure Parameters

Parameter	Description
<code>initiator_name</code>	The name of the saga initiator.
<code>timeout</code>	The timeout value specified as number of seconds. This value overrides the value of the <code>max_saga_duration</code> parameter.

162.3.2 GET_SAGA_ID Function

This function returns the saga, if any, associated with the current database session.

Syntax

```
function get_saga_id() return saga_id_t;
```

162.3.3 SET_SAGA_ID Procedure

This procedure sets the saga ID for a database session to the `saga_id` provided.

Syntax

```
procedure set_saga_id(saga_id IN saga_id_t);
```

Parameters

Table 162-3 SET_SAGA Procedure Parameters

Parameter	Description
saga_id	The saga identifier of the type <code>saga_id_t</code> .

162.3.4 COMMIT_SAGA Procedure

This procedure commits the saga that is identified with the `saga_id` parameter.

The `force` option is used to forcefully commit a saga participant transaction for pending or incomplete sagas. For the `COMMIT_SAGA()` call on the participant database, `force=TRUE` only commits the saga branch operation on the participant database. The default value of `force` is `TRUE`.

Syntax

```
procedure commit_saga(saga_participant IN VARCHAR2,
  saga_id IN saga_id_t,
  force IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 162-4 COMMIT_SAGA Procedure Parameters

Parameter	Description
saga_participant	The saga participant (<code>participant_name</code>).
saga_id	The saga identifier of the type <code>saga_id_t</code> .
force	The flag to indicate whether the commit saga operation is initiated for a saga branch.

162.3.5 ROLLBACK_SAGA Procedure

This procedure aborts the saga corresponding to the `saga_id` parameter.

The `force` option can be used to forcefully roll back a saga participant transaction for pending or incomplete sagas. For the `ROLLBACK_SAGA()` call on the participant database, `force=TRUE` only rolls back the saga branch operation on the participant database. The default value of `force` is `TRUE`.

Syntax

```
procedure rollback_saga (saga_participant IN VARCHAR2,
  saga_id IN saga_id_t,
  force IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 162-5 ROLLBACK_SAGA Procedure Parameters

Parameter	Description
saga_participant	The saga participant (<code>participant_name</code>).
saga_id	The saga identifier of the type <code>saga_id_t</code> .
force	The flag to indicate whether the rollback saga operation is initiated for a participant transaction. The default value is <code>TRUE</code> .

162.3.6 IS_INCOMPLETE Function

This function returns `TRUE` if the saga corresponding to the provided `saga_id` is considered incomplete.

A saga is considered incomplete for the following reasons:

- If the saga exceeds the duration identified by the `max_saga_duration` parameter or the duration established by the `begin_saga()` call.
- If the saga participant fails to finalize the saga (commit or rollback).

Syntax

```
function is_incomplete (saga_id IN saga_id_t) returns boolean;
```

Parameters

Table 162-6 IS_COMPLETE Function Parameters

Parameter	Description
saga_id	The saga identifier of the type <code>saga_id_t</code> .

162.3.7 SET_INCOMPLETE Procedure

This procedure marks the saga corresponding to the provided `saga_id` as incomplete.

This is an administrative interface to mark certain sagas as incomplete such that these sagas can be flagged for manual intervention.

Syntax

```
procedure set_incomplete (saga_id IN saga_id_t);
```

Parameters

Table 162-7 SET_INCOMPLETE Procedure Parameters

Parameter	Description
saga_id	The saga identifier of the type <code>saga_id_t</code> .

162.3.8 SEND_REQUEST Procedure

This procedure can be used by the client to enroll a participant in the initiated saga.

This procedure abstracts the creation of the saga message, conversion of JSON payloads, and enqueueing the message to the participant. The application developer can manually perform this step as well.

Syntax

```
procedure send_request(saga_id IN saga_id_t,  
    recipient      IN VARCHAR2,  
    payload        IN JSON DEFAULT NULL,  
    saga_version  IN NUMBER DEFAULT 1,  
    saga_spare    IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 162-8 SEND_REQUEST Procedure Parameters

Parameter	Description
saga_id	The saga identifier that is derived using the <code>BEGIN_SAGA()</code> function.
recipient	The participant to enroll in this saga.
payload	The JSON payload to call <code>request()</code> of the participant being enrolled.
saga_version	The version of the saga framework (default is 1).
saga_spare	The currently unused field.

DBMS_SCHEDULER

The `DBMS_SCHEDULER` package provides a collection of scheduling functions and procedures that can be called from any PL/SQL program.

This chapter contains the following topics:

- [Deprecated Subprograms](#)
- [Security Model](#)
- [Rules and Limits](#)
- [Operational Notes](#)
- [Data Structures](#)
- [Summary of DBMS_SCHEDULER Subprograms](#)



See Also:

Oracle Database Administrator's Guide for more information regarding how to use `DBMS_SCHEDULER`

163.1 DBMS_SCHEDULER Deprecated Subprograms

Oracle recommends that you do not use deprecated subprograms in new applications. Support for deprecated features is for backward compatibility only.

The following subprograms are deprecated with Oracle Database 12c Release 1 (12.1):

- [CREATE_CREDENTIAL Procedure](#)
- [DROP_CREDENTIAL Procedure](#)

163.2 DBMS_SCHEDULER Security Model

The `DBMS_SCHEDULER` package ignores privileges granted on scheduler objects, such as jobs or chains, through roles. Object privileges must be granted directly to the user.

163.3 DBMS_SCHEDULER Rules and Limits

These rules apply when using the `DBMS_SCHEDULER` package.

- Only `SYS` can perform actions on objects in the `SYS` schema.
- Several of the procedures accept comma-delimited lists of object names. If you provide a list of names, then the Scheduler stops executing the list at the first object that returns an

error. Therefore, the Scheduler does not perform the tasks needed for the remaining objects on the list.

For example, consider the statement `DBMS_SCHEDULER.STOP_JOB ('job1, job2, job3, sys.jobclass1, sys.jobclass2, sys.jobclass3');`

If `job3` cannot be stopped, then the jobs that follow it, `jobclass1`, `jobclass2`, and `jobclass3` cannot be stopped. The jobs that preceded `job3`, `job1` and `job2`, are stopped.

- Performing an action on an object that does not exist returns a PL/SQL exception stating that the object does not exist.

163.4 DBMS_SCHEDULER Operational Notes

The Scheduler uses a rich **calendar**ing syntax to enable you to define repeating schedules, such as "every Tuesday and Friday at 4:00 p.m." or "the second Wednesday of every month." This calendaring syntax is used in calendaring expressions in the `repeat_interval` argument of a number of package subprograms. Evaluating a calendaring expression results in a set of discrete timestamps.

See *Oracle Database Administrator's Guide* for examples of the calendaring syntax.

Calendaring Syntax

This section starts with the calendaring syntax. It is followed by descriptions of various parts of the syntax.

In the calendaring syntax, `*` means 0 or more.

```
repeat_interval = regular_schedule | combined_schedule
```

```
regular_schedule = frequency_clause
[";" interval_clause] [";" bymonth_clause] [";" byweekno_clause]
[";" byyearday_clause] [";" bydate_clause] [";" bymonthday_clause]
[";" byday_clause] [";" byhour_clause] [";" byminute_clause]
[";" bysecond_clause] [";" bysetpos_clause] [";" include_clause]
[";" exclude_clause] [";" intersect_clause] [";" periods_clause]
[";" byperiod_clause]
```

```
frequency_clause = "FREQ" "=" ( predefined_frequency | user_defined_frequency )
```

```
predefined_frequency = "YEARLY" | "MONTHLY" | "WEEKLY" | "DAILY" |
"HOURLY" | "MINUTELY" | "SECONDLY"
```

```
user_defined_frequency = named_schedule
```

```
interval_clause = "INTERVAL" "=" intervalnum
```

```
intervalnum = 1 through 99
```

```
bymonth_clause = "BYMONTH" "=" monthlist
```

```
monthlist = month ( "," month)*
```

```
month = numeric_month | char_month
```

```
numeric_month = 1 | 2 | 3 ... 12
```

```
char_month = "JAN" | "FEB" | "MAR" | "APR" | "MAY" | "JUN" |
"JUL" | "AUG" | "SEP" | "OCT" | "NOV" | "DEC"
```

```
byweekno_clause = "BYWEEKNO" "=" weeknumber_list
```

```
weeknumber_list = weeknumber ( "," weeknumber)*
```

```
weeknumber = [minus] weekno
```

```
weekno = 1 through 53
```

```
byyearday_clause = "BYYEARDAY" "=" yearday_list
```

```
yearday_list = yearday ( "," yearday)*
```



```

    yearday = [minus] yeardaynum
    yeardaynum = 1 through 366
bydate_clause = "BYDATE" "=" date_list
    date_list = date ( "," date)*
    date = [YYYY]MMDD [ offset | span ]
bymonthday_clause = "BYMONTHDAY" "=" monthday_list
    monthday_list = monthday ( "," monthday)*
    monthday = [minus] monthdaynum
    monthdaynum = 1 through 31
byday_clause = "BYDAY" "=" byday_list
    byday_list = byday ( "," byday)*
    byday = [weekdaynum] day
    weekdaynum = [minus] daynum
    daynum = 1 through 53 /* if frequency is yearly */
    daynum = 1 through 5 /* if frequency is monthly */
    day = "MON" | "TUE" | "WED" | "THU" | "FRI" | "SAT" | "SUN"
BYTIME clause: BYTIME=[hour_minute_second_list|minute_second_list]
    hour_minute_second_list: hh24mss, .., hh24mss
    minute_second_list: mmss, .. mmss
byhour_clause = "BYHOUR" "=" hour_list
    hour_list = hour ( "," hour)*
    hour = 0 through 23
byminute_clause = "BYMINUTE" "=" minute_list
    minute_list = minute ( "," minute)*
    minute = 0 through 59
bysecond_clause = "BYSECOND" "=" second_list
    second_list = second ( "," second)*
    second = 0 through 59
bysetpos_clause = "BYSETPOS" "=" setpos_list
    setpos_list = setpos ( "," setpos)*
    setpos = [minus] setpos_num
    setpos_num = 1 through 9999

include_clause = "INCLUDE" "=" schedule_list
exclude_clause = "EXCLUDE" "=" schedule_list
intersect_clause = "INTERSECT" "=" schedule_list
schedule_list = schedule_clause ( "," schedule_clause)*
schedule_clause = named_schedule [ offset ]
named_schedule = [schema "."] schedule
periods_clause = "PERIODS" "=" periodnum
byperiod_clause = "BYPERIOD" "=" period_list
period_list = periodnum ( "," periodnum)*
periodnum = 1 through 100

offset = ("+" | "-") ["OFFSET:"] duration_val
span = ("+" | "-" | "^") "SPAN:" duration_val
duration_val = dur-weeks | dur_days
dur_weeks = numofweeks "W"
dur_days = numofdays "D"
numofweeks = 1 through 53
numofdays = 1 through 376
minus = "-"

combined_schedule = schedule_list

```

Table 163-1 Values for repeat_interval

Name	Description
FREQ	This specifies the type of recurrence. It must be specified. The possible predefined frequency values are YEARLY, MONTHLY, WEEKLY, DAILY, HOURLY, MINUTELY, and SECONDLY. Alternatively, specifies an existing schedule to use as a user-defined frequency.
INTERVAL	This specifies a positive integer representing how often the recurrence repeats. The default is 1, which means every second for secondly, every day for daily, and so on. The maximum value is 99.
BYMONTH	This specifies which month or months you want the job to execute in. You can use numbers such as 1 for January and 3 for March, as well as three-letter abbreviations such as FEB for February and JUL for July.
BYWEEKNO	<p>This specifies the week of the year as a number. It follows ISO-8601, which defines the week as starting with Monday and ending with Sunday; and the first week of a year as the first week, which is mostly within the Gregorian year. The first week is equivalent to the following two variants: the week that contains the first Thursday of the Gregorian year; and the week containing January 4th.</p> <p>The ISO-8601 week numbers are integers from 1 to 52 or 53; parts of week 1 may be in the previous calendar year; parts of week 52 may be in the following calendar year; and if a year has a week 53, parts of it must be in the following calendar year.</p> <p>As an example, in the year 1998, the ISO week 1 began on Monday December 29th, 1997; and the last ISO week (week 53) ended on Sunday January 3rd, 1999. So December 29th, 1997, is in the ISO week 1998-01, and January 1st, 1999, is in the ISO week 1998-53.</p> <p>byweekno is only valid for YEARLY.</p> <p>Examples of invalid specifications are "FREQ=YEARLY; BYWEEKNO=1; BYMONTH=12" and "FREQ=YEARLY; BYWEEKNO=53; BYMONTH=1".</p>
BYYEARDAY	This specifies the day of the year as a number. Valid values are 1 to 366. An example is 69, which is March 10 (31 for January, 28 for February, and 10 for March). 69 evaluates to March 10 for non-leap years and March 9 in leap years. -2 will always evaluate to December 30th independent of whether it is a leap year.
BYDATE	<p>This specifies a list of dates, where each date is of the form [YYYY]MMDD. A list of consecutive dates can be generated by using the SPAN modifier, and a date can be adjusted with the OFFSET modifier. An example of a simple BYDATE clause follows:</p> <pre>BYDATE=0115,0315,0615,0915,1215,20060115</pre> <p>The following SPAN example is equivalent to <pre>BYDATE=0110,0111,0112,0113,0114,</pre> which is a span of 5 days starting at 1/10: <pre>BYDATE=0110+SPAN:5D</pre> <p>The plus sign in front of the SPAN keyword indicates a span starting at the supplied date. The minus sign indicates a span ending at the supplied date, and the "^" sign indicates a span of <i>n</i> days or weeks centered around the supplied date. If <i>n</i> is an even number, it is adjusted up to the next odd number.</p> <p>Offsets adjust the supplied date by adding or subtracting <i>n</i> days or weeks. <pre>BYDATE=0205-OFFSET:2W</pre> is equivalent to <pre>BYDATE=0205-14D</pre> (the OFFSET: keyword is optional), which is also equivalent to <pre>BYDATE=0122</pre>.</p> </p>

Table 163-1 (Cont.) Values for repeat_interval

Name	Description
BYMONTHDAY	This specifies the day of the month as a number. Valid values are 1 to 31. An example is 10, which means the 10th day of the selected month. You can use the minus sign (-) to count backward from the last day, so, for example, BYMONTHDAY=-1 means the last day of the month and BYMONTHDAY=-2 means the next to last day of the month.
BYDAY	This specifies the day of the week from Monday to Sunday in the form MON, TUE, and so on. Using numbers, you can specify the 26th Friday of the year, if using a YEARLY frequency, or the 4th THU of the month, using a MONTHLY frequency. Using the minus sign, you can say the second to last Friday of the month. For example, -1 FRI is the last Friday of the month.
BYHOUR	This specifies the hour on which the job is to run. Valid values are 0 to 23. As an example, 10 means 10 a.m.
BYMINUTE	This specifies the minute on which the job is to run. Valid values are 0 to 59. As an example, 45 means 45 minutes past the chosen hour.
BYSECOND	This specifies the second on which the job is to run. Valid values are 0 to 59. As an example, 30 means 30 seconds past the chosen minute.
BYSETPOS	<p>This selects one or more items, by position, in the list of timestamps that result after the whole calendaring expression is evaluated. It is useful for requirements such as running a job on the last workday of the month. Rather than attempting to express this with the other BY clauses, you can code the calendaring expression to evaluate to a list of every workday of the month, and then add the BYSETPOS clause to select only the last item of that list. Assuming that workdays are Monday through Friday, the syntax would then be:</p> <pre>FREQ=MONTHLY; BYDAY=MON,TUE,WED,THU,FRI; BYSETPOS=-1</pre> <p>Valid values are 1 through 9999. A negative number selects an item from the end of the list (-1 is the last item, -2 is the next to last item, and so on) and a positive number selects from the front of the list. The BYSETPOS clause is always evaluated last. BYSETPOS is only supported with the MONTHLY and YEARLY frequencies.</p> <p>The BYSETPOS clause is applied to the list of timestamps once per frequency period. For example, when the frequency is defined as MONTHLY, the Scheduler determines all valid timestamps for the month, orders that list, and then applies the BYSETPOS clause. The Scheduler then moves on to the next month and repeats the procedure. Assuming a start date of Jun 10, 2004, the example evaluates to: Jun 30, Jul 30, Aug 31, Sep 30, Oct 29, and so on.</p>
INCLUDE	<p>This includes one or more named schedules in the calendaring expression. That is, the set of timestamps defined by each included named schedule is added to the results of the calendaring expression. If an identical timestamp is contributed by both an included schedule and the calendaring expression, it is included in the resulting set of timestamps only once. The named schedules must have been defined with the CREATE_SCHEDULE procedure.</p> <p>This clause only works on a full day and therefore cannot be used with BYHOUR, BYMIN, and BYSECOND.</p>

Table 163-1 (Cont.) Values for repeat_interval

Name	Description
EXCLUDE	<p>This excludes one or more named schedules from the calendaring expression. That is, the set of timestamps defined by each excluded named schedule is removed from the results of the calendaring expression. The named schedules must have been defined with the <code>CREATE_SCHEDULE</code> procedure.</p> <p>This clause only works on a full day and therefore cannot be used with <code>BYHOUR</code>, <code>BYMIN</code>, and <code>BYSECOND</code>.</p>
INTERSECT	<p>This specifies an intersection between the calendaring expression results and the set of timestamps defined by one or more named schedules. Only the timestamps that appear both in the calendaring expression and in one of the named schedules are included in the resulting set of timestamps.</p> <p>For example, assume that the named schedule <code>last_sat</code> indicates the last Saturday in every month, and that for the year 2005, the only months where the last day of the month is also a Saturday are April and December. Assume also that the named schedule <code>end_qtr</code> indicates the last day of each quarter in 2005:</p> <pre>3/31/2005, 6/30/2005, 9/30/2005, 12/31/2005</pre> <p>These calendaring expressions result in the dates that follow:</p> <pre>3/31/2005, 4/30/2005, 6/30/2005, 9/30/2005, 12/31/2005</pre> <pre>FREQ=MONTHLY; BYMONTHDAY=-1; INTERSECT=last_sat,end_qtr</pre> <p>In this example, the terms <code>FREQ=MONTHLY; BYMONTHDAY=-1</code> indicate the last day of each month.</p> <p>This clause only works on a full day and therefore cannot be used with <code>BYHOUR</code>, <code>BYMIN</code>, and <code>BYSECOND</code>.</p>
PERIODS	<p>This identifies the number of periods that together form one cycle of a user-defined frequency. It is used in the <code>repeat_interval</code> expression of the schedule that defines the user-defined frequency. It is mandatory when the <code>repeat_interval</code> expression in the main schedule contains a <code>BYPERIOD</code> clause. The following example defines the quarters of a fiscal year.</p> <pre>FREQ=YEARLY;BYDATE=0301,0601,0901,1201;PERIODS=4</pre>
BYPERIOD	<p>This selects periods from a user-defined frequency. For example, if a main schedule names a user-defined frequency schedule that defines the fiscal quarters shown in the previous example, the clause <code>BYPERIOD=2,4</code> in the main schedule selects the 2nd and 4th fiscal quarters.</p>

Combining Schedules

There are two ways to combine schedules:

- Using a combined schedule expression, which is a list of individual schedules
 For example, to create a schedule for all company holidays, you provide a list of individual schedules, where each schedule in the list defines a single holiday. The Scheduler evaluates each individual schedule, and then returns a union of the timestamps returned by each individual schedule.

- Embedding other schedules into the main schedule using `include`, `exclude`, and `intersect` clauses

With this method, the embedded schedules inherit certain attributes from the main schedule.

- Timestamps generated by the `INCLUDE` clause that fall into periods that are skipped by the main schedule are ignored. This is the case when the main schedule skips periods due to the `INTERVAL` clause, the `BYPERIOD` clause, or the `BYMONTH` clause for `freq=monthly`.
- Days that are added by the `INCLUDE` clause follow the hourly/minutes/seconds execution pattern of the main schedule.
- When the `INCLUDE` clause is present, no date-specific defaults are retrieved from the start date (but time-specific defaults can be). (See ["Start Dates and Repeat Intervals"](#), later in this section.) For example, a `repeat_interval` of `FREQ=MONTHLY;INCLUDE=HOLIDAY` executes only on holidays and not on the month/day defaults retrieved from the start date.

The following is an example:

```
BEGIN
dbms_scheduler.create_schedule('embed_sched', repeat_interval =>
  'FREQ=YEARLY;BYDATE=0130,0220,0725');
dbms_scheduler.create_schedule('main_sched', repeat_interval =>
  'FREQ=MONTHLY;INTERVAL=2;BYMONTHDAY=15;BYHOUR=9,17;INCLUDE=embed_sched');
END;
/
```

In this example, the dates 1/30, 2/20, and 7/25 are added to the main schedule. However, the Scheduler does not include dates that fall in months that are skipped by the `INTERVAL` clause. If the start date of the main schedule is 1/1/2005, then 2/20 is not added. On the dates that are added, the embedded schedule follows the execution pattern of the main schedule: jobs are executed at 9:00 a.m. and 5:00 p.m. on 1/30 and 7/25. If the embedded schedule does not itself have a start date, it inherits the start date from the main schedule.

User-Defined Frequencies

Instead of using predefined frequencies like `DAILY`, `WEEKLY`, `MONTHLY`, and so on, you can create your own frequencies by creating a schedule that returns the start date of each period. For example, the following `repeat_interval` expression is used in a schedule named `fiscal_year` that defines the start of each quarter in a fiscal year:

```
FREQ=YEARLY;BYDATE=0301,0601,0901,1201;PERIODS=4
```

To return the last Wednesday of every quarter, you create a schedule (the "main schedule") that uses the `fiscal_year` schedule as a user-defined frequency:

```
FREQ=fiscal_year;BYDAY=-1WED
```

Periods in a user-defined frequency do not have to be equal in length. In the main schedule, the `BYSETPOS` clause and numbered weekdays are recalculated based on the size of each period. To select dates in specific periods, you must use the `BYPERIOD` clause in the main schedule. To enable this, the schedule that is used as the user-defined frequency must include a `PERIODS` clause, and it must set its start date appropriately. The first date returned by this schedule is used as the starting point of period 1.

As another example, assuming work days are Monday through Friday, to get the last work day of the 2nd and 4th quarters of the fiscal year, the `repeat_interval` clause in the main schedule is the following:

```
FREQ=fiscal_year;BYDAY=MON,TUE,WED,THU,FRI;BYPERIOD=2,4;BYSETPOS=-1
```

Start Dates and Repeat Intervals

The Scheduler retrieves the date and time from the job or schedule start date and incorporates them as defaults into the `repeat_interval`. For example, if the specified frequency is yearly and there is no `BYMONTH` or `BYMONTHDAY` clause in the repeat interval, then the month and day that the job runs on are retrieved from the start date. Similarly, if frequency is monthly but there is no `BYMONTHDAY` clause in the repeat interval, then the day of the month that the job runs on is retrieved from the start date. If present, `BYHOUR`, `BYMINUTE`, and `BYSECOND` defaults are also retrieved from the start date, and used if those clauses are not specified. Note that if the `INCLUDE`, `EXCLUDE`, or `INTERSECT` clauses are present, no date-related defaults are retrieved from the start date, but time-related defaults are. The following are some examples:

```
start_date:      4/15/05 9:00:00
repeat_interval: freq=yearly
```

is expanded internally to:

```
freq=yearly;bymonth=4;bymonthday=15;byhour=9;byminute=0;bysecond=0
```

The preceding schedule executes on 04/15/05 9:00:00, 04/15/06 9:00:00, 04/15/07 9:00:00, and so on.

For the next example, assume that schedule S1 has a `repeat_interval` of `FREQ=YEARLY;BYDATE=0701`.

```
start_date:      01/20/05 9:00:00
repeat_interval: freq=yearly;include=S1
```

is expanded internally to:

```
freq=yearly;byhour=9;byminute=0;bysecond=0;include=S1
```

Because an `INCLUDE` clause is present, date-related information is not retrieved from the start date. However, time-specific information is, so the preceding schedule executes on 07/01/05 9:00:00, 07/01/06 9:00:00, 07/01/08 9:00:00, and so on.

General Rules

When using a calendaring expression, consider the following rules:

- For a regular schedule (as opposed to a combined schedule), the calendar string must start with the frequency clause. All other clauses are optional and can be put in any order.
- All clauses are separated by a semicolon, and each clause can be present at most once, with the exception of the `include`, `exclude`, and `intersect` clauses.
- Spaces are allowed between syntax elements and the strings are case-insensitive.
- The list of values for a specific `BY` clause do not need to be ordered.

- When not enough `BY` clauses are present to determine what the next date is, this information is retrieved from the start date. For example, "`FREQ=YEARLY`" with a start date of `02/15/2003` becomes "`FREQ=YEARLY;BYMONTH=FEB;BYMONTHDAY=15`", which means every year on the 15th of February.

"`FREQ=YEARLY;BYMONTH=JAN,JUL`" with start date `01/21/2003` becomes "`FREQ=YEARLY;BYMONTH=JAN,JUL;BYMONTHDAY=21`", which means every year on January 21 and July 21.

- The `byweekno` clause is only allowed if the frequency is `YEARLY`. It cannot be used with other frequencies. When it is present, it will return all days in that week number. If you want to limit it to specific days within the week, you have to add a `BYDAY` clause. For example, "`FREQ=YEARLY;BYWEEKNO=2`" with a start date of `01/01/2003` will return:

```
01/06/2003, 01/07/2003, 01/08/2003, 01/09/2003, 01/10/2003, 01/11/2003,
01/12/2003, 01/05/2004, 01/06/2004, 01/07/2004, .... and so on.
```

Note that when the `byweekno` clause is used, it is possible that the dates returned are from a year other than the current year. For example, if returning dates for the year 2004 and the calendar string is "`FREQ=YEARLY;BYWEEKNO=1,53`" for the specified week numbers in 2004, it will return the dates:

```
12/29/03, 12/30/03, 12/31/03, 01/01/04, 01/02/04, 01/03/04, 01/04/04, 12/27/04,
12/28/04, 12/29/04, 12/30/04, 12/31/04, 01/01/05, 01/02/05
```

- For those `BY` clauses that do not have a consistent range of values, you can count backward by putting a "-" in front of the numeric value. For example, specifying `BYMONTHDAY=31` will not give you the last day of every month, because not every month has 31 days. Instead, `BYMONTHDAY=-1` will give you the last day of the month.

This is not supported for `BY` clauses that are fixed in size. In other words, `BYMONTH`, `BYHOUR`, `BYMINUTE`, and `BYSECOND` are not supported.

- The basic values for the `BYDAY` clause are the days of the week. When the frequency is `YEARLY`, or `MONTHLY`, you are allowed to specify a positive or negative number in front of each day of the week. In the case of `YEARLY`, `BYDAY=40MON`, indicates the 40th Monday of the year. In the case of `MONTHLY`, `BYDAY=-2SAT`, indicates the second to last Saturday of the month.

Note that positive or negative numbers in front of the weekdays are not supported for other frequencies and that in the case of yearly, the number ranges from -53 ... -1, 1 ... 53, whereas for the monthly frequency it is limited to -5 ... -1, 1... 5.

If no number is present in front of the weekday it specifies, every occurrence of that weekday in the specified frequency.

- The first day of the week is Monday.
- Repeating jobs with frequencies smaller than daily follow their frequencies exactly across daylight savings adjustments. For example, suppose that a job is scheduled to repeat every 3 hours, the clock is moved forward from 1:00 a.m. to 2:00 a.m., and the last time the job ran was midnight. Its next scheduled time will be 4:00 a.m. Thus, the 3 hour period between subsequent job runs is retained. The same applies when the clock is moved back. This behavior is not the case for repeating jobs that have frequencies of daily or larger. For example, if a repeating job is supposed to be executed on a daily basis at midnight, it will continue to run at midnight if the clock is moved forward or backward. When the execution time of such a daily (or larger frequency) job happens to fall inside a window where the clock is moved forward, the job executes at the end of the window.

- The calendaring syntax does not allow you to specify a time zone. Instead the Scheduler retrieves the time zone from the `start_date` argument. If jobs must follow daylight savings adjustments, then you must specify a region name for the time zone of the `start_date`. For example specifying the `start_date` time zone as 'US/Eastern' in New York ensures that daylight saving adjustments are automatically applied. If instead, the time zone of the `start_date` is set to an absolute offset, such as '-5:00', then daylight savings adjustments are not followed and your job execution is off by an hour for half the year.
- When `start_date` is NULL, the Scheduler determines the time zone for the repeat interval as follows:
 1. It checks whether or not the session time zone is a region name. The session time zone can be set by either:
 - Issuing an ALTER SESSION statement, for example:


```
SQL> ALTER SESSION SET time_zone = 'Asia/Shanghai';
```
 - Setting the ORA_SDTZ environment variable.
 2. If the session time zone is an absolute offset instead of a region name, the Scheduler uses the value of the DEFAULT_TIMEZONE Scheduler attribute. For more information, see the [SET_SCHEDULER_ATTRIBUTE Procedure](#).
 3. If the DEFAULT_TIMEZONE attribute is NULL, the Scheduler uses the time zone of `systimestamp` when the job or window is enabled.

BYSETPOS Clause Rules

The following are rules for the BYSETPOS clause.

- The BYSETPOS clause is the last clause to be evaluated. It is processed after all other BY clauses and the INCLUDE, EXCLUDE and INTERSECT clauses have been evaluated.
- The INTERVAL clause does not change the size of the period to which the BYSETPOS clause is applied. For example, when the frequency is set to monthly and interval is set to 3, the list of timestamps to which BYSETPOS is applied is generated from a month, not a quarter. The only impact of the INTERVAL clause is to cause months to be skipped. However, you can still select the second to last workday of the quarter like this:

```
FREQ=MONTHLY;INTERVAL=3;BYDAY=MON,TUE,WED,THU,FRI;BYSETPOS=-2
```

provided that you set the start date in the right month. This example returns the next to last workday of a month, and repeats once a quarter.

- To get consistent results, the set to which BYSETPOS is applied is determined from the beginning of the frequency period independently of when the evaluation occurs. Whether the Scheduler evaluates

```
FREQ=MONTHLY;BYDAY=MON,TUE,FRI;BYSETPOS=1,3
```

on 01/01/2004 or 01/15/2004, in both cases the expression evaluates to Friday 01/02/2004, and Tuesday 01/06/2004. The only difference is that when the expression is evaluated on 01/15/2004, the Scheduler determines that there are no matches in January because the timestamps found are in the past, and it moves on to the matches in the next month, February.

BYDATE Clause Rules

The following are rules for the `BYDATE` clause.

- If dates in the `BYDATE` clause do not have their optional year component, the job runs on those dates every year.
- The job execution times on the included dates are derived from the `BY` clauses in the calendaring expression. For example, if `repeat_interval` is defined as

```
freq=daily;byhour=8,13,18;byminute=0;bysecond=0;bydate=0502,0922
```

then the execution times on 05/02 and 09/22 are 8:00 a.m., 1:00 p.m., and 6:00 p.m.

EXCLUDE Clause Rules

Excluded dates without a time component are 24 hour periods. All timestamps that fall on an excluded date are removed. In the following example, `jan_fifteen` is a named schedule that resolves to the single date of 01/15:

```
freq=monthly;bymonthday=15,30;byhour=8,13,18;byminute=0;bysecond=0;
  exclude=jan_fifteenth
```

In this case, all three instances of the job are removed for 01/15.

OFFSET Rules

You can adjust the dates of individual named schedules by adding positive offsets to them. For example, to execute `JOB2` exactly 15 days after every occurrence of `JOB1`, add `+OFFSET:15D` to the schedule of `JOB1`, as follows:

```
BEGIN
dbms_scheduler.create_schedule('job2_schedule', repeat_interval =>
  'job1_schedule+OFFSET:15D');
END;
/
```

Note that negative offsets to named schedules are not supported.

Example 163-1 Putting It All Together

This example demonstrates the use of user-defined frequencies, spans, offsets, and the `BYSETPOS` and `INCLUDE` clauses. (Note that the `OFFSET:` keyword is optional in an offset clause.)

Many companies in the retail industry share the same fiscal year. The fiscal year starts on the Sunday closest to February 1st, and subsequent quarters start exactly 13 weeks later. The fiscal year schedule for the retail industry can be defined as the following:

```
begin
  dbms_scheduler.create_schedule('year_start', repeat_interval=>
    'FREQ=YEARLY;BYDATE=0201^SPAN:1W;BYDAY=SUN');
  dbms_scheduler.create_schedule('retail_fiscal_year',
    to_timestamp_tz('15-JAN-2005 12:00:00','DD-MON-YYYY HH24:MI:SS'),
    'year_start,year_start+13w,year_start+26w,year_start+39w;periods=4');
end;
/
```

The following schedule can be used to execute a job on the 5th day off in the 2nd and the 4th quarters of the retail industry. This assumes that Saturday and Sunday are off days as well as the days in the existing `holiday` schedule.

```
begin
  dbms_scheduler.create_schedule('fifth_day_off', repeat_interval=>
```

```
'FREQ=retail_fiscal_year;BYDAY=SAT,SUN;INCLUDE=holiday;
  BYPERIOD=2,4;BYSETPOS=5');
end;
/
```

163.5 DBMS_SCHEDULER Data Structures

The `DBMS_SCHEDULER` package defines `OBJECT` types and `TABLE` types.

OBJECT Types

- `JOBARG` Object Type
- `JOB_DEFINITION` Object Type
- `JOBATTR` Object Type
- `SCHEDULER$_STEP_TYPE` Object Type
- `SCHEDULER$_EVENT_INFO` Object Type
- `SCHEDULER_FILEWATCHER_RESULT` Object Type
- `SCHEDULER_FILEWATCHER_REQUEST` Object Type

TABLE Types

- `JOBARG_ARRAY` Table Type
- `JOB_DEFINITION_ARRAY` Table Type
- `JOBATTR_ARRAY` Table Type
- `SCHEDULER$_STEP_TYPE_LIST` Table Type

163.5.1 DBMS_SCHEDULER JOBARG Object Type

This type is used by the `JOB` and `JOBATTR` object types. It represents a job argument in a batch of job arguments.

Syntax

```
TYPE jobarg IS OBJECT (
  arg_position          NUMBER,
  arg_text_value       VARCHAR2(4000),
  arg_anydata_value    ANYDATA,
  arg_operation        VARCHAR2(5));
```

Attributes

Table 163-2 JOBARG Object Type Attributes

Attribute	Description
<code>arg_position</code>	Position of the argument
<code>arg_text_value</code>	Value of the argument if the type is <code>VARCHAR2</code>
<code>arg_anydata_value</code>	Value of the argument if the type is <code>AnyData</code>

Table 163-2 (Cont.) JOBARG Object Type Attributes

Attribute	Description
arg_operation	Type of the operation: <ul style="list-style-type: none"> • SET • RESET

JOBARG Constructor Function

This constructor function constructs a job argument. It is overloaded to construct job arguments with different types of values.

Syntax

Constructs a job argument with a text value.

```
constructor function jobarg (
  arg_position      IN POSITIVEN,
  arg_value         IN VARCHAR2)
RETURN SELF AS RESULT;
```

Constructs a job argument with an AnyData value.

```
constructor function jobarg (
  arg_position      IN POSITIVEN,
  arg_value         IN ANYDATA)
RETURN SELF AS RESULT;
```

Constructs a job argument with a NULL value.

```
constructor function jobarg (
  arg_position      IN POSITIVEN,
  arg_reset         IN BOOLEAN DEFAULT FALSE)
RETURN SELF AS RESULT;
```

Parameters**Table 163-3 JOBARG Constructor Function Parameters**

Parameter	Description
arg_position	Position of the argument
arg_value	Value of the argument
arg_reset	If arg_reset is TRUE, then the argument at that position is reset. Setting arg_reset to FALSE (which is the default) will create an argument with a NULL value.

JOBARG_ARRAY Table Type**Syntax**

```
TYPE jobarg_array IS TABLE OF jobarg;
```

163.5.2 JOBARG_ARRAY Table Type

The `jobarg_array` type is a table of `jobarg`.

Syntax

```
TYPE jobarg_array IS TABLE OF jobarg;
```

163.5.3 DBMS_SCHEDULER JOB_DEFINITION Object Type

This type is used by the `CREATE_JOBS` procedure and represents a job in a batch of jobs.

Syntax

```
TYPE job_definition IS OBJECT (
  job_name                VARCHAR2(100),
  job_class                VARCHAR2(32),
  job_style                VARCHAR2(11),
  program_name            VARCHAR2(100),
  job_action               VARCHAR2(4000),
  job_type                 VARCHAR2(20),
  schedule_name           VARCHAR2(65),
  repeat_interval          VARCHAR2(4000),
  schedule_limit           INTERVAL DAY TO SECOND,
  start_date               TIMESTAMP WITH TIME ZONE,
  end_date                 TIMESTAMP WITH TIME ZONE,
  event_condition          VARCHAR2(4000),
  queue_spec               VARCHAR2(100),
  number_of_arguments     NUMBER,
  arguments                SYS.JOBARG_ARRAY,
  job_priority             NUMBER,
  job_weight               NUMBER,
  max_run_duration         INTERVAL DAY TO SECOND,
  max_runs                 NUMBER,
  max_failures             NUMBER,
  logging_level            NUMBER,
  restartable              VARCHAR2(5),
  stop_on_window_close    VARCHAR2(5),
  raise_events             NUMBER,
  comments                 VARCHAR2(240),
  auto_drop                VARCHAR2(5),
  enabled                  VARCHAR2(5),
  follow_default_timezone VARCHAR2(5),
  parallel_instances       VARCHAR2(5),
  aq_job                   VARCHAR2(5),
  instance_id              NUMBER,
  credential_name          VARCHAR2(65),
  destination              VARCHAR2(4000),
  database_role            VARCHAR2(20),
  allow_runs_in_restricted_mode VARCHAR2(5);
  restart_on_recovery      BOOLEAN;
  restart_on_failure       BOOLEAN;)
```

Object Attributes

Table 163-4 provides brief descriptions of the attributes of the `JOB_DEFINITION` object type. For more complete information about these attributes, see the "[CREATE_JOB Procedure](#)" and the "[SET_ATTRIBUTE Procedure](#)".

Table 163-4 JOB_DEFINITION Object Types

Attribute	Description
<code>job_name</code>	Name of the job
<code>job_class</code>	Name of the job class
<code>job_style</code>	Style of the job: <ul style="list-style-type: none"> REGULAR LIGHTWEIGHT IN_MEMORY_RUNTIME IN_MEMORY_FULL
<code>program_name</code>	Name of the program that the job runs
<code>job_action</code>	Inline action of the job. This is either the code for an anonymous PL/SQL block or the name of a stored procedure, external executable, or chain.
<code>job_type</code>	Job action type ('PLSQL_BLOCK', 'STORED_PROCEDURE', 'EXECUTABLE', 'CHAIN', 'EXTERNAL_SCRIPT', 'SQL_SCRIPT', and 'BACKUP_SCRIPT')
<code>schedule_name</code>	Name of the schedule that specifies when the job has to execute
<code>repeat_interval</code>	Inline time-based schedule
<code>schedule_limit</code>	Maximum delay time between scheduled and actual job start before a job run is canceled
<code>start_date</code>	Start date and time of the job
<code>end_date</code>	End date and time of the job
<code>event_condition</code>	Event condition for event-based jobs
<code>queue_spec</code>	File watcher name or queue specification for event-based jobs
<code>number_of_arguments</code>	Number of job arguments
<code>arguments</code>	Array of job arguments
<code>job_priority</code>	Job priority
<code>job_weight</code>	*** Deprecated in Oracle Database 11gR2. Do not change the value of this attribute from the default, which is 1. Weight of the job for parallel execution.
<code>max_run_duration</code>	Maximum run duration of the job
<code>max_runs</code>	Maximum number of runs before the job is marked as completed
<code>max_failures</code>	Maximum number of failures tolerated before the job is marked as broken
<code>logging_level</code>	Job logging level
<code>restartable</code>	Indicates whether the job is restartable (TRUE) or not (FALSE)

Table 163-4 (Cont.) JOB_DEFINITION Object Types

Attribute	Description
stop_on_window_close	Indicates whether the job is stopped when the window that it runs in ends (TRUE) or not (FALSE). Equivalent to the stop_on_window_close job attribute described in the SET_ATTRIBUTE Procedure .
raise_events	State changes that raise events
comments	Comments on the job
auto_drop	If TRUE (the default), indicates that the job should be dropped once completed
enabled	Indicates whether the job should be enabled immediately after creating it (TRUE) or not (FALSE)
follow_default_timezone	If TRUE and if the job start_date is null, then when the default_timezone scheduler attribute is changed, the Scheduler recomputes the next run date and time for this job so that it is in accordance with the new time zone.
parallel_instances	For event-based jobs only. If TRUE, on the arrival of the specified event, the Scheduler creates a new lightweight job to handle that event, so multiple instances of the same event-based job can run in parallel. If FALSE, then an event is discarded if it is raised while the job that handles it is already running,
aq_job	For internal use only
instance_id	The instance ID of the instance that the job must run on For in-memory full jobs, the instance_id value determines in which instance to stop the job; if left NULL, the job is stopped in all instances.
credential_name	The credential to use for a single destination or the default credential for a group of destinations
destination	The name of a single external destination or database destination, or a group name of type external destination or database destination
database_role	In an Oracle Data Guard environment, the database role ('PRIMARY' or 'LOGICAL STANDBY') for which the job runs
allow_runs_in_restricted_mode	If TRUE, the job is permitted to run when the database is in restricted mode, provided that the job owner is permitted to log in during this mode
restart_on_recovery	If set to TRUE for a job and the job is stopped by a database shutdown, then the job is restarted when the database is recovered. If set to FALSE, and the job is stopped by a database shutdown, then the job is marked as stopped when the database is recovered.
restart_on_failure	If set to TRUE for a job and the job fails due to an application error, then the job is retried using the normal Scheduler retry mechanism (after 1 second, after 10 seconds, after 100 seconds, and so on, up to a maximum of 6 times). If all 6 retries fail (after about 30 hours), then the job is marked FAILED. If set to FALSE (the default), a failed job is immediately marked FAILED.

JOB_DEFINITION Constructor Function

This constructor function constructs a `job_definition` object.

Syntax

```

constructor function job_definition (
    job_name          IN      VARCHAR2,
    job_style         IN      VARCHAR2 DEFAULT 'REGULAR',
    program_name     IN      VARCHAR2 DEFAULT NULL,
    job_action        IN      VARCHAR2 DEFAULT NULL,
    job_type          IN      VARCHAR2 DEFAULT NULL,
    schedule_name    IN      VARCHAR2 DEFAULT NULL,
    repeat_interval  IN      VARCHAR2 DEFAULT NULL,
    event_condition  IN      VARCHAR2 DEFAULT NULL,
    queue_spec       IN      VARCHAR2 DEFAULT NULL,
    start_date       IN      TIMESTAMP WITH TIME ZONE DEFAULT NULL,
    end_date         IN      TIMESTAMP WITH TIME ZONE DEFAULT NULL,
    number_of_arguments IN  NATURAL DEFAULT NULL,
    arguments        IN      SYS.JOBARG_ARRAY DEFAULT NULL,
    job_class        IN      VARCHAR2 DEFAULT 'DEFAULT_JOB_CLASS',
    schedule_limit   IN      INTERVAL DAY TO SECOND DEFAULT NULL,
    job_priority     IN      NATURAL DEFAULT NULL,
    job_weight       IN      NATURAL DEFAULT NULL,
    max_run_duration IN      INTERVAL DAY TO SECOND DEFAULT NULL,
    max_runs         IN      NATURAL DEFAULT NULL,
    max_failures     IN      NATURAL DEFAULT NULL,
    logging_level    IN      NATURALN DEFAULT 64,
    restartable      IN      BOOLEAN DEFAULT FALSE,
    stop_on_window_close IN  BOOLEAN DEFAULT FALSE,
    raise_events     IN      NATURAL DEFAULT NULL,
    comments         IN      VARCHAR2 DEFAULT NULL,
    auto_drop        IN      BOOLEAN DEFAULT TRUE,
    enabled          IN      BOOLEAN DEFAULT FALSE,
    follow_default_timezone IN  BOOLEAN DEFAULT FALSE,
    parallel_instances IN  BOOLEAN DEFAULT FALSE,
    aq_job           IN      BOOLEAN DEFAULT FALSE,
    instance_id      IN      NATURAL DEFAULT NULL,
    credential_name  IN      VARCHAR2 DEFAULT NULL,
    destination      IN      VARCHAR2 DEFAULT NULL,
    database_role    IN      VARCHAR2 DEFAULT NULL,
    allow_runs_in_restricted_mode IN  BOOLEAN DEFAULT FALSE)
RETURN SELF AS RESULT;

```

JOB_DEFINITION_ARRAY Table Type

Syntax

```
TYPE job_definition_array IS TABLE OF job_definition;
```

163.5.4 JOB_DEFINITION_ARRAY Table Type

The type `job_definition_array` is a table of `job_definition`.

Syntax

```
TYPE job_definition_array IS TABLE OF job_definition;
```

163.5.5 JOBATTR Object Type

This type is used by the `SET_JOB_ATTRIBUTES` procedure and represents a job attribute in a batch of job attributes.

Syntax

```
TYPE jobattr IS OBJECT (
  job_name          VARCHAR2(100),
  attr_name         VARCHAR2(30),
  char_value        VARCHAR2(4000),
  char_value2       VARCHAR2(4000),
  args_value        JOBARG_ARRAY,
  num_value         NUMBER,
  timestamp_value   TIMESTAMP(6) WITH TIME ZONE,
  interval_value    INTERVAL DAY(2) TO SECOND(6));
```

Attributes

Table 163-5 JOBATTR Object Type Attributes

Attribute	Description
<code>job_name</code>	Name of the job
<code>attr_name</code>	Name of the attribute
<code>char_value</code>	Value of the argument if the type is <code>VARCHAR2</code>
<code>char_value2</code>	Second <code>VARCHAR2</code> attribute value
<code>args_value</code>	Value of the argument if the type is a <code>JOBARG</code> array
<code>num_value</code>	Value of the argument if the type is <code>NUMBER</code>
<code>timestamp_value</code>	Value of the argument if the type is <code>TIMESTAMP WITH TIME ZONE</code>
<code>interval_value</code>	Value of the argument if the type is <code>INTERVAL DAY TO SECOND</code>

JOBATTR Constructor Function

This constructor function constructs a job attribute. It is overloaded to create attribute values of the following types: `VARCHAR2`, `NUMBER`, `TIMESTAMP WITH TIME ZONE`, `INTERVAL DAY TO SECOND`, and an array of `JOBARG` types.

Syntax

```
constructor function jobattr (
  job_name          IN VARCHAR2,
  attr_name         IN VARCHAR2,
  attr_value        IN VARCHAR2,
  attr_value2       IN VARCHAR2 DEFAULT NULL)
  RETURN SELF AS RESULT;

constructor function jobattr (
  job_name          IN VARCHAR2,
  attr_name         IN VARCHAR2,
  attr_value        IN [NUMBER, BOOLEAN,
                       TIMESTAMP WITH TIME ZONE,
```



```

                                INTERVAL DAY TO SECOND, JOBARG_ARRAY))
RETURN SELF AS RESULT;

constructor function jobattr (
    job_name          IN VARCHAR2,
    attr_name         IN VARCHAR2)
RETURN SELF AS RESULT;

```

Parameters

Table 163-6 JOBATTR Constructor Function Parameters

Parameter	Description
job_name	Name of the job
attr_name	Name of the argument
attr_value	Value of the argument
attr_value2	Most attributes have only one value associated with them, but some can have two. The attr_value2 argument is for this optional second value.

JOBATTR Table Type

Syntax

```
TYPE jobattr_array IS TABLE OF jobattr;
```

163.5.6 JOBATTR_ARRAY Table Type

The type jobattr_array is a table of jobattr.

Syntax

```
TYPE jobattr_array IS TABLE OF jobattr;
```

163.5.7 SCHEDULER\$_STEP_TYPE Object Type

This type is used by RUN_CHAIN to return a list of chain steps with an initial state.

Syntax

```
TYPE scheduler$_step_type IS OBJECT (
    step_name  VARCHAR2(32),
    step_type  VARCHAR2(32));
```

Attributes

Table 163-7 SCHEDULER\$_STEP_TYPE Object Type Attributes

Attribute	Description
step_name	Name of the step
step_type	State of the step

163.5.8 SCHEDULER\$_STEP_TYPE_LIST Table Type

This type is a table of scheduler\$_step_type.

Syntax

```
TYPE scheduler$_step_type_list IS TABLE OF scheduler$_step_type;
```

163.5.9 SCHEDULER\$_EVENT_INFO Object Type

This is the datatype of the Scheduler event queue SYS.SCHEDULER\$_EVENT_QUEUE, from which your application consumes job state events raised by the Scheduler.

It is a secure queue owned by SYS.

Syntax

```
TYPE SCHEDULER$_EVENT_INFO IS OBJECT (
  event_type          VARCHAR2(4000),
  object_owner       VARCHAR2(4000),
  object_name        VARCHAR2(4000),
  event_timestamp    TIMESTAMP WITH TIME ZONE,
  error_code         NUMBER,
  error_msg          VARCHAR2(4000),
  event_status       NUMBER,
  log_id            NUMBER,
  run_count          NUMBER,
  failure_count     NUMBER,
  retry_count       NUMBER,
  spare1            NUMBER,
  spare2            NUMBER,
  spare3            VARCHAR2(4000),
  spare4            VARCHAR2(4000),
  spare5            TIMESTAMP WITH TIME ZONE,
  spare6            TIMESTAMP WITH TIME ZONE,
  spare7            RAW(2000),
  spare8            RAW(2000));
```

Attributes

Table 163-8 SCHEDULER_EVENT_INFO Object Type Attributes

Attribute	Description
event_type	One of "JOB_STARTED", "JOB_SUCCEEDED", "JOB_FAILED", "JOB_BROKEN", "JOB_COMPLETED", "JOB_STOPPED", "JOB_SCH_LIM_REACHED", "JOB_DISABLED", "JOB_CHAIN_STALLED", "JOB_OVER_MAX_DUR". For descriptions of these event types, see Table 163-85 .
object_owner	Owner of the job that raised the event
object_name	Name of the job that raised the event
event_timestamp	Time at which the event occurred
error_code	Applicable only when an error is thrown during job execution. Contains the top-level error code.

Table 163-8 (Cont.) SCHEDULER_EVENT_INFO Object Type Attributes

Attribute	Description
error_msg	Applicable only when an error is thrown during job execution. Contains the entire error stack.
event_status	Adds further qualification to the event type. If event_type is "JOB_STARTED," status 1 indicates that it is a normal start, and status 2 indicates that it is a retry. If event_type is "JOB_FAILED," status 4 indicates that it was a failure due to an error that was thrown during job execution, and status 8 indicates that it was an unusual termination of some kind. If event_type is "JOB_STOPPED," status 16 indicates that it was a normal stop, and status 32 indicates that it was a stop with the FORCE option set to TRUE.
log_id	Points to the ID in the scheduler job log from which additional information can be obtained. Note that there need not always be a log entry corresponding to an event. In such cases, log_id is NULL.
run_count	Run count for the job when the event was raised.
failure_count	Failure count for the job when the event was raised.
retry_count	Retry count for the job when the event was raised.
spare1 – spare8	Not currently in use.

163.5.10 SCHEDULER_FILEWATCHER_RESULT Object Type

This is the datatype of a file arrival event message.

You access the event message as a parameter of an event-based job (or a parameter of a program referenced by an event-based job). The message contains information needed to locate and process a file that arrived on a local or remote system.

Syntax

```
TYPE scheduler_filewatcher_result IS OBJECT (
  destination          VARCHAR2(4000),
  directory_path       VARCHAR2(4000),
  actual_file_name     VARCHAR2(4000),
  file_size            NUMBER,
  file_timestamp       TIMESTAMP WITH TIME ZONE,
  ts_ms_from_epoch     NUMBER,
  matching_requests    SYS.SCHEDULER_FILEWATCHER_REQ_LIST);
```

Attributes

Table 163-9 SCHEDULER_FILEWATCHER_RESULT Object Type Attributes

Attribute	Description
destination	Destination at which the file was found, expressed as a host name or IP address.
directory_path	Absolute path of directory in which the file was found.

Table 163-9 (Cont.) SCHEDULER_FILEWATCHER_RESULT Object Type Attributes

Attribute	Description
actual_file_name	Actual name of the file that was found. If the file name specified in the file watcher did not contain wildcards, then this is the same as the name specified in the file watcher.
file_size	Size of the file that was found, in bytes.
file_timestamp	Timestamp assigned to the file when the file watcher considered the file found, based on the minimum file size and steady state duration attributes.
ts_ms_from_epoch	For internal use only.
matching_requests	List of matching requests. This is a TABLE of type objects SCHEDULER_FILEWATCHER_REQUEST. Each matching request corresponds to a file watcher whose destination, directory_path, and file_name attributes matched the arrived file. See " SCHEDULER_FILEWATCHER_REQUEST Object Type ".

163.5.11 SCHEDULER_FILEWATCHER_REQUEST Object Type

This type is returned in the `matching_requests` attribute of the SCHEDULER_FILEWATCHER_RESULT Object Type. Its attributes are similar to the attributes of a file watcher.

Syntax

```
TYPE scheduler_filewatcher_request IS OBJECT (
  owner          VARCHAR2(4000),
  name           VARCHAR2(4000),
  requested_path_name VARCHAR2(4000),
  requested_file_name VARCHAR2(4000),
  credential_owner VARCHAR2(4000),
  credential_name VARCHAR2(4000),
  min_file_size  NUMBER,
  steady_state_dur NUMBER);
```

Attributes

Table 163-10 SCHEDULER_FILEWATCHER_REQUEST Object Type Attributes

Attribute	Description
owner	Owner of the matched file watcher.
name	Name of the matched file watcher.
requested_path_name	Value of the <code>directory_path</code> attribute of the matched file watcher.
requested_file_name	Value of the <code>file_name</code> attribute of the matched file watcher.
credential_owner	Owner of the credential referenced by the matched file watcher.
credential_name	Name of the credential referenced by the matched file watcher.
min_file_size	Value of the <code>min_file_size</code> attribute of the matched file watcher.

Table 163-10 (Cont.) SCHEDULER_FILEWATCHER_REQUEST Object Type Attributes

Attribute	Description
steady_state_dur	Value of the steady_state_duration attribute of the matched file watcher.

Related Topics

- [SCHEDULER_FILEWATCHER_RESULT Object Type](#)
This is the datatype of a file arrival event message.

163.6 Summary of DBMS_SCHEDULER Subprograms

This table lists the DBMS_SCHEDULER subprograms and briefly describes them.

Table 163-11 DBMS_SCHEDULER Package Subprograms

Subprogram	Description
ADD_EVENT_QUEUE_SUBSCRIBER Procedure	Adds a user as a subscriber to the Scheduler event queue SYS.SCHEDULER\$_EVENT_QUEUE
ADD_GROUP_MEMBER Procedure	Adds one or more members to an existing group
ADD_JOB_EMAIL_NOTIFICATION Procedure	Adds e-mail notifications for a job for a list of recipients and a list of job state events
ADD_TO_INCOMPATIBILITY Procedure	Adds jobs or programs to an existing incompatibility definition
ALTER_CHAIN Procedure	Alters specified steps of a chain
ALTER_RUNNING_CHAIN Procedure	Alters specified steps of a running chain
CLOSE_WINDOW Procedure	Closes an open window prematurely
COPY_JOB Procedure	Copies an existing job
CREATE_CHAIN Procedure	Creates a chain, which is a named series of programs that are linked together for a combined objective
CREATE_CREDENTIAL Procedure	Creates a credential
CREATE_DATABASE_DESTINATION Procedure	Creates a database destination for use with remote database jobs
CREATE_EVENT_SCHEDULE Procedure	Creates an event schedule, which is a schedule that starts a job based on the detection of an event
CREATE_FILE_WATCHER Procedure	Creates a file watcher, which is a Scheduler object that defines the location, name, and other properties of a file whose arrival on a system causes the Scheduler to start a job
CREATE_GROUP Procedure	Creates a group

Table 163-11 (Cont.) DBMS_SCHEDULER Package Subprograms

Subprogram	Description
CREATE_INCOMPATIBILITY Procedure	Creates an incompatibility definition
CREATE_JOB Procedure	Creates a single job
CREATE_JOB_CLASS Procedure	Creates a job class, which provides a way to group jobs for resource allocation and prioritization
CREATE_JOBS Procedure	Creates multiple jobs
CREATE_PROGRAM Procedure	Creates a program
CREATE_RESOURCE Procedure	Specifies resources used by jobs or creates a new resource
CREATE_SCHEDULE Procedure	Creates a schedule
CREATE_WINDOW Procedure	Creates a window, which provides a way to automatically activate different resource plans at different times
DEFINE_ANYDATA_ARGUMENT Procedure	Defines a program argument whose value is of a complex type and must be passed encapsulated in an AnyData object
DEFINE_CHAIN_EVENT_STEP Procedure	Adds or replaces a chain step and associates it with an event schedule or inline event. See also: DEFINE_CHAIN_STEP .
DEFINE_CHAIN_RULE Procedure	Adds a rule to an existing chain
DEFINE_CHAIN_STEP Procedure	Defines a chain step, which can be a program or another (nested) chain. See also: DEFINE_CHAIN_EVENT_STEP .
DEFINE_METADATA_ARGUMENT Procedure	Defines a special metadata argument for the program. You can retrieve specific metadata through this argument.
DEFINE_PROGRAM_ARGUMENT Procedure	Defines a program argument whose value can be passed as a string literal to the program
DISABLE Procedure	Disables a program, job, chain, window, database destination, external destination, file watcher, group, or incompatibility
DROP_AGENT_DESTINATION Procedure	Drops one or more external destinations. Use only when the preferred method of dropping external destinations—unregistering the Scheduler agent with the database—fails.
DROP_CHAIN Procedure	Drops an existing chain
DROP_CHAIN_RULE Procedure	Removes a rule from an existing chain
DROP_CHAIN_STEP Procedure	Drops a chain step

Table 163-11 (Cont.) DBMS_SCHEDULER Package Subprograms

Subprogram	Description
DROP_CREDENTIAL Procedure	Drops a credential
DROP_DATABASE_DESTINATION Procedure	Drops one or more database destinations
DROP_FILE_WATCHER Procedure	Drops one or more file watchers
DROP_GROUP Procedure	Drops one or more groups
DROP_INCOMPATIBILITY Procedure	Drops an existing incompatibility definition
DROP_JOB Procedure	Drops a job or all jobs in a job class
DROP_JOB_CLASS Procedure	Drops a job class
DROP_PROGRAM Procedure	Drops a program
DROP_PROGRAM_ARGUMENT Procedure	Drops a program argument
DROP_SCHEDULE Procedure	Drops a schedule
DROP_WINDOW Procedure	Drops a window
DUMP_IN_MEMORY_TRACE Procedure	Dumps the scheduler in-memory trace buffer of the specified process state object address into the current trace file of the requester process.
ENABLE Procedure	Enables a program, job, chain, window, database destination, external destination, file watcher, or group
END_DETACHED_JOB_RUN Procedure	Ends a running detached job
EVALUATE_CALENDAR_STRING Procedure	Evaluates the calendar string and tells you what the next execution date of a job or window will be
EVALUATE_RUNNING_CHAIN Procedure	Forces reevaluation of the rules of a running chain to trigger any rules for conditions that have been satisfied
GENERATE_JOB_NAME Function	Generates a unique name for a job. This enables you to identify jobs by adding a prefix, so, for example, Sally's jobs would be named <code>sally1</code> , <code>sally2</code> , and so on
GET_AGENT_INFO Function	Returns job information specific to an agent, such as how many are running and so on, depending on the attribute selected
GET_AGENT_VERSION Function	Returns the version string of a Scheduler agent that is registered with the database and is currently running
GET_ATTRIBUTE Procedure	Retrieves the value of an attribute of an object
GET_FILE Procedure	Retrieves a file from a host
GET_SCHEDULER_ATTRIBUTE Procedure	Retrieves the value of a Scheduler attribute

Table 163-11 (Cont.) DBMS_SCHEDULER Package Subprograms

Subprogram	Description
OPEN_WINDOW Procedure	Opens a window prematurely. The window is opened immediately for the duration
PURGE_LOG Procedure	Purges specific rows from the job and window logs
PUT_FILE Procedure	Saves a file to one or more hosts
REMOVE_EVENT_QUEUE_SUBSCRIBER Procedure	Unsubscribes a user from the Scheduler event queue <code>SYS.SCHEDULER\$_EVENT_QUEUE</code>
REMOVE_FROM_INCOMPATIBILITY Procedure	Removes jobs or programs from an incompatibility definition
REMOVE_GROUP_MEMBER Procedure	Removes one or more members from a group
REMOVE_JOB_EMAIL_NOTIFICATION Procedure	Removes e-mail notifications for a job
RESET_JOB_ARGUMENT_VALUE Procedure	Resets the current value assigned to an argument defined with the associated program
RUN_CHAIN Procedure	Immediately runs a chain by creating a run-once job
RUN_JOB Procedure	Runs a job immediately
SET_AGENT_REGISTRATION_PASS Procedure	Sets the agent registration password for a database
SET_ATTRIBUTE Procedure	Changes an attribute of a job, schedule, or other Scheduler object
SET_ATTRIBUTE_NULL Procedure	Changes an attribute of an object to NULL
SET_JOB_ANYDATA_VALUE Procedure	Sets the value of a job argument encapsulated in an <code>AnyData</code> object
SET_JOB_ARGUMENT_VALUE Procedure	Sets the value of a job argument
SET_JOB_ATTRIBUTES Procedure	Sets the value of a job attribute
SET_RESOURCE_CONSTRAINT Procedure	Specifies the resources used by jobs
SET_SCHEDULER_ATTRIBUTE Procedure	Sets the value of a Scheduler attribute
STOP_JOB Procedure	Stops a currently running job or all jobs in a job class

163.6.1 ADD_EVENT_QUEUE_SUBSCRIBER Procedure

This procedure adds a user as a subscriber to the Scheduler event queue `SYS.SCHEDULER$_EVENT_QUEUE`, and grants the user permission to dequeue from this queue using the designated agent.

Syntax

```
DBMS_SCHEDULER.ADD_EVENT_QUEUE_SUBSCRIBER (
    subscriber_name          IN VARCHAR2 DEFAULT NULL);
```


Parameters

Table 163-12 ADD_EVENT_QUEUE_SUBSCRIBER Procedure Parameters

Parameter	Description
subscriber_name	Name of the Oracle Advanced Queuing (AQ) agent to be used to subscribe to the Scheduler event queue. If NULL, an agent is created and assigned the user name of the calling user.

Usage Notes

The subscription is rule-based. The rule permits the user to see only events raised by jobs that the user owns, and filters out all other messages. If an AQ agent with the same name already exists, an error is raised.

163.6.2 ADD_GROUP_MEMBER Procedure

This procedure adds one or more members to an existing group.

Syntax

```
DBMS_SCHEDULER.ADD_GROUP_MEMBER (
    group_name          IN VARCHAR2,
    member              IN VARCHAR2);
```

Parameters

Table 163-13 ADD_GROUP_MEMBER Procedure Parameters

Parameter	Description
group_name	The name of the group.
member	<p>A comma-separated list of members to add to the group. Members must match the group type. A group of the same type can be a member. The Scheduler immediately expands the included group name into its list of members.</p> <p>An error is returned if any of the members do not exist. A member that is already in the group is skipped, and no error is generated.</p> <p>The keyword LOCAL can be included as a member for database destination or external destination groups. See the "CREATE_GROUP Procedure" for information about this keyword.</p>

Usage Notes

The following users may add members to a group:

- The group owner
- A user that has been granted the ALTER object privilege on the group
- A user with the CREATE ANY JOB system privilege

You must have the MANAGE_SCHEDULER privilege to add a member to a group of type WINDOW.



See Also:

"CREATE_GROUP Procedure"

163.6.3 ADD_JOB_EMAIL_NOTIFICATION Procedure

This procedure adds e-mail notifications for a job. E-mails are then sent to the specified list of recipients whenever any of the specified job state events is raised.

Syntax

```
DBMS_SCHEDULER.ADD_JOB_EMAIL_NOTIFICATION (
  job_name          IN VARCHAR2,
  recipients        IN VARCHAR2,
  sender            IN VARCHAR2 DEFAULT NULL,
  subject           IN VARCHAR2 DEFAULT DBMS_SCHEDULER.DEFAULT_NOTIFICATION_SUBJECT,
  body              IN VARCHAR2 DEFAULT DBMS_SCHEDULER.DEFAULT_NOTIFICATION_BODY,
  events            IN VARCHAR2 DEFAULT 'JOB_FAILED, JOB_BROKEN, JOB_SCH_LIM_REACHED,
                                     JOB_CHAIN_STALLED, JOB_OVER_MAX_DUR',
  filter_condition  IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-14 ADD_JOB_EMAIL_NOTIFICATION Procedure Parameters

Parameter	Description
job_name	Name of the job that e-mail notifications are added for. Cannot be NULL.
recipients	Comma-separated list of e-mail addresses to send notifications to. E-mail notifications for all listed events are sent to all recipients. Cannot be NULL.
sender	e-mail address to use as the sender address (the From: address) in the e-mail header. If NULL or omitted, the e-mail address specified in the Scheduler attribute <code>email_sender</code> is used. See <i>Oracle Database Administrator's Guide</i> for more information on this Scheduler attribute.
subject	The subject to use in the e-mail header. Table 163-15 describes the variables that you can include within this parameter. The Scheduler assigns values to these variables before sending the notification. If <code>subject</code> is omitted, the default subject is used. The default subject is the following text, where text enclosed in the '%' character represents a variable: 'Oracle Scheduler Job Notification - %job_owner%.%job_name%.%job_subname% %event_type%'

Table 163-14 (Cont.) ADD_JOB_EMAIL_NOTIFICATION Procedure Parameters

Parameter	Description
body	<p>The body of the e-mail message. Table 163-15 describes the variables that you can include within this parameter. The Scheduler assigns values to these variables before sending the notification. If <code>body</code> is omitted, the default body is used. The default body is the following text, where text enclosed in the '%' character represents a variable:</p> <pre>'Job: %job_owner%.%job_name%.%job_subname% Event: %event_type% Date: %event_timestamp% Log id: %log_id% Job class: %job_class_name% Run count: %run_count% Failure count: %failure_count% Retry count: %retry_count% Error code: %error_code% Error message: %error_message%'</pre>
events	<p>Comma-separate list of job state events to send e-mail notifications for. Cannot be NULL. A notification is sent to all recipients if any of the listed events is raised. Table 163-85 lists the valid events for this parameter. If <code>events</code> is omitted, notifications are sent for the following default events:</p> <pre>JOB_FAILED, JOB_BROKEN, JOB_SCH_LIM_REACHED, JOB_CHAIN_STALLED, JOB_OVER_MAX_DUR</pre>
filter_condition	<p>Used to filter events to send e-mail notifications for. If NULL, all occurrences of the specified events cause e-mail notifications to be sent. <code>filter_condition</code> must be a boolean SQL WHERE clause that may refer to the <code>:event</code> bind variable. This bind variable is automatically bound to an object of type <code>SCHEDULER\$_EVENT_INFO</code> that represents the raised event.</p> <p>For example, to send an e-mail notification only when the error number in an event is 600 or 700, use the following <code>filter_condition</code>:</p> <pre>:event.error_code=600 or :event.error_code=700</pre> <p>See "SCHEDULER\$_EVENT_INFO Object Type".</p>

[Table 163-15](#) lists the variables that you can use in the subject and body arguments.

Table 163-15 Variables Used in the SUBJECT and BODY Parameters

Variable	Comment
<code>%job_owner%</code>	Schema in which job was created
<code>%job_name%</code>	Name of the job that e-mail notifications are added for
<code>%job_subname%</code>	Present for event-based jobs with the <code>parallel_instances</code> attribute set and for chain steps
<code>%event_type%</code>	Valid values are listed in Table 163-85
<code>%event_timestamp%</code>	Time at which the event occurred

Table 163-15 (Cont.) Variables Used in the SUBJECT and BODY Parameters

Variable	Comment
%log_id%	Refers to the LOG_ID column in views *_SCHEDULER_JOB_LOG and *_SCHEDULER_JOB_RUN_DETAILS
%error_code%	Number of the error code.
%error_message%	The text of the error message
%run_count%	Run count for the job when the event was raised
%failure_count%	Failure count for the job when the event was raised
%retry_count%	Retry count for the job when the event was raised

Usage Notes

You can call `ADD_JOB_EMAIL_NOTIFICATION` once for each different set of notifications that you want to configure for a particular job. For example, you may want to send notifications for the `JOB_FAILED`, `JOB_BROKEN`, `JOB_SCH_LIM_REACHED`, and `JOB_CHAIN_STALLED` events to the principle DBA and all senior DBAs, but send a notification for the `JOB_OVER_MAX_DUR` event only to the principle DBA.

This procedure succeeds only if the Scheduler attribute `email_server` is set to a valid SMTP server. See *Oracle Database Administrator's Guide* for more information.

To call this procedure, you must be the job owner or have the `CREATE ANY JOB` system privilege or have the `ALTER` object privilege on the job.

163.6.4 ADD_TO_INCOMPATIBILITY Procedure

This procedure adds jobs or programs to an existing incompatibility definition.

Syntax

```
DBMS_SCHEDULER.ADD_TO_INCOMPATIBILITY (
    incompatibility_name    IN VARCHAR2,
    object_name             IN VARCHAR2);
```

Parameters

Table 163-16 ADD_TO_INCOMPATIBILITY Procedure Parameters

Parameter	Description
<code>incompatibility_name</code>	The name of the incompatibility definition.
<code>object_name</code>	One or more (comma-separated) programs or jobs

Usage Notes

This procedure does not raise an error if any specified objects already exist in the incompatibility definition.

**See Also:**Using Incompatibility Definitions in *Oracle Database Administrator's Guide*

163.6.5 ALTER_CHAIN Procedure

This procedure alters an attribute of the specified steps of a chain. This affects all future runs of the specified steps, both in the currently running chain job and in future runs of the same chain job or other chain jobs that point to the chain.

Syntax

Alters the value of a boolean attribute of one or more steps:

```
DBMS_SCHEDULER.ALTER_CHAIN (
  chain_name      IN VARCHAR2,
  step_name       IN VARCHAR2,
  attribute        IN VARCHAR2,
  value           IN BOOLEAN);
```

Alters the value of a character attribute of one or more steps:

```
DBMS_SCHEDULER.ALTER_CHAIN (
  chain_name      IN VARCHAR2,
  step_name       IN VARCHAR2,
  attribute        IN VARCHAR2,
  char_value      IN VARCHAR2);
```

Parameters

Table 163-17 ALTER_CHAIN Procedure Parameters

Parameter	Description
chain_name	The name of the chain to alter
step_name	The name of the step or a comma-separated list of steps to alter. This cannot be NULL.

Table 163-17 (Cont.) ALTER_CHAIN Procedure Parameters

Parameter	Description
attribute	<p>The attribute of the steps to change. Must be one of the following:</p> <ul style="list-style-type: none"> • 'PAUSE' <p>If set to TRUE for a step, after the step has run, its state changes to PAUSED (and the completed attribute remains FALSE).</p> <p>If PAUSE is reset to FALSE for a paused chain step (using ALTER_RUNNING_CHAIN), the state is set to its completion state (SUCCEEDED, FAILED, or STOPPED) and the completed attribute is set to TRUE.</p> <p>Setting PAUSE has no effect on steps that have already run. This allows execution of a chain to be suspended after the execution of certain steps.</p> • 'PAUSED_BEFORE' <p>If set to TRUE for a step and if any of the rule conditions that start the step are true, then its state changes to PAUSED and the step does not run.</p> <p>If PAUSED_BEFORE is reset to FALSE for a chain step that has paused before starting (using ALTER_RUNNING_CHAIN), then the step starts running if any of the rule conditions that start the step are true.</p> <p>Setting PAUSED_BEFORE has no effect on steps that are running or have already run. This allows execution of a chain to be suspended before the execution of certain steps.</p> • 'SKIP' <p>If set to TRUE for a step, when the step condition is met, instead of being run, the step is treated as if it has immediately succeeded. Setting SKIP to TRUE has no effect for a step that is running, scheduled to run after a delay, or has already run. If SKIP is set TRUE for a step that PAUSE is also set for, when the step condition is met, the step immediately changes to state PAUSED.</p> • 'RESTART_ON_FAILURE' <p>If set to TRUE for a step and the step fails due to an application error, then the step is retried using the normal Scheduler retry mechanism (after 1 second, after 10 seconds, after 100 seconds, and so on, up to a maximum of 6 times). If all 6 retries fail (after about 30 hours), then the chain step is marked FAILED.</p> <p>If set to FALSE (the default), a failed chain step is immediately marked FAILED.</p> • 'RESTART_ON_RECOVERY' <p>If set to TRUE for a step and the step is stopped by a database shutdown, then the step is restarted when the database is recovered.</p> <p>If set to FALSE, and the step is stopped by a database shutdown, then the step is marked as stopped when the database is recovered and the chain continues.</p> • 'DESTINATION_NAME' <p>The name of an existing database destination or external destination. You can view external destination names in the view ALL_SCHEDULER_EXTERNAL_DESTS, and database destination names in the views *_SCHEDULER_DB_DESTS. You cannot specify a destination group for this attribute. This parameter is NULL by default.</p> • 'CREDENTIAL_NAME' <p>The credential to use when running this step. NULL by default.</p>

Table 163-17 (Cont.) ALTER_CHAIN Procedure Parameters

Parameter	Description
value	The value to set for the attribute (for a boolean attribute).
char_value	The value to set for the attribute (for a character attribute).

Usage Notes

Altering a chain requires `ALTER` privileges on the chain either by being the owner of the chain, or by having the `ALTER` object privilege on the chain or by having the `CREATE ANY JOB` system privilege.

163.6.6 ALTER_RUNNING_CHAIN Procedure

This procedure alters an attribute of the specified steps of a chain. This affects only steps of the instance of the chain for the specified running chain job.

Syntax

```
DBMS_SCHEDULER.ALTER_RUNNING_CHAIN (
  job_name          IN VARCHAR2,
  step_name         IN VARCHAR2,
  attribute         IN VARCHAR2,
  value             IN {BOOLEAN|VARCHAR2});
```

Parameters

Table 163-18 ALTER_RUNNING_CHAIN Procedure Parameters

Parameter	Description
job_name	The name of the job that is running the chain
step_name	The name of the step or a comma-separated list of steps to alter. If this is set to <code>NULL</code> and attribute is <code>PAUSE</code> or <code>SKIP</code> , then all steps of the running chain are altered.

Table 163-18 (Cont.) ALTER_RUNNING_CHAIN Procedure Parameters

Parameter	Description
attribute	<p>The attribute of the steps to change. Valid values are:</p> <ul style="list-style-type: none"> <li data-bbox="602 373 1458 667"> <p>• 'PAUSE'</p> <p>If the PAUSE attribute is set TRUE for a step, then after the step runs, its state changes to PAUSED (and the completed attribute remains false).</p> <p>If PAUSE is reset to FALSE for a paused chain step (using ALTER_RUNNING_CHAIN), the state is set to completion (SUCCEEDED, FAILED, or STOPPED) and the completed attribute is set to TRUE. Setting PAUSE has no effect on steps that have already run. This allows execution of a chain to be suspended after the execution of certain steps. If step_name is set to NULL, PAUSE is set to TRUE for all steps of this running chain.</p> <li data-bbox="602 674 1458 1060"> <p>• 'PAUSE_BEFORE'</p> <p>If set to TRUE for a step that has not yet run and if any of the rule conditions that start the step are true, then its state changes to PAUSED and the step does not run.</p> <p>If PAUSE_BEFORE is reset to FALSE for a chain step that has paused before starting, then the step starts running if any of the rule conditions that start the step are true.</p> <p>Setting PAUSE_BEFORE has no effect on steps that are running or have already run. This allows execution of a chain to be suspended before the execution of certain steps.</p> <p>If step_name is set to NULL, then PAUSE_BEFORE is set to the specified value for all steps of this running chain.</p>

Table 163-18 (Cont.) ALTER_RUNNING_CHAIN Procedure Parameters

Parameter	Description
attribute CONTINUED	<ul style="list-style-type: none"> 'SKIP' If the SKIP attribute is set to TRUE for a step, when the step condition is met, instead of being run, the step is treated as if it has immediately succeeded. Setting SKIP to TRUE has no effect for a step that is running, scheduled to run after a delay, or has already run. If step_name is set to NULL, SKIP is set TRUE for all steps of this running chain. If SKIP is set TRUE for a step that PAUSE is also set for, when the step condition is met the step immediately changes to state PAUSED. 'RESTART_ON_FAILURE' If set to TRUE for a step and the step fails due to an application error, then the step is retried using the normal Scheduler retry mechanism (after 1 second, after 10 seconds, after 100 seconds, and so on, up to a maximum of 6 times). If all 6 retries fail (after about 30 hours), then the chain step is marked FAILED. If set to FALSE (the default), a failed chain step is immediately marked FAILED. 'RESTART_ON_RECOVERY' If the RESTART_ON_RECOVERY attribute is set to TRUE for a step, then if the step is stopped by a database shutdown, it is restarted when the database is recovered. If set to FALSE, then if the step is stopped by a database shutdown, the step is marked as stopped when the database is recovered and the chain continues. 'STATE' This changes the state of the steps. The state can only be changed if the step is not running. The state can only be changed to one of the following: 'NOT_STARTED', 'SUCCEEDED', 'FAILED error_code' If the state is being changed to FAILED, an error code must be included (this must be a positive integer).
value	The value to set for the attribute. Valid values are: TRUE, FALSE, 'NOT_STARTED', 'SUCCEEDED', or 'FAILED error_code'

Usage Notes

Altering a running chain requires you to have alter privileges on the job that is running (either as the owner, or as a user with ALTER privileges on the job or the CREATE ANY JOB system privilege).

When trying to update a step defined with a nested chain, it is necessary to specify the job_name as <SCHEMA>.<JOB_NAME>.<STEP_NAME_IN_TOP_LEVEL_CHAIN> to be able to make reference to the steps inside the subchain.

163.6.7 CLOSE_WINDOW Procedure

This procedure closes an open window prematurely. A closed window means that it is no longer in effect. When a window is closed, the Scheduler switches the resource plan to the

one that is in effect outside the window, or in the case of overlapping windows, to another window.

Syntax

```
DBMS_SCHEDULER.CLOSE_WINDOW (
    window_name          IN VARCHAR2);
```

Parameters

Table 163-19 CLOSE_WINDOW Procedure Parameters

Parameter	Description
window_name	The name of the window

Usage Notes

If you try to close a window that does not exist or is not open, an error is generated.

A job that is running does not stop when the window it is running in closes, unless the attribute `stop_on_window_close` is set to `TRUE` for the job. However, the resources allocated to the job can change if the resource plan changes.

When a running job has a group of type `WINDOW` as its schedule, the job is not stopped when its window is closed if another window in the same window group becomes active. This is the case even if the job has the attribute `stop_on_window_close` set to `TRUE`.

Closing a window requires the `MANAGE SCHEDULER` privilege.

163.6.8 COPY_JOB Procedure

This procedure copies all attributes of an existing job to a new job. The new job is created disabled, while the state of the existing job is unaltered.

Syntax

```
DBMS_SCHEDULER.COPY_JOB (
    old_job              IN VARCHAR2,
    new_job              IN VARCHAR2);
```

Parameters

Table 163-20 COPY_JOB Procedure Parameters

Parameter	Description
old_job	The name of the existing job
new_job	The name of the new job

Usage Notes

To copy a job, you must have privileges to create a job in the schema of the new job (the `CREATE JOB` system privilege if it is in your own schema, otherwise, the `CREATE ANY`

JOB system privilege). If the old job is not in the your own schema, then you must also have ALTER privileges on the old job or the CREATE ANY JOB system privilege.

163.6.9 CREATE_CHAIN Procedure

This procedure creates a new chain. The chain name can be optionally qualified with a schema name (for example, myschema.myname).

A chain is always created as disabled and must be enabled with the [ENABLE Procedure](#) before it can be used.

Syntax

```
DBMS_SCHEDULER.CREATE_CHAIN (
    chain_name          IN VARCHAR2,
    rule_set_name       IN VARCHAR2 DEFAULT NULL,
    evaluation_interval IN INTERVAL DAY TO SECOND DEFAULT NULL,
    comments            IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-21 CREATE_CHAIN Procedure Parameters

Parameter	Description
chain_name	The name to assign to the new chain, which can optionally be qualified with a schema. This must be unique in the SQL namespace, therefore, there cannot already be a table or other object with this name and schema.
rule_set_name	In the normal case, no rule set should be passed in. The Scheduler automatically creates a rule set and associated empty evaluation context. You then use DEFINE_CHAIN_RULE to add rules and DROP_CHAIN_RULE to remove them. Advanced users can create a rule set that describes their chain dependencies and pass it in here. This allows greater flexibility in defining rules. For example, conditions can refer to external variables, and tables can be exposed through the evaluation context. If you pass in a rule set, you must ensure that it is in the format of a chain rule set. (For example, all steps must be listed as variables in the evaluation context). If no rule set is passed in, the rule set created is of the form SCHED_RULESET{N} and the evaluation context created is of the form SCHED_EVCTX{N}
evaluation_interval	If this is NULL, reevaluation of the rules of a running chain are performed only when the job starts and when a step completes. A non-NULL value causes rule evaluations to also occur periodically at the specified interval. Because evaluation may be CPU-intensive, this should be conservatively set to the highest possible value or left at NULL if possible. evaluation_interval cannot be less than a minute or greater than a day.
comments	An optional comment describing the purpose of the chain

Usage Notes

To create a chain in your own schema, you must have the CREATE JOB system privilege. To create a chain in a different schema you must have the CREATE ANY JOB system privilege. If you do not provide a rule_set_name, a rule set and evaluation context is created in the schema that the chain is being created in, so you must have the privileges required to create

these objects. See the `DBMS_RULE_ADM.CREATE_RULE_SET` and `DBMS_RULE_ADM.CREATE_EVALUATION_CONTEXT` procedures for more information.

163.6.10 CREATE_CREDENTIAL Procedure

This deprecated procedure creates a stored username/password pair. Credentials are assigned to jobs so that they can authenticate with a local or remote host operating system or a remote Oracle database.



Note:

This procedure is deprecated with Oracle Database 12c Release 1 (12.1). While the procedure remains available in this package, for reasons of backward compatibility, Oracle recommends using the alternative enhanced functionality provided in the `DBMS_CREDENTIAL` package, specifically the `CREATE_CREDENTIAL Procedure`.

Syntax

```
DBMS_SCHEDULER.CREATE_CREDENTIAL (
  credential_name      IN VARCHAR2,
  username             IN VARCHAR2,
  password             IN VARCHAR2,
  database_role        IN VARCHAR2 DEFAULT NULL,
  windows_domain       IN VARCHAR2 DEFAULT NULL,
  comments             IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-22 CREATE_CREDENTIAL Procedure Parameters

Parameter	Description
<code>credential_name</code>	The name to assign to the credential. It can optionally be prefixed with a schema name. It cannot be set to <code>NULL</code> . It is converted to uppercase unless enclosed in double quotation marks.
<code>username</code>	The user name for logging into to the host operating system or remote Oracle database. This cannot be set to <code>NULL</code> and is case-sensitive. It cannot contain double quotes or spaces. Maximum length is 64.
<code>password</code>	The password for the user name. This cannot be set to <code>NULL</code> and is case sensitive. The password is stored obfuscated and is not displayed in the Scheduler dictionary views. Maximum length is 128.
<code>database_role</code>	The value of the <code>database_role</code> attribute is used as the system privilege for logging into a remote database to run a remote database job. Valid values are: <code>SYSDBA</code> and <code>SYSOPER</code>
<code>windows_domain</code>	For a Windows remote executable target, this is the domain that the specified user belongs to. The domain is converted to uppercase automatically. Maximum length is 64.
<code>comments</code>	A text string that can be used to describe the credential. Scheduler does not use this parameter. Maximum length is 240.

Usage Notes

Credentials reside in a particular schema and can be created by any user with the `CREATE JOB` system privilege. To create a credential in a schema other than your own, you must have the `CREATE ANY JOB` privilege.

163.6.11 CREATE_DATABASE_DESTINATION Procedure

This procedure creates a database destination. A database destination represents an Oracle database on which remote database jobs run.

The host that the remote database resides on must have a running Scheduler agent that is registered with the database that this procedure is called from.

Syntax

```
DBMS_SCHEDULER.CREATE_DATABASE_DESTINATION (
    destination_name      IN VARCHAR2,
    agent                 IN VARCHAR2,
    tns_name              IN VARCHAR2,
    comments              IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-23 CREATE_DATABASE_DESTINATION Procedure Parameters

Parameter	Description
<code>destination_name</code>	The name to assign to the database destination. It can optionally be prefixed with a schema name. Cannot be <code>NULL</code> . It is converted to uppercase unless enclosed in double quotation marks.
<code>agent</code>	The external destination name of the Scheduler agent to connect. Equivalent to an agent name. The external destination must already exist. The external destination representing an agent is created automatically on a database instance when the agent registers with that instance. An agent's name is specified in its agent configuration file. If it is not specified, it defaults to the first part (before the first period) of the name of the host it resides on.
<code>tns_name</code>	An Oracle Net connect identifier that is resolved to the Oracle database instance being connected to. The exact syntax depends on the Oracle Net configuration. The connect identifier can be a complete Oracle Net connect descriptor (network address and database service name) or a <i>net service name</i> , which is an alias for a connect descriptor. The alias must be resolved in the <code>tnsnames.ora</code> file on the local computer. The maximum size for <code>tns_name</code> is 2000 characters. If <code>tns_name</code> is <code>NULL</code> , the agent connects to the default Oracle database on its host. You specify the default database by assigning values to the <code>ORACLE_HOME</code> and <code>ORACLE_SID</code> parameters in the agent configuration file, <code>schagent.conf</code> , located in the agent home directory. See <i>Oracle Database Net Services Administrator's Guide</i> for more information on connect identifiers.
<code>comments</code>	A text string that describes the database destination. Scheduler does not use this argument.

Usage Notes

Database destinations reside in a particular schema and can be created by any user with the `CREATE JOB` system privilege. To create a database destination in a schema other than your own, you must have the `CREATE ANY JOB` privilege.

163.6.12 CREATE_EVENT_SCHEDULE Procedure

This procedure creates an event schedule, which is used to start a job when a particular event is raised.

Syntax

```
DBMS_SCHEDULER.CREATE_EVENT_SCHEDULE (
    schedule_name      IN VARCHAR2,
    start_date         IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
    event_condition    IN VARCHAR2 DEFAULT NULL,
    queue_spec         IN VARCHAR2,
    end_date           IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
    comments           IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-24 CREATE_EVENT_SCHEDULE Parameters

Parameter	Description
<code>schedule_name</code>	The name to assign to the schedule. The name must be unique in the SQL namespace. For example, a schedule cannot have the same name as a table in a schema. If no name is specified, then an error occurs.
<code>start_date</code>	This attribute specifies the date and time that this schedule becomes valid. Occurrences of the event before this date and time are ignored in the context of this schedule.
<code>event_condition</code>	This is a conditional expression based on the columns of the event source queue table. The expression must have the syntax of an Advanced Queuing rule. Accordingly, you can include user data properties in the expression, provided that the message payload is an object type, and that you prefix object attributes in the expression with <code>tab.user_data</code> . For more information on rules, see the <code>DBMS_AQADM.ADD_SUBSCRIBER</code> procedure.
<code>queue_spec</code>	This argument specifies either a file watcher name or the queue into which events that start this particular job are enqueued (the source queue). If the source queue is a secure queue, the <code>queue_spec</code> argument is a string containing a pair of values of the form <i>queue_name, agent name</i> . For non-secure queues, only the queue name need be provided. If a fully qualified queue name is not provided, the queue is assumed to be in the job owner's schema. In the case of secure queues, the agent name provided should belong to a valid agent that is currently subscribed to the queue.
<code>end_date</code>	The date and time after which jobs do not run and windows do not open. An event schedule that has no <code>end_date</code> is valid forever. <code>end_date</code> must be after the <code>start_date</code> . If it is not, then an error is generated when the schedule is created.

Table 163-24 (Cont.) CREATE_EVENT_SCHEDULE Parameters

Parameter	Description
comments	This attribute specifies an optional comment about the schedule. By default, this attribute is NULL.

Usage Notes

You must have the `CREATE JOB` privilege to create a schedule in your own schema or the `CREATE ANY JOB` privilege to create a schedule in someone else's schema by specifying `schema.schedule_name`. Once a schedule has been created, it can be used by other users. The schedule is created with access to `PUBLIC`. Therefore, there is no need to explicitly grant access to the schedule.

**See Also:**

["CREATE_FILE_WATCHER Procedure"](#)

163.6.13 CREATE_FILE_WATCHER Procedure

This procedure creates a file watcher, which is a Scheduler object that defines the location, name, and other properties of a file whose arrival on a system causes the Scheduler to start a job. After you create a file watcher, you reference it in an event-based job or event schedule.

Syntax

```
DBMS_SCHEDULER.CREATE_FILE_WATCHER (
  file_watcher_name      IN VARCHAR2,
  directory_path         IN VARCHAR2,
  file_name              IN VARCHAR2,
  credential_name        IN VARCHAR2,
  destination            IN VARCHAR2 DEFAULT NULL,
  min_file_size          IN PLS_INTEGER DEFAULT 0,
  steady_state_duration IN INTERVAL DAY TO SECOND DEFAULT NULL,
  comments               IN VARCHAR2 DEFAULT NULL,
  enabled                IN BOOLEAN DEFAULT TRUE);
```

Parameters**Table 163-25 CREATE_FILE_WATCHER Parameters**

Parameter	Description
file_watcher_name	The name to assign to the file watcher. The name must be unique in the SQL namespace. For example, a file watcher cannot have the same name as a table in a schema. This can optionally be prefixed with a schema name. Cannot be NULL.

Table 163-25 (Cont.) CREATE_FILE_WATCHER Parameters

Parameter	Description
directory_path	Directory in which the file is expected to arrive. The single wildcard '?' at the beginning of the path denotes the Oracle home path. For example, '?/rdbms/log' denotes the rdbms/log subdirectory of the Oracle home directory.
file_name	Name of the file to look for. Two wildcards are permitted anywhere in the file name: '?' denotes any single character, and '*' denotes zero or more characters. This attribute cannot be NULL.
credential_name	Name of a valid credential object. The file watcher uses the credential to authenticate itself with the host operating system to access the watched-for file. The file watcher owner must have EXECUTE privileges on the credential. Cannot be NULL.
destination	Name of an external destination. You create an external destination by registering a remote Scheduler agent with the database. See the view ALL_SCHEDULER_EXTERNAL_DESTS for valid external destination names. If this parameter is NULL, the file watcher is created on the local host.
min_file_size	Minimum size in bytes that the file must be before the file watcher considers the file found. Default is 0.
steady_state_duration	Minimum time interval that the file must remain unchanged before the file watcher considers the file found. Cannot exceed one hour. If NULL, an internal value is used. The minimum value is 10 seconds. Oracle recommends similar steady_state_duration values for all file watchers for efficient file watcher job operation. Also, the repeat interval of the file watcher schedule must be equal or greater than the steady_state_duration value.
comments	Optional comment.
enabled	If TRUE (the default), the file watcher is enabled.

Usage Notes

You must have the CREATE JOB system privilege to create a file watcher in your own schema. You require the CREATE ANY JOB system privilege to create a file watcher in a schema different from your own (except the SYS schema, which is disallowed).

163.6.14 CREATE_GROUP Procedure

This procedure creates a group. Groups contain members, which you can specify when you create the group or at a later time. There are three types of groups: window groups, database destination groups, and external destination groups.

You can use a group name in other DBMS_SCHEDULER package procedures to specify a list of objects. For example, to specify multiple destinations for a remote database job, you provide a group name for the DESTINATION_NAME parameter of the job.

Syntax

```
DBMS_SCHEDULER.CREATE_GROUP (
    group_name          IN VARCHAR2,
    group_type          IN VARCHAR2,
```



```
member          IN VARCHAR2 DEFAULT NULL,
comments       IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-26 CREATE_GROUP Procedure Parameters

Parameter	Description
group_name	The name to assign to the group. It can optionally be prefixed with a schema name. It cannot be NULL. It is converted to uppercase unless enclosed in double quotation marks.
group_type	<p>The type of members in the group. All members must be of the same type. Possible types are:</p> <ul style="list-style-type: none"> 'DB_DEST' Database destination: Members are database destinations, for running remote database jobs. 'EXTERNAL_DEST' External destination: Members are external destinations, for running remote external jobs. 'WINDOW' Members are Scheduler windows. You must have the <code>MANAGE SCHEDULER</code> privilege to create a group of this type. <p>Members in database destination and external destination groups have the following format:</p> <pre>[[schema.]credential@][schema.]destination</pre> <p>where:</p> <ul style="list-style-type: none"> <i>credential</i> is the name of an existing credential. <i>destination</i> is the name of an existing database destination or external destination. <p>The credential portion of a destination member is optional. If omitted, the job using this destination member uses its default credential.</p> <p>Members in window groups are window names. Because all Scheduler windows reside in the <code>SYS</code> schema, you do not specify a schema name for windows.</p>
member	<p>Optional comma-separated list of group members. The default is NULL. If NULL, use the <code>ADD_GROUP_MEMBER</code> procedure to add members. You can also use <code>ADD_GROUP_MEMBER</code> to add additional members at a later time.</p> <p>The keyword <code>LOCAL</code> can be used as a member in database destination groups and external destination groups.</p> <ul style="list-style-type: none"> In database destination groups, <code>LOCAL</code> represents the source database on which the job is created. It cannot be preceded with a credential. In external destination groups, <code>LOCAL</code> represents the host on which the source database resides. It can be optionally preceded with a credential name. If no credential is provided, jobs that use this group as their destination must have a default credential.
comments	A text string that describes the group. Scheduler does not use this argument.

Usage Notes

Groups reside in a particular schema and can be created by any user with the `CREATE JOB` system privilege. To create a group in a schema other than your own, you must have the `CREATE ANY JOB` privilege. The group name must be unique among all Scheduler objects.

You can grant the `SELECT` or `READ` privilege on a group so that other users can reference the group when creating jobs or schedules. To enable other users to modify a group, you can grant the `ALTER` privilege on the group.

Each group member must be unique within the group. For destination groups, the credential/destination name pairs must be unique within the group. An error is generated if any of the group members do not exist. For destination groups, both the credential and destination portions of a member must exist.

Another group of the same type can be a group member. The Scheduler immediately expands the included group name into its list of members.

Groups are created enabled, but you can disable them.

Example

The following PL/SQL block creates a group named `production_dest1`, whose members are database destinations for a collection of production databases.

```
BEGIN
  DBMS_SCHEDULER.CREATE_GROUP(
    GROUP_NAME    => 'production_dest1',
    GROUP_TYPE    => 'DB_DEST',
    MEMBER        => 'LOCAL, oracle_cred@prodhost1, prodhost2',
    COMMENTS      => 'All sector1 production machines');
END;
```

163.6.15 CREATE_INCOMPATIBILITY Procedure

This procedure creates an incompatibility definition.

Syntax

```
DBMS_SCHEDULER.CREATE_INCOMPATIBILITY (
  incompatibility_name  IN VARCHAR2,
  object_name          IN VARCHAR2,
  constraint_level     IN VARCHAR2 DEFAULT 'JOB_LEVEL',
  enabled              IN BOOLEAN DEFAULT TRUE,
  comments             IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-27 CREATE_INCOMPATIBILITY Procedure Parameters

Parameter	Description
<code>incompatibility_name</code>	The name of the incompatibility definition.
<code>object_name</code>	One or more (comma-separated) programs or jobs.

Table 163-27 (Cont.) CREATE_INCOMPATIBILITY Procedure Parameters

Parameter	Description
<code>constraint_level</code>	One or more (comma-separated) programs or jobs.
<code>enabled</code>	Specifies whether the constraint is initially enabled (<code>true</code>) or not enabled (<code>false</code>).
<code>comments</code>	Optional descriptive comment.

Usage Notes

If `object_name` contains multiple (comma-separated) values, they must be either all programs or all jobs that are incompatible with each other (that is, they cannot be run at the same time). For jobs, the list must consist of two or more jobs, and `constraint_level` must be 'JOB_LEVEL'. For programs, `constraint_level` can be either 'JOB_LEVEL' or 'PROGRAM_LEVEL'. When set to the default value 'JOB_LEVEL', only a single job that is based on the program (or programs) mentioned in `object_name` can run at the same time. When `constraint_level` is set to 'PROGRAM_LEVEL', the programs are incompatible, but the jobs based on the same program are not incompatible.

For example, if the value of `object_name` is 'P1,P2,P3' and `constraint_level` is 'PROGRAM_LEVEL', many jobs based on P1 can be running at the same time, but if any P1 based job is running, none based on P2 or P3 can be running. Or, similarly, many jobs based on P3 can be running at the same time, but none based on P1 or P2. If `constraint_level` is set to 'JOB_LEVEL', then only a single job out of all the jobs based on programs P1, P2 and P3 can be running at a time.



See Also:

Using Incompatibility Definitions in *Oracle Database Administrator's Guide*

163.6.16 CREATE_JOB Procedure

This procedure creates a single job.

If you create the job as enabled by setting the `enabled` attribute to `TRUE`, the Scheduler automatically runs the job according to its schedule. If you create the job disabled, the job does not run until you enable it with the [SET_ATTRIBUTE Procedure](#).

The procedure is overloaded. The different functionality of each form of syntax is presented along with the syntax declaration.

Syntax

Creates a job in a single call without using an existing program or schedule:

```
DBMS_SCHEDULER.CREATE_JOB (
  job_name          IN VARCHAR2,
  job_type          IN VARCHAR2,
  job_action        IN VARCHAR2,
  number_of_arguments IN PLS_INTEGER          DEFAULT 0,
  start_date        IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
```

```

repeat_interval      IN VARCHAR2                DEFAULT NULL,
end_date            IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
job_class           IN VARCHAR2                DEFAULT 'DEFAULT_JOB_CLASS',
enabled             IN BOOLEAN                 DEFAULT FALSE,
auto_drop           IN BOOLEAN                 DEFAULT TRUE,
comments            IN VARCHAR2                DEFAULT NULL,
credential_name     IN VARCHAR2                DEFAULT NULL,
destination_name    IN VARCHAR2                DEFAULT NULL);

```

Creates a job using a named schedule object and a named program object:

```

DBMS_SCHEDULER.CREATE_JOB (
  job_name           IN VARCHAR2,
  program_name       IN VARCHAR2,
  schedule_name      IN VARCHAR2,
  job_class          IN VARCHAR2                DEFAULT 'DEFAULT_JOB_CLASS',
  enabled            IN BOOLEAN                 DEFAULT FALSE,
  auto_drop          IN BOOLEAN                 DEFAULT TRUE,
  comments           IN VARCHAR2                DEFAULT NULL,
  job_style          IN VARCHAR2                DEFAULT 'REGULAR',
  credential_name    IN VARCHAR2                DEFAULT NULL,
  destination_name   IN VARCHAR2                DEFAULT NULL);

```

Creates a job using a named program object and an inlined schedule:

```

DBMS_SCHEDULER.CREATE_JOB (
  job_name           IN VARCHAR2,
  program_name       IN VARCHAR2,
  start_date         IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
  repeat_interval    IN VARCHAR2                DEFAULT NULL,
  end_date           IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
  job_class          IN VARCHAR2                DEFAULT 'DEFAULT_JOB_CLASS',
  enabled            IN BOOLEAN                 DEFAULT FALSE,
  auto_drop          IN BOOLEAN                 DEFAULT TRUE,
  comments           IN VARCHAR2                DEFAULT NULL,
  job_style          IN VARCHAR2                DEFAULT 'REGULAR',
  credential_name    IN VARCHAR2                DEFAULT NULL,
  destination_name   IN VARCHAR2                DEFAULT NULL);

```

Creates a job using a named schedule object and an inlined program:

```

DBMS_SCHEDULER.CREATE_JOB (
  job_name           IN VARCHAR2,
  schedule_name      IN VARCHAR2,
  job_type           IN VARCHAR2,
  job_action         IN VARCHAR2,
  number_of_arguments IN PLS_INTEGER           DEFAULT 0,
  job_class          IN VARCHAR2                DEFAULT 'DEFAULT_JOB_CLASS',
  enabled            IN BOOLEAN                 DEFAULT FALSE,
  auto_drop          IN BOOLEAN                 DEFAULT TRUE,
  comments           IN VARCHAR2                DEFAULT NULL,
  credential_name    IN VARCHAR2                DEFAULT NULL,
  destination_name   IN VARCHAR2                DEFAULT NULL);

```

Creates a job using an inlined program and an event:

```

DBMS_SCHEDULER.CREATE_JOB (
  job_name           IN VARCHAR2,
  job_type           IN VARCHAR2,
  job_action         IN VARCHAR2,
  number_of_arguments IN PLS_INTEGER           DEFAULT 0,
  start_date         IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,

```

```

event_condition      IN VARCHAR2          DEFAULT NULL,
queue_spec           IN VARCHAR2,
end_date             IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
job_class            IN VARCHAR2          DEFAULT 'DEFAULT_JOB_CLASS',
enabled              IN BOOLEAN          DEFAULT FALSE,
auto_drop            IN BOOLEAN          DEFAULT TRUE,
comments             IN VARCHAR2          DEFAULT NULL,
credential_name      IN VARCHAR2          DEFAULT NULL,
destination_name     IN VARCHAR2          DEFAULT NULL);

```

Creates a job using a named program object and an event:

```

DBMS_SCHEDULER.CREATE_JOB (
  job_name            IN VARCHAR2,
  program_name        IN VARCHAR2,
  start_date          IN TIMESTAMP WITH TIME ZONE,
  event_condition     IN VARCHAR2,
  queue_spec          IN VARCHAR2,
  end_date            IN TIMESTAMP WITH TIME ZONE,
  job_class           IN VARCHAR2          DEFAULT 'DEFAULT_JOB_CLASS',
  enabled             IN BOOLEAN          DEFAULT FALSE,
  auto_drop           IN BOOLEAN          DEFAULT TRUE,
  comments            IN VARCHAR2          DEFAULT NULL,
  job_style           IN VARCHAR2          DEFAULT 'REGULAR',
  credential_name     IN VARCHAR2          DEFAULT NULL,
  destination_name    IN VARCHAR2          DEFAULT NULL);

```

Parameters

Table 163-28 *CREATE_JOB Procedure Parameters*

Parameter	Description
job_name	<p>The name to assign to the job. The name must be unique in the SQL namespace. For example, a job cannot have the same name as a table in a schema. If the job being created will reside in another schema, it must be qualified with the schema name.</p> <p>If <code>job_name</code> is not specified, an error is generated. If you want to have a name generated by the Scheduler, you can use the <code>GENERATE_JOB_NAME</code> procedure to generate a name and then use the output in the <code>CREATE_JOB</code> procedure. The <code>GENERATE_JOB_NAME</code> procedure generates a number from a sequence, which is the job name. You can prefix the number with a string. The job name will then be the string with the number from the sequence appended to it. See "GENERATE_JOB_NAME Function" for more information.</p>

Table 163-28 (Cont.) CREATE_JOB Procedure Parameters

Parameter	Description
job_type	<p>This attribute specifies the type of job that you are creating. If it is not specified, an error is generated. See <code>job_action</code> in the next row for related information.</p> <p>The supported values are:</p> <ul style="list-style-type: none"> 'PLSQL_BLOCK' This specifies that the job is an anonymous PL/SQL block. Job or program arguments are not supported when the job or program type is <code>PLSQL_BLOCK</code>. In this case, the number of arguments must be 0. 'STORED_PROCEDURE' This specifies that the job is a PL/SQL or Java stored procedure, or an external C subprogram. Only procedures, not functions with return values, are supported. 'EXECUTABLE' This specifies that the job is going to be run outside the database using an external executable. External jobs are anything that can be executed from the command line of the operating system. <code>Anydata</code> arguments are not supported with a job or program type of <code>EXECUTABLE</code>. The job owner must have the <code>CREATE EXTERNAL JOB</code> system privilege before the job can be enabled or run. 'CHAIN' This specifies that the job is a chain. Arguments are not supported for a chain, so <code>number_of_arguments</code> must be 0. 'EXTERNAL_SCRIPT' This specifies that the job is an external script that uses the command shell of the computer running the job. For Windows this is <code>cmd.exe</code> and for UNIX based systems the <code>sh</code> shell, unless a different interpreter is specified by prefixing the first line of the script with <code>#!</code>. 'SQL_SCRIPT' This specifies that the job is a SQL*Plus script. The job must point to a credential that contains a valid operating system username and password. The SQL*Plus script is run by the SQL*Plus executable. The job may point to a connect credential that contains a database credential. If so, this credential is used to connect to the database before running the SQL*Plus script. Note that if you choose to use connect credential, you must use <code>set_attribute</code> to specify the <code>Connect_Credential_Name</code> attribute. If you do not have connect credential, you must include an explicit SQL*Plus connect statement providing a valid database <code>userid / password</code>. The job owner must have the <code>CREATE EXTERNAL JOB</code> system privilege. 'BACKUP_SCRIPT' This specifies that the job is an RMAN backup script. The script runs a connect statement that uses either a password or OS authentication before it executes any target commands. The job points to a credential that contains a valid operating system username and password. The RMAN session runs under this operating system user. The Scheduler uses the RMAN executable from the current Oracle home to run the script and throws an error if this is missing. The job owner must have the <code>CREATE EXTERNAL JOB</code> system privilege.

Table 163-28 (Cont.) CREATE_JOB Procedure Parameters

Parameter	Description
job_action	<p>This attribute specifies the action of the job. If <code>job_action</code> is not specified for an inline program, then an error is generated when creating the job.</p> <p>The job action is executed inside an autonomous transaction, and all autonomous transaction guidelines and restrictions apply. For example, online DDL operations are not allowed inside an autonomous transaction, and therefore cannot be used in the job action.</p> <p>The following actions are possible:</p> <ul style="list-style-type: none"> For a PL/SQL block: <p>The action is to execute PL/SQL code. These blocks must end with a semicolon. For example, <code>my_proc();</code> or <code>BEGIN my_proc(); END;</code> or <code>DECLARE arg pls_integer:= 10; BEGIN my_proc2(arg); END;</code></p> <p>Note that the Scheduler wraps <code>job_action</code> in its own block and passes the following to PL/SQL for execution: <code>DECLARE ... BEGIN job_action END;</code> This is done to declare some internal Scheduler variables. You can include any Scheduler metadata attribute except <code>event_message</code> in your PL/SQL code. You use the attribute name as you use any other PL/SQL identifier, and the Scheduler assigns it a value.</p> <p>See Table 163-40 for details on available metadata attributes.</p> For a stored procedure: <p>The action is the name of the stored procedure. You have to specify the schema if the procedure resides in another schema than the job. If case sensitivity is needed, enclose the schema name and the store procedure name in double quotes. For example, <code>job_action_action=>'Schema"."Procedure"</code>.</p> <p>PL/SQL procedures with <code>INOUT</code> or <code>OUT</code> arguments are not supported as <code>job_action</code> when the job or program type is <code>STORED_PROCEDURE</code>.</p> For an executable: <p>The action is the name of the external executable, including the full path name, but excluding any command-line arguments. If the action starts with a single question mark ('?'), the question mark is replaced by the path to the Oracle home directory for a local job or to the Scheduler agent home for a remote job. If the action contains an at-sign ('@') and the job is local, the at-sign is replaced with the SID of the current Oracle instance.</p> <p>NOTE: Shell script syntax is not supported, only syntax for the name of and path to an executable is supported.</p> For a chain: <p>The action is the name of a Scheduler chain object. You must specify the schema of the chain if it resides in a different schema than the job.</p> For an external script: <p>The <code>job_action</code> must be either the path to an operating system script or an inline operating system script. If the <code>job_action</code> is a path to a script, then the script must reside on every computer that the job runs on. The <code>job_action</code> may contain calls to SQL*Plus or RMAN executables directly, without having to specify its full path, given that they are stored on their default location for every computer that runs the job.</p> <p>The job can only have arguments that are strings or that can be cast to strings. These arguments are passed positionally when the script is called. The job must point to a credential that contains a valid operating system username and password.</p> For a SQL script:

Table 163-28 (Cont.) CREATE_JOB Procedure Parameters

Parameter	Description
	<p>The <code>job_action</code> must be either the path to a SQL*Plus script or an inline SQL*Plus script. If the <code>job_action</code> is a path to a script, then the script must reside on every computer that the job runs on.</p> <p>The job can only have arguments that are strings or that can be cast to strings. These arguments are passed positionally when the script is called. If the arguments are named, they are also bound to named variables in the SQL*Plus session.</p> <ul style="list-style-type: none"> For a backup script: <p>The <code>job_action</code> is either the path to a RMAN script or an inline RMAN script. If the <code>program_action</code> is a path to a script, then the script must reside on every computer that the program runs on.</p> <p>The job can only have arguments that are strings or that can be cast to strings. These arguments are passed positionally when the script is called.</p>
<code>number_of_arguments</code>	This attribute specifies the number of arguments that the job expects. The range is 0-255, with the default being 0.
<code>program_name</code>	The name of the program associated with this job. If the program is of type EXECUTABLE, the job owner must have the CREATE EXTERNAL JOB system privilege before the job can be enabled or run.
<code>start_date</code>	<p>This attribute specifies the first date and time on which this job is scheduled to start. If <code>start_date</code> and <code>repeat_interval</code> are left null, then the job is scheduled to run as soon as the job is enabled.</p> <p>For repeating jobs that use a calendaring expression to specify the repeat interval, <code>start_date</code> is used as a reference date. The first time the job runs is the first match of the calendaring expression that is on or after the current date and time.</p> <p>The Scheduler cannot guarantee that a job executes on an exact time because the system may be overloaded and thus resources unavailable.</p>
<code>event_condition</code>	This is a conditional expression based on the columns of the event source queue table. The expression must have the syntax of an Advanced Queuing rule. Accordingly, you can include user data properties in the expression provided that the message payload is an object type, and that you prefix object attributes in the expression with <code>tab.user_data</code> . For more information on rules, see the DBMS_AQADM.ADD_SUBSCRIBER procedure.
<code>queue_spec</code>	<p>This argument specifies either of the following:</p> <ul style="list-style-type: none"> The source queue where events that start this particular job are enqueued. If it is secure, then the <code>queue_spec</code> argument is a pair of values of the form <code>queue_name, agent name</code>. If it is not secure, then only the queue name need be provided. If a fully qualified queue name is not provided, the queue is assumed to be in the job owner's schema. In the case of secure queues, the agent name provided should belong to a valid agent that is currently subscribed to the queue. A file watcher name. For more information on this option, see <i>Oracle Database Administrator's Guide</i>.
<code>repeat_interval</code>	<p>This attribute specifies how often the job repeats. You can specify the repeat interval by using calendaring or PL/SQL expressions.</p> <p>The expression specified is evaluated to determine the next time the job should run. If <code>repeat_interval</code> is not specified, the job runs only once at the specified start date. See "Calendaring Syntax" for further information.</p>
<code>schedule_name</code>	The name of the schedule, window, or window group associated with this job.

Table 163-28 (Cont.) CREATE_JOB Procedure Parameters

Parameter	Description
job_class	The class this job is associated with.
end_date	<p>This attribute specifies the date and time after which the job expires and is no longer run. After the end_date, if auto_drop is TRUE, the job is dropped. If auto_drop is FALSE, the job is disabled and the STATE of the job is set to COMPLETED.</p> <p>If no value for end_date is specified, the job repeats forever unless max_runs or max_failures is set, in which case the job stops when either value is reached.</p> <p>The value for end_date must be after the value for start_date. If end_date is less than start_date, then an error will be generated. If end_date is the same as start_date, then the job will not execute and no error will be generated.</p>
comments	This attribute specifies a comment about the job. By default, this attribute is NULL.
job_style	<p>Style of the job being created. This argument can have one of the following values:</p> <ul style="list-style-type: none"> 'REGULAR' creates a regular job. This is the default. 'LIGHTWEIGHT' creates a lightweight job. This value is permitted only when the job references a program object. Use lightweight jobs when you have many short-duration jobs that run frequently. Under certain circumstances, using lightweight jobs can deliver a small performance gain. 'IN_MEMORY_RUNTIME' creates an in-memory runtime job. These jobs are based on lightweight job structures, so the same rules and restrictions apply; however, they further boost performance by keeping an in-memory cache, so they minimize disk access for pre-run and post-run actions. 'IN_MEMORY_FULL' creates an in-memory full job. In-memory full jobs require a program and cannot have a schedule or repeat interval. They run automatically when the job is enabled, and after running they are discarded. They keep all the job information in memory and are not backed up on disk, meaning that they are lost when the instance is rebooted. They are designed to run actions that must be performed immediately with the least amount of overhead possible.
credential_name	<p>The default credential to use with the job. Applicable only to remote database jobs, remote external jobs, local external jobs, script jobs, and event-based jobs that process file arrival events. The credential must exist.</p> <p>For local database jobs, it must be NULL.</p> <p>For local external jobs only, if this attribute is NULL (the default), then a preferred (default) credential is selected. See <i>Oracle Database Administrator's Guide</i> for information about preferred credentials for local external jobs.</p> <p>See also: "CREATE_CREDENTIAL Procedure"</p>

Table 163-28 (Cont.) CREATE_JOB Procedure Parameters

Parameter	Description
destination_name	<p>The database destination or external destination for the job. Use for remote database jobs and remote external jobs only. Must be NULL for jobs running on the local database or for local external jobs (executables).</p> <p>This attribute can be a single destination name or the name of a group of type 'EXTERNAL_DEST' or 'DB_DEST'. The single destination or group must already exist.</p> <p>The following applies to this attribute:</p> <ul style="list-style-type: none"> • If it is a database destination, it must have been created by the CREATE_DATABASE_DESTINATION Procedure. • If it is an external destination, it must have been implicitly created by registering a remote Scheduler agent with the local database. • If it is a group, each member of the group must exist, and the job must run on all destinations named in the group. See "CREATE_GROUP Procedure". <p>destination_name cannot reference a destination group when:</p> <ul style="list-style-type: none"> • The job type is 'CHAIN' • The job style is 'LIGHTWEIGHT', 'IN_MEMORY_RUNTIME', or 'IN_MEMORY_FULL' <p>If the credential_name argument of CREATE_JOB is NULL, each destination must be preceded by a credential, in the following format:</p> <pre>credential.destination</pre> <p>The credential must already exist. If the credential_name argument is provided, then it serves as the default credential for every destination that is not preceded by a credential.</p> <p>You can query the views *_SCHEDULER_DB_DESTS and ALL_SCHEDULER_EXTERNAL_DESTS for existing destinations and *_SCHEDULER_GROUP_MEMBERS for existing groups and their members.</p> <p>*** destination job attribute is deprecated in Oracle Database 11gR2 and superseded by destination_name.</p>
enabled	<p>This attribute specifies whether the job is created enabled or not. The possible settings are TRUE or FALSE. By default, this attribute is set to FALSE and, therefore, the job is created as disabled. A disabled job means that the metadata about the job has been captured, and the job exists as a database object. However, the Scheduler ignores the job and the job coordinator does not pick it for processing. In order for the job coordinator to process the job, the job must be enabled. You can enable a job by setting this argument to TRUE or by using the ENABLE procedure.</p>
auto_drop	<p>This flag, if TRUE, causes a job to be automatically dropped after it has completed or has been automatically disabled. A job is considered completed if:</p> <ul style="list-style-type: none"> • Its end date (or the end date of the job schedule) has passed. Note that a job with a Window schedule will not be auto-dropped when the window closes, because this is not considered to be the end of the Window. • It has run max_runs number of times. max_runs must be set with SET_ATTRIBUTE. • It is not a repeating job and has run once. <p>A job is disabled when it has failed max_failures times. max_failures is also set with SET_ATTRIBUTE.</p> <p>If this flag is set to FALSE, the jobs are not dropped and their metadata is kept until the job is explicitly dropped with the DROP_JOB procedure.</p> <p>By default, jobs are created with auto_drop set to TRUE.</p>

Usage Notes

Jobs are created as disabled by default. You must explicitly enable them so that they will become active and scheduled. Before enabling a job, ensure that all program arguments, if any, are defined, either by defining default values in the program object or by supplying values with the job.

The `JOB_QUEUE_PROCESSES` initialization parameter specifies the maximum number of processes that can be created for the execution of jobs. Beginning with Oracle Database 11g Release 2, `JOB_QUEUE_PROCESSES` applies to `DBMS_SCHEDULER` jobs. Setting this parameter to 0 disables `DBMS_SCHEDULER` jobs.

To create a job in your own schema, you need to have the `CREATE JOB` privilege. A user with the `CREATE ANY JOB` privilege can create a job in any schema. If the job being created will reside in another schema, the job name must be qualified with the schema name. For a job of type `EXECUTABLE` (or for a job that points to a program of type `EXECUTABLE`), the job owner must have the `CREATE EXTERNAL JOB` system privilege before the job can be enabled or run.

Associating a job with a particular class or program requires `EXECUTE` privileges for that class or program.

Not all possible job attributes can be set with `CREATE_JOB`. Some must be set after the job is created. For example, job arguments must be set with the [SET_JOB_ARGUMENT_VALUE Procedure](#) or the [SET_JOB_ANYDATA_VALUE Procedure](#). Other job attributes, such as `job_priority` and `max_runs`, are set with the [SET_ATTRIBUTE Procedure](#).

To create multiple jobs efficiently, use the `CREATE_JOBS` procedure.



Note:

The Scheduler runs event-based jobs for each occurrence of an event that matches the event condition of the job. However, events that occur while the job is already running are ignored; the event gets consumed, but does not trigger another run of the job.

163.6.17 CREATE_JOB_CLASS Procedure

This procedure creates a job class. Job classes are created in the `SYS` schema.

Syntax

```
DBMS_SCHEDULER.CREATE_JOB_CLASS (
  job_class_name          IN VARCHAR2,
  resource_consumer_group IN VARCHAR2 DEFAULT NULL,
  service                 IN VARCHAR2 DEFAULT NULL,
  logging_level           IN PLS_INTEGER
                          DEFAULT DBMS_SCHEDULER.LOGGING_RUNS,
  log_history             IN PLS_INTEGER DEFAULT NULL,
  comments                IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-29 CREATE_JOB_CLASS Procedure Parameters

Parameter	Description
job_class_name	<p>The name to assign to the job class. Job classes can only be created in the SYS schema.</p> <p>This attribute specifies the name of the job class and uniquely identifies the job class. The name must be unique in the SQL namespace. For example, a job class cannot have the same name as a table in a schema.</p>
resource_consumer_group	<p>This attribute specifies the resource consumer group that this class is associated with. A resource consumer group is a set of synchronous or asynchronous sessions that are grouped together based on their processing needs. A job class has a many-to-one relationship with a resource consumer group. The resource consumer group that the job class associates with determines the resources that are allocated to the job class.</p> <p>If a resource consumer group is dropped, job classes associated with it are then associated with the default resource consumer group.</p> <p>If no resource consumer group is specified, job classes are associated with the default resource consumer group.</p> <p>If the specified resource consumer group does not exist when creating the job class, an error occurs.</p>
service	<p>This attribute specifies the database service that the jobs in this class have affinity to. In an Oracle RAC environment, this means that the jobs in this class only run on those database instances that are assigned to the specific service.</p> <p>Note that a service can be mapped to a resource consumer group, so you can also control resources allocated to jobs by specifying a service. See DBMS_RESOURCE_MANAGER.SET_CONSUMER_GROUP_MAPPING for details. If both the resource_consumer_group and service attributes are specified, and if the service is mapped to a resource consumer group, the resource_consumer_group attribute takes precedence.</p> <p>If no service is specified, the job class belongs to the default service, which means it has no service affinity and any one of the database instances within the cluster might run the job. If the service that a job class belongs to is dropped, the job class will then belong to the default service.</p> <p>If the specified service does not exist when creating the job class, then an error occurs.</p>
logging_level	<p>This attribute specifies how much information is logged. The possible options are:</p> <ul style="list-style-type: none"> • DBMS_SCHEDULER.LOGGING_OFF No logging is performed for any jobs in this class. • DBMS_SCHEDULER.LOGGING_RUNS The Scheduler writes detailed information to the job log for all runs of each job in this class. This is the default. • DBMS_SCHEDULER.LOGGING_FAILED_RUNS The Scheduler logs only jobs that failed in this class. • DBMS_SCHEDULER.LOGGING_FULL In addition to recording every run of a job, the Scheduler records all operations performed on all jobs in this class. Every time a job is created, enabled, disabled, altered (with SET_ATTRIBUTE), stopped, and so, an entry is recorded in the log.

Table 163-29 (Cont.) CREATE_JOB_CLASS Procedure Parameters

Parameter	Description
log_history	This attribute controls the number of days that job log entries for jobs in this class are retained. It helps prevent the job log from growing indiscriminately. The range of valid values is 0 through 1000000. If set to 0, no history is kept. If NULL (the default), retention days are set by the log_history Scheduler attribute (set with SET_SCHEDULER_ATTRIBUTE).
comments	This attribute is for an optional comment about the job class. By default, this attribute is NULL.

Usage Notes

For users to create jobs that belong to a job class, the job owner must have EXECUTE privileges on the job class. Therefore, after the job class has been created, EXECUTE privileges must be granted on the job class so that users create jobs belonging to that class. You can also grant the EXECUTE privilege to a role.

Creating a job class requires the MANAGE_SCHEDULER system privilege.

163.6.18 CREATE_JOBS Procedure

This procedure creates multiple jobs and sets the values of their arguments in a single call.

Syntax

```
DBMS_SCHEDULER.CREATE_JOBS (
    jobdef_array      IN SYS.JOB_DEFINITION_ARRAY,
    commit_semantics  IN VARCHAR2 DEFAULT 'STOP_ON_FIRST_ERROR');
```

Parameters

Table 163-30 CREATE_JOBS Procedure Parameters

Parameter	Description
jobdef_array	The array of job definitions. See "Data Structures" for a description of the JOB_DEFINITION_ARRAY and JOB_DEFINITION datatypes.
commit_semantics	The commit semantics. The following types are supported: <ul style="list-style-type: none"> STOP_ON_FIRST_ERROR returns on the first error. Previous successfully created jobs are committed to disk. This is the default. TRANSACTIONAL returns on the first error and everything that happened before that error is rolled back. ABSORB_ERRORS tries to absorb any errors and attempts to create the rest of the jobs on the list. It commits all successfully created jobs. If errors occur, you can query the view SCHEDULER_BATCH_ERRORS for details.

Usage Notes

This procedure creates many jobs in the context of a single transaction. To realize the desired performance gains, the jobs being created must be grouped in batches of sufficient size.

Calling `CREATE_JOBS` with a small array size may not be much faster than calling `CREATE_JOB` once for each job.

You cannot use this procedure to create multiple-destination jobs. That is, the `destination` attribute of the `job_definition` object cannot reference a destination group.

Examples

See *Oracle Database Administrator's Guide*.

163.6.19 CREATE_PROGRAM Procedure

This procedure creates a program.

Syntax

```
DBMS_SCHEDULER.CREATE_PROGRAM (
    program_name          IN VARCHAR2,
    program_type          IN VARCHAR2,
    program_action        IN VARCHAR2,
    number_of_arguments  IN PLS_INTEGER DEFAULT 0,
    enabled               IN BOOLEAN DEFAULT FALSE,
    comments              IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-31 CREATE_PROGRAM Procedure Parameters

Parameter	Description
<code>program_name</code>	The name to assign to the program. The name must be unique in the SQL namespace. For example, a program cannot have the same name as a table in a schema. If no name is specified, then an error occurs.

Table 163-31 (Cont.) CREATE_PROGRAM Procedure Parameters

Parameter	Description
<code>program_type</code>	<p>This attribute specifies the type of program you are creating. If it is not specified then you get an error. These are the supported values for <code>program_type</code>:</p> <ul style="list-style-type: none"> • <code>'PLSQL_BLOCK'</code> This specifies that the program is a PL/SQL block. Job or program arguments are not supported when the job or program type is <code>PLSQL_BLOCK</code>. In this case, the number of arguments must be 0. • <code>'STORED_PROCEDURE'</code> This specifies that the program is a PL/SQL or Java stored procedure, or an external C subprogram. Only procedures, not functions with return values, are supported. PL/SQL procedures with <code>INOUT</code> or <code>OUT</code> arguments are not supported. • <code>'EXECUTABLE'</code> This specifies that the job is going to be run outside the database using an external executable. External programs imply anything that can be executed from the operating system command line. <code>AnyData</code> arguments are not supported with job or program type <code>EXECUTABLE</code>. • <code>'EXTERNAL_SCRIPT'</code> project 25230, this bullet and next two This specifies that the job is an external script that uses the command shell of the computer running the job. For Windows this is <code>cmd.exe</code> and for UNIX based systems the <code>sh</code> shell, unless a different interpreter is specified by prefixing the first line of the script with <code>#!</code>. • <code>'SQL_SCRIPT'</code> This specifies that the program is a SQL*Plus script. A job using this program must point to a credential that contains a valid operating system username and password. The SQL*Plus script is run by SQL*Plus executable. The job using this program may point to a connect credential that contains a database credential. If so, this credential is used to connect to the database before running the SQL*Plus script. Note that if you choose to use connect credential, you must use <code>set_attribute</code> to specify the <code>Connect_Credential_Name</code> attribute. If you do not have connect credential, you must include an explicit SQL*Plus connect statement providing a valid database userid / password. • <code>'BACKUP_SCRIPT'</code> This specifies that the program is an RMAN backup script. The script runs a connect statement that uses either a password or OS authentication before it executes any target commands. The Scheduler uses the RMAN executable from the current Oracle home to run the script and throws an error if this is missing.

Table 163-31 (Cont.) CREATE_PROGRAM Procedure Parameters

Parameter	Description
program_action	<p>This attribute specifies the action of the program. If program_action is not specified, an error is generated.</p> <p>project 25230 last 3 bullets</p> <p>The following actions are possible:</p> <ul style="list-style-type: none"> For a PL/SQL block, the action is to execute PL/SQL code. These blocks must end with a semicolon. For example, <code>my_proc();</code> or <code>BEGIN my_proc(); END;</code> or <code>DECLARE arg pls_integer:= 10; BEGIN my_proc2(arg); END;</code>. <p>Note that the Scheduler wraps job_action in its own block and passes the following to PL/SQL for execution: <code>DECLARE ... BEGIN job_action END;</code> This is done to declare some internal Scheduler variables. You can include any Scheduler metadata attribute except event_message in your PL/SQL code. You use the attribute name as you use any other PL/SQL identifier, and the Scheduler assigns it a value. See Table 163-40 for details on available metadata attributes.</p> <p>If it is an anonymous block, special Scheduler metadata may be accessed using the following variable names: job_name, job_owner, job_start, window_start, window_end. For more information, see the "DEFINE_METADATA_ARGUMENT Procedure".</p> <ul style="list-style-type: none"> For a stored procedure, the action is the name of the stored procedure. You have to specify the schema if the procedure resides in a schema other than the job. If case sensitivity is needed, enclose the schema name and the store procedure name in double quotes. For example, <code>program_action=>'Schema"."Procedure"'</code>. For an executable, the action is the name of the external executable, including the full path name, but excluding any command-line arguments. If the action starts with a single question mark ('?'), the question mark is replaced by the path to the Oracle home directory for a local job or to the Scheduler agent home for a remote job. If the action contains an at sign('@') and the job is local, the at sign is replaced with the SID of the current Oracle instance. For an external script, the action must be either the path to an operating system script or an inline operating system script. If the program_action is a path to a script, then the script must reside on every computer that the program runs on. The program_action may contain calls to SQL*Plus or RMAN executables directly, without having to specify its full path, given that they are stored on their default location for every computer that runs the job. <p>The job can only have arguments that are strings or that can be cast to strings. These arguments are passed positionally when the script is called. The program points</p>

Table 163-31 (Cont.) CREATE_PROGRAM Procedure Parameters

Parameter	Description
	<p>to a credential that contains a valid operating system username and password.</p> <ul style="list-style-type: none"> For a SQL script, the action must be either the path to a SQL*Plus script or an inline SQL*Plus script. If the <code>program_action</code> is a path to a script, then the script must reside on every computer that the program runs on. The job can only have arguments that are strings or that can be cast to strings. These arguments are passed positionally when the script is called. If the arguments are named, they are also bound to named variables in the SQL*Plus session. For a backup script, the action must be either the path to a RMAN script or an inline RMAN script. If the <code>program_action</code> is a path to a script, then the script must reside on every computer that the program runs on. The job can only have arguments that are strings or that can be cast to strings. These arguments are passed positionally when the script is called.
<code>number_of_arguments</code>	<p>This attribute specifies the number of arguments the program takes. If this parameter is not specified, then the default is 0. A program can have a maximum of 255 arguments.</p> <p>If the <code>program_type</code> is <code>PLSQL_BLOCK</code>, then this parameter is ignored.</p>
<code>enabled</code>	<p>This flag specifies whether the program should be created as enabled or not. If the flag is set to <code>TRUE</code>, then validity checks are made and the program is created as <code>ENABLED</code> if all the checks be successful. By default, this flag is set to <code>FALSE</code>, meaning not created enabled. You can also call the <code>ENABLE</code> procedure to enable the program before it can be used.</p>
<code>comments</code>	<p>A comment about the program. By default, this attribute is <code>NULL</code>.</p>

Usage Notes

To create a program in their own schema, users need the `CREATE JOB` privilege. A user with the `CREATE ANY JOB` privilege can create a program in any schema. A program is created in a disabled state by default (unless the `enabled` parameter is set to `TRUE`). It cannot be executed by a job until it is enabled.

To use your programs, other users must have `EXECUTE` privileges, therefore once a program has been created, you have to grant `EXECUTE` privileges on it.



See Also:

["DEFINE_PROGRAM_ARGUMENT Procedure"](#)

163.6.20 CREATE_RESOURCE Procedure

This procedure allows users to specify the resources used by jobs or to create a new resource.

Syntax

```
DBMS_SCHEDULER.CREATE_RESOURCE (
  resource_name  IN VARCHAR2,
  units          IN PLS_INTEGER,
  status         IN VARCHAR2 DEFAULT 'ENFORCE_CONSTRAINTS',
  constraint_level IN VARCHAR2 DEFAULT 'JOB_LEVEL',
  comments       IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-32 CREATE_RESOURCE Procedure Parameters

Parameter	Description
resource_name	The name of the resource.
units	The number of units of this resource that the job or program uses.
status	The status of the resource. <ul style="list-style-type: none"> 'ENFORCE_CONSTRAINTS'. This is the default value, and when set, will force the scheduler to enforce resource limits. When the maximum number of units of this resource has been reached no additional jobs using this resource will get started. 'IGNORE_CONSTRAINTS'. When set, the scheduler will ignore any constraints on this resource. 'BLOCKED_ALL_JOBS'. No jobs having a constraint on this resource will be allowed to run. The resource is considered to be permanently blocking until switched to one of the other two states.
constraint_level	Level of the constraint: <code>JOB_LEVEL</code> or <code>PROGRAM_LEVEL</code> . For incompatibilities, for <code>JOB_LEVEL</code> , the incompatibility members must be jobs; for <code>PROGRAM_LEVEL</code> the incompatibility members must be programs.
comments	Descriptive comment about the resource.

Usage Notes

The following example creates a new resource.

```
BEGIN
  DBMS_SCHEDULER.CREATE_RESOURCE(
    resource_name => 'my_resource',
    units => 3,
    state => 'ENFORCE_CONSTRAINTS',
    comments => 'Resource1'
  )
END;
/
```



See Also:

- [Creating or Dropping a Resource in Oracle Database Administrator's Guide](#)
- [SET_RESOURCE_CONSTRAINT Procedure](#)

163.6.21 CREATE_SCHEDULE Procedure

This procedure creates a schedule.

Syntax

```
DBMS_SCHEDULER.CREATE_SCHEDULE (
    schedule_name      IN VARCHAR2,
    start_date         IN TIMESTAMP WITH TIMEZONE DEFAULT NULL,
    repeat_interval    IN VARCHAR2,
    end_date           IN TIMESTAMP WITH TIMEZONE DEFAULT NULL,
    comments           IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-33 CREATE_SCHEDULE Procedure Parameters

Parameter	Description
schedule_name	The name to assign to the schedule. The name must be unique in the SQL namespace. For example, a schedule cannot have the same name as a table in a schema. If no name is specified, then an error occurs.
start_date	This attribute specifies the first date and time on which this schedule becomes valid. For a repeating schedule, the value for start_date is a reference date. In this case, the start of the schedule is not the start_date; it depends on the repeat interval specified. start_date is used to determine the first instance of the schedule. If start_date is specified in the past and no value for repeat_interval is specified, the schedule is invalid. For a repeating job or window, start_date can be derived from the repeat_interval if it is not specified. If start_date is null, then the date that the job or window is enabled is used. start_date and repeat_interval cannot both be null.
repeat_interval	This attribute specifies how often the schedule repeats. It is expressed using calendaring syntax. See " Calendaring Syntax " for further information. PL/SQL expressions are not allowed as repeat intervals for named schedules.
end_date	The date and time after which jobs will not run and windows will not open. A non-repeating schedule that has no end_date is valid forever. end_date has to be after the start_date. If this is not the case, then an error is generated when the schedule is created.
comments	This attribute specifies an optional comment about the schedule. By default, this attribute is NULL.

Usage Notes

This procedure requires the `CREATE JOB` privilege to create a schedule in your own schema or the `CREATE ANY JOB` privilege to create a schedule in someone else's schema by specifying `schema.schedule_name`. Once a schedule has been created, it can be used by other users. The schedule is created with access to `PUBLIC`. Therefore, there is no need to explicitly grant access to the schedule.

163.6.22 CREATE_WINDOW Procedure

This procedure creates a recurring time window and associates it with a resource plan. You can then use the window to schedule jobs that run under the associated resource plan. Windows are created in the `SYS` schema.

The procedure is overloaded.

Syntax

Creates a window using a named schedule object:

```
DBMS_SCHEDULER.CREATE_WINDOW (
  window_name          IN VARCHAR2,
  resource_plan        IN VARCHAR2,
  schedule_name        IN VARCHAR2,
  duration              IN INTERVAL DAY TO SECOND,
  window_priority      IN VARCHAR2 DEFAULT 'LOW',
  comments              IN VARCHAR2 DEFAULT NULL);
```

Creates a window using an inlined schedule:

```
DBMS_SCHEDULER.CREATE_WINDOW (
  window_name          IN VARCHAR2,
  resource_plan        IN VARCHAR2,
  start_date           IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
  repeat_interval      IN VARCHAR2,
  end_date             IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
  duration              IN INTERVAL DAY TO SECOND,
  window_priority      IN VARCHAR2 DEFAULT 'LOW',
  comments              IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-34 CREATE_WINDOW Procedure Parameters

Parameter	Description
<code>window_name</code>	The name to assign to the window. The name must be unique in the SQL namespace. All windows are in the <code>SYS</code> schema, so the preface 'SYS' is optional.

Table 163-34 (Cont.) CREATE_WINDOW Procedure Parameters

Parameter	Description
resource_plan	<p>This attribute specifies the resource plan that automatically activates when the window opens. When the window closes, the system switches to the appropriate resource plan, which is usually the plan that was in effect before the window opened, but can also be the plan of a different window.</p> <p>Only one resource plan can be associated with a window. It may be NULL or the empty string (""). When it is NULL, the resource plan in effect when the window opens stays in effect for the duration of the window. When it is the empty string, the resource manager is disabled for the duration of the window.</p> <p>If the window is open and the resource plan is dropped, then the resource allocation for the duration of the window is not affected.</p>
start_date	<p>This attribute specifies the first date and time on which this window is scheduled to open. If the value for start_date specified is in the past or is not specified, the window opens as soon as it is created.</p> <p>For repeating windows that use a calendaring expression to specify the repeat interval, the value for start_date is a reference date. The first time the window opens depends on the repeat interval specified and the value for start_date.</p>
duration	<p>This attribute specifies how long the window stays open. For example, 'interval '5' hour' for five hours. There is no default value for this attribute. Therefore, if no value is specified when the window is created, an error occurs. The duration is of type interval day to seconds and ranges from one minute to 99 days.</p>
schedule_name	<p>This attribute specifies the name of the schedule associated with the window.</p>
repeat_interval	<p>This attribute specifies how often the window repeats. It is expressed using the Scheduler calendaring syntax. See "Calendaring Syntax" for more information.</p> <p>A PL/SQL expression cannot be used to specify the repeat interval for a window.</p> <p>The expression specified is evaluated to determine the next time the window opens. If no repeat_interval is specified, the window opens only once at the specified start date.</p>
end_date	<p>This attribute specifies the date and time after which the window no longer opens. When the value for end_date is reached, the window is disabled. In the *_SCHEDULER_WINDOWS views, the enabled flag of the window is set to FALSE.</p> <p>A non-repeating window that has no value for end_date opens only once for the duration of the window. For a repeating window, if no end_date is specified, then the window keeps repeating forever.</p> <p>The end_date must be after the start_date. If it is not, then an error is generated when the window is created.</p>

Table 163-34 (Cont.) CREATE_WINDOW Procedure Parameters

Parameter	Description
window_priority	This attribute is only relevant when two windows overlap. Because only one window can be in effect at one time, the window priority determines which window opens. The two possible values for this attribute are 'HIGH' and 'LOW'. A high priority window has precedence over a low priority window, therefore, the low priority window does not open if it overlaps a high priority window. By default, windows are created with priority 'LOW'.
comments	This attribute specifies an optional comment about the window. By default, this attribute is NULL.

Usage Notes

Creating a window requires the `MANAGE SCHEDULER` privilege.

Scheduler windows are the principal mechanism used to automatically switch resource plans according to a schedule. You can also manually activate a resource plan by using the `ALTER SYSTEM SET RESOURCE_MANAGER_PLAN` statement or the `DBMS_RESOURCE_MANAGER.SWITCH_PLAN` package procedure. Note that either of these manual methods can also disable resource plan switching by Scheduler windows. For more information, see *Oracle Database Administrator's Guide* and "[SWITCH_PLAN Procedure](#)".

163.6.23 DEFINE_ANYDATA_ARGUMENT Procedure

This procedure defines a name or default value for a program argument that is of a complex type and must be encapsulated within an `ANYDATA` object. A job that references the program can override the default value.

Syntax

```
DBMS_SCHEDULER.DEFINE_ANYDATA_ARGUMENT (
    program_name          IN VARCHAR2,
    argument_position     IN PLS_INTEGER,
    argument_name         IN VARCHAR2 DEFAULT NULL,
    argument_type         IN VARCHAR2,
    default_value         IN SYS.ANYDATA,
    out_argument          IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-35 DEFINE_ANYDATA_ARGUMENT Procedure Parameters

Parameter	Description
program_name	The name of the program to be altered. A program with this name must exist.
argument_position	The position of the argument as it is passed to the executable. Argument numbers go from one to the <code>number_of_arguments</code> specified for the program. This must be unique, so it can replace any argument already defined at this position.

Table 163-35 (Cont.) DEFINE_ANYDATA_ARGUMENT Procedure Parameters

Parameter	Description
argument_name	The name to assign to the argument. It is optional, but must be unique for the program if it is specified. If you assign a name, the name can then be used by other package procedures, including the SET_JOB_ANYDATA_VALUE Procedure .
argument_type	The datatype of the argument being defined. This is not verified or used by the Scheduler. It is only used by the user of the program when deciding what value to assign to the argument.
default_value	The default value to be assigned to the argument encapsulated within an AnyData object. This is optional.
out_argument	This parameter is reserved for future use. It must be set to FALSE.

Usage Notes

All program arguments from one to the `number_of_arguments` value must be defined before a program can be enabled. If a default value for an argument is not defined with this procedure, a value must be defined in the job.

Defining a program argument requires that you be the owner of the program or have ALTER privileges on that program. You can also define a program argument if you have the CREATE ANY JOB privilege.

 **See Also:**

- ["DEFINE_PROGRAM_ARGUMENT Procedure"](#)
- ["SET_JOB_ANYDATA_VALUE Procedure"](#)

163.6.24 DEFINE_CHAIN_EVENT_STEP Procedure

This procedure adds or replaces a chain step and associates it with an event schedule or an inline event.

Once started in a running chain, this step does not complete until the specified event has occurred. Every step in a chain must be defined before the chain can be enabled and used. Defining a step gives it a name and specifies what happens during the step. If a step already exists with this name, the new step replaces the old one.

Syntax

```
DBMS_SCHEDULER.DEFINE_CHAIN_EVENT_STEP (
    chain_name          IN VARCHAR2,
    step_name           IN VARCHAR2,
    event_schedule_name IN VARCHAR2,
    timeout             IN INTERVAL DAY TO SECOND DEFAULT NULL);
```

```
DBMS_SCHEDULER.DEFINE_CHAIN_EVENT_STEP (
    chain_name          IN VARCHAR2,
```

```

step_name          IN VARCHAR2,
event_condition    IN VARCHAR2,
queue_spec         IN VARCHAR2,
timeout           IN INTERVAL DAY TO SECOND DEFAULT NULL);

```

Parameters

Table 163-36 DEFINE_CHAIN_EVENT_STEP Procedure Parameters

Parameter	Description
chain_name	The name of the chain that the step is in
step_name	The name of the step
event_schedule_name	The name of the event schedule that the step waits for
timeout	This parameter is reserved for future use
event_condition	See the CREATE_EVENT_SCHEDULE Procedure
queue_spec	See the CREATE_EVENT_SCHEDULE Procedure

Usage Notes

Defining a chain step requires ALTER privileges on the chain either as the owner of the chain, or as a user with the ALTER object privilege on the chain or the CREATE ANY JOB system privilege.

You can base a chain step on a file watcher as well. To do this, provide the file watcher name directly in the queue_spec parameter, or use a file watcher schedule for the event_schedule_name parameter.



See Also:

"[DEFINE_CHAIN_STEP Procedure](#)"

163.6.25 DEFINE_CHAIN_RULE Procedure

This procedure adds a new rule to an existing chain, specified as a condition-action pair. The condition is expressed using either SQL or the Scheduler chain condition syntax and indicates the prerequisites for the action to occur. The action is a result of the condition being met.

An actual rule object is created to store the rule in the schema where the chain resides. If a rule name is given, this name is used for the rule object. If an existing rule name in the schema of the chain is given, the existing rule is altered. (A schema different than the schema of the chain cannot be specified). If no rule name is given, one is generated in the form SCHED_RULE\${N}.

Syntax

```

DBMS_SCHEDULER.DEFINE_CHAIN_RULE (
  chain_name      IN VARCHAR2,
  condition       IN VARCHAR2,
  action          IN VARCHAR2,

```



```
rule_name          IN VARCHAR2 DEFAULT NULL,
comments          IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-37 DEFINE_CHAIN_RULE Procedure Parameters

Parameter	Description
chain_name	The name of the chain to alter
condition	<p>A boolean expression which must evaluate to <code>TRUE</code> for the action to be performed. Every chain must have a rule that evaluates to <code>TRUE</code> to start the chain. For this purpose, you can use a rule that has 'TRUE' as its condition if you are using Scheduler chain condition syntax, or '1=1' as its condition if you are using SQL syntax.</p> <ul style="list-style-type: none"> Scheduler Chain Condition Syntax See "Scheduler Chain Condition Syntax" and <i>Oracle Database Administrator's Guide</i> for details SQL WHERE Clause Syntax Conditions expressed with SQL must use the syntax of a SELECT statement WHERE clause. You can refer to chain step attributes by using the chain step name as a bind variable. The bind variable syntax is <code>:step_name.attribute</code>. (<code>step_name</code> refers to a typed object.) Possible attributes are: <code>completed</code>, <code>state</code>, <code>start_date</code>, <code>end_date</code>, <code>error_code</code>, and <code>duration</code>. Possible values for the state attribute include: 'NOT_STARTED', 'SCHEDULED', 'RUNNING', 'PAUSED', 'STALLED', 'SUCCEEDED', 'FAILED', and 'STOPPED'. If a step is in the state 'SUCCEEDED', 'FAILED', or 'STOPPED', its completed attribute is set to 'TRUE', otherwise completed is 'FALSE'.
action	<p>The action to be performed when the rule evaluates to <code>TRUE</code>. The action must consist of at least one keyword with an optional value and an optional delay clause.</p> <p>Possible actions include:</p> <ul style="list-style-type: none"> <code>[AFTER delay_interval] START step_1[,step_2 ...]</code> <code>STOP step_1[,step_2 ...]</code> <code>END [{end_value step_name.error_code}]</code> <p>At the beginning of the START action, a delay clause can specify a delay interval before performing the action. <code>delay_interval</code> is a formatted datetime interval of the form <code>HH:MM:SS</code>.</p> <p>The END action ends the chain with an error code equal to either the supplied <code>end_value</code> or the error code that <code>step_name</code> completes with. The default error code is 0, indicating a successful chain run.</p>
rule_name	The name of the rule being created. If no <code>rule_name</code> is given, one is generated in the form <code>SCHED_RULE\$_{N}</code> .
comments	An optional comment describing the rule. This is stored in the rule object created.

Scheduler Chain Condition Syntax

The Scheduler chain condition syntax provides an easy way to construct a condition using the states and error codes of steps in the current chain.

Chain Condition Syntax

The following are the available constructs for Scheduler chain condition syntax, which are all boolean expressions:

```

TRUE
FALSE
stepname [NOT] SUCCEEDED
stepname [NOT] FAILED
stepname [NOT] STOPPED
stepname [NOT] COMPLETED
stepname ERROR_CODE IN (integer, integer, integer ...)
stepname ERROR_CODE NOT IN (integer, integer, integer ...)
stepname ERROR_CODE = integer
stepname ERROR_CODE != integer
stepname ERROR_CODE <> integer
stepname ERROR_CODE > integer
stepname ERROR_CODE >= integer
stepname ERROR_CODE < integer
stepname ERROR_CODE <= integer

```

These boolean operators are available to create more complex conditions:

```

expression AND expression
expression OR expression
NOT (expression)

```

integer can be positive or negative. Parentheses may be used for clarity or to enforce ordering. You must use parentheses with the `NOT` operator.

PL/SQL code that runs as part of a step can set the value of `ERROR_CODE` for that step with the `RAISE_APPLICATION_ERROR` statement.

Usage Notes

Defining a chain rule requires `ALTER` privileges on the chain (either as the owner, or as a user with `ALTER` privileges on the chain or the `CREATE ANY JOB` system privilege).

You must define at least one rule that starts the chain and at least one that ends it. See the section "Adding Rules to a Chain" in *Oracle Database Administrator's Guide* for more information.

Examples

The following are examples of using rule conditions and rule actions.

Rule Conditions Using Scheduler Chain Condition Syntax

```

'step1 completed'
-- satisfied when step step1 has completed. (step1 completed is also TRUE when
any
-- of the following are TRUE: step1 succeeded, step1 failed, step1 stopped.)

'step1 succeeded and step2 succeeded'
-- satisfied when steps step1 and step2 have both succeeded

'step1 error_code > 100'
-- satisfied when step step1 has failed with an error_code greater than 100

'step1 error_code IN (1, 3, 5, 7)'
-- satisfied when step step1 has failed with an error_code of 1, 3, 5, or 7

```

Rule Conditions Using SQL Syntax

```
':step1.completed = 'TRUE' AND :step1.end_date >SYSDATE-1/24'
--satisfied when step step1 completed less than an hour ago

':step1.duration > interval '5' minute'
-- satisfied when step step1 has completed and took longer than 5 minutes to complete
```

Rule Actions

```
'AFTER 01:00:00 START step1, step2'
--After an hour start steps step1 and step2

'STOP step1'
--Stop step step1

END step4.error_code'
--End the chain with the error code that step step4 finished with. If step4 has not
completed, the chain will be ended unsuccessfully with error code 27435.

'END' or 'END 0'
--End the chain successfully (with error_code 0)

'END 100'
--End the chain unsuccessfully with error code 100.
```

163.6.26 DEFINE_CHAIN_STEP Procedure

This procedure adds or replaces a chain step and associates it with a program or a nested chain. When the chain step is started, the specified program or chain is run. If a step already exists with the name supplied in the `chain_name` argument, the new step replaces the old one.

The chain owner must have `EXECUTE` privileges on the program or chain associated with the step. Only one program or chain can run during a step.

You cannot set all possible step attributes with this procedure. Use the `ALTER_CHAIN` procedure to set additional chain step attributes, such as `credential_name` and `destination_name`.

Syntax

```
DBMS_SCHEDULER.DEFINE_CHAIN_STEP (
    chain_name          IN VARCHAR2,
    step_name           IN VARCHAR2,
    program_name        IN VARCHAR2);
```

Parameters

Table 163-38 DEFINE_CHAIN_STEP Procedure Parameters

Parameter	Description
<code>chain_name</code>	The name of the chain to alter.
<code>step_name</code>	The name of the step being defined. If a step already exists with this name, the new step replaces the old one.

Table 163-38 (Cont.) DEFINE_CHAIN_STEP Procedure Parameters

Parameter	Description
program_name	The name of a program or chain to run during this step. The chain owner must have EXECUTE privileges on this program or chain.

Usage Notes

Defining a chain step requires ALTER privileges on the chain (either as the owner, or a user with ALTER privileges on the chain or the CREATE ANY JOB system privilege).



See Also:

- ["ALTER_CHAIN Procedure"](#)
- ["DEFINE_CHAIN_EVENT_STEP Procedure"](#)

163.6.27 DEFINE_METADATA_ARGUMENT Procedure

This procedure defines a special metadata argument for the program. The Scheduler can pass Scheduler metadata through this argument to your stored procedure or other executable. You cannot set values for jobs using this argument.

Syntax

```
DBMS_SCHEDULER.DEFINE_METADATA_ARGUMENT (
  program_name          IN VARCHAR2,
  metadata_attribute    IN VARCHAR2,
  argument_position     IN PLS_INTEGER,
  argument_name         IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-39 DEFINE_METADATA_ARGUMENT Procedure Parameters

Parameter	Description
program_name	The name of the program to be altered
metadata_attribute	The metadata to be passed. Valid metadata attributes are: 'job_name', 'job_subname', 'job_owner', 'job_start', 'window_start', 'window_end', and 'event_message'. Table 163-40 describes these attributes in detail.
argument_position	The position of the argument as it is passed to the executable. The position cannot be greater than the number_of_arguments specified for the program. It must be unique, so it replaces any argument already defined at this position.
argument_name	The name to assign to the argument. It is optional, but must be unique for the program if it is specified. If you assign a name, the name can then be used by other package procedures.

Table 163-40 Metadata Attributes

Metadata Attribute	Datatype	Description
job_name	VARCHAR2	Name of the currently running job
job_subname	VARCHAR2	Subname of the currently running job. The name + subname form a unique identifier for a job that is running a chain step. NULL if the job is not part of a chain.
job_owner	VARCHAR2	Owner of the currently running job
job_scheduled_start	TIMESTAMP WITH TIME ZONE	When the currently running job was scheduled to start
job_start	TIMESTAMP WITH TIME ZONE	When the currently running job started
window_start	TIMESTAMP WITH TIME ZONE	If the job was started by a window, the time that the window opened
window_end	TIMESTAMP WITH TIME ZONE	If the job was started by a window, the time that the window is scheduled to close
event_message	(See Description)	For an event-based job, the message content of the event that started the job. The datatype of this attribute depends on the queue used for the event. It has the same type as the USER_DATA column of the queue table. In the case of a file arrival event, event_message is of type SYS.SCHEDULER_FILEWATCHER_RESULT. See "SCHEDULER_FILEWATCHER_RESULT Object Type".

Usage Notes

Defining a program argument requires that you be the owner of the program or have ALTER privileges on that program. You can also define a program argument if you have the CREATE ANY JOB privilege.

All metadata attributes except event_message can be used in PL/SQL blocks that you enter into the job_action or program_action attributes of jobs or programs, respectively. You use the attribute name as you use any other PL/SQL identifier, and the Scheduler assigns it a value.

163.6.28 DEFINE_PROGRAM_ARGUMENT Procedure

This procedure defines a name or default value for a program argument. If no default value is defined for a program argument, the job that references the program must supply an argument value. (The job can also override a default value.)

This procedure is overloaded.

Syntax

Defines a program argument without a default value:

```
PROCEDURE define_program_argument(
    program_name          IN VARCHAR2,
    argument_position     IN PLS_INTEGER,
    argument_name         IN VARCHAR2 DEFAULT NULL,
    argument_type         IN VARCHAR2,
    out_argument          IN BOOLEAN DEFAULT FALSE);
```

Defines a program argument with a default value:

```
PROCEDURE define_program_argument(
    program_name          IN VARCHAR2,
    argument_position     IN PLS_INTEGER,
    argument_name         IN VARCHAR2 DEFAULT NULL,
    argument_type         IN VARCHAR2,
    default_value         IN VARCHAR2,
    out_argument          IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-41 DEFINE_PROGRAM_ARGUMENT Procedure Parameters

Parameter	Description
program_name	The name of the program to be altered. A program with this name must exist.
argument_position	The position of the argument as it is passed to the executable. Argument numbers go from one to the <code>number_of_arguments</code> specified for the program. This must be unique so it replaces any argument already defined at this position.
argument_name	The name to assign to the argument. It is optional, but must be unique for the program if specified. If you assign a name, the name can then be used by other package procedures, including the SET_JOB_ARGUMENT_VALUE Procedure .
argument_type	The datatype of the argument being defined. This is not verified or used by the Scheduler. The program user uses <code>argument_type</code> when deciding what value to assign to the argument. Any valid SQL datatype is allowed.
default_value	The default value to be assigned to the argument if none is specified by the job.
out_argument	This parameter is reserved for future use. It must be set to <code>FALSE</code> .

Usage Notes

All program arguments from 1 to the `number_of_arguments` value must be defined before a program can be enabled. If a default value for an argument is not defined with this procedure, a value must be defined in the job.

Defining a program argument requires that you be the owner of the program or have `ALTER` privileges on that program. You can also define a program argument if you have the `CREATE ANY JOB` privilege.

`DEFINE_PROGRAM_ARGUMENT` only supports arguments of SQL type. Therefore, argument values that are not of SQL type, such as booleans, are not supported as program or job arguments.

See Also:

- ["DEFINE_ANYDATA_ARGUMENT Procedure"](#)
- ["SET_JOB_ARGUMENT_VALUE Procedure"](#)

163.6.29 DISABLE Procedure

This procedure disables a program, job, chain, window, database destination, external destination, file watcher, or group. When an object is disabled, its `enabled` attribute is set to `FALSE`.

Syntax

```
DBMS_SCHEDULER.DISABLE (
    name           IN VARCHAR2,
    force          IN BOOLEAN DEFAULT FALSE,
    commit_semantics IN VARCHAR2 DEFAULT 'STOP_ON_FIRST_ERROR');
```

Parameters

Table 163-42 DISABLE Procedure Parameters

Parameter	Description
<code>name</code>	The name of the object being disabled. Can be a comma-delimited list. If a job class name is specified, then all the jobs in the job class are disabled. The job class is not disabled. If a group name is specified, then the group is disabled, but the enabled state of the group members is unaffected.
<code>force</code>	If <code>TRUE</code> , objects are disabled even if other objects depend on them. See the usage notes for more information.
<code>commit_semantics</code>	The commit semantics. The following types are supported: <ul style="list-style-type: none"> <code>STOP_ON_FIRST_ERROR</code>: The procedure returns on the first error and the previous disable operations that were successful are committed to disk. This is the default. <code>TRANSACTIONAL</code>: The procedure returns on the first error and everything that happened before that error is rolled back. This type is only supported when disabling a job or a list of jobs. In addition, this type is not supported when <code>force</code> is set to <code>TRUE</code>. <code>ABSORB_ERRORS</code>: The procedure tries to absorb any errors and disable the rest of the jobs and commits all the disable operations that were successful. If errors occur, you can query the view <code>SCHEDULER_BATCH_ERRORS</code> for details. This type is only supported when disabling a job or a list of jobs.

Usage Notes

Windows must be preceded by `SYS`.

Disabling an object that is already disabled does not generate an error.

The purpose of the `force` option is to point out dependencies. No dependent objects are altered.

To run `DISABLE` for a window or a group of type `WINDOW`, you must have the `MANAGE SCHEDULER` privilege.

You can use `DISABLE` with any schema except the `SYS` schema.

Jobs

Disabling a job means that, although the metadata of the job is there, it should not run and the job coordinator will not pick up these jobs for processing. When a job is disabled, its `state` in the job queue is changed to `disabled`.

If `force` is set to `FALSE` and the job is currently running, an error is returned.

If `force` is set to `TRUE`, the job is disabled, but the currently running instance is allowed to finish.

For jobs with multiple destinations, you cannot disable a child job at a specific destination. Instead, you can disable the destination.

Programs

When a program is disabled, the status is changed to `disabled`. A disabled program implies that, although the metadata is still there, jobs that point to this program cannot run.

If `force` is set to `FALSE`, the program must not be referenced by any job, otherwise an error will occur.

If `force` is set to `TRUE`, those jobs that point to the program will not be disabled, however, they will fail at runtime because their program will not be valid.

Running jobs that point to the program are not affected by the `DISABLE` call and are allowed to continue.

No arguments that pertain to the program are affected when the program is disabled.

File Watchers

If `force` is set to `FALSE`, the file watcher must not be referenced by any job, otherwise an error will occur. If you force disabling a file watcher, jobs that depend on it become disabled.

Windows

This means that the window will not open, however, the metadata of the window is still there, so it can be reenabled.

If `force` is set to `FALSE`, the window must not be open or referenced by any job otherwise an error occurs.

If `force` is set to `TRUE`, disabling a window that is open will succeed but the window will not be closed. It will prevent the window from opening in the future until it is reenabled.

When the window is disabled, those jobs that have the window as their schedule will not be disabled.

Window Groups

When a group of type `WINDOW` is disabled, jobs (other than a running job) that have the window group as their schedule will not run when the member windows open. However, a job that has one of the window group members as its schedule still runs.

The metadata of the window group is still there, so it can be reenabled. Note that the members of the window group will still open.

If `force` is set to `FALSE`, the window group must not have any members that are open or referenced by any job, otherwise an error will occur.

If `force` is set to `TRUE`:

- The window group is disabled and the open window will be not closed or disabled. It will be allowed to continue to its end.
- The window group is disabled but those jobs that have the window group as their schedule will not be disabled.

Job Chains

When a chain is disabled, the metadata for the chain is still there, but jobs that point to it will not be able to be run. This allows changes to the chain to be made safely without the risk of having an incompletely specified chain run. If `force` is set to `FALSE`, the chain must not be referenced by any job, otherwise an error will occur. If `force` is set to `TRUE`, those jobs that point to the chain will not be disabled, however, they will fail at runtime. Running jobs that point to this chain are not affected by the `DISABLE` call and are allowed to complete.

Database Destinations

When you disable a database destination:

- The destination is skipped when a multiple destination job runs.
- If all destinations are disabled for a job, the Scheduler generates an error when it attempts to run the job.
- The `REFS_ENABLED` column in `*_SCHEDULER_JOB_DESTS` is set to `FALSE` for all jobs that reference the database destination.

External Destinations

When you disable an external destination:

- Dependent database destinations remain enabled, but the Scheduler generates an error when it attempts to run a job with a database destination that depends on the external destination.
- The `REFS_ENABLED` column in `*_SCHEDULER_JOB_DESTS` is set to `FALSE` for all external jobs that reference the external destination and for all database jobs with a database destination that depends on the external destination.

Groups

If you disable an external destination group or database destination group, the Scheduler generates an error when it attempts to run a job that names the group as its destination.

163.6.30 DROP_AGENT_DESTINATION Procedure

This procedure drops one or more external destinations, also known as agent destinations. It should be used only when the preferred method of dropping an external destination, using the `schagent` utility to unregister a Scheduler agent with a database, is unavailable due to failures.

This procedure can be called only by the `SYS` user or a user with the `MANAGE SCHEDULER` privilege.

**Note:**

External destinations are created on a source database only implicitly by registering an agent with the database. There is no user-callable `CREATE_AGENT_DESTINATION` procedure.

Syntax

```
DBMS_SCHEDULER.DROP_AGENT_DESTINATION (
    destination_name      IN VARCHAR2);
```

Parameters**Table 163-43 DROP_AGENT_DESTINATION Procedure Parameters**

Parameter	Description
<code>destination_name</code>	<p>A comma-separated list of external destinations to drop. Because user <code>SYS</code> owns all external destinations, do not prefix them with a schema name.</p> <p>The procedure stops processing if it encounters an external destination that does not exist. All external destinations processed before the error are dropped.</p> <p>Cannot be <code>NULL</code>.</p>

Usage Notes

When an external destination is dropped:

- All database destinations that refer to the external destination are disabled and their `agent` attribute is set to `NULL`.
- Members of external destination groups that refer to the destination are removed from the group.
- All job instances in the `*_SCHEDULER_JOB_DESTS` views that refer to the external destination are also dropped.
- Jobs running against the destination are stopped.

163.6.31 DROP_CHAIN Procedure

This procedure drops an existing chain.

Syntax

```
DBMS_SCHEDULER.DROP_CHAIN (
    chain_name      IN VARCHAR2,
    force           IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-44 DROP_CHAIN Procedure Parameters

Parameter	Description
chain_name	The name of the chain to drop. Can also be a comma-delimited list of chains.
force	If <code>force</code> is set to <code>FALSE</code> , the chain must not be referenced by any job, otherwise an error will occur. If <code>force</code> is set to <code>TRUE</code> , all jobs pointing to the chain are disabled before the chain is dropped. Running jobs that point to this chain are stopped before the chain is dropped.

Usage Notes

Dropping a chain requires alter privileges on the chain (either as the owner, or a user with `ALTER` privileges on the chain or the `CREATE ANY JOB` system privilege).

All steps associated with the chain are dropped. If no rule set was specified when the chain was created, then the automatically created rule set and evaluation context associated with the chain are also dropped, so the user must have the privileges required to do this. See the `DBMS_RULE_ADM.DROP_RULE_SET` and `DBMS_RULE_ADM.DROP_EVALUATION_CONTEXT` procedures for more information.

If `force` is `FALSE`, no jobs may be using this chain. If `force` is `TRUE`, any jobs that use this chain are disabled before the chain is dropped (and any of these jobs that are running will be stopped).

163.6.32 DROP_CHAIN_RULE Procedure

This procedure removes a rule from an existing chain. The rule object corresponding to this rule will also be dropped. The chain will not be disabled. If dropping this rule makes the chain invalid, the user should first disable the chain to ensure that it does not run.

Syntax

```
DBMS_SCHEDULER.DROP_CHAIN_RULE (
    chain_name      IN VARCHAR2,
    rule_name       IN VARCHAR2,
    force           IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-45 DROP_CHAIN_RULE Procedure Parameters

Parameter	Description
chain_name	The name of the chain to alter
rule_name	The name of the rule to drop
force	If <code>force</code> is set to <code>TRUE</code> , the drop operation proceeds even if the chain is currently running. The running chain is not stopped or interrupted. If <code>force</code> is set to <code>FALSE</code> and the chain is running, an error is generated.

Usage Notes

Dropping a chain rule requires alter privileges on the chain (either as the owner or as a user with ALTER privileges on the chain or the CREATE ANY JOB system privilege).

Dropping a chain rule also drops the underlying rule database object so you must have the privileges to drop this rule object. See the DBMS_RULE_ADM.DROP_RULE procedure for more information.

163.6.33 DROP_CHAIN_STEP Procedure

This procedure drops a chain step. If this chain step is still used in the chain rules, the chain will be disabled.

Syntax

```
DBMS_SCHEDULER.DROP_CHAIN_STEP (
  chain_name          IN VARCHAR2,
  step_name           IN VARCHAR2,
  force               IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-46 DROP_CHAIN_STEP Procedure Parameters

Parameter	Description
chain_name	The name of the chain to alter
step_name	The name of the step being dropped. Can be a comma-separated list.
force	If force is set to TRUE, this succeeds even if this chain is currently running. The running chain will not be stopped or interrupted. If force is set to FALSE and this chain is currently running, an error is thrown.

Usage Notes

Dropping a chain step requires ALTER privileges on the chain (either as the owner or as a user with ALTER privileges on the chain or the CREATE ANY JOB system privilege).

163.6.34 DROP_CREDENTIAL Procedure

This deprecated procedure drops a credential.

Note:

This procedure is deprecated with Oracle Database 12c Release 1 (12.1). While the procedure remains available in this package, for reasons of backward compatibility, Oracle recommends using the alternative enhanced functionality provided in the DBMS_CREDENTIAL package, specifically the DROP_CREDENTIAL Procedure.

Syntax

```
DBMS_SCHEDULER.DROP_CREDENTIAL (
    credential_name      IN VARCHAR2,
    force                IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-47 DROP_CREDENTIAL Procedure Parameters

Parameter	Description
credential_name	The name of the credential being dropped. This can optionally be prefixed with a schema name. This cannot be set to NULL.
force	If set to FALSE, the credential must not be referenced by any job, or an error will occur. If set to TRUE, the credential is dropped whether or not there are jobs referencing it. Jobs that reference the credential will continue to point to a nonexistent credential and throw an error at runtime.

Usage Notes

Only the owner of a credential or a user with the CREATE ANY JOB system privilege may drop the credential.

Running jobs that point to the credential are not affected by this procedure and are allowed to continue.

163.6.35 DROP_DATABASE_DESTINATION Procedure

This procedure drops one or more database destinations.

Syntax

```
DBMS_SCHEDULER.DROP_DATABASE_DESTINATION (
    destination_name    IN VARCHAR2);
```

Parameters

Table 163-48 DROP_DATABASE_DESTINATION Procedure Parameters

Parameter	Description
destination_name	The name of the destination to drop. Can be a comma-separated list of database destinations to drop. Each database destination can optionally be prefixed with a schema name. The procedure stops processing if it encounters a database destination that does not exist. All database destinations processed before the error are dropped. Cannot be NULL.

Usage Notes

Only the owner or a user with the CREATE ANY JOB system privilege may drop the database destination.

When a database destination is dropped:

- All job instances that refer to the destination in the *_SCHEDULER_JOB_DESTS views are also dropped.
- Jobs running against the destination are stopped.
- Members of database destination groups that refer to the destination are removed from the group.



See Also:

[CREATE_DATABASE_DESTINATION Procedure](#)

163.6.36 DROP_FILE_WATCHER Procedure

This procedure drops one or more file watchers.

Syntax

```
DBMS_SCHEDULER.DROP_FILE_WATCHER (
    file_watcher_name    IN VARCHAR2,
    force                IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-49 DROP_FILE_WATCHER Procedure Parameters

Parameter	Description
file_watcher_name	The file watcher to drop. Can be a comma-separated list of file watchers. Each file watcher name can optionally be prefixed with a schema name. Cannot be NULL.
force	If set to FALSE, the file watcher must not be referenced by any job, or an error occurs. If set to TRUE, the file watcher is dropped whether or not there are jobs referencing it. In this case, jobs that reference the dropped file watcher are disabled.

Usage Notes

Only the owner of a file watcher or a user with the CREATE ANY JOB system privilege may drop the file watcher.

Running jobs that point to the file watcher are not affected by this procedure and are allowed to continue.



See Also:

["CREATE_FILE_WATCHER Procedure"](#)

163.6.37 DROP_GROUP Procedure

This procedure drops one or more groups.

Syntax

```
DBMS_SCHEDULER.DROP_GROUP (  
    group_name      IN VARCHAR2,  
    force           IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-50 DROP_GROUP Procedure Parameters

Parameter	Description
group_name	A group to drop. Can be a comma-separated list of group names. Each group name can optionally be prefixed with a schema name. The procedure stops processing if it encounters a group that does not exist. All groups processed before the error are dropped. Cannot be NULL.
force	If FALSE, the group must not be referenced by any job, otherwise an error occurs. If TRUE, the group is dropped whether or not there are jobs referencing it. In this case, all jobs referencing the group are disabled and all job instances that reference the group are removed from the *_SCHEDULER_JOB_DESTS views.

Usage Notes

Only the owner or a user with the `CREATE ANY JOB` system privilege may drop a group. You must have the `MANAGE SCHEDULER` privilege to drop a group of type `WINDOW`.



See Also:

["CREATE_FILE_WATCHER Procedure"](#)

163.6.38 DROP_INCOMPATIBILITY Procedure

This procedure drops an existing incompatibility definition.

Syntax

```
DBMS_SCHEDULER.DROP_INCOMPATIBILITY (  
    incompatibility_name  IN VARCHAR2);
```

Parameters

Table 163-51 DROP_INCOMPATIBILITY Procedure Parameters

Parameter	Description
<code>incompatibility_name</code>	The name of the incompatibility definition.

Usage Notes



See Also:

Using Incompatibility Definitions in *Oracle Database Administrator's Guide*

163.6.39 DROP_JOB Procedure

This procedure drops one or more jobs or all jobs in one or more job classes. Dropping a job also drops all argument values set for that job.

Syntax

```
DBMS_SCHEDULER.DROP_JOB (
    job_name          IN VARCHAR2,
    force             IN BOOLEAN DEFAULT FALSE,
    defer             IN BOOLEAN DEFAULT FALSE,
    commit_semantics IN VARCHAR2 DEFAULT 'STOP_ON_FIRST_ERROR');
```

Parameters

Table 163-52 DROP_JOB Procedure Parameters

Parameter	Description
<code>job_name</code>	The name of a job or job class. Can be a comma-delimited list. For a job class, the <code>SYS</code> schema should be specified. If the name of a job class is specified, the jobs that belong to that job class are dropped, but the job class itself is not dropped.
<code>force</code>	If <code>force</code> is set to <code>TRUE</code> , the Scheduler first attempts to stop the running job instances (by issuing the <code>STOP_JOB</code> call with the <code>force</code> flag set to <code>false</code>), and then drops the jobs.
<code>defer</code>	If <code>defer</code> is set to <code>TRUE</code> , the Scheduler allows the running jobs to complete and then drops the jobs.

Table 163-52 (Cont.) DROP_JOB Procedure Parameters

Parameter	Description
<code>commit_semantics</code>	<p>The commit semantics. The following types are supported:</p> <ul style="list-style-type: none"> • <code>STOP_ON_FIRST_ERROR</code> returns on the first error and previous successful drop operations are committed to disk. This is the default. • <code>TRANSACTIONAL</code> returns on the first error. Everything that happened before that error is rolled back. This type is not supported when <code>force</code> is set to <code>TRUE</code>. • <code>ABSORB_ERRORS</code> tries to absorb any errors and drop the rest of the jobs, and commits all the successful drops. If errors occur, you can query the view <code>SCHEDULER_BATCH_ERRORS</code> for details. <p>Only <code>STOP_ON_FIRST_ERROR</code> is permitted when job classes are included in the <code>job_name</code> list.</p>

Usage Notes

If both `force` and `defer` are set to `FALSE` and a job is running at the time of the call, the attempt to drop that job fails. The entire call to `DROP_JOB` may then fail, depending on the setting of `commit_semantics`.

Setting both `force` and `defer` to `TRUE` results in an error.

Dropping a job requires `ALTER` privileges on the job either as the owner of the job or as a user with the `ALTER` object privilege on the job or the `CREATE ANY JOB` system privilege.

163.6.40 DROP_JOB_CLASS Procedure

This procedure drops a job class. Dropping a job class means that all the metadata about the job class is removed from the database.

Syntax

```
DBMS_SCHEDULER.DROP_JOB_CLASS (
    job_class_name      IN VARCHAR2,
    force               IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-53 DROP_JOB_CLASS Procedure Parameters

Parameter	Description
<code>job_class_name</code>	The name of the job class. Can be a comma-delimited list.
<code>force</code>	<p>If <code>force</code> is set to <code>FALSE</code>, a class being dropped must not be referenced by any jobs, otherwise an error occurs.</p> <p>If <code>force</code> is set to <code>TRUE</code>, jobs belonging to the class are disabled and their class is set to the default class. Only if this is successful is the class dropped.</p> <p>Running jobs that belong to the job class are not affected.</p>

Usage Notes

Dropping a job class requires the `MANAGE SCHEDULER` system privilege.

163.6.41 DROP_PROGRAM Procedure

This procedure drops a program. Any arguments that pertain to the program are also dropped when the program is dropped.

Syntax

```
DBMS_SCHEDULER.DROP_PROGRAM (
    program_name          IN VARCHAR2,
    force                 IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-54 DROP_PROGRAM Procedure Parameters

Parameter	Description
<code>program_name</code>	The name of the program to be dropped. Can be a comma-delimited list.
<code>force</code>	If <code>force</code> is set to <code>FALSE</code> , the program must not be referenced by any job, otherwise an error occurs. If <code>force</code> is set to <code>TRUE</code> , all jobs referencing the program are disabled before the program is dropped. Running jobs that point to the program are not affected by the <code>DROP_PROGRAM</code> call and are allowed to continue.

Usage Notes

Dropping a program requires that you be the owner of the program or have `ALTER` privileges on that program. You can also drop a program if you have the `CREATE ANY JOB` privilege.

163.6.42 DROP_PROGRAM_ARGUMENT Procedure

This procedure drops a program argument. An argument can be specified by either name (if one has been given) or position.

The procedure is overloaded.

Syntax

Drops a program argument by position:

```
DBMS_SCHEDULER.DROP_PROGRAM_ARGUMENT (
    program_name          IN VARCHAR2,
    argument_position     IN PLS_INTEGER);
```

Drops a program argument by name:

```
DBMS_SCHEDULER.DROP_PROGRAM_ARGUMENT (
    program_name          IN VARCHAR2,
    argument_name         IN VARCHAR2);
```

Parameters

Table 163-55 DROP_PROGRAM_ARGUMENT Procedure Parameters

Parameter	Description
<code>program_name</code>	The name of the program to be altered. A program with this name must exist.
<code>argument_name</code>	The name of the argument being dropped
<code>argument_position</code>	The position of the argument to be dropped

Usage Notes

Dropping a program argument requires that you be the owner of the program or have `ALTER` privileges on that program. You can also drop a program argument if you have the `CREATE ANY JOB` privilege.

163.6.43 DROP_RESOURCE Procedure

This procedure drops a resource.

Syntax

```
DBMS_SCHEDULER.DROP_RESOURCE (
    resource_name IN VARCHAR2,
    force         IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-56 DROP_RESOURCE Procedure Parameters

Parameter	Description
<code>resource_name</code>	The name of the resource to be dropped. Can be a comma-delimited list.
<code>force</code>	If <code>force</code> is set to <code>FALSE</code> , the resource must not have any existing constraints, otherwise an error occurs. If <code>force</code> is set to <code>TRUE</code> , the resource will be dropped and any constraints defined on this resource will also be dropped.

Usage Notes

Only the owner or a user with the `CREATE ANY JOB` system privilege may drop the resource.



See Also:

Creating or Dropping a Resource in *Oracle Database Administrator's Guide*

163.6.44 DROP_SCHEDULE Procedure

This procedure drops a schedule.

Syntax

```
DBMS_SCHEDULER.DROP_SCHEDULE (  
    schedule_name    IN VARCHAR2,  
    force            IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-57 DROP_SCHEDULE Procedure Parameters

Parameter	Description
schedule_name	The name of the schedule. Can be a comma-delimited list.
force	If <code>force</code> is set to <code>FALSE</code> , the schedule must not be referenced by any job or window, otherwise an error will occur. If <code>force</code> is set to <code>TRUE</code> , any jobs or windows that use this schedule are disabled before the schedule is dropped Running jobs and open windows that point to the schedule are not affected.

Usage Notes

You must be the owner of the schedule being dropped or have `ALTER` privileges for the schedule or the `CREATE ANY JOB` privilege.

163.6.45 DROP_WINDOW Procedure

This procedure drops a window. All metadata about the window is removed from the database. The window is removed from any groups that reference it.

Syntax

```
DBMS_SCHEDULER.DROP_WINDOW (  
    window_name      IN VARCHAR2,  
    force            IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-58 DROP_WINDOW Procedure Parameters

Parameter	Description
window_name	The name of the window. Can be a comma-delimited list.

Table 163-58 (Cont.) DROP_WINDOW Procedure Parameters

Parameter	Description
<code>force</code>	<p>If <code>force</code> is set to <code>FALSE</code>, the window must be not be open or referenced by any job, otherwise an error occurs.</p> <p>If <code>force</code> is set to <code>TRUE</code>, the window is dropped and those jobs that have the window as their schedule are disabled. However, jobs that have a window group, of which the dropped window is a member, as their schedule, are not disabled. If the window is open then, the Scheduler attempts to first close the window and then drop it. When the window is closed, normal close window rules apply.</p> <p>Running jobs that have the window as their schedule is allowed to continue, unless the <code>stop_on_window_close</code> flag is set to <code>TRUE</code> for the job. If this is the case, the job is stopped when the window is dropped.</p>

Usage Notes

Dropping a window requires the `MANAGE SCHEDULER` privilege.

163.6.46 DUMP_IN_MEMORY_TRACE Procedure

This procedure dumps the scheduler in-memory trace buffer of the specified process state object address into the current trace file of the requester process.

Syntax

```
DBMS_SCHEDULER.DUMP_IN_MEMORY_TRACE (
    PROCESS_ADDRESS IN RAW);
```

Parameters**Table 163-59 DUMP_IN_MEMORY_TRACE Procedure Parameters**

Parameter	Description
<code>PROCESS_ADDRESS</code>	State object address of the process being dumped.

Usage Notes

Either connecting as a `SYS` user or having the `DBA` role is required to execute `dump_in_memory_trace`.

163.6.47 ENABLE Procedure

This procedure enables a program, job, chain, window, database destination, external destination, file watcher, or group.

When an object is enabled, its `enabled` attribute is set to `TRUE`. By default, jobs, chains, and programs are created disabled and database destinations, external destinations, file watchers, windows, and groups are created enabled.

If a job was disabled and you enable it, the Scheduler begins to automatically run the job according to its schedule. Enabling a disabled job also resets the job `RUN_COUNT`, `FAILURE_COUNT` and `RETRY_COUNT` columns in the `*_SCHEDULER_JOBS` data dictionary views.

Validity checks are performed before enabling an object. If the check fails, the object is not enabled, and an appropriate error is returned. This procedure does not return an error if the object was already enabled.

Syntax

```
DBMS_SCHEDULER.ENABLE (
    name           IN VARCHAR2,
    commit_semantics IN VARCHAR2 DEFAULT 'STOP_ON_FIRST_ERROR');
```

Parameters

Table 163-60 ENABLE Procedure Parameters

Parameter	Description
name	<p>The name of the Scheduler object being enabled. Can be a comma-delimited list of names.</p> <p>If a job class name is specified, then all the jobs in the job class are enabled.</p> <p>If a group name is specified, then the group is enabled, but the enabled state of the group members is unaffected.</p>
commit_semantics	<p>The commit semantics. The following types are supported:</p> <ul style="list-style-type: none"> • <code>STOP_ON_FIRST_ERROR</code> - The procedure returns on the first error and previous successful enable operations are committed to disk. This is the default. • <code>TRANSACTIONAL</code> - The procedure returns on the first error and everything that happened before that error is rolled back. This type is only supported when enabling a job or a list of jobs. • <code>ABSORB_ERRORS</code> - The procedure tries to absorb any errors and enable the rest of the jobs. It commits all the enable operations that were successful. If errors occur, you can query the view <code>SCHEDULER_BATCH_ERRORS</code> for details. This type is only supported when enabling a job or a list of jobs.

Usage Notes

Window names must be preceded by `SYS`.

To run `ENABLE` for a window or group of type `WINDOW`, you must have the `MANAGE_SCHEDULER` privilege. For a job of type `EXECUTABLE` (or for a job that points to a program of type `EXECUTABLE`), the job owner must have the `CREATE_EXTERNAL_JOB` system privilege before the job can be enabled or run.

To enable a file watcher, the file watcher owner must have the `EXECUTE` privilege on the designated credential.

You can use `ENABLE` with any schema except the `SYS` schema.

163.6.48 END_DETACHED_JOB_RUN Procedure

This procedure ends a detached job run. A detached job points to a detached program, which is a program with the `detached` attribute set to `TRUE`.

A detached job run does not end until this procedure or the [STOP_JOB Procedure](#) is called.

Syntax

```
DBMS_SCHEDULER.END_DETACHED_JOB_RUN (
  job_name          IN VARCHAR2,
  error_number      IN PLS_INTEGER DEFAULT 0,
  additional_info   IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-61 END_DETACHED_JOB_RUN Procedure Parameters

Parameter	Description
<code>job_name</code>	The name of the job to end. Must be a detached job that is running.
<code>error_number</code>	If zero, then the job run is logged as succeeded. If -1013, then the job run is logged as stopped. If any other number, then the job run is logged as failed with that error number.
<code>additional_info</code>	This text is stored in the <code>additional_info</code> column of the <code>*_scheduler_job_run_details</code> views for this job run.

Usage Notes

This procedure requires that you either own the job or have `ALTER` privileges on it. You can also end any detached job run if you have the `CREATE ANY JOB` privilege.



See Also:

Oracle Database Administrator's Guide for information about detached jobs.

163.6.49 EVALUATE_CALENDAR_STRING Procedure

You can define repeat intervals of jobs, windows or schedules using the Scheduler calendaring syntax. This procedure evaluates the calendar expression and tells you the next execution date and time of a job or window. This is very useful for testing the correct definition of the calendar string without actually scheduling the job or window.

This procedure can also get multiple steps of the repeat interval by passing the `next_run_date` returned by one invocation as the `return_date_after` argument of the next invocation.

See the calendaring syntax described in "[Operational Notes](#)".

Syntax

```
DBMS_SCHEDULER.EVALUATE_CALENDAR_STRING (
    calendar_string    IN  VARCHAR2,
    start_date         IN  TIMESTAMP WITH TIME ZONE,
    return_date_after  IN  TIMESTAMP WITH TIME ZONE,
    next_run_date      OUT TIMESTAMP WITH TIME ZONE);
```

Parameters

Table 163-62 EVALUATE_CALENDAR_STRING Procedure Parameters

Parameter	Description
calendar_string	The calendar expression to be evaluated. The string must be in the calendaring syntax described in " Operational Notes ".
start_date	The date and time after which the repeat interval becomes valid. It can also be used to fill in specific items that are missing from the calendar string. Can optionally be NULL.
return_date_after	The return_date_after argument helps the Scheduler determine which one of all possible matches (all valid execution dates) to return from those determined by the start_date and the calendar string. When a NULL value is passed for this argument, the Scheduler automatically fills in systimestamp as its value.
next_run_date	The first timestamp that matches the calendar string and start date that occur after the value passed in for the return_date_after argument.

Examples

The following code fragment can be used to determine the next five dates a job will run given a specific calendar string.

```
SET SERVEROUTPUT ON;
ALTER SESSION set NLS_DATE_FORMAT = 'DD-MON-YYYY HH24:MI:SS';
Session altered.

DECLARE
start_date          TIMESTAMP;
return_date_after  TIMESTAMP;
next_run_date      TIMESTAMP;
BEGIN
start_date :=
    to_timestamp_tz('01-JAN-2003 10:00:00', 'DD-MON-YYYY HH24:MI:SS');
return_date_after := start_date;
FOR i IN 1..5 LOOP
    DBMS_SCHEDULER.EVALUATE_CALENDAR_STRING (
        'FREQ=DAILY;BYHOUR=9;BYMINUTE=30;BYDAY=MON,TUE,WED,THU,FRI',
        start_date, return_date_after, next_run_date);
    DBMS_OUTPUT.PUT_LINE('next_run_date: ' || next_run_date);
    return_date_after := next_run_date;
END LOOP;
END;
/

next_run_date: 02-JAN-03 09.30.00.000000 AM
next_run_date: 03-JAN-03 09.30.00.000000 AM
next_run_date: 06-JAN-03 09.30.00.000000 AM
```



```
next_run_date: 07-JAN-03 09.30.00.000000 AM
next_run_date: 08-JAN-03 09.30.00.000000 AM
```

PL/SQL procedure successfully completed.

Usage Notes

No specific Scheduler privileges are required.

163.6.50 EVALUATE_RUNNING_CHAIN Procedure

This procedure forces reevaluation of the rules of a running chain to trigger any rules for which the conditions have been satisfied. The job passed as an argument must point to a chain and must be running. If the job is not running, an error is thrown. (`RUN_JOB` can be used to start the job.)

If any of the steps of the chain are themselves running chains, another `EVALUATE_RUNNING_CHAIN` is performed on each of the nested running chains.

Syntax

```
DBMS_SCHEDULER.EVALUATE_RUNNING_CHAIN (
    job_name          IN VARCHAR2);
```

Parameters

Table 163-63 EVALUATE_RUNNING_CHAIN Procedure Parameter

Parameter	Description
job_name	The name of the running job (pointing to a chain) to reevaluate the rules for

Usage Notes

Running `EVALUATE_RUNNING_CHAIN` on a job requires alter privileges on the job (either as the owner, or as a user with `ALTER` privileges on the job or the `CREATE ANY JOB` system privilege).

 **Note:**

The Scheduler automatically evaluates a chain:

- At the start of the chain job
- When a chain step completes
- When an event occurs that is associated with an event step in the chain

For most chains, this is sufficient. `EVALUATE_RUNNING_CHAIN` should be used only under the following circumstances:

- After manual intervention of a running chain with the `ALTER_RUNNING_CHAIN` procedure
- When chain rules use SQL syntax and the rule conditions contain elements that are not under the control of the Scheduler.

In these cases, `EVALUATE_RUNNING_CHAIN` may not be needed if you set the `evaluation_interval` attribute when you created the chain.

163.6.51 GENERATE_JOB_NAME Function

This function returns a unique name for a job.

The name will be of the form `{prefix}N` where `N` is a number from a sequence. If no prefix is specified, the generated name will, by default, be `JOB$_1`, `JOB$_2`, `JOB$_3`, and so on. If `'SCOTT'` is specified as the prefix, the name will be `SCOTT1`, `SCOTT2`, and so on.

Syntax

```
DBMS_SCHEDULER.GENERATE_JOB_NAME (
    prefix          IN VARCHAR2 DEFAULT 'JOB$_') RETURN VARCHAR2;
```

Parameters

Table 163-64 GENERATE_JOB_NAME Function Parameter

Parameter	Description
<code>prefix</code>	The prefix to use when generating the job name

Usage Notes

If the prefix is explicitly set to `NULL`, the name is just the sequence number. In order to successfully use such numeric names, they must be surrounded by double quotes throughout the `DBMS_SCHEDULER` calls. A prefix cannot be longer than 18 characters and cannot end with a digit.

Note that, even though the `GENERATE_JOB_NAME` function never returns the same job name twice, there is a small chance that the returned name matches an already existing database object.

No specific Scheduler privileges are required to use this function.

163.6.52 GET_AGENT_INFO Function

This function can return job information specific to an agent, such as how many are running and so on, depending on the attribute selected.

Syntax

```
DBMS_SCHEDULER.GET_AGENT_INFO (
    agent_name      IN VARCHAR2,
    attribute       IN VARCHAR2) RETURN VARCHAR2;
```

Parameters

Table 163-65 GET_AGENT_INFO Function Parameter

Parameter	Description
agent_name	The name of an external destination where the agent is running
attribute	<p>Possible Attributes values</p> <ul style="list-style-type: none"> • VERSION: Returns the agent version number. Requires the <code>CREATE JOB</code> system privilege. • UPTIME: Returns the time the agent has been up and running. Requires the <code>CREATE JOB</code> system privilege. • NUMBER_OF_RUNNING_JOBS: Returns the number of jobs that the agent is currently running. Requires the <code>CREATE JOB</code> system privilege. • TOTAL_JOBS_RUN: Returns the number of jobs run by the agent since it was started. Requires the <code>CREATE JOB</code> system privilege. • RUNNING_JOBS: Returns a comma-separated list of the names of the jobs running currently. Requires the <code>MANAGE SCHEDULER</code> system privilege. • ALL: Returns all the information the previous options return. It requires the <code>MANAGE SCHEDULER</code> system privilege.

Usage Notes

This function returns the same information as the `schagent` utility status option. See *Oracle Database Administrator's Guide*.

163.6.53 GET_AGENT_VERSION Function

This function returns the version string of a Scheduler agent that is registered with the database and is currently running. `GET_AGENT_VERSION` throws an error if the agent is not registered with the database or if the agent is not currently running.

Syntax

```
DBMS_SCHEDULER.GET_AGENT_VERSION (
    agent_host      IN VARCHAR2) RETURN VARCHAR2;
```

Parameters

Table 163-66 GET_AGENT_VERSION Function Parameter

Parameter	Description
agent_host	Either the hostname and port on which the agent is running in the form <code>hostname:port</code> or the name of the agent as shown in the <code>destination_name</code> column of the <code>ALL_SCHEDULER_EXTERNAL_DESTS</code> view which lists all Scheduler agents registered with the database.

Usage Notes

This function requires the `CREATE EXTERNAL JOB` system privilege.

163.6.54 GET_ATTRIBUTE Procedure

This procedure retrieves the value of an attribute of a Scheduler object. It is overloaded to retrieve values of various types.

Syntax

```
DBMS_SCHEDULER.GET_ATTRIBUTE (
    name          IN VARCHAR2,
    attribute     IN VARCHAR2,
    value        OUT {VARCHAR2|PLS_INTEGER|BOOLEAN|DATE|TIMESTAMP|
                    TIMESTAMP WITH TIME ZONE|TIMESTAMP WITH LOCAL TIME ZONE|
                    INTERVAL DAY TO SECOND});
```

```
DBMS_SCHEDULER.GET_ATTRIBUTE (
    name          IN VARCHAR2,
    attribute     IN VARCHAR2,
    value        OUT VARCHAR2,
    value2       OUT VARCHAR2);
```

Parameters

Table 163-67 GET_ATTRIBUTE Procedure Parameters

Parameter	Description
name	The name of the object
attribute	The attribute being retrieved. See the SET_ATTRIBUTE Procedure for tables of attribute values.
value	The existing value of the attribute
value2	The <code>value2</code> argument is for an optional second value. Most attributes have only one value associated with them, but some can have two.

Usage Notes

To run `GET_ATTRIBUTE` for a job class, you must have the `MANAGE SCHEDULER` privilege or have `EXECUTE` privileges on the class. For a schedule, window, or group, no

privileges are necessary. Otherwise, you must be the owner of the object or have `ALTER` or `EXECUTE` privileges on that object or have the `CREATE ANY JOB` privilege.

See the [SET_ATTRIBUTE Procedure](#) for tables of attribute values that you can retrieve for the various Scheduler object types.

163.6.55 GET_FILE Procedure

This procedure retrieves a file from the operating system file system of a specified host. The file is copied to a destination, or its contents are returned in a procedure output parameter.

You can also use this procedure to retrieve the standard output or error text for a run of an external job that has an associated credential.

This procedure differs from the equivalent `UTL_FILE` procedure in that it uses a credential and can retrieve files from remote hosts that have only a Scheduler agent (and not an Oracle database) installed.

Syntax

```
DBMS_SCHEDULER.GET_FILE (
    source_file          IN VARCHAR2,
    source_host          IN VARCHAR2,
    credential_name      IN VARCHAR2,
    file_contents        IN OUT NOCOPY {BLOB|CLOB});
```

```
DBMS_SCHEDULER.GET_FILE (
    source_file          IN VARCHAR2,
    source_host          IN VARCHAR2,
    credential_name      IN VARCHAR2,
    destination_file_name IN VARCHAR2,
    destination_directory_object IN VARCHAR2,
    destination_permissions IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-68 GET_FILE Procedure Parameters

Parameter	Description
source_file	<p>Fully qualified path name of the file to retrieve from the operating system. The file name is case-sensitive and is not converted to uppercase. If the file name starts with a question mark ('?'), the question mark is replaced by the path to the Oracle home if getting a file from the local host, or to the Scheduler agent home if getting a file from a remote host.</p> <p>If the format of this parameter is <i>external_log_id_stdout</i>, then the stdout from the designated external job run is returned.</p> <p>If the format of this parameter is <i>external_log_id_stderr</i>, the error text from the designated external job run is returned.</p> <p>You obtain the value of <i>external_log_id</i> from the <i>ADDITIONAL_INFO</i> column of the <i>*_SCHEDULER_JOB_RUN_DETAILS</i> views. This column contains a set of name/value pairs in an indeterminate order, so you must parse this column for the <i>external_log_id</i> name/value pair, and then append either <i>_stdout</i> or <i>_stderr</i> to its value.</p> <p>The external job must have an associated credential. The <i>credential_name</i> parameter of <i>GET_FILE</i> must name the same credential that is used by the job, and the <i>source_host</i> parameter must be the same as the <i>destination</i> attribute of the job.</p>
source_host	<p>If the file is to be retrieved from a remote host, then this parameter must be a valid an external destination name. (An external destination is created when you register a remote Scheduler agent with the database. You can view external destination names in the views <i>*_SCHEDULER_EXTERNAL_DESTS</i>.)</p> <p>If <i>source_host</i> is NULL or set to 'localhost', then the file is retrieved from the file system of the local host. To determine the port number of a Scheduler agent, view the <i>schagent.conf</i> file, which is located in the Scheduler agent home directory on the remote host.</p>
credential_name	The name of the credential to use for accessing the file system.
file_contents	The variable into which the file contents is read.
destination_file_name	The file to which the file contents is written.
destination_directory_object	The directory object that specifies the path to the destination file, when <i>destination_file_name</i> is used. The caller must have the necessary privileges on the directory object.
destination_permissions	Reserved for future use

Usage Notes

The caller must have the *CREATE EXTERNAL JOB* system privilege and have *EXECUTE* privileges on the credential.

163.6.56 GET_SCHEDULER_ATTRIBUTE Procedure

This procedure retrieves the value of a Scheduler attribute.

Syntax

```
DBMS_SCHEDULER.GET_SCHEDULER_ATTRIBUTE (
    attribute    IN VARCHAR2,
    value       OUT VARCHAR2);
```

Parameters

Table 163-69 GET_SCHEDULER_ATTRIBUTE Procedure Parameters

Parameter	Description
attribute	The name of the attribute
value	The existing value of the attribute

Usage Notes

To run GET_SCHEDULER_ATTRIBUTE, you must have the `MANAGE SCHEDULER` privilege.

[Table 163-70](#) lists the Scheduler attributes that you can retrieve. For more detail on these attributes, see [Table 163-102](#) and the section "Configuring the Scheduler" in *Oracle Database Administrator's Guide*.

Table 163-70 Scheduler Attributes Retrievable with GET_SCHEDULER_ATTRIBUTE

Scheduler Attribute	Description
current_open_window	Name of the currently open window
default_timezone	Default time zone used by the Scheduler for repeat intervals and windows
email_sender	The default e-mail address of the sender for job state e-mail notifications
email_server	The SMTP server address that the Scheduler uses to send e-mail notifications for job state events. E-mail notifications cannot be sent if this attribute is <code>NULL</code> .
event_expiry_time	Time in seconds before an event generated by the Scheduler and enqueued onto the Scheduler event queue expires. May be <code>NULL</code> .
log_history	Retention period in days for job and window logs. The range of valid values is 0 through 1000000.
max_job_slave_processes	This Scheduler attribute is not used.

163.6.57 OPEN_WINDOW Procedure

This procedure manually opens a window, unrelated to its schedule.

The window opens and the resource plan associated with it takes effect immediately, for the duration specified or for the normal duration of the window, if no duration is given. Only an enabled window can be manually opened.

Syntax

```
DBMS_SCHEDULER.OPEN_WINDOW (
    window_name          IN VARCHAR2,
    duration              IN INTERVAL DAY TO SECOND,
    force                 IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 163-71 OPEN_WINDOW Procedure Parameters

Parameter	Description
window_name	The name of the window
duration	The duration of the window. It is of type interval day to second. If it is NULL, then the window opens for the regular duration as specified in the window metadata.
force	<p>If <code>force</code> is set to <code>FALSE</code>, then opening an already open window generates an error.</p> <p>If <code>force</code> is set to <code>TRUE</code>:</p> <p>You can open a window that is already open. The window stays open for the duration specified in the call, from the time the <code>OPEN_WINDOW</code> command was issued.</p> <p>For example: <code>window1</code> was created with a duration of four hours. It has now been open for two hours. If, at this point, you reopen <code>window1</code> using the <code>OPEN_WINDOW</code> call and do not specify a duration, then <code>window1</code> stays open for four hours because it was created with that duration. If you specified a duration of 30 minutes, the window will close in 30 minutes.</p> <p>The Scheduler automatically closes any window that is open at that time, even if it has a higher priority. For the duration of this manually opened window, the Scheduler does not open any other scheduled windows even if they have a higher priority.</p>

Usage Notes

Opening a window manually has no impact on regular scheduled runs of the window. The next open time of the window is not updated and is determined by the regular scheduled opening.

When a window that was manually opened closes, the rules about overlapping windows are applied to determine which other window should be opened at that time if any at all.

If there are jobs running when the window opens, the resources allocated to them might change if there is a switch in resource plan.

If a window fails to switch resource plans because the designated resource plan no longer exists or because resource plan switching by windows is disabled (for example, by using the `ALTER SYSTEM` statement with the `force` option), the failure to switch resource plans is recorded in the window log.

Opening a window requires the `MANAGE_SCHEDULER` privilege.

163.6.58 PURGE_LOG Procedure

The `PURGE_LOG` procedure purges rows from the job and window log that were not purged automatically by the scheduler.

By default, the Scheduler automatically purges all rows in the job log and window log that are older than 30 days. The `PURGE_LOG` procedure can be used to purge additional rows from the job and window log.

Rows in the job log table pertaining to the steps of a chain are purged only when the entry for the main chain job is purged (either manually or automatically).

Syntax

```
DBMS_SCHEDULER.PURGE_LOG (
  log_history          IN PLS_INTEGER  DEFAULT 0,
  which_log           IN VARCHAR2     DEFAULT 'JOB_AND_WINDOW_LOG',
  job_name            IN VARCHAR2     DEFAULT NULL);
```

Parameters

Table 163-72 PURGE_LOG Procedure Parameters

Parameter	Description
<code>log_history</code>	This specifies how much history (in days) to keep. The valid range is 0 - 1000000. If set to 0, no history is kept.
<code>which_log</code>	This specifies the log type. Valid values are: <code>job_log</code> , <code>window_log</code> , and <code>job_and_window_log</code> .
<code>job_name</code>	This specifies which job-specific entries must be purged from the job log. This can be a comma-delimited list of job names and job classes. Whenever <code>job_name</code> has a value other than <code>NULL</code> , the <code>which_log</code> argument implicitly includes the job log.

Usage Notes

This procedure requires the `MANAGE_SCHEDULER` privilege.

Examples

The following completely purges all rows from both the job log and the window log:

```
DBMS_SCHEDULER.PURGE_LOG();
```

The following purges all rows from the window log that are older than 5 days:

```
DBMS_SCHEDULER.PURGE_LOG(5, 'window_log');
```

The following purges all rows from the window log that are older than 1 day and all rows from the job log that are related to jobs in `jobclass1` and older than 1 day:

```
DBMS_SCHEDULER.PURGE_LOG(1, 'job_and_window_log', 'sys.jobclass1');
```

163.6.59 PUT_FILE Procedure

This procedure saves a file to the operating system file system of a specified remote host or of the local computer.

It differs from the equivalent UTL_FILE procedure in that it uses a credential and can save files to a remote host that has only a Scheduler agent (and not an Oracle Database) installed.

Syntax

```
DBMS_SCHEDULER.PUT_FILE (
    destination_file      IN VARCHAR2,
    destination_host      IN VARCHAR2,
    credential_name       IN VARCHAR2,
    file_contents         IN {BLOB|CLOB},
    destination_permissions IN VARCHAR2 DEFAULT NULL);
```

```
DBMS_SCHEDULER.PUT_FILE (
    destination_file      IN VARCHAR2,
    destination_host      IN VARCHAR2,
    credential_name       IN VARCHAR2,
    source_file_name      IN VARCHAR2,
    source_directory_object IN VARCHAR2,
    destination_permissions IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-73 PUT_FILE Procedure Parameters

Parameter	Description
destination_file	Fully qualified path name of the file to save to the operating system file system. The file name is case-sensitive. If the file name starts with a question mark ('?'), the question mark is replaced by the path to the Oracle home if saving to the local host, or to the Scheduler agent home if saving to a remote host.
destination_host	If NULL or set to 'localhost', the file is saved to the file system of the local computer. To save to a remote host, this parameter must be a valid external destination name. (An external destination is created when you register a remote Scheduler agent with the database. You can view external destination names in the views *_SCHEDULER_EXTERNAL_DESTS.)
credential_name	The name of the credential to use for accessing the destination file system.
file_contents	The variable from which the file contents is read.
source_file_name	The file from which the file contents is written
source_directory_object	The directory object that specifies the path to the source file, when source_file_name is used. The caller must have the necessary privileges on the directory object.
destination_permissions	Reserved for future use

Usage Notes

The caller must have the `CREATE EXTERNAL JOB` system privilege and have `EXECUTE` privileges on the credential.

163.6.60 REMOVE_EVENT_QUEUE_SUBSCRIBER Procedure

This procedure unsubscribes a user from the Scheduler event queue `SYS.SCHEDULER$_EVENT_QUEUE`.

Syntax

```
DBMS_SCHEDULER.REMOVE_EVENT_QUEUE_SUBSCRIBER (
    subscriber_name      IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-74 REMOVE_EVENT_QUEUE_SUBSCRIBER Procedure Parameters

Parameter	Description
<code>subscriber_name</code>	Name of the Oracle Advanced Queuing (AQ) agent to remove the subscription from. If <code>NULL</code> , the user name of the calling user is used.

Usage Notes

After the agent is unsubscribed, it is deleted. If the agent does not exist or is not currently subscribed to the Scheduler event queue, an error is raised.

163.6.61 REMOVE_FROM_INCOMPATIBILITY Procedure

This procedure removes jobs or programs from an existing incompatibility definition.

Syntax

```
DBMS_SCHEDULER.REMOVE_FROM_INCOMPATIBILITY (
    incompatibility_name  IN VARCHAR2,
    object_name          IN VARCHAR2);
```

Parameters

Table 163-75 REMOVE_FROM_INCOMPATIBILITY Procedure Parameters

Parameter	Description
<code>incompatibility_name</code>	The name of the incompatibility definition.
<code>object_name</code>	One or more (comma-separated) programs or jobs

Usage Notes

This procedure does not raise an error if any specified objects do not already exist in the incompatibility definition.

**See Also:**Using Incompatibility Definitions in *Oracle Database Administrator's Guide*

163.6.62 REMOVE_GROUP_MEMBER Procedure

This procedure removes one or more members from an existing group.

Syntax

```
DBMS_SCHEDULER.REMOVE_GROUP_MEMBER (
    group_name          IN VARCHAR2,
    member              IN VARCHAR2);
```

Parameters

Table 163-76 REMOVE_GROUP_MEMBER Procedure Parameters

Parameter	Description
group_name	The name of the group.
member_name	The name of the member to remove from group. Comma-separated list of members to remove. An error is returned if any of the members is not part of the group. A group of the same type can be named as a member. The Scheduler immediately expands the included group name into its list of members. If the member is a destination, any job instances that run on this destination are removed from the *_SCHEDULER_JOB_DESTS views.

Usage Notes

The following users may remove members from a group:

- The group owner
- A user that has been granted the ALTER object privilege on the group
- A user with the CREATE ANY JOB system privilege

You must have the MANAGE SCHEDULER privilege to remove a member from a group of type WINDOW.

**See Also:**["CREATE_GROUP Procedure"](#)

163.6.63 REMOVE_JOB_EMAIL_NOTIFICATION Procedure

This procedure removes e-mail notifications for a job. You can remove all e-mail notifications or remove notifications only for specified recipients or specified events.

Syntax

```
DBMS_SCHEDULER.REMOVE_JOB_EMAIL_NOTIFICATION (
  job_name          IN VARCHAR2,
  recipients        IN VARCHAR2 DEFAULT NULL,
  events            IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-77 ADD_JOB_EMAIL_NOTIFICATION Procedure Parameters

Parameter	Description
job_name	Name of the job to remove e-mail notifications for. Cannot be NULL.
recipients	E-mail address to remove e-mail notification for. Comma-separated list of e-mail addresses.
events	Job state event to remove e-mail notification for. Comma-separated list of job state events.

Usage Notes

When you specify multiple recipients and multiple events, the notification for each specified event is removed for each specified recipient. The procedure ignores any recipients or events that are specified but that were not previously added.

If `recipients` is NULL, e-mail notifications for the specified events are removed for all existing recipients. If `events` is NULL, notifications for all events are removed for the specified recipients. If both `recipients` and `events` are NULL, all e-mail notifications are removed for the job.

For example, if `recipients` is 'jsmith@example.com,rjones@example.com' and `events` is 'JOB_FAILED,JOB_BROKEN', then notifications for both the `JOB_FAILED` and `JOB_BROKEN` events are removed for both `jsmith` and `rjones`. If `recipients` is NULL, then notifications for both the `JOB_FAILED` and `JOB_BROKEN` events are removed for `jsmith`, `rjones`, and any other previously defined recipients for these events.

To call this procedure, you must be the job owner or a user with the `CREATE ANY JOB` system privilege or `ALTER` object privilege on the job.



See Also:

"[ADD_JOB_EMAIL_NOTIFICATION Procedure](#)"

163.6.64 RESET_JOB_ARGUMENT_VALUE Procedure

This procedure resets (clears) the value previously set to an argument for a job.

RESET_JOB_ARGUMENT_VALUE is overloaded.

Syntax

Clears a previously set job argument value by argument position:

```
DBMS_SCHEDULER.RESET_JOB_ARGUMENT_VALUE (
    job_name          IN VARCHAR2,
    argument_position IN PLS_INTEGER);
```

Clears a previously set job argument value by argument name:

```
DBMS_SCHEDULER.RESET_JOB_ARGUMENT_VALUE (
    job_name          IN VARCHAR2,
    argument_name     IN VARCHAR2);
```

Parameters

Table 163-78 RESET_JOB_ARGUMENT_VALUE Procedure Parameters

Parameter	Description
job_name	The name of the job being altered
argument_position	The position of the program argument being reset
argument_name	The name of the program argument being reset

Usage Notes

If the corresponding program argument has no default value, the job is disabled. Resetting a program argument of a job belonging to another user requires ALTER privileges on that job. Arguments can be specified by position or by name.

RESET_JOB_ARGUMENT_VALUE requires that you be the owner of the job or have ALTER privileges on that job. You can also reset a job argument value if you have the CREATE ANY JOB privilege.

RESET_JOB_ARGUMENT_VALUE only supports arguments of SQL type. Therefore, argument values that are not of SQL type, such as booleans, are not supported as program or job arguments.

163.6.65 RUN_CHAIN Procedure

This procedure immediately runs a chain or part of a chain by creating a run-once job with the job name given.

If no job_name is given, one is generated of the form RUN_CHAIN\$_chainnameN, where chainname is the first 8 characters of the chain name and N is an integer.

If a list of start steps is given, only those steps are started when the chain begins running. Steps not in the list that would normally have started are skipped and paused (so that they or the steps after them do not run).

If `start_steps` is `NULL`, then the chain starts normally—that is, it performs an initial evaluation to see which steps to start running).

If a list of initial step states is given, the newly created chain job sets every listed step to the state specified for that step before evaluating the chain rules to see which steps to start. (Steps in the list are not started.)

Syntax

Runs a chain, with a list of start steps.

```
DBMS_SCHEDULER.RUN_CHAIN (
    chain_name          IN VARCHAR2,
    start_steps         IN VARCHAR2,
    job_name            IN VARCHAR2 DEFAULT NULL);
```

Runs a chain, with a list of initial step states.

```
DBMS_SCHEDULER.RUN_CHAIN (
    chain_name          IN VARCHAR2,
    step_state_list    IN SYS.SCHEDULER$_STEP_TYPE_LIST,
    job_name           IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-79 RUN_CHAIN Procedure Parameters

Parameter	Description
<code>chain_name</code>	The name of the chain to run
<code>job_name</code>	The name of the job to create to run the chain
<code>start_steps</code>	Comma-separated list of the steps to start when the chain starts running
<code>step_state_list</code>	List of chain steps with an initial state (SUCCEEDED or FAILED) to set for each. Set the attributes of <code>sys.scheduler\$_step_type</code> as follows: <code>step_name</code> The name of the step <code>step_type</code> 'SUCCEEDED' or 'FAILED' <code>error_number</code> where <code>error_number</code> is a positive or negative integer.

Usage Notes

Running a chain requires `CREATE JOB` if the job is being created in the user's schema, or `CREATE ANY JOB` otherwise. In addition, the owner of the job being created needs execute privileges on the chain (as the owner of the chain, or as a user with the `EXECUTE` privilege on the chain or the `EXECUTE ANY PROGRAM` system privilege).

Examples

The following example illustrates how to start a chain in the middle by providing the initial state of some chain steps.

```
declare
    initial_step_states sys.scheduler$_step_type_list;
begin
    initial_step_states := sys.scheduler$_step_type_list(
        sys.scheduler$_step_type('step1', 'SUCCEEDED'),
        sys.scheduler$_step_type('step2', 'FAILED 27486'),
```

```

sys.scheduler$_step_type('step3', 'SUCCEEDED'),
sys.scheduler$_step_type('step5', 'SUCCEEDED');
dbms_scheduler.run_chain('my_chain', initial_step_states);
end;
/

```

163.6.66 RUN_JOB Procedure

This procedure runs a job immediately.

If a job is enabled, the Scheduler runs it automatically. It is not necessary to call RUN_JOB to run a job according to its schedule. Use RUN_JOB to run a job outside of its normal schedule.

Syntax

```

DBMS_SCHEDULER.RUN_JOB (
  job_name          IN VARCHAR2,
  use_current_session IN BOOLEAN DEFAULT TRUE);

```

Parameters

Table 163-80 RUN_JOB Procedure Parameters

Parameter	Description
job_name	<p>A job name or a comma-separated list of entries, where each is the name of an existing job, optionally preceded by a schema name and dot separator.</p> <p>If you specify a multiple-destination job, the job runs on all destinations. In this case, the use_current_session argument must be FALSE.</p>
use_current_session	<p>This specifies whether or not the job run should occur in the same session that the procedure was invoked from. The job always runs as the job owner, in the job owner's schema, unless it has credential specified, then the job runs using the user named in the credential.</p> <p>When use_current_session is set to TRUE:</p> <ul style="list-style-type: none"> You can test a job and see any possible errors on the command line. state, run_count, last_start_date, last_run_duration, and failure_count of *_scheduler_jobs are not updated. RUN_JOB can be run in parallel with a regularly scheduled job run. <p>When use_current_session is set to FALSE:</p> <ul style="list-style-type: none"> You need to check the job log to find error information. All relevant fields in *_scheduler_jobs are updated. RUN_JOB fails if a regularly scheduled job is running. <p>For jobs that have a specified destination or destination group, or point to chains or programs with the detached attribute set to TRUE, use_current_session must be FALSE.</p>

Usage Notes

Jobs do not have to be enabled. If a job is disabled, the following validity checks are performed before running it:

- The job points to a valid job class.

- The job owner has `EXECUTE` privileges on the job class.
- If a program or chain is referenced, the program/chain exists.
- If a program or chain is referenced, the job owner has privileges to execute the program/chain.
- All argument values have been set (or have defaults).
- The job owner has the `CREATE EXTERNAL JOB` privilege if this is an external job.

A `TRUE` value for `use_current_session` is not permitted for the following types of jobs:

- Jobs that specify a destination or destination group in the `destination_name` attribute
- Jobs that point to chains (chain jobs)
- Jobs that make use of detached programs (detached jobs).

above bug fix 1261887 6.12.11

When `use_current_session` is `TRUE`, the call to `RUN_JOB` blocks until the job completes. Any errors that occur during the execution of the job are returned as errors to the `RUN_JOB` procedure.

Using `RUN_JOB` with `use_current_session=TRUE` does not update the job state and the job will not appear in `*_SCHEDULER_RUNNING_JOBS` views.

above bug fix 19185117 9.15.14

When `use_current_session` is `FALSE`, `RUN_JOB` returns immediately, and the job is picked up by the job coordinator process and passed on to a job secondary process for execution. The Scheduler views and logs must be queried for the outcome of the job.

Multiple user sessions can use `RUN_JOB` in their sessions simultaneously when `use_current_session` is set to `TRUE`.

`RUN_JOB` requires that you own the job or have `ALTER` privileges on that job. You can also run a job if you have the `CREATE ANY JOB` privilege.

Example

The following is an example of using `RUN_JOB`.

```
BEGIN
  DBMS_SCHEDULER.RUN_JOB(
    JOB_NAME      => 'EODJOB, DSS.ETLJOB',
    USE_CURRENT_SESSION => FALSE);
END;
```

163.6.67 SET_AGENT_REGISTRATION_PASS Procedure

This procedure sets the agent registration password for a database.

A Scheduler agent must register with the database before the database can submit jobs to the agent. The agent must provide this password when registering.

Syntax

```
DBMS_SCHEDULER.SET_AGENT_REGISTRATION_PASS (
  registration_password  IN VARCHAR2,
```

```

expiration_date      IN TIMESTAMP WITH TIME ZONE DEFAULT NULL,
max_uses             IN NUMBER DEFAULT NULL);

```

Parameters

Table 163-81 SET_AGENT_REGISTRATION_PASS Procedure Parameters

Parameter	Description
registration_password	This is the password that remote agents must specify in order to successfully register with the database. If this is NULL, then no agents will be able to register with the database.
expiration_date	If this is set to a non-NULL value, then the registration_password is not valid after this date. After this date, no agents can register with the database. This cannot be set to a date in the past.
max_uses	This is the maximum number of successful registrations that can be performed with this password. After the number of successful registrations has been performed with this password, then no agents can register with the database. This cannot be set to 0 or a negative value. If this is set to NULL, then there will be no limit on the number of successful registrations.

Usage Notes

To prevent abuse, this password can be set to expire after a given date or a maximum number of successful registrations. This procedure will overwrite any password already set. This requires the `MANAGE SCHEDULER` system privilege.

By default, `max_uses` is set to `NULL`, which means that there is no limit to the number of successful registrations.

Oracle recommends that an agent registration password be reset after every agent registration or every known set of agent registrations. Furthermore, Oracle recommends that this password be set to `NULL` if no new agents are being registered.

163.6.68 SET_ATTRIBUTE Procedure

This procedure modifies an attribute of a Scheduler object. It is overloaded to accept values of various types.

To set an attribute to `NULL`, use the `SET_ATTRIBUTE_NULL` procedure. The attributes that can be set depend on the object being altered. All object attributes can be changed, except the object name.

Syntax

```

DBMS_SCHEDULER.SET_ATTRIBUTE (
    name           IN VARCHAR2,
    attribute      IN VARCHAR2,
    value          IN {BOOLEAN|DATE|TIMESTAMP|
                     TIMESTAMP WITH TIME ZONE|TIMESTAMP WITH LOCAL TIME ZONE|
                     INTERVAL DAY TO SECOND});

```

```

DBMS_SCHEDULER.SET_ATTRIBUTE (
    name           IN VARCHAR2,
    attribute      IN VARCHAR2,
    value          IN VARCHAR2,

```

```
value2          IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 163-82 SET_ATTRIBUTE Procedure Parameters

Parameter	Description
name	The name of the object.
attribute	See Table 163-84 through Table 163-94 .
value	The new value being set for the attribute. This cannot be NULL. To set an attribute value to NULL, use the SET_ATTRIBUTE_NULL procedure.
value2	The value2 argument is for an optional second value. Most attributes have only one value associated with them, but some can have two.

[Table 163-83](#) is a directory of Scheduler object types and tables of attributes for the object types.

These object types can be viewed with Scheduler Data Dictionary Views, listed in *Oracle Database Administrator's Guide*.

Table 163-83 Attribute Tables for Scheduler Object Types

Scheduler Object Type	Table of Attributes
Job	Table 163-84
Program	Table 163-86
Schedule	Table 163-87
File Watcher	Table 163-88
Job Class	Table 163-89
Window	Table 163-90
Chain	Table 163-91
Database Destination	Table 163-92
External Destination	Table 163-93
Group	Table 163-94
Credential	Table 163-95
Resource	Table 163-96

Usage Notes

If an object is altered and it was in the enabled state, the Scheduler first disables it, then makes the change and reenables it. If any errors are encountered during the enable process, the object is not reenabled and an error is generated.

If an object is altered and it was in the disabled state, it remains disabled after it is altered.

To run `SET_ATTRIBUTE` for a window, a group of type `WINDOW`, or job class, you must have the `MANAGE_SCHEDULER` privilege. Otherwise, you must be the owner of the object being altered or have `ALTER` privileges on that object or have the `CREATE ANY JOB` privilege.

Job

If there is a running instance of the job when the `SET_ATTRIBUTE` call is made, it is not affected by the call. The change is only affects future runs of the job.

If any of the schedule attributes of a job are altered while the job is running, the time of the next job run is scheduled using the new schedule attributes. Schedule attributes of a job include `schedule_name`, `start_date`, `end_date`, and `repeat_interval`.

If any of the program attributes of a job are altered while the job is running, the new program attributes take effect the next time the job runs. Program attributes of a job include `program_name`, `job_action`, `job_type`, and `number_of_arguments`.

If any job argument values are altered while the job is running, the new values take effect the next time the job runs.

Granting the `ALTER` privilege on a job lets a user alter all attributes of that job except its program attributes (`program_name`, `job_type`, `job_action`, `program_action`, and `number_of_arguments`) and does not allow a user to use a PL/SQL expression to specify the schedule for a job.

Oracle recommends that you not alter a job that was automatically created for you by the database. Jobs that were created by the database have the column `SYSTEM` set to `TRUE` in job views.

Program

If any currently running jobs use the program that was altered, they continue to run with the program definition prior to the alter. The job runs with the new program definition the next time the job executes.

Schedule

If a schedule is altered, the change does not affect running jobs and open windows that use this schedule. The change only goes into effect the next time the jobs runs or the window opens.

File Watcher

If a file watcher is altered, any currently running event-based jobs started by the file arrival event are not affected. On the local system, the new file watcher attributes take effect the next time that the file watcher checks for the arrival of the file (every ten minutes by default). On remote systems, there may be an additional delay before the new file watcher attributes take effect.

Job Class

With the exception of the default job class, all job classes can be altered. To alter a job class, you must have the `MANAGE_SCHEDULER` privilege.

When a job class is altered, running jobs that belong to the class are not affected. The change only takes effect for jobs that have not started running yet. Job Class names must be preceded by `SYS`.

Window

When a window is altered, it does not affect an active window. The changes only take effect the next time the window opens.

If there is no current resource plan, when a window with a designated resource plan opens, the Resource Manager activates with that plan. Window names must be preceded by `SYS`.

Job Attribute Values

Table 163-84 lists attribute values for jobs.



Note:

See the `CREATE_JOB` procedure and the `CREATE_JOBS` procedure for more complete descriptions of the attributes in this table.

Table 163-84 Job Attribute Values

Name	Description
<code>allow_runs_in_restricted_mode</code>	If <code>TRUE</code> , the job is permitted to run when the database is in restricted mode, provided that the job owner is permitted to log in during this mode. <code>FALSE</code> by default.
<code>auto_drop</code>	This attribute, if <code>TRUE</code> , causes a job to be automatically dropped after it completes or is automatically disabled. A job is considered completed if: <ul style="list-style-type: none"> • Its end date (or the end date of the schedule) has passed. • It has run <code>max_runs</code> number of times. <code>max_runs</code> must be set with <code>SET_ATTRIBUTE</code>. • It is not a repeating job and has run once. A job is automatically disabled when it has failed <code>max_failures</code> times. <code>max_failures</code> is also set with <code>SET_ATTRIBUTE</code> . If this attribute is set to <code>FALSE</code> , the jobs are not dropped and their metadata is kept until the job is explicitly dropped with the <code>DROP_JOB</code> procedure. By default, jobs are created with <code>auto_drop</code> set to <code>TRUE</code> .
<code>comments</code>	An optional comment.
<code>connect_credential_name</code>	feature 25230 This attribute may be set to point to a database credential. For a SQL*Plus or backup script job, the credential connects to the database before running the script. For other job types, it is ignored. The job owner must have execute privileges on the credential, otherwise the job fails. Using a <code>connect_credential_name</code> is recommended since it allows the password to be stored securely in a credential in the database rather than in plain view in the job, program action, or script.
<code>credential_name</code>	This attribute specifies the name of the credential object (credential) to use for a remote database job, a remote external job, a local external job, or an event-based job that processes a file arrival event. For local external jobs only, if this attribute is <code>NULL</code> (the default), then a preferred (default) credential is selected. See <i>Oracle Database Administrator's Guide</i> for information about preferred credentials for local external jobs.

Table 163-84 (Cont.) Job Attribute Values

Name	Description
database_role	<p>This attribute applies when the database participates in an Oracle Data Guard environment. If this attribute is set to 'PRIMARY', the job runs only when the database is in the role of the primary database. If set to 'LOGICAL STANDBY', the job runs only when the database is in the role of a logical standby. The default is 'PRIMARY' when the database is the primary database, and 'LOGICAL STANDBY' when the database is a logical standby.</p> <p>Note: If you want a job to run for all database roles on a particular host, you must create two copies of the job on that host: one with a database_role of 'PRIMARY', and the other with a database_role of 'LOGICAL STANDBY'.</p>
destination	<p>*** Deprecated in Oracle Database 11g Release 2. Use destination_name instead.</p> <p>This attribute specifies a host on which to run a remote external job. It must be set to the host name or IP address of the destination host. It can optionally be followed by a port number, in the following format:</p> <p><i>hostname:port</i></p> <p>This attribute is set to NULL by default.</p>
destination_name	<p>The database destination or external destination for the job. Use for remote database jobs and remote external jobs only. For jobs running on the local database or for local external jobs (executables), must be NULL.</p> <p>See Table 163-28 for details about this attribute.</p>
end_date	<p>Specifies the date and time after which the job expires and is no longer run. After the end_date, if is TRUE, the job is dropped. If auto_drop is FALSE, the job is disabled and the STATE of the job is set to COMPLETED.</p> <p>If no value for end_date is specified, the job repeats forever unless max_runs or max_failures is set, in which case the job stops when either value is reached.</p> <p>The value for end_date must be after the value for start_date. If end_date is less than start_date, then an error will be generated. If end_date is the same as start_date, then the job will not execute and no error will be generated.</p>
event_spec	<p>This attribute takes two values: the value argument specifies the event condition and the value2 argument specifies the queue specification. For more details, see the descriptions for the event_condition and queue_spec arguments in the "CREATE_JOB Procedure".</p>
follow_default_timezone	<p>If TRUE and if the job start_date is null, then when the default_timezone scheduler attribute is changed, the Scheduler recomputes the next run date and time for this job so that it is in accordance with the new time zone.</p> <p>For example, if the job was set to run at 02:00 in the previous time zone, it will run at 02:00 in the new time zone.</p> <p>If the job start_date is not null, then the time zone for the run date and time for the job is always specified by the time zone of the start_date.</p> <p>If FALSE, the next start date and time for the job is not recomputed when the default_timezone scheduler attribute is changed. In this case, if the old time zone is three hours earlier than the new time zone, then a job scheduled to run at 02:00 in the old time zone runs at 05:00 in the new time zone.</p> <p>Summer and winter transitions do not change the default time zone name.</p>

Table 163-84 (Cont.) Job Attribute Values

Name	Description
instance_id	Valid only in an Oracle Real Application Clusters environment. Indicates the instance on which the job is to be run.
instance_stickiness	<p>This attribute should only be used for a database running in an Oracle Real Application Clusters (Oracle RAC) environment. By default, it is set to <code>TRUE</code>. If you set <code>instance_stickiness</code> to <code>TRUE</code>, jobs start running on the instance with the lightest load and the Scheduler thereafter attempts to run on the instance that it last ran on. If that instance is either down or so overloaded that it does not start new jobs for a significant period of time, another instance runs the job. If the interval between runs is large, <code>instance_stickiness</code> is ignored and the job is handled as if it were a non-sticky job.</p> <p>If <code>instance_stickiness</code> is set to <code>FALSE</code>, each instance of the job runs on the first instance available.</p> <p>For environments other than Oracle RAC, this attribute is not useful because there is only one instance.</p>
job_action	The action that the job performs, depending on the <code>job_type</code> attribute. For example, if <code>job_type</code> is <code>'STORED_PROCEDURE'</code> , <code>job_action</code> contains the name of the stored procedure.
job_class	The class this job is associated with.
job_priority	<p>This attribute specifies the priority of this job relative to other jobs in the same class as this job. If multiple jobs within a class are scheduled to be executed at the same time, the job priority determines the order in which jobs from that class are picked up for execution by the job coordinator. It can be a value from 1 through 5, with 1 being the first to be picked up for job execution.</p> <p>If no job priority is specified when creating a job, the default priority of 3 is assigned to it.</p>
job_type	<p>The type of this job. Valid values are: <code>'PLSQL_BLOCK'</code>, <code>'STORED_PROCEDURE'</code>, <code>'EXECUTABLE'</code>, <code>CHAIN</code>, <code>'EXTERNAL_SCRIPT'</code>, <code>'SQL_SCRIPT'</code>, and <code>'BACKUP_SCRIPT'</code>.</p> <p>If this is set, <code>program_name</code> must be <code>NULL</code>.</p>
job_weight	<p>*** Deprecated in Oracle Database 11gR2. Do not change the value of this attribute from the default, which is 1.</p> <p>Weight of the job for parallel execution.</p>

Table 163-84 (Cont.) Job Attribute Values

Name	Description
logging_level	<p>This attribute specifies how much information is logged. The possible options are:</p> <p><code>DBMS_SCHEDULER.LOGGING_OFF</code></p> <p>(The default) No logging is performed for this job. However, the logging level of the job class takes precedence and job logging may occur.</p> <p><code>DBMS_SCHEDULER.LOGGING_FAILED_RUNS</code></p> <p>The Scheduler logs only jobs that failed, with the reason for failure. If the job class has a higher logging level, then the higher logging level takes precedence.</p> <p><code>DBMS_SCHEDULER.LOGGING_RUNS</code></p> <p>The Scheduler writes detailed information to the job log for all runs of each job in this class. If the job class has a higher logging level, then the higher logging level takes precedence.</p> <p><code>DBMS_SCHEDULER.LOGGING_FULL</code></p> <p>In addition to recording every run of a job, the Scheduler records all operations performed on the job, including create, enable, disable, alter (with <code>SET_ATTRIBUTE</code>), stop, and so on.</p>
max_failures	<p>This attribute specifies the number of times a job can fail on consecutive scheduled runs before it is automatically disabled. Once a job is disabled, it is no longer executed and its <code>STATE</code> is set to <code>BROKEN</code> in the <code>*_SCHEDULER_JOB</code> views.</p> <p><code>max_failures</code> can be an integer between 1 to 1,000,000. By default, it is set to <code>NULL</code>, which indicates that new instances of the job are started regardless of how many previous instances have failed.</p>
max_run_duration	<p>This attribute specifies the maximum amount of time that the job should be allowed to run. Its datatype is <code>INTERVAL DAY TO SECOND</code>. If this attribute is set to a non-zero and non-<code>NULL</code> value, and job duration exceeds this value, the Scheduler raises an event of type <code>JOB_OVER_MAX_DUR</code>. It is then up to your event handler to decide whether or not to allow the job to continue.</p>
max_runs	<p>This attribute specifies the maximum number of consecutive scheduled runs of the job. Once <code>max_runs</code> is reached, the job is disabled and its state is changed to <code>COMPLETED</code>.</p> <p><code>max_runs</code> can be an integer between 1 and 1,000,000. By default, it is set to <code>NULL</code>, which means that it repeats forever or until <code>end_date</code> or <code>max_failures</code> is reached.</p>
number_of_arguments	<p>The number of arguments if the program is inlined. If this is set, <code>program_name</code> should be <code>NULL</code>.</p>

Table 163-84 (Cont.) Job Attribute Values

Name	Description
parallel_instances	<p>This is a boolean attribute that can be set only for event-based jobs.</p> <p>If FALSE (the default), then if an event is raised and the event-based job that processes that event is already running, the new event is ignored.</p> <p>If TRUE, then an instance of the job is started for every instance of the event, and each job instance is a lightweight job so multiple instances of the same event-based job can run in parallel. Each lightweight job takes its attributes (such as action, maximum run duration, and so on) from the definition of the event-based job (its <i>parent job</i>). After the lightweight job completes, it is dropped. There is no explicit limit to the number of lightweight jobs that can run simultaneously to process multiple instances of the event. However, limitations may be imposed by available system resources.</p> <p>The lightweight jobs are not visible in any of the *_SCHEDULER_JOBS views. However, they are visible in the *_SCHEDULER_RUNNING_JOBS views. The name of each lightweight job is the same as that of the parent job, and a subname is automatically generated to distinguish each lightweight job from its parent and from its siblings.</p>
program_name	<p>The name of a program object to use with this job. If this is set, job_action, job_type and number_of_arguments should be NULL.</p>
raise_events	<p>This attribute tells the Scheduler at what stages of the job execution to raise events. It is a bit vector in which zero or more of the following bits can be set. Each bit has a package constant corresponding to it.</p> <ul style="list-style-type: none"> • job_started CONSTANT PLS_INTEGER := 1 • job_succeeded CONSTANT PLS_INTEGER := 2 • job_failed CONSTANT PLS_INTEGER :=4 • job_broken CONSTANT PLS_INTEGER :=8 • job_completed CONSTANT PLS_INTEGER :=16 • job_stopped CONSTANT PLS_INTEGER :=32 • job_sch_lim_reached CONSTANT PLS_INTEGER :=64 • job_disabled CONSTANT PLS_INTEGER :=128 • job_chain_stalled CONSTANT PLS_INTEGER :=256 • job_all_events CONSTANT PLS_INTEGER := 511 • job_run_completed CONSTANT PLS_INTEGER := job_succeeded + job_failed + job_stopped <p>Table 163-85 describes these event types in detail.</p>
repeat_interval	<p>Either a PL/SQL function returning the next date and time on which to run, or calendaring syntax expression. If this is set, schedule_name should be NULL. See "Calendaring Syntax" for more information.</p>

Table 163-84 (Cont.) Job Attribute Values

Name	Description
restartable	<p>This attribute specifies whether or not a job can be restarted in case of failure. By default, jobs are not restartable and this attribute is set to <code>FALSE</code>. Setting this to <code>TRUE</code> means that if a job fails while running, it is restarted from the beginning point of the job.</p> <p>In the case of a chain job, if this attribute is <code>TRUE</code>, the chain is restarted from the beginning after an application failure. If this attribute is <code>FALSE</code>, or if there has been a database failure, the chain is restarted at the last running step. The <code>restart_on_recovery</code> attribute of that step then determines if the step is restarted or marked as stopped. (If marked as stopped, the chain evaluates rules and continues.)</p> <p>Note that setting this attribute to <code>TRUE</code> might lead to data inconsistencies in some situations, for example, if data is committed within a job.</p> <p>Retries on errors are not counted as regular runs. The run count or failure count is not incremented until the job succeeds or has failed all its six retries.</p> <p>The restartable attribute is used by the Scheduler to determine whether to retry the job not only on regular application errors, but after a database malfunction as well. The Scheduler retries the job a maximum of six times. The first time, it waits for one second and multiplies this wait time with a factor of 10 each time thereafter.</p> <p>Both the run count and failure count are incremented by 1 if the job has failed all its six retries. If the job immediately succeeds, or it succeeds on one of its retries, run count is incremented by 1.</p> <p>The Scheduler stops retrying a job when:</p> <ul style="list-style-type: none"> • One of the retries succeeds. • All of its six retries have failed. • The next retry would occur after the next regularly scheduled run of the job. <p>The Scheduler no longer retries the job if the next scheduled retry is past the next regularly scheduled run for repeating jobs.</p>
schedule_limit	<p>In heavily loaded systems, jobs are not always started at their scheduled time. This attribute enables you to have the Scheduler not start a job at all if the delay in starting the job is larger than the interval specified. It can be a value of 1 minute to 99 days. For example, if a job was supposed to start at noon and the schedule limit is set to 60 minutes, the job will not be run if it has not started to run by 1:00 p.m.</p> <p>If <code>schedule_limit</code> is not specified, the job is executed at some later date as soon as there are resources available to run it. By default, this attribute is set to null, which indicates that the job can be run at any time after its scheduled time. A scheduled job run that is skipped because of this attribute does not count against the number of runs and failures of the job. An entry in the job log reflects the skipped run.</p>
schedule_name	<p>The name of a schedule, window, or group of type <code>WINDOW</code> to use as the schedule for this job. If this is set, <code>end_date</code>, <code>start_date</code> and <code>repeat_interval</code> should all be <code>NULL</code>.</p>
start_date	<p>The original date and time on which this job started or is scheduled to start. If this is set, <code>schedule_name</code> should be <code>NULL</code>.</p>

Table 163-84 (Cont.) Job Attribute Values

Name	Description
stop_on_window_close	<p>This attribute only applies if the schedule of a job is a window or a window group. Setting this attribute to <code>TRUE</code> implies that the job should stop once the associated window is closed. The job is stopped using the <code>stop_job</code> procedure with <code>force</code> set to <code>FALSE</code>.</p> <p>By default, <code>stop_on_window_close</code> is set to <code>FALSE</code>. Therefore, if you do not set this attribute, the job continues after the window closes.</p> <p>Note that, although the job is allowed to continue, its resource allocation will probably change because closing a window generally also implies a change in resource plans.</p>
store_output	<p>This is a boolean attribute. If set to <code>TRUE</code>, then for job runs that are logged, all job output and error messages are stored in the <code>*_JOB_RUN_DETAILS</code> views. If set to <code>FALSE</code>, then the output and messages are not stored. For new jobs, this is set, by default, to <code>TRUE</code>.</p>

The following event types are valid values for the `raise_events` attribute in [Table 163-84](#).

Table 163-85 Event Types Raised by the Scheduler

Event Type	Description
job_all_events	Not an event, but a constant that provides an easy way for you to enable all events
job_broken	The job has been disabled and has changed to the <code>BROKEN</code> state because it exceeded the number of failures defined by the <code>max_failures</code> job attribute
job_chain_stalled	A job running a chain is in the <code>CHAIN_STALLED</code> state. A running chain becomes stalled if there are no steps running or scheduled to run and the chain <code>evaluation_interval</code> is set to <code>NULL</code> . No progress is made in the chain unless there is manual intervention.
job_completed	The job completed because it reached its <code>max_runs</code> or <code>end_date</code>
job_disabled	The job was disabled by the Scheduler or by a call to <code>SET_ATTRIBUTE</code>
job_failed	The job failed, either due to an error or an unusual termination.
job_over_max_dur	The job exceeded the maximum run duration specified by its <code>max_run_duration</code> attribute. (Note: you do not need to enable this event with the <code>raise_events</code> job attribute; it is always enabled.)
job_run_completed	A job run either failed, succeeded, or was stopped
job_sch_lim_reached	The schedule limit of the job was reached. The job was not started because the delay in starting the job exceeded the value of the <code>schedule_limit</code> job attribute.
job_started	The job started
job_stopped	The job was stopped by a call to <code>STOP_JOB</code>
job_succeeded	The job completed successfully

Program Attribute Values

[Table 163-86](#) lists program attribute values.



Note:

See the "[CREATE_PROGRAM Procedure](#)" for more complete descriptions of the attributes in this table.

Table 163-86 Program Attribute Values

Name	Description
comments	An optional comment. This can describe what the program does or give usage details.
detached	If TRUE, the program is a detached program. See <i>Oracle Database Administrator's Guide</i> for information about detached jobs and detached programs.
number_of_arguments	The number of arguments required by the stored procedure or other executable that the program invokes
program_action	The action that the program performs, indicated by the <code>program_type</code> attribute. For example, if <code>program_type</code> is 'STORED_PROCEDURE', <code>program_action</code> contains the name of the stored procedure.
program_type	The type of program. This must be one of these supported program types: 'PLSQL_BLOCK', 'STORED_PROCEDURE', and 'EXECUTABLE'.

Schedule Attribute Values

[Table 163-87](#) lists schedule attribute values.



Note:

See "[CREATE_SCHEDULE Procedure](#)" for more complete descriptions of the attributes in this table.

Table 163-87 Schedule Attribute Values

Name	Description
comments	An optional comment.
end_date	The cutoff date and time after which the schedule does not specify any dates.
event_spec	This attribute takes two values: the <code>value</code> argument should contain the event condition and the <code>value2</code> argument should contain the queue specification. For more details, see the descriptions for the <code>event_condition</code> and <code>queue_spec</code> arguments to the " CREATE_JOB Procedure ".
repeat_interval	An attribute specifying how often the schedule should repeat, using the calendaring syntax. See " Calendaring Syntax " for more information.
start_date	The start or reference date and time used by the calendaring syntax.

File Watcher Attribute Values

Table 163-88 lists file watcher attribute values.

Table 163-88 File Watcher Attribute Values

Parameter	Description
destination	Remote host name or IP address where the file is expected to arrive. If NULL, destination is the local host.
directory_path	Directory in which the file is expected to arrive. The single wildcard '?' at the beginning of the path denotes the Oracle home path. For example, '?/rdbms/log' denotes the rdbms/log subdirectory of the Oracle home directory.
file_name	Name of the file being looked for. Two wildcards are permitted anywhere in the file name: '?' denotes any single character, and '*' denotes zero or more characters. This attribute cannot be NULL.
credential_name	Name of a valid credential object. The file watcher uses the credential to authenticate itself with the host operating system to access the watched-for file. The file watcher owner must have the EXECUTE privilege on the credential. Cannot be NULL.
min_file_size	Minimum file size in bytes before the file watcher considers the file found. Default is 0.
steady_state_duration	Minimum time interval that the file must remain unchanged before the file watcher considers the file found. If NULL, an internal value is used. The lower limit for this attribute is 10 seconds.
comments	Optional comment.

Job Class Attribute Values

Table 163-89 lists job class attribute values.

**Note:**

See the "[CREATE_JOB_CLASS Procedure](#)" for more complete descriptions of the attributes in this table.

Table 163-89 Job Class Attribute Values

Name	Description
comments	An optional comment about the class.
log_history	This attribute controls the number of days that job log entries for jobs in this class are retained. It helps prevent the job log from growing indiscriminately. The range of valid values is 0 through 1000000. If set to 0, no history is kept. If NULL, retention days are set by the log_history Scheduler attribute (set with SET_SCHEDULER_ATTRIBUTE).

Table 163-89 (Cont.) Job Class Attribute Values

Name	Description
logging_level	<p>This attribute specifies how much information is logged. The valid values are:</p> <ul style="list-style-type: none"> DBMS_SCHEDULER.LOGGING_OFF No logging is performed for any jobs in this class. DBMS_SCHEDULER.LOGGING_FAILED_RUNS The Scheduler logs only jobs in the class that failed, with the reason for failure. DBMS_SCHEDULER.LOGGING_RUNS The Scheduler writes detailed information to the job log for all runs of each job in this class. This is the default. DBMS_SCHEDULER.LOGGING_FULL The Scheduler records all operations performed on all jobs in this class, in addition to recording every run of a job. Every time a job is created, enabled, disabled, altered (with SET_ATTRIBUTE), stopped, and so on, an entry is recorded in the log.
resource_consumer_group	<p>The resource consumer group that a class is associated with. All jobs in the class run under this resource consumer group. See <i>Oracle Database Administrator's Guide</i> for a description of resource consumer groups and the Database Resource Manager.</p>
service	<p>The database service that the jobs in the job class have affinity to. If both the resource_consumer_group and service attributes are set for a job class, and if the service is mapped to a resource consumer group, the resource_consumer_group attribute takes precedence.</p>

Window Attribute Values

Table 163-90 lists window attribute values.



Note:

See the "[CREATE_WINDOW Procedure](#)" for more complete descriptions of the attributes in this table.

Table 163-90 Window Attribute Values

Name	Description
comments	An optional comment about the window.
duration	The duration of the window.
end_date	The date after which the window no longer opens. If this is set, schedule_name must be NULL.
repeat_interval	An attribute specifying how often the schedule should repeat, using the calendaring syntax. PL/SQL date functions are not allowed. If this is set, schedule_name must be NULL. See " Calendaring Syntax " for more information.

Table 163-90 (Cont.) Window Attribute Values

Name	Description
resource_plan	<p>The resource plan to be associated with a window. When the window opens, the system switches to this resource plan. When the window closes, the original resource plan is restored. If a resource plan has been made active with the <i>force</i> option, no resource plan switch occurs.</p> <p>Only one resource plan can be associated with a window. It may be NULL or the empty string (""). When it is NULL, the resource plan that is in effect when the window opens stays in effect for the duration of the window. When it is the empty string, the resource manager is disabled for the duration of the window.</p>
schedule_name	The name of a schedule to use with this window. If this is set, start_date, end_date, and repeat_interval must all be NULL.
start_date	The next date and time on which this window is scheduled to open. If this is set, schedule_name must be NULL.
window_priority	The priority of the window. Must be either 'LOW' (default) or 'HIGH'.

Chain Attribute Values

Table 163-91 lists chain attribute values.

**Note:**

See the "[CREATE_CHAIN Procedure](#)" for more complete descriptions of the attributes in this table.

Table 163-91 Chain Attribute Values

Name	Description
comments	An optional comment describing the purpose of the chain.
evaluation_interval	<p>If not NULL, provides an additional evaluation of the chain at this interval, as well as at normal evaluation times (when the job starts, when a step completes, or when an event that is associated with an event step arrives)</p> <p>This attribute should only be used when chain rules use SQL syntax and the rule conditions contain elements that are not under the control of the Scheduler, because the extra interval is CPU intensive. For most chains, the normal evaluation times are sufficient.</p>

Table 163-91 (Cont.) Chain Attribute Values

Name	Description
rule_set_name	<p>In the normal case, no rule set should be passed in. The Scheduler automatically creates a rule set and associated empty evaluation context. You then use <code>DEFINE_CHAIN_RULE</code> to add rules and <code>DROP_CHAIN_RULE</code> to remove them.</p> <p>Advanced users can create a rule set that describes their chain dependencies and pass it in here. This allows greater flexibility in defining rules. For example, conditions can refer to external variables, and tables can be exposed through the evaluation context. If you pass in a rule set, you must ensure that it is in the format of a chain rule set. (For example, all steps must be listed as variables in the evaluation context). If no rule set is passed in, the rule set created is of the form <code>SCHED_RULESET\${N}</code> and the evaluation context created is of the form <code>SCHED_EVCTX\${N}</code>.</p>

Database Destination Attribute Values

Table 163-92 lists database destination attribute values.



Note:

See the "[CREATE_DATABASE_DESTINATION Procedure](#)" for more complete descriptions of the attributes in this table.

Table 163-92 Database Destination Attribute Values

Name	Description
agent	<p>The name of the external destination (also known as agent destination) that is used to connect to the remote database.</p> <p>You can obtain valid external destination names from the view <code>ALL_SCHEDULER_EXTERNAL_DESTS</code>.</p>
connect_info	<p>The TNS connect descriptor that identifies the remote database to connect to, or the net service name (alias) in <code>tnsnames.ora</code> that resolves to the connect descriptor.</p> <p>Note: This corresponds to the <code>tns_name</code> argument of <code>CREATE_DATABASE_DESTINATION</code>.</p>
enabled	If <code>TRUE</code> , the database destination is enabled.
comments	An optional comment about the database destination.

External Destination Attribute Values

Table 163-93 lists external destination attribute values.

 **Note:**

External destinations are created only implicitly by registering a remote Scheduler agent with the local database.

Table 163-93 External Destination Attribute Values

Name	Description
hostname	(GET_ATTRIBUTE only) The fully qualified host name (including domain) or IP address of the computer on which the Scheduler agent resides.
port	(GET_ATTRIBUTE only) The TCP port number on which the agent listens.
ip_address	(GET_ATTRIBUTE only) The IP address of the host on which the agent resides.
enabled	If TRUE, the external destination is enabled.
comments	An optional comment about the external destination.

Group Attribute Values

Table 163-94 lists group attribute values.

 **Note:**

See the "[CREATE_GROUP Procedure](#)" for more complete descriptions of the attributes in this table.

Table 163-94 Group Attribute Values

Name	Description
group_type	(GET_ATTRIBUTE only) The group type (either WINDOW, DB_DEST, or EXTERNAL_DEST).
member_name	Comma-separated list of members. Replaces the existing list of members. To add one or more members to the existing list, use ADD_GROUP_MEMBER. Note: this attribute corresponds to the <code>member</code> argument of CREATE_GROUP.
enabled	If TRUE, the group is enabled.
comments	An optional comment about the group.
number_of_members	(GET_ATTRIBUTE only) The number of members in the group.

Credential Attribute Values

Table 163-95 lists credential attribute values.

 **Note:**

Credential attribute values for the `SET_ATTRIBUTE` and `GET_ATTRIBUTE` procedures are deprecated with Oracle Database Release 12c Release 1 (12.1). While these attribute values remain available in this package, for reasons of backward compatibility, Oracle recommends using the alternative enhanced functionality provided in the `DBMS_CREDENTIAL` package, specifically the attribute parameter in the `UPDATE_CREDENTIAL Procedure`.

Table 163-95 Credential Attribute Values

Name	Description
username	The user name for logging into to the host operating system or remote Oracle database. Maximum length is 64.
password	The password for the user name. Maximum length is 128.
comments	A description of the credential. Maximum length is 240.
windows_domain	For a Windows remote executable target, this is the domain that the specified user belongs to. Maximum length is 64.
database_role	The value of the <code>database_role</code> attribute is used as the system privilege for logging into a remote database to run a remote database job. Valid values are: SYSDBA and SYSOPER.

Resource Attribute Values

[Table 163-96](#) lists resource attribute values.

Table 163-96 Resource Attribute Values

Name	Description
resource_name	The name of the resource
units	The number of units of this resource that the job or program uses.
status	The status of the resource. ENFORCE_CONSTRAINTS. This is the default value, and when set, will force the scheduler to enforce resource limits. When the maximum number of units of this resource has been reached, no additional jobs using this resource will get started. IGNORE_CONSTRAINTS. When set, the scheduler will ignore any constraints on this resource. BLOCKED_ALL_JOBS. No jobs having a constraint on this resource will be allowed to run. The resource is considered to be permanently blocking until switched to one of the other two states.
constraint_level	Level of the constraint: JOB_LEVEL or PROGRAM_LEVEL For incompatibilities, for JOB_LEVEL, the incompatibility members must be jobs; for PROGRAM_LEVEL the incompatibility members must be programs.
comments	Descriptive comment about the resource.

163.6.69 SET_ATTRIBUTE_NULL Procedure

This procedure sets an attribute of an object to `NULL`.

The attributes that can be set depend on the object being altered. If the object is enabled, it is disabled before being altered and reenabled afterward. If the object cannot be reenabled, an error is generated and the object is left in a disabled state.

Syntax

```
DBMS_SCHEDULER.SET_ATTRIBUTE_NULL (
    name          IN VARCHAR2,
    attribute     IN VARCHAR2);
```

Parameters

Table 163-97 SET_ATTRIBUTE_NULL Procedure Parameters

Parameter	Description
name	The name of the object
attribute	The attribute being changed

Usage Notes

To run `SET_ATTRIBUTE_NULL` for a window, group of type `WINDOW`, or job class, you must have the `MANAGE_SCHEDULER` privilege. Otherwise, you must be the owner of the object being altered or have `ALTER` privileges on that object or have the `CREATE ANY JOB` privilege.

163.6.70 SET_JOB_ANYDATA_VALUE Procedure

This procedure sets the value for an argument of the associated program for a job, encapsulated in an `AnyData` object.

It overrides any default value set for the program argument. `NULL` is a valid assignment for a program argument.

The argument can be specified by position or by name. You can specify by name only when:

- The job points to a saved program object
- The argument was assigned a name with the [DEFINE_ANYDATA_ARGUMENT Procedure](#)

Scheduler does no type checking of the argument at any time.

`SET_JOB_ANYDATA_VALUE` is overloaded.

Syntax

Sets a program argument by its position.

```
DBMS_SCHEDULER.SET_JOB_ANYDATA_VALUE (
    job_name          IN VARCHAR2,
    argument_position IN PLS_INTEGER,
    argument_value    IN SYS.ANYDATA);
```

Sets a program argument by its name.

```
DBMS_SCHEDULER.SET_JOB_ANYDATA_VALUE (
  job_name          IN VARCHAR2,
  argument_name     IN VARCHAR2,
  argument_value    IN SYS.ANYDATA);
```

Parameters

Table 163-98 SET_JOB_ANYDATA_VALUE Procedure Parameters

Parameter	Description
job_name	The name of the job to be altered
argument_name	The name of the program argument being set
argument_position	The position of the program argument being set
argument_value	The new value to be assigned to the program argument, encapsulated in an AnyData object

Usage Notes

SET_JOB_ANYDATA_VALUE requires that you own the job or have ALTER privileges on that job. You can also set a job argument value if you have the CREATE ANY JOB privilege.

SET_JOB_ANYDATA_VALUE does not apply to lightweight jobs because lightweight jobs cannot take AnyData arguments.

See Also:

- ["SET_JOB_ARGUMENT_VALUE Procedure"](#)
- ["DEFINE_ANYDATA_ARGUMENT Procedure"](#)

163.6.71 SET_JOB_ARGUMENT_VALUE Procedure

This procedure sets the value of an argument for a job.

It overrides any default value set for the corresponding program or stored procedure argument. The argument can be specified by position or by name. You can specify by name only when:

- The job points to a saved program object
- The argument was assigned a name with the [DEFINE_PROGRAM_ARGUMENT Procedure](#) or the [DEFINE_METADATA_ARGUMENT Procedure](#)

Scheduler does no type checking of the argument at any time.

SET_JOB_ARGUMENT_VALUE is overloaded.

Syntax

Sets an argument value by position:

```
DBMS_SCHEDULER.SET_JOB_ARGUMENT_VALUE (
  job_name           IN VARCHAR2,
  argument_position  IN PLS_INTEGER,
  argument_value     IN VARCHAR2);
```

Sets an argument value by name:

```
DBMS_SCHEDULER.SET_JOB_ARGUMENT_VALUE (
  job_name           IN VARCHAR2,
  argument_name      IN VARCHAR2,
  argument_value     IN VARCHAR2);
```

Parameters

Table 163-99 SET_JOB_ARGUMENT_VALUE Procedure Parameters

Parameter	Description
job_name	The name of the job to be altered
argument_name	The name of the program argument being set
argument_position	The position of the program argument being set
argument_value	The new value to be set for the program argument. To set a non-VARCHAR value, use the SET_JOB_ANYDATA_VALUE procedure.

Usage Notes

SET_JOB_ARGUMENT_VALUE requires that you be the owner of the job or have ALTER privileges on that job. You can also set a job argument value if you have the CREATE ANY JOB privilege.

SET_JOB_ARGUMENT_VALUE only supports arguments of SQL type. Therefore, argument values that are not of SQL type, such as booleans, are not supported as program or job arguments.

SET_JOB_ARGUMENT_VALUE can be used to set arguments of lightweight jobs but only if the argument is of type VARCHAR2.



See Also:

- ["SET_JOB_ANYDATA_VALUE Procedure"](#)
- ["DEFINE_PROGRAM_ARGUMENT Procedure"](#)

163.6.72 SET_JOB_ATTRIBUTES Procedure

This procedure changes an attribute of a job.

Syntax

```
DBMS_SCHEDULER.SET_JOB_ATTRIBUTES (
  jobattr_array      IN JOBATTR_ARRAY,
  commit_semantics   IN VARCHAR2 DEFAULT 'STOP_ON_FIRST_ERROR');
```

Parameters

Table 163-100 SET_JOB_ATTRIBUTES Procedure Parameters

Parameter	Description
jobattr_array	The array of job attribute changes.
commit_semantics	The commit semantics. The following types are supported: <ul style="list-style-type: none"> • <code>STOP_ON_FIRST_ERROR</code> returns on the first error and commits previous successful attribute changes to disk. This is the default. • <code>TRANSACTIONAL</code> returns on the first error and rolls back everything that happened before that error. • <code>ABSORB_ERRORS</code> tries to absorb any errors and complete the rest of the job attribute changes on the list. It commits all the successful changes. If errors occur, you can query the view <code>SCHEDULER_BATCH_ERRORS</code> for details.

Usage Notes

Calling `SET_ATTRIBUTE` on an enabled job disables the job, changes the attribute value, and reenables the job. `SET_JOB_ATTRIBUTES` changes the attribute values in the context of a single transaction.

163.6.73 SET_RESOURCE_CONSTRAINT Procedure

This procedure allows users to specify the resources used by jobs.

Syntax

```
DBMS_SCHEDULER.SET_RESOURCE_CONSTRAINT (
    object_name      IN VARCHAR2,
    resource_name    IN VARCHAR2,
    units            IN NUMBER DEFAULT 1);
```

Parameters

Table 163-101 SET_RESOURCE_CONSTRAINT Procedure Parameters

Parameter	Description
object_name	The name of a program or a job, or a comma separated list of these objects.
resource_name	The name of the resource.
units	The number of units of this resource that the job or program uses.

Usages Notes

`object_name` can be the name or comma-separated list of names of either programs or jobs. This creates a constraint on the named resource for these programs or jobs.

`units` specifies the number of units of the resource that the program or job can use. If `units` is set to 0, then the program or job does not use this resource anymore, and the

resulting constraint is deleted. Setting `units` to 0 on a resource with no previous constraint results in an error.

When multiple constraints are defined on the same resource, the object types must match. When one or more existing constraints for a resource are based on jobs and a new constraint is added for the same resource that is based on a program (or vice versa) an error will be raised.

163.6.74 SET_SCHEDULER_ATTRIBUTE Procedure

This procedure sets the value of a Scheduler attribute. This takes effect immediately but the resulting changes may not be seen immediately, depending on the attribute affected.

[Table 163-102](#) provides short attribute descriptions for the `SET_SCHEDULER_ATTRIBUTE` procedure. For complete descriptions, see section "Setting Scheduler Preferences" in *Oracle Database Administrator's Guide*.

Syntax

```
DBMS_SCHEDULER.SET_SCHEDULER_ATTRIBUTE (  
    attribute      IN VARCHAR2,  
    value          IN VARCHAR2);
```

Parameters

Table 163-102 SET_SCHEDULER_ATTRIBUTE Procedure Parameters

Parameter	Description
attribute	<p>The name of the Scheduler attribute. Possible values are:</p> <ul style="list-style-type: none"> • 'default_timezone': Repeating jobs and windows that use the calendaring syntax retrieve the time zone from this attribute when start_date is not specified. See "Calendaring Syntax" for more information. • 'email_server': The SMTP server address that the Scheduler uses to send e-mail notifications for job state events. E-mail notifications cannot be sent if this attribute is NULL. • 'email_sender': The default e-mail address of the sender of job state e-mail notifications. • 'email_server_credential': The schema and name of an existing credential object that SYS has execute object privileges on. Default is NULL. The username and password stored in this credential are used to authenticate with the e-mail server when sending e-mail notifications. • 'email_server_encryption': This attribute indicates whether or not encryption is enabled for this email server connection, and if so, at what point encryption starts, and with which protocol. Values are: <ul style="list-style-type: none"> – NONE: the default, indicating no encryption used – SSL_TLS: indicating that either SSL or TLS are used, from the beginning of the connection – STARTTLS: indicating that the connection starts unencrypted, but the command STARTTLS is sent to the e-mail server and starts encryption • 'event_expiry_time': The time, in seconds, before a job state event generated by the Scheduler expires from the Scheduler event queue. If NULL, job state events expire after 24 hours. • 'log_history': The number of days that log entries for both the job log and the window log are retained. Default is 30 and the range of valid values is 0 through 1000000. • 'max_job_slave_processes': This Scheduler attribute is not used.
value	The new value of the attribute

Usage Notes

To run SET_SCHEDULER_ATTRIBUTE, you must have the `MANAGE SCHEDULER` privilege.



See Also:

Oracle Database Administrator's Guide for more detailed descriptions of Scheduler attributes

163.6.75 STOP_JOB Procedure

This procedure stops currently running jobs or all jobs in a job class.

After stopping the job, the state of a one-time job is set to `STOPPED`, whereas the state of a repeating job is set to `SCHEDULED` or `COMPLETED`, depending on whether the next run of the job is scheduled.

If a job pointing to a chain is stopped, all running steps of the running chain are stopped.

If a job has multiple destinations, the database attempts to stop the job at all destinations.

For external jobs, `STOP_JOB` stops only the external process that was directly started by the job action. It does not stop child processes of external jobs.

For in-memory full jobs in an Oracle Real Application Clusters environment, `STOP_JOB` uses the `instance_id` attribute of the job definition to determine in which instance (or all of them if the attribute is left null) to stop the in-memory full job. (In-memory full jobs are kept cached in memory, and as such are limited to the instance currently caching them. Because of this, the same `job_name` can in some conditions be used for different jobs on different instances.)

Syntax

```
DBMS_SCHEDULER.STOP_JOB (
  job_name          IN VARCHAR2
  force             IN BOOLEAN DEFAULT FALSE
  commit_semantics IN VARCHAR2 DEFAULT 'STOP_ON_FIRST_ERROR');
```

Parameters

Table 163-103 STOP_JOB Procedure Parameters

Parameter	Description
<code>job_name</code>	<p>Name of a job to stop. Can be a comma-separated list of jobs, where each entry can be one of the following:</p> <ul style="list-style-type: none"> Job name: the name of an existing job, optionally preceded by a schema name and dot separator. Job destination ID: a number, obtained from the <code>JOB_DEST_ID</code> column of the <code>*_SCHEDULER_JOB_DESTS</code> views, that represents the unique combination of a job, a credential, and a destination. Job class: the name of a job class. Must be preceded by the <code>SYS</code> schema name and a dot separator. <p>If you specify a job class, all jobs that belong to that job class are stopped. If you specify a job that was created with a destination group as its <code>destination_name</code> attribute, all job instances on all destinations are stopped.</p>

Table 163-103 (Cont.) STOP_JOB Procedure Parameters

Parameter	Description
<code>force</code>	<p>If <code>force</code> is set to <code>FALSE</code>, the Scheduler tries to gracefully stop the job using an interrupt mechanism. This method gives control back to the secondary process, which can update the status of the job in the job queue to stopped. If this fails, an error is returned.</p> <p>If <code>force</code> is set to <code>TRUE</code>, the Scheduler immediately terminates the secondary process. Oracle recommends that <code>STOP_JOB</code> with <code>force</code> set to <code>TRUE</code> be used only after a <code>STOP_JOB</code> with <code>force</code> set to <code>FALSE</code> has failed.</p> <p>Use of the <code>force</code> option requires the <code>MANAGE SCHEDULER</code> system privilege.</p>
<code>commit_semantics</code>	<p>The commit semantics. The following two types are supported:</p> <ul style="list-style-type: none">• <code>STOP_ON_FIRST_ERROR</code>: The procedure returns on the first error and commits previous successful stop operations to disk. This is the default.• <code>ABSORB_ERRORS</code>: The procedure tries to absorb any errors, stops the rest of the jobs, and commits all the successful stop operations. This type is available only if no job classes are specified in the <code>job_name</code> list. If errors occur, you can query the view <code>SCHEDULER_BATCH_ERRORS</code> for details.

Usage Notes

`STOP_JOB` without the `force` option requires that you be the owner of the job or have `ALTER` privileges on that job. You can also stop a job if you have the `CREATE ANY JOB` or `MANAGE SCHEDULER` privilege.

`STOP_JOB` with the `force` option requires that you have the `MANAGE SCHEDULER` privilege.

Example

The following is an example of using `STOP_JOB`.

```
BEGIN
  DBMS_SCHEDULER.STOP_JOB('DSS.ETLJOB', 984, 1223, SYS.ETL_JOBCLASS');
END;
```

DBMS_SEARCH

The `DBMS_SEARCH` package enables the indexing of multiple schema objects in a single index.

This Oracle Text package provides procedures and functions to create, maintain, and query a ubiquitous search index. Ubiquitous database search is a full-text and range-based search across multiple tables and views. To add data sources from different schemas to the index, the index owner must have `SELECT` and `DML` access to the sources.

A complete description of this package is available in *Oracle Text Reference*.

Related Topics

- [Oracle Text Reference](#)

DBMS_SERVER_ALERT

The `DBMS_SERVER_ALERT` package enables you to configure the Oracle Database server to issue an alert when a threshold for a specified server metric has been violated. You can configure both warning and critical thresholds for a large number of predefined metrics.

If a warning threshold is reached, the server generates a severity level 5 alert. If a critical threshold is reached, the server generates a severity level 1 alert.

The chapter contains the following topics:

- [Security Model](#)
- [Object Types](#)
- [Relational Operators](#)
- [Supported Metrics](#)
- [Summary of DBMS_SERVER_ALERT Subprograms](#)

165.1 DBMS_SERVER_ALERT Security Model

The user needs `DBA` or `IMP_FULL_DATABASE` roles to use the `DBMS_SERVER_ALERT` package.

165.2 DBMS_SERVER_ALERT Object Types

You qualify the metric by an individual object for the listed object types.

Table 165-1 Object Types Defined as Constants

Constant	Description
<code>OBJECT_TYPE_SYSTEM</code>	Metrics collected on the system level for each instance.
<code>OBJECT_TYPE_FILE</code>	Metrics collected on the file level. These are used for <code>AVG_FILE_READ_TIME</code> and <code>AVG_FILE_WRITE_TIME</code> metrics.
<code>OBJECT_TYPE_SERVICE</code>	Metrics collected on the service level. Currently <code>ELAPSED_TIME_PER_CALL</code> and <code>CPU_TIME_PER_CALL</code> are collected.
<code>OBJECT_TYPE_TABLESPACE</code>	Metrics collected on the tablespace level. Note: Dictionary managed tablespaces are not supported.
<code>OBJECT_TYPE_EVENT_CLASS</code>	Metrics collected on wait event class level. Currently supported metrics are <code>AVG_USERS_WAITING</code> and <code>DB_TIME_WAITING</code> .
<code>OBJECT_TYPE_SESSION</code>	Metrics collected on the session level. Currently only <code>BLOCKED_USERS</code> is collected. The threshold can only be set at the instance level, which means that no object name should be specified when setting the threshold for this type of metric.
<code>OBJECT_TYPE_WRCCLIENT</code>	Refers to a group of metrics (<code>WCR_...</code>) used during replay to monitor the replay clients' performance

165.3 DBMS_SERVER_ALERT Relational Operators

You can specify a relational comparison operator to determine whether or not a given metric's value violates the threshold setting. The server supports the following operators.

Table 165-2 Relational Operators Defined as Constants

Constant	Description
OPERATOR_CONTAINS	A metric value matching an entry in a list of threshold values is considered a violation.
OPERATOR_DO_NOT_CHECK	The metric value is not compared to the threshold value, and no alerts are generated. Use this operator to disable alerts for a metric.
OPERATOR_EQ	A metric value equal to the threshold value is considered a violation.
OPERATOR_GE	A metric value greater than or equal to the threshold value is considered a violation.
OPERATOR_GT	A metric value greater than the threshold value is considered a violation.
OPERATOR_LE	A metric value less than or equal to the threshold value is considered a violation.
OPERATOR_LT	A metric value less than the threshold value is considered a violation.
OPERATOR_NE	A metric value not equal to the threshold value is considered a violation.

165.4 DBMS_SERVER_ALERT Supported Metrics

These metrics are supported. All internal metric names are supplied as package constants.

Table 165-3 List of Supported Metrics

Metric Name (Internal)	Metric Name (External)	Units
AVG_FILE_READ_TIME	Average File Read Time	Microseconds
AVG_FILE_WRITE_TIME	Average File Write Time	Microseconds
AVG_USERS_WAITING	Average Number of Users Waiting on a Class of Wait Events	Count of sessions
BLOCKED_USERS	Number of Users blocked by some Session	Number of Users
BRANCH_NODE_SPLITS_SEC	Branch Node Splits (for each second)	Splits for each Second
BRANCH_NODE_SPLITS_TXN	Branch Node Splits (for each transaction)	Splits for each Transaction
BUFFER_CACHE_HIT	Buffer Cache Hit (%)	% of cache accesses

Table 165-3 (Cont.) List of Supported Metrics

Metric Name (Internal)	Metric Name (External)	Units
CONSISTENT_CHANGES_SEC	Consistent Changes (for each second)	Changes for each Second
CONSISTENT_CHANGES_TXN	Consistent Changes (for each transaction)	Changes for each Transaction
CONSISTENT_GETS_SEC	Consistent Gets (for each second)	Gets for each Second
CONSISTENT_GETS_TXN	Consistent Gets (for each transaction)	Gets for each Transaction
CR_BLOCKS_CREATED_SEC	CR Blocks Created (for each second)	Blocks for each Second
CR_BLOCKS_CREATED_TXN	CR Blocks Created (for each transaction)	Blocks for each Transaction
CR_RECORDS_APPLIED_SEC	CR Undo Records Applied (for each second)	Records for each Second
CR_RECORDS_APPLIED_TXN	CR Undo Records Applied (for each transaction)	Records for each Transaction
CURSOR_CACHE_HIT	Cursor Cache Hit (%)	% of soft parses
DATABASE_WAIT_TIME	Database Wait Time (%)	% of all database time
DATABASE_CPU_TIME	Database CPU Time (%)	% of all database time
DB_BLKGETS_SEC	DB Block Gets (for each second)	Gets for each Second
DB_BLKGETS_TXN	DB Block Gets (for each transaction)	Gets for each Transaction
DB_TIME_WAITING	Percent of Database Time Spent Waiting on a Class of Wait Events	% of Database Time
DBWR_CKPT_SEC	DBWR Checkpoints (for each second)	Checkpoints for each Second
DISK_SORT_SEC	Sorts to Disk (for each second)	Sorts for each Second
DISK_SORT_TXN	Sorts to Disk (for each transaction)	Sorts for each Transaction
ELAPSED_TIME_PER_CALL	Elapsed time for each user call for each service	Microseconds for each call
ENQUEUE_DEADLOCKS_SEC	Enqueue Deadlocks (for each second)	Deadlocks for each Second
ENQUEUE_DEADLOCKS_TXN	Enqueue Deadlocks (for each transaction)	Deadlocks for each Transaction
ENQUEUE_REQUESTS_SEC	Enqueue Requests (for each second)	Requests for each Second
ENQUEUE_REQUESTS_TXN	Enqueue Requests (for each transaction)	Requests for each Transaction
ENQUEUE_TIMEOUTS_SEC	Enqueue Timeouts (for each second)	Timeouts for each Second
ENQUEUE_TIMEOUTS_TXN	Enqueue Timeouts (for each transaction)	Timeouts for each Transaction
ENQUEUE_WAITS_SEC	Enqueue Waits (for each second)	Waits for each Second
ENQUEUE_WAITS_TXN	Enqueue Waits (for each transaction)	Waits for each Transaction
EXECUTE_WITHOUT_PARSE	Executes Performed Without Parsing	% of all executes
FULL_INDEX_SCANS_SEC	Fast Full Index Scans (for each second)	Scans for each Second

Table 165-3 (Cont.) List of Supported Metrics

Metric Name (Internal)	Metric Name (External)	Units
FULL_INDEX_SCANS_TXN	Fast Full Index Scans (for each transaction)	Scans for each Transaction
GC_AVG_CR_GET_TIME	Global Cache CR Request	Milliseconds
GC_AVG_CUR_GET_TIME	Global Cache Current Request	Milliseconds
GC_BLOCKS_CORRUPT	Global Cache Blocks Corrupt	Blocks
GC_BLOCKS_LOST	Global Cache Blocks Lost	Blocks
HARD_PARSSES_SEC	Hard Parses (for each second)	Parses for each Second
HARD_PARSSES_TXN	Hard Parses (for each transaction)	Parses for each Transaction
LEAF_NODE_SPLITS_SEC	Leaf Node Splits (for each second)	Splits for each Second
LEAF_NODE_SPLITS_TXN	Leaf Node Splits (for each transaction)	Splits for each Transaction
LIBRARY_CACHE_HIT	Library Cache Hit (%)	% of cache accesses
LIBRARY_CACHE_MISS	Library Cache Miss (%)	% of cache accesses
LOGONS_CURRENT	Current Number of Logons	Number of Logons
LOGONS_SEC	Cumulative Logons (for each second)	Logons for each Second
LOGONS_TXN	Cumulative Logons (for each transaction)	Logons for each Transaction
LONG_TABLE_SCANS_SEC	Scans on Long Tables (for each second)	Scans for each Second
LONG_TABLE_SCANS_TXN	Scans on Long Tables (for each transaction)	Scans for each Transaction
OPEN_CURSORS_SEC	Cumulative Open Cursors (for each second)	Cursors for each Second
MEMORY_SORTS_PCT	Sorts in Memory (%)	% of sorts
NETWORK_BYTES_SEC	Network Bytes, for each second	Bytes for each Second
OPEN_CURSORS_CURRENT	Current Number of Cursors	Number of Cursors
OPEN_CURSORS_TXN	Cumulative Open Cursors (for each transaction)	Cursors for each Transaction
OS_SCHED_CPU_WAIT_TIME	Operating System Scheduler CPU Wait (by time)	Microseconds
PARSE_FAILURES_SEC	Parse Failures (for each second)	Parses for each Second
PARSE_FAILURES_TXN	Parse Failures (for each transaction)	Parses for each Transaction
PGA_CACHE_HIT	PGA Cache Hit (%)	% bytes processed in PGA
PHYS_DESGN_WAIT_SCT	Physical Design Wait (by session count)	Count of sessions
PHYSICAL_READS_SEC	Physical Reads (for each second)	Reads for each Second
PHYSICAL_READS_TXN	Physical Reads (for each transaction)	Reads for each Transaction
PHYSICAL_WRITES_SEC	Physical Writes (for each second)	Writes for each Second
PHYSICAL_WRITES_TXN	Physical Writes (for each transaction)	Writes for each Transaction

Table 165-3 (Cont.) List of Supported Metrics

Metric Name (Internal)	Metric Name (External)	Units
PHYSICAL_READS_DIR_SEC	Direct Physical Reads (for each second)	Reads for each Second
PHYSICAL_READS_DIR_TXN	Direct Physical Reads (for each transaction)	Reads for each Transaction
PHYSICAL_WRITES_DIR_SEC	Direct Physical Writes (for each second)	Writes for each Second
PHYSICAL_WRITES_DIR_TXN	Direct Physical Writes (for each transaction)	Writes for each Transaction
PHYSICAL_READS_LOB_SEC	Direct LOB Physical Reads (for each second)	Reads for each Second
PHYSICAL_READS_LOB_TXN	Direct LOB Physical Reads (for each transaction)	Reads for each Transaction
PHYSICAL_WRITES_LOB_SEC	Direct LOB Physical Writes (for each second)	Writes for each Second
PHYSICAL_WRITES_LOB_TXN	Direct LOB Physical Writes (for each transaction)	Writes for each Transaction
PROCESS_LIMIT_PCT	Process Limit Usage (%)	% of maximum value
PX_DOWNGRADED_SEC	Downgraded Parallel Operations (for each second)	Operations for each Second
PX_DOWNGRADED_25_SEC	Downgraded to 25% and more (for each second)	Operations for each Second
PX_DOWNGRADED_50_SEC	Downgraded to 50% and more (for each second)	Operations for each Second
PX_DOWNGRADED_75_SEC	Downgraded to 75% and more (for each second)	Operations for each Second
PX_DOWNGRADED_SER_SEC	Downgraded to serial (for each second)	Operations for each Second
RB_RECORDS_APPLIED_SEC	Rollback Undo Records Applied (for each second)	Records for each Second
RB_RECORDS_APPLIED_TXN	Rollback Undo Records Applied (for each transaction)	Records for each Transaction
REDO_ALLOCATION_HIT	Redo Log Allocation Hit	% of redo allocations
REDO_GENERATED_SEC	Redo Generated (for each second)	Redo Bytes for each Second
REDO_GENERATED_TXN	Redo Generated (for each transaction)	Redo Bytes for each Transaction
REDO_WRITES_SEC	Redo Writes (for each second)	Writes for each Second
REDO_WRITES_TXN	Redo Writes (for each transaction)	Writes for each Transaction
RECURSIVE_CALLS_SEC	Recursive Calls (for each second)	Calls for each Second
RECURSIVE_CALLS_TXN	Recursive Calls (for each transaction)	Calls for each Transaction
RESPONSE_TXN	Response (for each transaction)	Seconds for each Transaction
ROWS_PER_SORT	Rows Processed for each Sort	Rows for each Sort

Table 165-3 (Cont.) List of Supported Metrics

Metric Name (Internal)	Metric Name (External)	Units
SESS_LOGICAL_READS_SEC	Session Logical Reads (for each second)	Reads for each Second
SESS_LOGICAL_READS_TXN	Session Logical Reads (for each transaction)	Reads for each Transaction
SESSION_CPU_SEC	Database CPU (for each second)	Microseconds for each Second
SESSION_CPU_TXN	Database CPU (for each transaction)	Microseconds for each Transaction
SESSION_LIMIT_PCT	Session Limit Usage (%)	% of maximum value
SHARED_POOL_FREE_PCT	Shared Pool Free(%)	% of shared pool
SOFT_PARSE_PCT	Soft Parse (%)	% of all parses
SQL_SRV_RESPONSE_TIME	Service Response (for each execution)	Seconds
TABLESPACE_PCT_FULL	Tablespace space usage	% full
TABLESPACE_BYT_FREE	Tablespace bytes space usage	Kilobytes free
TOTAL_TABLE_SCANS_SEC	Total Table Scans (for each second)	Scans for each Second
TOTAL_TABLE_SCANS_TXN	Total Table Scans (for each transaction)	Scans for each Transaction
TOTAL_INDEX_SCANS_SEC	Total Index Scans (for each second)	Scans for each Second
TOTAL_INDEX_SCANS_TXN	Total Index Scans (for each transaction)	Scans for each Transaction
TOTAL_PARSSES_SEC	Total Parses (for each second)	Parses for each Second
TOTAL_PARSSES_TXN	Total Parses (for each transaction)	Parses for each Transaction
USER_COMMITS_SEC	User Commits (for each second)	Commits for each Second
USER_COMMITS_TXN	User Commits (for each transaction)	Commits for each Transaction
USER_ROLLBACKS_SEC	User Rollbacks (for each second)	Rollbacks for each Second
USER_ROLLBACKS_TXN	User Rollbacks (for each transaction)	Rollbacks for each Transaction
USER_CALLS_SEC	User Calls (for each second)	Calls for each Second
USER_CALLS_TXN	User Calls (for each transaction)	Calls for each Transaction
USER_CALLS_PCT	User Calls (%)	% of all calls
USER_LIMIT_PCT	User Limit Usage (%)	% of maximum value
WCR_AVG_IO_LAT	Average IO response time (for a WRC client)	Milliseconds
WCR_PCPU	Percentage of replay threads on CPU (for a WRC client)	% of total replay threads
WCR_PIO	Percentage of replay threads doing IOs (for a WRC client)	% of total replay threads

165.5 Summary of DBMS_SERVER_ALERT Subprograms

This table lists the DBMS_SERVER_ALERT subprograms and briefly describes them.

Table 165-4 DBMS_SERVER_ALERT Package Subprograms

Subprogram	Description
EXPAND_MESSAGE Function	Expands alert messages
GET_THRESHOLD Procedure	Gets the current threshold settings for a specified metric
SET_THRESHOLD Procedure	Sets the warning and critical thresholds for a specified metric

165.5.1 EXPAND_MESSAGE Function

This function expands alert messages.

Syntax

```
DBMS_SERVER_ALERT.EXPAND_MESSAGE (
  user_language      IN  VARCHAR2,
  message_id        IN  NUMBER,
  argument_1        IN  VARCHAR2,
  argument_2        IN  VARCHAR2,
  argument_3        IN  VARCHAR2,
  argument_4        IN  VARCHAR2,
  argument_5        IN  VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 165-5 EXPAND_MESSAGE Function Parameters

Parameter	Description
user_language	The language of the current session.
message_id	Id of the alert message
argument_1	The first argument in the alert message.
argument_2	The second argument in the alert message.
argument_3	The third argument in the alert message.
argument_4	The fourth argument in the alert message.
argument_5	The fifth argument in the alert message.

165.5.2 GET_THRESHOLD Procedure

This procedure gets the current threshold settings for the specified metric.

Syntax

```
DBMS_SERVER_ALERT.GET_THRESHOLD (
  metrics_id        IN  BINARY_INTEGER,
  warning_operator  OUT BINARY_INTEGER,
  warning_value     OUT VARCHAR2,
  critical_operator  OUT BINARY_INTEGER,
  critical_value    OUT VARCHAR2,
  observation_period OUT BINARY_INTEGER,
  consecutive_occurrences OUT BINARY_INTEGER,
```

```

instance_name      IN  VARCHAR2,
object_type        IN  BINARY_INTEGER,
object_name        IN  VARCHAR2);

```

Parameters

Table 165-6 GET_THRESHOLD Procedure Parameters

Parameter	Description
metrics_id	The internal name of the metric. See " Supported Metrics ".
warning_operator	The operator for the comparing the actual value with the warning threshold.
warning_value	The warning threshold value.
critical_operator	The operator for the comparing the actual value with the critical threshold.
critical_value	The critical threshold value.
observation_period	The period at which the metric values are computed and verified against the threshold setting.
consecutive_occurrences	The number of observation periods the metric value should violate the threshold value before the alert is issued.
instance_name	The name of the instance for which the threshold is set. This is NULL for database-wide alerts. In cases in which this parameter is not NULL, this should be set to one of the INSTANCE_NAME values found in the GV\$INSTANCE View.
object_type	Either OBJECT_TYPE_SYSTEM or OBJECT_TYPE_SERVICE.
object_name	The name of the object.

Usage Notes

Note that this subprogram does not check if the value of the `instance_name` parameter is meaningful or valid.

165.5.3 SET_THRESHOLD Procedure

This procedure sets the warning and critical thresholds for a specified metric.

Syntax

```

DBMS_SERVER_ALERT.SET_THRESHOLD(
  metrics_id          IN  BINARY_INTEGER,
  warning_operator    IN  BINARY_INTEGER,
  warning_value       IN  VARCHAR2,
  critical_operator   IN  BINARY_INTEGER,
  critical_value      IN  VARCHAR2,
  observation_period  IN  BINARY_INTEGER,
  consecutive_occurrences IN BINARY_INTEGER,
  instance_name       IN  VARCHAR2,
  object_type         IN  BINARY_INTEGER,
  object_name        IN  VARCHAR2);

```

Parameters

Table 165-7 SET_THRESHOLD Procedure Parameters

Parameter	Description
<code>metrics_id</code>	The internal name of the metric. See " Supported Metrics ".
<code>warning_operator</code>	The operator for the comparing the actual value with the warning threshold (such as <code>OPERATOR_GE</code>). See " Relational Operators ".
<code>warning_value</code>	The warning threshold value. This is <code>NULL</code> if no warning threshold is set. A list of values may be specified for <code>OPERATOR_CONTAINS</code> .
<code>critical_operator</code>	The operator for the comparing the actual value with the critical threshold. See " Relational Operators ".
<code>critical_value</code>	The critical threshold value. This is <code>NULL</code> if not set. A list of values may be specified for <code>OPERATOR_CONTAINS</code> .
<code>observation_period</code>	The period at which the metric values are computed and verified against the threshold setting. The valid range is 1 to 60 minutes.
<code>consecutive_occurrences</code>	The number of observation periods the metric value should violate the threshold value before the alert is issued.
<code>instance_name</code>	The name of the instance for which the threshold is set. This is <code>NULL</code> for database-wide alerts.
<code>object_type</code>	See " Object Types ".
<code>object_name</code>	The name of the object. This is <code>NULL</code> for <code>SYSTEM</code> .

Usage Notes

Note that this subprogram does not check if the value of the `instance_name` parameter is meaningful or valid. Passing a name that does not identify a valid instance will result in a threshold that is not used by any by any instance although the threshold setting will be visible in the `DBA_THRESHOLDS` view. The exception is the lower-case string 'database_wide' which is semantically equivalent to passing `NULL` for the instance name, the latter being the preferred usage.

DBMS_SERVICE

The `DBMS_SERVICE` package lets you create, delete, activate, and deactivate services for a single instance.

The chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Operating Procedures](#)
- [Exceptions](#)
- [Summary of DBMS_SERVICE Subprograms](#)

 **See Also:**

Oracle Real Application Clusters Administration and Deployment Guide for administering services in Oracle Real Application Clusters.

166.1 DBMS_SERVICE Overview

`DBMS_SERVICE` supports the workload management of high availability, quality of service, job scheduling, and other planned operations in the RDBMS for the purposes of workload measurement, management, prioritization, and XA and distributed transaction management.

Oracle Real Application Clusters (RAC) can manage service names across instances as administered through `SRVCTL`. The `DBMS_SERVICE` package allows the creation, deletion, starting, and stopping of services in a single instance. Additionally, it provides the ability to disconnect all sessions that connect to an instance with a service name.

 **See Also:**

For more information about Oracle Real Application Clusters, *Oracle Real Application Clusters Administration and Deployment Guide*.

166.2 DBMS_SERVICE Security Model

The `DBMS_SERVICE` package has certain security requirements.

Privileges

The client using this package must have the `ALTER SYSTEM` execution privilege and the `V$SESSION` table read privilege.

Schemas

This package must be installed under `SYS` schema.

Roles

The `EXECUTE` privilege of the package is granted to the `DBA` role only.

166.3 DBMS_SERVICE Constants

The `DBMS_SERVICE` package provides constants that can be used for specifying parameter values.

- Constants used in calling arguments are described in [Table 166-1](#)
- Constants used in connection balancing goal arguments are described in [Table 166-2](#)
- Constants used in TAF failover attribute arguments are described in [Table 166-3](#)

Table 166-1 Constants Used in Calling Arguments

Name	Type	Value	Description
<code>GOAL_NONE</code>	NUMBER	0	Disables Load Balancing Advisory
<code>GOAL_SERVICE_TIME</code>	NUMBER	1	Load Balancing Advisory is based on elapsed time for work done in the service plus available bandwidth to the service
<code>GOAL_THROUGHPUT</code>	NUMBER	2	Load Balancing Advisory is based on the rate that work is completed in the service plus available bandwidth to the service

Table 166-2 Constants Used in Connection Balancing Goal Arguments

Name	Type	Value	Description
<code>CLB_GOAL_SHORT</code>	NUMBER	1	Connection load balancing uses Load Balancing Advisory, when Load Balancing Advisory is enabled (either <code>goal_service_time</code> or <code>goal_throughput</code>). When <code>GOAL=NONE</code> (no load balancing advisory), connection load balancing uses an abridged advice based on CPU utilization.

Table 166-2 (Cont.) Constants Used in Connection Balancing Goal Arguments

Name	Type	Value	Description
CLB_GOAL_LONG	NUMBER	2	Balances the number of connections for each instance using session count for each service. This setting is recommended for applications with long connections such as forms. This setting can be used with Load Balancing Advisory when the connection pool is sized to accommodate gravitation within the pool itself (without adding or removing connections). The latter is the most efficient design.

Table 166-3 Constants Used in High Availability Attribute Arguments for FAN, Application Continuity, Transaction Guard and TAF

Name	Type	Value	Description
FAILOVER_METHOD_NONE	VARCHAR2	0	Server side TAF is not enabled for this service
FAILOVER_METHOD_BASIC	VARCHAR2	1	Server side TAF method is BASIC. BASIC is the only value currently supported. This means that a new connection is established at failure time.
FAILOVER_TYPE_NONE	VARCHAR		Server side TAF type is NONE
FAILOVER_TYPE_SESSION	VARCHAR		Server side TAF failover type is SESSION. At failure time, if the failover type is SESSION, TAF reconnects to a surviving node and re-establish a vanilla database session. Customizations (for example, ALTER SESSION) must be re-executed in a failover callback.
FAILOVER_TYPE_SELECT	VARCHAR		Server side TAF failover type is SELECT
FAILOVER_RETRIES	NUMBER		Number of connection attempts when failover occurs. Specifies the number of times for Application Continuity and TAF to attempt the reconnect and re-authenticate pair. The value must be an integer greater than 0. The default in Oracle Database 12c Release 1 (12.1) for Application Continuity is 30.
FAILOVER_RESTORE_NONE	CONSTANT VARCHAR2	NONE	The initial state is not restored before replaying for Application Continuity and TAF. This is recommended for OCI applications that use Application Continuity and build their own state in the request. For example, SQLPLUS.
FAILOVER_RESTORE_BASIC	VARCHAR2	LEVEL1	This is the recommended value for Java and ODP.NET applications using Application Continuity. The initial states that the user knows are restored automatically before replaying. If the user needs additional states, a callback must be registered.

Table 166-3 (Cont.) Constants Used in High Availability Attribute Arguments for FAN, Application Continuity, Transaction Guard and TAF

Name	Type	Value	Description
FAILOVER_DELAY	NUMBER		Number of seconds delay between each connection attempt. This is the delay that Application Continuity and TAF waits if a reconnect and re-authentication fails. The value must be an integer greater than 0. The default in Oracle Database 12c Release 1 (12.1) is 10s when using Application Continuity. Using FAILOVER_DELAY the failover can be delayed until the service is next available. This can work well in conjunction with a planned outage that may make a service temporarily unavailable (such as for several minutes).
STOP_OPTION_NONE	VARCHAR		Sessions are not disconnected.
STOP_OPTION_IMMEDIATE	VARCHAR		Sessions are disconnected immediately after the drain_timeout expires.
STOP_OPTION_TRANSACTIONAL	VARCHAR		Sessions are disconnected after the transactions during the drain_timeout. The sessions disconnect immediately when drain_timeout expires.
DYNAMIC	NUMBER		For Application Continuity, this parameter specifies whether the session state that is not transactional is changed by the application during request execution. A value of DYNAMIC is recommended for all applications. If you are in any doubt, or the application can be customized, you must use DYNAMIC.

Usage Notes

- If a TAF callback has been registered, then the failover retries and failover delay are ignored. If an error occurs, TAF continues to re-attempt the connect and authentication as long as the callback returns a value of OCI_FO_RETRY. Any delay must be coded into the callback logic
- Server side TAF settings override client-side counterparts that might be configured in TNS connect descriptors. If TAF is not configured on the client side, then at a minimum, the failover type must be set to enable TAF. If the failover type is set on the server side, then the failover method defaults to BASIC. Delay and retries are optional and may be specified independently.

166.4 DBMS_SERVICE Operating Procedures

You cannot use the following procedures with Oracle Real Applications Clusterware, Oracle Restart, and Oracle Global Data Services.

- – [CREATE_SERVICE Procedure](#)
- [DELETE_SERVICE Procedure](#)
- [MODIFY_SERVICE Procedure](#)

- [START_SERVICE Procedure](#)
- [STOP_SERVICE Procedure](#)
- With Oracle Database 12c release 1, you are advised to use the parameter interface in all service-related subprograms.
- If you wish to use `DBMS_SERVICE` on a pluggable database (PDB) in a single instance, you must connect to that PDB first.

166.5 DBMS_SERVICE Exceptions

This table lists the exceptions raised by the `DBMS_SERVICE` package.

Table 166-4 DBMS_SERVICE Exceptions

Exception	Error Code	Description
<code>NULL_SERVICE_NAME</code>	44301	Service name argument was found to be NULL
<code>NULL_NETWORK_NAME</code>	44302	Network name argument was found to be NULL
<code>SERVICE_EXISTS</code>	44303	Service name already exists
<code>SERVICE_DOES_NOT_EXIST</code>	44304	Specified service does not exist
<code>SERVICE_IN_USE</code>	44305	Specified service was running
<code>SERVICE_NAME_TOO_LONG</code>	44306	Service name was too long
<code>NETWORK_PREFIX_TOO_LONG</code>	44307	Network name, excluding the domain, was too long
<code>NOT_INITIALIZED</code>	44308	Services layer was not yet initialized
<code>GENERAL_FAILURE</code>	44309	An unknown failure
<code>MAX_SERVICES_EXCEEDED</code>	44310	Maximum number of services has been reached
<code>SERVICE_NOT_RUNNING</code>	44311	Specified service was not running
<code>DATABASE_CLOSED</code>	44312	Database was closed
<code>INVALID_INSTANCE</code>	44313	Instance name argument was not valid
<code>NETWORK_EXISTS</code>	44314	Network name already exists
<code>NULL_ATTRIBUTES</code>	44315	All attributes specified were NULL
<code>INVALID_ARGUMENT</code>	44316	Invalid argument supplied
<code>DATABASE_READONLY</code>	44317	Database is open read-only
<code>MAX_SN_LENGTH</code>	44318	Total length of all running service network names exceeded the maximum allowable length
<code>ERR_AQ_SERVICE</code>	44319	Cannot delete AQ service
<code>ERR_GLB_SERVICE</code>	44320	Cannot delete global service
<code>ERR_INVALID_PDB_NAME</code>	44771	Invalid name for a pluggable database

Table 166-4 (Cont.) DBMS_SERVICE Exceptions

Exception	Error Code	Description
ERR_CRS_API	44772	Cluster ready services (CRS) operation failed
ERR_PDB_CLOSED	44773	Cannot perform requested service operation
ERR_PDB_INVALID	44774	Pluggable database attribute cannot be changed
ERR_PDB_NAME	44775	Pluggable database service cannot be created
ERR_PDB_EXP	44776	Pluggable database service cannot be deleted
ERR_PDB_FAIL	44777	Pluggable database service cannot be started

166.6 Summary of DBMS_SERVICE Subprograms

This table lists the DBMS_SERVICE subprograms and briefly describes them.

Table 166-5 DBMS_SERVICE Package Subprograms

Subprogram	Description
CREATE_SERVICE Procedure	Creates service
DELETE_SERVICE Procedure	Deletes service
DISCONNECT_SESSION Procedure	Disconnects sessions running under this service
MODIFY_SERVICE Procedure	Modifies service
START_SERVICE Procedure	Activates service
STOP_SERVICE Procedure	Stops service

166.6.1 CREATE_SERVICE Procedure

This procedure creates a service name in the data dictionary. Services are also created in the data dictionary implicitly when you set the service in the `service_name` parameter or by means of the `ALTER SYSTEM SET SERVICE_NAMES` command.

Note:

The service attribute values `FAILOVER_TYPE = TRANSACTION` with `SESSION_STATE_CONSISTENCY = STATIC` are no longer a supported service attribute combination.

In previous releases, you could use the service parameter `SESSION_STATE_CONSISTENCY` to manage session state automatically using **Application Continuity** by setting `SESSION_STATE_CONSISTENCY` to `DYNAMIC` or `STATIC`. However, starting with Oracle Database 23ai, you can no longer use the `STATIC` option. Instead, use one of the following failover options:

- `FAILOVER_TYPE = AUTO` with `SESSION_STATE_CONSISTENCY = AUTO`
- `FAILOVER_TYPE = TRANSACTION` with `SESSION_STATE_CONSISTENCY = DYNAMIC`

These configurations enforce session state tracking in Oracle Database, ensuring that session state is preserved at session migration and session failover.

Syntax

```
DBMS_SERVICE.CREATE_SERVICE(
    service_name          IN VARCHAR2,
    network_name          IN VARCHAR2,
    parameter_array       IN TABLE OF VARCHAR2(100));
```

This overload is maintained for backward compatibility:

```
DBMS_SERVICE.CREATE_SERVICE(
    service_name          IN VARCHAR2,
    network_name          IN VARCHAR2,
    goal                  IN NUMBER DEFAULT NULL,
    dtp                   IN BOOLEAN DEFAULT NULL,
    true_cache_service    IN VARCHAR2,
    aq_ha_notifications   IN BOOLEAN DEFAULT NULL,
    failover_method        IN VARCHAR2 DEFAULT NULL,
    failover_type          IN VARCHAR2 DEFAULT NULL,
    failover_retries       IN NUMBER DEFAULT NULL,
    failover_delay         IN NUMBER DEFAULT NULL,
    clb_goal               IN NUMBER DEFAULT NULL,
    edition                IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 166-6 CREATE_SERVICE Procedure Parameters

Parameter	Description
<code>service_name</code>	Name of the service, limited to 64 characters in the Data Dictionary

Table 166-6 (Cont.) CREATE_SERVICE Procedure Parameters


Parameter	Description
network_name	Network name of the service as used in SQLNet connect descriptors for client connections. This is limited to the NET service_names character set (see <i>Oracle Database Net Services Reference</i>).
parameter_array	Associative array with name-value pairs of the service attributes. Supported names: <ul style="list-style-type: none"> • goal • dtp • true_cache_service • aq_ha_notifications • failover_method • failover_type • failover_retries • failover_restore • failover_delay • clb_goal • edition • commit_outcome • reset_state • retention_timeout • replay_initiation_timeout • session_state_consistency • sql_translation_profile • drain_timeout • stop_option • placement_policy
goal	Workload management goal directive for the service. Valid values: <ul style="list-style-type: none"> • DBMS_SERVICE.GOAL_SERVICE_TIME • DBMS_SERVICE.GOAL_THROUGHPUT • DBMS_SERVICE.GOAL_NONE
dtp	Declares the service to be for X/Open Distributed Transaction Processing (DTP) or any distributed transaction (especially XA)
true_cache_service	Name of the True Cache service being registered with the primary service.
aq_ha_notifications	Determines whether Fast Application Notification (FAN) is enabled for OCI/OCCI/ODP. In Oracle Database12c, FAN uses Oracle Notification Services (ONS). This parameter is still used to enable FAN. FAN is recommended for all High Availability systems, and is on by default for Application Continuity
failover_method	Failover TYPE for the service for Application Continuity and TAF. If the failover_type is set to TRANSACTION on the service, this automatically sets COMMIT_OUTCOME to TRUE. JDBC Replay Driver uses the FAILOVER_TYPE service attribute setting of TRANSACTION for TRANSACTION failover. OCI uses the older settings of SELECT and SESSION. The server only accepts FAILOVER_METHOD = BASIC with the TRANSACTION setting.
failover_type	TRANSACTION for Application Continuity. SELECT or BASIC for TAF.

Table 166-6 (Cont.) CREATE_SERVICE Procedure Parameters

Parameter	Description
<code>failover_retries</code>	Number of connection retries for Application Continuity and TAF. Using the <code>failover_retries</code> and <code>failover_delay</code> parameters, the failover can be delayed until the service is next available. This parameter is for connecting. It does not control the number of failovers, which is 3 for each incident for Application Continuity.
<code>failover_delay</code>	Delay in seconds between connection retries for Application Continuity and TAF. The default is 10 seconds for Application Continuity. Do not use a 0-second delay if the service needs time to failover and register. Long delays are good for planned outages and to failover to Data Guard. Short delays work well with RAC when the service is already available.
<code>edition</code>	<p>If this argument has a non-NULL value, this provides the initial session edition for subsequent database connections using this service that do not specify an edition. If no value is specified, this argument has no effect.</p> <p>During service creation or modification, no validation is performed on this parameter.</p> <p>At connection time, if the connecting user does not have <code>USE</code> privilege on the edition, or the edition does not exist, this raises the error <code>ORA-38802 (edition does not exist)</code>.</p>
<code>drain_timeout</code>	If this parameter is defined, all sessions connected to that service are drained by the client drivers and pools using Fast Connection Failover (FCF). The <code>drain_timeout</code> can be set on the service, so stopping and relocating drains for this time by default.
<code>stop_option</code>	<p>Provides options to terminate a session. The supported values are:</p> <ul style="list-style-type: none"> • <code>TRANSACTIONAL</code> <code>drain_timeout</code> applies to the transactions. After the <code>drain_timeout</code> expire, the sessions are immediately killed. • <code>IMMEDIATE</code> The sessions are killed after <code>drain_timeout</code> expires. • <code>NONE</code> Sessions are not terminated. <p>However, these parameter values can be overridden using the command line.</p>
<code>commit_outcome</code>	<p>Determines whether transaction <code>COMMIT</code> outcome is accessible after the <code>COMMIT</code> has executed. While the database guarantees that <code>COMMIT</code> is durable, this ensures that the outcome of the <code>COMMIT</code> is durable. Applications use the feature to probe the status of the commit last executed after an outage, and is available to applications to determine an outcome. Note:</p> <ul style="list-style-type: none"> • Invoking the GET_LTXID_OUTCOME Procedure of the <code>DBMS_APP_CONT</code> package requires that the <code>commit_outcome</code> attribute be set. • <code>commit_outcome</code> has no effect on active Data Guard and read-only databases. • <code>commit_outcome</code> is only allowed on the database service and on user-defined database services

Table 166-6 (Cont.) CREATE_SERVICE Procedure Parameters

Parameter	Description
reset_state	Clears the session state usage between requests, so that each new request starts clean (usage web and stateless applications).
retention_timeout	Used in conjunction with <code>commit_outcome</code> , it determines the amount of time (in seconds) that the <code>COMMIT_OUTCOME</code> is retained. Default is 24 hours (86400). Maximum value is 30 days (2592000).
replay_initiation_timeout	For Application Continuity, <code>replay_initiation_timeout</code> is the difference between the time of original execution of first operation of a request, and the time that the replay is ready to start after a successful reconnect. Replay initiation time is measured from the time that the request was originally submitted until the time that replay has connected and is ready to replay. When replay is expected, keep this value high. Default is 900 seconds.
session_state_consistency	Describes how nontransactional is changed during a request (DYNAMIC). This parameter is considered only if <code>failover_type</code> is set to <code>TRANSACTION</code> for Application Continuity. Examples of session state are NLS settings, optimizer preferences, event settings, PL/SQL global variables, temporary tables, advanced queues, LOBs, and result cache. If these values change after the request starts, set to <code>DYNAMIC</code> (default). Almost all applications should use <code>DYNAMIC</code> mode. If you are unsure, use <code>DYNAMIC</code> mode.
sql_translation_profile	Name of SQL translation profile.
clb_goal	Method used for Connection Load Balancing (see Table 166-2)
placement_policy	NUMBER Placement policy for the service. Possible values: <ul style="list-style-type: none"> • 0: PDB-NONE • 1: PDB-SINGLETON • 2: PDB-UNIFORM

 **Note:**

Values other than 0 are applicable only in the ATP-Dedicated Cloud in an Oracle RAC environment.

Examples

```
DBMS_SERVICE.CREATE_SERVICE('ernie.example.com','ernie.example.com');

DECLARE
  params dbms_service.svc_parameter_array;
BEGIN
  params('TRUE_CACHE_SERVICE')      := 'C_SALES';
  params('FAILOVER_TYPE')           := 'TRANSACTION';
  params('REPLAY_INITIATION_TIMEOUT') := 1800;
  params('RETENTION_TIMEOUT')       := 86400;
  params('FAILOVER_DELAY')          := 10;
  params('FAILOVER_RETRIES')        := 30;
```

```

params('DRAIN_TIMEOUT')           :=60;
params('STOP_OPTION')              :='DBMS_SERVICE.STOP_OPTION_IMMEDIATE';
params('FAILOVER_RESTORE')         :='DBMS_SERVICE.FAILOVER_RESTORE_BASIC';
params('commit_outcome')           :='true';
params('aq_ha_notifications')      :='true';
DBMS_SERVICE.MODIFY_SERVICE('GOLD',params);
END;
```

166.6.2 DELETE_SERVICE Procedure

This procedure deletes a service from the data dictionary.

Note:

Starting with Oracle Database 19c, customer use of the `SERVICE_NAME` parameter is deprecated. It can be desupported in a future release. It must not be used for high availability (HA) deployments. It is not supported to use service name parameter for any HA operations. This restriction includes FAN, load balancing, `FAILOVER_TYPE`, `FAILOVER_RESTORE`, `SESSION_STATE_CONSISTENCY`, and any other uses.

You cannot use this subprogram if your services are managed by Oracle Clusterware, Oracle Restart, or Oracle Global Data Services.

Syntax

```
DBMS_SERVICE.DELETE_SERVICE(
    service_name IN VARCHAR2);
```

Parameters

Table 166-7 DELETE_SERVICE Procedure Parameters

Parameter	Description
<code>service_name</code>	Name of the service, limited to 64 characters in the Data Dictionary

Examples

```
DBMS_SERVICE.DELETE_SERVICE('ernie.example.com');
```

166.6.3 DISCONNECT_SESSION Procedure

This procedure disconnects sessions with the named service at the current instance.

Syntax

```
DBMS_SERVICE.DISCONNECT_SESSION(
    service_name      IN VARCHAR2,
    disconnect_option IN NUMBER DEFAULT POST_TRANSACTION);
```

Parameters

Table 166-8 DISCONNECT_SESSION Procedure Parameters

Parameter	Description
<code>service_name</code>	Name of the service, limited to 64 characters in the Data Dictionary
<code>disconnect_option</code>	The options, package constants, are expressed as NUMBER: <ul style="list-style-type: none">• <code>POST_TRANSACTION = 0</code>: session disconnects after the current transaction commits or rolls back• <code>IMMEDIATE = 1</code>: session disconnects immediately• <code>NOREPLAY = 2</code>: session disconnects immediately and be flagged to not be replayed by application continuity, that is <code>IMMEDIATE</code> and <code>NOREPLAY</code> together Note: <code>IMMEDIATE</code> or <code>POST_TRANSACTION</code> and <code>NOREPLAY</code> is automatically translated as 1 or 0 or 2 respectively. However, passing a string literal (quoted using either the ' or " characters, such as "IMMEDIATE" or 'POST_TRANSACTION' or 'NOREPLAY') raises an error.

Usage Notes

- This procedure can be used in the context of a single instance as well as with Oracle Real Application Clusters.
- This subprogram does not return until all corresponding sessions are disconnected. Therefore, use the `DBMS_JOB` package or put the SQL session in background if the caller does not want to wait for all corresponding sessions to be disconnected.

Examples

This disconnects sessions with `service_name 'ernie.example.com'`.

```
DBMS_SERVICE.DISCONNECT_SESSION('ernie.example.com');
```

If a service is using application continuity, and you do not want the sessions replayed but simply terminated, use the following:

```
EXECUTE DBMS_SERVICE.DISCONNECT_SESSION('service name', DBMS_SERVICE.NOREPLAY);
```


166.6.4 MODIFY_SERVICE Procedure

This procedure modifies an existing service.

Note:

You cannot use the second version of subprogram if your services are managed by Oracle Clusterware, Oracle Restart, or Oracle Global Data Services. The version with the parameter array interface applies to databases that are not managed by Oracle Clusterware, Oracle Restart or Oracle Global Data Services. New attributes are only available using the parameter interface.

Syntax

```
DBMS_SERVICE.MODIFY_SERVICE(
    service_name          IN VARCHAR2,
    parameter_array      IN svc_parameter_array);
```

This overload is maintained for backward compatibility:

```
DBMS_SERVICE.MODIFY_SERVICE(
    service_name          IN VARCHAR2,
    goal                  IN NUMBER DEFAULT NULL,
    dtp                   IN BOOLEAN DEFAULT NULL,
    true_cache_service   IN VARCHAR2,
    aq_ha_notifications  IN BOOLEAN DEFAULT NULL,
    failover_method       IN VARCHAR2 DEFAULT NULL,
    failover_type         IN VARCHAR2 DEFAULT NULL,
    failover_retries     IN NUMBER DEFAULT NULL,
    failover_delay        IN NUMBER DEFAULT NULL,
    clb_goal              IN NUMBER DEFAULT NULL,
    edition               IN VARCHAR2 DEFAULT NULL,
    modify_edition        IN BOOLEAN DEFAULT FALSE;
```

Parameters

Table 166-9 MODIFY_SERVICE Procedure Parameters

Parameter	Description
service_name	Name of the service, limited to 64 characters in the Data Dictionary

Table 166-9 (Cont.) MODIFY_SERVICE Procedure Parameters

Parameter	Description
parameter_array	<p>Associative array with name/value pairs of the service attributes. Supported names:</p> <ul style="list-style-type: none"> • goal • dtp • true_cache_service • aq_ha_notifications • failover_method • failover_type • failover_restore • failover_retries • failover_delay • drain_timeout • stop_option • edition • commit_outcome • retention_timeout • replay_initiation_timeout • session_state_consistency • sql_translation_profile • placement_policy
goal	<p>Workload management goal directive for the service. Valid values:</p> <ul style="list-style-type: none"> • DBMS_SERVICE.GOAL_SERVICE_TIME • DBMS_SERVICE.GOAL_THROUGHPUT • DBMS_SERVICE.GOAL_NONE
dtp	<p>Declares the service to be for X/Open Distributed Transaction Processing (DTP) or any distributed transaction (especially XA)</p>
true_cache_service	<p>Name of the True Cache service being registered with the primary service.</p>
aq_ha_notifications	<p>Determines whether Fast Application Notification (FAN) is enabled for OCI/OCCI/ODP. In Oracle Database12c, FAN uses Oracle Notification Services (ONS). This parameter is still used to enable FAN. FAN is recommended for all High Availability systems, and is on by default for Application Continuity</p>
failover_method	<p>Failover TYPE for the service for Application Continuity and TAF. If the failover_type is set to TRANSACTION on the service, this automatically sets COMMIT_OUTCOME to TRUE. JDBC Replay Driver uses the FAILOVER_TYPE service attribute setting of TRANSACTION for TRANSACTION failover. OCI uses the older settings of SELECT and SESSION. The server only accepts FAILOVER_METHOD = BASIC with the TRANSACTION setting.</p>
failover_type	<p>Failover TYPE for the service for Application Continuity and TAF.</p>
failover_restore	<p>For Application Continuity, when the failover_restore parameter is set, the session states are restored before replaying for ODP.NET and Java. Use LEVEL1 for ODP.NET and Java with Application Continuity to restore the initial state.</p> <p>For AC OCI, use NONE for applications that are not STATIC.</p>

Table 166-9 (Cont.) MODIFY_SERVICE Procedure Parameters

Parameter	Description
<code>failover_retries</code>	Number of connection retries for Application Continuity and TAF. Using the <code>failover_retries</code> and <code>failover_delay</code> parameters, the failover can be delayed until the service is next available. This parameter is for connecting. It does not control the number of failovers, which is 3 for each incident for Application Continuity.
<code>failover_delay</code>	Delay in seconds between connection retries for Application Continuity and TAF. The default is 10 seconds for Application Continuity. Do not use a 0-second delay if the service needs time to failover and register. Long delays are good for planned outages and to failover to Data Guard. Short delays work well with Oracle RAC when the service is already available.
<code>drain_timeout</code>	When this parameter is set, all sessions connected to that service are drained by the client drivers and pools using Fast Connection Failover (FCF). The <code>drain_timeout</code> can be set on the service, to stop and relocate drains for this time by default.
<code>edition</code>	<p>If this argument has a non-NULL value, this provides the initial session edition for subsequent database connections using this service that do not specify an edition. If no value is specified, this argument has no effect.</p> <p>During service creation or modification, no validation is performed on this parameter.</p> <p>At connection time, if the connecting user does not have <code>USE</code> privilege on the edition, or the edition does not exist, this raises the error <code>ORA-38802</code> (edition does not exist).</p>
<code>commit_outcome</code>	<p>Determines whether transaction <code>COMMIT</code> outcome is accessible after the <code>COMMIT</code> has executed. While the database guarantees that <code>COMMIT</code> is durable, this ensures that the outcome of the <code>COMMIT</code> is durable. Applications use the feature to probe the status of the commit last executed after an outage, and is available to applications to determine an outcome. Note:</p> <ul style="list-style-type: none"> Invoking the GET_LTXID_OUTCOME Procedure of the <code>DBMS_APP_CONT</code> package requires that the <code>commit_outcome</code> attribute be set. <code>commit_outcome</code> has no effect on active Data Guard and read-only databases. <code>commit_outcome</code> is allowed only on user-defined database services
<code>retention_timeout</code>	Used in conjunction with <code>commit_outcome</code> , it determines the amount of time (in seconds) that the <code>COMMIT_OUTCOME</code> is retained. Default is 24 hours (86400). Maximum value is 30 days (2592000).
<code>replay_initiation_timeout</code>	For Application Continuity, <code>replay_initiation_timeout</code> is the difference between the time of original execution of first operation of a request, and the time that the replay is ready to start after a successful reconnect. Replay initiation time is measured from the time that the request was originally submitted until the time that replay has connected and is ready to replay. When replay is expected, keep this value high. Default is 900 seconds.

Table 166-9 (Cont.) MODIFY_SERVICE Procedure Parameters

Parameter	Description
session_state_consistency	Describes how nontransactional is changed during a request. This parameter is considered only if <code>failover_type</code> is set to <code>TRANSACTION</code> for Application Continuity. Examples of session state are NLS settings, optimizer preferences, event settings, PL/SQL global variables, temporary tables, advanced queues, LOBs, and result cache. If these values change after the request starts, set to <code>DYNAMIC</code> (default). Almost all applications should use <code>DYNAMIC</code> mode. If you are unsure, use <code>DYNAMIC</code> mode.
sql_translation_profile	Name of SQL translation profile.
modify_edition	If <code>TRUE</code> , the edition service attribute is updated to use the edition argument value. If <code>FALSE</code> or <code>NULL</code> , the edition attribute is not updated.
clb_goal	Method used for Connection Load Balancing (see Table 166-2)
placement_policy	NUMBER Placement policy for the service. Possible values: <ul style="list-style-type: none"> • 0: PDB-NONE • 1: PDB-SINGLETON • 2: PDB-UNIFORM

 **Note:**

Values other than 0 are applicable only in the ATP-Dedicated Cloud in an Oracle RAC environment.

Usage Notes

- If you are using Clustered Managed Services with Oracle Clusterware, or using Oracle Restart with your single instance database, you must modify services using the `srvctl` command rather than `DBMS_SERVICE`. When the service is started by Oracle Clusterware or Oracle Restart, the service is modified in the database to match the resource defined to either Oracle Clusterware or Oracle Restart. Any changes made with `DBMS_SERVICE` are lost unless they are also made with the corresponding `srvctl` command. Starting with 11.2.0.2, service attribute modifications take effect immediately when the service is started or modified by `srvctl`.
- Although users can modify the edition attribute while the service is up and running, it may not be safe to do so. Users must proceed with caution because this causes new connections to be connected at the new edition, while the existing connection is not affected. This can cause mid-tier operations to connect to the wrong edition.

166.6.5 START_SERVICE Procedure

This procedure starts a service. In Oracle RAC, implementing this option acts on the instance specified.



Note:

You cannot use this subprogram if your services are managed by Oracle Clusterware, Oracle Restart or Oracle Global Data Services.

Syntax

```
DBMS_SERVICE.START_SERVICE(  
    service_name IN VARCHAR2,  
    instance_name IN VARCHAR2);
```

Parameters

Table 166-10 START_SERVICE Procedure Parameters

Parameter	Description
service_name	Name of the service limited to 64 characters in the Data Dictionary
instance_name	Name of the instance where the service must be activated (optional). NULL results in starting of the service on the local instance. In single instance, this can only be the current instance or NULL. Specify DBMS_SERVICE.ALL_INSTANCES to start the service on all configured instances.

Examples

```
DBMS_SERVICE.START_SERVICE('ernie.example.com');
```

166.6.6 STOP_SERVICE Procedure

This procedure stops a service.



Note:

You cannot use this subprogram if your services are managed by Oracle Clusterware, Oracle Restart or Oracle Global Data Services.

Syntax

```
DBMS_SERVICE.STOP_SERVICE(  
    service_name IN VARCHAR2,  
    instance_name IN VARCHAR2 DEFAULT NULL,  
    stop_option IN VARCHAR2 DEFAULT NULL,
```

```

drain_timeout IN NUMBER    DEFAULT NULL,
replay       IN BOOLEAN   DEFAULT TRUE);

```

Parameters

Table 166-11 STOP_SERVICE Procedure Parameters

Parameter	Description
service_name	Name of the service limited to 64 characters in the Data Dictionary
instance_name	Name of the instance where the service must be stopped (optional). NULL results in stopping of the service locally. In single instance, this can only be the current instance or NULL. The default in Oracle RAC and exclusive case is NULL. Specify DBMS_SERVICE.ALL_INSTANCES to stop the service on all configured instances.
stop_option	To specify how sessions are stopped with draining. The possible values are as follows: <ul style="list-style-type: none"> IMMEDIATE: sessions are aborted immediately after the time specified in drain_timeout. TRANASCTIONAL: applies for transactions. After the transaction expires, the sessions are immediately terminated. NONE: sessions are not terminated. These values can be overridden on the command line using SRVCTL.
drain_timeout	The time in seconds for the session to drain.
replay	Enable application continuity replay.

Examples

```
DBMS_SERVICE.STOP_SERVICE('ernie.example.com');
```

167

DBMS_SESSION

This package provides access to `SQL ALTER SESSION` and `SET ROLE` statements, and other session information, from PL/SQL. You can use `DBMS_SESSION` to set preferences and security levels.

This chapter contains the following topics:

- [Security Model](#)
- [Operational Notes](#)
- [Data Structures](#)
- [Summary of DBMS_SESSION Subprograms](#)

167.1 DBMS_SESSION Security Model

This package runs with the privileges of the calling user, rather than the package owner `SYS`.

167.2 DBMS_SESSION Operational Notes

You should not attempt to turn `close_cached_open_cursors` on or off.

167.3 DBMS_SESSION Data Structures

The `DBMS_SESSION` package defines `TABLE` types.

Table Types

- [INTEGER_ARRAY Table Type](#)
- [LNAME_ARRAY Table Type](#)

167.3.1 DBMS_SERVICE INTEGER_ARRAY Table Type

`INTEGER_ARRAY` is a table type of `BINARY_INTEGER`.

Syntax

```
TYPE integer_array IS TABLE OF BINARY_INTEGER INDEX BY BINARY_INTEGER;
```

167.3.2 DBMS_SERVICE LNAME_ARRAY Table Type

`LNAME_ARRAY` is a table type of `VARCHAR2`.

Syntax

```
TYPE lname_array IS TABLE OF VARCHAR2(4000) INDEX BY BINARY_INTEGER;
```

167.4 Summary of DBMS_SESSION Subprograms

This table lists the DBMS_SESSION subprograms in alphabetical order and briefly describes them.

Table 167-1 DBMS_SESSION Package Subprograms

Subprogram	Description
CLEAR_ALL_CONTEXT Procedure	Clears all context information.
CLEAR_ALL_LOCAL_CONTEXTS Procedure	Clears all session based application context values that are set in the current session.
CLEAR_CONTEXT Procedure	Clears the context.
CLEAR_IDENTIFIER Procedure	Clears the identifier.
CLOSE_DATABASE_LINK Procedure	Closes database link.
CURRENT_IS_ROLE_ENABLED Function	Determines if the named role is currently enabled.
FREE_UNUSED_USER_MEMORY Procedure	Lets you reclaim unused memory after performing operations requiring large amounts of memory.
GET_PACKAGE_MEMORY_UTILIZATION Procedure	Describes static package memory usage.
IS_ROLE_ENABLED Function	Determines if the named role is enabled for the session.
IS_SESSION_ALIVE Function	Determines if the specified session is active.
LIST_CONTEXT Procedures	Returns a list of active namespace and context for the current session.
MODIFY_PACKAGE_STATE Procedure	Used to perform various actions (as specified by the <code>action_flags</code> parameter) on the session state of all PL/SQL program units active in the session.
RESET_PACKAGE Procedure	De-instantiates all packages in the session.
SESSION_IS_ROLE_ENABLED Function	Determines if the named role is enabled at the session level.
SESSION_TRACE_DISABLE Procedure	Resets the session-level SQL trace for the session from which it was called.
SESSION_TRACE_ENABLE Procedure	Enables session-level SQL trace for the invoking session.
SET_CONTEXT Procedure	Sets or resets the value of a context attribute.
SET_EDITION_DEFERRED Procedure	Requests a switch to the specified edition.
SET_IDENTIFIER Procedure	Sets the identifier.
SET-NLS Procedure	Sets Globalization Support (NLS).
SET_ROLE Procedure	Sets role.
SET_SQL_TRACE Procedure	Turns tracing on or off.
SLEEP Procedure	Suspends the session for a specified period of time.
SWITCH_CURRENT_CONSUMER_GROUP Procedure	Facilitates changing the current resource consumer group of a user's current session.

Table 167-1 (Cont.) DBMS_SESSION Package Subprograms

Subprogram	Description
UNIQUE_SESSION_ID Function	Returns an identifier that is unique for all sessions currently connected to this database.

167.4.1 CLEAR_ALL_CONTEXT Procedure

This procedure clears application context information in the specified namespace.

Syntax

```
DBMS_SESSION.CLEAR_ALL_CONTEXT
(namespace VARCHAR2);
```

Parameters

Table 167-2 CLEAR_ALL_CONTEXT Procedure Parameters

Parameter	Description
namespace	The namespace where the application context information is to be cleared. Required.

Usage Notes

- This procedure must be invoked directly or indirectly by the trusted package.
- Any changes in context value are reflected immediately and subsequent calls to access the value through SYS_CONTEXT return the most recent value.

167.4.2 CLEAR_ALL_LOCAL_CONTEXTS Procedure

This procedure clears all session-based application context values that are set in the current session and are initialized locally, externally, and globally, but cannot be accessed globally.

Syntax

```
DBMS_SESSION.CLEAR_ALL_LOCAL_CONTEXTS;
```

Usage Notes

Any public user with the CLEAR ALL LOCAL CONTEXTS privilege can execute this procedure. If a user without the CLEAR ALL LOCAL CONTEXTS privilege executes this procedure, it fails with the following error:

```
ORA-01056: User $USER_NAME does not have CLEAR ALL LOCAL CONTEXTS privilege
```

167.4.3 CLEAR_CONTEXT Procedure

This procedure clears application context in the specified namespace.

Syntax

```
DBMS_SESSION.CLEAR_CONTEXT
  namespace      VARCHAR2,
  client_identifier VARCHAR2
  attribute      VARCHAR2);
```

Parameters

Table 167-3 CLEAR_CONTEXT Procedure Parameters

Parameter	Description
namespace	<p>Namespace in which the application context is to be cleared. Required.</p> <p>For a session-local context, namespace must be specified. If namespace is defined as Session Local Context, then client_identifier is optional since it is only associated with a globally accessed context.</p> <p>For a globally accessed context, namespace must be specified. NULL is a valid value for client_identifier because a session with no identifier set can see a context that looks like the (namespace, attribute, value, username, null) set using SET_CONTEXT.</p>
client_identifier	Applies to a global context and is optional for other types of contexts; 64-byte maximum
attribute	Specific attribute in the namespace to be cleared. Optional. the default is NULL. If you specify attribute as NULL, then (namespace, attribute, value) for that namespace are cleared from the session. If attribute is not specified, then all context information that has the namespace and client_identifier arguments is cleared.

Usage Notes

- This procedure must be invoked directly or indirectly by the trusted package.
- Any changes in context value are reflected immediately and subsequent calls to access the value through SYS_CONTEXT return the most recent value.

167.4.4 CLEAR_IDENTIFIER Procedure

This procedure removes the set_client_id in the session.

Syntax

```
DBMS_SESSION.CLEAR_IDENTIFIER;
```

Usage Notes

This procedure is executable by public.

167.4.5 CLOSE_DATABASE_LINK Procedure

This procedure closes an open database link. It is equivalent to the following SQL statement:
`ALTER SESSION CLOSE DATABASE LINK <name>`

Syntax

```
DBMS_SESSION.CLOSE_DATABASE_LINK (  
    dblink VARCHAR2);
```

Parameters

Table 167-4 CLOSE_DATABASE_LINK Procedure Parameters

Parameter	Description
dblink	Name of the database link to close

167.4.6 CURRENT_IS_ROLE_ENABLED Function

This function determines if the named role is currently enabled.

Syntax

```
DBMS_SESSION.CURRENT_IS_ROLE_ENABLED (  
    rolename VARCHAR2)  
RETURN BOOLEAN;
```

Parameters

Table 167-5 CURRENT_IS_ROLE_ENABLED Function Parameters

Parameter	Description
rolename	Name of the role.

Return Values

- TRUE-if the role is enabled.
- FALSE-if the role is not enabled.

167.4.7 FREE_UNUSED_USER_MEMORY Procedure

This procedure reclaims unused memory after performing operations requiring large amounts of memory (more than 100K).

Examples of operations that use large amounts of memory include:

- Large sorting where entire `sort_area_size` is used and `sort_area_size` is hundreds of KB.
- Compiling large PL/SQL packages, procedures, or functions.
- Storing hundreds of KB of data within PL/SQL indexed tables.

You can monitor user memory by tracking the statistics "session UGA memory" and "session PGA memory" in the `v$sesstat` or `v$statname` fixed views. Monitoring these statistics also shows how much memory this procedure has freed.

**Note:**

This procedure should only be used in cases where memory is at a premium. It should be used infrequently and judiciously.

Syntax

```
DBMS_SESSION.FREE_UNUSED_USER_MEMORY;
```

Return Values

The behavior of this procedure depends upon the configuration of the server operating on behalf of the client:

- **Dedicated server:** This returns unused PGA memory and session memory to the operating system. Session memory is allocated from the PGA in this configuration.
- **Shared server:** This returns unused session memory to the `shared_pool`. Session memory is allocated from the `shared_pool` in this configuration.

Usage Notes

In order to free memory using this procedure, the memory must not be in use.

After an operation allocates memory, only the same type of operation can reuse the allocated memory. For example, after memory is allocated for sort, even if the sort is complete and the memory is no longer in use, only another sort can reuse the sort-allocated memory. For both sort and compilation, after the operation is complete, the memory is no longer in use, and the user can call this procedure to free the unused memory.

An indexed table implicitly allocates memory to store values assigned to the indexed table's elements. Thus, the more elements in an indexed table, the more memory the RDBMS allocates to the indexed table. As long as there are elements within the indexed table, the memory associated with an indexed table is in use.

The scope of indexed tables determines how long their memory is in use. Indexed tables declared globally are indexed tables declared in packages or package bodies. They allocate memory from session memory. For an indexed table declared globally, the memory remains in use for the lifetime of a user's login (lifetime of a user's session), and is freed after the user disconnects from ORACLE.

Indexed tables declared locally are indexed tables declared within functions, procedures, or anonymous blocks. These indexed tables allocate memory from PGA memory. For an indexed table declared locally, the memory remains in use for as long as the user is still running the procedure, function, or anonymous block in which the indexed table is declared. After the procedure, function, or anonymous block is finished running, the memory is then available for other locally declared indexed tables to use (in other words, the memory is no longer in use).

Assigning an uninitialized, "empty" indexed table to an existing index table is a method to explicitly re-initialize the indexed table and the memory associated with the indexed

table. After this operation, the memory associated with the indexed table is no longer in use, making it available to be freed by calling this procedure. This method is particularly useful on indexed tables declared globally which can grow during the lifetime of a user's session, as long as the user no longer needs the contents of the indexed table.

The memory rules associated with an indexed table's scope still apply; this method and this procedure, however, allow users to intervene and to explicitly free the memory associated with an indexed table.

Examples

The following PL/SQL illustrates the method and the use of procedure `FREE_UNUSED_USER_MEMORY`.

```
CREATE PACKAGE foobar
  type number_idx_tbl is table of number indexed by binary_integer;

  store1_table number_idx_tbl;    -- PL/SQL indexed table
  store2_table number_idx_tbl;    -- PL/SQL indexed table
  store3_table number_idx_tbl;    -- PL/SQL indexed table
  ...
END;                                -- end of foobar

DECLARE
  ...
  empty_table number_idx_tbl;    -- uninitialized ("empty") version
BEGIN
  FOR i in 1..1000000 loop
    store1_table(i) := i;        -- load data
  END LOOP;
  ...
  store1_table := empty_table;   -- "truncate" the indexed table
  ...
  -
  dbms_session.free_unused_user_memory; -- give memory back to system

  store1_table(1) := 100;        -- index tables still declared;
  store2_table(2) := 200;        -- but truncated.
  ...
END;
```

167.4.8 GET_PACKAGE_MEMORY_UTILIZATION Procedure

This procedure describes static package memory usage.

The output collections describe memory usage in each instantiated package. Each package is described by its owner name, package name, used memory amount, and unused allocated memory amount. The amount of unused memory is greater than zero because of memory fragmentation and also because once used free memory chunks initially go to a free list owned by the package memory heap. They are released back to the parent heap only when the [FREE_UNUSED_USER_MEMORY Procedure](#) is invoked.

Syntax

```
DBMS_SESSION.GET_PACKAGE_MEMORY_UTILIZATION (
  owner_names OUT NOCOPY LNAME_ARRAY,
  unit_names  OUT NOCOPY LNAME_ARRAY,
  unit_types  OUT NOCOPY INTEGER_ARRAY,
```

```
used_amounts    OUT NOCOPY INTEGER_ARRAY,
free_amounts    OUT NOCOPY INTEGER_ARRAY);
```

Parameters

Table 167-6 GET_PACKAGE_MEMORY_UTILIZATION Function Parameters

Parameter	Description
owner_name	Owner of package
unit_name	Name of package
unit_types	Value of the type# columns of the dictionary table obj\$
used_amounts	Amount of allocated memory specified in bytes
free_amounts	Amount of available memory specified in bytes

167.4.9 IS_ROLE_ENABLED Function

This function determines if the named role is enabled for this session.



Note:

This function is deprecated starting in Oracle Database 19c. Use `DBMS_SESSION.CURRENT_IS_ROLE_ENABLED` or `DBMS_SESSION.SESSION_IS_ROLE_ENABLED` instead.

Syntax

```
DBMS_SESSION.IS_ROLE_ENABLED (
    rolename    VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 167-7 IS_ROLE_ENABLED Function Parameters

Parameter	Description
rolename	Name of the role.\

Return Values

Table 167-8 IS_ROLE_ENABLED Function Return Values

Return	Description
is_role_enabled	TRUE or FALSE, depending on whether the role is enabled

167.4.10 IS_SESSION_ALIVE Function

This function determines if the specified session is active.

Syntax

```
DBMS_SESSION.IS_SESSION_ALIVE (
    uniqueid VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 167-9 IS_SESSION_ALIVE Function Parameters

Parameter	Description
uniqueid	Unique ID of the session: This is the same one as returned by UNIQUE_SESSION_ID.

Return Values

Table 167-10 IS_SESSION_ALIVE Function Return Values

Return	Description
is_session_alive	TRUE or FALSE, depending on whether the session is active

167.4.11 LIST_CONTEXT Procedures

This procedure returns a list of active namespaces and contexts for the current session.

Syntax

```
TYPE AppCtxRecTyp IS RECORD (
    namespace VARCHAR2(30),
    attribute VARCHAR2(30),
    value      VARCHAR2(256));

TYPE AppCtxTabTyp IS TABLE OF AppCtxRecTyp INDEX BY BINARY_INTEGER;

DBMS_SESSION.LIST_CONTEXT (
    list OUT AppCtxTabTyp,
    size OUT NUMBER);
```

Parameters

Table 167-11 LIST_CONTEXT Procedure Parameters

Parameter	Description
list	Buffer to store a list of application context set in the current session

Return Values

Table 167-12 LIST_CONTEXT Procedure Return Values

Return	Description
list	A list of (namespace, attribute, values) set in current session
size	Returns the number of entries in the buffer returned

Usage Notes

The context information in the list appears as a series of <namespace> <attribute> <value>. Because `list` is a table type variable, its size is dynamically adjusted to the size of returned list.

167.4.12 MODIFY_PACKAGE_STATE Procedure

This procedure is used to perform various actions (as specified by the `action_flags` parameter) on the session state of all PL/SQL program units active in the session. This takes effect after the PL/SQL call that made the current invocation finishes running.

The procedure uses the `DBMS_SESSION` constants listed in [Table 167-14](#).

Syntax

```
DBMS_SESSION.MODIFY_PACKAGE_STATE(  
    action_flags IN PLS_INTEGER);
```


Parameters

Table 167-13 MODIFY_PACKAGE_STATE Procedure Parameters

Parameter	Description
<code>action_flags</code>	<p>Bit flags that determine the action taken on PL/SQL program units:</p> <p><code>DBMS_SESSION.FREE_ALL_RESOURCES</code> (or 1)—frees all memory associated with each of the previously run PL/SQL programs from the session. Clears the current values of any package globals and closes cached cursors. On subsequent use, the PL/SQL program units are reinstantiated and package globals are reinitialized. Invoking <code>MODIFY_PACKAGE_STATE</code> with the <code>DBMS_SESSION.FREE_ALL_RESOURCES</code> parameter provides functionality identical to the <code>DBMS_SESSION.RESET_PACKAGE()</code> interface.</p> <p><code>DBMS_SESSION.REINITIALIZE</code> (or 2)—reinitializes packages without actually being freed and recreated from scratch. Instead the package memory is reused. In terms of program semantics, the <code>DBMS_SESSION.REINITIALIZE</code> flag is similar to the <code>DBMS_SESSION.FREE_ALL_RESOURCES</code> flag in that both have the effect of reinitializing all packages.</p> <p>However, <code>DBMS_SESSION.REINITIALIZE</code> should exhibit better performance than the <code>DBMS_SESSION.FREE_ALL_RESOURCES</code> option because:</p> <ul style="list-style-type: none"> • Packages are reinitialized without actually being freed and recreated from scratch. Instead the package memory gets reused. • Any open cursors are closed, semantically speaking. However, the cursor resource is not actually freed. It is simply returned to the PL/SQL cursor cache. The cursor cache is not flushed. Hence, cursors corresponding to frequently accessed static SQL in PL/SQL remains cached in the PL/SQL cursor cache and the application does not incur the overhead of opening, parsing, and closing a new cursor for those statements on subsequent use. • The session memory for PL/SQL modules without global state (such as types, stored-procedures) are not freed and recreated.

Usage Notes

See the parameter descriptions in [Table 167-16](#) for the differences between the flags and why `DBMS_SESSION.REINITIALIZE` exhibits better performance than `DBMS_SESSION.FREE_ALL_RESOURCES`.

Table 167-14 Action_flags Constants for MODIFY_PACKAGE_STATE

Constant	Description
<code>FREE_ALL_RESOURCES</code>	<code>PLS_INTEGER:= 1</code>
<code>REINITIALIZE</code>	<code>PLS_INTEGER:= 2</code>

- Reinitialization refers to the process of resetting all package variables to their initial values and running the initialization block (if any) in the package bodies. Consider the package:

```
package P is
  n number;
  m number := P2.foo;
  d date := SYSDATE;
  cursor c is select * from emp;
  procedure bar;
end P;
/
package body P is
  v varchar2(20) := 'hello';
  procedure bar is
  begin
    ...
  end;
  procedure init_pkg is
  begin
    ....
  end;
begin
  -- initialization block
  init_pkg;
  ...
  ...
end P;
/
```

For the package P, reinitialization involves:

- Setting P.n to NULL
- Invoking function P2.foo and setting P.m to the value returned from P2.foo
- Setting P.d to the return value of SYSDATE built-in
- Closing cursor P.c if it was previously opened
- Setting P.v to 'hello'
- Running the initialization block in the package body
- The reinitialization for a package is done only if the package is actually referenced subsequently. Furthermore, the packages are reinitialized in the order in which they are referenced subsequently.
- When using FREE_ALL_RESOURCES or REINITIALIZE, make sure that resetting package variable values does not affect the application.
- Because DBMS_SESSION.REINITIALIZE does not actually cause all the package state to be freed, in some situations, the application could use significantly more session memory than if the FREE_ALL_RESOURCES flag or the RESET_PACKAGE procedure had been used. For instance, after performing DBMS_SESSION.MODIFY_PACKAGE_STATE(DBMS_SESSION.REINITIALIZE), if the application does not refer to many of the packages that were previously referenced, then the session memory for those packages remains until the end of the session (or until DBMS_SESSION.RESET_PACKAGE is called).
- Because the client-side PL/SQL code cannot reference remote package variables or constants, you must explicitly use the values of the constants. For example, DBMS_SESSION.MODIFY_PACKAGE_STATE(DBMS_SESSION.REINITIALIZE) does not compile on the client because it uses the constant DBMS_SESSION.REINITIALIZE.

Instead, use `DBMS_SESSION.MODIFY_PACKAGE_STATE(2)` on the client, because the argument is explicitly provided.

Examples

This example illustrates the use of `DBMS_SESSION.MODIFY_PACKAGE_STATE`. Consider a package `P` with some global state (a cursor `c` and a number `cnt`). When the package is first initialized, the package variable `cnt` is 0 and the cursor `c` is `CLOSED`. Then, in the session, change the value of `cnt` to 111 and also execute an `OPEN` operation on the cursor. If you call `print_status` to display the state of the package, you see that `cnt` is 111 and that the cursor is `OPEN`. Next, call `DBMS_SESSION.MODIFY_PACKAGE_STATE`. If you print the status of the package `P` again using `print_status`, you see that `cnt` is 0 again and the cursor is `CLOSED`. If the call to `DBMS_SESSION.MODIFY_PACKAGE_STATE` had not been made, then the second `print_status` would have printed 111 and `OPEN`.

```
create or replace package P is
  cnt    number := 0;
  cursor c is select * from emp;
  procedure print_status;
end P;
/
show errors;

create or replace package body P is
  procedure print_status is
  begin
    dbms_output.put_line('P.cnt = ' || cnt);
    if c%ISOPEN then
      dbms_output.put_line('P.c is OPEN');
    else
      dbms_output.put_line('P.c is CLOSED');
    end if;
  end;
end P;
/
show errors;

SQL> set serveroutput on;
SQL> begin
  2  P.cnt := 111;
  3  open p.c;
  4  P.print_status;
  5  end;
  6  /
P.cnt = 111
P.c is OPEN

PL/SQL procedure successfully completed.

SQL> begin
  2  dbms_session.modify_package_state(dbms_session.reinitialize);
  3  end;
  4  /

PL/SQL procedure successfully completed.

SQL> set serveroutput on;
SQL>
SQL> begin
  2  P.print_status;
```

```
3 end;  
4 /  
P.cnt = 0  
P.c is CLOSED
```

PL/SQL procedure successfully completed.

167.4.13 RESET_PACKAGE Procedure

This procedure de-instantiates all packages in this session. It frees the package state.

Note:

See "[SESSION_TRACE_ENABLE Procedure](#)". The `MODIFY_PACKAGE_STATE` interface, introduced in Oracle9i, provides an equivalent of the `RESET_PACKAGE` capability. It is an efficient, lighter-weight variant for reinitializing the state of all PL/SQL packages in the session.

Memory used for caching the execution state is associated with all PL/SQL functions, procedures, and packages that were run in a session.

For packages, this collection of memory holds the current values of package variables and controls the cache of cursors opened by the respective PL/SQL programs. A call to `RESET_PACKAGE` frees the memory associated with each of the previously run PL/SQL programs from the session, and, consequently, clears the current values of any package globals and closes any cached cursors.

`RESET_PACKAGE` can also be used to reliably restart a failed program in a session. If a program containing package variables fails, then it is hard to determine which variables need to be reinitialized. `RESET_PACKAGE` guarantees that all package variables are reset to their initial values.

Syntax

```
DBMS_SESSION.RESET_PACKAGE;
```

Usage Notes

Because the amount of memory consumed by all executed PL/SQL can become large, you might use `RESET_PACKAGE` to trim down the session memory footprint at certain points in your database application. However, make sure that resetting package variable values does not affect the application. Also, remember that later execution of programs that have lost their cached memory and cursors will perform slower, because they need to re-create the freed memory and cursors.

`RESET_PACKAGE` does not free the memory, cursors, and package variables immediately when called.

**Note:**

RESET_PACKAGE only frees the memory, cursors, and package variables after the PL/SQL call that made the invocation finishes running.

For example, PL/SQL procedure P1 calls PL/SQL procedure P2, and P2 calls RESET_PACKAGE. The RESET_PACKAGE effects do not occur until procedure P1 finishes execution (the PL/SQL call ends).

Examples

This SQL*Plus script runs a large program with many PL/SQL program units that may or may not use global variables, but it doesn't need them beyond this execution:

```
EXECUTE large_plsql_program1;
```

To free up PL/SQL cached session memory:

```
EXECUTE DBMS_SESSION.RESET_PACKAGE;
```

To run another large program:

```
EXECUTE large_plsql_program2;
```

167.4.14 SESSION_IS_ROLE_ENABLED Function

This function determines if the named role is enabled for the login user session.

Syntax

```
DBMS_SESSION.SESSION_IS_ROLE_ENABLED (  
    rolename    VARCHAR2)  
    RETURN BOOLEAN;
```

Parameters

Table 167-15 SESSION_IS_ROLE_ENABLED Function Parameters

Parameter	Description
rolename	Name of the role.

Return Values

- TRUE-if the role is enabled.
- FALSE-if the role is not enabled.

167.4.15 SESSION_TRACE_DISABLE Procedure

This procedure resets the session-level SQL trace for the session from which it was called. Client ID and service/module/action traces are not affected.

Syntax

```
DBMS_SESSION.SESSION_TRACE_DISABLE;
```

167.4.16 SESSION_TRACE_ENABLE Procedure

This procedure enables session-level SQL trace for the invoking session. Invoking this procedure results in SQL tracing of every SQL statement issued by the session.

Syntax

```
DBMS_SESSION.SESSION_TRACE_ENABLE (
    waits      IN   BOOLEAN DEFAULT TRUE,
    binds      IN   BOOLEAN DEFAULT FALSE,
    plan_stat  IN   VARCHAR2 DEFAULT NULL);
```

Parameters

Table 167-16 SESSION_TRACE_ENABLE Procedure Parameters

Parameter	Description
waits	Specifies if wait information is to be traced
binds	Specifies if bind information is to be traced
plan_stat	Frequency at which we dump row source statistics. Value should be 'NEVER', 'FIRST_EXECUTION' (equivalent to NULL) or 'ALL_EXECUTIONS'.

167.4.17 SET_CONTEXT Procedure

This procedure sets the context, of which there are four types: session local, globally initialized, externally initialized, and globally accessed.

Of the five parameters, only the first three are required; the final two parameters are optional, used only in globally accessed contexts. Further parameter information appears in the parameter table and the usage notes.

Syntax

```
DBMS_SESSION.SET_CONTEXT (
    namespace VARCHAR2,
    attribute  VARCHAR2,
    value      VARCHAR2,
    username   VARCHAR2,
    client_id  VARCHAR2 );
```

Parameters

Table 167-17 SET_CONTEXT Procedure Parameters

Parameter	Description
namespace	The namespace of the application context to be set, limited to 128 bytes. Exceeding the maximum permissible length will result in an error during the execution of the procedure.
attribute	The attribute of the application context to be set, limited to 128 bytes. Exceeding the maximum permissible length will result in an error during the execution of the procedure.
value	Value of the application context to be set, limited to 4 kilobytes.
username	Database username attribute of the application context, limited to 128 bytes. Exceeding the maximum permissible length will result in an error during the execution of the procedure. The default value is NULL.
client_id	Application-specific client_id attribute of the application context, limited to 64 bytes. The default value is NULL.

Usage Notes

- The first three parameters are required for all types of context.
- The `username` parameter must be a valid SQL identifier.
- The `client_id` parameter must be a string of at most 64 bytes. It is case-sensitive and must match the argument provided for `set_identifier`.
- If the `namespace` parameter is a global context namespace, then the `username` parameter is matched against the current database user name in the session, and the `client_id` parameter is matched against the current `client_id` in the session. If these parameters are not set, NULL is assumed, enabling any user to see the context values.
- This procedure must be invoked directly or indirectly by the trusted package.
- The caller of SET_CONTEXT must be in the calling stack of a procedure that has been associated to the context namespace through a CREATE CONTEXT statement. The checking of the calling stack does not cross a DBMS boundary.
- No limit applies to the number of attributes that can be set in a namespace. An attribute retains its value during the user's session unless it is reset by the user.
- If the value of the parameter in the namespace has been set, SET_CONTEXT overwrites this value.
- Any changes in context value are reflected immediately and subsequent calls to access the value through SYS_CONTEXT return the most recent value.

 **See Also:**

Oracle Database Security Guide for more information about

- "Setting the username and client ID"
- "Example: Creating a Global Application Context that Uses a Client Session ID"

167.4.18 SET_EDITION_DEFERRED Procedure

This procedure requests a switch to the specified edition. The switch takes effect at the end of the current client call.

Syntax

```
DBMS_SESSION.SET_EDITION_DEFERRED (
    edition    IN    VARCHAR2);
```

Parameters

Table 167-18 SET_EDITION_DEFERRED Procedure Parameters

Parameter	Description
edition	Name of the edition to which to switch. The contents of the string are processed as a SQL identifier; double quotation marks must surround the remainder of the string if special characters or lower case characters are present in the edition's actual name and, if double quotation marks are not used, the contents are set in uppercase. The caller must have <code>USE</code> privilege on the named edition.

167.4.19 SET_IDENTIFIER Procedure

This procedure sets the client ID in the session.

Syntax

```
DBMS_SESSION.SET_IDENTIFIER (
    client_id VARCHAR2);
```

Parameters

Table 167-19 SET_IDENTIFIER Procedure Parameters

Parameter	Description
client_id	Case-sensitive application-specific identifier of the current database session. The maximum number of bytes for this parameter is 64 bytes. If the input exceeds 64 bytes, then <code>ORA-28264</code> is raised.

Usage Notes

- `SET_IDENTIFIER` sets the session's client id to the given value. This value can be used to identify sessions in `v$session` by means of `v$session.client_identifier`. It can also be used to identify sessions by means of `sys_context('USERENV','CLIENT_IDENTIFIER')`.
- This procedure is executable by `PUBLIC`.

167.4.20 SET_NLS Procedure

This procedure sets up your Globalization Support (NLS). It is equivalent to the SQL statement: `ALTER SESSION SET <nls_parameter> = <value>`.

Syntax

```
DBMS_SESSION.SET_NLS (
    param VARCHAR2,
    value VARCHAR2);
```

Parameters

Table 167-20 SET_NLS Procedure Parameters

Parameter	Description
param	Globalization Support parameter. The parameter name must begin with 'NLS'.
value	Parameter value. If the parameter is a text literal, then it needs embedded single-quotes. For example, "set_nls (nls_date_format,'DD-MON-YY')".

167.4.21 SET_ROLE Procedure

This procedure enables and disables roles. It is equivalent to the `SET ROLE` SQL statement.

Syntax

```
DBMS_SESSION.SET_ROLE (
    role_cmd VARCHAR2);
```

Parameters

Table 167-21 SET_ROLE Procedure Parameters

Parameter	Description
role_cmd	Text is appended to "set role" and then run as SQL

Usage Notes

Note that the procedure creates a new transaction if it is not invoked from within an existing transaction.

167.4.22 SET_SQL_TRACE Procedure

This procedure turns tracing on or off. It is equivalent to the SQL statement `ALTER SESSION SET SQL_TRACE`

Syntax

```
DBMS_SESSION.SET_SQL_TRACE (
    sql_trace boolean);
```

Parameters

Table 167-22 SET_SQL_TRACE Procedure Parameters

Parameter	Description
sql_trace	TRUE turns tracing on, FALSE turns tracing off

167.4.23 SLEEP Procedure

This procedure suspends the session for a specified period of time.

Syntax

```
DBMS_SESSION.SLEEP (
    seconds IN NUMBER);
```

Parameters

Table 167-23 SLEEP Procedure Parameters

Parameter	Description
seconds	Amount of time, in seconds, to suspend the session. The smallest increment can be entered in hundredths of a second; for example, 1.95 is a legal time value.

167.4.24 SWITCH_CURRENT_CONSUMER_GROUP Procedure

This procedure changes the current resource consumer group of a user's current session.

This lets you switch to a consumer group if you have the switch privilege for that particular group. If the caller is another procedure, then this enables the user to switch to a consumer group for which the owner of that procedure has switch privilege.

Syntax

```
DBMS_SESSION.switch_current_consumer_group (
    new_consumer_group    IN VARCHAR2,
    old_consumer_group    OUT VARCHAR2,
    initial_group_on_error IN BOOLEAN);
```

Parameters

Table 167-24 SWITCH_CURRENT_CONSUMER_GROUP Procedure Parameters

Parameter	Description
<code>new_consumer_group</code>	Name of consumer group to which you want to switch
<code>old_consumer_group</code>	Name of the consumer group from which you just switched out
<code>initial_group_on_error</code>	If TRUE, then sets the current consumer group of the caller to his/her initial consumer group in the event of an error

Return Values

This procedure outputs the old consumer group of the user in the parameter `old_consumer_group`.

Note:

- The `old_consumer_group` parameter returns the name of old consumer group only if it were set explicitly. That is, you might get NULL if the old consumer group was set by some mapping rules.
- You can switch back to the old consumer group later using the value returned in `old_consumer_group`.

Exceptions

Table 167-25 SWITCH_CURRENT_CONSUMER_GROUP Procedure Exceptions

Exception	Description
29368	Non-existent consumer group
1031	Insufficient privileges
29396	Cannot switch to OTHER_GROUPS consumer group

Usage Notes

The owner of a procedure must have privileges on the group from which a user was switched (`old_consumer_group`) in order to switch them back. There is one exception: The procedure can always switch the user back to his/her initial consumer group (skipping the privilege check).

By setting `initial_group_on_error` to TRUE, `SWITCH_CURRENT_CONSUMER_GROUP` puts the current session into the default group, if it can't put it into the group designated by `new_consumer_group`. The error associated with the attempt to move a session into `new_consumer_group` is raised, even though the current consumer group has been changed to the initial consumer group.

Examples

```

CREATE OR REPLACE PROCEDURE high_priority_task is
  old_group varchar2(30);
  prev_group varchar2(30);
  curr_user varchar2(30);
BEGIN
  -- switch invoker to privileged consumer group. If we fail to do so, an
  -- error is thrown, but the consumer group does not change
  -- because 'initial_group_on_error' is set to FALSE

  dbms_session.switch_current_consumer_group('tkrogrp1', old_group, FALSE);
  -- set up exception handler (in the event of an error, we do not want to
  -- return to caller while leaving the session still in the privileged
  -- group)

  BEGIN
    -- perform some operations while under privileged group

  EXCEPTION
    WHEN OTHERS THEN
      -- It is possible that the procedure owner does not have privileges
      -- on old_group. 'initial_group_on_error' is set to TRUE to make sure
      -- that the user is moved out of the privileged group in such a
      -- situation

      dbms_session.switch_current_consumer_group(old_group,prev_group,TRUE);
      RAISE;
    END;

  -- we've succeeded. Now switch to old_group, or if cannot do so, switch
  -- to caller's initial consumer group

  dbms_session.switch_current_consumer_group(old_group,prev_group,TRUE);
END high_priority_task;
/

```

167.4.25 UNIQUE_SESSION_ID Function

This function returns an identifier that is unique for all sessions currently connected to this database. Multiple calls to this function during the same session always return the same result.

Syntax

```

DBMS_SESSION.UNIQUE_SESSION_ID
  RETURN VARCHAR2;

```

Pragmas

```

pragma restrict_references(unique_session_id,WNDS,RNDS,WNPS);

```

Return Values

Table 167-26 UNIQUE_SESSION_ID Function Return Values

Return	Description
unique_session_id	Returns up to 24 bytes

167.4.26 USE_DEFAULT_EDITION_ALWAYS procedure

This procedure turns a mode 'on' or 'off' that disassociates the session from an edition at the end of each and every client call.

Following each call and before the next top level call, no edition will be in use by the session. The session will use the reigning database default edition on its next operation.

Syntax

```
DBMS_SESSION.USE_DEFAULT_EDITION_ALWAYS (
    mode_on IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 167-27 USE_DEFAULT_EDITION_ALWAYS Procedure Parameters

Parameter	Description
mode_on	TRUE to turn on this mode, FALSE to turn off this mode.

Usage Notes

- A choice of session edition that might otherwise occur due to use of ALTER SESSION SET EDITION, SET_EDITION_DEFERRED, USE_DEFAULT_EDITION_DEFERRED, or the edition-choosing aspect of ALTER SESSION SET CONTAINER will be overridden by this mode.
- Turn this mode off before invoking the above mechanisms to avoid the overriding effect.

167.4.27 USE_DEFAULT_EDITION_DEFERRED procedure

This procedure disassociates the session from an edition.

The reset takes effect at the end of the current client call. Following this call, and before the next top level call, no edition will be in use by the session. The session will use the reigning database default edition on its next operation.

Syntax

```
DBMS_SESSION.USE_DEFAULT_EDITION_DEFERRED
```

DBMS_SFW_ACL_ADMIN

The DBMS_SFW_ACL_ADMIN package provides interfaces for administering and managing access control policies for the "database service firewall" feature. Each policy is represented by an access control list (ACL) containing hosts that are allowed access to a specific database service. Local listeners and server processes validate all inbound client connections against the ACL.

This chapter contains the following topics:

- [DBMS_SFW_ACL_ADMIN Security Model](#)
- [DBMS_SFW_ACL_ADMIN Operational Notes](#)
- [DBMS_SFW_ACL_ADMIN Examples](#)
- [Summary of DBMS_SFW_ACL_ADMIN Subprograms](#)

168.1 DBMS_SFW_ACL_ADMIN Security Model

This package is owned by the DBSFUSER schema. The procedures in this package can be run only by the DBSFUSER user.

168.2 DBMS_SFW_ACL_ADMIN Operational Notes

These operation notes apply to DBMS_SFW_ACL_ADMIN.

- An ACL contains entries, which are called "ace", for "access control entries".
- You add entries to an ACL using the [IP_ADD_ACE Procedure](#) and [IP_ADD_PDB_ACE Procedure](#). After calling these procedures, you call the [COMMIT_ACL Procedure](#) to send the updated ACL to the listeners. Similarly, if you remove entries from an ACL using the [IP_REMOVE_ACE Procedure](#), [IP_REMOVE_ACL Procedure](#), [IP_REMOVE_PDB_ACE Procedure](#), or [IP_REMOVE_PDB_ACL Procedure](#), you need to call the [COMMIT_ACL Procedure](#) to update the ACL on the listeners.
- Access control must be enabled using the new FIREWALL endpoint attribute and the new LOCAL_REGISTRATION_ADDRESS_listenerName parameter. The configuration can be done manually in listener.ora or through the Server Control Utility (SRVCTL). Refer to the *Oracle Database Net Services Reference* and the *Oracle Real Application Clusters Administration and Deployment Guide* for configuration instructions.
- You can query the IP_ACL table to show the committed ACLs. But to see the ACLs that have been sent to the local listeners, you have to query the V\$IP_ACL or GV\$IP_ACL view. The IP_ACL table can contain ACLs that are not in [G]V\$IP_ACL because the database services for those ACLs were not running at the time of the commit. When the services are running, you can call the COMMIT_ACL procedure again to send the committed ACLs in the IP_ACL table to the local listeners.

In an Oracle RAC environment, GV\$IP_ACL can be used to query ACLs across the database cluster, and V\$IP_ACL to query ACLs in the connected instance.

168.3 DBMS_SFW_ACL_ADMIN Examples

These three examples show how DBMS_SFW_ACL_ADMIN can be used to administer and manage access control policies.

The following example adds three access control entries to the ACL and commits them.

```
## Connect to DBSFUSER
SQL> connect dbsfuser/<password>
Connected.

## Create an ACL for database service SVC1
SQL> exec dbms_sfw_acl_admin.ip_add_ace('svc1','192.168.12.1');
PL/SQL procedure successfully completed.

SQL> exec dbms_sfw_acl_admin.ip_add_ace('svc1','192.168.12.2');
PL/SQL procedure successfully completed.

SQL> exec dbms_sfw_acl_admin.ip_add_ace('svc1','test02.example.com');
PL/SQL procedure successfully completed.

## Commit the ACLs to the DB ACL table.
## This sends the ACLs for running services to ALL local Listeners
SQL> exec dbms_sfw_acl_admin.commit_acl;
PL/SQL procedure successfully completed.
```

The following example retrieves the ACLs committed from the previous example.

```
SQL> select * from ip_acl;
SERVICE_NAME          HOST
-----
"SVC1.EXAMPLE.COM"     192.168.12.1
"SVC1.EXAMPLE.COM"     192.168.12.2
"SVC1.EXAMPLE.COM"     TEST02.EXAMPLE.COM

## View ACLs sent to the local Listeners
## NOTE: ACLs are sent ONLY to running services
SQL> select * from v$ip_acl;
SERVICE_NAME          HOST          CON_ID
-----
SVC1.EXAMPLE.COM      192.168.12.1      1
SVC1.EXAMPLE.COM      192.168.12.2      1
SVC1.EXAMPLE.COM      TEST02.EXAMPLE.COM 1
```

The following example adds access control entries for pluggable database "PDB1" using various host formats.

```
SQL> exec dbms_sfw_acl_admin.ip_add_pdb_ace('pdb1','192.168.12.3');
PL/SQL procedure successfully completed.

SQL> exec dbms_sfw_acl_admin.ip_add_pdb_ace('pdb1','192.168.12.0/23');
PL/SQL procedure successfully completed.

SQL> exec dbms_sfw_acl_admin.ip_add_pdb_ace('pdb1','192.168.12.*');
PL/SQL procedure successfully completed.

SQL> exec dbms_sfw_acl_admin.commit_acl;
PL/SQL procedure successfully completed.
```

168.4 Summary of DBMS_SFW_ACL_ADMIN Subprograms

This table lists the DBMS_SFW_ACL_ADMIN subprograms and briefly describes them.

Table 168-1 DBMS_SFW_ACL_ADMIN Package Subprograms

Subprogram	Description
COMMIT_ACL Procedure	Commits changes to the ACL tables, and propagates the changes to the local listeners for database instances.
IP_ADD_ACE Procedure	Adds an access control entry to the ACL for a database service.
IP_ADD_PDB_ACE Procedure	Adds an access control entry to the ACL for all the database services in a pluggable database (PDB).
IP_REMOVE_ACE Procedure	Removes an entry from the ACL for a database service.
IP_REMOVE_ACL Procedure	Removes all entries from the ACL for a database service.
IP_REMOVE_PDB_ACE Procedure	Removes an access control entry from the ACL for all the database services in a pluggable database (PDB).
IP_REMOVE_PDB_ACL Procedure	Removes all entries from the ACL for all the database services in a pluggable database (PDB).

168.4.1 COMMIT_ACL Procedure

This procedure commits changes to the ACL tables. It also propagates the changes to the local listeners for database instances.

If you have changed access entries for database services, but the database services were not running at the time when you called the COMMIT_ACL procedure, then those changes will be committed to the ACL tables, but they will not be sent to the local listener. To send the entries to the listener, start up the database services, and call the COMMIT_ACL procedure again.

This procedure returns when the operation has completed successfully.

Syntax

```
DBMS_SFW_ACL_ADMIN.COMMIT_ACL;
```

Parameters

None

168.4.2 IP_ADD_ACE Procedure

This procedure adds an access control entry to the ACL for a database service.

Syntax

```
DBMS_SFW_ACL_ADMIN.IP_ADD_ACE (
  p_service_name IN VARCHAR2,
  p_host         IN VARCHAR2);
```


Parameters

Table 168-2 IP_ADD_ACE Procedure Parameters

Parameter	Description
p_service_name	The name of the database service for which you want to add an access control entry.
p_host	The host of the client that is allowed access to the service. This value can be a host name, an IPv4 address, or an IPv6 address. Wildcard "*" for IPv4 and CIDR format are also allowed.

168.4.3 IP_ADD_PDB_ACE Procedure

This procedure adds an access control entry to the ACL for all the database services in a pluggable database (PDB).

Syntax

```
DBMS_SFW_ACL_ADMIN.IP_ADD_PDB_ACE (
  p_pdb_name IN VARCHAR2,
  p_host     IN VARCHAR2);
```

Parameters

Table 168-3 IP_ADD_PDB_ACE Procedure Parameters

Parameter	Description
p_pdb_name	The name of the PDB.
p_host	The host of the client that is allowed access to the database services in the PDB. This value can be a host name, an IPv4 address, or an IPv6 address. Wildcard "*" for IPv4 and CIDR format are also allowed.

168.4.4 IP_REMOVE_ACE Procedure

This procedure removes an entry from the ACL for a database service.

Syntax

```
DBMS_SFW_ACL_ADMIN.IP_REMOVE_ACE (
  p_service_name IN VARCHAR2,
  p_host         IN VARCHAR2);
```

Parameters

Table 168-4 IP_REMOVE_ACE Procedure Parameters

Parameter	Description
p_service_name	The name of the database service from which you want to remove an access control entry.

Table 168-4 (Cont.) IP_REMOVE_ACE Procedure Parameters

Parameter	Description
p_host	The host that you want to remove from the ACL. This value can be a host name, an IPv4 address, or an IPv6 address. Wildcard "*" for IPv4 and CIDR format are also allowed. This has to match the existing value exactly. You can query the IP_ACL table to get the list of entries for a database service.

168.4.5 IP_REMOVE_ACL Procedure

This procedure removes all entries from the ACL for a database service.

Syntax

```
DBMS_SFW_ACL_ADMIN.IP_REMOVE_ACL (
  p_service_name IN VARCHAR2);
```

Parameters

Table 168-5 IP_REMOVE_ACL Procedure Parameters

Parameter	Description
p_service_name	The name of the database service whose ACL you want to clear.

168.4.6 IP_REMOVE_PDB_ACE Procedure

This procedure removes an access control entry from the ACL for all the database services in the specified pluggable database (PDB).

Syntax

```
DBMS_SFW_ACL_ADMIN.IP_REMOVE_PDB_ACE (
  p_pdb_name IN VARCHAR2,
  p_host     IN VARCHAR2);
```

Parameters

Table 168-6 IP_REMOVE_PDB_ACE Procedure Parameters

Parameter	Description
p_pdb_name	The name of the PDB.
p_host	The host that you want to remove from the ACL. This value can be a host name, an IPv4 address, or an IPv6 address. Wildcard "*" for IPv4 and CIDR format are also allowed. This has to match the existing value exactly. You can query the IP_ACL table to get the list of entries for a database service.

168.4.7 IP_REMOVE_PDB_ACL Procedure

This procedure removes all entries from the ACL for all the database services in the specified pluggable database (PDB).

Syntax

```
DBMS_SFW_ACL_ADMIN.IP_REMOVE_PDB_ACL (  
    p_pdb_name IN VARCHAR2);
```

Parameters

Table 168-7 IP_REMOVE_PDB_ACL Procedure Parameters

Parameter	Description
p_pdb_name	The name of the PDB.

DBMS_SHARED_POOL

The `DBMS_SHARED_POOL` package provides access to the shared pool, which is the shared memory area where cursors and PL/SQL objects are stored. `DBMS_SHARED_POOL` enables you to display the sizes of objects in the shared pool, and mark them for keeping or not-keeping in order to reduce memory fragmentation.

This chapter contains the following topics:

- [Overview](#)
- [Operational Notes](#)
- [Summary of DBMS_SHARED_POOL Subprograms](#)

169.1 DBMS_SHARED_POOL Overview

The procedures provided here may be useful when loading large PL/SQL objects. When large PL/SQL objects are loaded, users response time is affected because of the large number of smaller objects that need to be aged out from the shared pool to make room (due to memory fragmentation). In some cases, there may be insufficient memory to load the large objects.

`DBMS_SHARED_POOL` is also useful for frequently executed triggers. You may want to keep compiled triggers on frequently used tables in the shared pool.

Additionally, `DBMS_SHARED_POOL` supports sequences. Sequence numbers are lost when a sequence is aged out of the shared pool. `DBMS_SHARED_POOL` is useful for keeping sequences in the shared pool and thus preventing the loss of sequence numbers.

169.2 DBMS_SHARED_POOL Operational Notes

To create `DBMS_SHARED_POOL`, run the `DBMSPOOL.SQL` script. The `PRVTPPOOL.PLB` script is automatically executed after `DBMSPOOL.SQL` runs. These scripts are *not* run by as part of standard database creation.

169.3 Summary of DBMS_SHARED_POOL Subprograms

This table lists the `DBMS_SHARED_POOL` subprograms and briefly describes them.

Table 169-1 *DBMS_SHARED_POOL Package Subprograms*

Subprogram	Description
ABORTED_REQUEST_THRESHOLD Procedure	Sets the aborted request threshold for the shared pool
KEEP Procedure	Keeps an object in the shared pool
MARKHOT Procedure	Marks a library cache object as a hot object

Table 169-1 (Cont.) DBMS_SHARED_POOL Package Subprograms

Subprogram	Description
PURGE Procedure	Purges the named object or specified heap(s) of the object
SIZES Procedure	Shows objects in the shared pool that are larger than the specified size
UNKEEP Procedure	Unkeeps the named object
UNMARKHOT Procedure	Unmarks a library cache object as a hot object

169.3.1 ABORTED_REQUEST_THRESHOLD Procedure

This procedure sets the aborted request threshold for the shared pool.

Syntax

```
DBMS_SHARED_POOL.ABORTED_REQUEST_THRESHOLD (
    threshold_size NUMBER);
```

Parameters

Table 169-2 ABORTED_REQUEST_THRESHOLD Procedure Parameters

Parameter	Description
threshold_size	Size, in bytes, of a request which does not try to free unpinned (not "unkeep-ed") memory within the shared pool. The range of threshold_size is 5000 to ~2 GB inclusive.

Exceptions

An exception is raised if the threshold is not in the valid range.

Usage Notes

Usually, if a request cannot be satisfied on the free list, then the RDBMS tries to reclaim memory by freeing objects from the LRU list and checking periodically to see if the request can be fulfilled. After finishing this step, the RDBMS has performed a near equivalent of an 'ALTER SYSTEM FLUSH SHARED_POOL'.

Because this impacts all users on the system, this procedure "localizes" the impact to the process failing to find a piece of shared pool memory of size greater than thresh_hold size. This user gets the 'out of memory' error without attempting to search the LRU list.

169.3.2 KEEP Procedure

This procedure keeps an object in the shared pool. Once an object has been kept in the shared pool, it is not subject to aging out of the pool. This may be useful for

frequently used large objects. When large objects are brought into the shared pool, several objects may need to be aged out to create a contiguous area large enough.

Syntax

```
DBMS_SHARED_POOL.KEEP (
    name          VARCHAR2,
    flag          CHAR DEFAULT 'P');

DBMS_SHARED_POOL.KEEP (
    schema        VARCHAR2,
    objname       VARCHAR2,
    namespace     NUMBER,
    heaps         NUMBER,
    edition_name  VARCHAR2 DEFAULT NULL);

DBMS_SHARED_POOL.KEEP (
    hash          VARCHAR2,
    namespace     NUMBER,
    heaps         NUMBER);
```

Parameters

Table 169-3 KEEP Procedure Parameters

Parameter	Description
name	The name of the object to keep.
flag	A character string indicating the kind of object to keep in the shared pool. The string is not case sensitive. This parameter is optional. If the parameter is not specified, the package assumes that the first parameter is the name of a package/procedure/function and will resolve the name. <ul style="list-style-type: none"> • Set to 'P' or 'p' to fully specify that the input is the name of a package/procedure/function. • Set to 'Q' or 'q' to specify that the input is the name of a sequence. • Set to 'R' or 'r' to specify that the input is the name of a trigger. • Set to 'T' or 't' to specify that the input is the name of a type. • Set to 'JS' or 'js' to specify that the input is the name of a java source. • Set to 'JC' or 'jc' to specify that the input is the name of a java class. • Set to 'JD' or 'jd' to specify that the input is the name of a java shared data. • Set to 'JR' or 'jr' to specify that the input is the name of a java resource. • Set to 'C' or 'c' to specify that the input is the name of a cursor.
schema	The user name or the schema to which the object belongs to.
objname	The name of the object to keep.
namespace	A number indicating the library cache namespace in which the object has to be searched for.
heaps	The heaps to keep. For example, if heap 0 and heap 6 are to be kept.
edition_name	The name of the edition that the target object resides in. This parameter is optional.
hash	A 16-byte hash value for the object.

Exceptions

An exception is raised if the named object is not found.

Usage Notes

There are two kinds of objects:

- PL/SQL objects, triggers, sequences, types, and Java objects, which are specified by name.
- SQL cursor objects which are specified by a two-part number (indicating a location in the shared pool).

For example:

```
DBMS_SHARED_POOL.KEEP('scott.hispackage')
```

This keeps package `HISPACKAGE`, owned by `SCOTT`. The names for PL/SQL objects follow SQL rules for naming objects (for example, delimited identifiers and multibyte names are allowed). A cursor can be kept by `DBMS_SHARED_POOL.KEEP('0034CFFF, 20348871', 'C')`, `0034CFFF` being the `ADDRESS` and `20348871` the `HASH_VALUE`. Note that the complete hexadecimal address must be in the first 8 characters.

169.3.3 MARKHOT Procedure

This procedure marks a library cache object as a hot object.

Syntax

```
DBMS_SHARED_POOL.MARKHOT (
  schema          VARCHAR2,
  objname         VARCHAR2,
  namespace       NUMBER DEFAULT 1,
  global          BOOLEAN DEFAULT TRUE,
  edition_name    VARCHAR2 DEFAULT NULL);
```

```
DBMS_SHARED_POOL.MARKHOT (
  hash           VARCHAR2,
  namespace       NUMBER DEFAULT 1,
  global          BOOLEAN DEFAULT TRUE);
```

Parameters

Table 169-4 MARKHOT Procedure Parameters

Parameter	Description
schema	User name or the schema to which the object belongs
objname	Name of the object
namespace	Number indicating the library cache namespace in which the object is to be searched. Views, such as <code>USER_OBJECTS</code> and <code>DBA_OBJECTS</code> , reflect the namespace as a number column, as do most dictionary tables such as <code>OBJ\$</code> .
global	If <code>TRUE</code> (default), mark the object hot on all Oracle RAC instances
hash	16-byte hash value for the object

Table 169-4 (Cont.) MARKHOT Procedure Parameters

Parameter	Description
edition_name	Denotes the name of the edition that the target object resides in. This parameter is optional.

Exceptions

ORA-06502: An exception is raised if the named object cannot be found due to incorrect input

ORA-04043: An exception is raised if the named object cannot be found (bad namespace, or hash input)

Usage Notes

If a package or type's specification is marked hot or unhot, then the corresponding package or type body will be implicitly marked as hot or unhot.

Users can examine column, V\$DB_OBJECT_CACHE.PROPERTY, to see whether or not the object has been marked hot. The values for PROPERTY are:

- HOTCOPYnnn- An object that is a hot copy with integer identifier of 'nnn'. For example, HOTCOPY5, HOTCOPY94, and HOTCOPY125.
- HOTCOPY-As above but the identifier is unknown
- HOT-The "root" kgl object that has been marked as hot
- NULL-A normal object

169.3.4 PURGE Procedure

This procedure purges the named object or specified heaps of the object.

Syntax

```
DBMS_SHARED_POOL.PURGE (
    name          VARCHAR2,
    flag          CHAR DEFAULT 'P',
    heaps         NUMBER DEFAULT 1);
```

```
DBMS_SHARED_POOL.PURGE (
    schema        VARCHAR2,
    objname       VARCHAR2,
    namespace     NUMBER,
    heaps         NUMBER,
    edition_name  VARCHAR2 DEFAULT NULL);
```

```
DBMS_SHARED_POOL.PURGE (
    hash          VARCHAR2,
    namespace     NUMBER,
    heaps         NUMBER);
```


Parameters

Table 169-5 PURGE Procedure Parameters

Parameter	Description
name	Name of the object to purge. The value for this identifier is the concatenation of the address and hash_value columns from the v\$sqlarea view. This is displayed by the SIZES procedure. Currently, TABLE and VIEW objects may not be purged.
flag	A character string indicating the kind of object to purge from the shared pool. The string is not case sensitive. This parameter is optional. If the parameter is not specified, the package assumes that the first parameter is the name of a package/procedure/function and will resolve the name. <ul style="list-style-type: none"> Set to 'P' or 'p' to fully specify that the input is the name of a package/procedure/function. Set to 'Q' or 'q' to specify that the input is the name of a sequence. Set to 'R' or 'r' to specify that the input is the name of a trigger. Set to 'T' or 't' to specify that the input is the name of a type. Set to 'JS' or 'js' to specify that the input is the name of a java source. Set to 'JC' or 'jc' to specify that the input is the name of a java class. Set to 'JD' or 'jd' to specify that the input is the name of a java shared data. Set to 'JR' or 'jr' to specify that the input is the name of a java resource. Set to 'C' or 'c' to specify that the input is the name of a cursor.
heaps	Heaps to be purged. For example, if heap 0 and heap 6 are to be purged: 1<<0 1<<6 => hex 0x41 => decimal 65, so specify heaps =>65. Default value is 1, that is, heap 0 which means the whole object would be purged
schema	User name or the schema to which the object belongs
objname	Name of the object to purge
namespace	Parameter is a number indicating the library cache namespace in which the object is to be searched
hash	16-byte hash value for the object
edition_name	The name of the edition that the target object resides in. This parameter is optional.

Exceptions

ORA-6570: An exception is raised if the named object cannot be found

ORA-6570: An object cannot be purged it marked as permanently kept

Usage Notes

All objects supported by the [KEEP Procedure](#) are supported for PURGE.

169.3.5 PURGE_ROW_CACHE Procedure

This procedure purges the row cache as identified by cache id, or a specific object within the selected cache.

Syntax

```
DBMS_SHARED_POOL.PURGE_ROW_CACHE (
    cacheid number, hash varchar2 DEFAULT null);
```

Parameters

Table 169-6 PURGE_ROW_CACHE Procedure Parameters

Parameter	Description
cacheid	Indicates which cache to purge.
hash	The hash value of a targeted object to purge within the named cache. The default value (NULL) purges the entire cache.

169.3.6 SIZES Procedure

This procedure shows objects in the `shared_pool` that are larger than the specified size. The name of the object is also given, which can be used as an argument to either the `KEEP` or `UNKEEP` calls.

Syntax

```
DBMS_SHARED_POOL.SIZES (
    minsize NUMBER);
```

Parameters

Table 169-7 SIZES Procedure Parameters

Parameter	Description
minsize	Size, in kilobytes, over which an object must be occupying in the shared pool, in order for it to be displayed.

Usage Notes

Issue the `SQLDBA` or `SQLPLUS` `'SET SERVEROUTPUT ON SIZE XXXXX'` command prior to using this procedure so that the results are displayed.

169.3.7 UNKEEP Procedure

This procedure unkeeps the named object.

Syntax

```
DBMS_SHARED_POOL.UNKEEP (
    name          VARCHAR2,
    flag          CHAR DEFAULT 'P');
```

```
DBMS_SHARED_POOL.UNKEEP (
  schema      VARCHAR2,
  objname     VARCHAR2,
  namespace   NUMBER,
  edition_name VARCHAR2 DEFAULT NULL);
```

```
DBMS_SHARED_POOL.UNKEEP (
  hash        VARCHAR2,
  namespace   NUMBER);
```

⚠ WARNING:

This procedure may not be supported in the future if automatic mechanisms are implemented to make this unnecessary.

Parameters

Table 169-8 UNKEEP Procedure Parameters

Parameter	Description
name	The name of the object to unkeep.
flag	A character string indicating what kind of object to keep the name identifies. The string is not case sensitive. This parameter is optional. If the parameter is not specified, the package assumes that the first parameter is the name of a package/procedure/function and will resolve the name.
schema	The user name or the schema to which the object belongs to.
objname	The name of the object to unkeep.
namespace	A number that indicates the library cache namespace in which the object has to be searched for.
edition_name	The name of the edition that the target object resides in. This parameter is optional.
hash	A 16-byte hash value for the object.

Exceptions

ORA-06502: An exception is raised if the named object cannot be found

169.3.8 UNMARKHOT Procedure

This procedure unmarks a library cache object as a hot object.

Syntax

```
DBMS_SHARED_POOL.UNMARKHOT (
  schema      VARCHAR2,
  objname     VARCHAR2,
  namespace   NUMBER DEFAULT 1,
  global      BOOLEAN DEFAULT TRUE,
  edition_name VARCHAR2 DEFAULT NULL);
```

```
DBMS_SHARED_POOL.UNMARKHOT (
    hash          VARCHAR2,
    namespace     NUMBER DEFAULT 1,
    global        BOOLEAN DEFAULT TRUE);
```

Parameters

Table 169-9 UNMARKHOT Procedure Parameters

Parameter	Description
schema	User name or the schema to which the object belongs
objname	Name of the object
namespace	Number indicating the library cache namespace in which the object is to be searched
global	If TRUE, unmark the object hot on all Oracle RAC instances. The default value of this parameter is TRUE.
hash	A 16-byte hash value for the object
edition_name	Denotes the name of the edition that the target object resides in. This parameter is optional.

Exceptions

ORA-06502: An exception is raised if the named object cannot be found due to incorrect input

ORA-04043: An exception is raised if the named object cannot be found (bad namespace, or hash input, or non-existent object)

Usage Notes

If a package or type's specification is marked hot or unhot, then the corresponding package or type body will be implicitly marked as hot or unhot.

DBMS_SHARDING_DIRECTORY

This package provides procedures to manage an Oracle Globally Distributed Database sharded database created with directory-based data distribution.

This chapter contains the following topics:

- [DBMS_SHARDING_DIRECTORY Overview](#)
- [DBMS_SHARDING_DIRECTORY Security Model](#)
- [Summary of DBMS_SHARDING_DIRECTORY Subprograms](#)

170.1 DBMS_SHARDING_DIRECTORY Overview

PL/SQL package `DBMS_SHARDING_DIRECTORY` provides support operations on the directory table for sharded databases using the directory-based data distribution method.

This package includes procedures to:

- Add a key to a partition entry
- Remove a key mapping entry
- Flag a key for partition split

The APIs in this package can be invoked on the shard catalog.

The directory table is automatically created during root table creation. The definition of the directory table is `shard user schema.root_table$SDIR`.

When adding and removing keys there are APIs that include commit and those that do not. Unless the commit versions of the APIs are used, the directory content is not propagated to the shards until commit is issued explicitly.



See Also:

Directory-Based Sharding in *Oracle Globally Distributed Database Guide* for a detailed description of sharded database directory-based data distribution.

170.2 DBMS_SHARDING_DIRECTORY Security Model

All `DBMS_SHARDING_DIRECTORY` subprograms require the user to have `EXECUTE` privilege over the `DBMS_SHARDING_DIRECTORY` package.

Only the schema owner of the root table is allowed to execute the procedures in this package, and they can only execute it on the shard catalog.

170.3 DBMS_SHARDING_DIRECTORY Public Constants

There are public constants defined for use with the `DBMS_SHARDING_DIRECTORY.setAssignmentRule` procedure for key-to-partition assignment rules.

All such constants are defined as part of the `DBMS_SHARDING_DIRECTORY` package. Any references to these constants must be prefixed by `DBMS_SHARDING_DIRECTORY.` and followed by the symbols in the following lists

- `NONE` constant number :=0; -- turn off rule-based assignment
- `LAST_PARTITION` constant number := 1; -- rule for assigning key only to the last added partition
- `ROUND_ROBIN` constant number :=2; -- rule for assigning key to partition by round robin
- `RANDOM` constant number :=3; -- rule for assigning key to partition randomly
- `CUSTOM` constant number :=4; -- TBD

170.4 Summary of DBMS_SHARDING_DIRECTORY Subprograms

This table lists and describes the subprograms of the `DBMS_SHARDING_DIRECTORY` package

Table 170-1 DBMS_SHARDING_DIRECTORY Package Subprograms

Subprogram	Description
addKeyToPartition Procedure	This procedure allows you to add a new key to the directory with the specified partition name.
addKeyToPartitionCommit Procedure	This procedure allows you to add a new key to the directory with the specified partition name, and performs a commit at the end.
flagKeyForSplit Procedure	This procedure allows you to mark a key in the directory for split, to be performed later.
removeKey Procedure	This procedure allows you to remove a key from the directory.
removeKeyCommit Procedure	This procedure allows you to remove a key from the directory, and performs a commit at the end.
setAssignmentRule	This procedure allows you to indicate an automatic key-to-partition assignment rule for subsequent new key inserts into the root table.

170.4.1 addKeyToPartition Procedure

This procedure allows you to add a new key to the directory with the specified partition name.

Syntax

```
DBMS_SHARDING_DIRECTORY.addKeyToPartition(
  (schema_name    IN varchar2,
   root_table     IN varchar2,
   partition_name IN  varchar2,
   key ... );
```

Parameters

Table 170-2 addKeyToPartition Procedure Parameters

Parameter	Description
schema_name	Root table schema name.
partition_name	Name of the partition.
root_table	Root table name.
key	Shard key column values.

Usage Notes

Note that the `key` column value needs to be in the same order as specified in the `CREATE TABLE` statement with the correct types. The procedure can only succeed if the provided key does not yet exist in the directory.

170.4.2 addKeyToPartitionCommit Procedure

This procedure allows you to add a new key to the directory with the specified partition name.

Syntax

```
DBMS_SHARDING_DIRECTORY.addKeyToPartitionCommit(
  (schema_name    IN varchar2,
   root_table     IN varchar2,
   partition_name IN  varchar2,
   key ... );
```

Parameters

Table 170-3 addKeyToPartitionCommit Procedure Parameters

Parameter	Description
schema_name	Root table schema name.
partition_name	Name of the partition.
root_table	Root table name.
key	Shard key column values.

Usage Notes

The `addKeyToPartitionCommit` procedure is exactly the same as the `addKeyToPartition` procedure with the same parameters, except that it performs a commit automatically at the end.

Note that the `key` column value needs to be in the same order as specified in the `CREATE TABLE` statement with the correct types. The procedure can only succeed if the provided key does not yet exist in the directory.

170.4.3 flagKeyForSplit Procedure

This procedure allows you to mark a key in the directory for split, to be performed later.

Syntax

```
DBMS_SHARDING_DIRECTORY.flagKeyForSplit(  
    (schema_name    IN varchar2,  
     root_table     IN varchar2,  
     key ... );
```

Parameters

Table 170-4 flagKeyForSplit Procedure Parameters

Parameter	Description
<code>schema_name</code>	Root table schema name.
<code>root_table</code>	Root table name.
<code>key</code>	Shard key column values.

Usage Notes

Note that the `key` column values need to be in the same order as specified in the `CREATE TABLE` statement with the correct types. The procedure can only succeed if the provided key exists in the directory.

A subsequent `ALTER TABLE SPLIT PARTITION` operation will go through all the keys that have been marked for split in the directory and split the corresponding data out into the new partition.

170.4.4 removeKey Procedure

This procedure allows you to remove a key from the directory.

Syntax

```
DBMS_SHARDING_DIRECTORY.removeKey(  
    (schema_name    IN varchar2,  
     root_table     IN varchar2,  
     key ... );
```


Parameters

Table 170-5 removeKey Procedure Parameters

Parameter	Description
schema_name	Root table schema name.
root_table	Root table name.
key	Shard key column values.

Usage Notes

Note that the `key` column values need to be in the same order as specified in the `CREATE TABLE` statement with the correct types. The procedure can only succeed if the provided key exists in the directory, and there are no tables (either root table or child tables) with rows still referencing the key.

170.4.5 removeKeyCommit Procedure

This procedure allows you to remove a key from the directory.

Syntax

```
DBMS_SHARDING_DIRECTORY.removeKeyCommit(
  (schema_name    IN varchar2,
   root_table     IN varchar2,
   key ... );
```

Parameters

Table 170-6 removeKeyCommit Procedure Parameters

Parameter	Description
schema_name	Root table schema name.
root_table	Root table name.
key	Shard key column values.

Usage Notes

The `removeKeyCommit` procedure is exactly the same as the `removeKey` procedure with the same parameters, except that it performs a commit automatically at the end.

Note that the `key` column values need to be in the same order as specified in the `CREATE TABLE` statement with the correct types. The procedure can only succeed if the provided key exists in the directory, and there are no tables (either root table or child tables) with rows still referencing the key.

170.4.6 setAssignmentRule

This procedure allows you to indicate an automatic key-to-partition assignment rule for subsequent new key inserts into the root table.

It will be in effect across different sessions and regardless of system restart until another call to this procedure is made with a different `rule_id` value, or with `NONE`, meaning automatic assignment should be turned off.

Rule ID values are defined in [DBMS_SHARDING_DIRECTORY Public Constants](#).

Syntax

```
DBMS_SHARDING_DIRECTORY.setAssignmentRule(  
    (schema_name    IN varchar2,  
     root_table     IN varchar2,  
     rule_id        IN number);
```

Parameters

Table 170-7 setAssignmentRule Procedure Parameters

Parameter	Description
<code>schema_name</code>	Root table schema name.
<code>root_table</code>	Root table name.
<code>rule_id</code>	Rule ID value, as defined in DBMS_SHARDING_DIRECTORY Public Constants .

DBMS_SODA

The `DBMS_SODA` package is a `PL/SQL` package implementing Simple Oracle Document Access (`SODA`). `SODA` allows you to use the Oracle Database as a NoSQL document store. The core abstraction provided by `SODA` is that of document collections. The `DBMS_SODA` package allows you to create, list, and delete document collections from `PL/SQL`, and to perform CRUD (create, replace, update, delete) operations on documents. All `DDL` functions are encapsulated within this package.

This chapter contains the following topics:

- [DBMS_SODA Security Model](#)
- [Summary of DBMS_SODA Subprograms](#)
- [Summary of SODA Online Redefinition Subprograms](#)

See Also:

- [Oracle Database SODA for PL/SQL Developer's Guide](#)
- [SODA Types](#)

171.1 DBMS_SODA Security Model

This package is available to users with the `SODA_APP` role.

All `SODA` types (packages and types) are `SYS` types. `PUBLIC` is granted `EXECUTE` privilege on the `DBMS_SODA` described in this chapter.

171.2 Summary of DBMS_SODA Subprograms

This table lists the `DBMS_SODA` subprograms in alphabetical order and briefly describes them.

Table 171-1 DBMS_SODA Package Subprograms

Subprogram	Purpose
CREATE_COLLECTION Function	Creates a collection using the collection name and metadata.
DROP_COLLECTION Function	Drops an existing collection from the user's schema. This also removes all the documents in the collection.
GET_AS_OF_SCN Function	This function returns the current database SCN number.

Table 171-1 (Cont.) DBMS_SODA Package Subprograms

Subprogram	Purpose
GET_AS_OF_TIMESTAMP Function	This function returns the current database timestamp value.
GET_DEFAULT_METADATA_AS_CLOB Function	This function returns the default metadata.
GET_DEFAULT_METADATA_AS_VARCHAR2 Function	This function returns the default metadata.
LIST_COLLECTION_NAMES Function	Lists the collection names in the user's schema as a table of NVARCHAR2.
OPEN_COLLECTION Function	Opens an existing collection.

171.2.1 CREATE_COLLECTION Function

Creates a collection using the collection name and metadata. Uses the settings specified in the metadata and auto-assigns the ones that are not, and returns the collection object. If the metadata argument is omitted or set to `NULL`, a collection is created with default metadata. The returned collection is open for `read` and/or `write` operations. If a collection already exists, the function just opens and returns the collection object.

Syntax

```
DBMS_SODA.CREATE_COLLECTION (
    collection_Name      IN NVARCHAR2,
    metadata             IN VARCHAR2 DEFAULT NULL,
    create_Mode         IN PLS_INTEGER DEFAULT CREATE_MODE_DDL)
RETURN SODA_Collection_T;
```

Parameters

Table 171-2 CREATE_COLLECTION Parameters

Parameter	Description
<code>collection_Name</code>	The name of the collection. The value of <code>collection_Name</code> is case-sensitive.
<code>metadata</code>	The metadata of the collection in <code>VARCHAR2</code> format.

Table 171-2 (Cont.) CREATE_COLLECTION Parameters

Parameter	Description
create_Mode	<p>Valid values are:</p> <ul style="list-style-type: none"> DBMS_SODA.CREATE_MODE_DDL (default). First attempts to create a new table for the collection. If table exists already, tries to map that existing table to the collection. Minimal checking is performed to ensure the table shape matches supplied collection metadata (if not, then an error is returned). DBMS_SODA.CREATE_MODE_MAP. Tries to map an existing table to the collection. Minimal checking is performed to ensure the table shape matches supplied collection metadata (if not, then an error is returned).

Return Values

The function returns a `Soda_Collection_T` object representing the collection.

Exceptions

- Descriptor Error—if the input descriptor is invalid
- Error—if an error occurs while creating the collection

**See Also:**

Oracle Database SODA for PL/SQL Developer's Guide

171.2.2 DROP_COLLECTION Function

Drops an existing collection from the user's schema. This also removes all the documents in the collection.

Syntax

```
DBMS_SODA.DROP_COLLECTION (
    collection_Name    IN NVARCHAR2,
    purge              IN BOOLEAN DEFAULT FALSE,
    drop_Mapped_Table IN BOOLEAN DEFAULT FALSE)
RETURN NUMBER;
```

Parameters

Table 171-3 DROP_COLLECTION Parameters

Parameter	Description
collection_Name	The name of the collection. The value of collection_Name is case-sensitive.
purge	The default value is FALSE.
drop_Mapped_Table	The default value is FALSE.

Return values

This function returns the following values:

- 1—if the collection was dropped successfully
- 0—if the collection does not exist

Exceptions

If an error occurs while dropping the collection, for example, due to uncommitted writes to the collection or privilege issues.



See Also:

Oracle Database SODA for PL/SQL Developer's Guide

171.2.3 GET_AS_OF_SCN Function

This function returns the current database SCN number.

Syntax

```
DBMS_SODA.GET_AS_OF_SCN ( )  
RETURN NUMBER;
```

Return values

This function returns the current database SCN number.

171.2.4 GET_AS_OF_TIMESTAMP Function

This function returns the current database timestamp value.

Syntax

```
DBMS_SODA.GET_AS_OF_TIMESTAMP ( )  
RETURN VARCHAR2;
```

Return values

This function returns the current database timestamp value.

171.2.5 GET_DEFAULT_METADATA_AS_CLOB Function

This function returns the default metadata.

Syntax

```
DBMS_SODA.GET_DEFAULT_METADATA_AS_CLOB ( )  
RETURN CLOB;
```

Return Values

This function returns the default metadata using the `CLOB` datatype.

171.2.6 GET_DEFAULT_METADATA_AS_VARCHAR2 Function

This function returns the default metadata.

Syntax

```
DBMS_SODA.GET_DEFAULT_METADATA_AS_VARCHAR2 ( )  
RETURN VARCHAR2;
```

Return Values

This function returns the default metadata using the `VARCHAR2` datatype.

171.2.7 LIST_COLLECTION_NAMES Function

This function returns a list of collection names in the user's schema as a table of `NVARCHAR2`.

Syntax

```
DBMS_SODA.LIST_COLLECTION_NAMES ( )  
RETURN SODA_CollName_List_T;
```

Return Values

This function returns a list of collection names as a table of `NVARCHAR2 (255)`. The collection list is empty if there are no collections in the schema.

Exceptions

`Error`—if an error occurs while listing the collection names.

**See Also:**

Oracle Database SODA for PL/SQL Developer's Guide

171.2.8 OPEN_COLLECTION Function

Opens an existing collection for `read` and/or `write` operations.

Syntax

```
DBMS_SODA.OPEN_COLLECTION (
    collection_Name      IN NVARCHAR2)
RETURN SODA_Collection_T;
```

Parameters

Table 171-4 OPEN_COLLECTION Parameters

Parameter	Description
<code>collection_Name</code>	The name of the collection. The value of <code>collection_Name</code> is case-sensitive.

Return Values

This function returns the following values:

- a collection object which is open
- `NULL`, if the collection does not exist

Exceptions

`Error`—if an error occurs while creating the collection

See Also:

- [Opening an Existing Document Collection with SODA for PL/SQL](#)
- [Checking Whether a Given Collection Exists with SODA for PL/SQL](#)

171.3 Summary of SODA Online Redefinition Subprograms

This table lists the SODA Online Redefinition subprograms in alphabetical order and briefly describes them.

Table 171-5 SODA Online Redefinition Subprograms

Subprogram	Purpose
ABORT_REDEF_COLLECTION Procedure	This procedure reverts the changes made to a collection if there are any errors in <code>CREATE_INTERIM_COLLECTION</code> , <code>START_REDEF_COLLECTION</code> , <code>COPY_COLLECTION_DEPENDENTS</code> , <code>SYNC_INTERIM_COLLECTION</code> , or due to any other reasons.
CAN_REDEF_COLLECTION Procedure	This procedure checks if the data table can be redefined. If the data table cannot be redefined, errors are raised.
COPY_COLLECTION_DEPENDENTS Procedure	This procedure copies all the dependents that are defined on the original table to the interim table. However, if the interim table is JSON type, constraints like <code>IS JSON NOT NULL</code> will not be copied because those are extraneous.
CREATE_INTERIM_COLLECTION Procedure	This procedure creates an interim SODA collection. The <code>interim_metadata</code> specifies the changes the user needs to make. For example, a delta applied as a patch to the original metadata.
FINISH_REDEF_COLLECTION Procedure	This procedure performs the following tasks in one atomic transaction. It introduces a downtime. This can only be called after every dependent required for a SODA data table is present on the interim collection, otherwise an error is raised.
START_REDEF_COLLECTION Procedure	This procedure starts the redefinition process. Copies the existing data from the original table to the interim table and performs the required transformations on the redefined columns.
SYNC_INTERIM_COLLECTION Procedure	This procedure synchronizes the changes to the interim table if the original data table was changed. This procedure can only be called after every dependent required for the SODA data table is present on the interim collection, otherwise, an error is raised.
TO_UUID Function	This function is used to remap the version column of the collection table during Data Pump Import to UUID values. This function is only for use with the <code>REMAP_DATA</code> feature of Data Pump.

171.3.1 ABORT_REDEF_COLLECTION Procedure

This procedure reverts the changes made to a collection if there are any errors in CREATE_INTERIM_COLLECTION, START_REDEF_COLLECTION, COPY_COLLECTION_DEPENDENTS, SYNC_INTERIM_COLLECTION, or due to any other reasons.

Syntax

```
DBMS_SODA.ABORT_REDEF_COLLECTION (
    collection_name      IN  NVARCHAR2,
    interim_collection_name IN NVARCHAR2);
```

Parameters

Table 171-6 ABORT_REDEF_COLLECTION Procedure Parameters

Parameter	Description
collection_name	The name of the collection to be redefined.
interim_collection_name	The name used for the interim collection.

171.3.2 CAN_REDEF_COLLECTION Procedure

This procedure checks if the data table can be redefined. If the data table cannot be redefined, errors are raised.

Syntax

```
DBMS_SODA.CAN_REDEF_COLLECTION (
    collection_name IN NVARCHAR2);
```

Parameters

Table 171-7 CAN_REDEF_COLLECTION Procedure Parameters

Parameter	Description
collection_name	The name of the collection to be redefined.

171.3.3 COPY_COLLECTION_DEPENDENTS Procedure

This procedure copies all the dependents that are defined on the original table to the interim table.

Syntax

```
DBMS_SODA.COPY_COLLECTION_DEPENDENTS (
    collection_name      IN  NVARCHAR,
    interim_collection_name IN NVARCHAR2,
    ignore_error        IN  BOOLEAN DEFAULT NULL,
    num_errors          OUT PLS_INTEGER);
```

Parameters

Table 171-8 COPY_COLLECTION_DEPENDENTS Procedure Parameters

Parameter	Description
<code>collection_name</code>	The name of the collection to be redefined.
<code>interim_collection_name</code>	The name used for the interim collection.
<code>ignore_error</code>	Ignore the errors encountered in the process and proceed.
<code>num_errors</code>	The number of errors encountered in the process.

171.3.4 CREATE_INTERIM_COLLECTION Procedure

This procedure creates an interim SODA collection. The `interim_metadata` specifies the changes the user needs to make. For example, a delta applied as a patch to the original metadata.

Syntax

```
DBMS_SODA.CREATE_INTERIM_COLLECTION (
  collection_name      IN  NVARCHAR2,
  interim_collection_name  IN  NVARCHAR2,
  interim_metadata     IN  VARCHAR2);
```

Parameters

Table 171-9 CREATE_INTERIM_COLLECTION Procedure Parameters

Parameter	Description
<code>collection_name</code>	The name of the collection to be redefined.
<code>interim_collection_name</code>	The name used for the interim collection.
<code>interim_metadata</code>	The metadata snippet specifying the columns that need to be redefined and how they need to be redefined.

Usage Notes

The `interim_metadata` parameter can contain the following fields. An error is raised if other fields are present and if the fields are not the same as those in the metadata for the original collection.

- Set `contentColumn.sqlType` to `JSON` in order to redefine the `CONTENT` column to `JSON` type, automatically generating the `VERSION` column if needed.
- Set `versionColumn.method` to `UUID` to redefine the `VERSION` column to use `UUID`.
- Set `tableName` to specify a name for the data table of this interim collection. If this field is not present, a default data table name will be generated according to the rules of table name defaulting outlined in Default Naming of a Collection Table. However, if the table already exists, the collection is created using the `MAP` mode. In this scenario, make sure that the mapped table does not have any constraints defined.
- The user can combine the above fields in the supplied `interim_metadata` snippet. For example, the most common use case is to both redefine the content column to `JSON` type

and redefine the version column to UUID, which can be achieved by setting the interim_metadata parameter to {"contentColumn" : {"sqlType": "JSON"}, "versionColumn" : {"method": "UUID"}}.

171.3.5 FINISH_REDEF_COLLECTION Procedure

This procedure performs the following tasks in one atomic transaction. It introduces a downtime. This can only be called after every dependent required for a SODA data table is present on the interim collection, otherwise an error is raised.

Syntax

```
DBMS_SODA.FINISH_REDEF_COLLECTION (
  collection_name          IN  NVARCHAR,
  interim_collection_name IN  NVARCHAR2,
  dml_lock_timeout        IN  PLS_INTEGER DEFAULT NULL);
```

Parameters

Table 171-10 FINISH_REDEF_COLLECTION Procedure Parameters

Parameter	Description
collection_name	The name of the collection to be redefined.
interim_collection_name	The name used for the interim collection.
dml_lock_timeout	The wait period in seconds. If the lock is not acquired within this wait period, an error occurs.

Usage Notes

This action cannot be undone. After this procedure is executed, you cannot perform ROLLBACK procedure provided by the DBMS_REDEFINITION package.

Caution:

Before calling FINISH_REDEF_COLLECTION Procedure, the interim collection should be tried out to make sure it can be accessed and is working as expected. In case of any issues, use [ABORT_REDEF_COLLECTION Procedure](#).

It is very important to do this before calling FINISH_REDEF_COLLECTION because the latter cannot be reversed.

171.3.6 START_REDEF_COLLECTION Procedure

This procedure starts the redefinition process. Copies the existing data from the original table to the interim table and performs the required transformations on the redefined columns.

Syntax

```
DBMS_SODA.START_REDEF_COLLECTION (
  collection_name          IN  NVARCHAR,
  interim_collection_name IN  NVARCHAR2,
  copy_vpd_opt            IN  DEFAULT NULL,
  refresh_dep_mviews     IN  DEFAULT NULL);
```

Parameters

Table 171-11 START_REDEF_COLLECTION Procedure Parameters

Parameter	Description
collection_name	The name of the collection to be redefined.
interim_collection_name	The name used for the interim collection.
copy_vpd_opt	Can be either <code>DBMS_REDEFINITION.CONST_VPD_MANUAL</code> or <code>DBMS_REDEFINITION.CONST_VPD_NONE</code> . <code>DBMS_REDEFINITION.CONST_VPD_MANUAL</code> is used to indicate to copy VPD policies manually. <code>DBMS_REDEFINITION.CONST_VPD_NONE</code> is used to indicate that there are no VPD policies on the original table. If NULL, <code>DBMS_REDEFINITION.CONST_VPD_NONE</code> is used.
refresh_dep_mviews	Can be N or Y. When set to N, fast refresh of dependent materialized views is performed when the <code>START_REDEF_TABLE</code> procedure is run, each time the <code>SYNC_INTERIM_TABLE</code> procedure is run, and when the <code>FINISH_REDEF_TABLE</code> procedure is run. If NULL, N is used.

171.3.7 SYNC_INTERIM_COLLECTION Procedure

This procedure synchronizes the changes to the interim table if the original data table was changed. This procedure can only be called after every dependent required for the SODA data table is present on the interim collection, otherwise, an error is raised.

Syntax

```
DBMS_SODA.SYNC_INTERIM_COLLECTION (
  collection_name          IN  NVARCHAR,
  interim_collection_name IN  NVARCHAR2);
```

Parameters

Table 171-12 SYNC_INTERIM_COLLECTION Procedure Parameters

Parameter	Description
collection_name	The name of the collection to be redefined.
interim_collection_name	The name used for the interim collection.

171.3.8 TO_UUID Function

This function is used to remap the version column of the collection table during Data Pump Import to UUID values. This function is only for use with the `REMAP_DATA` feature of Data Pump.

Syntax

```
DBMS_SODA.TO_UUID (  
    placeholder          IN    NVARCHAR2)  
RETURN VARCHAR2;
```

Parameters

Table 171-13 TO_UUID Parameters

Parameter	Description
placeholder	This parameter is not used and can be ignored. It is used due to the syntactic constraints for the Data Pump <code>REMAP_DATA</code> function.

Return values

This function returns a hexadecimal string that can be used as a `UUID` value.



See Also:

`REMAP_DATA` in the *Oracle® Database Utilities Guide*.

DBMS_SPACE

The `DBMS_SPACE` package enables you to analyze segment growth and space requirements.

This chapter contains the following topics:

- [Security Model](#)
- [Data Structures](#)
- [Summary of DBMS_SPACE Subprograms](#)

172.1 DBMS_SPACE Security Model

This package runs with `SYS` privileges. The execution privilege is granted to `PUBLIC`. Subprograms in this package run under the caller security. The user must have `ANALYZE` privilege on the object.

172.2 DBMS_SPACE Data Structures

The `DBMS_SPACE` package defines an `OBJECT` type, a `RECORD` type, and a `TABLE` type.

OBJECT Types

[CREATE_TABLE_COST_COLINFO](#) Object Type

RECORD Types

[ASA_RECO_ROW](#) Record Type

TABLE Types

[ASA_RECO_ROW_TB](#) Table Type

172.2.1 DBMS_SPACE CREATE_TABLE_COST_COLINFO Object Type

This type describes the datatype and size of a column in the table.

Syntax

```
TYPE create_table_cost_colinfo IS OBJECT(  
    col_type    VARCHAR(200),  
    col_size    NUMBER)
```

Attributes

Table 172-1 CREATE_TABLE_COST_COLINFO Object Type

Attribute	Description
col_type	Column type
col_size	Column size

172.2.2 DBMS_SPACE ASA_RECO_ROW Record Type

This type contains the column type of individual columns returned by the ASA_RECOMMENDATIONS Function.

Syntax

```
TYPE asa_reco_row IS RECORD (
  tablespace_name    VARCHAR2(30),
  segment_owner     VARCHAR2(30),
  segment_name      VARCHAR2(30),  segment_type    VARCHAR2(18),
  partition_name    VARCHAR2(30),
  allocated_space   NUMBER,
  used_space        NUMBER,
  reclaimable_space NUMBER,
  chain_rowexcess   NUMBER,
  recommendations   VARCHAR2(1000),
  c1                VARCHAR2(1000),
  c2                VARCHAR2(1000),
  c3                VARCHAR2(1000),
  task_id           NUMBER,
  mesg_id           NUMBER);
```

Attributes

Table 172-2 ASA_RECO_ROW Attributes

Field	Description
tablespace_name	Name of the tablespace containing the object
segment_owner	Name of the schema
segment_name	Name of the object
segment_type	Type of the segment 'TABLE','INDEX' and so on
partition_name	Name of the partition
allocated_space	Space allocated to the segment
used_space	Space actually used by the segment
reclaimable_space	Reclaimable free space in the segment
chain_rowexcess	Percentage of excess chain row pieces that can be eliminated
recommendations	Recommendation or finding for this segment
c1	Command associated with the recommendation
c2	Command associated with the recommendation

Table 172-2 (Cont.) ASA_RECO_ROW Attributes

Field	Description
c3	Command associated with the recommendation
task_id	Advisor Task that processed this segment
mesg_id	Message ID corresponding to the recommendation

Related Topics

- [DBMS_SPACE ASA_RECOMMENDATIONS Function](#)
This function returns recommendations using the stored results of the auto segment advisor. This function returns results from the latest run on any given object.

172.2.3 DBMS_SPACE ASA_RECO_ROW_TB Table Type

The type `asa_reco_row_tb` is a table of `asa_reco_row`.

Syntax

```
TYPE asa_reco_row_tb IS TABLE OF asa_reco_row;
```

172.3 Summary of DBMS_SPACE Subprograms

This table lists the `DBMS_SPACE` subprograms and briefly describes them.

Table 172-3 DBMS_SPACE Package Subprograms

Subprogram	Description
ASA_RECOMMENDATIONS Function	Returns recommendations/findings of segment advisor run automatically by the system or manually invoked by the user
CREATE_INDEX_COST Procedure	Determines the cost of creating an index on an existing table
CREATE_TABLE_COST Procedures	Determines the size of the table given various attributes
FREE_BLOCKS Procedure	Returns information about free blocks in an object (table, index, or cluster)
ISDATAFILEDROPPABLE_NAME Procedure	Checks whether a datafile is droppable
OBJECT_DEPENDENT_SEGMENTS Function	Returns the list of segments that are associated with the object
OBJECT_GROWTH_TREND Function	A table function where each row describes the space usage of the object at a specific point in time
SHRINK_TABLESPACE Procedure	Analyzes a bigfile tablespace before resizing or resizes a bigfile tablespace and optionally returns information about the resize operation
SPACE_USAGE Procedures	Returns information about free blocks in an auto segment space managed segment
UNUSED_SPACE Procedure	Returns information about unused space in an object (table, index, or cluster)

172.3.1 DBMS_SPACE ASA_RECOMMENDATIONS Function

This function returns recommendations using the stored results of the auto segment advisor. This function returns results from the latest run on any given object.

Syntax

```
DBMS_SPACE.ASA_RECOMMENDATIONS (
    all_runs          IN    VARCHAR2 DEFAULT := TRUE,
    show_manual      IN    VARCHAR2 DEFAULT := TRUE,
    show_findings    IN    VARCHAR2 DEFAULT := FALSE)
RETURN ASA_RECO_ROW_TB PIPELINED;
```

Parameters

Table 172-4 ASA_RECOMMENDATIONS Procedure Parameters

Parameter	Description
all_runs	Returns the results of all the auto advisor runs or only the results of the latest run. The valid values are TRUE and FALSE. The default value is TRUE. If TRUE, returns recommendations/findings for all runs of auto segment advisor. If FALSE, returns the results of the LATEST run only. LATEST does not make sense for manual invocation of segment advisor. This is applicable only for auto advisor.
show_manual	This parameter is used to indicate if the results of manual jobs should be included. If TRUE, results of manual tasks are shown. If FALSE, results of manual tasks are not shown. Specifying manual=true does not negate the specification of auto advisor tasks. However, the all_runs settings may override manual. If all_runs is FALSE, implying we only want to see the latest of auto advisor job, then manual may not be specified as TRUE. The valid values are TRUE and FALSE. The default value is TRUE.
show_findings	Shows only the findings instead of the recommendations. The valid values are TRUE and FALSE. The default value is FALSE.

Table 172-5 Parameter Usage

all_runs	show_manual	show_findings	Outcome
TRUE	TRUE	TRUE	All findings from auto advisor and manual tasks.
TRUE	TRUE	FALSE	All recommendations from auto advisor and manual tasks.
TRUE	FALSE	TRUE	All findings from auto advisor tasks.
TRUE	FALSE	FALSE	All recommendations from all auto advisor tasks.

Table 172-5 (Cont.) Parameter Usage

all_runs	show_manual	show_findings	Outcome
FALSE	TRUE	TRUE	N/A
FALSE	TRUE	FALSE	N/A
FALSE	FALSE	TRUE	Findings for the latest auto advisor task.
FALSE	FALSE	FALSE	Recommendations from the latest auto advisor task.

172.3.2 CREATE_INDEX_COST Procedure

This procedure determines the cost of creating an index on an existing table. The input is the DDL statement that will be used to create the index. The procedure will output the storage required to create the index.

Syntax

```
DBMS_SPACE.CREATE_INDEX_COST (
    ddl          IN   VARCHAR2,
    used_bytes   OUT  NUMBER,
    alloc_bytes  OUT  NUMBER,
    plan_table   IN   VARCHAR2 DEFAULT NULL);
```

Pragmas

```
pragma restrict_references (create_index_cost,WNDS);
```

Parameters

Table 172-6 CREATE_INDEX_COST Procedure Parameters

Parameter	Description
ddl	The create index DDL statement
used_bytes	The number of bytes representing the actual index data
alloc_bytes	Size of the index when created in the tablespace
plan_table	Which plan table to use, default NULL

Usage Notes

- The table on which the index is created must already exist.
- The computation of the index size depends on statistics gathered on the segment.
- It is imperative that the table must have been analyzed recently.
- In the absence of correct statistics, the results may be inaccurate, although the procedure will not raise any errors.

172.3.3 CREATE_TABLE_COST Procedures

This procedure is used in capacity planning to determine the size of the table given various attributes. The size of the object can vary widely based on the tablespace storage attributes, tablespace block size, and so on. There are two overloads of this procedure.

- The first version takes the column information of the table as argument and outputs the table size.
- The second version takes the average row size of the table as argument and outputs the table size.

This procedure can be used on tablespace of dictionary managed and locally managed extent management as well as manual and auto segment space management.

Syntax

```
DBMS_SPACE.CREATE_TABLE_COST (
    tablespace_name    IN VARCHAR2,
    avg_row_size       IN NUMBER,
    row_count          IN NUMBER,
    pct_free           IN NUMBER,
    used_bytes         OUT NUMBER,
    alloc_bytes        OUT NUMBER);
```

```
DBMS_SPACE.CREATE_TABLE_COST (
    tablespace_name    IN VARCHAR2,
    colinfos           IN CREATE_TABLE_COST_COLUMNS,
    row_count          IN NUMBER,
    pct_free           IN NUMBER,
    used_bytes         OUT NUMBER,
    alloc_bytes        OUT NUMBER);
```

```
CREATE TYPE create_table_cost_colinfo IS OBJECT (
    COL_TYPE    VARCHAR(200),
    COL_SIZE    NUMBER);
```

Parameters

Table 172-7 CREATE_TABLE_COST Procedure Parameters

Parameter	Description
tablespace_name	The tablespace in which the object will be created. The default is SYSTEM tablespace.
avg_row_size	The anticipated average row size in the table
colinfos	The description of the columns
row_count	The anticipated number of rows in the table
pct_free	The percentage of free space in each block for future expansion of existing rows due to updates
used_bytes	The space used by user data
alloc_bytes	The size of the object taking into account the tablespace extent characteristics

Usage Notes

- The `used_bytes` represent the actual bytes used by the data. This includes the overhead due to the block metadata, `pctfree` etc.
- The `alloc_bytes` represent the size of the table when it is created in the tablespace. This takes into account, the size of the extents in the tablespace and tablespace extent management properties.

Examples

```
-- review the parameters
SELECT argument_name, data_type, type_owner, type_name
FROM all_arguments
WHERE object_name = 'CREATE_TABLE_COST'
AND overload = 2

-- examine the input parameter type
SELECT text
FROM dba_source
WHERE name = 'CREATE_TABLE_COST_COLUMNS';

-- drill down further into the input parameter type
SELECT text
FROM dba_source
WHERE name = 'create_table_cost_colinfo';

set serveroutput on

DECLARE
  ub NUMBER;
  ab NUMBER;
  c1 sys.create_table_cost_columns;
BEGIN
  c1 := sys.create_table_cost_columns( sys.create_table_cost_colinfo('NUMBER',10),
    sys.create_table_cost_colinfo('VARCHAR2',30),
    sys.create_table_cost_colinfo('VARCHAR2',30),
    sys.create_table_cost_colinfo('DATE',NULL));

  DBMS_SPACE.CREATE_TABLE_COST('SYSTEM',c1,100000,0,ub,ab);

  DBMS_OUTPUT.PUT_LINE('Used Bytes: ' || TO_CHAR(ub));
  DBMS_OUTPUT.PUT_LINE('Alloc Bytes: ' || TO_CHAR(ab));
END;
/
```

172.3.4 FREE_BLOCKS Procedure

This procedure returns information about free blocks in an object (table, index, or cluster).

See [SPACE_USAGE Procedures](#) for returning free block information in an auto segment space managed segment.

Syntax

```
DBMS_SPACE.FREE_BLOCKS (
  segment_owner  IN  VARCHAR2,
  segment_name   IN  VARCHAR2,
  segment_type   IN  VARCHAR2,
```

```
freelist_group_id IN NUMBER,
free_blks          OUT NUMBER,
scan_limit        IN NUMBER DEFAULT NULL,
partition_name    IN VARCHAR2 DEFAULT NULL);
```

Pragmas

```
pragma restrict_references(free_blocks,WNDS);
```

Parameters

Table 172-8 FREE_BLOCKS Procedure Parameters

Parameter	Description
segment_owner	Schema name of the segment to be analyzed
segment_name	Segment name of the segment to be analyzed
segment_type	Type of the segment to be analyzed (TABLE, INDEX, or CLUSTER): <ul style="list-style-type: none"> • TABLE • TABLE PARTITION • TABLE SUBPARTITION • INDEX • INDEX PARTITION • INDEX SUBPARTITION • CLUSTER • LOB • LOB PARTITION • LOB SUBPARTITION
freelist_group_id	Freelist group (instance) whose free list size is to be computed
free_blks	Returns count of free blocks for the specified group
scan_limit	Maximum number of free list blocks to read (optional). Use a scan limit of X you are interested only in the question, "Do I have X blocks on the free list?"
partition_name	Partition name of the segment to be analyzed. This is only used for partitioned tables. The name of subpartition should be used when partitioning is composite.

Examples

The following uses the CLUS cluster in SCOTT schema with 4 freelist groups. It returns the number of blocks in freelist group 3 in CLUS.

```
DBMS_SPACE.FREE_BLOCKS('SCOTT', 'CLUS', 'CLUSTER', 3, :free_blocks);
```



Note:

An error is raised if `scan_limit` is not a positive number.

172.3.5 ISDATAFILEDROPPABLE_NAME Procedure

This procedure checks whether a datafile is droppable. This procedure may be called before actually dropping the file.

Syntax

```
DBMS_SPACE.ISDATAFILEDROPPABLE_NAME (
    filename    IN    VARCHAR2,
    value       OUT   NUMBER);
```

Pragmas

```
pragma restrict_references (free_blocks,WNDS);
```

Parameters

Table 172-9 ISDATAFILEDROPPABLE_NAME Procedure Parameters

Parameter	Description
filename	Name of the file
value	Values: 0 if the file is not droppable, 1 if the file is droppable.

Examples

```
DECLARE fname VARCHAR2(100); retval NUMBER;BEGIN SELECT file_name INTO
fname FROM dba_data_files WHERE file_name like
'%empty%';DBMS_SPACE.ISDATAFILEDROPPABLE_NAME(fname,
retval);DBMS_OUTPUT.PUT_LINE(retval);END;/
```

172.3.6 OBJECT_DEPENDENT_SEGMENTS Function

This table function, given an object, returns the list of segments that are associated with the object.

Syntax

```
DBMS_SPACE.OBJECT_DEPENDENT_SEGMENTS (
    objowner    IN    VARCHAR2,
    objname     IN    VARCHAR2,
    partname    IN    VARCHAR2,
    objtype     IN    NUMBER)
RETURN dependent_segments_table PIPELINED;
```

Parameters

Table 172-10 OBJECT_DEPENDENT_SEGMENTS Function Parameters

Parameter	Description
objowner	The schema containing the object
objname	The name of the object
partname	The name of the partition

Table 172-10 (Cont.) OBJECT_DEPENDENT_SEGMENTS Function Parameters

Parameter	Description
objtype	Type of the object: <ul style="list-style-type: none"> • OBJECT_TYPE_TABLE constant positive := 1; • OBJECT_TYPE_NESTED_TABLE constant positive := 2; • OBJECT_TYPE_INDEX constant positive := 3; • OBJECT_TYPE_CLUSTER constant positive := 4; • OBJECT_TYPE_TABLE_PARTITION constant positive := 7; • OBJECT_TYPE_INDEX_PARTITION constant positive := 8; • OBJECT_TYPE_TABLE_SUBPARTITION constant positive := 9; • OBJECT_TYPE_INDEX_SUBPARTITION constant positive := 10; • OBJECT_TYPE_MV constant positive := 13; • OBJECT_TYPE_MVLOG constant positive := 14;

Return Values

The content of one row of a dependent_segments_table:

```
TYPE object_dependent_segment IS RECORD (
  segment_owner    VARCHAR2(100),
  segment_name     VARCHAR2(100),
  segment_type     VARCHAR2(100),
  tablespace_name  VARCHAR2(100),
  partition_name   VARCHAR2(100),
  lob_column_name  VARCHAR2(100));
```

Table 172-11 OBJECT_DEPENDENT_SEGMENT Type Parameters

Parameter	Description
segment_owner	The schema containing the segment
segment_name	The name of the segment
segment_type	The type of the segment, such as table, index or LOB
tablespace_name	The name of the tablespace
partition_name	The name of the partition, if any
lob_column_name	The name of the LOB column, if any

172.3.7 OBJECT_GROWTH_TREND Function

This is a table function. The output is one or more rows where each row describes the space usage of the object at a specific point in time.

Either the space usage totals will be retrieved from Automatic Workload Repository Facilities (AWRF), or the current space usage will be computed and combined with space usage deltas retrieved from AWRF.

Syntax

```
DBMS_SPACE.OBJECT_GROWTH_TREND (
    object_owner      IN   VARCHAR2,
    object_name       IN   VARCHAR2,
    object_type       IN   VARCHAR2,
    partition_name    IN   VARCHAR2 DEFAULT NULL,
    start_time        IN   TIMESTAMP DEFAULT NULL,
    end_time          IN   TIMESTAMP DEFAULT NULL,
    interval          IN   DSINTERVAL_UNCONSTRAINED DEFAULT NULL,
    skip_interpolated IN   VARCHAR2 DEFAULT 'FALSE',
    timeout_seconds   IN   NUMBER DEFAULT NULL,
    single_datapoint_flag IN VARCHAR2 DEFAULT 'TRUE')
RETURN object_growth_trend_table PIPELINED;
```

Parameters

Table 172-12 OBJECT_GROWTH_TREND Function Parameters

Parameter	Description
object_owner	The schema containing the object
object_name	The name of the object
object_type	The type of the object
partition_name	The name of the partition
start_time	Statistics generated after this time will be used in generating the growth trend
end_time	Statistics generated until this time will be used in generating the growth trend
interval	The interval at which to sample
skip_interpolated	Whether interpolation of missing values should be skipped
timeout_seconds	The time-out value for the function in seconds
single_data_point_flag	Whether in the absence of statistics the segment should be sampled

Return Values

The `object_growth_trend_row` and `object_growth_trend_table` are used by the `OBJECT_GROWTH_TREND` table function to describe its output.

```
TYPE object_growth_trend_row IS RECORD(
    timepoint      TIMESTAMP,
    space_usage    NUMBER,
    space_alloc    NUMBER,
    quality        VARCHAR(20));
```

Table 172-13 OBJECT_GROWTH_TREND_ROW Type Parameters

Parameter	Description
timepoint	The time at which the statistic was recorded
space_usage	The space used by data
space_alloc	The size of the segment including overhead and unused space

Table 172-13 (Cont.) OBJECT_GROWTH_TREND_ROW Type Parameters

Parameter	Description
quality	The quality of result: "GOOD", "INTERPOLATED", "PROJECTION"

```
TYPE object_growth_trend_table IS TABLE OF object_growth_trend_row;
```

172.3.8 SHRINK_TABLESPACE Procedure

This procedure can resize a bigfile tablespace or analyze a bigfile tablespace before resizing.

Syntax

```
DBMS_SPACE.SHRINK_TABLESPACE (
    ts_name          IN VARCHAR2,
    shrink_mode      IN NUMBER,
    target_size      IN NUMBER,
    shrink_result    OUT CLOB);
```

```
DBMS_SPACE.SHRINK_TABLESPACE (
    ts_name          IN VARCHAR2,
    shrink_mode      IN NUMBER,
    target_size      IN NUMBER);
```

Parameters

Table 172-14 SHRINK_TABLESPACE Procedure Parameters

Parameter	Description
ts_name	The name of the tablespace to be analyzed or resized
shrink_mode	The shrink mode to execute. The values are: <ul style="list-style-type: none"> • TS_MODE_ANALYZE • TS_MODE_SHRINK • TS_MODE_SHRINK_FORCE The default mode is TS_MODE_SHRINK which moves objects online by default, except for index-organized tables. TS_MODE_SHRINK_FORCE will move objects online by default, but if the online move fails, it will attempt to move them offline.
target_size	The desired tablespace size specified in bytes . The default value is TS_TARGET_MAX_SHRINK.

Table 172-14 (Cont.) SHRINK_TABLESPACE Procedure Parameters

Parameter	Description
shrink_result	<p>Output result of the procedure returned as a CLOB.</p> <p>The output results for TS_MODE_SHRINK include:</p> <ul style="list-style-type: none"> total number and size of moved objects original and new datafile size process time <p>The output results for TS_MODE_ANALYZE include:</p> <ul style="list-style-type: none"> list of movable objects total number and size of movable objects suggested target size process time

Examples

This example analyzes bigfile tablespace TBS_1.

```
set serveroutput on
execute dbms_space.shrink_tablespace('TBS_1', shrink_mode =>
DBMS_SPACE.TS_MODE_ANALYZE);

-----ANALYZE
RESULT-----
1. { BG_TEST.SYS_IL0000081422C00004$$ | type: INDEX | blocks: 256 |
tablespace_name: TBS_1 }
2. { BG_TEST.SYS_IL0000081422C00005$$ | type: INDEX | blocks: 512 |
tablespace_name: TBS_1 }
3. { BG_TEST.T2 | type: TABLE | blocks: 512 | tablespace_name: TBS_1 }
4. { BG_TEST.T2_LOB1 | type: LOBSEGMENT | blocks: 45824 | tablespace_name:
TBS_1}
5. { BG_TEST.T2_LOB2 | type: LOBSEGMENT | blocks: 41216 | tablespace_name:
TBS_1}
Total Movable Objects: 5
Total Movable Size(GB): .67
Original Datafile Size(GB): 10
Suggested Target Size(GB): 2.09
Process Time: +00 00:00:03.94897
```

This example shrinks the bigfile tablespace TBS_1 to its current minimum possible size.

```
set serveroutput on
execute dbms_space.shrink_tablespace('TBS_1');

-----SHRINK RESULT-----
Total Moved Objects: 5
Total Moved Size(GB): 1.35
Original Datafile Size(GB): 10
New Datafile Size(GB): 1.81
Process Time: +00 00:00:50.94897
```

172.3.9 SPACE_USAGE Procedures

This procedure has two variations to show space usage.

The first form of the procedure shows the space usage of data blocks under the segment High Water Mark. You can calculate usage for LOBS, LOB PARTITIONS and LOB SUBPARTITIONS. This procedure can only be used on tablespaces that are created with auto segment space management. The bitmap blocks, segment header, and extent map blocks are not accounted for by this procedure. Note that this overload cannot be used on SECUREFILE LOBS.

Note:

For LOB segments, the number of blocks that is returned from `full_blocks` and `unformatted_blocks` is actually the number of chunks for the LOB segment.

The second form of the procedure returns information about SECUREFILE LOB space usage. It will return the amount of space in blocks being used by all the SECUREFILE LOBS in the LOB segment. The procedure displays the space actively used by the LOB column, freed space that has retention expired, and freed space that has retention unexpired. Note that this overload can be used only on SECUREFILE LOBS.

Syntax

```
DBMS_SPACE.SPACE_USAGE (
    segment_owner          IN  VARCHAR2,
    segment_name           IN  VARCHAR2,
    segment_type           IN  VARCHAR2,
    unformatted_blocks     OUT  NUMBER,
    unformatted_bytes     OUT  NUMBER,
    fs1_blocks             OUT  NUMBER,
    fs1_bytes              OUT  NUMBER,
    fs2_blocks             OUT  NUMBER,
    fs2_bytes              OUT  NUMBER,
    fs3_blocks             OUT  NUMBER,
    fs3_bytes              OUT  NUMBER,
    fs4_blocks             OUT  NUMBER,
    fs4_bytes              OUT  NUMBER,
    full_blocks            OUT  NUMBER,
    full_bytes             OUT  NUMBER,
    partition_name         IN  VARCHAR2 DEFAULT NULL);
```

```
DBMS_SPACE.SPACE_USAGE (
    segment_owner          IN  VARCHAR2,
    segment_name           IN  VARCHAR2,
    segment_type           IN  VARCHAR2,
    segment_size_blocks   OUT  NUMBER,
    segment_size_bytes    OUT  NUMBER,
    used_blocks            OUT  NUMBER,
    used_bytes             OUT  NUMBER,
    expired_blocks        OUT  NUMBER,
    expired_bytes         OUT  NUMBER,
    unexpired_blocks      OUT  NUMBER,
```

```

unexpired_bytes      OUT  NUMBER,
partition_name       IN   VARCHAR2 DEFAULT NULL);

```

Parameters

Table 172-15 SPACE_USAGE Procedure Parameters

Parameter	Description
segment_owner	Schema name of the segment to be analyzed
segment_name	Name of the segment to be analyzed
partition_name	Partition name of the segment to be analyzed
segment_type	Type of the segment to be analyzed (TABLE, INDEX, or CLUSTER): <ul style="list-style-type: none"> • TABLE • TABLE PARTITION • TABLE SUBPARTITION • INDEX • INDEX PARTITION • INDEX SUBPARTITION • CLUSTER • LOB • LOB PARTITION • LOB SUBPARTITION
unformatted_blocks	For LOB segments, the number of blocks that is returned from unformatted_blocks is actually the number of chunks for the LOB segment.
unformatted bytes	Total number of bytes unformatted
fs1_blocks	Number of blocks having at least 0 to 25% free space
fs1_bytes	Number of bytes having at least 0 to 25% free space
fs2_blocks	Number of blocks having at least 25 to 50% free space
fs2_bytes	Number of bytes having at least 25 to 50% free space
fs3_blocks	Number of blocks having at least 50 to 75% free space
fs3_bytes	Number of bytes having at least 50 to 75% free space
fs4_blocks	Number of blocks having at least 75 to 100% free space
fs4_bytes	Number of bytes having at least 75 to 100% free space
full_blocks	The number of blocks that is returned from full_blocks is actually the number of chunks for the LOB segment
full_bytes	Total number of bytes full in the segment
segment_size_blocks	Number of blocks allocated to the segment
segment_size_bytes	Number of bytes allocated to the segment
used_blocks	Number blocks allocated to the LOB that contains active data
used_bytes	Number bytes allocated to the LOB that contains active data
expired_blocks	Number of expired blocks used by the LOB to keep version data
expired_bytes	Number of expired bytes used by the LOB to keep version data
unexpired_blocks	Number of unexpired blocks used by the LOB to keep version data

Table 172-15 (Cont.) SPACE_USAGE Procedure Parameters

Parameter	Description
unexpired_bytes	Number of unexpired bytes used by the LOB to keep version data
partition_name	Name of the partition (NULL if not a partition)

Examples

```

variable unf number;
variable unfb number;
variable fs1 number;
variable fs1b number;
variable fs2 number;
variable fs2b number;
variable fs3 number;
variable fs3b number;
variable fs4 number;
variable fs4b number;
variable full number;
variable fullb number;

begin
dbms_space.space_usage('U1','T',
                      'TABLE',
                      :unf, :unfb,
                      :fs1, :fs1b,
                      :fs2, :fs2b,
                      :fs3, :fs3b,
                      :fs4, :fs4b,
                      :full, :fullb);

end;
/
print unf ;
print unfb ;
print fs4 ;
print fs4b;
print fs3 ;
print fs3b;
print fs2 ;
print fs2b;
print fs1 ;
print fs1b;
print full;
print fullb;

```

172.3.10 UNUSED_SPACE Procedure

This procedure returns information about unused space in an object (table, index, or cluster).

Syntax

```

DBMS_SPACE.UNUSED_SPACE (
    segment_owner          IN VARCHAR2,
    segment_name           IN VARCHAR2,
    segment_type           IN VARCHAR2,
    total_blocks           OUT NUMBER,

```

```

total_bytes          OUT NUMBER,
unused_blocks        OUT NUMBER,
unused_bytes         OUT NUMBER,
last_used_extent_file_id OUT NUMBER,
last_used_extent_block_id OUT NUMBER,
last_used_block      OUT NUMBER,
partition_name       IN  VARCHAR2 DEFAULT NULL);

```

Parameters

Table 172-16 UNUSED_SPACE Procedure Parameters

Parameter	Description
segment_owner	Schema name of the segment to be analyzed
segment_name	Segment name of the segment to be analyzed
segment_type	Type of the segment to be analyzed (TABLE, INDEX, or CLUSTER): <ul style="list-style-type: none"> • TABLE • TABLE PARTITION • TABLE SUBPARTITION • INDEX • INDEX PARTITION • INDEX SUBPARTITION • CLUSTER • LOB • LOB PARTITION • LOB SUBPARTITION
total_blocks	Returns total number of blocks in the segment
total_bytes	Returns total number of blocks in the segment, in bytes
unused_blocks	Returns number of blocks which are not used
unused_bytes	Returns, in bytes, number of blocks which are not used
last_used_extent_file_id	Returns the file ID of the last extent which contains data
last_used_extent_block_id	Returns the starting block ID of the last extent which contains data
last_used_block	Returns the last block within this extent which contains data
partition_name	Partition name of the segment to be analyzed. This is only used for partitioned tables; the name of subpartition should be used when partitioning is compose.

Examples

The following declares the necessary bind variables and executes.

```

DBMS_SPACE.UNUSED_SPACE('SCOTT', 'EMP', 'TABLE', :total_blocks,
:total_bytes, :unused_blocks, :unused_bytes, :lastextf,
:last_extb, :lastusedblock);

```

DBMS_SPACE_ADMIN

The `DBMS_SPACE_ADMIN` package provides functionality for locally managed tablespaces.

This chapter contains the following topics:

- [Security Model](#)
- [Constants](#)
- [Operational Notes](#)
- [Summary of DBMS_SPACE_ADMIN Subprograms](#)



See Also:

Oracle Database Administrator's Guide for an example and description of using `DBMS_SPACE_ADMIN`.

173.1 DBMS_SPACE_ADMIN Security Model

This package runs with `SYS` privileges; therefore, any user who has privilege to execute the package can manipulate the bitmaps.

173.2 DBMS_SPACE_ADMIN Constants

The `DBMS_SPACE_ADMIN` package provides constants that can be used for specifying parameter values.

Table 173-1 DBMS_SPACE_ADMIN Constants

Constant	Type	Value	Description
<code>SEGMENT_VERIFY_EXTENTS</code>	POSITIVE	1	Verifies that the space owned by segment is appropriately reflected in the bitmap as used
<code>SEGMENT_VERIFY_EXTENTS_GLOBAL</code>	POSITIVE	2	Verifies that the space owned by segment is appropriately reflected in the bitmap as used and that no other segment claims any of this space to be used by it
<code>SEGMENT_MARK_CORRUPT</code>	POSITIVE	3	Marks a temporary segment as corrupt whereby facilitating its elimination from the dictionary (without space reclamation)

Table 173-1 (Cont.) DBMS_SPACE_ADMIN Constants

Constant	Type	Value	Description
SEGMENT_MARK_VALID	POSITIVE	4	Marks a corrupt temporary segment as valid. It is useful when the corruption in the segment extent map or elsewhere has been resolved and the segment can be dropped normally.
SEGMENT_DUMP_EXTENT_MAP	POSITIVE	5	Dumps the extent map for a given segment
TABLESPACE_VERIFY_BITMAP	POSITIVE	6	Verifies the bitmap of the tablespace with extent maps of the segments in that tablespace to make sure everything is consistent
TABLESPACE_EXTENT_MAKE_FREE	POSITIVE	7	Marks the block range (extent) as free in the bitmaps
TABLESPACE_EXTENT_MAKE_USED	POSITIVE	8	Marks the block range (extent) as used in the bitmaps
SEGMENT_VERIFY_BASIC	POSITIVE	9	Performs the basic metadata checks
SEGMENT_VERIFY_DEEP	POSITIVE	10	Performs deep verification
SEGMENT_VERIFY_SPECIFIC	POSITIVE	11	Performs a specific check for the segment
HWM_CHECK	POSITIVE	12	Checks high water mark (HWM)
BMB_CHECK	POSITIVE	13	Checks integrity among L1, L2 and L3 BMBs (Bit Map Blocks)
SEG_DICT_CHECK	POSITIVE	14	Checks consistency of segment header with corresponding SEG entry
EXTENT_TS_BITMAP_CHECK	POSITIVE	15	Checks whether the tablespace bitmaps corresponding to the extent map are marked used
DB_BACKPOINTER_CHECK	POSITIVE	16	Checks whether the L1 BMBs, L2 BMBs, L3 BMBs and data blocks point to the same parent segment
EXTENT_SEGMENT_BITMAP_CHECK	POSITIVE	17	Checks whether the bitmap blocks are consistent with the extent map
BITMAPS_CHECK	POSITIVE	18	Checks from the datablocks that the bitmap states representing the blocks are consistent
TS_VERIFY_BITMAPS	POSITIVE	19	Checks whether the tablespace bitmaps are consistent with the extents belonging to that tablespace
TS_VERIFY_DEEP	POSITIVE	20	Performs TS_VERIFY_BITMAPS and TS_VERIFY_SEGMENTS with DEEP option
TS_VERIFY_SEGMENTS	POSITIVE	21	Performs ASSM_SEGMENT_VERIFY on all segments in the tablespace, taking either the BASIC or the DEEP option

Table 173-1 (Cont.) DBMS_SPACE_ADMIN Constants

Constant	Type	Value	Description
SEGMENTS_DUMP_BITMAP_SUMMARY	POSITIVE	27	Dumps only bitmap block summaries

173.3 DBMS_SPACE_ADMIN Operational Notes

Before migrating the `SYSTEM` tablespace, certain conditions must be met. These conditions are enforced by the `TABLESPACE_MIGRATE_TO_LOCAL` procedure, except for the cold backup.

- The database must have a default temporary tablespace that is not `SYSTEM`.
- Dictionary-managed tablespaces cannot have any rollback segments.
- A locally managed tablespace must have at least one online rollback segment. If you are using automatic undo management, then an undo tablespace must be online.
- All tablespaces—except the tablespace containing the rollback segment or the undo tablespace—must be read-only.
- You must have a cold backup of the database.
- The system must be in restricted mode.

173.4 Summary of DBMS_SPACE_ADMIN Subprograms

This table lists the `DBMS_SPACE_ADMIN` subprograms and briefly describes them.

Table 173-2 DBMS_SPACE_ADMIN Package Subprograms

Subprogram	Description
ASSM_SEGMENT_VERIFY Procedure	Verifies segments created in ASSM (Automatic Segment-Space Management) tablespaces
ASSM_TABLESPACE_VERIFY Procedure	Verifies ASSM tablespaces
DROP_EMPTY_SEGMENTS Procedure	Drops segments from empty tables or table fragments and dependent objects
GET_SEGADV_ATTRIB Procedure	returns the values of attributes of <code>DBSM_SPACE_ADMIN</code> package
MATERIALIZE_DEFERRED_SEGMENTS Procedure	Materializes segments for tables and table fragments with deferred segment creation and their dependent objects
SEGMENT_CORRUPT Procedure	Marks the segment corrupt or valid so that appropriate error recovery can be done
SEGMENT_DROP_CORRUPT Procedure	Drops a segment currently marked corrupt (without reclaiming space)
SEGMENT_DUMP Procedure	Dumps the segment header and extent maps of a given segment
SEGMENT_VERIFY Procedure	Verifies the consistency of the extent map of the segment

Table 173-2 (Cont.) DBMS_SPACE_ADMIN Package Subprograms

Subprogram	Description
SET_SEGADV_ATTRIB Procedure	Sets/changes the values of attributes of DBSM_SPACE_ADMIN package
TABLESPACE_FIX_BITMAPS Procedure	Marks the appropriate block range (extent) as free or used in bitmap
TABLESPACE_FIX_SEGMENT_STAT ES Procedure	Fixes the state of the segments in a tablespace in which migration was aborted
TABLESPACE_MIGRATE_FROM_LOCAL Procedure	Migrates a locally managed tablespace to dictionary-managed tablespace
TABLESPACE_MIGRATE_TO_LOCAL Procedure	Migrates a tablespace from dictionary-managed format to locally managed format
TABLESPACE_REBUILD_BITMAPS Procedure	Rebuilds the appropriate bitmaps
TABLESPACE_REBUILD_QUOTAS Procedure	Rebuilds quotas for given tablespace
TABLESPACE_RELOCATE_BITMAPS Procedure	Relocates the bitmaps to the destination specified
TABLESPACE_VERIFY Procedure	Verifies that the bitmaps and extent maps for the segments in the tablespace are synchronized

173.4.1 ASSM_SEGMENT_VERIFY Procedure

Given a segment definition, the procedure verifies the basic consistency of the space metadata blocks as well as consistency between space metadata and segment data blocks. This procedure verifies segments created in Automatic Segment Space Management (ASSM) tablespaces.

There is however a difference between basic verification and deep verification:

- Basic verification involves consistency checks of space metadata, such as integrity among level 1, level 2, level 3 bitmap blocks, consistency of segment extent map and level 1 bitmap ranges.
- Deep verification involves consistency checks between datablocks and space metadata blocks such as whether the datablocks point correctly to the parent level 1 bitmap blocks, and whether the freeness states in the datablocks are consistent with the freeness states of bits in level 1 bitmap blocks corresponding to the datablocks.

Syntax

```
DBMS_SPACE_ADMIN.ASSM_SEGMENT_VERIFY (
  segment_owner  IN VARCHAR2,
  segment_name   IN VARCHAR2,
  segment_type   IN VARCHAR2,
  partition_name IN VARCHAR2,
  verify_option  IN POSITIVE DEFAULT SEGMENT_VERIFY_BASIC,
  attrib         IN POSITIVE DEFAULT NULL);
```

Parameters

Table 173-3 ASSM_SEGMENT_VERIFY Procedure Parameters

Parameter	Description
segment_owner	Schema that owns the segment
segment_name	Name of the segment to be verified
segment_type	Segment namespace is one of TABLE, TABLE PARTITION, TABLE SUBPARTITION, INDEX, INDEX PARTITION, INDEX SUBPARTITION, LOB, LOB PARTITION, LOB SUBPARTITION, CLUSTER
partition_name	Name of the partition or subpartition
verify_option	One of the following options: <ul style="list-style-type: none"> SEGMENT_VERIFY_BASIC := 9. Performs the basic metadata checks (Default) SEGMENT_VERIFY_DEEP := 10. Performs deep verification SEGMENT_VERIFY_SPECIFIC := 11. Performs a specific check for the segment
attrib	When option SEGMENT_VERIFY_SPECIFIC is specified as option, attrib can be one of the following: <ul style="list-style-type: none"> HWM_CHECK := 12. Checks whether high water mark information is accurate BMB_CHECK := 13. Checks whether space bitmap blocks have correct backpointers to the segment header SEG_DICT_CHECK := 14. Checks whether dictionary information for segment is accurate EXTENT_TS_BITMAP_CHECK := 15. Checks whether extent maps are consistent with file level bitmaps DB_BACKPOINTER_CHECK := 16. Checks whether datablocks have correct backpointers to the space metadata blocks EXTENT_SEGMENT_BITMAP_CHECK := 17. Checks whether extent map in the segment matches the bitmaps in the segment BITMAPS_CHECK := 18. Checks whether space bitmap blocks are accurate

Usage Notes

- Using this procedure requires SYSDBA privileges.
- You can determine the relative file # and header block # (header_relative_file and header_block parameters) by querying DBA_SEGMENTS.
- This procedure outputs a dump file named sid_ora_process_ID.trc to the location specified in the USER_DUMP_DEST initialization parameter.

173.4.2 ASSM_TABLESPACE_VERIFY Procedure

This procedure verifies all the segments created in an ASSM tablespace. The verification for each segment performs basic consistency checks of the space metadata blocks as well as consistency checks between space metadata and segment data blocks.

Syntax

```
DBMS_SPACE_ADMIN.ASSM_TABLESPACE_VERIFY (
    tablespace_name  IN VARCHAR2,
    ts_option        IN POSITIVE,
    segment_option   IN POSITIVE DEFAULT NULL);
```

Parameters

Table 173-4 ASSM_TABLESPACE_VERIFY Procedure Parameters

Parameter	Description
tablespace_name	Name of the tablespace to verify. The tablespace must be an ASSM tablespace.
ts_option	<ul style="list-style-type: none"> 19: SecureFiles supports DBMS_SPACE_ADMIN.ASSM_TABLESPACE_VERIFY only when you set the value of TS_OPTION to 19. TS_VERIFY_BITMAPS := 19. The bitmaps are verified against the extents. This detects bits that are marked used or free wrongly and detects multiple allocation of extents. The file metadata is validated against file\$ and control file. TS_VERIFY_DEEP := 20. This option is used to verify the file bitmaps as well perform checks on all the segments. TS_VERIFY_SEGMENTS := 21. This option is used to invoke SEGMENT_VERIFY on all the segments in the tablespace. Optionally you can write a script that queries all the segments in the tablespace and invoke SEGMENT_VERIFY.
segment_option	<p>When TS_VERIFY_SEGMENTS is specified, segment_option can be one of the following:</p> <ul style="list-style-type: none"> SEGMENT_VERIFY_BASIC := 9 SEGMENT_VERIFY_DEEP := 10 <p>The value of segment_option is NULL when TS_VERIFY_DEEP or TS_VERIFY_BITMAPS is specified.</p>

Usage Notes

- Using this procedure requires SYSDBA privileges.
- This procedure outputs a dump file named `sid_ora_process_ID.trc` to the location specified in the `USER_DUMP_DEST` initialization parameter.

173.4.3 DROP_EMPTY_SEGMENTS Procedure

This procedure drops segments from empty tables or table fragments and dependent objects.

Syntax

```
DBMS_SPACE_ADMIN.DROP_EMPTY_SEGMENTS (  
    schema_name      IN      VARCHAR2  DEFAULT NULL,  
    table_name       IN      VARCHAR2  DEFAULT NULL,  
    partition_name   IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 173-5 DROP_EMPTY_SEGMENTS Procedure Parameters

Parameter	Description
schema_name	Name of schema
table_name	Name of table
partition_name	Name of partition

Usage Notes

Given a schema name, this procedure scans all tables in the schema. For each table, if the table or any of its fragments are found to be empty, and the table satisfies certain criteria (restrictions being the same as those described in "Restrictions on Deferred Segment Creation"), then the empty table fragment and associated index segments are dropped along with the corresponding LOB data and index segments. A subsequent insert creates segments with the same properties.

Optionally:

- No `schema_name` is specified, in which case tables belonging to all schemas are scanned
- Both `schema_name` and `table_name` are specified to perform the operation on a specified table
- All three arguments are supplied, restricting the operation to the partition and its dependent objects

173.4.4 GET_SEGADV_ATTRIB Procedure

This procedure returns the values of attributes of `DBMS_SPACE_ADMIN` package.

Syntax

```
DBMS_SPACE_ADMIN.GET_SEGADV_ATTRIB(  
    attribute IN NUMBER,  
    value     OUT NUMBER);
```

Parameters

Table 173-6 GET_SEGADV_ATTRIB Procedure Parameters

Parameter	Description
attribute	Supported attributes: <ul style="list-style-type: none"> COMP_ADVISOR — Provides an option to enable or disable Compression Advisor for Automatic Segment Advisor. By default Compression Advisor is enabled for Automatic Segment Advisor. COMP_LOB — Provides an option to enable or disable Compression Advisor for the tables with LOB columns while Automatic Segment Advisor is running. By default Compression Advisor is enabled for tables with LOB columns.
value	Supported values: <ul style="list-style-type: none"> ATTR_ENABLE : 1 ATTR_DISABLE : 0

173.4.5 MATERIALIZE_DEFERRED_SEGMENTS Procedure

This procedure materializes segments for tables and table fragments with deferred segment creation and their dependent objects.

Syntax

```
DBMS_SPACE_ADMIN.MATERIALIZE_DEFERRED_SEGMENTS (
  schema_name      IN      VARCHAR2  DEFAULT NULL,
  table_name       IN      VARCHAR2  DEFAULT NULL,
  partition_name   IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 173-7 MATERIALIZE_DEFERRED_SEGMENTS Procedure Parameters

Parameter	Description
schema_name	Name of schema
table_name	Name of table
partition_name	Name of partition

Usage Notes

Given a schema name, this procedure scans all tables in the schema. For each table, if the deferred or delayed segment property is set for the table or any of its fragments, then a new segment is created for those fragments and their dependent objects.

Optionally:

- No `schema_name` is specified, in which case tables belonging to all schemas are scanned

- Both `schema_name` and `table_name` are specified to perform the operation on a specified table
- All three arguments are supplied, restricting the operation to the partition and its dependent objects

173.4.6 SEGMENT_CORRUPT Procedure

This procedure marks the segment corrupt or valid so that appropriate error recovery can be performed.

It cannot be used on the `SYSTEM` tablespace.

Syntax

```
DBMS_SPACE_ADMIN.SEGMENT_CORRUPT (
  tablespace_name      IN   VARCHAR2,
  header_relative_file IN   POSITIVE,
  header_block        IN   NUMBER,
  corrupt_option       IN   POSITIVE DEFAULT SEGMENT_MARK_CORRUPT);
```

Parameters

Table 173-8 SEGMENT_CORRUPT Procedure Parameters

Parameter	Description
<code>tablespace_name</code>	Name of tablespace in which segment resides
<code>header_relative_file</code>	Relative file number of segment header
<code>header_block</code>	Block number of segment header
<code>corrupt_option</code>	SEGMENT_MARK_CORRUPT (default) or SEGMENT_MARK_VALID

Usage Notes

You can determine the relative file number and block number (`header_relative_file` and `header_block` parameter) of the segment header block by querying `DBA_SEGMENTS`.

Examples

The following example marks the segment as corrupt:

```
EXECUTE DBMS_SPACE_ADMIN.SEGMENT_CORRUPT('USERS', 4, 33,
DBMS_SPACE_ADMIN.SEGMENT_MARK_CORRUPT);
```

Alternately, the next example marks a corrupt segment valid:

```
EXECUTE DBMS_SPACE_ADMIN.SEGMENT_CORRUPT('USERS', 4, 33,
DBMS_SPACE_ADMIN.SEGMENT_MARK_VALID);
```

173.4.7 SEGMENT_DROP_CORRUPT Procedure

This procedure drops a segment currently marked corrupt (without reclaiming space).

For this to work, the segment must be marked *temporary*. To mark a corrupt segment as temporary, issue a `DROP` command on the segment.

Syntax

```
DBMS_SPACE_ADMIN.SEGMENT_DROP_CORRUPT (
    tablespace_name      IN    VARCHAR2,
    header_relative_file IN    POSITIVE,
    header_block         IN    NUMBER);
```

Parameters

Table 173-9 SEGMENT_DROP_CORRUPT Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace in which segment resides
header_relative_file	Relative file number of segment header
header_block	Block number of segment header

Usage Notes

- The space for the segment is not released, and it must be fixed by using the [TABLESPACE_FIX_BITMAPS Procedure](#) or the [TABLESPACE_REBUILD_BITMAPS Procedure](#).
- The procedure cannot be used on the SYSTEM tablespace.
- You can determine the relative file number and block number (header_relative_file and header_block parameter) of the segment header block by querying DBA_SEGMENTS.

Examples

```
EXECUTE DBMS_SPACE_ADMIN.SEGMENT_DROP_CORRUPT('USERS', 4, 33);
```

173.4.8 SEGMENT_DUMP Procedure

This procedure dumps the segment header and bitmap blocks of a specific segment to the location specified in the USER_DUMP_DEST initialization parameter.

Syntax

```
DBMS_SPACE_ADMIN.SEGMENT_DUMP (
    tablespace_name      IN    VARCHAR2,
    header_relative_file IN    POSITIVE,
    header_block         IN    NUMBER,
    dump_option          IN    POSITIVE DEFAULT SEGMENT_DUMP_EXTENT_MAP);
```

Parameters

Table 173-10 SEGMENT_DUMP Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace in which segment resides
header_relative_file	Relative file number of segment header
header_block	Block number of segment header

Table 173-10 (Cont.) SEGMENT_DUMP Procedure Parameters

Parameter	Description
dump_option	One of the following options: <ul style="list-style-type: none"> SEGMENT_DUMP_EXTENT_MAP SEGMENT_DUMP_BITMAP_SUMMARY

Usage Notes

- You can produce a slightly abbreviated dump, which includes the segment header and bitmap block summaries, without percent-free states of each block if you pass `SEGMENT_DUMP_BITMAP_SUMMARY` as the `dump_option` parameter.
- You can determine the relative file number and block number (`header_relative_file` and `header_block` parameter) of the segment header block by querying `DBA_SEGMENTS.HEADER_FILE`. If `HEADER_FILE` is greater than 1023 then use `DBA_DATA_FILES.RELATIVE_FNO`.

Examples

```
EXECUTE DBMS_SPACE_ADMIN.SEGMENT_DUMP('USERS', 4, 33);
```

173.4.9 SEGMENT_VERIFY Procedure

This procedure checks the consistency of the segment extent map with the tablespace file bitmaps.

Syntax

```
DBMS_SPACE_ADMIN.SEGMENT_VERIFY (
  tablespace_name      IN      VARCHAR2,
  header_relative_file IN      POSITIVE,
  header_block         IN      NUMBER,
  verify_option        IN      POSITIVE DEFAULT SEGMENT_VERIFY_EXTENTS);
```

Parameters**Table 173-11 SEGMENT_VERIFY Procedure Parameters**

Parameters	Description
tablespace_name	Name of tablespace in which segment resides
header_relative_file	Relative file number of segment header
header_block	Block number of segment header
verify_option	What kind of check to do: <code>SEGMENT_VERIFY_EXTENTS</code> or <code>SEGMENT_VERIFY_EXTENTS_GLOBAL</code>

Usage Notes

- Anomalies are output as block range, bitmap-block, bitmap-block-range, anomaly-information, in the trace file for all block ranges found to have incorrect space representation. The kinds of problems which would be reported are free space not

considered free, used space considered free, and the same space considered used by multiple segments.

- You can determine the relative file number and block number (header_relative_file and header_block parameter) of the segment header block by querying DBA_SEGMENTS.

Examples

The following example verifies that the segment with segment header at relative file number 4, block number 33, has its extent maps and bitmaps synchronized.

```
EXECUTE DBMS_SPACE_ADMIN.SEGMENT_VERIFY('USERS', 4, 33,
DBMS_SPACE_ADMIN.SEGMENT_VERIFY_EXTENTS);
```

173.4.10 SET_SEGADV_ATTRIB Procedure

This procedure sets the values of attributes of DBMS_SPACE_ADMIN package.

Syntax

```
DBMS_SPACE_ADMIN.SET_SEGADV_ATTRIB (
    attribute IN NUMBER,
    value     IN NUMBER);
```

Parameters

Table 173-12 SET_SEGADV_ATTRIB Procedure Parameters

Parameter	Description
attribute	Supported attributes: <ul style="list-style-type: none"> • COMP_ADVISOR — Provides an option to enable or disable Compression Advisor for Automatic Segment Advisor. By default Compression Advisor is enabled for Automatic Segment Advisor. • COMP_LOB — Provides an option to enable or disable Compression Advisor for the tables with LOB columns while Automatic Segment Advisor is running. By default Compression Advisor is enabled for tables with LOB columns.
value	Supported values: <ul style="list-style-type: none"> • ATTR_ENABLE : 1 • ATTR_DISABLE : 0

173.4.11 TABLESPACE_FIX_BITMAPS Procedure

This procedure marks the appropriate block range (extent) as free or used in bitmap. It cannot be used on the SYSTEM tablespace.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_FIX_BITMAPS (
    tablespace_name IN VARCHAR2,
    dbarange_relative_file IN POSITIVE,
    dbarange_begin_block IN POSITIVE,
```

```
dbarange_end_block    IN    POSITIVE,
fix_option            IN    POSITIVE);
```

Parameters

Table 173-13 TABLESPACE_FIX_BITMAPS Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace
dbarange_relative_file	Relative file number of block range (extent)
dbarange_begin_block	Block number of beginning of extent
dbarange_end_block	Block number (inclusive) of end of extent
fix_option	One of the following options: <ul style="list-style-type: none"> TABLESPACE_EXTENT_MAKE_FREE TABLESPACE_EXTENT_MAKE_USED

Examples

The following example marks bits for 51 blocks for relative file number 4, beginning at block number 33 and ending at 83, as `USED` in bitmaps.

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_FIX_BITMAPS('USERS', 4, 33, 83,
DBMS_SPACE_ADMIN.EXTENT_MAKE_USED);
```

Alternatively, specifying an option of `TABLESPACE_EXTENT_MAKE_FREE` marks the bits free in bitmaps. The `BEGIN` and `END` blocks must be in extent boundary and be extent multiple; otherwise, an error is raised.

173.4.12 TABLESPACE_FIX_SEGMENT_STATES Procedure

This procedure fixes the state of the segments in a tablespace in which migration was aborted.

During tablespace migration to or from local, the segments are put in a transient state. If migration is aborted, then the segment states are corrected by SMON when event 10906 is set. A database with segments in such a transient state cannot be downgraded. The procedure can be used to fix the state of such segments.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_FIX_SEGMENT_STATES (
    tablespace_name    IN    VARCHAR);
```

Parameters

Table 173-14 TABLESPACE_FIX_SEGMENT_STATES Procedure Parameters

Parameter Name	Description
tablespace_name	Name of the tablespace whose segments must be fixed

Usage Notes

The tablespace must be kept online and read/write when this procedure is called.

Examples

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_FIX_SEGMENT_STATES('TS1')
```

173.4.13 TABLESPACE_MIGRATE_FROM_LOCAL Procedure

This procedure migrates a locally managed tablespace to a dictionary-managed tablespace.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_MIGRATE_FROM_LOCAL (
    tablespace_name      IN      VARCHAR2);
```

Parameter

Table 173-15 TABLESPACE_MIGRATE_FROM_LOCAL Procedure Parameter

Parameter	Description
tablespace_name	Name of tablespace

Usage Notes

The tablespace must be kept online and read/write during migration. Migration of temporary tablespaces and migration of SYSTEM tablespaces are not supported.

Examples

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_MIGRATE_FROM_LOCAL('USERS');
```

173.4.14 TABLESPACE_MIGRATE_TO_LOCAL Procedure

This procedure migrates the tablespace from a dictionary-managed format to a locally managed format. Tablespaces migrated to locally managed format are user managed.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_MIGRATE_TO_LOCAL (
    tablespace_name      IN      VARCHAR2,
    unit_size            IN      POSITIVE DEFAULT NULL,
    rfno                 IN      POSITIVE DEFAULT NULL);
```

Parameters

Table 173-16 TABLESPACE_MIGRATE_TO_LOCAL Procedure Parameters

Parameter Name	Description
tablespace_name	Name of the tablespace to be migrated

Table 173-16 (Cont.) TABLESPACE_MIGRATE_TO_LOCAL Procedure Parameters

Parameter Name	Description
<code>unit_size</code>	Bitmap unit size (which is the size of the smallest possible chunk of space that can be allocated) in the tablespace specified in number of blocks
<code>rfno</code>	Relative File Number of the file where the bitmap blocks are placed

Usage Notes

- Before you migrate the `SYSTEM` tablespace, migrate any dictionary-managed tablespaces that you want to use in read/write mode to locally managed. After the `SYSTEM` tablespace is migrated, you cannot change dictionary-managed tablespaces to read/write.

 **See Also:***Oracle Database Administrator's Guide*

- The tablespace must be kept online and read/write during migration. Note that temporary tablespaces cannot be migrated.
- Allocation Unit may be specified optionally. The default is calculated by the system based on the highest common divisor of all extents (used or free) for the tablespace. This number is further trimmed based on the `MINIMUM EXTENT` for the tablespace (5 if `MINIMUM EXTENT` is not specified). Thus, the calculated value will not be larger than the `MINIMUM EXTENT` for the tablespace. The last free extent in every file is ignored for GCD calculation. If you specify the unit size, then it must be a factor of the `unit_size` calculated by the system; otherwise an error message is returned.
- The Relative File Number parameter is used to place the bitmaps in a desired file. If space is not found in the file, then an error is issued. The data file specified must be part of the tablespace being migrated. If the dataflow is not specified, then the system chooses a dataflow in which to place the initial bitmap blocks. If space is not found for the initial bitmaps, then an error is raised.

Examples

To migrate a tablespace 'TS1' in 2KB blocksize with minimum extent size 1MB:

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_MIGRATE_TO_LOCAL('TS1', 512, 2);
```

The bitmaps are placed in file with relative file number 2.

173.4.15 TABLESPACE_REBUILD_BITMAPS Procedure

This procedure rebuilds the appropriate bitmaps. If no bitmap block is specified, then it rebuilds all bitmaps for the given tablespace.

The procedure cannot be used on the `SYSTEM` tablespace.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_REBUILD_BITMAPS (
    tablespace_name      IN      VARCHAR2,
    bitmap_relative_file IN      POSITIVE  DEFAULT NULL,
    bitmap_block         IN      POSITIVE  DEFAULT NULL);
```

Parameters

Table 173-17 TABLESPACE_REBUILD_BITMAPS Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace
bitmap_relative_file	Relative file number of bitmap block to rebuild
bitmap_block	Block number of bitmap block to rebuild

Usage Notes

Only full rebuild is supported.

Examples

The following example rebuilds bitmaps for all the files in the `USERS` tablespace.

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_REBUILD_BITMAPS('USERS');
```

173.4.16 TABLESPACE_REBUILD_QUOTAS Procedure

This procedure rebuilds quotas for the given tablespace.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_REBUILD_QUOTAS (
    tablespace_name      IN      VARCHAR2);
```

Parameters

Table 173-18 TABLESPACE_REBUILD_QUOTAS Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace

Examples

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_REBUILD_QUOTAS('USERS');
```

173.4.17 TABLESPACE_RELOCATE_BITMAPS Procedure

This procedure relocates the bitmaps to the destination specified.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_RELOCATE_BITMAPS (
    tablespace_name    IN    VARCHAR2,
    filno              IN    POSITIVE,
    blkno              IN    POSITIVE);
```

Parameters

Table 173-19 TABLESPACE_RELOCATE_BITMAPS Procedure Parameters

Parameter Name	Description
tablespace_name	Name of tablespace
filno	Relative File Number of the destination file
blkno	Block Number of the destination range

Usage Notes

- Migration of a tablespace from dictionary-managed to locally managed format could result in the creation of `SPACE HEADER` segment that contains the bitmap blocks. The `SPACE HEADER` segment is treated as user data. If you explicitly resize a file at or below the space header segment, then an error is issued. Use the `TABLESPACE_RELOCATE_BITMAPS` command to move the control information to a different destination and then resize the file.
- This procedure cannot be used on the `SYSTEM` tablespace.
- The tablespace must be kept online and read/write during relocation of bitmaps. This can be done only on migrated locally managed tablespaces.

Examples

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_RELOCATE_BITMAPS('TS1', 3, 4);
```

Moves the bitmaps to file 3, block 4.

Note:

The source and the destination addresses must not overlap. The destination block number is rounded down to the unit boundary. If there is user data in that location, then an error is raised.

173.4.18 TABLESPACE_VERIFY Procedure

This procedure verifies that the bitmaps and extent maps for the segments in the tablespace are synchronized.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_VERIFY (
    tablespace_name      IN    VARCHAR2,
    verify_option        IN    POSITIVE DEFAULT TABLESPACE_VERIFY_BITMAP);
```

Parameters

Table 173-20 TABLESPACE_VERIFY Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace
verify_option	One option is supported: TABLESPACE_VERIFY_BITMAP

Examples

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_VERIFY('USERS');
```

DBMS_SPD

The `DBMS_SPD` package provides subprograms for managing SQL plan directives (SPD).

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Views](#)
- [Summary of DBMS_SPD Subprograms](#)



See Also:

- [DBMS_STATS](#)
- *Oracle Database SQL Tuning Guide* regarding SQL plan directives

174.1 DBMS_SPD Overview

This package provides subprograms for managing SQL plan directives (SPD).

SPD are objects generated automatically by Oracle. For example, if Oracle detects that the single table cardinality estimated made by the optimizer is different from the actual number of rows returned when accessing the table, it will automatically create a directive to perform dynamic statistics for the table. When any SQL statement referencing the table is compiled, the optimizer will perform dynamic statistics for the table to get a more accurate estimate.

174.2 DBMS_SPD Security Model

`DBMS_SPD` is an invoker-rights package. The invoker requires `ADMINISTER SQL MANAGEMENT OBJECT` privilege for executing most of the subprograms in this package. Also, the subprograms commit the current transaction (if any), perform the operation, and then commit it again.

174.3 DBMS_SPD Views

The DBA view `DBA_SQL_PLAN_DIRECTIVES` shows all the directives created in the system and the view `DBA_SQL_PLAN_DIR_OBJECTS` displays the objects that are included in the directives.

174.4 Summary of DBMS_SPD Subprograms

This table lists and briefly describes the `DBMS_SPD` package subprograms.

Table 174-1 DBMS_SPD Package Subprograms

Subprogram	Description
ALTER_SQL_PLAN_DIRECTIVE Procedure	Changes different attributes of a SQL plan directive
CREATE_STGTAB_DIRECTIVE Procedure	Creates a staging table into which to pack (export) SQL plan directives.
DROP_SQL_PLAN_DIRECTIVE Procedure	Drops a SQL plan directive
FLUSH_SQL_PLAN_DIRECTIVE Procedure	Allows for manual flushing of the SQL plan directives that are automatically recorded in SGA memory while executing SQL statements.
GET_PREFS Function	Gets the values for preferences for SQL plan directives
PACK_STGTAB_DIRECTIVE Function	Packs (exports) SQL plan directives into a staging table.
SET_PREFS Procedure	Allows the setting of different preferences for SQL plan directives
UNPACK_STGTAB_DIRECTIVE Function	Unpacks (imports) SQL plan directives from a staging table.

174.4.1 ALTER_SQL_PLAN_DIRECTIVE Procedure

This procedure changes different attributes of a SQL plan directive.

Syntax

```
DBMS_SPD.ALTER_SQL_PLAN_DIRECTIVE (
    directive_id      IN      NUMBER,
    attribute_name    IN      VARCHAR2,
    attribute_value   IN      VARCHAR2);
```

Parameters

Table 174-2 ALTER_SQL_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
directive_id	SQL plan directive ID
attribute_name	<ul style="list-style-type: none"> ENABLED AUTO_DROP
attribute_value	<p>Possible values:</p> <ul style="list-style-type: none"> ENABLED: <ul style="list-style-type: none"> - If YES directive is enabled and may be used - If NO directive is not enabled and will not be used AUTO_DROP: <ul style="list-style-type: none"> - If YES directive will be dropped automatically if not used for SPD_RETENTION_WEEKS. This is the default behavior. - If NO directive will not be dropped automatically

Exceptions

- ORA-38171 `INSUFFICIENT_PRIVILEGE`: The user does not have proper privilege to perform the operation.
- ORA-28104 `INVALID_INPUT`: The input value is not valid.
- ORA-13158 `OBJECT_DOES_NOT_EXIST`: The specified object does not exist.

Usage Notes

The `ADMINISTER SQL MANAGEMENT OBJECT` privilege is required to execute this procedure.

Examples

```
BEGIN
  DBMS_SPD.ALTER_SQL_PLAN_DIRECTIVE (12345, 'STATE', 'PERMANENT');
END;
```

174.4.2 CREATE_STGTAB_DIRECTIVE Procedure

This procedure creates a staging table into which to pack (export) SQL plan directives.

Syntax

```
DBMS_SPD.CREATE_STGTAB_DIRECTIVE (
  table_name          IN VARCHAR2,
  table_owner         IN VARCHAR2 := USER,
  tablespace_name     IN VARCHAR2 := NULL);
```

Parameters

Table 174-3 *CREATE_STGTAB_DIRECTIVE Procedure Parameters*

Parameter	Description
<code>table_name</code>	Name of staging table
<code>table_owner</code>	Name of schema owner of staging table. Default is current schema.
<code>tablespace_name</code>	Name of tablespace. Default <code>NULL</code> means create staging table in the default tablespace:

Exceptions

- ORA-38171 `INSUFFICIENT_PRIVILEGE`: The user does not have proper privilege to perform the operation.
- ORA-28104 `INVALID_INPUT`: The input value is not valid.
- ORA-44001 `INVALID_SCHEMA`: The input schema does not exist.
- ORA-13159 `TABLE_ALREADY_EXISTS`: The specified table already exists.
- ORA-29304 `TABLESPACE_MISSING`: The specified tablespace does not exist.

Usage Notes

The `ADMINISTER SQL MANAGEMENT OBJECT` privilege is required to execute this procedure.

174.4.3 DROP_SQL_PLAN_DIRECTIVE Procedure

This procedure drops a SQL plan directive.

Syntax

```
DBMS_SPD.DROP_SQL_PLAN_DIRECTIVE (  
    directive_id      IN      NUMBER);
```

Parameters

Table 174-4 *DROP_SQL_PLAN_DIRECTIVE Procedure Parameters*

Parameter	Description
directive_id	SQL plan directive ID

Exceptions

- ORA-38171 `INSUFFICIENT_PRIVILEGE`: The user does not have proper privilege to perform the operation.
- ORA-28104 `INVALID_INPUT`: The input value is not valid.
- ORA-13158 `OBJECT_DOES_NOT_EXIST`: The specified object does not exist.

Usage Notes

The `ADMINISTER SQL MANAGEMENT OBJECT` privilege is required to execute this procedure.

Examples

```
BEGIN  
    DBMS_SPD.DROP_SQL_PLAN_DIRECTIVE (12345);  
END;
```

174.4.4 FLUSH_SQL_PLAN_DIRECTIVE Procedure

This procedure allows for manual flushing of the SQL plan directives that are automatically recorded in SGA memory while executing SQL statements.

The information recorded in the SGA is periodically flushed by an Oracle background process. This procedure provides a way to flush the information manually.

Syntax

```
DBMS_SPD.FLUSH_SQL_PLAN_DIRECTIVE;
```

Exceptions

ORA-38171 `INSUFFICIENT_PRIVILEGE`: The user does not have proper privilege to perform the operation.

Usage Notes

The `ADMINISTER SQL MANAGEMENT OBJECT` privilege is required to execute this procedure.

Examples

```
BEGIN
  DBMS_SPD.FLUSH_SQL_PLAN_DIRECTIVE;
END;
```

174.4.5 GET_PREFS Function

This function returns the value for the specified preferences for SQL plan directives.

Syntax

```
DBMS_SPD.GET_PREFS (
  pname      IN  VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 174-5 *GET_PREFS Function Parameters*

Parameter	Description
pname	Preference name. The procedure supports the preference <code>SPD_RETENTION_WEEKS</code> .

Return Values

Preference value

Exceptions

- ORA-38171 `INSUFFICIENT_PRIVILEGE`: The user does not have proper privilege to perform the operation.
- ORA-28104 `INVALID_INPUT`: The input value is not valid.

Usage Notes

- The `ADMINISTER SQL MANAGEMENT OBJECT` privilege is required to execute this procedure.
- `SPD_RETENTION_WEEKS` - SQL plan directives are purged if not used for more than the value set for this preference.

Examples

```
SELECT DBMS_SPD.GET_PREFS('SPD_RETENTION_WEEKS') FROM DUAL;
```

174.4.6 PACK_STGTAB_DIRECTIVE Function

This function packs (exports) SQL plan directives into a staging table.

Syntax

```
DBMS_SPD.PACK_STGTAB_DIRECTIVE (
    table_name      IN VARCHAR2,
    table_owner     IN VARCHAR2 := USER,
    directive_id    IN NUMBER    := NULL,
    obj_list        IN OBJECTTAB := NULL)
RETURN NUMBER
```

Parameters

Table 174-6 *PACK_STGTAB_DIRECTIVE* Function Parameters

Parameter	Description
table_name	Name of staging table
table_owner	Name of schema owner of staging table. Default is current schema.
directive_id	SQL plan directive ID. Default NULL means all directives in the system.
obj_list	Used to filter the directives to be packed based on the objects used in directives. If obj_list is not NULL, a directive is packed only if all the objects in the directive exist in obj_list.

Return Values

Number of SQL plan directives packed.

Exceptions

- ORA-38171 INSUFFICIENT_PRIVILEGE: The user does not have proper privilege to perform the operation.
- ORA-28104 INVALID_INPUT: The input value is not valid.
- ORA-44001 INVALID_SCHEMA: The input schema does not exist.
- ORA-29304 INVALID_STGTAB: The specified staging table is invalid or does not exist.
- ORA-13158 OBJECT_DOES_NOT_EXIST: The specified object does not exist.

Usage Notes

The ADMINISTER SQL MANAGEMENT OBJECT privilege is required to execute this procedure.

Examples

```
-- Pack all directives in the system
SELECT DBMS_SPD.PACK_STGTAB_DIRECTIVE('mydirtab') FROM DUAL;

SET SERVEROUTPUT ON;
```

```

-- Pack directives relevant to objects in SH schema
DECLARE
  my_list  DBMS_SPD.OBJECTTAB := DBMS_SPD.ObjectTab();
  dir_cnt  NUMBER;
BEGIN
  my_list.extend(1);
  my_list(1).owner := 'SH';           -- schema name
  my_list(1).object_name := NULL;     -- all tables in SH
  my_list(1).object_type := 'TABLE';  -- type of object

  dir_cnt :=
    DBMS_SPD.PACK_STGTAB_DIRECTIVE('mydirtab', obj_list => my_list);
  DBMS_OUTPUT.PUT_LINE('dir_cnt = ' || dir_cnt);
END;

-- Pack directives relevant to tables SALES and CUSTOMERS in SH schema
DECLARE
  my_list  DBMS_SPD.OBJECTTAB := DBMS_SPD.ObjectTab();
  dir_cnt  NUMBER;
BEGIN
  my_list.extend(2);

  -- SALES table
  my_list(1).owner := 'SH';
  my_list(1).object_name := 'SALES';
  my_list(1).object_type := 'TABLE';

  -- CUSTOMERS table
  my_list(2).owner := 'SH';
  my_list(2).object_name := 'CUSTOMERS';
  my_list(2).object_type := 'TABLE';

  dir_cnt :=
    DBMS_SPD.PACK_STGTAB_DIRECTIVE('mydirtab', obj_list => my_list);
  DBMS_OUTPUT.PUT_LINE('dir_cnt = ' || dir_cnt);
END;

```

174.4.7 SET_PREFS Procedure

This procedure allows the setting of different preferences for SQL plan directives.

Syntax

```

DBMS_SPD.SET_PREFS (
  pname      IN  VARCHAR2,
  pvalue     IN  VARCHAR2);

```

Parameters

Table 174-7 *SET_PREFS Procedure Parameters*

Parameter	Description
pname	Preference name. The procedure supports the preference SPD_RETENTION_WEEKS.

Table 174-7 (Cont.) SET_PREFS Procedure Parameters

Parameter	Description
pvalue	<p>Preference value.</p> <ul style="list-style-type: none"> SPD_RETENTION_WEEKS: SQL plan directives are purged if not used for more than the value set for this preference. Default is 53 (SPD_RETENTION_WEEKS_DEFAULT) weeks, which means a directive is purged if it has been left unused for little over a year. It can be set to any value greater than or equal to 0. Also value NULL can be passed to set the preference to default.

Exceptions

- ORA-38171 INSUFFICIENT_PRIVILEGE: The user does not have proper privilege to perform the operation.
- ORA-28104 INVALID_INPUT: The input value is not valid.

Usage Notes

- The ADMINISTER SQL MANAGEMENT OBJECT privilege is required to execute this procedure.
- SPD_RETENTION_WEEKS - SQL plan directives are purged if not used for more than the value set for this preference.

Examples

```
BEGIN
  DBMS_SPD.SET_PREFS('SPD_RETENTION_WEEKS', '4');
END;
```

174.4.8 UNPACK_STGTAB_DIRECTIVE Function

This procedure unpacks (imports) SQL plan directives from a staging table.

Syntax

```
DBMS_SPD.UNPACK_STGTAB_DIRECTIVE (
  table_name      IN VARCHAR2,
  table_owner     IN VARCHAR2 := USER,
  directive_id    IN NUMBER    := NULL,
  obj_list        IN OBJECTTAB := NULL)
RETURN NUMBER
```

Parameters

Table 174-8 UNPACK_STGTAB_DIRECTIVE Function Parameters

Parameter	Description
table_name	Name of staging table
table_owner	Name of schema owner of staging table. Default is current schema.

Table 174-8 (Cont.) UNPACK_STGTAB_DIRECTIVE Function Parameters

Parameter	Description
directive_id	SQL plan directive ID. Default NULL means all directives in the system.
obj_list	Used to filter the directives to be unpacked based on the objects used in directives. If obj_list is not NULL, a directive is unpacked only if all the objects in the directive exist in obj_list.

Return Values

Number of SQL plan directives unpacked.

Exceptions

- ORA-38171 INSUFFICIENT_PRIVILEGE: The user does not have proper privilege to perform the operation.
- ORA-28104 INVALID_INPUT: The input value is not valid.
- ORA-44001 INVALID_SCHEMA: The input schema does not exist.
- ORA-29304 INVALID_STGTAB: The specified staging table is invalid or does not exist.
- ORA-13158 OBJECT_DOES_NOT_EXIST: The specified object does not exist.

Usage Notes

The ADMINISTER SQL MANAGEMENT OBJECT privilege is required to execute this procedure.

Examples

```
-- Unack all directives in the staging table
SELECT DBMS_SPD.UNPACK_STGTAB_DIRECTIVE('mydirtab') FROM DUAL;

SET SERVEROUTPUT ON;
-- Unpack directives relevant to objects in SH schema
DECLARE
  my_list DBMS_SPD.OBJECTTAB := DBMS_SPD.ObjectTab();
  dir_cnt number;
BEGIN
  my_list.extend(1);
  my_list(1).owner := 'SH';           -- schema name
  my_list(1).object_name := null;     -- all tables in SH
  my_list(1).object_type := 'TABLE';  -- type of object

  dir_cnt :=
    DBMS_SPD.UNPACK_STGTAB_DIRECTIVE('mydirtab', obj_list => my_list);
  DBMS_OUTPUT.PUT_LINE('dir_cnt = ' || dir_cnt);
END;

-- Unpack directives relevant to tables SALES and CUSTOMERS in SH schema
DECLARE
  my_list DBMS_SPD.OBJECTTAB := DBMS_SPD.ObjectTab();
  dir_cnt NUMBER;
begin
  my_list.extend(2);
```

```
-- SALES table
my_list(1).owner := 'SH';
my_list(1).object_name := 'SALES';
my_list(1).object_type := 'TABLE';

-- CUSTOMERS table
my_list(2).owner := 'SH';
my_list(2).object_name := 'CUSTOMERS';
my_list(2).object_type := 'TABLE';

dir_cnt :=
  DBMS_SPD.UNPACK_STGTAB_DIRECTIVE('mydirtab', obj_list => my_list);
  DBMS_OUTPUT.PUT_LINE('dir_cnt = ' || dir_cnt);
END;
```

DBMS_SPM

The `DBMS_SPM` package supports the SQL plan management feature by providing an interface for the DBA or other user to perform controlled manipulation of plan history and SQL plan baselines maintained for various SQL statements.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Examples](#)
- [Data Structures](#)
- [Summary of DBMS_SPM Subprograms](#)



See Also:

For more information about "Using SQL Plan Management" in the *Oracle Database SQL Tuning Guide*

175.1 DBMS_SPM Overview

The `DBMS_SPM` package allows the user to manage SQL execution plans using SQL plan management.

SQL plan management prevents performance regressions resulting from sudden changes to the execution plan of a SQL statement by recording and evaluating the execution plans of SQL statements over time, and builds SQL plan baselines composed of a set of existing plans known to be efficient. The SQL plan baselines are then used to preserve performance of corresponding SQL statements, regardless of changes occurring in the system. Common usage scenarios where SQL plan management can improve or preserve SQL performance include:

- A database upgrade that installs a new optimizer version usually results in plan changes for a small percentage of SQL statements, with most of the plan changes resulting in either no performance change or improvement. However, certain plan changes may cause performance regressions. The use of SQL plan baselines significantly minimizes potential performance regressions resulting from a database upgrade.
- Ongoing system and data changes can impact plans for some SQL statements, potentially causing performance regressions. The use of SQL plan baselines helps to minimize performance regressions and stabilize SQL performance.
- Deployment of new application modules means introducing new SQL statements into the system. The application software may use appropriate SQL execution plans developed under a standard test configuration for the new SQL statements. If the system production

configuration differs significantly from the test configuration, SQL plan baselines can be evolved over time to produce better performance.

175.2 DBMS_SPM Security Model

The package is owned by `SYS`. The `EXECUTE` package privilege is required to execute its procedures. Any user granted the `ADMINISTER SQL MANAGEMENT OBJECT` privilege is able to execute the `DBMS_SPM` package.

175.3 DBMS_SPM Constants

The `DBMS_SPM` package provides constants that can be used for specifying parameter values.

These are shown in the following table. These constants are defined as standard input for the `time_limit` parameter of the `EVOLVE_SQL_PLAN_BASELINE` Function.

Table 175-1 DBMS_SPM Constants

Constant	Type	Value	Description
<code>AUTO_LIMIT</code>	<code>INTEGER</code>	<code>2147483647</code>	Oracle determines the appropriate time spent by the <code>EVOLVE_SQL_PLAN_BASELINE</code> Function.
<code>NO_LIMIT</code>	<code>INTEGER</code>	<code>2147483647 -1</code>	There is no limit to the time spent by the <code>EVOLVE_SQL_PLAN_BASELINE</code> Function.

175.4 DBMS_SPM Examples

These examples will help you understand use of `DBMS_SPM`.

Detailed examples are located under the following topics:

- [Migrating Stored Outlines to SQL Plan Baselines](#)
- [Migrating Outlines to Utilize SQL Plan Management Features](#)
- [Migrating Outlines to Preserve Stored Outline Behavior](#)
- [Performing Follow-Up Tasks After Stored Outline Migration](#)

175.5 DBMS_SPM Data Structures

The `DBMS_SPM` package defines a `TABLE` type.

Table Types

- [DBMS_SPM NAMELIST Table Type](#)

175.5.1 DBMS_SPM NAMELIST Table Type

This type allows for a list of names as an input parameter.

Syntax

```
TYPE name_list IS TABLE OF VARCHAR2(30);
```

175.6 Summary of DBMS_SPM Subprograms

This table lists and briefly describes the DBMS_SPM package subprograms.

Table 175-2 DBMS_SPM Package Subprograms

Subprogram	Description
ACCEPT_SQL_PLAN_BASELINE Procedure	Accepts a plan based on the recommendation of an evolve task
ADD_VERIFIED_SQL_PLAN_BASELINE Function	Finds the plans available for the given SQL_ID in different sources such as Cursor Cache, Auto SQL Tuning Set, and Automatic Workload Repository.
ALTER_SQL_PLAN_BASELINE Function	Changes an attribute of a single plan or all plans associated with a SQL statement using the attribute name/value format
CANCEL_EVOLVE_TASK Procedure	Cancel a currently executing evolve task
CONFIGURE Procedure	Sets configuration options for SQL management base, in parameter/value format
CREATE_EVOLVE_TASK Function	Creates an advisor task and sets its parameters
CREATE_STGTAB_BASELINE Procedure	Creates a staging table that used for transporting SQL plan baselines from one system to another
DROP_EVOLVE_TASK Procedure	Drops an evolved task
DROP_SQL_PLAN_BASELINE Function	Drops a single plan, or all plans associated with a SQL statement
EVOLVE_SQL_PLAN_BASELINE Function	Evolve SQL plan baselines associated with one or more SQL statements
EXECUTE_EVOLVE_TASK Function	Executes a previously created evolve task
IMPLEMENT_EVOLVE_TASK Function	Implements a plan based on the recommendation of an evolve task
INTERRUPT_EVOLVE_TASK Procedure	Interrupts a currently executing evolve task
LOAD_PLANS_FROM_CURSOR_CACHE Functions	Loads one or more plans present in the cursor cache for a SQL statement
LOAD_PLANS_FROM_AWR Function	Loads the SQL Management Base (SMB) with SQL plan baselines for a set of SQL statements using the plans from the AWR, and returns the number of plans loaded
LOAD_PLANS_FROM_SQLSET Function	Loads plans stored in a SQL tuning set (STS) into SQL plan baselines

Table 175-2 (Cont.) DBMS_SPM Package Subprograms

Subprogram	Description
MIGRATE_STORED_OUTLINE Functions	Migrates existing stored outlines to SQL plan baselines
PACK_STGTAB_BASELINE Function	Packs (exports) SQL plan baselines from SQL management base into a staging table
RESET_EVOLVE_TASK Procedure	Resets an evolve task to its initial state
RESUME_EVOLVE_TASK Procedure	Resumes a previously interrupted task
REPORT_AUTO_EVOLVE_TASK Function	Displays the results of an execution of an automatic evolve task.
REPORT_EVOLVE_TASK Function	Displays the results of an evolved task
SET_EVOLVE_TASK_PARAMETER Procedure	Sets a parameter of an evolve task
UNPACK_STGTAB_BASELINE Function	Unpacks (imports) SQL plan baselines from a staging table into SQL management base

175.6.1 ACCEPT_SQL_PLAN_BASELINE Procedure

The procedure accepts a plan based on the recommendation of an evolve task.

Syntax

```
DBMS_SPM.ACCEPT_SQL_PLAN_BASELINE (
  task_name      IN  VARCHAR2,
  object_id      IN  NUMBER      := NULL,
  task_owner     IN  VARCHAR2    := NULL,
  force          IN  BOOLEAN     := FALSE);
```

Parameters

Table 175-3 ACCEPT_SQL_PLAN_BASELINE Procedure Parameters

Parameter	Description
task_name	Identifier of task to implement
object_id	Identifier of the advisor framework object that represents a single plan. If NULL, the report is generated for all objects.
task_owner	Owner of the evolve task. Defaults to the current schema owner.
force	Accept the plan even if the advisor did not recommend such an action. The default is FALSE requiring acceptance of the plan only if the plan is verified and shows sufficient improvement in benefit.

175.6.2 ADD_VERIFIED_SQL_PLAN_BASELINE Function

This function finds the plans available for the given SQL_ID in different sources such as Cursor Cache, Auto SQL Tuning Set, and Automatic Workload Repository.

Syntax

```
DBMS_SPM.ADD_VERIFIED_SQL_PLAN_BASELINE (
    sql_id IN VARCHAR2
);
```

Parameters

Table 175-4 ADD_VERIFIED_SQL_PLAN_BASELINE Function Parameters

Parameter	Description
sql_id	The SQL statement identifier, which is used to identify the plans in different sources, such as the cursor cache.

Return Value

A CLOB containing a report of SQL plan baselines verified, reproduced and accepted.

Usage Notes

SQL plan baselines are created to ensure that the best-known plans are used for the selected SQL statement. These are the steps that the function executes:

1. Loads plans from Cursor Cache, Automatic Workload Repository, and Auto SQL Tuning Set (SYS_AUTO_STG) into SQL Plan Management SQL plan history in a non-accepted state.
2. Uses the SQL Plan Management Evolve Advisor internally to identify the best-performing execution plans. The best-performing plans are accepted.

When the function has completed, it will have accepted the best plans among the plans available from the Cursor Cache, AWR, and the Automatic SQL Tuning Set.



Note:

"Administer SQL Management Object" privilege. is required.

Examples

Example 1:36k32wnz0v0fd923079310

```
select sql_id, plan_hash_value, sql_text
from   v$sql
where  sql_text like 'select /* SPM_TEST_QUERY%'
/
```

```
SQL_ID          PLAN_HASH_VALUE  SQL_TEXT
```



```
-----
-----
36k32wnz0v0fd  923079310      select /* SPM_TEST_QUERY */ num from
example_spm_table where id = 100
```

Example 2:9230793102448381833

```
select sql_text, sqlset_name, plan_hash_value
from   dba_sqlset_statements
where  sql_text like 'select /* SPM_TEST_QUERY%';
```

```
SQL_TEXT
SQLSET_NAME  PLAN_HASH_VALUE
-----
```

```
-----
select /* SPM_TEST_QUERY */ num from example_spm_table where id =
100   SYS_AUTO_STS   923079310
select /* SPM_TEST_QUERY */ num from example_spm_table where id =
100   SYS_AUTO_STS   2448381833
```

Example 3:

```
set tab off
set serveroutput on
set pagesize 100
set linesize 250
set long 100000
column report format a200

var rep clob;

BEGIN
  :rep := DBMS_SPM.ADD_VERIFIED_SQL_PLAN_BASELINE('36k32wnz0v0fd');
END;
/
```

```
select :rep report from dual;
```

```
SQL Plan Baselines verified for SQL ID: 36k32wnz0v0fd
```

```
-----
-----
Plan Hash Value  Plan Name                                Reproduced
Accepted  Source
-----  -----  -----
-----  -----
923079310        SQL_PLAN_163tr5qgzwmgt05ce4c2e         YES
YES            CURSOR CACHE
2448381833       SQL_PLAN_163tr5qgzwmgt1f191f3e         YES
NO            SQL TUNING SET
-----
-----
```

```
SQL Handle      : SQL_130f372d9ffe4df9
```

```
SQL Text      : select /* SPM_TEST_QUERY */ num from example_spm_table where
id = 100
-----
-----
```

Example 4:

```
select sql_text, accepted, enabled, sql_handle, plan_name
from dba_sql_plan_baselines
where sql_text like 'select /* SPM_TEST_QUERY%';
```

```
SQL_TEXT                                     ACC
ENA SQL_HANDLE          PLAN_NAME
-----
select /* SPM_TEST_QUERY */ num from example_spm_table where id = 100 YES
YES SQL_130f372d9ffe4df9 SQL_PLAN_163tr5qgzwmgt05ce4c2e
select /* SPM_TEST_QUERY */ num from example_spm_table where id = 100 NO
YES SQL_130f372d9ffe4df9 SQL_PLAN_163tr5qgzwmgt1f191f3e
```

Example 5

```
select * from
table(dbms_xplan.display_sql_plan_baseline('SQL_130f372d9ffe4df9'));
```

```
-----
---
SQL handle: SQL_130f372d9ffe4df9
SQL text: select /* SPM_TEST_QUERY */ num from example_spm_table where id =
100
-----
---
```

```
-----
---
Plan name: SQL_PLAN_163tr5qgzwmgt05ce4c2e      Plan id: 923079310
Enabled: YES      Fixed: NO      Accepted: YES      Origin: EVOLVE-LOAD-FROM-
CURSOR-CACHE
Plan rows: From Auto SQL Tuning Set
-----
---
```

```
Plan hash value: 923079310
-----
-----
```

Id	Operation	Name	Rows	Bytes
0	SELECT STATEMENT			
2 (100)				
1	TABLE ACCESS BY INDEX ROWID	EXAMPLE_SPM_TABLE	1	8

```
|      2      (0)| 00:00:01 |
|* 2 | INDEX UNIQUE SCAN | SPM_TAB_PK | 1
|      |      1      (0)| 00:00:01 |
-----
-----
```

Predicate Information (identified by operation id):

```
2 - access("ID"=100)
```

```
-----
Plan name: SQL_PLAN_163tr5qgzwmgt1f191f3e      Plan id: 2448381833
Enabled: YES      Fixed: NO      Accepted: NO      Origin: EVOLVE-LOAD-
FROM-STS
Plan rows: From Auto SQL Tuning Set
-----
-----
```

Plan hash value: 2448381833

```
-----
| Id | Operation          | Name                | Rows | Bytes | Cost
(%CPU)| Time              |                    |      |      |
-----
|  0 | SELECT STATEMENT   |                    |      |      |  3
(100)|                    |                    |      |      |
|*  1 | TABLE ACCESS FULL| EXAMPLE_SPM_TABLE  |    1 |    8 |
3      (0)| 00:00:01 |
-----
-----
```

Predicate Information (identified by operation id):

```
1 - filter("ID"=100)
```

175.6.3 ALTER_SQL_PLAN_BASELINE Function

This function changes an attribute of a single plan or all plans associated with a SQL statement using the attribute name/value format.

Syntax

```
DBMS_SPM.ALTER_SQL_PLAN_BASELINE (
    sql_handle      IN VARCHAR2 := NULL,
    plan_name       IN VARCHAR2 := NULL,
    attribute_name  IN VARCHAR2,
    attribute_value IN VARCHAR2)
RETURN PLS_INTEGER;
```

Parameters

Table 175-5 ALTER_SQL_PLAN_BASELINE Function Parameters

Parameter	Description
sql_handle	SQL statement handle. It identifies plans associated with a SQL statement for an attribute change. If NULL then plan_name must be specified.
plan_name	Name of a specific plan. Default NULL means set the attribute for all plans associated with a SQL statement identified by sql_handle. If NULL then sql_handle must be specified.
attribute_name	Name of the plan attribute to set (see table below).
attribute_value	Value of the plan attribute to use (see table below)

Table 175-6 Names & Values for ALTER_SQL_PLAN_BASELINE Function Parameters

Name	Description	Possible Values
enabled	'YES' means the plan is available for use by the optimizer. It may or may not be used, depending on accepted status.	'YES' or 'NO'
fixed	'YES' means the SQL plan baseline is not evolved over time. A fixed plan takes precedence over a non-fixed plan.	'YES' or 'NO'
autopurge	'YES' means the plan is purged if it is not used for a time period. 'NO' means it is never purged.	'YES' or 'NO'
plan_name	Name of the plan	String of up to 30 characters
description	Plan description.	String of up to 500 bytes

Return Values

The number of plans altered.

Usage Notes

When a single plan is specified, one of the various statuses, or plan name, or description can be altered. When all plans for a SQL statement are specified, one of various statuses, or description can be altered. This function can be called numerous times, each time setting a different plan attribute of same plan(s) or different plan(s).

175.6.4 CANCEL_EVOLVE_TASK Procedure

The procedure cancels a currently executing evolve task. All intermediate results are removed from the task.

Syntax

```
DBMS_SPM.CANCEL_EVOLVE_TASK (
    task_name          IN VARCHAR2);
```

Parameters

Table 175-7 CANCEL_EVOLVE_TASK Procedure Parameters

Parameter	Description
task_name	Identifier of task to cancel

175.6.5 CONFIGURE Procedure

This procedure sets configuration options for the SQL management base and for the maintenance of SQL plan baselines. You can call this function multiple times, setting a different configuration option each time.

Syntax

```
DBMS_SPM.CONFIGURE (
    parameter_name    IN VARCHAR2,
    parameter_value   IN VARCHAR2 := NULL,
    allow             IN BOOLEAN := TRUE);
```

Parameters

Table 175-8 CONFIGURE Procedure Parameters

Parameter	Description
parameter_name	Name of parameter to set (see table below).
parameter_value	Value of parameter to use (see table below). The maximum length of parameter_value is 1000 characters.
allow	Whether to include (<i>true</i>) or exclude (<i>false</i>) matching SQL statements and plans for the <i>auto_capture_*</i> parameters. If null, then the procedure ignores the specified parameter.

Table 175-9 Names and Values for CONFIGURE Procedure Parameters

Parameter Name	Description	Possible Values
auto_capture_action	Action to include (=) or exclude (<>) for SQL plan management automatic capture, depending on whether allow is TRUE or FALSE. A null value removes the filter for parameter_name entirely.	Action name, for example, R%
auto_capture_module	Module to include (=) or exclude (<>) for SQL plan management auto capture, depending on whether allow is TRUE or FALSE. A null value removes the filter for parameter_name entirely. The database only uses this filter when OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES is TRUE.	Module name, for example, LOGGER
auto_capture_parsing_schema_name	Parsing schema to include (=) or exclude (<>) for SQL plan management auto capture, depending on whether allow is TRUE or FALSE. A null value removes the filter for parameter_name entirely. The database only uses this filter when OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES is TRUE.	Schema name, for example, HR
auto_capture_sql_text	Search pattern to apply to SQL text of LIKE or NOT LIKE, depending on whether allow is TRUE or FALSE. A null value removes the filter for parameter_name entirely. The database only uses this filter when OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES is TRUE.	Text of a SQL statement, for example, SELECT a%
auto_spm_evolve_task	Setting to enable or disable the high-frequency SPM Evolve Advisor task. The high-frequency task runs every hour and runs for no longer than 30 minutes. These settings are not configurable. The frequent executions mean that the optimizer has more opportunities to find and evolve better performing plans. The default value is OFF, which means the high-frequency SPM Evolve Advisor task is disabled. The value AUTO enables Real-time SQL plan management.. The value ON enables the high-frequency SPM Evolve Advisor task. This implements a feature called Background-Verified automatic SQL plan management The value ALLOW is ignored. Note: See About Automatic SQL Plan Management in the Oracle Database SQL Tuning Guide, which discusses the high frequency SPM Evolve task and explains the difference between real-time and background-verified Automatic SQL Plan Management.	ON, OFF, AUTO

Table 175-9 (Cont.) Names and Values for CONFIGURE Procedure Parameters

Parameter Name	Description	Possible Values
<code>plan_retention_weeks</code>	Number of weeks to retain unused plans before the database purges them. A null value resets to the default value of 53 weeks, or 1 year plus 1 week. (This retains plans for annually executing queries.) The value of <code>allow</code> is ignored.	5–523 (default is 53)
<code>space_budget_percent</code>	Maximum percent of <code>SYSAUX</code> space that can be used for SQL management base. The database issues alerts when this amount is exceeded. A null value resets the percentage to the default value of 10%. The value of <code>allow</code> is ignored.	1–50 (default is 10)

Exceptions

Table 175-10 CONFIGURE Exceptions

Error Number	Description
ORA-38133	Invalid parameter name
ORA-38134	Invalid parameter value
ORA-38150	Not enough space for new filter
ORA-38151	Module name too long
ORA-38152	Action name too long
ORA-38304	Missing or invalid user name

Usage Notes

- When `parameter_name` is `auto_capture_sql_text`, the `parameter_value` is an automatic search filter. The filter uses the search pattern of `LIKE parameter_name` when `allow=>>true`. The filter uses the pattern `NOT LIKE parameter_name` when `allow=>>false`.

For all other non-null `parameter_name` values, the search pattern depends on the `allow` setting. The parameter uses an equal sign (=) when `allow=>>true`. The parameter uses a not-equal sign (<>) when `allow=>>false`.
- You can configure multiple automatic capture parameters of different types. You cannot specify multiple values for the same parameter. Instead, the values specified for a particular parameter are combined. For example, specifying `auto_capture_sql_text` to be `'%TABLE1%'`, `TRUE`, and `'%TABLE2%'`, `FALSE` will result in matching SQL text `LIKE '%TABLE1%'` and `NOT LIKE '%TABLE2%'`. The database uses these configuration settings only when the initialization parameter `OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES` is set to `TRUE`.
- A null value for `parameter_value` removes the filter for `parameter_name` entirely. By using `parameter_value=>''` in combination with `allow=FALSE`, you can filter out

all values for a parameter, and then create a separate filter to include only specified values. The `DBA_SQL_MANAGEMENT_CONFIG` view shows the current filters.

- The default space budget for SQL management base is no more than ten percent of the size of `SYSAUX` tablespace. The space budget can be set to a maximum of 50%. The default unused plan retention period is one year and one week, which means a plan will be automatically purged if it has not been used for more than a year. The retention period can be set to a maximum of 523 weeks (i.e. a little over 10 years).
- When the space occupied by SQL management base exceeds the defined space budget limit, a weekly database alert is generated.

Examples

The following example creates a filter for SQL text that is like `SELECT a%`:

```
EXEC DBMS_SPM.CONFIGURE('AUTO_CAPTURE_SQL_TEXT', 'select a%', 'TRUE');
```

The following example filters out the `HR` parsing schema:

```
EXEC DBMS_SPM.CONFIGURE('AUTO_CAPTURE_PARSING_SCHEMA_NAME', 'HR', 'FALSE');
```

The following example removes any existing filters for SQL text:

```
EXEC DBMS_SPM.CONFIGURE('AUTO_CAPTURE_SQL_TEXT', NULL, NULL);
```

The following example removes any `LIKE` or `NOT LIKE` filters for the SQL text `select a%`:

```
EXEC DBMS_SPM.CONFIGURE('AUTO_CAPTURE_SQL_TEXT', 'select a%', NULL);
```

The following example creates a filter with the predicate `(action LIKE 'R%') OR (action LIKE '%E_')`:

```
EXEC DBMS_SPM.CONFIGURE('AUTO_CAPTURE_ACTION', 'R%', 'TRUE');
EXEC DBMS_SPM.CONFIGURE('AUTO_CAPTURE_ACTION', '%E_', 'TRUE');
```

The following example creates a filter with the predicate `NOT(module LIKE 'LOGGER') AND NOT(module LIKE 'UTIL_')`:

```
EXEC DBMS_SPM.CONFIGURE('AUTO_CAPTURE_MODULE', 'LOGGER', 'FALSE');
EXEC DBMS_SPM.CONFIGURE('AUTO_CAPTURE_MODULE', 'UTIL_', 'FALSE');
```

175.6.6 CREATE_EVOLVE_TASK Function

The function has two overloads, both of which create an advisor task and sets its parameters. This version which takes a SQL handle creates an evolve task in order to evolve one or more plans for a given SQL statement.

Syntax

```
DBMS_SPM.CREATE_EVOLVE_TASK (
    sql_handle IN VARCHAR2 := NULL,
```



```

plan_name      IN VARCHAR2 := NULL,
time_limit     IN NUMBER    := DBMS_SPM.AUTO_LIMIT,
task_name      IN VARCHAR2 := NULL,
description    IN VARCHAR2 := NULL)
RETURN VARCHAR2;

DBMS_SPM.CREATE_EVOLVE_TASK (
  plan_list     IN DBMS_SPM.NAME_LIST,
  time_limit    IN NUMBER    := DBMS_SPM.AUTO_LIMIT,
  task_name     IN VARCHAR2 := NULL,
  description   IN VARCHAR2 := NULL)
RETURN VARCHAR2;

```

Parameters

Table 175-11 CREATE_EVOLVE_TASK Function Parameters

Parameter	Description
sql_handle	Handle of a SQL statement. The default NULL considers all SQL statements with non-accepted plans.
plan_list	List of plan names. The plans may belong to different SQL statements.
plan_name	Plan identifier. The default NULL considers all non-accepted plans of the specified SQL handle or all SQL statements if the SQL handle is NULL.
time_limit	Time limit in number of minutes. The time limit is global and it is used in the following manner. The time limit for first non-accepted plan is equal to the input value. The time limit for the second non-accepted plan is equal to (input value - time spent in first plan verification) and so on. The default DBMS_SPM.AUTO_LIMIT means let the system choose an appropriate time limit based on the number of plan verifications required to be done. The value DBMS_SPM.NO_LIMIT means no time limit.
task_name	Evolve task name
description	Description of the task (maximum 256 characters)

Return Values

SQL evolve task unique name

175.6.7 CREATE_STGTAB_BASELINE Procedure

This procedure creates a staging table used for transporting SQL plan baselines from one system to another.

Syntax

```

DBMS_SPM.CREATE_STGTAB_BASELINE (
  table_name      IN VARCHAR2,
  table_owner     IN VARCHAR2 := NULL,
  tablespace_name IN VARCHAR2 := NULL);

```

Parameters

Table 175-12 CREATE_STGTAB_BASELINE Procedure Parameters

Parameter	Description
<i>table_name</i>	Name of staging table to create for the purpose of packing and unpacking SQL plan baselines
<i>table_owner</i>	Name of owner of the staging table. The default, NULL, means that the current schema is the table owner.
<i>tablespace_name</i>	Name of the tablespace. The default, NULL, results in creating the staging table in the default tablespace.

Usage Notes

The creation of staging table is the first step. To migrate SQL plan baselines from one system to another, the user or DBA has to perform a series of steps as follows:

1. Create a staging table in the source system
2. Select SQL plan baselines in the source system and pack them into the staging table
3. Copy the staging table from the source system to the target system. For example, you can use Oracle Data Pump to export and import the staging table.
4. Select SQL plan baselines from the staging table and unpack them into the target system

175.6.8 DROP_EVOLVE_TASK Procedure

The procedure drops an evolved task.

Syntax

```
DBMS_SPM.DROP_EVOLVE_TASK (
    task_name          IN VARCHAR2);
```

Parameters

Table 175-13 DROP_EVOLVE_TASK Procedure Parameters

Parameter	Description
<i>task_name</i>	Identifier of the task that you want to drop

175.6.9 DROP_SQL_PLAN_BASELINE Function

This function drops a single plan, or all plans associated with a SQL statement.

Syntax

```
DBMS_SPM.DROP_SQL_PLAN_BASELINE (
    sql_handle         IN VARCHAR2 := NULL,
    plan_name          IN VARCHAR2 := NULL)
RETURN PLS_INTEGER;
```

Parameters

Table 175-14 DROP_SQL_PLAN_BASELINE Function Parameters

Parameter	Description
sql_handle	SQL statement handle. It identifies plans associated with a SQL statement that are to be dropped. If NULL then plan_name must be specified.
plan_name	Plan name. It identifies a specific plan. Default NULL means to drop all plans associated with the SQL statement identified by sql_handle.

Return Values

The number of plans dropped

175.6.10 EVOLVE_SQL_PLAN_BASELINE Function

This function evolves SQL plan baselines associated with one or more SQL statements. A SQL plan baseline is evolved when one or more of its non-accepted plans is changed to an accepted plan or plans.

If interrogated by the user (parameter `verify = 'YES'`), the execution performance of each non-accepted plan is compared against the performance of a plan chosen from the associated SQL plan baseline. If the non-accepted plan performance is found to be better than SQL plan baseline performance, the non-accepted plan is changed to an accepted plan provided such action is permitted by the user (parameter `commit = 'YES'`).

The second form of the function employs a plan list format.

Syntax

```
DBMS_SPM.EVOLVE_SQL_PLAN_BASELINE (
  sql_handle   IN VARCHAR2 := NULL,
  plan_name    IN VARCHAR2 := NULL,
  time_limit   IN INTEGER   := DBMS_SPM.AUTO_LIMIT,
  verify       IN VARCHAR2 := 'YES',
  commit       IN VARCHAR2 := 'YES')
RETURN CLOB;

DBMS_SPM.EVOLVE_SQL_PLAN_BASELINE (
  plan_list    IN DBMS_SPM.NAME_LIST,
  time_limit   IN INTEGER   := DBMS_SPM.AUTO_LIMIT,
  verify       IN VARCHAR2 := 'YES',
  commit       IN VARCHAR2 := 'YES')
RETURN CLOB;
```

Parameters

Table 175-15 EVOLVE_SQL_PLAN_BASELINE Function Parameters

Parameter	Description
sql_handle	SQL statement identifier. Unless <code>plan_name</code> is specified, NULL means to consider all statements with non-accepted plans in their SQL plan baselines.
plan_name	Plan identifier. Default NULL means to consider all non-accepted plans in the SQL plan baseline of either the identified SQL statement or all SQL statements if <code>sql_handle</code> is NULL.
plan_list	A list of plan names. Each plan in the list can belong to same or different SQL statement.
time_limit	Time limit in number of minutes. This applies only if <code>verify = 'YES'</code> . The time limit is global and it is used as follows: The time limit for first non-accepted plan verification is set equal to the input value; the time limit for second non-accepted plan verification is set equal to (input value - time spent in first plan verification); and so on. <ul style="list-style-type: none"> DBMS_SPM.AUTO_LIMIT (Default) lets the system choose an appropriate time limit based on the number of plan verifications required to be done. DBMS_SPM.NO_LIMIT means there is no time limit. A positive integer value represents a user specified time limit.
verify	Specifies whether to execute the plans and compare the performance before changing non-accepted plans into accepted plans. A performance verification involves executing a non-accepted plan and a plan chosen from corresponding SQL plan baseline and comparing their performance statistics. If non-accepted plan shows performance improvement, it is changed to an accepted plan. <ul style="list-style-type: none"> 'YES' (Default) - verifies that a non-accepted plan gives better performance before changing it to an accepted plan 'NO' - directs not to execute plans but only to change non-accepted plans into accepted plans
commit	Specifies whether to update the ACCEPTED status of non-accepted plans from 'NO' to 'YES'. <ul style="list-style-type: none"> 'YES' (Default) - perform updates of qualifying non-accepted plans and generate a report that shows the updates and the result of performance verification when <code>verify = 'YES'</code>. 'NO' - generate a report without any updates. Note that <code>commit = 'NO'</code> together with <code>verify = 'NO'</code> represents a no-op.

Return Values

A CLOB containing a formatted text report showing non-accepted plans in sequence, each with a possible change of its ACCEPTED status, and if `verify = 'YES'` the result of their performance verification.

Usage Notes

Invoking this subprogram requires the ADMINISTER SQL MANAGEMENT OBJECT privilege.

175.6.11 EXECUTE_EVOLVE_TASK Function

The function executes a previously created evolve task.

Syntax

```
DBMS_SPM.EXECUTE_EVOLVE_TASK (
    task_name      IN VARCHAR2,
    execution_name IN VARCHAR2 := NULL,
    execution_desc IN VARCHAR2 := NULL);
RETURN VARCHAR2;
```

Parameters

Table 175-16 EXECUTE_EVOLVE_TASK Function Parameters

Parameter	Description
task_name	Evolve task name
execution_name	Name to qualify and identify an execution. If not specified, it is generated by the advisor and returned by the function.
execution_desc	Description of the execution (maximum 256 characters)

Return Values

Name of the new execution

175.6.12 IMPLEMENT_EVOLVE_TASK Function

The function implements all the actions recommended by an evolve task.

Syntax

```
DBMS_SPM.IMPLEMENT_EVOLVE_TASK (
    task_name      IN VARCHAR2,
    task_owner     IN VARCHAR2 := NULL,
    execution_name IN VARCHAR2 := NULL,
    force          IN BOOLEAN   := FALSE)
RETURN NUMBER;
```

Parameters

Table 175-17 IMPLEMENT_EVOLVE_TASK Function Parameters

Parameter	Description
task_name	Identifier of task to report
task_owner	Owner of the evolve task. Defaults to the current schema owner.
execution_name	Name to qualify and identify an execution. If NULL, the action will be taken for the last task execution.

Table 175-17 (Cont.) IMPLEMENT_EVOLVE_TASK Function Parameters

Parameter	Description
force	Accept all plans even if the advisor did not recommend such an action. The default is <code>FALSE</code> requiring acceptance of the plan only if the plan is verified and shows sufficient improvement in benefit.

Return Values

The number of plans accepted

175.6.13 INTERRUPT_EVOLVE_TASK Procedure

The procedure interrupts a currently executing evolve task. The task ends its operations as at a normal exit and the user can access the intermediate results. The task can be resumed later.

Syntax

```
DBMS_SPM.INTERRUPT_EVOLVE_TASK (
    task_name          IN VARCHAR2);
```

Parameters**Table 175-18 INTERRUPT_EVOLVE_TASK Procedure Parameters**

Parameter	Description
task_name	Identifier of task to interrupt

175.6.14 LOAD_PLANS_FROM_AWR Function

This function loads the SQL Management Base (SMB) with SQL plan baselines for a set of SQL statements using the plans from the AWR, and returns the number of plans loaded.

Syntax

```
DBMS_SPM.LOAD_PLANS_FROM_AWR
    begin_snap      IN NUMBER,
    end_snap        IN NUMBER,
    basic_filter     IN VARCHAR2 := NULL,
    fixed           IN VARCHAR2 := 'NO',
    enabled         IN VARCHAR2 := 'YES',
    commit_rows     IN NUMBER := 1000)
RETURN PLS_INTEGER;
```

Parameters

Table 175-19 LOAD_PLANS_FROM_AWR Function Parameters

Parameter	Description
begin_snap	Begin snapshot
end_snap	End snapshot
basic_filter	SQL predicate to filter the SQL from AWR. NULL means all plans in AWR are selected. Specifies the SQL predicate that filters the SQL from the shared SQL area defined on attributes of the SQLSET_ROW.
fixed	Default 'NO' means the loaded plans will not change the current 'fixed' property of the SQL plan baseline into which they are loaded.
enabled	Default 'YES' means the loaded plans will be considered by the optimizer
commit_rows	Number of SQL plans to load before doing a periodic commit.
dbid	The DBID that is used for imported or PDB-level AWR data.

Usage Notes

Requires the `Administer SQL Management Object` privilege



See Also:

For information on the `SQLSET_ROW` objects, see [SQLSET_ROW Object Type](#).

175.6.15 LOAD_PLANS_FROM_CURSOR_CACHE Functions

This function loads one or more plans present in the cursor cache for a SQL statement, or a set of SQL statements. It has four overloads: using SQL statement text, using SQL handle, using SQL ID, or using `attribute_name` and `attribute_value` pair.

Syntax

```
DBMS_SPM.LOAD_PLANS_FROM_CURSOR_CACHE (
  sql_id          IN VARCHAR2,
  plan_hash_value IN NUMBER   := NULL,
  sql_text        IN CLOB,
  fixed           IN VARCHAR2 := 'NO',
  enabled         IN VARCHAR2 := 'YES')
RETURN PLS_INTEGER;
```

```
DBMS_SPM.LOAD_PLANS_FROM_CURSOR_CACHE (
  sql_id          IN VARCHAR2,
  plan_hash_value IN NUMBER   := NULL,
```

```

    sql_handle      IN VARCHAR2,
    fixed           IN VARCHAR2 := 'NO',
    enabled         IN VARCHAR2 := 'YES')
RETURN PLS_INTEGER;

DBMS_SPM.LOAD_PLANS_FROM_CURSOR_CACHE (
    sql_id          IN VARCHAR2,
    plan_hash_value IN NUMBER   := NULL,
    fixed           IN VARCHAR2 := 'NO',
    enabled         IN VARCHAR2 := 'YES')
RETURN PLS_INTEGER;

DBMS_SPM.LOAD_PLANS_FROM_CURSOR_CACHE (
    attribute_name  IN VARCHAR2,
    attribute_value IN VARCHAR2,
    fixed           IN VARCHAR2 := 'NO',
    enabled         IN VARCHAR2 := 'YES')
RETURN PLS_INTEGER;

```

Parameters

Table 175-20 LOAD_PLANS_FROM_CURSOR_CACHE Function Parameters

Parameter	Description
sql_id	SQL statement identifier. Identifies a SQL statement in the cursor cache. Note: In the third overload the text of identified SQL statement is extracted from cursor cache and is used to identify the SQL plan baseline into which the plan(s) are loaded. If the SQL plan baseline doesn't exist it is created.
plan_hash_value	Plan identifier. Default NULL means capture all plans present in the cursor cache for the SQL statement identified by SQL_ID.
sql_text	SQL text to use in identifying the SQL plan baseline into which the plans are loaded. If the SQL plan baseline does not exist, it is created. The use of text is crucial when the user tunes a SQL statement by adding hints to its text and then wants to load the resulting plan(s) into the SQL plan baseline of the original SQL statement.
sql_handle	SQL handle to use in identifying the SQL plan baseline into which the plans are loaded. The sql_handle must denote an existing SQL plan baseline. The use of handle is crucial when the user tunes a SQL statement by adding hints to its text and then wants to load the resulting plan(s) into the SQL plan baseline of the original SQL statement.
fixed	Default 'NO' means the loaded plans are used as non-fixed plans. Value 'YES' means the loaded plans are used as fixed plans and the SQL plan baseline will not be evolved over time.
attribute_name	One of possible attribute names: <ul style="list-style-type: none"> SQL_TEXT" 'PARSING_SCHEMA_NAME' 'MODULE' 'ACTION'

Table 175-20 (Cont.) LOAD_PLANS_FROM_CURSOR_CACHE Function Parameters

Parameter	Description
attribute_value	Attribute value is used as a search pattern of LIKE predicate if attribute name is 'SQL_TEXT'. Otherwise, it is used as an equality search value. (for example, for specifying attribute_name => 'SQL_TEXT', and attribute_value => '% HR-123 %' means applying SQL_TEXT LIKE '% HR-123 %' as a selection filter. Similarly, specifying attribute_name => 'MODULE', and attribute_value => 'HR' means applying 'MODULE = 'HR' as a plan selection filter). The attribute value is upper-cased except when it is enclosed in double quotes or attribute name is 'SQL_TEXT'.
enabled	Default 'YES' means the loaded plans are enabled for use by the optimizer

Return Values

Number of plans loaded

Usage Notes

Invoking this subprogram requires the ADMINISTER SQL MANAGEMENT OBJECT privilege.

175.6.16 LOAD_PLANS_FROM_SQLSET Function

This function loads plans stored in a SQL tuning set (STS) into SQL plan baselines. The plans loaded from STS are not verified for performance but added as accepted plans to existing or new SQL plan baselines. This function can be used to seed SQL management base with new SQL plan baselines.

Syntax

```
DBMS_SPM.LOAD_PLANS_FROM_SQLSET (
    sqlset_name      IN  VARCHAR2,
    sqlset_owner     IN  VARCHAR2 := NULL,
    basic_filter     IN  VARCHAR2 := NULL,
    fixed            IN  VARCHAR2 := 'NO',
    enabled          IN  VARCHAR2 := 'YES'
    commit_rows     IN  NUMBER   := 1000)
RETURN PLS_INTEGER;
```

Parameters

Table 175-21 LOAD_PLANS_FROM_SQLSET Function Parameters

Parameter	Description
sqlset_name	Name of the STS from where the plans are loaded into SQL plan baselines
sqlset_owner	Owner of STS. NULL means current schema is the owner.

Table 175-21 (Cont.) LOAD_PLANS_FROM_SQLSET Function Parameters

Parameter	Description
<code>basic_filter</code>	A filter applied to the STS to select only qualifying plans to be loaded. The filter can take the form of any <code>WHERE</code> clause predicate that can specified against the view <code>DBA_SQLSET_STATEMENTS</code> . For example <code>basic_filter => 'sql_text like 'select /*LOAD_STS*/%'</code> or <code>basic_filter => 'sql_id='b62q7nc33gzwx''</code> .
<code>fixed</code>	Default 'NO' means the loaded plans are used as non-fixed plans. Value 'YES' means the loaded plans are used as fixed plans and the SQL plan baseline will not be evolved over time.
<code>enabled</code>	Default 'YES' means the loaded plans are enabled for use by the optimizer
<code>commit_rows</code>	Number of SQL plans to load before doing a periodic commit. This helps to shorten the undo log.

Return Values

The number of plans loaded

Usage Notes

- To load plans from a remote system, first load the plans into an STS on the remote system, export/import the STS from remote to local system, and then use this function.
- To load plans from Automatic Workload Repository (AWR), first load the plans stored in AWR snapshots into an STS, and then use this procedure.
- The user can also capture plans resident in the cursor cache for one or more SQL statements into an STS, and then use this procedure.

175.6.17 MIGRATE_STORED_OUTLINE Functions

This function migrates stored outlines for one or more SQL statements to plan baselines in the SQL management base (SMB). Users can specify which stored outline(s) to be migrated based on outline name, SQL text, or outline category, or migrate all stored outlines in the system to SQL plan baselines.

This second overload of the function migrates stored outlines for one or more SQL statements to plan baselines in the SQL management base (SMB) given one or more outline names.

Syntax

```
DBMS_SPM.MIGRATE_STORED_OUTLINE (
    attribute_name    IN  VARCHAR2,
    attribute_value   IN  CLOB,
    fixed             IN  VARCHAR2 := 'NO')
RETURN CLOB;
```

```
DBMS_SPM.MIGRATE_STORED_OUTLINE (
    outln_list        IN  DBMS_SPM.NAME_LIST,
    fixed            IN  VARCHAR2 := 'NO')
RETURN CLOB;
```

Parameters

Table 175-22 MIGRATE_STORED_OUTLINE Function Parameters

Parameter	Description
<code>attribute_name</code>	Specifies the type of parameter used in <code>attribute_value</code> to identify the migrated stored outlines. It is case insensitive. Possible values: <ul style="list-style-type: none"> <code>outline_name</code> <code>sql_text</code> <code>category</code> <code>all</code>
<code>attribute_value</code>	Based on <code>attribute_name</code> , this can be: <ul style="list-style-type: none"> Name of stored outline to be migrated SQL text of stored outlines to be migrated Category of stored outlines to be migrated NULL if <code>attribute_name</code> is <code>all</code>
<code>fixed</code>	NO (default) or YES. Specifies the "fixed" status of the plans generated during migration. By default, plans are generated as "non-fixed" plans.
<code>outln_list</code>	List of outline names to be migrated

Return Values

A CLOB containing a formatted report to describe the statistics during the migration, including:

- Number of stored outlines successfully migrated
- Number of stored outlines (and also the corresponding outline names) failed to be migrated and the reasons for the failure

Usage Note

- When the user specifies an outline name, the function migrates stored outlines to plan baseline based on given outline name, which uniquely identifies a single stored outline to be migrated.
- When the user specifies SQL text, the function migrates all stored outlines created for a given SQL statement. A single SQL statement can have multiple stored outlines created for it under different category names. One plan baseline plan is created for each stored outline. The new plan baselines have category names set to `DEFAULT`. The module name of a plan baseline is set to be the same as the stored outline.
- When the user specifies a category name, the function migrates all stored outlines with the given category name. Only one stored outline exists per category per SQL statement. One plan baseline is created for each stored outline.
- When user specifies to migrate `all`, the function migrates all stored outlines in the system to plan baselines. One plan baseline is created for each stored outline.

175.6.18 PACK_STGTAB_BASELINE Function

This function packs (exports) SQL plan baselines from SQL management base into a staging table.

Syntax

```
DBMS_SPM.PACK_STGTAB_BASELINE (
  table_name      IN VARCHAR2,
  table_owner     IN VARCHAR2 := NULL,
  sql_handle      IN VARCHAR2 := NULL,
  plan_name       IN VARCHAR2 := NULL,
  sql_text        IN CLOB      := NULL,
  creator         IN VARCHAR2 := NULL,  origin          IN VARCHAR2 := NULL,
  enabled         IN VARCHAR2 := NULL,
  accepted        IN VARCHAR2 := NULL,
  fixed           IN VARCHAR2 := NULL,
  module          IN VARCHAR2 := NULL,
  action          IN VARCHAR2 := NULL)
RETURN NUMBER;
```

Parameters

Table 175-23 PACK_STGTAB_BASELINE Function Parameters

Parameter	Description
table_name	Name of staging table into which SQL plan baselines are packed (case insensitive unless double quoted)
table_owner	Name of staging table owner. Default NULL means current schema is the table owner
sql_handle	SQL handle (case sensitive)
plan_name	Plan name (case sensitive, % wildcards accepted)
sql_text	SQL text string (case sensitive, % wildcards accepted)
creator	Creator of SQL plan baseline (case insensitive unless double quoted)
origin	Origin of SQL plan baseline, should be 'MANUAL-LOAD', 'AUTO-CAPTURE', 'MANUAL_SQLTUNE' or 'AUTO-SQLTUNE' (case insensitive)
enabled	Must be 'YES' or 'NO' (case insensitive)
accepted	Must be 'YES' or 'NO' (case insensitive)
fixed	Must be 'YES' or 'NO' (case insensitive)
module	Module (case sensitive)
action	Action (case sensitive)

Return Values

Number of SQL plan baselines packed

175.6.19 RESET_EVOLVE_TASK Procedure

This procedure resets an evolve task to its initial state.

All intermediate results will be removed from the task. Call this procedure on a task that is not currently executing.

Syntax

```
DBMS_SPM.RESET_EVOLVE_TASK (
    task_name          IN  VARCHAR2);
```

Parameters

Table 175-24 RESET_EVOLVE_TASK Procedure Parameters

Parameter	Description
task_name	Identifier of task to reset

175.6.20 RESUME_EVOLVE_TASK Procedure

The procedure resumes a previously interrupted task.

Syntax

```
DBMS_SPM.RESUME_EVOLVE_TASK (
    task_name          IN  VARCHAR2);
```

Parameters

Table 175-25 RESUME_EVOLVE_TASK Procedure Parameters

Parameter	Description
task_name	Identifier of task to resume

175.6.21 REPORT_AUTO_EVOLVE_TASK Function

The procedure displays the results of an execution of an automatic evolve task.

Syntax

```
DBMS_SPM.REPORT_AUTO_EVOLVE_TASK (
    type          IN  VARCHAR2 := TYPE_TEXT,
    level         IN  VARCHAR2 := LEVEL_TYPICAL,
    section       IN  VARCHAR2 := SECTION_ALL,
    object_id     IN  NUMBER   := NULL,
    execution_name IN  VARCHAR2 := NULL)
RETURN CLOB;
```

Parameters

Table 175-26 REPORT_AUTO_EVOLVE_TASK Function Parameters

Parameter	Description
type	Type of the report. Possible values are TEXT, HTML, XML
level	Format of the report. Possible values are BASIC, TYPICAL, ALL.
section	Particular section in the report. Possible values are: SUMMARY, FINDINGS, PLANS, INFORMATION, ERRORS, ALL.
object_id	Identifier of the advisor framework object that represents a single plan. If NULL, the report is generated for all objects.
execution_name	Name to qualify and identify an execution. If NULL, the report is generated for the last task execution.

Return Values

The report

175.6.22 REPORT_EVOLVE_TASK Function

The procedure displays the results of an evolved task.

Syntax

```
DBMS_SPM.REPORT_EVOLVE_TASK (
  task_name      IN  VARCHAR2,
  type           IN  VARCHAR2  := TYPE_TEXT,
  level         IN  VARCHAR2  := LEVEL_TYPICAL,
  section       IN  VARCHAR2  := SECTION_ALL,
  object_id     IN  NUMBER    := NULL,
  task_owner    IN  VARCHAR2  := NULL,
  execution_name IN  VARCHAR2  := NULL)
RETURN CLOB;
```

Parameters

Table 175-27 REPORT_EVOLVE_TASK Function Parameters

Parameter	Description
task_name	Identifier of task to report
type	Type of the report. Possible values are TEXT, HTML, XML
level	Format of the report. Possible values are BASIC, TYPICAL, ALL.
section	Particular section in the report. Possible values are: SUMMARY, FINDINGS, PLANS, INFORMATION, ERRORS, ALL.
object_id	Identifier of the advisor framework object that represents a single plan. If NULL, the report is generated for all objects.
task_owner	Owner of the evolve task. Defaults to the current schema owner.
execution_name	Name to qualify and identify an execution. If NULL, the report is generated for the last task execution.

Return Values

The report

175.6.23 SET_EVOLVE_TASK_PARAMETER Procedure

The procedure sets a parameter of an evolve task, either a VARCHAR2 or a NUMBER.

Syntax

```
DBMS_SPM.SET_EVOLVE_TASK_PARAMETER (
    task_name      IN  VARCHAR2,
    parameter      IN  VARCHAR2,
    value          IN  NUMBER);
```

```
DBMS_SPM.SET_EVOLVE_TASK_PARAMETER (
    task_name      IN  VARCHAR2 := NULL,
    parameter      IN  VARCHAR2,
    value          IN  VARCHAR2);
```

Parameters

Table 175-28 SET_EVOLVE_TASK_PARAMETER Procedure Parameters

Parameter	Description
task_name	Evolve task name
parameter	Name of the parameter to set (see following table)
value	Value of the parameter (see following table)

The following table describes parameters for the SET_EVOLVE_TASK_PARAMETER procedure.

Table 175-29 DBMS_SPM.SET_EVOLVE_TASK_PARAMETER Parameters

Parameter	Description	Default
alternate_plan_source	<p>Determines which sources to search for additional plans:</p> <ul style="list-style-type: none"> AUTO (the database selects the source automatically) AUTOMATIC_WORKLOAD_REPOSITORY CURSOR_CACHE SQL_TUNING_SET <p>You can combine multiple values with the plus sign (+).</p>	<p>The default depends on whether the SPM Evolve Advisor task is automated or manual:</p> <ul style="list-style-type: none"> If automated, the default is AUTO. If manual, the default is CURSOR_CACHE+AUTOMATIC_WORKLOAD_REPOSITORY.

Table 175-29 (Cont.) DBMS_SPM.SET_EVOLVE_TASK_PARAMETER Parameters

Parameter	Description	Default
alternate_plan_baseline	<p>Determines which alternative plans should be loaded:</p> <ul style="list-style-type: none"> AUTO lets Autonomous Database choose whether to load plans for statements with or without baselines. EXISTING loads alternate plans with for statements with existing baselines. NEW loads alternative plans for statements without a baseline, in which case a new baseline is created. <p>You can combine multiple values with the plus sign (+), as in EXISTING+NEW.</p>	EXISTING
alternate_plan_limit	Specifies the maximum number of plans to load in total (that is, not the limit for each SQL statement).	<p>The default depends on whether the SPM Evolve Advisor task is automated or manual:</p> <ul style="list-style-type: none"> If automated, the default is UNLIMITED. If manual, the default is 10.
accept_plans	<p>Specifies whether to accept recommended plans automatically.</p> <p>When ACCEPT_PLANS is true, SQL plan management automatically accepts all plans recommended by the task.</p> <p>When ACCEPT_PLANS is false, the task verifies the plans and generates a report of its findings, but does not evolve the plans automatically. You can use a report to identify new SQL plan baselines and accept them manually.</p>	true (regardless of whether the advisor is run automatically or manually)
time_limit	Global time limit in seconds. This is the total time allowed for the task.	<p>The default depends on whether the SPM Evolve Advisor task is automated or manual:</p> <ul style="list-style-type: none"> If automated, the default is 3600. If manual, the default is 2147483646.



See Also:

Oracle Database Licensing Information User Manual for details on which features are supported for different editions and services

175.6.24 UNPACK_STGTAB_BASELINE Function

This function unpacks (imports) SQL plan baselines from a staging table into SQL management base.

Syntax

```
DBMS_SPM.UNPACK_STGTAB_BASELINE (
    table_name      IN VARCHAR2,
    table_owner     IN VARCHAR2 := NULL,
    sql_handle      IN VARCHAR2 := NULL,
    plan_name       IN VARCHAR2 := NULL,
    sql_text        IN CLOB      := NULL,
    creator         IN VARCHAR2 := NULL,    origin          IN VARCHAR2 := NULL,
    enabled         IN VARCHAR2 := NULL,
    accepted        IN VARCHAR2 := NULL,
    fixed           IN VARCHAR2 := NULL,
    module          IN VARCHAR2 := NULL,
    action          IN VARCHAR2 := NULL)
RETURN NUMBER;
```

Parameters

Table 175-30 UNPACK_STGTAB_BASELINE Function Parameters

Parameter	Description
table_name	Name of staging table from which SQL plan baselines are unpacked (case insensitive unless double quoted)
table_owner	Name of staging table owner. Default NULL means current schema is the table owner
sql_handle	SQL handle (case sensitive)
plan_name	Plan name (case sensitive, % wildcards accepted)
sql_text	SQL text string (case sensitive, % wildcards accepted)
creator	Creator of SQL plan baseline (case insensitive unless double quoted)
origin	Origin of SQL plan baseline, should be 'MANUAL-LOAD', 'AUTO-CAPTURE', 'MANUAL_SQLTUNE' or 'AUTO-SQLTUNE' (case insensitive)
enabled	Must be 'YES' or 'NO' (case insensitive)
accepted	Must be 'YES' or 'NO' (case insensitive)
fixed	Must be 'YES' or 'NO' (case insensitive)
module	Module (case sensitive)
action	Action (case sensitive)

Return Values

Number of plans unpacked

DBMS_SQL

The `DBMS_SQL` package provides an interface to use dynamic SQL to parse any data manipulation language (DML) or data definition language (DDL) statement using PL/SQL.

For example, you can enter a `DROP TABLE` statement from within a stored procedure by using the [PARSE Procedures](#) supplied with the `DBMS_SQL` package.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Exceptions](#)
- [Operational Notes](#)
- [Examples](#)
- [Data Structures](#)
- [Summary of DBMS_SQL Subprograms](#)

See Also:

For more information on native dynamic SQL, see *Oracle Database PL/SQL Language Reference*.

176.1 DBMS_SQL Overview

Oracle lets you write stored procedures and anonymous PL/SQL blocks that use dynamic SQL. Dynamic SQL statements are not embedded in your source program; rather, they are stored in character strings that are input to, or built by, the program at runtime. This enables you to create more general-purpose procedures. For example, dynamic SQL lets you create a procedure that operates on a table whose name is not known until runtime.

Native Dynamic SQL is an alternative to `DBMS_SQL` that lets you place dynamic SQL statements directly into PL/SQL blocks. In most situations, Native Dynamic SQL is easier to use and performs better than `DBMS_SQL`. However, Native Dynamic SQL itself has certain limitations:

- There is no support for so-called Method 4 (for dynamic SQL statements with an unknown number of inputs or outputs)
- There are some tasks that can only be performed using `DBMS_SQL`. For tasks that require `DBMS_SQL`, see *Oracle Database PL/SQL Language Reference*.

The ability to use dynamic SQL from within stored procedures generally follows the model of the Oracle Call Interface (OCI).

 **See Also:**

Oracle Call Interface Programmer's Guide

PL/SQL differs somewhat from other common programming languages, such as C. For example, addresses (also called pointers) are not user-visible in PL/SQL. As a result, there are some differences between the Oracle Call Interface and the `DBMS_SQL` package. These differences include the following:

- The OCI binds by address and the `DBMS_SQL` package binds by value.
- With `DBMS_SQL` you must call `VARIABLE_VALUE` to retrieve the value of an `OUT` parameter for an anonymous block, and you must call `COLUMN_VALUE` after fetching rows to retrieve the values of the columns in the rows into your program.
- The current release of the `DBMS_SQL` package does not provide `CANCEL` cursor procedures.
- Indicator variables are not required, because `NULLs` are fully supported as values of a PL/SQL variable.

176.2 DBMS_SQL Security Model

`DBMS_SQL` is a `SYS`-owned package compiled with `AUTHID CURRENT_USER`. Any `DBMS_SQL` subprogram called from an anonymous PL/SQL block runs with the privileges of the current user.

 **See Also:**

Oracle Database PL/SQL Language Reference for more information about using Invoker Rights or Definer Rights

Preventing Malicious or Accidental Access of Open Cursor Numbers

An error, `ORA-29471`, is raised when any `DBMS_SQL` subprogram is called with a cursor number that does not denote an open cursor. When the error is raised, an alert is issued to the alert log and `DBMS_SQL` becomes inoperable for the life of the session.

If the actual value for the cursor number in a call to the [IS_OPEN Function](#) denotes a cursor currently open in the session, the return value is `TRUE`. If the actual value is `NULL`, then the return value is `FALSE`. Otherwise, this raises an `ORA-29471` error.

Preventing Inappropriate Use of a Cursor

Cursors are protected from security breaches that subvert known existing cursors.

Checks are made when binding and executing. Optionally, checks may be performed for every single `DBMS_SQL` subprogram call. The check is:

- The `current_user` is the same on calling the subprogram as it was on calling the most recent parse.

- The enabled roles on calling the subprogram must be identical to the enabled roles on calling the most recent parse.
- The container is the same on calling the subprogram as it was on calling the most recent parse.

Consistent with the use of definer's rights subprograms, roles do not apply.

If either check fails, then an `ORA-29470` error is raised.

The mechanism for defining when checks are performed is a new overload for the `OPEN_CURSOR` subprogram, which takes a formal parameter, `security_level`, with allowed values `NULL`, `1` and `2`.

- When `security_level = 1` (or is `NULL`), the checks are made only when binding and executing.
- When `security_level = 2`, the checks are always made.

Upgrade Considerations

This security regime is stricter than those in the previous releases. As a consequence, users of `DBMS_SQL` may encounter runtime errors on upgrade.

176.3 DBMS_SQL Constants

The `DBMS_SQL Constants` package provides constants that are used with the `language_flag` parameter of the `PARSE` Procedures.

These constants are described in the following table.

Table 176-1 DBMS_SQL Constants

Name	Type	Value	Description
V6	INTEGER	0	Specifies Oracle database version 6 behavior
NATIVE	INTEGER	1	Specifies normal behavior for the database to which the program is connected
V7	INTEGER	2	Specifies Oracle database version 7 behavior
FOREIGN_SYNTA X	INTEGER	4294967295	Specifies a non-Oracle database syntax and behavior. The SQL statement to be parsed needs to be translated first using the SQL translation profile set in the database session. The SQL translation profile is a database schema object that directs how SQL statements are translated to Oracle. An error is raised if a profile is not set.

Related Topics

- [PARSE Procedures](#)
This procedure parses the given statement in the given cursor. All statements are parsed immediately. In addition, DDL statements are run immediately when parsed.

176.4 DBMS_SQL Operational Notes

These operational notes describe processing queries, processing updates, inserts, and deletes, and locating errors.

Processing Queries

If you are using dynamic SQL to process a query, then you must perform the following steps:

1. Specify the variables that are to receive the values returned by the `SELECT` statement by calling the [DEFINE_COLUMN Procedures](#), the [DEFINE_COLUMN_LONG Procedure](#), or the [DEFINE_ARRAY Procedure](#).
2. Run your `SELECT` statement by calling the [EXECUTE Function](#).
3. Call the [FETCH_ROWS Function](#) (or `EXECUTE_AND_FETCH`) to retrieve the rows that satisfied your query.
4. Call [COLUMN_VALUE Procedure](#) or [COLUMN_VALUE_LONG Procedure](#) to determine the value of a column retrieved by the [FETCH_ROWS Function](#) for your query. If you used anonymous blocks containing calls to PL/SQL procedures, then you must call the [VARIABLE_VALUE Procedures](#) to retrieve the values assigned to the output variables of these procedures.

Processing Updates, Inserts, and Deletes

If you are using dynamic SQL to process an `INSERT`, `UPDATE`, or `DELETE`, then you must perform the following steps:

1. Run your `INSERT`, `UPDATE`, or `DELETE` statement by calling the [EXECUTE Function](#).
2. If statements have the `returning` clause, then you must call the [VARIABLE_VALUE Procedures](#) to retrieve the values assigned to the output variables.

Locating Errors

The `DBMS_SQL` package has additional functions for obtaining information about the last referenced cursor in the session. The values returned by these functions are meaningful only immediately after a SQL statement is run. In addition, some error-locating functions are meaningful only after certain `DBMS_SQL` calls. For example, you call the [LAST_ERROR_POSITION Function](#) immediately after calling one of the [PARSE Procedures](#).

176.5 DBMS_SQL Execution Flow

These functions comprise the `DBMS_SQL` execution flow.

1. [OPEN_CURSOR](#)
2. [PARSE](#)
3. [BIND_VARIABLE](#), [BIND_VARIABLE_PKG](#) or [BIND_ARRAY](#)
4. [DEFINE_COLUMN](#), [DEFINE_COLUMN_LONG](#) or [DEFINE_ARRAY](#)
5. [EXECUTE](#)

6. [FETCH_ROWS](#) or [EXECUTE_AND_FETCH](#)
7. [VARIABLE_VALUE](#), [VARIABLE_PKG](#), [COLUMN_VALUE](#) or [COLUMN_VALUE_LONG](#)
8. [CLOSE_CURSOR](#)

176.5.1 OPEN_CURSOR

To process a SQL statement, you must have an open cursor. When you call the `OPEN_CURSOR` Functions, you receive a cursor `ID` number for the data structure representing a valid cursor maintained by Oracle.

These cursors are distinct from cursors defined at the precompiler, OCI, or PL/SQL level, and are used only by the `DBMS_SQL` package.

Related Topics

- [OPEN_CURSOR Functions](#)
This function opens a new cursor.

176.5.2 PARSE

Every SQL statement must be parsed by calling the `PARSE` procedures. Parsing the statement checks the statement's syntax and associates it with the cursor in your program.

You can parse any DML or DDL statement. DDL statements are run on the parse, which performs the implied commit.

The execution flow of `DBMS_SQL` is shown in [Figure 176-1](#).

Figure 176-1 DBMS_SQL Execution Flow

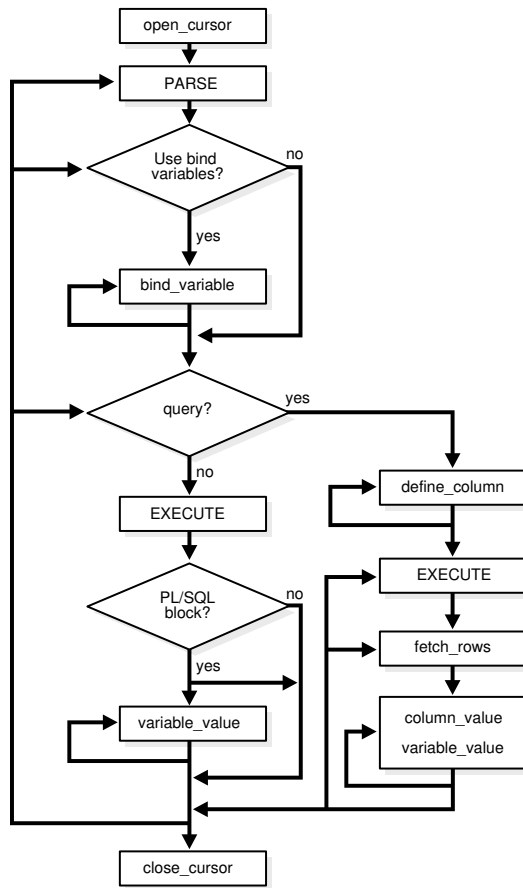


illustration: arpls008
release: 9
caption: DBMS_SQL Execution Flow
date: 7/31/01
platform: pc
ref: ADG8013

Related Topics

- [PARSE Procedures](#)
 This procedure parses the given statement in the given cursor. All statements are parsed immediately. In addition, DDL statements are run immediately when parsed.

176.5.3 BIND_VARIABLE, BIND_VARIABLE_PKG or BIND_ARRAY

Many DML statements require that data in your program be input to Oracle. When you define a SQL statement that contains input data to be supplied at runtime, you must use placeholders in the SQL statement to mark where data must be supplied.

For each placeholder in the SQL statement, you must call one of the [BIND_ARRAY Procedures](#), or [BIND_VARIABLE Procedures](#), or the [BIND_VARIABLE_PKG Procedure](#) to supply the value of a variable in your program (or the values of an array) to the placeholder. When the SQL statement is subsequently run, Oracle uses the data that your program has placed in the output and input, or bind variables.

DBMS_SQL can run a DML statement multiple times — each time with a different bind variable. The `BIND_ARRAY` procedure lets you bind a collection of scalars, each value of which is used as an input variable once for each `EXECUTE`. This is similar to the array interface supported by the OCI.

Note that the datatype of the values bound to placeholders cannot be PL/SQL-only datatypes.

176.5.4 DEFINE_COLUMN, DEFINE_COLUMN_LONG, or DEFINE_ARRAY

The `DEFINE_COLUMN`, `DEFINE_COLUMN_LONG`, and `DEFINE_ARRAY` procedures specify the variables that receive `SELECT` values on a query.

The columns of the row being selected in a `SELECT` statement are identified by their relative positions as they appear in the select list, from left to right. For a query, you must call one of the define procedures ([DEFINE_COLUMN Procedures](#), [DEFINE_COLUMN_LONG Procedure](#), or [DEFINE_ARRAY Procedure](#)) to specify the variables that are to receive the `SELECT` values, much the way an `INTO` clause does for a static query.

Use the `DEFINE_COLUMN_LONG` procedure to define `LONG` columns, in the same way that `DEFINE_COLUMN` is used to define non-`LONG` columns. You must call `DEFINE_COLUMN_LONG` before using the [COLUMN_VALUE_LONG Procedure](#) to fetch from the `LONG` column.

Use the `DEFINE_ARRAY` procedure to define a PL/SQL collection into which you want to fetch rows in a single `SELECT` statement. `DEFINE_ARRAY` provides an interface to fetch multiple rows at one fetch. You must call `DEFINE_ARRAY` before using the `COLUMN_VALUE` procedure to fetch the rows.

176.5.5 EXECUTE

Call the `EXECUTE` Function to run your SQL statement.

Related Topics

- [EXECUTE Function](#)
This function executes a given cursor. This function accepts the `ID` number of the cursor and returns the number of rows processed.

176.5.6 FETCH_ROWS or EXECUTE_AND_FETCH

The `FETCH_ROWS` Function retrieves the rows that satisfy the query. Each successive fetch retrieves another set of rows, until the fetch is unable to retrieve any more rows. Instead of calling `EXECUTE` Function and then `FETCH_ROWS`, you may find it more efficient to call `EXECUTE_AND_FETCH` Function if you are calling `EXECUTE` for a single execution.

Related Topics

- [FETCH_ROWS Function](#)
This function fetches a row from a given cursor.
- [EXECUTE Function](#)
This function executes a given cursor. This function accepts the `ID` number of the cursor and returns the number of rows processed.
- [EXECUTE_AND_FETCH Function](#)
This function executes the given cursor and fetches rows.

176.5.7 VARIABLE_VALUE, VARIABLE_VALUE_PKG, COLUMN_VALUE, or COLUMN_VALUE_LONG

The type of call determines which procedure or function to use.

For queries, call the [COLUMN_VALUE Procedure](#) to determine the value of a column retrieved by the [FETCH_ROWS Function](#).

For anonymous blocks containing calls to `PL/SQL` procedures or DML statements with `returning` clause, call the [VARIABLE_VALUE Procedures](#) or the [VARIABLE_VALUE_PKG Procedure](#) to retrieve the values assigned to the output variables when statements were run.

To fetch only part of a `LONG` database column (which can be up to two gigabytes in size), use the [DEFINE_COLUMN_LONG Procedure](#). You can specify the offset (in bytes) into the column value, and the number of bytes to fetch.

176.5.8 CLOSE_CURSOR

When you no longer need a cursor for a session, close the cursor by calling the `CLOSE_CURSOR` Procedure. If you are using an Oracle Open Gateway, then you may need to close cursors at other times as well. Consult your *Oracle Open Gateway* documentation for additional information.

Related Topics

- [CLOSE_CURSOR Procedure](#)
This procedure closes a given cursor.

176.6 DBMS_SQL Exceptions

This exception is raised by the `COLUMN_VALUE` Procedure or the `VARIABLE_VALUE` Procedures when the type of the given `OUT` parameter (for where to put the requested value) is different from the type of the value.

```
inconsistent_type EXCEPTION;  
pragma exception_init(inconsistent_type, -6562);
```

Related Topics

- [COLUMN_VALUE Procedure](#)
This procedure returns the value of the cursor element for a given position in a given cursor. This procedure is used to access the data fetched by calling `FETCH_ROWS`.
- [VARIABLE_VALUE Procedures](#)
This procedure returns the value of the named variable for a given cursor. It is used to return the values of bind variables inside PL/SQL blocks or DML statements with `returning` clause.

176.7 DBMS_SQL Examples

These example procedures use the `DBMS_SQL` package.

Example : Using DBMS_SQL Demo

This example does not need dynamic SQL because the text of the statement is known at compile time, but it illustrates the basic concept underlying the package.

The `DEMO` procedure deletes all of the employees from the `EMP` table whose salaries are greater than the salary that you specify when you run `DEMO`.

```
CREATE OR REPLACE PROCEDURE demo(salary IN NUMBER) AS  
    cursor_name INTEGER;  
    rows_processed INTEGER;  
BEGIN  
    cursor_name := dbms_sql.open_cursor;  
    DBMS_SQL.PARSE(cursor_name, 'DELETE FROM emp WHERE sal > :x',  
                   DBMS_SQL.NATIVE);  
    DBMS_SQL.BIND_VARIABLE(cursor_name, 'x', salary);  
    rows_processed := DBMS_SQL.EXECUTE(cursor_name);  
    DBMS_SQL.CLOSE_CURSOR(cursor_name);  
EXCEPTION  
WHEN OTHERS THEN  
    DBMS_SQL.CLOSE_CURSOR(cursor_name);  
END;
```

Example 2

The following sample procedure is passed a SQL statement, which it then parses and runs:

```
CREATE OR REPLACE PROCEDURE exec(string IN varchar2) AS  
    cursor_name INTEGER;  
    ret INTEGER;  
BEGIN
```

```
cursor_name := DBMS_SQL.OPEN_CURSOR;
```

DDL statements are run by the parse call, which performs the implied commit.

```
DBMS_SQL.PARSE(cursor_name, string, DBMS_SQL.NATIVE);
ret := DBMS_SQL.EXECUTE(cursor_name);
DBMS_SQL.CLOSE_CURSOR(cursor_name);
END;
```

Creating such a procedure enables you to perform the following operations:

- The SQL statement can be dynamically generated at runtime by the calling program.
- The SQL statement can be a DDL statement or a DML without binds.

For example, after creating this procedure, you could make the following call:

```
exec('create table acct(c1 integer)');
```

You could even call this procedure remotely, as shown in the following example. This lets you perform remote DDL.

```
exec@domain.com('CREATE TABLE acct(c1 INTEGER)');
```

Example 3

The following sample procedure is passed the names of a source and a destination table, and copies the rows from the source table to the destination table. This sample procedure assumes that both the source and destination tables have the following columns:

```
id          of type NUMBER
name        of type VARCHAR2(30)
birthdate  of type DATE
```

This procedure does not need the use of dynamic SQL; however, it illustrates the concepts of this package.

```
CREATE OR REPLACE PROCEDURE copy (
    source      IN VARCHAR2,
    destination IN VARCHAR2) IS
    id_var      NUMBER;
    name_var    VARCHAR2(30);
    birthdate_var DATE;
    source_cursor INTEGER;
    destination_cursor INTEGER;
    ignore      INTEGER;
BEGIN

    -- Prepare a cursor to select from the source table:
    source_cursor := dbms_sql.open_cursor;
    DBMS_SQL.PARSE(source_cursor,
        'SELECT id, name, birthdate FROM ' || source,
        DBMS_SQL.NATIVE);
    DBMS_SQL.DEFINE_COLUMN(source_cursor, 1, id_var);
    DBMS_SQL.DEFINE_COLUMN(source_cursor, 2, name_var, 30);
    DBMS_SQL.DEFINE_COLUMN(source_cursor, 3, birthdate_var);
    ignore := DBMS_SQL.EXECUTE(source_cursor);

    -- Prepare a cursor to insert into the destination table:
```

```

destination_cursor := DBMS_SQL.OPEN_CURSOR;
DBMS_SQL.PARSE(destination_cursor,
                'INSERT INTO ' || destination ||
                ' VALUES (:id_bind, :name_bind, :birthdate_bind)',
                DBMS_SQL.NATIVE);

-- Fetch a row from the source table and insert it into the destination table:
LOOP
  IF DBMS_SQL.FETCH_ROWS(source_cursor)>0 THEN
    -- get column values of the row
    DBMS_SQL.COLUMN_VALUE(source_cursor, 1, id_var);
    DBMS_SQL.COLUMN_VALUE(source_cursor, 2, name_var);
    DBMS_SQL.COLUMN_VALUE(source_cursor, 3, birthdate_var);

    -- Bind the row into the cursor that inserts into the destination table. You
    -- could alter this example to require the use of dynamic SQL by inserting an
    -- if condition before the bind.
    DBMS_SQL.BIND_VARIABLE(destination_cursor, ':id_bind', id_var);
    DBMS_SQL.BIND_VARIABLE(destination_cursor, ':name_bind', name_var);
    DBMS_SQL.BIND_VARIABLE(destination_cursor, ':birthdate_bind',
                           birthdate_var);

    ignore := DBMS_SQL.EXECUTE(destination_cursor);
  ELSE
    -- No more rows to copy:
    EXIT;
  END IF;
END LOOP;

-- Commit and close all cursors:
COMMIT;
DBMS_SQL.CLOSE_CURSOR(source_cursor);
DBMS_SQL.CLOSE_CURSOR(destination_cursor);
EXCEPTION
  WHEN OTHERS THEN
    IF DBMS_SQL.IS_OPEN(source_cursor) THEN
      DBMS_SQL.CLOSE_CURSOR(source_cursor);
    END IF;
    IF DBMS_SQL.IS_OPEN(destination_cursor) THEN
      DBMS_SQL.CLOSE_CURSOR(destination_cursor);
    END IF;
    RAISE;
END;
/

```

Example 4: RETURNING clause

With this clause, INSERT, UPDATE, and DELETE statements can return values of expressions in bind variables.

If a single row is inserted, updated, or deleted, then use DBMS_SQL.BIND_VARIABLE to bind these outbinds. To get the values in these bind variables, call DBMS_SQL.VARIABLE_VALUE

Note:

This process is similar to DBMS_SQL.VARIABLE_VALUE, which must be called after running a PL/SQL block with an outbind inside DBMS_SQL.

i) Single-row insert

```

CREATE OR REPLACE PROCEDURE single_Row_insert
  (c1 NUMBER, c2 NUMBER, r OUT NUMBER) IS
  c NUMBER;
  n NUMBER;
  BEGIN
    c := DBMS_SQL.OPEN_CURSOR;
    DBMS_SQL.PARSE(c, 'INSERT INTO tab VALUES (:bnd1, :bnd2) ' ||
      'RETURNING c1*c2 INTO :bnd3', DBMS_SQL.NATIVE);
    DBMS_SQL.BIND_VARIABLE(c, 'bnd1', c1);
    DBMS_SQL.BIND_VARIABLE(c, 'bnd2', c2);
    DBMS_SQL.BIND_VARIABLE(c, 'bnd3', r);
    n := DBMS_SQL.EXECUTE(c);
    DBMS_SQL.VARIABLE_VALUE(c, 'bnd3', r); -- get value of outbind variable
    DBMS_SQL.CLOSE_CURSOR(c);
  END;
/

```

ii) Single-row update

```

CREATE OR REPLACE PROCEDURE single_Row_update
  (c1 NUMBER, c2 NUMBER, r out NUMBER) IS
  c NUMBER;
  n NUMBER;
  BEGIN
    c := DBMS_SQL.OPEN_CURSOR;
    DBMS_SQL.PARSE(c, 'UPDATE tab SET c1 = :bnd1, c2 = :bnd2 ' ||
      'WHERE rownum < 2 ' ||
      'RETURNING c1*c2 INTO :bnd3', DBMS_SQL.NATIVE);
    DBMS_SQL.BIND_VARIABLE(c, 'bnd1', c1);
    DBMS_SQL.BIND_VARIABLE(c, 'bnd2', c2);
    DBMS_SQL.BIND_VARIABLE(c, 'bnd3', r);
    n := DBMS_SQL.EXECUTE(c);
    DBMS_SQL.VARIABLE_VALUE(c, 'bnd3', r); -- get value of outbind variable
    DBMS_SQL.CLOSE_CURSOR(c);
  END;
/

```

iii) Single-row delete

```

CREATE OR REPLACE PROCEDURE single_Row_Delete
  (c1 NUMBER, r OUT NUMBER) IS
  c NUMBER;
  n number;
  BEGIN
    c := DBMS_SQL.OPEN_CURSOR;
    DBMS_SQL.PARSE(c, 'DELETE FROM tab WHERE ROWNUM = :bnd1 ' ||
      'RETURNING c1*c2 INTO :bnd2', DBMS_SQL.NATIVE);
    DBMS_SQL.BIND_VARIABLE(c, 'bnd1', c1);
    DBMS_SQL.BIND_VARIABLE(c, 'bnd2', r);
    n := DBMS_SQL.EXECUTE(c);
    DBMS_SQL.VARIABLE_VALUE(c, 'bnd2', r); -- get value of outbind variable
    DBMS_SQL.CLOSE_CURSOR(c);
  END;
/

```

iv) Multiple-row insert

```

CREATE OR REPLACE PROCEDURE multi_Row_insert
(c1 DBMS_SQL.NUMBER_TABLE, c2 DBMS_SQL.NUMBER_TABLE,
 r OUT DBMS_SQL.NUMBER_TABLE) is
c NUMBER;
n NUMBER;
BEGIN
c := DBMS_SQL.OPEN_CURSOR;
DBMS_SQL.PARSE(c, 'insert into tab VALUES (:bnd1, :bnd2) ' ||
'RETURNING c1*c2 INTO :bnd3', DBMS_SQL.NATIVE);
DBMS_SQL.BIND_ARRAY(c, 'bnd1', c1);
DBMS_SQL.BIND_ARRAY(c, 'bnd2', c2);
DBMS_SQL.BIND_ARRAY(c, 'bnd3', r);
n := DBMS_SQL.EXECUTE(c);
DBMS_SQL.VARIABLE_VALUE(c, 'bnd3', r);-- get value of outbind variable
DBMS_SQL.CLOSE_CURSOR(c);
END;
/

```

v) Multiple-row update.

```

CREATE OR REPLACE PROCEDURE multi_Row_update
(c1 NUMBER, c2 NUMBER, r OUT DBMS_SQL.NUMBER_TABLE) IS
c NUMBER;
n NUMBER;
BEGIN
c := DBMS_SQL.OPEN_CURSOR;
DBMS_SQL.PARSE(c, 'UPDATE tab SET c1 = :bnd1 WHERE c2 = :bnd2 ' ||
'RETURNING c1*c2 INTO :bnd3', DBMS_SQL.NATIVE);
DBMS_SQL.BIND_VARIABLE(c, 'bnd1', c1);
DBMS_SQL.BIND_VARIABLE(c, 'bnd2', c2);
DBMS_SQL.BIND_ARRAY(c, 'bnd3', r);
n := DBMS_SQL.EXECUTE(c);
DBMS_SQL.VARIABLE_VALUE(c, 'bnd3', r);-- get value of outbind variable
DBMS_SQL.CLOSE_CURSOR(c);
END;
/

```

Note:

bnd1 and bnd2 can be arrays too. The value of the expression for all the rows updated will be in bnd3. There is no way to determine which rows were updated for each value of bnd1 and bnd2.

vi) Multiple-row delete

```

CREATE OR REPLACE PROCEDURE multi_row_delete
(c1 DBMS_SQL.NUMBER_TABLE,
 r OUT DBMS_SQL.NUMBER_TABLE) is
c NUMBER;
n NUMBER;
BEGIN
c := DBMS_SQL.OPEN_CURSOR;
DBMS_SQL.PARSE(c, 'DELETE FROM tab WHERE c1 = :bnd1' ||
'RETURNING c1*c2 INTO :bnd2', DBMS_SQL.NATIVE);
DBMS_SQL.BIND_ARRAY(c, 'bnd1', c1);
DBMS_SQL.BIND_ARRAY(c, 'bnd2', r);
n := DBMS_SQL.EXECUTE(c);
DBMS_SQL.VARIABLE_VALUE(c, 'bnd2', r);-- get value of outbind variable

```

```

        DBMS_SQL.CLOSE_CURSOR(c);
    END;
/

```

vii) outbind in bulk PL/SQL

```

CREATE OR REPLACE PROCEDURE foo (n NUMBER, square OUT NUMBER) IS
BEGIN square := n * n; END;/

CREATE OR REPLACE PROCEDURE bulk_plsql
    (n DBMS_SQL.NUMBER_TABLE, square OUT DBMS_SQL.NUMBER_TABLE) IS
c NUMBER;
r NUMBER;
BEGIN
    c := DBMS_SQL.OPEN_CURSOR;
    DBMS_SQL.PARSE(c, 'BEGIN foo(:bnd1, :bnd2); END;', DBMS_SQL.NATIVE);
    DBMS_SQL.BIND_ARRAY(c, 'bnd1', n);
    DBMS_SQL.BIND_ARRAY(c, 'bnd2', square);
    r := DBMS_SQL.EXECUTE(c);
    DBMS_SQL.VARIABLE_VALUE(c, 'bnd2', square);
END;
/

```

Note:

DBMS_SQL.BIND_ARRAY of number_Table internally binds a number. The number of times statement is run depends on the number of elements in an inbind array.

Example 5: Binds and Defines of User-defined Types in DBMS_SQL

```

CREATE TYPE dnames_var IS VARRAY(7) OF VARCHAR2(30)
/

CREATE TABLE depts (region VARCHAR2(25), dept_names dnames_var)
/
INSERT INTO depts VALUES('Europe', dnames_var('Shipping','Sales','Finance'))
/
INSERT INTO depts VALUES('Americas', dnames_var('Sales','Finance','Shipping'))
/
INSERT INTO depts VALUES('Asia',
dnames_var('Finance','Payroll','Shipping','Sales'))
/

CREATE OR REPLACE PROCEDURE update_depts(new_dnames dnames_var, region VARCHAR2)
IS
    some_dnames dnames_var;
    c          NUMBER;
    r          NUMBER;
    sql_stmt VARCHAR2(32767) :=
        'UPDATE depts SET dept_names = :b1 WHERE region = :b2 RETURNING dept_names
        INTO :b3';

BEGIN

    c := DBMS_SQL.OPEN_CURSOR;

    DBMS_SQL.PARSE(c, sql_stmt, dbms_sql.native);

```

```

DBMS_SQL.BIND_VARIABLE(c, 'b1', new_dnames);
DBMS_SQL.BIND_VARIABLE(c, 'b2', region);
DBMS_SQL.BIND_VARIABLE(c, 'b3', some_dnames);

r := DBMS_SQL.EXECUTE(c);

-- Get value of outbind variable
DBMS_SQL.VARIABLE_VALUE(c, 'b3', some_dnames);

DBMS_SQL.CLOSE_CURSOR(c);

-- select dept_names
sql_stmt := 'SELECT dept_names FROM depts WHERE region = :b1';

c := DBMS_SQL.OPEN_CURSOR;
DBMS_SQL.PARSE(c, sql_stmt, dbms_sql.native);

DBMS_SQL.DEFINE_COLUMN(c, 1, some_dnames);
DBMS_SQL.BIND_VARIABLE(c, 'b1', region);

r := DBMS_SQL.EXECUTE_AND_FETCH(c);

DBMS_SQL.COLUMN_VALUE(c, 1, some_dnames);

DBMS_SQL.CLOSE_CURSOR(c);

-- loop through some_dnames collections
FOR i IN some_dnames.FIRST .. some_dnames.LAST LOOP
    DBMS_OUTPUT.PUT_LINE('Dept. Name = ' || some_dnames(i) || ' Updated!');
END LOOP;
END;
/

DECLARE
    new_dnames dnames_var;
BEGIN
    new_dnames := dnames_var('Benefits', 'Advertising', 'Contracting',
                             'Executive', 'Marketing');
    update_depts(new_dnames, 'Asia');
END;
/

```

176.8 DBMS_SQL Data Structures

The `DBMS_SQL` package defines `RECORD` type and `TABLE` type data structures.

RECORD Types

- [DBMS_SQL DESC_REC Record Type](#) (deprecated)
- [DBMS_SQL DESC_REC2 Record Type](#)
- [DBMS_SQL DESC_REC3 Record Type](#)
- [DBMS_SQL DESC_REC4 Record Type](#)

TABLE Types for DESCRIBE_COLUMNS Procedures

- [DBMS_SQL DESC_TAB Table Type](#)

- [DBMS_SQL DESC_TAB2 Table Type](#)
- [DBMS_SQL DESC_TAB3 Table Type](#)
- [DBMS_SQL DESC_TAB4 Table Type](#)

TABLE Types For Scalar and LOB Collections

DBMS_SQL bulk operations are only supported with these predefined DBMS_SQL TABLE types.

- [DBMS_SQL BFILE_TABLE Table Type](#)
- [DBMS_SQL BINARY_DOUBLE_TABLE Table Type](#)
- [DBMS_SQL BINARY_FLOAT_TABLE Table Type](#)
- [DBMS_SQL BLOB_TABLE Table Type](#)
- [DBMS_SQL CLOB_TABLE Table Type](#)
- [DBMS_SQL DATE_TABLE Table Type](#)
- [DBMS_SQL INTERVAL_DAY_TO_SECOND_TABLE Table Type](#)
- [DBMS_SQL INTERVAL_YEAR_TO_MONTH_TABLE Table Type](#)
- [DBMS_SQL JSON_TABLE Table Type](#)
- [DBMS_SQL NUMBER_TABLE Table Type](#)
- [DBMS_SQL TIME_TABLE Table Type](#)
- [DBMS_SQL TIME_WITH_TIME_ZONE_TABLE Table Type](#)
- [DBMS_SQL TIMESTAMP_TABLE Table Type](#)
- [DBMS_SQL TIMESTAMP_WITH_LTZ_TABLE Table Type](#)
- [DBMS_SQL TIMESTAMP_WITH_TIME_ZONE_TABLE Table Type](#)
- [DBMS_SQL UROWID_TABLE Table Type](#)
- [DBMS_SQL VARCHAR2_TABLE Table Type](#)
- [DBMS_SQL VARCHAR2A Table Type](#)
- [DBMS_SQL VARCHAR2S Table Type](#)
- [DBMS_SQL VECTOR Table Type](#)

176.8.1 DBMS_SQL DESC_REC Record Type

This record type holds the describe information for a single column in a dynamic query.

**Note:**

This type has been deprecated in favor of the [DESC_REC2 Record Type](#).

It is the element type of the `DESC_TAB` table type and the [DESCRIBE_COLUMNS Procedure](#).

Syntax

```

TYPE desc_rec IS RECORD (
    col_type          BINARY_INTEGER := 0,
    col_max_len       BINARY_INTEGER := 0,
    col_name          VARCHAR2(32)   := '',
    col_name_len      BINARY_INTEGER := 0,
    col_schema_name   VARCHAR2(32)   := '',
    col_schema_name_len BINARY_INTEGER := 0,
    col_precision     BINARY_INTEGER := 0,
    col_scale         BINARY_INTEGER := 0,
    col_charsetid     BINARY_INTEGER := 0,
    col_charsetform   BINARY_INTEGER := 0,
    col_null_ok       BOOLEAN        := TRUE);
TYPE desc_tab IS TABLE OF desc_rec INDEX BY BINARY_INTEGER;

```

Fields**Table 176-2 DESC_REC Fields**

Field	Description
col_type	Type of column
col_max_len	Maximum column length
col_name	Name of column
col_name_len	Length of column name
col_schema_name	Column schema name
col_schema_name_len	Length of column schema name
col_precision	Precision of column
col_scale	Scale of column
col_charsetid	Column character set id
col_charsetform	Column character set form
col_null_ok	NULL column flag; TRUE, if NULL possible

176.8.2 DBMS_SQL DESC_REC2 Record Type

DESC_REC2 is the element type of the DESC_TAB2 table type and the DESCRIBE_COLUMNS2 Procedure.

This record type is identical to DESC_REC except for the col_name field, which has been expanded to the maximum possible size for VARCHAR2. It is therefore preferred to DESC_REC because column name values can be greater than 32 characters. DESC_REC is deprecated as a result.

Syntax

```

TYPE desc_rec2 IS RECORD (
    col_type          binary_integer := 0,
    col_max_len       binary_integer := 0,
    col_name          varchar2(32767) := '',
    col_name_len      binary_integer := 0,
    col_schema_name   varchar2(32)   := '',

```

```

col_schema_name_len binary_integer := 0,
col_precision       binary_integer := 0,
col_scale           binary_integer := 0,
col_charsetid       binary_integer := 0,
col_charsetform     binary_integer := 0,
col_null_ok         boolean         := TRUE);

```

Fields

Table 176-3 DESC_REC2 Fields

Field	Description
col_type	Type of column
col_max_len	Maximum column length
col_name	Name of column
col_name_len	Length of column name
col_schema_name	Column schema name
col_schema_name_len	Length of column schema name
col_precision	Precision of column
col_scale	Scale of column
col_charsetid	Column character set id
col_charsetform	Column character set form
col_null_ok	NULL column flag; TRUE, if NULL possible

Related Topics

- [DESCRIBE_COLUMNS2 Procedure](#)
This procedure describes the specified column. This is an alternative to DESCRIBE_COLUMNS Procedure.

176.8.3 DBMS_SQL DESC_REC3 Record Type

DESC_REC3 is the element type of the DESC_TAB3 table type and the DESCRIBE_COLUMNS3 Procedure.

DESC_REC3 is identical to DESC_REC2 except for two additional fields to hold the type name (type_name) and type name len (type_name_len) of a column in a dynamic query. These two fields hold the type name and type name length when the column is a user-defined type (a collection or object type). The col_type_name and col_type_name_len fields are only populated when the col_type field's value is 109, the Oracle type number for user-defined types.

Syntax

```

TYPE desc_rec3 IS RECORD (
  col_type           binary_integer := 0,
  col_max_len       binary_integer := 0,
  col_name          varchar2(32767) := '',
  col_name_len      binary_integer := 0,
  col_schema_name   varchar2(32)   := '',
  col_schema_name_len binary_integer := 0,
  col_precision     binary_integer := 0,

```

```

col_scale          binary_integer := 0,
col_charsetid     binary_integer := 0,
col_charsetform   binary_integer := 0,
col_null_ok       boolean := TRUE,
col_type_name     varchar2(32767) := '',
col_type_name_len binary_integer := 0);

```

Fields

Table 176-4 DESC_REC3 Fields

Field	Description
col_type	Type of column
col_max_len	Maximum column length
col_name	Name of column
col_name_len	Length of column name
col_schema_name	Column schema name
col_schema_name_len	Length of column schema name
col_precision	Precision of column
col_scale	Scale of column
col_charsetid	Column character set ID
col_charsetform	Column character set form
col_null_ok	NULL column flag; TRUE, if NULL possible
col_type_name	User-define type column type name, this field is valid when col_type is 109
col_type_name_len	Length of user-define type column type name, this field is valid when col_type is 109

Related Topics

- [DESCRIBE_COLUMNS3 Procedure](#)
This procedure describes the specified column. This is an alternative to DESCRIBE_COLUMNS Procedure.

176.8.4 DBMS_SQL DESC_REC4 Record Type

DESC_REC4 is the element type of the DESC_TAB4 table type and the DESCRIBE_COLUMNS3 Procedure.

DESC_REC4 is identical to DESC_REC3 except that it supports longer identifiers in the fields that hold the schema name (col_schema_name) and type name (col_type_name) of a column in a dynamic query.

Syntax

```

TYPE desc_rec4 IS RECORD (
  col_type          binary_integer := 0,
  col_max_len      binary_integer := 0,
  col_name         varchar2(32767) := '',
  col_name_len     binary_integer := 0,
  col_schema_name  DBMS_ID := '',

```

```

col_schema_name_len    binary_integer := 0,
col_precision          binary_integer := 0,
col_scale              binary_integer := 0,
col_charsetid         binary_integer := 0,
col_charsetform       binary_integer := 0,
col_null_ok           boolean := TRUE,
col_type_name         DBMS_ID := '',
col_type_name_len     binary_integer := 0);

```

See Also:

Oracle Database PL/SQL Language Reference for more information about the predefined subtype `DBMS_ID`.

Fields

Table 176-5 DESC_REC4 Fields

Field	Description
col_type	Type of column
col_max_len	Maximum column length
col_name	Name of column
col_name_len	Length of column name
col_schema_name	Column schema name
col_schema_name_len	Length of column schema name
col_precision	Precision of column
col_scale	Scale of column
col_charsetid	Column character set ID
col_charsetform	Column character set form
col_null_ok	NULL column flag; TRUE, if NULL possible
col_type_name	User-define type column type name, this field is valid when col_type is 109
col_type_name_len	Length of user-define type column type name, this field is valid when col_type is 109

Related Topics

- [DESCRIBE_COLUMNS3 Procedure](#)
This procedure describes the specified column. This is an alternative to DESCRIBE_COLUMNS Procedure.

176.8.5 DBMS_SQL BFILE_TABLE Table Type

This is a table of `BFILE`.

Syntax

```
TYPE bfile_table IS TABLE OF BFILE INDEX BY BINARY_INTEGER;
```

176.8.6 DBMS_SQL BINARY_DOUBLE_TABLE Table Type

This is a table of BINARY_DOUBLE.

Syntax

```
TYPE binary_double_table IS TABLE OF BINARY_DOUBLE INDEX BY BINARY_INTEGER;
```

176.8.7 DBMS_SQL BINARY_FLOAT_TABLE Table Type

This is a table of BINARY_FLOAT.

Syntax

```
TYPE binary_float_table IS TABLE OF BINARY_FLOAT INDEX BY BINARY_INTEGER;
```

176.8.8 DBMS_SQL BLOB_TABLE Table Type

This is a table of BLOB.

Syntax

```
TYPE blob_table IS TABLE OF BLOB INDEX BY BINARY_INTEGER;
```

176.8.9 DBMS_SQL BOOLEAN_TABLE Table Type

This is a table of BOOLEAN.

Syntax

```
TYPE boolean_table IS TABLE OF BOOLEAN INDEX BY BINARY_INTEGER;
```

176.8.10 DBMS_SQL CLOB_TABLE Table Type

This is a table of CLOB.

Syntax

```
TYPE clob_table IS TABLE OF CLOB INDEX BY BINARY_INTEGER;
```

176.8.11 DBMS_SQL DATE_TABLE Table Type

This is a table of DATE.

Syntax

```
type date_table IS TABLE OF DATE INDEX BY BINARY_INTEGER;
```

176.8.12 DBMS_SQL DESC_TAB Table Type

This is a table of DESC_REC Record Type.

Syntax

```
TYPE desc_tab IS TABLE OF desc_rec INDEX BY BINARY_INTEGER;
```

Related Topics

- [DBMS_SQL DESC_REC Record Type](#)
This record type holds the describe information for a single column in a dynamic query.

176.8.13 DBMS_SQL DESC_TAB2 Table Type

This is a table of DESC_REC2 Record Type.

Syntax

```
TYPE desc_tab2 IS TABLE OF desc_rec2 INDEX BY BINARY_INTEGER;
```

Related Topics

- [DBMS_SQL DESC_REC2 Record Type](#)
DESC_REC2 is the element type of the DESC_TAB2 table type and the DESCRIBE_COLUMNS2 Procedure.

176.8.14 DBMS_SQL DESC_TAB3 Table Type

This is a table of DESC_REC3 Record Type.

Syntax

```
TYPE desc_tab3 IS TABLE OF desc_rec3 INDEX BY BINARY_INTEGER;
```

Related Topics

- [DBMS_SQL DESC_REC3 Record Type](#)
DESC_REC3 is the element type of the DESC_TAB3 table type and the DESCRIBE_COLUMNS3 Procedure.

176.8.15 DBMS_SQL DESC_TAB4 Table Type

This is a table of DBMS_SQL DESC_REC4 Record Type.

Syntax

```
TYPE DESC_TAB4 IS TABLE OF DESC_REC4 INDEX BY BINARY_INTEGER;
```

Related Topics

- [DBMS_SQL DESC_REC4 Record Type](#)
DESC_REC4 is the element type of the DESC_TAB4 table type and the DESCRIBE_COLUMNS3 Procedure.

176.8.16 DBMS_SQL INTERVAL_DAY_TO_SECOND_TABLE Table Type

This is a table of `DSINTERVAL_UNCONSTRAINED`.

Syntax

```
TYPE interval_day_to_second_Table IS TABLE OF  
    DSINTERVAL_UNCONSTRAINED INDEX BY binary_integer;
```

176.8.17 DBMS_SQL INTERVAL_YEAR_TO_MONTH_TABLE Table Type

This is a table of `YMINTERVAL_UNCONSTRAINED`.

Syntax

```
TYPE interval_year_to_month_table IS TABLE OF YMINTERVAL_UNCONSTRAINED  
    INDEX BY BINARY_INTEGER;
```

176.8.18 DBMS_SQL JSON_TABLE Table Type

This is a table of `JSON`.

Syntax

```
TYPE JSON_TABLE IS TABLE OF JSON INDEX BY BINARY_INTEGER;
```

Related Topics

- [BIND_ARRAY Procedures](#)
- [COLUMN_VALUE Procedure](#)
- [DEFINE_ARRAY Procedure](#)
- [DBMS_JSON Constants](#)

176.8.19 DBMS_SQL NUMBER_TABLE Table Type

This is a table of `NUMBER`.

Syntax

```
TYPE number_table IS TABLE OF NUMBER INDEX BY BINARY_INTEGER;
```

176.8.20 DBMS_SQL TIME_TABLE Table Type

This is a table of `TIME_UNCONSTRAINED`.

Syntax

```
TYPE time_table IS TABLE OF TIME_UNCONSTRAINED INDEX BY BINARY_INTEGER;
```


176.8.21 DBMS_SQL TIME_WITH_TIME_ZONE_TABLE Table Type

This is a table of TIME_TZ_UNCONSTRAINED.

Syntax

```
TYPE time_with_time_zone_table IS TABLE OF TIME_TZ_UNCONSTRAINED  
INDEX BY BINARY_INTEGER;;
```

176.8.22 DBMS_SQL TIMESTAMP_TABLE Table Type

This is a table of TIMESTAMP_UNCONSTRAINED.

Syntax

```
TYPE timestamp_table IS TABLE OF TIMESTAMP_UNCONSTRAINED INDEX BY BINARY_INTEGER;
```

176.8.23 DBMS_SQL TIMESTAMP_WITH_LTZ_TABLE Table Type

This is a table of TIMESTAMP_LTZ_UNCONSTRAINED

Syntax

```
TYPE timestamp_with_ltz_table IS TABLE OF  
TIMESTAMP_LTZ_UNCONSTRAINED INDEX BY binary_integer;
```

176.8.24 DBMS_SQL TIMESTAMP_WITH_TIME_ZONE_TABLE Table Type

This is a table of TIMESTAMP_TZ_UNCONSTRAINED.

Syntax

```
TYPE timestamp_with_time_zone_Table IS TABLE OF  
TIMESTAMP_TZ_UNCONSTRAINED INDEX BY binary_integer;
```

176.8.25 DBMS_SQL UROWID_TABLE Table Type

This is a table of UROWID.

Syntax

```
TYPE urowid_table IS TABLE OF UROWID INDEX BY BINARY_INTEGER;
```

176.8.26 DBMS_SQL VARCHAR2_TABLE Table Type

This is table of VARCHAR2(4000).

Syntax

```
TYPE varchar2_table IS TABLE OF VARCHAR2(4000) INDEX BY BINARY_INTEGER;
```

176.8.27 DBMS_SQL VARCHAR2A Table Type

This is table of VARCHAR2 (32767).

Syntax

```
TYPE varchar2a IS TABLE OF VARCHAR2(32767) INDEX BY BINARY_INTEGER;
```

176.8.28 DBMS_SQL VARCHAR2S Table Type

This is table of VARCHAR2 (256).



Note:

This type has been superseded by the [VARCHAR2A Table Type](#). Although it is currently retained for backward compatibility of legacy code, it is in the process of deprecation and will be de-supported in a future release.

Syntax

```
TYPE varchar2s IS TABLE OF VARCHAR2(256) INDEX BY BINARY_INTEGER;
```

176.8.29 DBMS_SQL VECTOR Table Type

This is a table of VECTOR.

DBMS_SQL bulk operations are supported with this predefined DBMS_SQL TABLE type.

Syntax

```
TYPE VECTOR_Table IS TABLE OF VECTOR INDEX BY BINARY_INTEGER;
```

176.9 Summary of DBMS_SQL Subprograms

This table lists the DBMS_SQL subprograms and briefly describes them.

Table 176-6 DBMS_SQL Package Subprograms

Subprogram	Description
BIND_ARRAY Procedures	Binds a given value to a given collection.
BIND_VARIABLE Procedures	Binds a given value to a given variable.
BIND_VARIABLE_PKG Procedure	Binds a given value to a given package variable.
CLOSE_CURSOR Procedure	Closes given cursor and frees memory.
COLUMN_VALUE Procedure	Returns value of the cursor element for a given position in a cursor.
COLUMN_VALUE_LONG Procedure	Returns a selected part of a LONG column, that has been defined using DEFINE_COLUMN_LONG.

Table 176-6 (Cont.) DBMS_SQL Package Subprograms

Subprogram	Description
DEFINE_ARRAY Procedure	Defines a collection to be selected from the given cursor, used only with <code>SELECT</code> statements.
DEFINE_COLUMN Procedures	Defines a column to be selected from the given cursor, used only with <code>SELECT</code> statements.
DEFINE_COLUMN_CHAR Procedure	Defines a column of type <code>CHAR</code> to be selected from the given cursor, used only with <code>SELECT</code> statements.
DEFINE_COLUMN_LONG Procedure	Defines a <code>LONG</code> column to be selected from the given cursor, used only with <code>SELECT</code> statements.
DEFINE_COLUMN_RAW Procedure	Defines a column of type <code>RAW</code> to be selected from the given cursor, used only with <code>SELECT</code> statements.
DEFINE_COLUMN_ROWID Procedure	Defines a column of type <code>ROWID</code> to be selected from the given cursor, used only with <code>SELECT</code> statements.
DESCRIBE_COLUMNS Procedure	Describes the columns for a cursor opened and parsed through <code>DBMS_SQL</code> .
DESCRIBE_COLUMNS2 Procedure	Describes the specified column, an alternative to DESCRIBE_COLUMNS Procedure .
DESCRIBE_COLUMNS3 Procedure	Describes the specified column, an alternative to DESCRIBE_COLUMNS Procedure .
EXECUTE Function	Executes a given cursor.
EXECUTE_AND_FETCH Function	Executes a given cursor and fetch rows.
FETCH_ROWS Function	Fetches a row from a given cursor.
GET_NEXT_RESULT Procedures	Gets the statement of the next result returned to the caller of the recursive statement or, if this caller sets itself as the client for the recursive statement, the next result returned to this caller as client.
IS_OPEN Function	Returns <code>TRUE</code> if given cursor is open.
LAST_ERROR_POSITION Function	Returns byte offset in the SQL statement text where the error occurred.
LAST_ROW_COUNT Function	Returns cumulative count of the number of rows fetched
LAST_ROW_ID Function	Returns <code>ROWID</code> of last row processed.
LAST_SQL_FUNCTION_CODE Function	Returns SQL function code for statement.
OPEN_CURSOR Functions	Returns cursor ID number of new cursor.
PARSE Procedures	Parses given statement.
RETURN_RESULT Procedures	Returns the result of an executed statement to the client application.
TO_CURSOR_NUMBER Function	Takes an <code>OPENED</code> strongly or weakly-typed ref cursor and transforms it into a <code>DBMS_SQL</code> cursor number.
TO_REFCURSOR Function	Takes an <code>OPENED</code> , <code>PARSED</code> , and <code>EXECUTED</code> cursor and transforms/migrates it into a PL/SQL manageable <code>REF CURSOR</code> (a weakly-typed cursor) that can be consumed by PL/SQL native dynamic SQL switched to use native dynamic SQL.
VARIABLE_VALUE Procedures	Returns value of named variable for given cursor.

Table 176-6 (Cont.) DBMS_SQL Package Subprograms

Subprogram	Description
VARIABLE_VALUE_PKG Procedure	Returns value of named variable for given cursor. It is used to return the values of bind variables inside PL/SQL blocks or DML statements with returning clause for a declared package. The type of the variable must be declared in the package specification.

176.9.1 BIND_ARRAY Procedures

This procedure binds a given value or set of values to a given variable in a cursor, based on the name of the variable in the statement.

Syntax

```
DBMS_SQL.BIND_ARRAY (
    c                IN INTEGER,
    name             IN VARCHAR2,
    <variable>      IN <table_type>
    [,index1        IN INTEGER,
    index2          IN INTEGER] ] );
```

Where the <variable> and its corresponding <table_type> can be any one of the following matching pairs, with BIND_ARRAY being overloaded to accept different data types.

```
bdbl_tab    Binary_Double_Table
bf_tab      Bfile_Table
bflt_tab    Binary_Float_Table
bl_tab      Blob_Table
bool_tab    Boolean_Table
c_tab       Varchar2_Table
c_tab       Varchar2A
cl_tab      Clob_Table
d_tab       Date_Table
ids_tab     Interval_Day_To_Second_Table
iym_tab     Interval_Year_To_Month_Table
j_tab       Json_Table
n_tab       Number_Table
tm_tab      Time_Table
tms_tab     Timestamp_Table
tstz_tab    Timestamp_With_ltz_Table
tstz_tab    Timestamp_With_Time_Zone_Table
ttz_tab     Time_With_Time_Zone_Table
ur_tab      Urowid_Table
v_tab       Vector_Table
```

Parameters

Table 176-7 BIND_ARRAY Procedure Parameters

Parameter	Description
c	ID number of the cursor to which you want to bind a value.
name	Name of the collection in the statement.
variable	Local variable that has been declared as <table_type>. The table type can be one of the predefined options or a user defined collection type. For a full list of predefined DBMS_SQL table types for scalar and LOB collections, see DBMS_SQL Data Structures.
index1	Index for the table element that marks the lower bound of the range.
index2	Index for the table element that marks the upper bound of the range.

Usage Notes

For binding a range, the table must contain the elements that specify the range — `tab(index1)` and `tab(index2)` — but the range does not have to be dense. `index1` must be less than or equal to `index2`. All elements between `tab(index1)` and `tab(index2)` are used in the bind.

If you do not specify indexes in the bind call, and two different binds in a statement specify tables that contain a different number of elements, then the number of elements actually used is the minimum number between all tables. This is also the case if you specify indexes — the minimum range is selected between the two indexes for all tables.

Not all bind variables in a query have to be array binds. Some can be regular binds and the same value are used for each element of the collections in expression evaluations (and so forth).

Bulk Array Binds

Bulk selects, inserts, updates, and deletes can enhance the performance of applications by bundling many calls into one. The `DBMS_SQL` package lets you work on collections of data using the PL/SQL table type.

Table items are unbounded homogeneous collections. In persistent storage, they are like other relational tables and have no intrinsic ordering. But when a table item is brought into the workspace (either by querying or by navigational access of persistent data), or when it is created as the value of a PL/SQL variable or parameter, its elements are given subscripts that can be used with array-style syntax to get and set the values of elements.

The subscripts of these elements need not be dense, and can be any number including negative numbers. For example, a table item can contain elements at locations -10, 2, and 7 only.

When a table item is moved from transient workspace to persistent storage, the subscripts are not stored; the table item is unordered in persistent storage.

At bind time the table is copied out from the PL/SQL buffers into local `DBMS_SQL` buffers (the same as for all scalar types) and then the table is manipulated from the local

DBMS_SQL buffers. Therefore, if you change the table after the bind call, then that change does not affect the way the execute acts.

Example 176-1 Use DBMS_SQL.BIND_ARRAY with VECTOR

```
CREATE TABLE vec_seq_table(
  col_vector VECTOR(1, float32),
  col_seq NUMBER
);

SET SERVEROUTPUT ON;
DECLARE
  cur NUMBER;
  stmt_1 VARCHAR2(255) :=
    'INSERT INTO vec_seq_table(col_vector, col_seq) VALUES (:1, :2)';
  number_array DBMS_SQL.NUMBER_TABLE;
  v_array DBMS_SQL.VECTOR_TABLE;
  rowsProcessed NUMBER;
BEGIN
  FOR cnt IN 1 .. 5 LOOP
    v_array(cnt) := TO_VECTOR([' || cnt || '], 1, float32);
    number_array(cnt) := cnt;
  END LOOP;

  cur := DBMS_SQL.OPEN_CURSOR();
  DBMS_SQL.PARSE(cur, stmt_1, DBMS_SQL.NATIVE);
  DBMS_SQL.BIND_ARRAY(cur, ':1', v_array);
  DBMS_SQL.BIND_ARRAY(cur, ':2', number_array);
  rowsProcessed := DBMS_SQL.EXECUTE(cur);
  DBMS_SQL.CLOSE_CURSOR(cur);
  COMMIT;
END;
/

SELECT * FROM vec_seq_table ORDER BY col_seq;
```

Result:

COL_VECTOR	COL_SEQ
[1.0E+000]	1
[2.0E+000]	2
[3.0E+000]	3
[4.0E+000]	4
[5.0E+000]	5

Example 176-2 Examples Using Bulk DML

This series of examples shows how to use bulk array binds (table items) in the SQL DML statements INSERT, UPDATE and DELETE.

Here is an example of a bulk INSERT statement that demonstrates adding seven new employees to the emp table:

```
DECLARE
  stmt VARCHAR2(200);
  empno_array      DBMS_SQL.NUMBER_TABLE;
  empname_array    DBMS_SQL.VARCHAR2_TABLE;
  jobs_array       DBMS_SQL.VARCHAR2_TABLE;
  mgr_array        DBMS_SQL.NUMBER_TABLE;
  hiredate_array   DBMS_SQL.VARCHAR2_TABLE;
  sal_array        DBMS_SQL.NUMBER_TABLE;
  comm_array       DBMS_SQL.NUMBER_TABLE;
  deptno_array     DBMS_SQL.NUMBER_TABLE;
  c               NUMBER;
  dummy           NUMBER;
BEGIN
  empno_array(1) := 9001;
  empno_array(2) := 9002;
  empno_array(3) := 9003;
  empno_array(4) := 9004;
  empno_array(5) := 9005;
  empno_array(6) := 9006;
  empno_array(7) := 9007;

  empname_array(1) := 'Dopey';
  empname_array(2) := 'Grumpy';
  empname_array(3) := 'Doc';
  empname_array(4) := 'Happy';
  empname_array(5) := 'Bashful';
  empname_array(6) := 'Sneezy';
  empname_array(7) := 'Sleepy';

  jobs_array(1) := 'Miner';
  jobs_array(2) := 'Miner';
  jobs_array(3) := 'Miner';
  jobs_array(4) := 'Miner';
  jobs_array(5) := 'Miner';
  jobs_array(6) := 'Miner';
  jobs_array(7) := 'Miner';

  mgr_array(1) := 9003;
  mgr_array(2) := 9003;
  mgr_array(3) := 9003;
  mgr_array(4) := 9003;
  mgr_array(5) := 9003;
  mgr_array(6) := 9003;
  mgr_array(7) := 9003;

  hiredate_array(1) := '06-DEC-2006';
  hiredate_array(2) := '06-DEC-2006';
  hiredate_array(3) := '06-DEC-2006';
  hiredate_array(4) := '06-DEC-2006';
  hiredate_array(5) := '06-DEC-2006';
  hiredate_array(6) := '06-DEC-2006';
  hiredate_array(7) := '06-DEC-2006';

  sal_array(1) := 1000;
  sal_array(2) := 1000;
  sal_array(3) := 1000;
  sal_array(4) := 1000;
  sal_array(5) := 1000;
  sal_array(6) := 1000;
  sal_array(7) := 1000;
```

```
comm_array(1) := 0;
comm_array(2) := 0;
comm_array(3) := 0;
comm_array(4) := 0;
comm_array(5) := 0;
comm_array(6) := 0;
comm_array(7) := 0;

deptno_array(1) := 11;
deptno_array(2) := 11;
deptno_array(3) := 11;
deptno_array(4) := 11;
deptno_array(5) := 11;
deptno_array(6) := 11;
deptno_array(7) := 11;

stmt := 'INSERT INTO emp VALUES (
      :num_array, :name_array, :jobs_array, :mgr_array, :hiredate_array,
      :sal_array, :comm_array, :deptno_array)';
c := DBMS_SQL.OPEN_CURSOR;
DBMS_SQL.PARSE(c, stmt, DBMS_SQL.NATIVE);
DBMS_SQL.BIND_ARRAY(c, ':num_array', empno_array);
DBMS_SQL.BIND_ARRAY(c, ':name_array', empname_array);
DBMS_SQL.BIND_ARRAY(c, ':jobs_array', jobs_array);
DBMS_SQL.BIND_ARRAY(c, ':mgr_array', mgr_array);
DBMS_SQL.BIND_ARRAY(c, ':hiredate_array', hiredate_array);
DBMS_SQL.BIND_ARRAY(c, ':sal_array', sal_array);
DBMS_SQL.BIND_ARRAY(c, ':comm_array', comm_array);
DBMS_SQL.BIND_ARRAY(c, ':deptno_array', deptno_array);

dummy := DBMS_SQL.EXECUTE(c);
DBMS_SQL.CLOSE_CURSOR(c);
EXCEPTION WHEN OTHERS THEN
  IF DBMS_SQL.IS_OPEN(c) THEN
    DBMS_SQL.CLOSE_CURSOR(c);
  END IF;
  RAISE;
END;
/
SHOW ERRORS;
```

Here is an example of a bulk UPDATE statement that demonstrates updating salaries for four existing employees in the emp table:

```
DECLARE
  stmt VARCHAR2(200);
  empno_array DBMS_SQL.NUMBER_TABLE;
  salary_array DBMS_SQL.NUMBER_TABLE;
  c NUMBER;
  dummy NUMBER;
BEGIN

  empno_array(1) := 7369;
  empno_array(2) := 7876;
  empno_array(3) := 7900;
  empno_array(4) := 7934;

  salary_array(1) := 10000;
  salary_array(2) := 10000;
  salary_array(3) := 10000;
  salary_array(4) := 10000;
```



```

stmt := 'update emp set sal = :salary_array
        WHERE empno = :num_array';
c := DBMS_SQL.OPEN_CURSOR;
DBMS_SQL.PARSE(c, stmt, DBMS_SQL.NATIVE);
DBMS_SQL.BIND_ARRAY(c, ':num_array', empno_array);
DBMS_SQL.BIND_ARRAY(c, ':salary_array', salary_array);
dummy := DBMS_SQL.EXECUTE(c);
DBMS_SQL.CLOSE_CURSOR(c);

EXCEPTION WHEN OTHERS THEN
    IF DBMS_SQL.IS_OPEN(c) THEN
        DBMS_SQL.CLOSE_CURSOR(c);
    END IF;
    RAISE;
END;
/

```

In a `DELETE` statement, for example, you could bind an array in the `WHERE` clause and have the statement be run for each element in the array:

```

DECLARE
    stmt VARCHAR2(200);
    dept_no_array DBMS_SQL.NUMBER_TABLE;
    c NUMBER;
    dummy NUMBER;
begin
    dept_no_array(1) := 10; dept_no_array(2) := 20;
    dept_no_array(3) := 30; dept_no_array(4) := 40;
    dept_no_array(5) := 30; dept_no_array(6) := 40;
    stmt := 'delete from emp where deptno = :dept_array';
    c := DBMS_SQL.OPEN_CURSOR;
    DBMS_SQL.PARSE(c, stmt, DBMS_SQL.NATIVE);
    DBMS_SQL.BIND_ARRAY(c, ':dept_array', dept_no_array, 1, 4);
    dummy := DBMS_SQL.EXECUTE(c);
    DBMS_SQL.CLOSE_CURSOR(c);

    EXCEPTION WHEN OTHERS THEN
        IF DBMS_SQL.IS_OPEN(c) THEN
            DBMS_SQL.CLOSE_CURSOR(c);
        END IF;
        RAISE;
END;
/

```

In the preceding example, only elements 1 through 4 are used as specified by the `BIND_ARRAY` call. Each element of the array potentially deletes a large number of employees from the database.

176.9.2 BIND_VARIABLE Procedures

These procedures bind a given value or set of values to a given variable in a cursor, based on the name of the variable in the statement.

Syntax

```

DBMS_SQL.BIND_VARIABLE (
    c                IN INTEGER,
    name             IN VARCHAR2,
    value            IN <datatype>);

```

Where <datatype> can be any one of the following types:

```
ADT (user-defined object types)
BINARY_DOUBLE
BINARY_FLOAT
BFILE
BLOB
BOOLEAN
CLOB CHARACTER SET ANY_CS
DATE
DSINTERVAL_UNCONSTRAINED
JSON
NESTED table
NUMBER
OPAQUE types
REF
TIME_UNCONSTRAINED
TIME_TZ_UNCONSTRAINED
TIMESTAMP_LTZ_UNCONSTRAINED
TIMESTAMP_TZ_UNCONSTRAINED
TIMESTAMP_UNCONSTRAINED
UROWID
VARCHAR2 CHARACTER SET ANY_CS
VARRAY
VECTOR
YMINTERVAL_UNCONSTRAINED
```

Notice that `BIND_VARIABLE` is overloaded to accept different data types.

The following syntax is also supported for `BIND_VARIABLE`. The square brackets `[]` indicate an optional parameter for the `BIND_VARIABLE` procedure.

```
DBMS_SQL.BIND_VARIABLE (
    c           IN INTEGER,
    name        IN VARCHAR2,
    value       IN VARCHAR2 CHARACTER SET ANY_CS [,out_value_size IN INTEGER]);
```

To bind `CHAR`, `RAW`, and `ROWID` data, you can use the following variations on the syntax:

```
DBMS_SQL.BIND_VARIABLE_CHAR (
    c           IN INTEGER,
    name        IN VARCHAR2,
    value       IN CHAR CHARACTER SET ANY_CS [,out_value_size IN INTEGER]);
```

```
DBMS_SQL.BIND_VARIABLE_RAW (
    c           IN INTEGER,
    name        IN VARCHAR2,
    value       IN RAW [,out_value_size IN INTEGER]);
```

```
DBMS_SQL.BIND_VARIABLE_ROWID (
    c           IN INTEGER,
    name        IN VARCHAR2,
    value       IN ROWID);
```

Pragmas

```
pragma restrict_references(bind_variable,WNDS);
```

Parameters

Table 176-8 BIND_VARIABLE Procedures Parameters

Parameter	Description
c	ID number of the cursor to which you want to bind a value.
name	Name of the variable in the statement. The length of the bind variable name must be <=30 bytes.
value	Value that you want to bind to the variable in the cursor. For IN and IN/OUT variables, the value has the same type as the type of the value being passed in for this parameter.
out_value_size	Maximum expected OUT value size, in bytes, for the VARCHAR2, RAW, CHAR OUT or IN/OUT variable. If no size is given, then the length of the current value is used. This parameter must be specified if the value parameter is not initialized.

Usage Notes

If the variable is an IN or IN/OUT variable or an IN collection, then the given bind value must be valid for the variable or array type. Bind values for OUT variables are ignored.

The bind variables or collections of a SQL statement are identified by their names. When binding a value to a bind variable or bind array, the string identifying it in the statement must contain a leading colon, as shown in the following example:

```
SELECT emp_name FROM emp WHERE SAL > :X;
```

For this example, the corresponding bind call would look similar to

```
BIND_VARIABLE(cursor_name, ':X', 3500);
```

or

```
BIND_VARIABLE (cursor_name, 'X', 3500);
```

176.9.3 BIND_VARIABLE_PKG Procedure

This procedure binds a variable given value or set of values to a given variable in a cursor, based on the name of the variable in the statement. The type of the variable must be declared in the package specification. Bulk operations are not supported for these types.

Syntax

```
DBMS_SQL.BIND_VARIABLE_PKG (
  c           IN INTEGER,
  name       IN VARCHAR2,
  value      IN <datatype>);
```

Where <datatype> can be any one of the following data types:

- RECORD
- VARRAY

- NESTED TABLE
- INDEX BY PLS_INTEGER TABLE
- INDEX BY BINARY_INTEGER TABLE

Table 176-9 BIND_VARIABLE_PKG Parameters

Parameter	Description
c	ID number of the cursor from which to get the values.
name	Name of the variable in the statement for which you are retrieving the value.
value	<ul style="list-style-type: none"> • Single row option: Returns the value of the variable for the specified position. Oracle raises the exception <code>ORA-06562, inconsistent_type</code>, if the type of this output parameter differs from the actual type of the value, as defined by the call to <code>BIND_VARIABLE_PKG</code>. • Array option: Local variable that has been declared <code><table_type></code>

Example 176-3 Dynamic SQL using DBMS_SQL.BIND_VARIABLE_PKG to Bind a Package Variable

The variables types are declared in the package specification. The `BIND_VARIABLE_PKG` is used to bind the variable `v1` in the cursor SQL statement.

```

CREATE OR REPLACE PACKAGE ty_pkg AS
    TYPE rec IS RECORD ( n1 NUMBER, n2 NUMBER);
    TYPE trec IS TABLE OF REC INDEX BY BINARY_INTEGER;
    TYPE trecv IS TABLE OF NUMBER;
    TYPE trecv IS VARRAY(100) OF NUMBER;
END ty_pkg;
/
CREATE OR REPLACE PROCEDURE dyn_sql_ibbi AS
    dummy NUMBER;
    cur NUMBER;
    v1 ty_pkg.trec;
    str VARCHAR2(3000);
    n1 NUMBER;
    n2 NUMBER;
BEGIN
    FOR i in 1..3 LOOP
        v1(i).n1 := i*10;
        v1(i).n2 := i*20;
    END LOOP;
    str := 'SELECT * FROM TABLE(:v1) ' ;
    cur := DBMS_SQL.OPEN_CURSOR();
    DBMS_SQL.PARSE(cur, str, DBMS_SQL.NATIVE);
    DBMS_SQL.BIND_VARIABLE_PKG(cur, ':v1', v1);
    dummy := DBMS_SQL.EXECUTE(cur);
    DBMS_SQL.DEFINE_COLUMN(cur, 1, n1);
    DBMS_SQL.DEFINE_COLUMN(cur, 2, n2);

```

```

LOOP
  IF DBMS_SQL.FETCH_ROWS(cur) > 0 THEN
    -- get column values of the row
    DBMS_SQL.COLUMN_VALUE(cur, 1, n1);
    DBMS_SQL.COLUMN_VALUE(cur, 2, n2);
    DBMS_OUTPUT.PUT_LINE('n1 = '||n1||' n2 = '||n2);
  ELSE
    -- No more rows
    EXIT;
  END IF;
END LOOP;
DBMS_SQL.CLOSE_CURSOR(cur);
END dyn_sql_ibbi;
/
EXEC dyn_sql_ibbi;

n1 = 10 n2 = 20
n1 = 20 n2 = 40
n1 = 30 n2 = 60

```

176.9.4 CLOSE_CURSOR Procedure

This procedure closes a given cursor.

Syntax

```
DBMS_SQL.CLOSE_CURSOR (
  c      IN OUT INTEGER);
```

Pragmas

```
pragma restrict_references(close_cursor,RNDS,WNDS);
```

Parameters

Table 176-10 CLOSE_CURSOR Procedure Parameters

Parameter	Mode	Description
c	IN	ID number of the cursor that you want to close.
c	OUT	Cursor is set to null. After you call CLOSE_CURSOR, the memory allocated to the cursor is released and you can no longer fetch from that cursor.

176.9.5 COLUMN_VALUE Procedure

This procedure returns the value of the cursor element for a given position in a given cursor. This procedure is used to access the data fetched by calling `FETCH_ROWS`.

Syntax

```
DBMS_SQL.COLUMN_VALUE (
    c           IN  INTEGER,
    position    IN  INTEGER,
    value       OUT <datatype>
    [,column_error OUT NUMBER]
    [,actual_length OUT INTEGER]);
```

Where square brackets [] indicate optional parameters and <datatype> can be any one of the following types:

```
BINARY_DOUBLE
BINARY_FLOAT
BFILE
BLOB
BOOLEAN
CLOB CHARACTER SET ANY_CS
DATE
DSINTERVAL_UNCONSTRAINED
JSON
NUMBER
TIME_TZ_UNCONSTRAINED
TIME_UNCONSTRAINED
TIMESTAMP_LTZ_UNCONSTRAINED
TIMESTAMP_TZ_UNCONSTRAINED
TIMESTAMP_UNCONSTRAINED
UROWID
VARCHAR2 CHARACTER SET ANY_CS
VECTOR
YMINTERVAL_UNCONSTRAINED
user-defined object types
collections (VARRAYs and nested tables)
REFs
Opaque types
```

For variables containing CHAR, RAW, and ROWID data, you can use the following variations on the syntax:

```
DBMS_SQL.COLUMN_VALUE_CHAR (
    c           IN  INTEGER,
    position    IN  INTEGER,
    value       OUT CHAR CHARACTER SET ANY_CS
    [,column_error OUT NUMBER]
    [,actual_length OUT INTEGER]);
```

```
DBMS_SQL.COLUMN_VALUE_RAW (
    c           IN  INTEGER,
    position    IN  INTEGER,
    value       OUT RAW
    [,column_error OUT NUMBER]
    [,actual_length OUT INTEGER]);
```

```
DBMS_SQL.COLUMN_VALUE_ROWID (
```

```

c          IN  INTEGER,
position   IN  INTEGER,
value      OUT ROWID
[,column_error OUT NUMBER]
[,actual_length OUT INTEGER]);

```

The following syntax enables the `COLUMN_VALUE` procedure to accommodate bulk operations:

```

DBMS_SQL.COLUMN_VALUE(
  c          IN          INTEGER,
  position   IN          INTEGER,
  <param_name> IN OUT NOCOPY <table_type>);

```

Where the `<param_name>` and its corresponding `<table_type>` can be any one of these matching pairs:

```

bdbl_tab    Binary_Double_Table
bf_tab      Bfile_Table
bflt_tab    Binary_Float_Table
bl_tab      Blob_Table
bool_tab    Boolean_Table
c_tab       Varchar2_Table
c_tab       Varchar2A
cl_tab      Clob_Table
d_tab       Date_Table
ids_tab     Interval_Day_To_Second_Table
iym_tab     Interval_Year_To_Month_Table
j_tab       Json_table
n_tab       Number_Table
tm_tab      Time_Table
tms_tab     Timestamp_Table
tstz_tab    Timestamp_With_ltz_Table
tstz_tab    Timestamp_With_Time_Zone_Table
ttz_tab     Time_With_Time_Zone_Table
ur_tab      Urowid_Table
v_tab       Vector_Table

```

Pragmas

```
pragma restrict_references(column_value,RNDS,WNDS);
```

Parameters

Table 176-11 COLUMN_VALUE Procedure Parameters (Single Row)

Parameter	Description
c	ID number of the cursor from which you are fetching the values.
position	Relative position of the column in the cursor. The first column in a statement has position 1.
value	Returns the value at the specified column. Oracle raises exception <code>ORA-06562, inconsistent_type</code> , if the type of this output parameter differs from the actual type of the value, as defined by the call to <code>DEFINE_COLUMN</code> .
column_error	Returns any error code for the specified column value.

Table 176-11 (Cont.) COLUMN_VALUE Procedure Parameters (Single Row)

Parameter	Description
actual_length	The actual length, before any truncation, of the value in the specified column.

Table 176-12 COLUMN_VALUE Procedure Parameters (Bulk)

Parameter	Description
c	ID number of the cursor from which you are fetching the values.
position	Relative position of the column in the cursor. The first column in a statement has position 1.
<param_name>	Local variable that has been declared <table_type>. <param_name> is an IN OUT NOCOPY parameter for bulk operations. For bulk operations, the subprogram appends the new elements at the appropriate (implicitly maintained) index. For instance if on utilizing the DEFINE_ARRAY Procedure a batch size (the cnt parameter) of 10 rows was specified and a start index (lower_bound) of 1 was specified, then the first call to this subprogram after calling the FETCH_ROWS Function will populate elements at index 1..10, and the next call will populate elements 11..20, and so on.

Exceptions

INCONSISTENT_TYPE (ORA-06562) is raised if the type of the given OUT parameter value is different from the actual type of the value. This type was the given type when the column was defined by calling procedure DEFINE_COLUMN.

Example 176-4 Use COLUMN_VALUE Procedure with the VECTOR Data Type

This example demonstrates using the COLUMN_VALUE procedure along with the procedures DEFINE_ARRAY, the table type VECTOR_Table, and the function FROM_VECTOR to interact with a table with a VECTOR column.

```
DROP TABLE dbmsSqlTable;
CREATE TABLE dbmsSqlTable (embedding VECTOR(3, float32), id NUMBER);
INSERT INTO dbmsSqlTable VALUES ('[1.11, 2.22, 3.33]', 1);
INSERT INTO dbmsSqlTable VALUES ('[4.44, 5.55, 6.66]', 2);
INSERT INTO dbmsSqlTable VALUES ('[7.77, 8.88, 9.99]', 3);

SET SERVEROUTPUT ON;

DECLARE
    cur NUMBER;
    stmt_1 VARCHAR2(255) := 'SELECT embedding FROM dbmsSqlTable ORDER BY id';
    vecArray DBMS_SQL.VECTOR_TABLE;
    rowsProcessed NUMBER;
BEGIN
    cur := DBMS_SQL.OPEN_CURSOR();
    DBMS_SQL.PARSE(cur, stmt_1, DBMS_SQL.NATIVE);
    DBMS_SQL.DEFINE_ARRAY(cur, 1, vecArray, 3, 1);
```



```

rowsProcessed := DBMS_SQL.EXECUTE_AND_FETCH(cur);

FOR i IN 1..rowsProcessed LOOP
    DBMS_SQL.COLUMN_VALUE(cur, 1, vecArray);
    DBMS_OUTPUT.PUT_LINE('fetched ID ' || i || ': ' ||
FROM_VECTOR(vecArray(i)));
END LOOP;
DBMS_SQL.CLOSE_CURSOR(cur);
END;
/

```

Result:

```

fetched ID 1: [1.11000001E+000,2.22000003E+000,3.32999992E+000]
fetched ID 2: [4.44000006E+000,5.55000019E+000,6.65999985E+000]
fetched ID 3: [7.76999998E+000,8.88000011E+000,9.98999977E+000]

```

176.9.6 COLUMN_VALUE_LONG Procedure

This procedure gets part of the value of a long column.

Syntax

```

DBMS_SQL.COLUMN_VALUE_LONG (
    c           IN  INTEGER,
    position    IN  INTEGER,
    length      IN  INTEGER,
    offset      IN  INTEGER,
    value       OUT VARCHAR2,
    value_length OUT INTEGER);

```

Pragmas

```
pragma restrict_references(column_value_long,RNDS,WNDS);
```

Parameters

Table 176-13 COLUMN_VALUE_LONG Procedure Parameters

Parameter	Description
c	Cursor ID number of the cursor from which to get the value.
position	Position of the column of which to get the value.
length	Number of bytes of the long value to fetch.
offset	Offset into the long field for start of fetch.
value	Value of the column as a VARCHAR2.
value_length	Number of bytes actually returned in value.

176.9.7 DEFINE_ARRAY Procedure

This procedure defines the collection for column into which you want to fetch rows (with a FETCH_ROWS call). This procedure lets you do batch fetching of rows from a

single `SELECT` statement. A single fetch call brings over a number of rows into the PL/SQL aggregate object.

When you fetch the rows, they are copied into `DBMS_SQL` buffers until you run a `COLUMN_VALUE` call, at which time the rows are copied into the table that was passed as an argument to the `COLUMN_VALUE` call.

Syntax

```
DBMS_SQL.DEFINE_ARRAY (
  c                IN INTEGER,
  position         IN INTEGER,
  <variable>      IN <table_type>
  cnt             IN INTEGER,
  lower_bound     IN INTEGER);
```

Where `<variable>` and its corresponding `<table_type>` can be any one of the following matching pairs, with `DEFINE_ARRAY` being overloaded to accept different data types:

<code>bdbl_tab</code>	<code>Binary_Double_Table</code>
<code>bf_tab</code>	<code>Bfile_Table</code>
<code>bflt_tab</code>	<code>Binary_Float_Table</code>
<code>bl_tab</code>	<code>Blob_Table</code>
<code>bool_tab</code>	<code>Boolean_Table</code>
<code>c_tab</code>	<code>Varchar2_Table</code>
<code>c_tab</code>	<code>Varchar2A</code>
<code>cl_tab</code>	<code>Clob_Table</code>
<code>d_tab</code>	<code>Date_Table</code>
<code>ids_tab</code>	<code>Interval_Day_To_Second_Table</code>
<code>iym_tab</code>	<code>Interval_Year_To_Month_Table</code>
<code>j_tab</code>	<code>Json_Table</code>
<code>n_tab</code>	<code>Number_Table</code>
<code>tm_tab</code>	<code>Time_Table</code>
<code>tms_tab</code>	<code>Timestamp_Table</code>
<code>tstz_tab</code>	<code>Timestamp_With_ltz_Table</code>
<code>tstz_tab</code>	<code>Timestamp_With_Time_Zone_Table</code>
<code>ttz_tab</code>	<code>Time_With_Time_Zone_Table</code>
<code>ur_tab</code>	<code>Urowid_Table</code>
<code>v_tab</code>	<code>Vector_Table</code>

Pragmas

```
pragma restrict_references (define_array,RNDS,WNDS);
```

The subsequent `FETCH_ROWS` call fetch "count" rows. When the `COLUMN_VALUE` call is made, these rows are placed in positions `lower_bound`, `lower_bound+1`, `lower_bound+2`, and so on. While there are still rows coming, the user keeps issuing `FETCH_ROWS/COLUMN_VALUE` calls. The rows keep accumulating in the table specified as an argument in the `COLUMN_VALUE` call.

Parameters

Table 176-14 DEFINE_ARRAY Procedure Parameters

Parameter	Description
c	ID number of the cursor to which you want to bind an array.
position	Relative position of the column in the array being defined. The first column in a statement has position 1.
variable	Local variable that has been declared as <table_type>. The table type can be one of the predefined options or a user defined collection type. For a full list of predefined DBMS_SQL table types for scalar and LOB collections, see DBMS_SQL Data Structures .
cnt	Number of rows that must be fetched.
lower_bound	Results are copied into the collection, starting at this lower bound index.

Usage Notes

The count (cnt) must be an integer greater than zero; otherwise an exception is raised. The lower_bound can be positive, negative, or zero. A query on which a DEFINE_ARRAY call was issued cannot contain array binds.

Examples

```

PROCEDURE BULK_PLSQL(deptid NUMBER)
  TYPE namelist IS TABLE OF employees.last_name%TYPE;
  TYPE sallist IS TABLE OF employees.salary%TYPE;
  names    namelist;
  sals     sallist;
  c        NUMBER;
  r        NUMBER;
  sql_stmt VARCHAR2(32767) :=
    'SELECT last_name, salary FROM employees WHERE department_id = :b1';

BEGIN
  c := DBMS_SQL.OPEN_CURSOR;
  DBMS_SQL.PARSE(c, sql_stmt, dbms_sql.native);

  DBMS_SQL.BIND_VARIABLE(c, 'b1', deptid);

  DBMS_SQL.DEFINE_ARRAY(c, 1, names, 5);
  DBMS_SQL.DEFINE_ARRAY(c, 2, sals, 5);

  r := DBMS_SQL.EXECUTE(c);

  LOOP
    r := DBMS_SQL.FETCH_ROWS(c);
    DBMS_SQL.COLUMN_VALUE(c, 1, names);
    DBMS_SQL.COLUMN_VALUE(c, 2, sals);
    EXIT WHEN r != 5;
  END LOOP;

  DBMS_SQL.CLOSE_CURSOR(c);

  -- loop through the names and sals collections
  FOR i IN names.FIRST .. names.LAST LOOP

```

```

        DBMS_OUTPUT.PUT_LINE('Name = ' || names(i) || ', salary = ' || sals(i));
    END LOOP;
END;
/

```

Example 176-5 Example: Defining an Array

The following examples show how to use the `DEFINE_ARRAY` procedure:

```

declare
    c      NUMBER;
    d      NUMBER;
    n_tab  DBMS_SQL.NUMBER_TABLE;
    indx   NUMBER := -10;
BEGIN
    c := DBMS_SQL.OPEN_CURSOR;
    dbms_sql.parse(c, 'select n from t order by 1', DBMS_SQL.NATIVE);

    DBMS_SQL.DEFINE_ARRAY(c, 1, n_tab, 10, indx);

    d := DBMS_SQL.EXECUTE(c);
    loop
        d := DBMS_SQL.FETCH_ROWS(c);

        DBMS_SQL.COLUMN_VALUE(c, 1, n_tab);

        EXIT WHEN d != 10;
    END LOOP;

    DBMS_SQL.CLOSE_CURSOR(c);

    EXCEPTION WHEN OTHERS THEN
        IF DBMS_SQL.IS_OPEN(c) THEN
            DBMS_SQL.CLOSE_CURSOR(c);
        END IF;
        RAISE;
END;
/

```

Each time the preceding example calls [FETCH_ROWS Function](#), it fetches 10 rows that are kept in `DBMS_SQL` buffers. When the [COLUMN_VALUE Procedure](#) is called, those rows move into the PL/SQL table specified (in this case `n_tab`), at positions -10 to -1, as specified in the `DEFINE` statements. When the second batch is fetched in the loop, the rows go to positions 0 to 9; and so on.

A current index into each array is maintained automatically. This index is initialized to "indx" at `EXECUTE` time and is updated every time `COLUMN_VALUE` is called. If you reexecute at any point, then the current index for each `DEFINE` is reinitialized to "indx".

In this way the entire result of the query is fetched into the table. When `FETCH_ROWS` cannot fetch 10 rows, it returns the number of rows actually fetched (if no rows could be fetched, then it returns zero) and exits the loop.

Here is another example of using the `DEFINE_ARRAY` procedure:

Consider a table `MULTI_TAB` defined as:

```

CREATE TABLE multi_tab (num NUMBER,
                        dat1 DATE,
                        var VARCHAR2(24),
                        dat2 DATE)

```

To select everything from this table and move it into four PL/SQL tables, you could use the following simple program:

```

DECLARE
    c          NUMBER;
    d          NUMBER;
    n_tab      DBMS_SQL.NUMBER_TABLE;
    d_tab1     DBMS_SQL.DATE_TABLE;
    v_tab      DBMS_SQL.VARCHAR2_TABLE;
    d_tab2     DBMS_SQL.DATE_TABLE;
    indx       NUMBER := 10;
BEGIN

    c := DBMS_SQL.OPEN_CURSOR;
    DBMS_SQL.PARSE(c, 'select * from multi_tab order by 1', DBMS_SQL.NATIVE);

    DBMS_SQL.DEFINE_ARRAY(c, 1, n_tab, 5, indx);
    DBMS_SQL.DEFINE_ARRAY(c, 2, d_tab1, 5, indx);
    DBMS_SQL.DEFINE_ARRAY(c, 3, v_tab, 5, indx);
    DBMS_SQL.DEFINE_ARRAY(c, 4, d_tab2, 5, indx);

    d := DBMS_SQL.EXECUTE(c);

    LOOP
        d := DBMS_SQL.FETCH_ROWS(c);

        DBMS_SQL.COLUMN_VALUE(c, 1, n_tab);
        DBMS_SQL.COLUMN_VALUE(c, 2, d_tab1);
        DBMS_SQL.COLUMN_VALUE(c, 3, v_tab);
        DBMS_SQL.COLUMN_VALUE(c, 4, d_tab2);

        EXIT WHEN d != 5;
    END LOOP;

    DBMS_SQL.CLOSE_CURSOR(c);

/*

The four tables can be used for anything. One usage might be to use BIND_ARRAY to
move the rows to another table by using a statement such as 'INSERT into SOME_T
values (:a, :b, :c, :d);

*/

EXCEPTION WHEN OTHERS THEN
    IF DBMS_SQL.IS_OPEN(c) THEN
        DBMS_SQL.CLOSE_CURSOR(c);
    END IF;
    RAISE;
END;
/

```

176.9.8 DEFINE_COLUMN Procedures

This procedure defines a column to be selected from the given cursor. This procedure is only used with `SELECT` cursors.

The column being defined is identified by its relative position in the `SELECT` list of the statement in the given cursor. The type of the `COLUMN` value determines the type of the column being defined.

See also the [DEFINE_COLUMN_CHAR Procedure](#), [DEFINE_COLUMN_LONG Procedure](#), [DEFINE_COLUMN_RAW Procedure](#) and [DEFINE_COLUMN_ROWID Procedure](#).

Syntax

```
DBMS_SQL.DEFINE_COLUMN (
    c           IN INTEGER,
    position    IN INTEGER,
    column      IN <datatype>);
```

Where <datatype> can be any one of the following types:

```
BINARY_DOUBLE
BINARY_FLOAT
BFILE
BLOB
BOOLEAN
CLOB CHARACTER SET ANY_CS
DATE
DSINTERVAL_UNCONSTRAINED
JSON
NUMBER
TIME_UNCONSTRAINED
TIME_TZ_UNCONSTRAINED
TIMESTAMP_LTZ_UNCONSTRAINED
TIMESTAMP_TZ_UNCONSTRAINED
TIMESTAMP_UNCONSTRAINED
UROWID
VECTOR
YMINTERVAL_UNCONSTRAINED
user-defined object types
collections (VARRAYs and nested tables)
REFs
Opaque types
```

Note that `DEFINE_COLUMN` is overloaded to accept different datatypes.

The following syntax is also supported for the `DEFINE_COLUMN` procedure:

```
DBMS_SQL.DEFINE_COLUMN (
    c           IN INTEGER,
    position    IN INTEGER,
    column      IN VARCHAR2 CHARACTER SET ANY_CS,
    column_size IN INTEGER);
```

Pragmas

```
pragma restrict_references (define_column, RNDS, WNDS);
```

Parameters

Table 176-15 DEFINE_COLUMN Procedure Parameters

Parameter	Description
c	ID number of the cursor for the row being defined to be selected.
position	Relative position of the column in the row being defined. The first column in a statement has position 1.

Table 176-15 (Cont.) DEFINE_COLUMN Procedure Parameters

Parameter	Description
column	Value of the column being defined. The type of this value determines the type for the column being defined.
column_size	Maximum expected size of the column value in bytes for columns of type VARCHAR2.

Usage Notes

When using character length semantics the maximum number of bytes that can be returned for a column value of type VARCHAR2 is calculated as: `column_size * maximum character byte size for the current character set`. For example, specifying the `column_size` as 10 means that a maximum of 30 (10*3) bytes can be returned when using character length semantics with a UTF8 character set regardless of the number of characters this represents.

176.9.9 DEFINE_COLUMN_CHAR Procedure

This procedure defines a column with CHAR data to be selected from the given cursor. This procedure is only used with SELECT cursors.

The column being defined is identified by its relative position in the SELECT list of the statement in the given cursor. The type of the COLUMN value determines the type of the column being defined.

See also the [DEFINE_COLUMN Procedures](#), [DEFINE_COLUMN_LONG Procedure](#), [DEFINE_COLUMN_RAW Procedure](#) and [DEFINE_COLUMN_ROWID Procedure](#).

Syntax

```
DBMS_SQL.DEFINE_COLUMN_CHAR (
    c           IN INTEGER,
    position    IN INTEGER,
    column      IN CHAR CHARACTER SET ANY_CS,
    column_size IN INTEGER);
```

Pragmas

```
pragma restrict_references(define_column,RNDS,WNDS);
```

Parameters

Table 176-16 DEFINE_COLUMN_CHAR Procedure Parameters

Parameter	Description
c	ID number of the cursor for the row being defined to be selected
position	Relative position of the column in the row being defined. The first column in a statement has position 1.
column	Value of the column being defined. The type of this value determines the type for the column being defined.

Table 176-16 (Cont.) DEFINE_COLUMN_CHAR Procedure Parameters

Parameter	Description
column_size	Maximum expected size of the column value in characters for columns of type CHAR.

176.9.10 DEFINE_COLUMN_LONG Procedure

This procedure defines a LONG column for a SELECT cursor. The column being defined is identified by its relative position in the SELECT list of the statement for the given cursor. The type of the COLUMN value determines the type of the column being defined.

See also the [DEFINE_COLUMN Procedures](#), [DEFINE_COLUMN_CHAR Procedure](#), [DEFINE_COLUMN_RAW Procedure](#) and [DEFINE_COLUMN_ROWID Procedure](#).

Syntax

```
DBMS_SQL.DEFINE_COLUMN_LONG (
    c           IN INTEGER,
    position    IN INTEGER);
```

Parameters

Table 176-17 DEFINE_COLUMN_LONG Procedure Parameters

Parameter	Description
c	ID number of the cursor for the row being defined to be selected.
position	Relative position of the column in the row being defined. The first column in a statement has position 1.

176.9.11 DEFINE_COLUMN_RAW Procedure

This procedure defines a column of type RAW to be selected from the given cursor.

This procedure is only used with SELECT cursors.

The column being defined is identified by its relative position in the SELECT list of the statement in the given cursor. The type of the COLUMN value determines the type of the column being defined.

See also the [DEFINE_COLUMN Procedures](#), [DEFINE_COLUMN_CHAR Procedure](#), [DEFINE_COLUMN_LONG Procedure](#) and [DEFINE_COLUMN_ROWID Procedure](#).

Syntax

```
DBMS_SQL.DEFINE_COLUMN_RAW (
    c           IN INTEGER,
    position    IN INTEGER,
    column      IN RAW,
    column_size IN INTEGER);
```


Pragmas

```
pragma restrict_references(define_column,RNDS,WNDS);
```

Parameters**Table 176-18 DEFINE_COLUMN_RAW Procedure Parameters**

Parameter	Description
c	ID number of the cursor for the row being defined to be selected.
position	Relative position of the column in the row being defined. The first column in a statement has position 1.
column	Value of the column being defined. The type of this value determines the type for the column being defined.
column_size	Maximum expected size of the column value in bytes for columns of RAW type.

176.9.12 DEFINE_COLUMN_ROWID Procedure

This procedure defines a column of type `ROWID` to be selected from the given cursor. This procedure is only used with `SELECT` cursors.

The column being defined is identified by its relative position in the `SELECT` list of the statement in the given cursor. The type of the `COLUMN` value determines the type of the column being defined.

See also the [DEFINE_COLUMN Procedures](#), [DEFINE_COLUMN_CHAR Procedure](#), [DEFINE_COLUMN_LONG Procedure](#) and [DEFINE_COLUMN_RAW Procedure](#).

Syntax

```
DBMS_SQL.DEFINE_COLUMN_ROWID (
  c           IN INTEGER,
  position    IN INTEGER,
  column      IN ROWID);
```

Pragmas

```
pragma restrict_references(define_column,RNDS,WNDS);
```

Parameters**Table 176-19 DEFINE_COLUMN_ROWID Procedure Parameters**

Parameter	Description
c	ID number of the cursor for the row being defined to be selected
position	Relative position of the column in the row being defined. The first column in a statement has position 1.
column	Value of the column being defined. The type of this value determines the type for the column being defined.

176.9.13 DESCRIBE_COLUMNS Procedure

This procedure describes the columns for a cursor opened and parsed through `DBMS_SQL`.

Syntax

```
DBMS_SQL.DESCRIBE_COLUMNS (
  c           IN  INTEGER,
  col_cnt    OUT INTEGER,
  desc_t     OUT DESC_TAB);
```

Parameters

Table 176-20 DESCRIBE_COLUMNS Procedure Parameters

Parameter	Description
<code>c</code>	ID number of the cursor for the columns being described
<code>col_cnt</code>	Number of columns in the select list of the query
<code>desc_t</code>	Describe table to fill in with the description of each of the columns of the query

Example 176-6 Describe Columns

This code can be used as a substitute to the SQL*Plus `DESCRIBE` call by using a `SELECT *` query on the table that you want to describe.

```
DECLARE
  c           NUMBER;
  d           NUMBER;
  col_cnt    INTEGER;
  f           BOOLEAN;
  rec_tab    DBMS_SQL.DESC_TAB;
  col_num    NUMBER;
  PROCEDURE print_rec(rec in DBMS_SQL.DESC_REC) IS
  BEGIN
    DBMS_OUTPUT.NEW_LINE;
    DBMS_OUTPUT.PUT_LINE('col_type           = ' || rec.col_type);
    DBMS_OUTPUT.PUT_LINE('col_maxlen        = ' || rec.col_max_len);
    DBMS_OUTPUT.PUT_LINE('col_name         = ' || rec.col_name);
    DBMS_OUTPUT.PUT_LINE('col_name_len     = ' || rec.col_name_len);
    DBMS_OUTPUT.PUT_LINE('col_schema_name  = ' || rec.col_schema_name);
    DBMS_OUTPUT.PUT_LINE('col_schema_name_len = ' ||
rec.col_schema_name_len);
    DBMS_OUTPUT.PUT_LINE('col_precision    = ' || rec.col_precision);
    DBMS_OUTPUT.PUT_LINE('col_scale        = ' || rec.col_scale);
    DBMS_OUTPUT.PUT('col_null_ok          = ');
    IF (rec.col_null_ok) THEN
      DBMS_OUTPUT.PUT_LINE('true');
    ELSE
      DBMS_OUTPUT.PUT_LINE('false');
    END IF;
  END;
BEGIN
```

```

c := DBMS_SQL.OPEN_CURSOR;

DBMS_SQL.PARSE(c, 'SELECT * FROM scott.bonus', DBMS_SQL.NATIVE);

d := DBMS_SQL.EXECUTE(c);

DBMS_SQL.DESCRIBE_COLUMNS(c, col_cnt, rec_tab);

/*
 * Following loop could simply be for j in 1..col_cnt loop.
 * Here we are simply illustrating some of the PL/SQL table
 * features.
 */
col_num := rec_tab.first;
IF (col_num IS NOT NULL) THEN
  LOOP
    print_rec(rec_tab(col_num));
    col_num := rec_tab.next(col_num);
    EXIT WHEN (col_num IS NULL);
  END LOOP;
END IF;

DBMS_SQL.CLOSE_CURSOR(c);
END;
/

```

176.9.14 DESCRIBE_COLUMNS2 Procedure

This procedure describes the specified column. This is an alternative to DESCRIBE_COLUMNS Procedure.

Syntax

```

DBMS_SQL.DESCRIBE_COLUMNS2 (
  c           IN INTEGER,
  col_cnt    OUT INTEGER,
  desc_t     OUT DESC_TAB2);

```

Pragmas

```
PRAGMA RESTRICT_REFERENCES(describe_columns2,WNDS);
```

Parameters

Table 176-21 DESCRIBE_COLUMNS2 Procedure Parameters

Parameter	Description
c	ID number of the cursor for the columns being described.
col_cnt	Number of columns in the select list of the query.
desc_t	Describe table to fill in with the description of each of the columns of the query. This table is indexed from one to the number of elements in the select list of the query.

Related Topics

- [DESCRIBE_COLUMNS Procedure](#)

This procedure describes the columns for a cursor opened and parsed through DBMS_SQL.

176.9.15 DESCRIBE_COLUMNS3 Procedure

This procedure describes the specified column. This is an alternative to DESCRIBE_COLUMNS Procedure.

Syntax

```
DBMS_SQL.DESCRIBE_COLUMNS3 (
  c           IN  INTEGER,
  col_cnt    OUT INTEGER,
  desc_t     OUT DESC_TAB3);
```

```
BMS_SQL.DESCRIBE_COLUMNS3 (
  c           IN  INTEGER,
  col_cnt    OUT INTEGER,
  desc_t     OUT DESC_TAB4);
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES(describe_columns3,WNDS);
```

Parameters**Table 176-22 DESCRIBE_COLUMNS3 Procedure Parameters**

Parameter	Description
c	ID number of the cursor for the columns being described.
col_cnt	Number of columns in the select list of the query.
desc_t	Describe table to fill in with the description of each of the columns of the query. This table is indexed from one to the number of elements in the select list of the query.

Usage Notes

The cursor passed in by the cursor ID has to be OPENED and PARSED, otherwise an "invalid cursor id" error is raised.

Examples

```
CREATE TYPE PROJECT_T AS OBJECT
  ( projname    VARCHAR2(20),
    mgr         VARCHAR2(20) )
/

CREATE TABLE projecttab(deptno NUMBER, project HR.PROJECT_T)
/

DECLARE
  curid      NUMBER;
  desctab    DBMS_SQL.DESC_TAB3;
  colcnt    NUMBER;
  sql_stmt   VARCHAR2(200) := 'select * from projecttab';
```

```

BEGIN

    curid := DBMS_SQL.OPEN_CURSOR;

    DBMS_SQL.PARSE(curid, sql_stmt, DBMS_SQL.NATIVE);

    DBMS_SQL.DESCRIBE_COLUMNS3(curid, colcnt, desctab);

    FOR i IN 1 .. colcnt LOOP
        IF desctab(i).col_type = 109 THEN
            DBMS_OUTPUT.PUT(desctab(i).col_name || ' is user-defined type: ');
            DBMS_OUTPUT.PUT_LINE(desctab(i).col_schema_name || '.' ||
                desctab(i).col_type_name);
        END IF;
    END LOOP;

    DBMS_SQL.CLOSE_CURSOR(curid);
END;
/

```

Output:

```
PROJECT is user-defined type: HR.PROJECT_T
```

Related Topics

- [DESCRIBE_COLUMNS Procedure](#)
This procedure describes the columns for a cursor opened and parsed through DBMS_SQL.

176.9.16 EXECUTE Function

This function executes a given cursor. This function accepts the ID number of the cursor and returns the number of rows processed.

The return value is only valid for INSERT, UPDATE, and DELETE statements; for other types of statements, including DDL, the return value is undefined and must be ignored.

Syntax

```

DBMS_SQL.EXECUTE (
    c    IN INTEGER)
RETURN INTEGER;

```

Parameters

Table 176-23 EXECUTE Function Parameters

Parameter	Description
c	Cursor ID number of the cursor to execute.

Return Values

Returns number of rows processed

Usage Notes

The `DBMS_SQL` cursor that is returned by the `TO_CURSOR_NUMBER` Function performs in the same way as a `DBMS_SQL` cursor that has already been executed. Consequently, calling `EXECUTE` for this cursor will cause an error.

176.9.17 EXECUTE_AND_FETCH Function

This function executes the given cursor and fetches rows.

This function provides the same functionality as calling `EXECUTE` and then calling `FETCH_ROWS`. Calling `EXECUTE_AND_FETCH` instead, however, may reduce the number of network round-trips when used against a remote database.

The `EXECUTE_AND_FETCH` function returns the number of rows actually fetched.

Syntax

```
DBMS_SQL.EXECUTE_AND_FETCH (
    c          IN INTEGER,
    exact      IN BOOLEAN DEFAULT FALSE)
RETURN INTEGER;
```

Pragmas

```
pragma restrict_references (execute_and_fetch, WNDS);
```

Parameters

Table 176-24 EXECUTE_AND_FETCH Function Parameters

Parameter	Description
<code>c</code>	ID number of the cursor to execute and fetch.
<code>exact</code>	Set to <code>TRUE</code> to raise an exception if the number of rows actually matching the query differs from one. Note: Oracle does not support the exact fetch <code>TRUE</code> option with <code>LONG</code> columns. Even if an exception is raised, the rows are still fetched and available.

Return Values

Returns designated rows

176.9.18 FETCH_ROWS Function

This function fetches a row from a given cursor.

You can call `FETCH_ROWS` repeatedly as long as there are rows remaining to be fetched. These rows are retrieved into a buffer, and must be read by calling `COLUMN_VALUE`, for each column, after each call to `FETCH_ROWS`.

The `FETCH_ROWS` function accepts the ID number of the cursor to fetch, and returns the number of rows actually fetched.

Syntax

```
DBMS_SQL.FETCH_ROWS (
    c          IN INTEGER)
RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(fetch_rows,WNDS);
```

Parameters

Table 176-25 FETCH_ROWS Function Parameters

Parameter	Description
c	ID number.

Return Values

Returns a row from a given cursor

176.9.19 GET_NEXT_RESULT Procedures

This procedure gets the statement of the next result returned to the caller of the recursive statement or, if this caller sets itself as the client for the recursive statement, the next result returned to this caller as client.

The statements are returned in same order as they are returned by the [RETURN_RESULT Procedures](#).

Syntax

```
DBMS_SQL.GET_NEXT_RESULT (
    c          IN          INTEGER,
    rc         OUT        SYS_REFCURSOR);
```

```
DBMS_SQL.GET_NEXT_RESULT (
    c          IN          INTEGER,
    rc         OUT        INTEGER);
```

Parameters

Table 176-26 GET_NEXT_RESULT Procedure Parameters

Parameter	Description
c	Recursive statement cursor
rc	Cursor or ref cursor of the statement of the next returned result

Exceptions

ORA-01403 no_data_found: This is raised when there is no further returned statement result.

Usage Notes

- After the cursor of a statement result is retrieved, the caller must close the cursor properly when it is no longer needed.
- The cursors for all unretrieved returned statements will be closed after the cursor of the recursive statement is closed.

Examples

```

DECLARE
  c INTEGER;
  rc SYS_REFCURSOR;
BEGIN
  c := DBMS_SQL.OPEN_CURSOR(treat_as_client_for_results => TRUE);
  DBMS_SQL.PARSE(c          => c,
                 statement   => 'begin proc; end;');
  DBMS_SQL.EXECUTE(c);
  LOOP
    BEGIN
      DBMS_SQL.GET_NEXT_RESULT(c, rc);
    EXCEPTIONS
      WHEN no_data_found THEN
        EXIT;
    END;
    LOOP
      FETCH rc INTO ...
      ...
    END LOOP;
  END LOOP;
END;

```

176.9.20 IS_OPEN Function

This function checks to see if the given cursor is currently open.

Syntax

```

DBMS_SQL.IS_OPEN (
  c          IN INTEGER)
  RETURN BOOLEAN;

```

Pragmas

```
pragma restrict_references(is_open,RNDS,WNDS);
```

Parameters

Table 176-27 IS_OPEN Function Parameters

Parameter	Description
c	Cursor ID number of the cursor to check.

Return Values

Returns `TRUE` for any cursor number that has been opened but not closed, and `FALSE` for a `NULL` cursor number. Note that the [CLOSE_CURSOR Procedure](#) Procedure `NULLS` out the cursor variable passed to it.

Exceptions

ORA-29471 `DBMS_SQL access denied`: This is raised if an invalid cursor ID number is detected. Once a session has encountered and reported this error, every subsequent `DBMS_SQL` call in the same session will raise this error, meaning that `DBMS_SQL` is non-operational for this session.

176.9.21 LAST_ERROR_POSITION Function

This function returns the byte offset in the SQL statement text where the error occurred. The first character in the SQL statement is at position 0.

Syntax

```
DBMS_SQL.LAST_ERROR_POSITION  
    RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(last_error_position,RNDS,WNDS);
```

Return Values

Returns the byte offset in the SQL statement text where the error occurred

Usage Notes

Call this function after a `PARSE` call, before any other `DBMS_SQL` procedures or functions are called.

176.9.22 LAST_ROW_COUNT Function

This function returns the cumulative count of the number of rows fetched.

Syntax

```
DBMS_SQL.LAST_ROW_COUNT  
    RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(last_row_count,RNDS,WNDS);
```

Return Values

Returns the cumulative count of the number of rows fetched

Usage Notes

Call this function after a `FETCH_ROWS` or an `EXECUTE_AND_FETCH` call. If called after an `EXECUTE` call, then the value returned is zero.

176.9.23 LAST_ROW_ID Function

This function returns the ROWID of the last row processed.

Syntax

```
DBMS_SQL.LAST_ROW_ID  
    RETURN ROWID;
```

Pragmas

```
pragma restrict_references(last_row_id,RNDS,WNDS);
```

Return Values

Returns the ROWID of the last row processed

Usage Notes

Call this function after a FETCH_ROWS or an EXECUTE_AND_FETCH call.

176.9.24 LAST_SQL_FUNCTION_CODE Function

This function returns the SQL function code for the statement.

These codes are listed in the *Oracle Call Interface Programmer's Guide*.

Syntax

```
DBMS_SQL.LAST_SQL_FUNCTION_CODE  
    RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(last_sql_function_code,RNDS,WNDS);
```

Return Values

Returns the SQL function code for the statement

Usage Notes

You must call this function immediately after the SQL statement is run; otherwise, the return value is undefined.

176.9.25 OPEN_CURSOR Functions

This function opens a new cursor.

The `security_level` parameter allows for application of fine-grained control to the security of the opened cursor.

Syntax

```
DBMS_SQL.OPEN_CURSOR (  
    treat_as_client_for_results    IN    BOOLEAN    DEFAULT FALSE)  
    RETURN INTEGER;
```

```
DBMS_SQL.OPEN_CURSOR (
    security_level          IN    INTEGER,
    treat_as_client_for_results IN    BOOLEAN    DEFAULT FALSE)
RETURN INTEGER;
```

Parameters

Table 176-28 OPEN_CURSOR Function Parameters

Parameter	Description
security_level	<p>Specifies the level of security protection to enforce on the opened cursor. Valid security level values are 0, 1, and 2. When a NULL argument value is provided to this overload, as well as for cursors opened using the overload of open_cursor without the security_level parameter, the default security level value 1 will be enforced on the opened cursor.</p> <ul style="list-style-type: none"> Level 0 - allows all DBMS_SQL operations on the cursor without any security checks. The cursor may be fetched from, and even re-bound and re-executed, by code running with a different effective userid or roles than those in effect at the time the cursor was parsed. This level of security is off by default. Level 1 - requires that the referenced container, effective userid, and roles of the caller to DBMS_SQL for bind and execute operations on this cursor must be the same as those of the caller of the most recent parse operation on this cursor. Level 2 - requires that the referenced container, effective userid, and roles of the caller to DBMS_SQL for all bind, execute, define, describe, and fetch operations on this cursor must be the same as those of the caller of the most recent parse operation on this cursor.
treat_as_client_for_results	<p>Allows the caller of the recursive statement to set itself as the client to receive the statement results returned from the recursive statement to client. The statement results returned may be retrieved by the GET_NEXT_RESULT Procedures.</p>

Pragmas

```
pragma restrict_references(open_cursor,RNDS,WNDS);
```

Return Values

Returns the cursor ID number of the new cursor

Usage Notes

- When you no longer need this cursor, you must close it explicitly by calling the [CLOSE_CURSOR Procedure](#).
- You can use cursors to run the same SQL statement repeatedly or to run a new SQL statement. When a cursor is reused, the contents of the corresponding cursor data area are reset when the new SQL statement is parsed. It is never necessary to close and reopen a cursor before reusing it.

176.9.26 PARSE Procedures

This procedure parses the given statement in the given cursor. All statements are parsed immediately. In addition, DDL statements are run immediately when parsed.

There are multiple versions of the `PARSE` procedure:

- Taking a `VARCHAR2` statement as an argument
- Taking a segmented string, one taking `VARCHAR2A`, a `TABLE OF VARCHAR2(32767)`, and another, taking `VARCHAR2S`, a `TABLE OF VARCHAR2(256)`, as argument. These overloads concatenate elements of a PL/SQL table statement and parse the resulting string. You can use these procedures to parse a statement that is longer than the limit for a single `VARCHAR2` variable by splitting up the statement.
- Taking a `CLOB` statement as an argument. You can use the `CLOB` overload version of the parse procedure to parse a SQL statement larger than 32K bytes.

Syntax

Each version has multiple overloads.

```
DBMS_SQL.PARSE (
    c                IN    INTEGER,
    statement        IN    VARCHAR2,
    language_flag    IN    INTEGER[
[,edition          IN    VARCHAR2 DEFAULT NULL],
    apply_crossedition_trigger IN    VARCHAR2 DEFAULT NULL,
    fire_apply_trigger IN    BOOLEAN DEFAULT TRUE]
[,schema          IN    VARCHAR2 DEFAULT NULL]
[,container       IN    VARCHAR2]);
```

```
DBMS_SQL.PARSE (
    c                IN    INTEGER,
    statement        IN    CLOB,
    language_flag    IN    INTEGER[
[,edition          IN    VARCHAR2 DEFAULT NULL],
    apply_crossedition_trigger IN    VARCHAR2 DEFAULT NULL,
    fire_apply_trigger IN    BOOLEAN DEFAULT TRUE]
[,schema          IN    VARCHAR2 DEFAULT NULL]
[,container       IN    VARCHAR2]);
```

```
DBMS_SQL.PARSE (
    c                IN    INTEGER,
    statement        IN    VARCHAR2A,
    lb              IN    INTEGER,
    ub              IN    INTEGER,
    lfflg          IN    BOOLEAN,
    language_flag    IN    INTEGER[
[,edition          IN    VARCHAR2 DEFAULT NULL],
    apply_crossedition_trigger IN    VARCHAR2 DEFAULT NULL,
    fire_apply_trigger IN    BOOLEAN DEFAULT TRUE]
[,schema          IN    VARCHAR2 DEFAULT NULL]
[,container       IN    VARCHAR2]);
```

```
DBMS_SQL.PARSE (
    c                IN    INTEGER,
    statement        IN    VARCHAR2s,
    lb              IN    INTEGER,
```

```

ub                IN    INTEGER,
lfflg            IN    BOOLEAN,
language_flag    IN    INTEGER[
[,edition        IN    VARCHAR2 DEFAULT NULL],
  apply_crossedition_trigger IN  VARCHAR2 DEFAULT NULL,
  fire_apply_trigger    IN    BOOLEAN DEFAULT TRUE]
[,schema        IN    VARCHAR2 DEFAULT NULL]
[,container      IN    VARCHAR2)];

```

Parameters

Table 176-29 PARSE Procedure Parameters

Parameter	Description
c	ID number of the cursor in which to parse the statement.
statement	<p>SQL statement to be parsed. SQL statements larger than 32K that may be stored in CLOBs.</p> <p>Unlike a PL/SQL statement, your SQL statement must not include a final semicolon. For example:</p> <pre>DBMS_SQL.PARSE(cursor1, 'BEGIN proc; END;', 2);</pre> <pre>DBMS_SQL.PARSE(cursor1, 'INSERT INTO tab VALUES(1)', 2);</pre>
lb	Lower bound for elements in the statement
ub	Upper bound for elements in the statement
lfflg	If TRUE, then insert a linefeed after each element on concatenation.
language_flag	Specifies the behavior for the SQL statement. For more information about the possible values and its corresponding behaviors, see DBMS_SQL Constants
edition	<p>Specifies the edition in which to run the statement under the following conditions:</p> <ul style="list-style-type: none"> • If NULL and container is NULL, the statement will be run in the current edition. • If a valid container is specified, passing NULL indicates the statement is to run in the target container's default edition. • Given the user and the edition with which the statement is to be executed, the user must have USE privilege on the edition. <p>The following general conditions apply. The contents of the string are processed as a SQL identifier; double quotation marks must surround the remainder of the string if special characters or lowercase characters are present in the edition's actual name, and if double quotation marks are not used the contents will be uppercased.</p>

Table 176-29 (Cont.) PARSE Procedure Parameters

Parameter	Description
<code>apply_crossedition_trigger</code>	Specifies the unqualified name of a forward crossedition trigger that is to be applied to the specified SQL. The name is resolved using the <code>edition</code> and <code>current_schema</code> setting in which the statement is to be executed. The trigger must be owned by the user that will execute the statement. If a non-NULL value is specified, the specified crossedition trigger will be executed assuming <code>fire_apply_trigger</code> is TRUE, the trigger is enabled, the trigger is defined on the table which is the target of the statement, the type of the statement matches the trigger's <code>dml_event_clause</code> , any effective WHEN and UPDATE OF restrictions are satisfied, and so on. Other forward crossedition triggers may also be executed, selected using the "crossedition trigger DML rules" applied as if the specified trigger was doing a further DML to the table that is the target of the statement. Non-crossedition triggers and reverse crossedition triggers will not be executed. The contents of the string are processed as a SQL identifier; double quotation marks must surround the remainder of the string if special characters or lowercase characters are present in the trigger's actual name, and if double quotation marks are not used, the contents will be uppercased.
<code>fire_apply_trigger</code>	Indicates whether the specified <code>apply_crossedition_trigger</code> is itself to be executed, or must only be a guide used in selecting other triggers. This is typically set FALSE when the statement is a replacement for the actions the <code>apply_crossedition_trigger</code> would itself perform. If FALSE, the specified trigger is not executed, but other triggers are still selected for firing as if the specified trigger was doing a DML to the table that is the target of the statement. The <code>apply_crossedition_trigger</code> and <code>fire_apply_trigger</code> parameters are ignored if the statement is not a DML.
<code>schema</code>	Specifies the schema in which to resolve unqualified object names. If NULL, the current schema is the effective user's schema.
<code>container</code>	Name of the target container in which the cursor is to run. If NULL or unspecified, the name of the target container is that of the calling container and no container switch is performed. If a valid container name is specified, the current user must be a common user with SET CONTAINER privilege to switch to the target container. If a container switch completes, the effective user will have its default roles.

Usage Notes

- Using DBMS_SQL to dynamically run DDL statements can cause the program to stop responding. For example, a call to a procedure in a package results in the package being locked until the execution returns to the user side. Any operation that results in a conflicting lock, such as dynamically trying to drop the package before the first lock is released, stops the program from running.
- Because client-side code cannot reference remote package variables or constants, you must explicitly use the values of the constants.

For example, the following code does *not* compile on the client:

```
DBMS_SQL.PARSE(cur_hdl, stmt_str, DBMS_SQL.NATIVE); -- uses constant
DBMS_SQL.NATIVE
```

The following code works on the client, because the argument is explicitly provided:

DBMS_SQL.PARSE(cur_hdl, stmt_str, 1); -- compiles on the client

- The VARCHAR2S type is currently supported for backward compatibility of legacy code. However, you are advised to use VARCHAR2A both for its superior capability and because VARCHAR2S will be deprecated in a future release.
- To parse SQL statements larger than 32 KB, the new CLOB overload version of the PARSE procedure can be used instead of the VARCHAR2A overload.
- If the container parameter value is the same as the calling container, a container switch will not occur. However, the default roles of the current user will be in effect.

Exceptions

If you create a type, procedure, function, or package using DBMS_SQL that has compilation warnings, an ORA-24344 exception is raised, and the PL/SQL unit is still created.

176.9.27 RETURN_RESULT Procedures

This procedure returns the result of an executed statement to the client application.

The result can be retrieved later by the client. Alternatively, it can return the statement result to and be retrieved later by the immediate caller that executes a recursive statement in which this statement result will be returned.

The caller can be:

- A PL/SQL stored procedure executing the recursive statement using DBMS_SQL
- A Java stored procedure using JDBC
- A .NET stored procedure using ADO.NET
- An external procedure using the Oracle Call Interface (OCI)

Syntax

```
DBMS_SQL.RETURN_RESULT(
  rc          IN OUT    SYS_REFCURSOR,
  to_client   IN        BOOLEAN          DEFAULT TRUE);
```

```
DBMS_SQL.RETURN_RESULT(
  rc          IN OUT    INTEGER,
  to_client   IN        BOOLEAN          DEFAULT TRUE);
```

Parameters

Table 176-30 RETURN_RESULT Procedure Parameters

Parameter	Description
rc	Statement cursor or ref cursor
to_client	Returns (or does not return) the statement result to the client. If not, it is returned to the immediate caller.

Usage Notes

- Currently only a SQL query can be returned, and the return of statement results over remote procedure calls is not supported.
- Once the statement is returned, it is no longer accessible except by the client or the immediate caller to which it is returned.
- Statement results cannot be returned when the statement being executed by the client or any intermediate recursive statement is a SQL query and an error is raised.
- A ref cursor being returned can be strongly or weakly-typed.
- A query being returned can be partially fetched.
- Because EXECUTE IMMEDIATE statement provides no interface to retrieve the statement results returned from its recursive statement, the cursors of the statement results returned to the caller of the EXECUTE IMMEDIATE statement will be closed when the statement completes. To retrieve the returned statement results from a recursive statement in PL/SQL, use DBMS_SQL to execute the recursive statement.

Examples

```
CREATE PROCEDURE proc AS
  rc1 sys_refcursor;
  rc2 sys_refcursor;
BEGIN
  OPEN rc1 FOR SELECT * FROM t1;
  DBMS_SQL.RETURN_RESULT(rc1);
  OPEN rc2 FOR SELECT * FROM t2;
  DBMS_SQL.RETURN_RESULT(rc2);
END;
/
```

176.9.28 TO_CURSOR_NUMBER Function

This function takes an OPENED strongly or weakly-typed ref cursor and transforms it into a DBMS_SQL cursor number.

Syntax

```
DBMS_SQL.TO_CURSOR_NUMBER (
  rc IN OUT SYS_REFCURSOR)
RETURN INTEGER;
```

Parameters

Table 176-31 TO_CURSOR_NUMBER Function Parameters

Parameter	Description
rc	REF CURSOR to be transformed into a cursor number

Return Values

Returns a DBMS_SQL manageable cursor number transformed from a REF CURSOR

Usage Notes

- The REF CURSOR passed in has to be OPENED, otherwise an error is raised.
- Once the REF CURSOR is transformed into a DBMS_SQL cursor number, the REF CURSOR is no longer accessible by any native dynamic SQL operations.
- The DBMS_SQL cursor that is returned by this subprogram performs in the same way as a DBMS_SQL cursor that has already been executed.

Examples

```

CREATE OR REPLACE PROCEDURE DO_QUERY(sql_stmt VARCHAR2) IS
  TYPE CurType IS REF CURSOR;
  src_cur      CurType;
  curid        NUMBER;
  desctab      DBMS_SQL.DESC_TAB;
  colcnt       NUMBER;
  namevar      VARCHAR2(50);
  numvar       NUMBER;
  datevar      DATE;
  empno        NUMBER := 100;
BEGIN

  -- sql_stmt := 'select ..... from employees where employee_id = :b1';
  OPEN src_cur FOR sql_stmt USING empno;

  -- Switch from native dynamic SQL to DBMS_SQL
  curid := DBMS_SQL.TO_CURSOR_NUMBER (src_cur);

  DBMS_SQL.DESCRIBE_COLUMNS(curid, colcnt, desctab);

  -- Define columns
  FOR i IN 1 .. colcnt LOOP
    IF desctab(i).col_type = 2 THEN
      DBMS_SQL.DEFINE_COLUMN(curid, i, numvar);
    ELSIF desctab(i).col_type = 12 THEN
      DBMS_SQL.DEFINE_COLUMN(curid, i, datevar);
    .....
  ELSE
    DBMS_SQL.DEFINE_COLUMN(curid, i, namevar, 25);
  END IF;
  END LOOP;

  -- Fetch Rows
  WHILE DBMS_SQL.FETCH_ROWS(curid) > 0 LOOP
    FOR i IN 1 .. colcnt LOOP
      IF (desctab(i).col_type = 1) THEN
        DBMS_SQL.COLUMN_VALUE(curid, i, namevar);
      ELSIF (desctab(i).col_type = 2) THEN
        DBMS_SQL.COLUMN_VALUE(curid, i, numvar);
      ELSIF (desctab(i).col_type = 12) THEN
        DBMS_SQL.COLUMN_VALUE(curid, i, datevar);
      ....
    END IF;
  END LOOP;
  END LOOP;

  DBMS_SQL.CLOSE_CURSOR(curid);

```

```
END;
/
```

176.9.29 TO_REFCURSOR Function

This function takes an `OPENED`, `PARSED`, and `EXECUTED` cursor and transforms/migrates it into a PL/SQL manageable `REF CURSOR` (a weakly-typed cursor) that can be consumed by PL/SQL native dynamic SQL switched to use native dynamic SQL.

This subprogram is only used with `SELECT` cursors.

Syntax

```
DBMS_SQL.TO_REFCURSOR(
    cursor_number IN OUT INTEGER)
RETURN SYS_REFCURSOR;
```

Parameters

Table 176-32 TO_REFCURSOR Function Parameters

Parameter	Description
<code>cursor_number</code>	Cursor number of the cursor to be transformed into <code>REF CURSOR</code>

Return Values

Returns a PL/SQL `REF CURSOR` transformed from a `DBMS_SQL` cursor number

Usage Notes

- The cursor passed in by the `cursor_number` has to be `OPENED`, `PARSED`, and `EXECUTED`; otherwise an error is raised.
- Once the `cursor_number` is transformed into a `REF CURSOR`, the `cursor_number` is no longer accessible by any `DBMS_SQL` operations.
- After a `cursor_number` is transformed into a `REF CURSOR`, using `DBMS_SQL.IS_OPEN` to check to see if the `cursor_number` is still open results in an error.
- If the cursor number was last parsed with a valid container parameter, it cannot be converted to a `REF CURSOR`.

Examples

```
CREATE OR REPLACE PROCEDURE DO_QUERY(mgr_id NUMBER) IS
    TYPE CurType IS REF CURSOR;
    src_cur          CurType;
    curid            NUMBER;
    sql_stmt         VARCHAR2(200);
    ret             INTEGER;
    empnos          DBMS_SQL.Number_Table;
    depts           DBMS_SQL.Number_Table;
BEGIN

    -- DBMS_SQL.OPEN_CURSOR
    curid := DBMS_SQL.OPEN_CURSOR;

    sql_stmt := 'SELECT EMPLOYEE_ID, DEPARTMENT_ID from employees where MANAGER_ID
```

```

= :b1';

DBMS_SQL.PARSE(curid, sql_stmt, DBMS_SQL.NATIVE);
DBMS_SQL.BIND_VARIABLE(curid, 'b1', mgr_id);
ret := DBMS_SQL.EXECUTE(curid);

-- Switch from DBMS_SQL to native dynamic SQL
src_cur := DBMS_SQL.TO_REFCURSOR(curid);

-- Fetch with native dynamic SQL
FETCH src_cur BULK COLLECT INTO empnos, depts;

IF empnos.COUNT > 0 THEN
  DBMS_OUTPUT.PUT_LINE('EMPNO DEPTNO');
  DBMS_OUTPUT.PUT_LINE('-----');
  -- Loop through the empnos and depts collections
  FOR i IN 1 .. empnos.COUNT LOOP
    DBMS_OUTPUT.PUT_LINE(empnos(i) || ' ' || depts(i));
  END LOOP;
END IF;
-- Close cursor
CLOSE src_cur;
END;
/

```

176.9.30 VARIABLE_VALUE Procedures

This procedure returns the value of the named variable for a given cursor. It is used to return the values of bind variables inside PL/SQL blocks or DML statements with **returning clause**.

Syntax

```

DBMS_SQL.VARIABLE_VALUE (
  c           IN  INTEGER,
  name       IN  VARCHAR2,
  value      OUT NOCOPY <datatype>);

```

Where <datatype> can be any one of the following types:

```

ADT (user-defined object types)
BINARY_DOUBLE
BINARY_FLOAT
BFILE
BLOB
BOOLEAN
CLOB CHARACTER SET ANY_CS
DATE
DSINTERVAL_UNCONSTRAINED
JSON
NESTED table
NUMBER
OPAQUE types
REF
TIME_UNCONSTRAINED
TIME_TZ_UNCONSTRAINED
TIMESTAMP_LTZ_UNCONSTRAINED

```

```
TIMESTAMP_TZ_UNCONSTRAINED
TIMESTAMP_UNCONSTRAINED
UROWID
VARCHAR2 CHARACTER SET ANY_CS
VARRAY
VECTOR
YMINTERVAL_UNCONSTRAINED
```

For variables containing CHAR, RAW, and ROWID data, you can use the following variations on the syntax:

```
DBMS_SQL.VARIABLE_VALUE_CHAR (
  c          IN  INTEGER,
  name       IN  VARCHAR2,
  value      OUT CHAR CHARACTER SET ANY_CS);
```

```
DBMS_SQL.VARIABLE_VALUE_RAW (
  c          IN  INTEGER,
  name       IN  VARCHAR2,
  value      OUT RAW);
```

```
DBMS_SQL.VARIABLE_VALUE_ROWID (
  c          IN  INTEGER,
  name       IN  VARCHAR2,
  value      OUT ROWID);
```

The following syntax enables the VARIABLE_VALUE procedure to accommodate bulk operations:

```
DBMS_SQL.VARIABLE_VALUE (
  c          IN  INTEGER,
  name       IN  VARCHAR2,
  value      OUT NOCOPY <table_type>);
```

For bulk operations, <table_type> must be a supported DBMS_SQL predefined TABLE type.

See [DBMS_SQL Data Structures](#)

Pragmas

```
pragma restrict_references(variable_value,RNDS,WNDS);
```

Parameters

Table 176-33 VARIABLE_VALUE Procedure Parameters

Parameter	Description
c	ID number of the cursor from which to get the values.
name	Name of the variable for which you are retrieving the value.
value	<ul style="list-style-type: none"> Single row option: Returns the value of the variable for the specified position. Oracle raises the exception ORA-06562, inconsistent_type, if the type of this output parameter differs from the actual type of the value, as defined by the call to BIND_VARIABLE. Array option: Local variable that has been declared <table_type>. For bulk operations, value is an OUT NOCOPY parameter.

176.9.31 VARIABLE_VALUE_PKG Procedure

This procedure returns the value of the named variable for a given cursor.

It is used to return the values of bind variables of collection or record types inside PL/SQL blocks or DML statements with `returning` clause for a declared package. The type of the variable must be declared in the package specification. Bulk operations are not supported for these types.

Syntax

```
DBMS_SQL.VARIABLE_VALUE_PKG (
  c          IN   INTEGER,
  name       IN   VARCHAR2,
  value      OUT NOCOPY <table_type>);
```

Where <datatype> can be any one of the following data types:

- RECORD
- VARRAY
- NESTED TABLE
- INDEX BY PLS_INTEGER TABLE
- INDEX BY BINARY_INTEGER TABLE

Parameters

Table 176-34 VARIABLE_VALUE_PKG Parameters

Parameter	Description
c	ID number of the cursor from which to get the values.
name	Name of the variable for which you are retrieving the value.
value	<ul style="list-style-type: none"> • Single row option: Returns the value of the variable for the specified position. Oracle raises the exception <code>ORA-06562, inconsistent_type</code>, if the type of this output parameter differs from the actual type of the value, as defined by the call to <code>BIND_VARIABLE_PKG</code>. • Array option: Local variable that has been declared <table_type>.

Example 176-7 Dynamic SQL using DBMS_SQL.VARIABLE_VALUE_PKG to Get the Value of a Bind Variable

The data types are declared in the package specification. The `VARIABLE_VALUE_PKG` is used to get the value of the bind variable `v2` in the cursor SQL statement.

```
CREATE OR REPLACE PACKAGE ty_pkg AS
TYPE rec IS RECORD
  ( n1 NUMBER,
```

```
        n2 NUMBER);
TYPE trect IS TABLE OF NUMBER;
END ty_pkg;
/
CREATE OR REPLACE PROCEDURE dyn_sql_nt AS
    dummy NUMBER;
    cur    NUMBER;
    v1 ty_pkg.trect;
    v2 ty_pkg.trect;
    str VARCHAR2(3000);
BEGIN
    v1 := ty_pkg.trect(1000);
    str := 'declare v1 ty_pkg.trect; begin v1:=v1; v1(1) := 2000; :v2 :=
v1; end;' ;
    cur := DBMS_SQL.OPEN_CURSOR();
    DBMS_SQL.PARSE(cur, str, DBMS_SQL.NATIVE);
    DBMS_SQL.BIND_VARIABLE_PKG(cur, ':v1', v1);
    DBMS_SQL.BIND_VARIABLE_PKG(cur, ':v2', v2);
    dummy := DBMS_SQL.EXECUTE(cur);
    DBMS_SQL.VARIABLE_VALUE_PKG(cur, ':v2', v2);
    DBMS_OUTPUT.PUT_LINE('n = '
|| v2(1));
    DBMS_SQL.CLOSE_CURSOR(cur);
END dyn_sql_nt;
/
EXEC dyn_sql_nt;

n = 2000
```

DBMS_SQL_FIREWALL

The `DBMS_SQL_FIREWALL` package enables you to monitor users and detect or prevent SQL injection attacks against those users.

This chapter contains the following topics:

- [DBMS_SQL_FIREWALL Overview](#)
- [DBMS_SQL_FIREWALL Security Model](#)
- [DBMS_SQL_FIREWALL Constants](#)
- [Summary of DBMS_SQL_FIREWALL Subprograms](#)

177.1 DBMS_SQL_FIREWALL Overview

The `DBMS_SQL_FIREWALL` PL/SQL package enables you to manage SQL Firewall, which tracks and can block SQL injection attacks.

The `DBMS_SQL_FIREWALL` package enables you to capture SQL activities of users, create allow-lists (that is, permitted actions) from the captured SQL activities, and then enforce the allow-lists to prevent or detect potential SQL injection attacks. In addition to SQL statements, the allow-list can contain a context list, which is a set of session contexts allowed for database connections. An example of a context can be IP addresses. You can also configure SQL Firewall to not run when Oracle Scheduler is running, because to do so may interfere with Oracle Scheduler operations. After you enable the allow-list, any SQL that the user performs will be monitored by SQL Firewall. SQL that the user performs that is not in the allow-list is considered to be a SQL injection attack. You can configure SQL Firewall to either allow the user to continue performing these SQL operations, or you can block these activities. Note that the SQL operations that violate the allow-list will always be written to a log table that you can query with data dictionary views.

You can configure SQL Firewall in both the root and in individual pluggable databases (PDBs).

Related Topics

- [Oracle Database Security Guides](#)

177.2 DBMS_SQL_FIREWALL Security Model

Oracle Database protects the administration of SQL Firewall by storing its metadata in tables in the `SYS` schema.

Hence, these tables rely on dictionary protection, just as other dictionary tables in `SYS` do. Therefore, users who have the `SELECT ANY TABLE` system privilege cannot query these tables unless they also have the `SELECT ANY DICTIONARY` system privilege or are granted the `SELECT` object privileges on the tables. Only the `SYS` user can grant these privileges to other users.

Oracle Database stores the SQL Firewall tables in the `SYSAUX` tablespace by default. If you want to move the SQL Firewall log tables to a different (user-defined) tablespace, then you must first disable SQL Firewall, and then use the `MOVE` clause of the `ALTER TABLE` statement to perform the move operation.

To use the procedures in the `DBMS_SQL_FIREWALL` package, a user must be granted the `SQL_FIREWALL_ADMIN` role.

Related Topics

- *Oracle Database Security Guide*

177.3 DBMS_SQL_FIREWALL Constants

The `DBMS_SQL_FIREWALL` package provides constants that are used with several SQL Firewall procedures.

These constants are described in the following table.

Table 177-1 DBMS_SQL_FIREWALL Constants

Name	Type	Value	Description
<code>DBMS_SQL_FIREWALL.ENFORCE_ALL</code>	NUMBER	3	Enforces both allowed SQL and allowed contexts when you run the <code>DBMS_SQL_FIREWALL.ENABLE_ALLOW_LIST</code> procedure
<code>DBMS_SQL_FIREWALL.ENFORCE_CONTEXT</code>	NUMBER	1	Enforces allowed contexts when you run the <code>DBMS_SQL_FIREWALL.ENABLE_ALLOW_LIST</code> procedure.
<code>DBMS_SQL_FIREWALL.ENFORCE_SQL</code>	NUMBER	2	Enforces allowed SQL when you run the <code>DBMS_SQL_FIREWALL.ENABLE_ALLOW_LIST</code> procedure
<code>DBMS_SQL_FIREWALL.ALL_LOGS</code>	NUMBER	3	Purges all logs when you run the <code>DBMS_SQL_FIREWALL.PURGE</code> procedure
<code>DBMS_SQL_FIREWALL.CAPTURE_LOG</code>	NUMBER	1	Purges only capture logs when you run the <code>DBMS_SQL_FIREWALL.PURGE</code> procedure
<code>DBMS_SQL_FIREWALL.IP_ADDRESS</code>	NUMBER	3	Specifies the user's IP address when you run the <code>DBMS_SQL_FIREWALL.ADD_ALLOWED_CONTEXT</code> or <code>DBMS_SQL_FIREWALL.DELETE_ALLOWED_CONTEXT</code> procedure

Table 177-1 (Cont.) DBMS_SQL_FIREWALL Constants

Name	Type	Value	Description
DBMS_SQL_FIREWALL.OS_PROGRAM	NUMBER	1	Specifies the user's operating system program when you run the DBMS_SQL_FIREWALL.ADD_ALLOWED_CONTEXT or DBMS_SQL_FIREWALL.DELETE_ALLOWED_CONTEXT procedure
DBMS_SQL_FIREWALL.OS_SYSTEM_NAME	NUMBER	2	Specifies an operating system name when you run the DBMS_SQL_FIREWALL.ADD_ALLOWED_CONTEXT or DBMS_SQL_FIREWALL.DELETE_ALLOWED_CONTEXT procedure
DBMS_SQL_FIREWALL.SCHEDULER_JOB	NUMBER	1	Indicates whether SQL Firewall will capture and enforce allow-lists for database connections and SQL executions during Oracle Scheduler operations. Use this constant with the DBMS_SQL_FIREWALL.EXCLUDE and DBMS_SQL_FIREWALL.INCLUDE procedures.
DBMS_SQL_FIREWALL.VIOLATION_LOG	NUMBER	2	Purges only violation logs when you run the DBMS_SQL_FIREWALL.PURGE procedure

177.4 Summary of DBMS_SQL_FIREWALL Subprograms

This table lists and describes the DBMS_SQL_FIREWALL package subprograms.

Table 177-2 DBMS_SQL_FIREWALL Package Subprograms

Subprogram	Description
ADD_ALLOWED_CONTEXT Procedure	Adds a context to the list of allowed contexts for a user who is configured for SQL Firewall
APPEND_ALLOW_LIST Procedure	Appends additional contents to an existing allow-list by using the existing capture logs or violation logs of the user, or both
APPEND_ALLOW_LIST_SINGLE_SQL Procedure	Appends a single SQL record to the violation log or capture log to an existing allow-list

Table 177-2 (Cont.) DBMS_SQL_FIREWALL Package Subprograms

Subprogram	Description
CREATE_CAPTURE Procedure	Creates a SQL Firewall capture for a specified user at a given level
DELETE_ALLOWED_CONTEXT Procedure	Deletes a SQL Firewall context value that had been assigned to a user
DELETE_ALLOWED_SQL Procedure	Deletes a specified entry from the allowed SQL that had been assigned to a user
DISABLE Procedure	Disables SQL Firewall
DISABLE_ALLOW_LIST Procedure	Disables SQL Firewall allow-list enforcement for a given user
DROP_ALLOW_LIST Procedure	Deletes the SQL Firewall allow-list of a specified user
DROP_CAPTURE Procedure	Drops a SQL Firewall capture and deletes all the associated capture logs
ENABLE Procedure	Enables SQL Firewall
ENABLE_ALLOW_LIST Procedure	Enables SQL Firewall allow-list enforcement for a given user
EXCLUDE Procedure	Prevents SQL Firewall from capturing or enforcing allow-lists for database connections and SQL executions during Oracle Scheduler operations
EXPORT_ALLOW_LIST Procedure	Exports the allow-list of the given user in JSON format, into the CLOB provided from the <code>allow_list</code> argument
FLUSH_LOGS Procedure	Flushes all the SQL Firewall logs that reside in the memory into the log tables
GENERATE_ALLOW_LIST Procedure	Generates a SQL Firewall allow-list for the specified user by using data from the existing capture logs of the user
IMPORT_ALLOW_LIST Procedure	Imports the allow-list from the specified CLOB for the given user, to the target database
INCLUDE Procedure	Enables SQL Firewall to capture and enforce allow-lists for database connections and SQL executions during Oracle Scheduler operations
PURGE_LOG Procedure	Purges SQL Firewall logs
START_CAPTURE Procedure	Starts a SQL Firewall capture for a user
STOP_CAPTURE Procedure	Stops a SQL Firewall capture for a user
UPDATE_ALLOW_LIST_ENFORCEMENT Procedure	Updates the SQL Firewall allow-list enforcement options for the given user

177.4.1 ADD_ALLOWED_CONTEXT Procedure

This procedure adds a context to the list of allowed contexts for a user's SQL Firewall allow-list.

Syntax

```
DBMS_SQL_FIREWALL.ADD_ALLOWED_CONTEXT (
  username      IN  VARCHAR2,
  context_type  IN  NUMBER,
  value         IN  VARCHAR2);
```

Parameters

Table 177-3 ADD_ALLOWED_CONTEXT Procedure Parameters

Parameter	Description
username	Specifies the name of the user who has a SQL Firewall allow-list. To find all the users who has an allow-list, query <code>DBA_SQL_FIREWALL_ALLOW_LISTS</code> .
context_type	Specifies one of the following context types: <ul style="list-style-type: none"> • <code>DBMS_SQL_FIREWALL.IP_ADDRESS</code> accepts IPv4 and IPv6 addresses and subnets in the CIDR notation. • <code>DBMS_SQL_FIREWALL.OS_USERNAME</code> accepts any valid operating system user name, such as <code>oracle</code>. • <code>DBMS_SQL_FIREWALL.OS_PROGRAM</code> accepts any valid operating system program name, such as <code>sqlplus</code> or <code>SQL Developer</code>.
value	Specifies the value of the <code>context_type</code> constant, such as an IP address for <code>DBMS_SQL_FIREWALL.IP_ADDRESS</code> . To allow a local (bequeathed) connection that does not have an IP address, specify with the value <code>Local</code> for the <code>DBMS_SQL_FIREWALL.IP_ADDRESS</code> type. To specify all values of the context (such as all possible operating system programs), then enter the <code>%</code> wild card character.

Usage Notes

- You can find the user's current context type settings by querying the following data dictionary views:
 - `DBA_SQL_FIREWALL_ALLOWED_IP_ADDR`
 - `DBA_SQL_FIREWALL_ALLOWED_OS_PROG`
 - `DBA_SQL_FIREWALL_ALLOWED_OS_USER`
- Before you can add any contexts for the user, the user's allow-list must be created (using the `DBMS_SQL_FIREWALL.GENERATE_ALLOW_LIST` procedure).
- This procedure can be run when the allow-list is enabled or disabled, and it takes effects immediately.

Example

```
BEGIN
  DBMS_SQL_FIREWALL.ADD_ALLOWED_CONTEXT (
    username      => 'PFITCH',
```

```

    context_type => DBMS_SQL_FIREWALL.OS_PROGRAM,
    value        => 'SQL Developer'
);
END;
/

```

177.4.2 APPEND_ALLOW_LIST Procedure

This procedure appends additional contents to an existing allow-list by using the existing capture logs or violation logs of the user, or both.

Syntax

```

DBMS_SQL_FIREWALL.APPEND_ALLOW_LIST (
    username      IN VARCHAR2,
    source        IN NUMBER);

```

Parameters

Table 177-4 APPEND_ALLOW_LIST Procedure Parameters

Parameter	Description
username	Specifies the name of the user who was designated for the SQL Firewall allow-list. To find this user, query DBA_SQL_FIREWALL_ALLOW_LISTS.
source	Specifies one of the following log types: <ul style="list-style-type: none"> DBMS_SQL_FIREWALL.CAPTURE_LOG DBMS_SQL_FIREWALL.VIOLATION_LOG DBMS_SQL_FIREWALL.ALL_LOGS

Usage Notes

- DBMS_SQL_FIREWALL.APPEND_ALLOW_LIST processes the specified source logs and identifies contents to be appended to the allow-list. Then it populates the SQL Firewall metadata tables for the allowed SQL and allowed contexts, which will be used during the allow-list enforcement.
- You can run this procedure when the allow-list is either enabled or disabled.
- The change takes effect immediately.
- A new allow-list version number will be associated with all the allowed SQL entries added by the same DBMS_SQL_FIREWALL.APPEND_ALLOW_LIST execution. This new version number will be 1 plus the current maximum allow-list version of the specified user.

Example

```

BEGIN
    DBMS_SQL_FIREWALL.APPEND_ALLOW_LIST (
        username      => 'PFITCH',
        source        => DBMS_SQL_FIREWALL.CAPTURE_LOG
    );
END;
/

```

177.4.3 APPEND_ALLOW_LIST_SINGLE_SQL Procedure

This procedure appends a single SQL record to the violation log or capture log to an existing allow-list.

This procedure is useful for when you want to individually append SQL commands from the violations log or the capture log to an existing allow-list.

Syntax

```
DBMS_SQL_FIREWALL.APPEND_ALLOW_LIST_SINGLE_SQL (
  username      IN  VARCHAR2,
  sql_signature IN  VARCHAR2,
  current_user  IN  VARCHAR2,
  top_level     IN  VARCHAR2,
  source        IN  NUMBER DEFAULT);
```

Parameters

Table 177-5 APPEND_ALLOW_LIST_SINGLE_SQL Procedure Parameters

Parameter	Description
username	Specifies the name of the user who was designated for the SQL Firewall allow-list. To find this user, query <code>DBA_SQL_FIREWALL_ALLOW_LISTS</code> .
sql_signature	Specifies the signature of the SQL to be added. To find the signature of the SQL for the target record, query the <code>DBA_SQL_FIREWALL_CAPTURE</code> or <code>DBA_SQL_FIREWALL_VIOLATIONS</code> dynamic view.
current_user	Specifies the name of the user who the SQL command was executed as. For example, if user <code>pfitch</code> invokes a definer's rights procedure created in the <code>psmith</code> schema, then all the SQL commands in the procedure are executed as <code>psmith</code> , the <code>current_user</code> . If the procedure is an invoker's rights procedure, then the <code>current_user</code> is the invoker, <code>pfitch</code> .
top_level	Specifies whether the SQL that was executed was top level. Possible values are as follows: <ul style="list-style-type: none"> Y (for Yes) means that the target SQL record is top-level (that is, the statement that the user directly runs). N (for No) means that the target SQL record is not top-level (that is, the SQL command that is issued from PL/SQL units).
source	Specifies the source log to add the SQL record from: <ul style="list-style-type: none"> <code>DBMS_SQL_FIREWALL.CAPTURE_LOG</code> <code>DBMS_SQL_FIREWALL.VIOLATION_LOG</code> (default)

Usage Notes

- `DBMS_SQL_FIREWALL.APPEND_ALLOW_LIST_SINGLE_SQL` processes the specified source log and identifies the target SQL record to be appended to the allow-list. Then it populates the SQL Firewall metadata tables for the allowed SQL, which will be used during the allow-list enforcement.
- You can run this procedure when the allow-list is either enabled or disabled.
- The change takes effect immediately.

- A new allow-list version number will be associated with the newly added allowed SQL entry.

Example

1. Query the `DBA_SQL_FIREWALL_VIOLATIONS` or the `DBA_SQL_FIREWALL_CAPTURE_LOGS` data dictionary view to find the target SQL record that you want to add to the allow-list. Obtain the values for the `USERNAME`, `SQL_SIGNATURE`, `CURRENT_USER`, and `TOP_LEVEL` columns for the target SQL record.
2. Enter these values in the `DBMS_SQL_FIREWALL.APPEND_ALLOW_LIST_SINGLE_SQL` SQL procedure to add the target SQL record to the allow-list. For example:

```
BEGIN
  DBMS_SQL_FIREWALL.APPEND_ALLOW_LIST_SINGLE_SQL (
    username      => 'PFITCH',
    sql_signature =>
'7D33A84D0A1B56E382B9A92D01BCD19933969CB16E2AB4934A2258563F5ADB44',
    current_user  => 'PSMITH',
    top_level     => 'N',
    source        => DBMS_SQL_FIREWALL.CAPTURE_LOG
  );
END;
/
```

177.4.4 CREATE_CAPTURE Procedure

This procedure creates a SQL Firewall capture for a specified user at a given level.

Syntax

```
DBMS_SQL_FIREWALL.CREATE_CAPTURE (
  username      IN VARCHAR2,
  top_level_only IN BOOLEAN,
  start_capture IN BOOLEAN);
```

Parameters

Table 177-6 CREATE_CAPTURE Procedure Parameters

Parameter	Description
<code>username</code>	Specifies the name of the user whose SQL Firewall capture is to be created. To find existing users, query <code>DBA_SQL_FIREWALL_CAPTURES</code> .
<code>top_level_only</code>	<ul style="list-style-type: none"> • <code>TRUE</code> captures only SQL statements that have been directly issued by the user • <code>FALSE</code> captures both top-level SQL statements and SQL statements that have been issued by PL/SQL units. This setting is the default.

Table 177-6 (Cont.) CREATE_CAPTURE Procedure Parameters

Parameter	Description
start_capture	<ul style="list-style-type: none"> TRUE starts the capture process right away, after you run DBMS_SQL_FIREWALL.CREATE_CAPTURE. This setting is the default. FALSE does not start the capture process. You can start it later on by using DBMS_SQL_FIREWALL.START_CAPTURE.

Usage Notes

To find the status of existing SQL Firewall captures, including users who have already been configured for SQL Firewall captures, query the DBA_SQL_FIREWALL_CAPTURES data dictionary view.

Example

```
BEGIN
  DBMS_SQL_FIREWALL.CREATE_CAPTURE (
    username      => 'C##HR_ADMIN',
    top_level_only => TRUE,
    start_capture => TRUE
  );
END;
/
```

177.4.5 DELETE_ALLOWED_CONTEXT Procedure

This procedure deletes a context from the list of allowed contexts for a user's SQL Firewall allow-list.

Syntax

```
DBMS_SQL_FIREWALL.DELETE_ALLOWED_CONTEXT (
  username      IN VARCHAR2,
  context_type  IN NUMBER,
  value         IN VARCHAR2);
```

Parameters

Table 177-7 DELETE_ALLOWED_CONTEXT Procedure Parameters

Parameter	Description
username	Specifies the name of the user who was designated for the SQL Firewall allow-list. To find this user, query DBA_SQL_FIREWALL_ALLOW_LISTS.
context_type	<ul style="list-style-type: none"> DBMS_SQL_FIREWALL.IP_ADDRESS accepts IPv4 and IPv6 addresses and subnets in the CIDR notation. DBMS_SQL_FIREWALL.OS_USERNAME accepts any valid operating system user name, such as oracle. DBMS_SQL_FIREWALL.OS_PROGRAM accepts any valid operating system program name, such as sqlplus or SQL Developer.

Table 177-7 (Cont.) DELETE_ALLOWED_CONTEXT Procedure Parameters

Parameter	Description
value	Specifies the value of the <code>context_type</code> constant, such as an IP address for <code>DBMS_SQL_FIREWALL.IP_ADDRESS</code> . If you omit this value or specify <code>NULL</code> , then all the allowed context values of the specified context type are deleted. This setting is the default.

Usage Notes

- You can find the user's current context type settings by querying the following data dictionary views:
 - `DBA_SQL_FIREWALL_ALLOWED_IP_ADDR`
 - `DBA_SQL_FIREWALL_ALLOWED_OS_PROG`
 - `DBA_SQL_FIREWALL_ALLOWED_OS_USER`
- This procedure can be run when the allow-list is enabled or disabled, and it takes effects immediately.

Example

```
BEGIN
  DBMS_SQL_FIREWALL.DELETE_ALLOWED_CONTEXT, (
    username      => 'PFITCH',
    context_type  => DBMS_SQL_FIREWALL.OS_PROGRAM,
    value         => 'SQL Developer'
  );
END;
/
```

177.4.6 DELETE_ALLOWED_SQL Procedure

This procedure deletes a specified entry from the list of allowed SQL for a user's SQL Firewall allow-list

Syntax

```
DBMS_SQL_FIREWALL.DELETE_ALLOWED_SQL (
  username      IN  VARCHAR2,
  allowed_sql_id IN  NUMBER);
```

Parameters

Table 177-8 DELETE_ALLOWED_SQL Procedure Parameters

Parameter	Description
username	Specifies the name of the user who was designated for the SQL Firewall allow-list. To find this user, query <code>DBA_SQL_FIREWALL_ALLOW_LISTS</code> .

Table 177-8 (Cont.) DELETE_ALLOWED_SQL Procedure Parameters

Parameter	Description
allowed_sql_id	Specifies the ID of the allowed SQL entry to be deleted from the allowed SQL of this user. To find this value, query DBA_SQL_FIREWALL_ALLOWED_SQL.

Usage Notes

- You can run this procedure when the allow-list is either enabled or disabled.
- The change takes effect immediately.

Example

```
BEGIN
  DBMS_SQL_FIREWALL.DELETE_ALLOWED_SQL (
    username      => 'PFITCH',
    allowed_sql_id => 1
  );
END;
/
```

177.4.7 DISABLE Procedure

This procedure disables SQL Firewall and stops all the existing captures and allow-lists that are enabled.

Syntax

```
DBMS_SQL_FIREWALL.DISABLE;
```

Parameters

None

Usage Notes

You can find the current status of SQL Firewall by querying the DBA_SQL_FIREWALL_STATUS data dictionary view.

Example

```
EXEC DBMS_SQL_FIREWALL.DISABLE;
```

177.4.8 DISABLE_ALLOW_LIST Procedure

This procedure immediately disables SQL Firewall allow-list enforcement for a given user.

Syntax

```
DBMS_SQL_FIREWALL.DISABLE_ALLOW_LIST (
  username      IN VARCHAR2);
```

Parameters

Table 177-9 DISABLE_ALLOW_LIST Procedure Parameters

Parameter	Description
username	Specifies the name of the user who was designated for the SQL Firewall allow-list. To find this user, query DBA_SQL_FIREWALL_ALLOW_LISTS. If you specify NULL, then all allow-lists that are currently enabled will be disabled.

Usage Notes

To find the status of users' allow-lists, query the DBA_SQL_FIREWALL_ALLOW_LISTS data dictionary view.

Example

```
EXEC DBMS_SQL_FIREWALL.DISABLE_ALLOW_LIST ('PFITCH');
```

177.4.9 DROP_ALLOW_LIST Procedure

This procedure deletes the SQL Firewall allow-list of a specified user.

Syntax

```
DBMS_SQL_FIREWALL.DROP_ALLOW_LIST (
    username          IN  VARCHAR2);
```

Parameters

Table 177-10 DROP_ALLOW_LIST Procedure Parameters

Parameter	Description
username	Specifies the name of the user who was designated for the SQL Firewall allow-list. To find this user, query DBA_SQL_FIREWALL_ALLOW_LISTS.

Usage Notes

- To find the status of users' allow-lists, query the DBA_SQL_FIREWALL_ALLOW_LISTS data dictionary view.
- You cannot drop an allow-list that is currently enabled. To disable an allow-list, run the DBMS_SQL_FIREWALL.DISABLE_ALLOW_LIST procedure.

Example

```
EXEC DBMS_SQL_FIREWALL.DROP_ALLOW_LIST ('PFITCH');
```

177.4.10 DROP_CAPTURE Procedure

This procedure drops a SQL Firewall capture and deletes all the associated capture logs.

Syntax

```
DBMS_SQL_FIREWALL.DROP_CAPTURE (
    username          IN VARCHAR2);
```

Parameters

Table 177-11 DROP_CAPTURE procedure Parameters

Parameter	Description
username	Specifies the name of the user whose SQL Firewall capture is to be dropped. To find this user, query <code>DBA_SQL_FIREWALL_CAPTURES</code> .

Usage Notes

- To find the status of existing SQL Firewall captures, query the `DBA_SQL_FIREWALL_CAPTURES` data dictionary view.
- You cannot drop a capture that is currently running. To stop the capture, run the `DBMS_SQL_FIREWALL.STOP_CAPTURE` procedure.
- Dropping a capture for a user does not affect the user's allow-list, which can continue to run even if the capture has been dropped. Captures and allow-lists are separate entities.

Example

```
EXEC DBMS_SQL_FIREWALL.DROP_CAPTURE ('C##HR_ADMIN');
```

177.4.11 ENABLE Procedure

This procedure enables SQL Firewall and starts all existing captures and allow-lists that are configured to be enabled.

Syntax

```
DBMS_SQL_FIREWALL.ENABLE;
```

Parameters

None

Usage Notes

You can find the current status of SQL Firewall by querying the `DBA_SQL_FIREWALL_STATUS` data dictionary view.

Example

```
EXEC DBMS_SQL_FIREWALL.ENABLE;
```

177.4.12 ENABLE_ALLOW_LIST Procedure

This procedure immediately enables SQL Firewall allow-list enforcement for a given user.

Syntax

```
DBMS_SQL_FIREWALL.ENABLE_ALLOW_LIST (
  username      IN VARCHAR2,
  enforce       IN NUMBER,
  block         IN BOOLEAN;
```

Parameters

Table 177-12 ENABLE_ALLOW_LIST Procedure Parameters

Parameter	Description
username	Specifies the name of the user whose SQL Firewall allow-list is to be enabled. To find this user, query <code>DBA_SQL_FIREWALL_ALLOW_LISTS</code> . If you enter <code>NULL</code> , then the allow-lists for all users who do not yet have allow-lists enabled are enabled.
enforce	<ul style="list-style-type: none"> <code>DBMS_SQL_FIREWALL.ENFORCE_CONTEXT</code> enforces the allowed contexts that have been configured. <code>DBMS_SQL_FIREWALL.ENFORCE_SQL</code> enforces the allowed SQL that has been configured. <code>DBMS_SQL_FIREWALL.ENFORCE_ALL</code> enforces both allowed contexts and allowed SQL. This setting is the default.
block	<ul style="list-style-type: none"> <code>TRUE</code> blocks user's database connection or the user's SQL execution whenever the user violates the allow-list definition. <code>FALSE</code> allows unmatched user database connections or SQL commands to proceed. This setting is the default.

Usage Notes

- To find the status of users' allow-lists, query the `DBA_SQL_FIREWALL_ALLOW_LISTS` data dictionary view.
- SQL Firewall always generates a violation log for any unmatched database connection or SQL statement regardless of the `block` option setting.

Example

```
BEGIN
  DBMS_SQL_FIREWALL.ENABLE_ALLOW_LIST (
    username      => 'PFITCH',
    enforce       => DBMS_SQL_FIREWALL.ENFORCE_SQL,
    block         => TRUE
  );
END;
```

177.4.13 EXCLUDE Procedure

This procedure prevents SQL Firewall from capturing or enforcing allow-lists for database connections and SQL executions during Oracle Scheduler operations.

Oracle Scheduler jobs are often used in databases for various maintenance purposes. Accidentally interrupting critical jobs can cause undesirable consequences. You can configure SQL Firewall to not capture any SQL statements nor enforce any allow-lists that are run during an Oracle Scheduler job session. This procedure applies to all users that have been configured for SQL Firewall captures and allow-lists. By default, Oracle Scheduler jobs are excluded from SQL Firewall operations.

Syntax

```
DBMS_SQL_FIREWALL.EXCLUDE (  
    FEATURE          IN NUMBER);
```

Parameters

Table 177-13 EXCLUDE Procedure Parameters

Parameter	Description
FEATURE	Enter DBMS_SQL_FIREWALL.SCHEDULER_JOB for this value.

Usage Notes

- To find the status of whether SQL Firewall is enforced during Oracle Scheduler operations, query the EXCLUDE_JOBS column of the DBA_SQL_FIREWALL_STATUS data dictionary view. If the output is Y, then Oracle Scheduler jobs are excluded from SQL Firewall operations.
- To enable Oracle Firewall to run during Oracle Scheduler operations, run the DBMS_SQL_FIREWALL.INCLUDE procedure.

Example

```
EXEC DBMS_SQL_FIREWALL.EXCLUDE (DBMS_SQL_FIREWALL.SCHEDULER_JOB);
```

177.4.14 EXPORT_ALLOW_LIST Procedure

This procedure exports the allow-list of the given user in JSON format, into the CLOB provided from the allow_list argument.

Syntax

```
DBMS_SQL_FIREWALL.EXPORT_ALLOW_LIST (  
    username      IN      VARCHAR2,  
    allow_list    IN/OUT CLOB;
```

Parameters

Table 177-14 EXPORT_ALLOW_LIST Procedure Parameters

Parameter	Description
username	Specifies the user that the allow-list was created for. To find which user has an allow-list, query <code>DBA_SQL_FIREWALL_ALLOW_LISTS</code> .
allow_list	Specifies the CLOB (which must already exist) into which the exported allow-list must go

Usage Notes

- Before you run this procedure, you must create the CLOB and then pass it to the API (for example, by `DBMS_LOB.CREATETEMPORARY` for the PL/SQL client, or by `OracleConnection.createClob()` for JDBC Java client).
- The export operation includes the allow-list's settings (`status`, `enforce`, `block`, `top_level_only`, `generated_on`, and `status_updated_on` timestamp), **allowed SQL**, and allowed contexts. In addition, the export operation includes all the referenced SQL logs (by the allowed SQL).
- `DBMS_SQL_FIREWALL.EXPORT_ALLOW_LIST` does not export capture logs or violation logs.
- To find the status of users' allow-lists, query the `DBA_SQL_FIREWALL_ALLOW_LISTS` data dictionary view.
- If you want to export all the SQL Firewall metadata, which includes captures and allow-lists for all users, then instead of using `DBMS_SQL_FIREWALL.EXPORT_ALLOW_LIST`, use the `include=SQL_FIREWALL` clause in the Oracle Data Pump `expdp` command. See *Oracle Database Security Guide*.

Example

```

BEGIN
  DBMS_SQL_FIREWALL.EXPORT_ALLOW_LIST (
    username      => 'PFITCH',
    allow_list    => ALLOW_LIST_CLOB;
  );
END;
/

```

177.4.15 FLUSH_LOGS Procedure

This procedure flushes all the SQL Firewall logs that reside in the memory into the log tables.

Syntax

```
DBMS_SQL_FIREWALL.FLUSH_LOGS;
```

Parameters

None

Usage Notes

- Usually you do not need to invoke this procedure explicitly, because logs in the memory are flushed to the log tables frequently in the background. But in case if you want to see the capture logs or violation logs immediately after the action during when SQL Firewall is running, you can run this procedure before looking at the logs.
- The `DBMS_SQL_FIREWALL.FLUSH_LOGS` procedure is equivalent to the `DBMS_MEMOPTIMIZE_ADMIN.WRITES_FLUSH` procedure. (See [WRITES_FLUSH Procedure.](#))

Example

```
EXEC DBMS_SQL_FIREWALL.FLUSH_LOGS;
```

177.4.16 GENERATE_ALLOW_LIST Procedure

This procedure generates a SQL Firewall allow-list for the specified user by using the existing capture logs of the user.

Syntax

```
DBMS_SQL_FIREWALL.GENERATE_ALLOW_LIST (
    username          IN VARCHAR2;
```

Parameters

Table 177-15 GENERATE_ALLOW_LIST Procedure Parameters

Parameter	Description
username	Specifies the name of the user who was designated for the SQL Firewall allow-list. To find this user, query <code>DBA_SQL_FIREWALL_CAPTURES</code> .

Usage Notes

- To find information about existing generated allow-lists, query the `DBA_SQL_FIREWALL_ALLOW_LISTS` data dictionary view.
- Before you run this procedure, the following components must be in place:
 - The specified user must exist.
 - A capture (using `DBMS_SQL_FIREWALL.CREATE_CAPTURE`) has been created for this user. This capture must be disabled (using `DBMS_SQL_FIREWALL.STOP_CAPTURE`) before you can generate an allow-list for the user.
 - No allow-list exists yet for the user.

Example

```
EXEC DBMS_SQL_FIREWALL.GENERATE_ALLOW_LIST ('PFITCH');
```

177.4.17 IMPORT_ALLOW_LIST Procedure

This procedure imports the allow-list from the specified CLOB for the given user, to the target database.

Syntax

```
DBMS_SQL_FIREWALL.IMPORT_ALLOW_LIST (
  username      IN      VARCHAR2,
  allow_list    IN      CLOB;
```

Parameters

Table 177-16 IMPORT_ALLOW_LIST Procedure Parameters

Parameter	Description
username	Specifies the user of the exported allow-list. To check whether this user already had an allow-list created in the target database, query <code>DBA_SQL_FIREWALL_ALLOW_LISTS</code> .
allow_list	Specifies the CLOB that was created when the allow-list was exported with <code>DBMS_SQL_FIREWALL.EXPORT_ALLOW_LIST</code> .

Usage Notes

- If this user does not have an allow-list in the target database, a new allow-list will be created for this user using the allow-list from the JSON payload. The new allow-list will have the same settings (`status`, `top_level_only`, `enforce`, `block`, `generated_on`, `status_updated_on`), same allowed contexts and same allowed SQL as the one in the JSON. If the specified user already has an allow-list in the target database, then all the settings (`status`, `top_level_only`, `enforce`, `block`, and various timestamps) of the existing allow-list will remain untouched, but only the allowed SQL and allowed contexts from the JSON will be merged into the ones for the existing allow-list.
- In addition, the import operation includes all the referenced SQL logs (by the allowed SQL).
- To find the status of users' allow-lists, query the `DBA_SQL_FIREWALL_ALLOW_LISTS` data dictionary view.
- If you want to import all the SQL Firewall metadata, which includes captures and allow-lists, then instead of using `DBMS_SQL_FIREWALL.IMPORT_ALLOW_LIST`, use the `include=SQL_FIREWALL` clause in the Oracle Data Pump `impdp` command. See *Oracle Database Security Guide*.

Example

```
BEGIN
  DBMS_SQL_FIREWALL.IMPORT_ALLOW_LIST (
    username      => 'PFITCH',
    allow_list    => ALLOW_LIST_CLOB;
  );
```



```
END;
/
```

177.4.18 INCLUDE Procedure

This procedure enables SQL Firewall to capture and enforce allow-lists for database connections and SQL executions during Oracle Scheduler operations.

Syntax

```
DBMS_SQL_FIREWALL.INCLUDE (
    FEATURE          IN NUMBER);
```

Parameters

Table 177-17 INCLUDE Procedure Parameters

Parameter	Description
FEATURE	Enter DBMS_SQL_FIREWALL.SCHEDULER_JOB for this value.

Usage Notes

- To find the status of whether SQL Firewall is enforced during Oracle Scheduler operations, query the EXCLUDE_JOBS column of the DBA_SQL_FIREWALL_STATUS data dictionary view. If the output is N, then SQL Firewall can perform during Oracle Scheduler operations.
- To prevent SQL Firewall from running during Oracle Scheduler operations, run the DBMS_SQL_FIREWALL.EXCLUDE procedure.

Example

```
EXEC DBMS_SQL_FIREWALL.INCLUDE (DBMS_SQL_FIREWALL.SCHEDULER_JOB);
```

177.4.19 PURGE_LOG Procedure

This procedure purges SQL Firewall logs that belong to the given user based on the specified purge time (that is, logs that were generated before the specified purge time).

Syntax

```
BEGIN
    DBMS_SQL_FIREWALL.PURGE_LOG (
        username      IN VARCHAR2,
        purge_time    IN TIMESTAMP WITH TIME ZONE,
        log_type      IN NUMBER);
```

Parameters

Table 177-18 PURGE_LOG Procedure Parameters

Parameter	Description
username	Specifies the user whose capture logs or violation logs you want to purge. To see capture logs, query DBA_SQL_FIREWALL_CAPTURE_LOGS; to see violation logs, query DBA_SQL_FIREWALL_VIOLATIONS.
purge_time	The timestamp (in <code>TIMESTAMP</code> format) that you can specify to purge only logs that were generated before a certain time. If you omit this value, then Oracle Database purges all logs, regardless of the time when they were generated.
log_type	Specifies the type of the logs to be purged. <ul style="list-style-type: none"> DBMS_SQL_FIREWALL.CAPTURE_LOG DBMS_SQL_FIREWALL.VIOLATION_LOG DBMS_SQL_FIREWALL.ALL_LOGS (default)

Usage Notes

To find information about SQL Firewall logs, query the `DBA_SQL_FIREWALL_VIOLATIONS` data dictionary view.

Example

```
BEGIN
  DBMS_SQL_FIREWALL.PURGE_LOG (
    username    => 'PSMITH',
    purge_time  => TO_TIMESTAMP_TZ('23-JAN-22 18.44.42 -07:00',
  'DD/MM/YY HH24:MI:SS TZH:TZM'),
    log_type    => DBMS_SQL_FIREWALL.VIOLATION_LOG
  );
END;
/
```

177.4.20 START_CAPTURE Procedure

This procedure immediately starts a SQL Firewall capture for a user.

Syntax

```
DBMS_SQL_FIREWALL.START_CAPTURE (
  username      IN VARCHAR2);
```

Parameters

Table 177-19 START_CAPTURE Procedure Parameters

Parameter	Description
username	Specifies the name of the user to be designated for the SQL Firewall capture.

Usage Notes

- A user can only have one SQL Firewall capture. To find if the user already has been configured for a capture, query the `DBA_SQL_FIREWALL_CAPTURES` data dictionary view.
- After you start the capture process, all SQL the user enters is captured into the SQL Firewall capture log table. You can periodically check the this SQL by querying the `DBA_SQL_FIREWALL_CAPTURE_LOGS` data dictionary view.

Example

```
EXEC DBMS_SQL_FIREWALL.START_CAPTURE ('PFITCH');
```

177.4.21 STOP_CAPTURE Procedure

This procedure immediately stops a SQL Firewall capture for a given user.

Syntax

```
DBMS_SQL_FIREWALL.STOP_CAPTURE (
    username          IN  VARCHAR2);
```

Parameters**Table 177-20 STOP_CAPTURE Procedure Parameters**

Parameter	Description
username	Specifies the name of the user who was designated for the SQL Firewall capture. To find this user, query <code>DBA_SQL_FIREWALL_CAPTURES</code> .

Usage Notes

- The capture process must be currently running before you can run this procedure. You can check its status by querying the `DBA_SQL_FIREWALL_CAPTURES` data dictionary view.
- After you stop the capture process, you can generate an allow-list for the user by running the `DBMS_SQL_FIREWALL.GENERATE_ALLOW_LIST` procedure.

Example

```
EXEC DBMS_SQL_FIREWALL.STOP_CAPTURE ('PFITCH');
```

177.4.22 UPDATE_ALLOW_LIST_ENFORCEMENT Procedure

This procedure immediately updates the SQL Firewall allow-list enforcement options for the given user.

Syntax

```
BEGIN
    DBMS_SQL_FIREWALL.UPDATE_ALLOW_LIST_ENFORCEMENT (
        username          IN  VARCHAR2,
```

```

enforce      IN  NUMBER,
block        IN  BOOLEAN);

```

Parameters

Table 177-21 UPDATE_ALLOW_LIST_ENFORCEMENT Procedure Parameters

Parameter	Description
username	Specifies the name of the user for whom the allow-list was generated. To find this user, query DBA_SQL_FIREWALL_ALLOW_LISTS. If you enter NULL, then the enforcement options of all the existing allow-lists (both enabled or disabled allow-lists) are updated.
enforce	<ul style="list-style-type: none"> DBMS_SQL_FIREWALL.ENFORCE_CONTEXT enforces the allowed contexts that have been configured. DBMS_SQL_FIREWALL.ENFORCE_SQL enforces the allowed SQL that has been configured. DBMS_SQL_FIREWALL.ENFORCE_ALL enforces both allowed contexts and allowed SQL. This setting is the default.
block	<ul style="list-style-type: none"> TRUE blocks user's database connection or the user's SQL execution whenever the user violates the allow-list definition. FALSE allows unmatched user database connections or SQL commands to proceed. This setting is the default.

Usage Notes

To find the status of users' allow-lists, query the DBA_SQL_FIREWALL_ALLOW_LISTS data dictionary view.

Example

```

BEGIN
  DBMS_SQL_FIREWALL.UPDATE_ALLOW_LIST_ENFORCEMENT (
    username      => 'PFITCH',
    enforce       => DBMS_SQL_FIREWALL.ENFORCE_SQL,
    block         => TRUE
  );
END;
/

```

DBMS_SQL_MONITOR

The `DBMS_SQL_MONITOR` package provides information about Real-Time SQL Monitoring and Real-Time Database Operation Monitoring.

This chapter contains the following topics:

- [DBMS_SQL_MONITOR Overview](#)
- [DBMS_SQL_MONITOR Security Model](#)
- [DBMS_SQL_MONITOR Constants](#)
- [Summary of DBMS_SQL_MONITOR Subprograms](#)



See Also:

[DBMS_SQLTUNE](#)

178.1 DBMS_SQL_MONITOR Overview

The `DBMS_SQL_MONITOR` package provides information about Real-Time SQL Monitoring and Real-Time Database Operation Monitoring.

These features provide automatic monitoring of SQL statements, PL/SQL blocks, or composite database operations that are considered high-cost. A simple database operation is a single SQL statement or PL/SQL procedure or function. A composite database operation is activity between two defined points in time in a database session. The monitored data is collected in the `V$SQL_MONITOR` and `V$SQL_PLAN_MONITOR` views.

The following subprograms begin and end monitoring of a composite database operation:

- [BEGIN_OPERATION Function](#)
- [END_OPERATION Procedure](#)

The following subprograms report on monitoring data collected in `V$SQL_MONITOR` and `V$SQL_PLAN_MONITOR`:

- [REPORT_SQL_MONITOR Function](#)
- [REPORT_SQL_MONITOR_XML Function](#)
- [REPORT_SQL_MONITOR_LIST Function](#)
- [REPORT_SQL_MONITOR_LIST_XML Function](#)

178.2 DBMS_SQL_MONITOR Security Model

This package is available to `PUBLIC` and executes with invoker's rights privileges. The reporting functions require privileges to select data from the catalog as provided by the role `SELECT_CATALOG_ROLE`.

178.3 DBMS_SQL_MONITOR Constants

The `DBMS_SQL_MONITOR` package uses the constants shown in the following table.

Table 178-1 DBMS_SQL_MONITOR Constants

Constant	Type	Value	Description
<code>FORCE_TRACKING</code>	<code>VARCHAR2(30)</code>	<code>'Y'</code>	Force track the composite database operation when the operation starts
<code>NO_FORCE_TRACKING</code>	<code>VARCHAR2(30)</code>	<code>'N'</code>	Do not force track the composite database operation when the operation starts. It is only tracked when it has consumed 5 seconds of CPU or I/O time.

178.4 Summary of DBMS_SQL_MONITOR Subprograms

This table lists and describes the `DBMS_SQL_MONITOR` package subprograms.

Table 178-2 DBMS_SQL_MONITOR Package Subprograms

Subprogram	Description
BEGIN_OPERATION Function	This function starts a database operation in the current session.
END_OPERATION Procedure	This function ends a database operation in the current session. If the specified database operation does not exist, then this function has no effect.
REPORT_SQL_MONITOR Function	This function builds a detailed report with monitoring information for a SQL statement, PL/SQL block, or database operation.
REPORT_SQL_MONITOR_XML Function	This function is identical to the <code>REPORT_SQL_MONITOR</code> function, except that the return type is <code>XMLType</code> .
REPORT_SQL_MONITOR_LIST Function	This function builds a report for all or a subset of database operations that have been monitored by Oracle Database.
REPORT_SQL_MONITOR_LIST_XML Function	This function is identical to the <code>REPORT_SQL_MONITOR_LIST</code> function, except that it returns <code>XMLType</code> .

178.4.1 BEGIN_OPERATION Function

This function starts a database operation in the current session.

Syntax

```
DBMS_SQL_MONITOR.BEGIN_OPERATION (
  dbop_name      IN VARCHAR2,
  dbop_eid       IN NUMBER   := NULL,
  forced_tracking IN VARCHAR2 := NO_FORCE_TRACKING,
  attribute_list IN VARCHAR2 := NULL,
  session_id     IN NUMBER   := NULL,
  session_serial IN NUMBER   := NULL)
RETURN NUMBER;
```

Parameters

Table 178-3 *BEGIN_OPERATION Procedure Parameters*

Parameter	Description
dbop_name	Name for the composite database operation.
dbop_eid	Unique identifier for the current execution of the composite database operation.
forced_tracking	Whether tracking is forced. Possible values are: <ul style="list-style-type: none"> FORCE_TRACKING - forces the composite database operation to be tracked when the operation starts. You can also use the string variable Y. NO_FORCE_TRACKING - tracks the operation only when it has consumed at least 5 seconds of CPU or I/O time. You can also use the string variable N. See " DBMS_SQL_MONITOR Constants ".
attribute_list	List of user-created attributes. It is a comma-separated list of name-value pairs (for example, 'table_name=emp, operation=load').
session_id	Session ID of the session to be monitored. If omitted (or null), then the database monitors the current session.
session_serial	Serial number of the session to be monitored. If omitted (or null), then the database uses only the session ID to determine the session.

Return Values

This function returns the database operation execution ID. If the value is null for dbop_eid, then the database generates a unique value.

178.4.2 END_OPERATION Procedure

This procedure ends a database operation in the current session. If the specified database operation does not exist, then this function has no effect.

Syntax

```
DBMS_SQL_MONITOR.END_OPERATION (
    dbop_name      IN VARCHAR2,
    dbop_eid       IN NUMBER);
```

Parameters

Table 178-4 END_OPERATION Procedure Parameters

Parameter	Description
dbop_name	Name of a composite database operation
dbop_eid	Unique identifier for the current execution of the composite database operation

178.4.3 REPORT_SQL_MONITOR Function

This function builds a detailed report with monitoring information for a SQL statement, PL/SQL block, or database operation.

For each operation, it gives key information and associated global statistics. Use this function to get detailed monitoring information for a database operation.

The target database operation for this report can be:

- The last database operation monitored by Oracle Database (default, no parameter).
- The last database operation executed in the specified session and monitored by Oracle Database. The session is identified by its session ID and optionally its serial number (-1 is current session).
- The last execution of a specific database operation identified by its `sql_id`.
- A specific execution of a database operation identified by the combination `sql_id`, `sql_exec_start`, and `sql_exec_id`.
- The last execution of a specific database operation identified by `dbop_name`.
- The specific execution of a database operation identified by the combination `dbop_name`, `dbop_exec_id`.

Syntax

```
DBMS_SQL_MONITOR.REPORT_SQL_MONITOR (
    sql_id          IN VARCHAR2 DEFAULT NULL,
    dbop_name       IN VARCHAR2 DEFAULT NULL,
    dbop_exec_id    IN NUMBER   DEFAULT NULL,
    session_id      IN NUMBER   DEFAULT NULL,
    session_serial  IN NUMBER   DEFAULT NULL,
```



```

sql_exec_start      IN DATE      DEFAULT NULL,
sql_exec_id         IN NUMBER     DEFAULT NULL,
inst_id             IN NUMBER     DEFAULT NULL,
start_time_filter   IN DATE      DEFAULT NULL,
end_time_filter     IN DATE      DEFAULT NULL,
instance_id_filter  IN NUMBER     DEFAULT NULL,
parallel_filter     IN VARCHAR2  DEFAULT NULL,
plan_line_filter    IN NUMBER     DEFAULT NULL,
event_detail        IN VARCHAR2  DEFAULT 'YES',
bucket_max_count    IN NUMBER     DEFAULT 128,
bucket_interval     IN NUMBER     DEFAULT NULL,
base_path           IN VARCHAR2  DEFAULT NULL,
last_refresh_time   IN DATE      DEFAULT NULL,
report_level        IN VARCHAR2  DEFAULT 'TYPICAL',
type                IN VARCHAR2  DEFAULT 'TEXT',
sql_plan_hash_value IN NUMBER     DEFAULT NULL,
con_name            IN VARCHAR2  DEFAULT NULL)
RETURN CLOB;

```

Parameters

Table 178-5 *REPORT_SQL_MONITOR Procedure Parameters*

Parameter	Description
sql_id	SQL_ID of the simple database operation for which monitoring information should be displayed. Use NULL (default) to display monitoring information for the last simple database operation monitored by Oracle.
dbop_name	DBOP_NAME for which monitoring information of the composite database operation is displayed
dbop_exec_id	Execution ID for the composite database operation for which monitoring information is displayed
session_id	Targets only the subset of statements executed and monitored on behalf of the specified session. Default is NULL. Use -1 or USERENV('SID') for the current session.
session_serial	In addition to session_id, you can specify the session serial number to ensure the desired session incarnation is targeted. This is ignored when session_id is NULL.
sql_exec_start	Time at which execution of the monitored SQL was started. Only applicable when sql_id is specified. Used to display monitoring information for a particular execution of sql_id. When NULL (default), the last execution of sql_id is shown.
sql_exec_id	A numeric ID generated internally by SQL monitor to identify different executions of the same SQL statement. Thus each execution will have the same sql_id but a different sql_exec_id. Only applicable when sql_id is specified and is used to display monitoring information for a particular execution of sql_id. When NULL (default), the last execution of sql_id is shown.
inst_id	Looks only at queries started on the specified instance. Use -1 to target the current instance. The default, NULL will target all instances.
start_time_filter	If not NULL, the report shows activity from V\$ACTIVE_SESSION_HISTORY started after this date. If NULL, the reported activity starts once the targeted database operation has started.

Table 178-5 (Cont.) REPORT_SQL_MONITOR Procedure Parameters

Parameter	Description
end_time_filter	If not NULL, the report shows activity from V\$ACTIVE_SESSION_HISTORY started before this date. If NULL, the reported activity ends when the targeted database operation has ended or SYSDATE if the operation is still executing.
instance_id_filter	Only looks at activity for the specified instance. Use NULL (the default) to target all instances. Only relevant if the query runs in parallel.
parallel_filter	Parallel filter applies only to parallel execution and allows you to select only a subset of the processes involved in the parallel execution. The string parallel_filter can be: <ul style="list-style-type: none"> • NULL - target all parallel execution servers as wells as the query coordinator • ['qc'] [servers (<svr_grp>[,] <svr_set>[,] <svr_num>)] where any NULL value is interpreted as ALL
plan_line_filter	Selects activity and execution statistics for the specified line number in the plan of a SQL.
event_detail	When set to NO, the activity is aggregated by wait_class only. Use YES (default) to aggregate by wait_class, event_name.
bucket_max_count	Specifies the maximum number of buckets to create in the report
bucket_interval	Represents the exact time interval, in seconds, of all histogram buckets. If specified, bucket_max_count is ignored.
base_path	URL path for flex HTML resources since flex HTML format requires access to external files (Java scripts and the flash swf file).
last_refresh_time	If not NULL (default), the time when the report was last retrieved (SYSDATE attribute of the report tag). Use this option when you want to display the report of an running query and when that report is refreshed on a regular basis. This optimizes the size of the report since only the new changed information will be returned. In particular, the following will be optimized: <ul style="list-style-type: none"> • SQL text will not be returned when this option is specified • Activity histogram will start at the bucket that intersects that time. The entire content of the bucket is returned, even if last_refresh_time is after the start of that bucket

Table 178-5 (Cont.) REPORT_SQL_MONITOR Procedure Parameters

Parameter	Description
report_level	<p>Level of detail for the report. Of the following, only one can be specified:</p> <ul style="list-style-type: none"> NONE: Minimum possible BASIC: This is equivalent to <code>sql_text-plan-xplan-sessions-instance-activity_histogram-plan_histogram-metrics</code> where the token "-" implies that report section will not be included in the report. TYPICAL: Everything but <code>plan_histogram</code> ALL: Everything <p>In addition, individual report sections can also be enabled or disabled by using a <code>±section_name</code>. Several sections are defined:</p> <ul style="list-style-type: none"> XPLAN: Shows explain plan. ON by default. PLAN: Shows plan monitoring statistics. ON by default. SESSIONS: Show session details. Applies only to parallel queries. ON by default. INSTANCE: Shows instance details. Applies only to parallel and cross instance queries. ON by default. PARALLEL: An umbrella parameter for specifying sessions as well as instance details ACTIVITY: Shows activity summary at global level, plan line level and session INSTANCE LEVEL: (If applicable). ON by default. BINDS: Shows bind information when available. ON by default. METRICS: Shows metric data (such as CPU and IOs) over time. ON by default ACTIVITY_HISTOGRAM: Shows a histogram of the overall query activity. ON by default. PLAN_HISTOGRAM: Shows activity histogram at plan line level. OFF by default. OTHER: Other information. ON by default. <p>In addition, SQL text can be specified at different levels:</p> <ul style="list-style-type: none"> -SQL_TEXT: No SQL text in report +SQL_TEXT: Alright with partial SQL text, that is, up to the first 2000 chars as stored in <code>GV\$SQL_MONITOR</code> SQL_FULLTEXT: No full SQL text, that is, <code>+sql_text</code> +SQL_FULLTEXT: Show full SQL text (default)
type	<p>Report type:</p> <ul style="list-style-type: none"> TEXT: text report (default) HTML: simple HTML report ACTIVE: database active report. Some information (explain plan, <code>activity_histogram</code>, <code>metrics</code> and <code>plan_histogram</code>) is only shown when this type is selected XML: raw data for the report
sql_plan_hash_value	Targets only those with the specified plan hash value. Default is NULL.
con_name	Container name in a multitenant database.

Return Values

SQL monitor report, an XML document.

Usage Notes

The user invoking this function must have privilege to access the following fixed views:

- GV\$SQL_MONITOR
- GV\$SQL_PLAN_MONITOR
- GV\$ACTIVE_SESSION_HISTORY
- GV\$SESSION_LONGOPS
- GV\$SQL if SQL full text is requested and its length is greater than 2 KB

178.4.4 REPORT_SQL_MONITOR_XML Function

This function is identical to the `REPORT_SQL_MONITOR` function, except that the return type is `XMLType`.

Related Topics

- [REPORT_SQL_MONITOR Function](#)
This function builds a detailed report with monitoring information for a SQL statement, PL/SQL block, or database operation.

178.4.5 REPORT_SQL_MONITOR_LIST Function

This function builds a report for all or a subset of database operations that have been monitored by Oracle Database.

For each database operation, it gives key information and associated global statistics.

Syntax

```
DBMS_SQL_MONITOR.REPORT_SQL_MONITOR_LIST (
  sql_id           IN VARCHAR2 DEFAULT NULL,
  dbop_name       IN VARCHAR2 DEFAULT NULL,
  monitor_type    IN NUMBER   DEFAULT MONITOR_TYPE_ALL,
  session_id     IN NUMBER   DEFAULT NULL,
  session_serial  IN NUMBER   DEFAULT NULL,
  inst_id        IN NUMBER   DEFAULT NULL,
  active_since_date IN DATE    DEFAULT NULL,
  active_since_sec IN NUMBER   DEFAULT NULL,
  last_refresh_time IN DATE    DEFAULT NULL,
  report_level    IN VARCHAR2 DEFAULT 'TYPICAL',
  auto_refresh    IN NUMBER   DEFAULT NULL,
  base_path      IN VARCHAR2 DEFAULT NULL,
  type           IN VARCHAR2 DEFAULT 'TEXT',
  con_name       IN VARCHAR2 DEFAULT NULL)
RETURN CLOB;
```

Parameters

Table 178-6 *REPORT_SQL_MONITOR_LIST Procedure Parameters*

Parameter	Description
sql_id	SQL_ID of the simple database operation for which monitoring information should be displayed. Use NULL (default) to display monitoring information for the last operation monitored by Oracle Database.
dbop_name	DBOP_NAME for which monitoring information of the composite database operation is displayed.
monitor_type	Monitor type: <ul style="list-style-type: none"> MONITOR_TYPE_SQL returns only simple database operations MONITOR_TYPE_DBOP returns composite database operations MONITOR_TYPE_ALL returns all types
session_id	Targets only the subset of database operations executed and monitored on behalf of the specified session. Default is NULL. Use -1 or USERENV('SID') for the current session.
session_serial	In addition to session_id, you can specify the session serial number to ensure the desired session incarnation is targeted. This is ignored when session_id is NULL.
inst_id	Looks only at monitored database operations originating from the specified instance. Use -1 to target the instance where the report executed. To target all instances, use NULL (default).
active_since_date	If not NULL (default), returns monitored database operations that have been active since the specified time. This includes all operations that are executing, as well as all operations that have completed their execution after the specified start time.
active_since_sec	If not NULL (default), returns monitored database operations that have been active since the specified time. This includes all operations that are executing, as well as all operations that have completed their execution after the specified date and time. In this case, the start time is specified relative to the current SYSDATE minus a specified number of seconds. For example, use 3600 to limit the report to all operations that have been active in the past 1 hour.
last_refresh_time	If not NULL (default), the time when the list report was last retrieved. This optimizes the case where an application shows the list and refreshes the report on a regular basis (such as once every 5 seconds). In this case, the report will show details about the execution of monitored queries that have been active since the specified last_refresh_time. For other queries, the report returns the execution key (sql_id, sql_exec_start, and sql_exec_id). Also, for queries that have their first refresh time after the specified date, only the SQL execution key and statistics are returned.
report_level	Level of detail for the report. The level can be BASIC (SQL text up to 200 character), TYPICAL (which include full SQL text assuming that cursor has not aged out, in which case the SQL text is included up to 2000 characters), or ALL which is the same as TYPICAL.
auto_refresh	Specifies the duration in seconds after which report data will be automatically refreshed while the monitored SQL or database operation is still executing. This applies to active report types.

Table 178-6 (Cont.) REPORT_SQL_MONITOR_LIST Procedure Parameters

Parameter	Description
base_path	URL path for flex HTML resources since flex HTML format requires access to external files (java scripts and the flash swf file).
type	Report type: <ul style="list-style-type: none"> TEXT: text report (default) HTML: simple HTML report ACTIVE: database active report. Some information (explain plan, activity_histogram, metrics, and plan_histogram) is only shown when this type is selected. XML: raw data for the report
con_name	Container name in a multitenant database.

Return Values

A report in text, XML, or HTML format that contains the list of the database operations monitored.

Usage Notes

- Use the [REPORT_SQL_MONITOR Function](#) to get detailed monitoring information for a single database operation.
- The user invoking this function needs to have the privilege to access the fixed views `GV$SQL_MONITOR` and `GV$SQL`.

178.4.6 REPORT_SQL_MONITOR_LIST_XML Function

This function is identical to the `REPORT_SQL_MONITOR_LIST` function, except that it returns `XMLType`.

Related Topics

- [REPORT_SQL_MONITOR_LIST Function](#)
This function builds a report for all or a subset of database operations that have been monitored by Oracle Database.

DBMS_SQL_TRANSLATOR

The `DBMS_SQL_TRANSLATOR` package provides an interface for creating, configuring, and using SQL translation profiles.

This chapter contains the following topics:

- [Security Model](#)
- [Constants](#)
- [Operational Notes](#)
- [Exceptions](#)
- [Examples](#)
- [Summary of DBMS_SQL_TRANSLATOR Subprograms](#)



See Also:

SQL Translation Framework Architecture and Overview in *Oracle Database Migration Guide*

179.1 DBMS_SQL_TRANSLATOR Security Model

`DBMS_SQL_TRANSLATOR` is an invoker's rights package.

When translating a SQL statement or error, the translator package procedure will be invoked with the same current user and current schema as those in which the SQL statement being parsed. The owner of the translator package must be granted the `TRANSLATE SQL` user privilege on the current user.

Additionally, the current user must be granted the `EXECUTE` privilege on the translator package.

179.2 DBMS_SQL_TRANSLATOR Constants

`DBMS_SQL_TRANSLATOR` defines several constants to use when specifying parameter values.

These are shown in the following table.

Table 179-1 DBMS_SQL_TRANSLATOR Constants

Constant	Value	Type	Description
ATTR_EDITIONABLE	'EDITIONABLE'	VARCHAR2 (30)	Name of the SQL translation profile attribute that specifies whether the SQL translation profile becomes an editioned or noneditioned object if editioning is later enabled for the schema object type SQL translation profile in the owner's schema (see Operational Notes)
ATTR_FOREIGN_SQL_SYNTAX	'FOREIGN_SQL_SYNTAX'	VARCHAR2 (30)	Name of the SQL translation profile attribute that indicates if the profile is for translation of foreign SQL syntax (see Operational Notes)
ATTR_LOG_TRANSLATION_ERROR	'TRANSLATION_ERROR'	VARCHAR2 (30)	Name of the SQL translation profile attribute that controls if the profile should log translation error in the database alert log (see Operational Notes)
ATTR_RAISE_TRANSLATION_ERROR	'TRANSLATION_ERROR'	VARCHAR2 (30)	Name of the SQL translation profile attribute that controls if the profile should raise translation error if a SQL statement or error fails to be translated (see Operational Notes)
ATTR_TRANSLATE_NEW_SQL	'TRANSLATE_NEW_SQL'	VARCHAR2 (30)	Name of the SQL translation profile attribute that controls if the profile should translate new SQL statements and errors (see Operational Notes)
ATTR_TRACE_TRANSLATION	'TRACE_TRANSLATION'	VARCHAR2 (30)	Name of the SQL translation profile attribute that controls tracing (see Operational Notes)
ATTR_TRANSLATOR	'TRANSLATOR'	VARCHAR2 (30)	Name of the SQL translation profile attribute that specifies the translator package (see Operational Notes)
ATTR_VALUE_TRUE	'TRUE'	VARCHAR2 (30)	Value to set a SQL translation profile attribute to true (see Operational Notes)
ATTR_VALUE_FALSE	'FALSE'	VARCHAR2 (30)	Value to set a SQL translation profile attribute to false (see Operational Notes)

179.3 DBMS_SQL_TRANSLATOR Operational Notes

The subprograms that modify a profile have DDL transaction semantics and when invoked will commit any open transaction in the session.

ATTR_EDITIONABLE Constant

Editionable is true by default.

ATTR_FOREIGN_SQL_SYNTAX Constant

Foreign SQL syntax is true by default.

ATTR_LOG_TRANSLATION_ERROR Constant

- If log translation is enabled in a SQL translation profile, an alert log is written to the database alert log if no custom translation is found for a SQL statement or error. This allows the user to catch any error in the custom translation in a profile.
- Log translation error is false by default.

ATTR_RAISE_TRANSLATION_ERROR Constant

Raise translation error is false by default.

ATTR_TRANSLATE_NEW_SQL Constant

- The name of the SQL translation profile attribute that controls if the profile should translate new SQL statements and errors. If so, the translator package, if registered, will translate a new SQL statement or error not already translated in custom translations, and also register the new translation as custom translation. If not, any new SQL statement or error encountered will result in a translation error
- Translate new SQL statements and errors is true by default.

ATTR_TRACE_TRANSLATION Constant

- If tracing is enabled in a SQL translation profile, any SQL statement or error translated by the profile in a database session and its translation is written to the database session's trace file.
- Tracing is disabled by default.

ATTR_TRANSLATOR Constant

- The translator package must be a PL/SQL package with the following three procedures. The [TRANSLATE_SQL Procedure](#) and the [TRANSLATE_ERROR Procedure](#) are called to translate SQL statements and errors. The names of the parameters of the translate procedures must be followed.

```
PROCEDURE TRANSLATE_SQL(
    sql_text          IN CLOB,
    translated_text   OUT CLOB);
```

```
PROCEDURE TRANSLATE_ERROR(
    error_code        IN BINARY_INTEGER,
    translated_code   OUT BINARY_INTEGER,
    translated_sqlstate OUT VARCHAR2);
```

Parameters:

```
profile_name      - profile name
sql_text          - SQL statement to be translated
translated_text   - translated SQL statement
error_code        - Oracle error code
translated_code   - translated error code
translated_sqlstate - translated SQLSTATE
```

- When NULL is returned in translated_text, translated_code, or translated_sqlstate, it means that no translation is required and the original SQL statement, error code, or SQLSTATE is used instead.
- The name of the translator package follows the naming rules for database packages of the form [schema.]package_name. When the schema and package names are used, they

are set to uppercase by default unless surrounded by double quotation marks. For example, setting a translator package, `translator => 'dbms_tsqL_translator'` is the same as `translator => 'Dbms_Tsql_Translator'` and `translator => 'DBMS_TSQ_L_TRANSLATOR'`, but not the same as `translator => "dbms_tsqL_translator"`. The default schema name is the profile owner.

- The translator attribute is not set by default.

ATTR_VALUE_TRUE Constant

The value to set a SQL translation profile attribute to true.

ATTR_VALUE_FALSE Constant

The value to set a SQL translation profile attribute to false.

179.4 DBMS_SQL_TRANSLATOR Exceptions

This table lists the exceptions raised by the `DBMS_SQL_TRANSLATOR` package.

Table 179-2 Exceptions Raised by DBMS_SQL_TRANSLATOR

Exception	Error Code	Description
BAD_ARGUMENT	29261	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEG E	1031	User has insufficient privilege for the operation
NO_SUCH_PROFILE	24252	Profile does not exist
NO_SUCH_USER	1918	Profile owner does not exist
NO_TRANSLATION_FOUND	24253	No translation of the SQL statement or error code found
PROFILE_EXISTS	955	Profile already exists

179.5 DBMS_SQL_TRANSLATOR Examples

This is an example of basic SQL translation using `DBMS_SQL_TRANSLATOR`.

Basic SQL Translation

```
BEGIN
  DBMS_SQL_TRANSLATOR.CREATE_PROFILE(
    profile_name => 'tsqL_application');
  DBMS_SQL_TRANSLATOR.SET_ATTRIBUTE(
    profile_name => 'tsqL_application',
    attribute_name => DBMS_SQL_TRANSLATOR.ATTR_TRANSLATOR,
    attribute_value => 'migration_repo.sybase_tsqL_translator');
END;
```

179.6 Summary of DBMS_SQL_TRANSLATOR Subprograms

This table lists the DBMS_SQL_TRANSLATOR subprograms and briefly describes them.

Table 179-3 DBMS_SQL_TRANSLATOR Package Subprograms

Subprogram	Description
CREATE_PROFILE Procedure	Creates a SQL translation profile
DEREGISTER_SQL_TRANSLATION Procedure	Deregisters the custom translation of a SQL statement in a SQL translation profile
DEREGISTER_ERROR_TRANSLATION Procedure	Deregisters the translation of an Oracle error code and <code>SQLSTATE</code> in a SQL translation profile
DROP_PROFILE Procedure	Drops a SQL translation profile and its contents
ENABLE_ERROR_TRANSLATION Procedure	Enables or disables a custom translation of an Oracle error code in a SQL translation profile
ENABLE_SQL_TRANSLATION Procedure	Enables or disables a custom translation of a SQL statement in a SQL translation profile
EXPORT_PROFILE Procedure	Exports the content of a SQL translation profile
IMPORT_PROFILE Procedure	Imports the content of a SQL translation profile
REGISTER_ERROR_TRANSLATION Procedure	Registers a custom translation of an Oracle error code and <code>SQLSTATE</code> in a SQL translation profile
REGISTER_SQL_TRANSLATION Procedure	Registers a custom translation of a SQL statement in a SQL translation profile
SET_ATTRIBUTE Procedure	Sets an attribute of a SQL translation profile
SQL_HASH Function	Computes the hash value of a SQL statement in a SQL translation profile
SQL_ID Function	Computes the SQL identifier of a SQL statement in a SQL translation profile
TRANSLATE_ERROR Procedure	Translates an Oracle error code and an ANSI <code>SQLSTATE</code> using a SQL translation profile
TRANSLATE_SQL Procedure	Translates a SQL statement using a SQL translation profile

179.6.1 CREATE_PROFILE Procedure

This procedure creates a SQL translation profile.

Syntax

```
DBMS_SQL_TRANSLATOR.CREATE_PROFILE (
    profile_name    IN VARCHAR2);
```

Parameters

Table 179-4 CREATE_PROFILE Procedure Parameters

Parameter	Description
profile_name	Name of profile

Exceptions

Table 179-5 CREATE_PROFILE Procedure Exceptions

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEGE	User has insufficient privilege for the operation
NO_SUCH_USER	Profile owner does not exist
PROFILE_EXISTS	Profile already exists

Usage Notes

- A SQL translation profile is a database schema object that resides in SQL translation profile namespace. Its name follows the naming rules for database objects of the form [schema.]name. When the schema and profile names are used in the DBMS_SQL_TRANSLATOR package, they are uppercased unless surrounded by double quotation marks. For example, the translation profile profile_name => 'tsql_application' is the same as profile_name => 'Tsql_Application' and profile_name => 'TSQL_APPLICATION', but not the same as profile_name => 'tsql_application'.
- A SQL translation profile is an editionable object type.
- A SQL translation profile cannot be created as a common object in a multitenant container database (CDB).
- To destroy a SQL translation profile, use the [DROP_PROFILE Procedure](#).

Examples

```
BEGIN
  DBMS_SQL_TRANSLATOR.CREATE_PROFILE(profile_name => 'tsql_application');
END;
```

179.6.2 DEREGISTER_SQL_TRANSLATION Procedure

This procedure deregisters the custom translation of a SQL statement in a SQL translation profile.

Syntax

```
DBMS_SQL_TRANSLATOR.DEREGISTER_SQL_TRANSLATION (
  profile_name      IN  VARCHAR2,
  sql_text          IN  CLOB);
```

Parameters

Table 179-6 *DEREGISTER_SQL_TRANSLATION Procedure Parameters*

Parameter	Description
profile_name	Name of profile
sql_text	SQL statement

Exceptions

Table 179-7 *DEREGISTER_SQL_TRANSLATION Procedure Exceptions*

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEGE	User has insufficient privilege for the operation
NO_SUCH_USER	Profile owner does not exist
PROFILE_EXISTS	Profile already exists

Examples

```
BEGIN
  DBMS_SQL_TRANSLATOR.DEREGISTER_SQL_TRANSLATION (
    profile_name => 'tsql_application',
    sql_text     => 'select top 5 * from emp');
END;
```

179.6.3 DEREGISTER_ERROR_TRANSLATION Procedure

This procedure deregisters the translation of an Oracle error code and `SQLSTATE` in a SQL translation profile.

Syntax

```
DBMS_SQL_TRANSLATOR.DEREGISTER_ERROR_TRANSLATION (
  profile_name      IN  VARCHAR2,
  error_code        IN  PLS_INTEGER);
```

Parameters

Table 179-8 *DEREGISTER_ERROR_TRANSLATION Procedure Parameters*

Parameter	Description
profile_name	Name of profile
error_code	Oracle error code

Exceptions

Table 179-9 DEREGISTER_ERROR_TRANSLATION Procedure Exceptions

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEGE	User has insufficient privilege for the operation
NO_SUCH_USER	Profile owner does not exist
NO_SUCH_PROFILE	Profile does not exist

Examples

```
BEGIN
  DBMS_SQL_TRANSLATOR.DEREGISTER_ERROR_TRANSLATION(
    profile_name => 'tsql_application',
    error_code   => 1);
END;
```

179.6.4 DROP_PROFILE Procedure

This procedure drops a SQL translation profile and its contents.

Syntax

```
DBMS_SQL_TRANSLATOR.DROP_PROFILE (
  profile_name IN VARCHAR2);
```

Parameters

Table 179-10 DROP_PROFILE Procedure Parameters

Parameter	Description
profile_name	Name of profile

Exceptions

Table 179-11 DROP_PROFILE Procedure Exceptions

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEGE	User has insufficient privilege for the operation
NO_SUCH_USER	Profile owner does not exist
NO_SUCH_PROFILE	Profile does not exist

Examples

```
BEGIN
  DBMS_SQL_TRANSLATOR.DROP_PROFILE (
```

```

        profile_name => 'tsql_application');
END;
```

179.6.5 ENABLE_ERROR_TRANSLATION Procedure

This procedure enables or disables a custom translation of an Oracle error code in a SQL translation profile.

Syntax

```

DBMS_SQL_TRANSLATOR.ENABLE_ERROR_TRANSLATION (
    profile_name     IN  VARCHAR2,
    sql_text         IN  CLOB,
    enable           IN  BOOLEAN DEFAULT TRUE);
```

Parameters

Table 179-12 *ENABLE_ERROR_TRANSLATION Procedure Parameters*

Parameter	Description
profile_name	Name of profile
sql_text	SQL statement
enable	Enable or disable the translation

Exceptions

Table 179-13 *ENABLE_ERROR_TRANSLATION Procedure Exceptions*

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEGE	User has insufficient privilege for the operation
NO_SUCH_USER	Profile owner does not exist
NO_SUCH_PROFILE	Profile does not exist

Examples

```

BEGIN
    DBMS_SQL_TRANSLATOR.ENABLE_ERROR_TRANSLATION(
        profile_name => 'tsql_application',
        sql_text     => 'SELECT TOP 5 * FROM emp'
        enable       => TRUE);
END;
```

179.6.6 ENABLE_SQL_TRANSLATION Procedure

This procedure enables or disables a custom translation of a SQL statement in a SQL translation profile.

Syntax

```

DBMS_SQL_TRANSLATOR.ENABLE_SQL_TRANSLATION (
    profile_name     IN  VARCHAR2,
```

```
sql_text      IN CLOB,
enable        IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 179-14 *ENABLE_SQL_TRANSLATION Procedure Parameters*

Parameter	Description
profile_name	Name of profile
sql_text	SQL statement
enable	Enable or disable the translation

Exceptions

Table 179-15 *ENABLE_SQL_TRANSLATION Procedure Exceptions*

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEGE	User has insufficient privilege for the operation
NO_SUCH_USER	Profile owner does not exist
NO_SUCH_PROFILE	Profile does not exist

Examples

```
BEGIN
  DBMS_SQL_TRANSLATOR.ENABLE_SQL_TRANSLATION(
    profile_name => 'tsql_application',
    sql_text     => 'select top 5 * from emp',
    enable       => TRUE);
END;
```

179.6.7 EXPORT_PROFILE Procedure

This procedure exports the content of a SQL translation profile.

Syntax

```
DBMS_SQL_TRANSLATOR.EXPORT_PROFILE (
  profile_name IN VARCHAR2,
  content      OUT NOCOPY CLOB);
```

Parameters

Table 179-16 *EXPORT_PROFILE Procedure Parameters*

Parameter	Description
profile_name	Name of profile
content	Content of profile

Exceptions

Table 179-17 EXPORT_PROFILE Procedure Exceptions

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEGE	User has insufficient privilege for the operation
NO_SUCH_USER	Profile owner does not exist
NO_SUCH_PROFILE	Profile does not exist

Usage Notes

- The content of the SQL translation profile is exported in XML format as follows. Note that the profile name will not be exported.

```
SQLTranslationProfile Translator="translator package name"
                      ForeignSQLSyntax="TRUE|FALSE"
                      TranslateNewSQL="TRUE|FALSE"
                      RaiseTranslationError="TRUE|FALSE"
                      LogTranslationError="TRUE|FALSE"
                      TraceTranslation="TRUE|FALSE"
                      Editionable="TRUE|FALSE">
  <SQLTranslations>
    <SQLTranslation Enabled="TRUE|FALSE">
      <SQLText>original SQL text</SQLText>
      <TranslatedText>translated SQL text</TranslatedText>
    </SQLTranslation>
    ...
  </SQLTranslations>
  <ErrorTranslations>
    <ErrorTranslation Enabled="TRUE|FALSE">
      <ErrorCode>Oracle error code</ErrorCode>
      <TranslatedCode>translated error code</TranslatedCode>
      <TranslatedSQLSTATE>translated SQLSTATE</TranslatedSQLSTATE>
    </ErrorTranslation>
    ...
  </ErrorTranslations>
</SQLTranslationProfile>
```

- To import the content to a SQL translation profile, use the [IMPORT_PROFILE Procedure](#).

Examples

```
DECLARE
  content CLOB;
BEGIN
  DBMS_SQL_TRANSLATOR.EXPORT_PROFILE(
    profile_name => 'tsql_application',
    content      => content);
END;
```

179.6.8 IMPORT_PROFILE Procedure

This procedure imports the content of a SQL translation profile.

Syntax

```
DBMS_SQL_TRANSLATOR.IMPORT_PROFILE (
  profile_name      IN   VARCHAR2,
  content           IN   CLOB);
```

Parameters

Table 179-18 *IMPORT_PROFILE Procedure Parameters*

Parameter	Description
profile_name	Name of profile
content	Content of profile

Exceptions

Table 179-19 *IMPORT_PROFILE Procedure Exceptions*

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEGE	User has insufficient privilege for the operation
NO_SUCH_USER	Profile owner does not exist

Usage Notes

- The content of the SQL translation profile must be in XML format as used by the [EXPORT_PROFILE Procedure](#). All elements and attributes are optional.
- If the profile does not exist, it is created. If it exists, the content overrides any existing attribute, translator package, SQL or error translation registration.
- To export the content to a SQL translation profile, use the [EXPORT_PROFILE Procedure](#).

Examples

```
DECLARE
  content CLOB;
BEGIN
  DBMS_SQL_TRANSLATOR.IMPORT_PROFILE(
    profile_name => 'tsql_application',
    content      => content);
END;
```

179.6.9 REGISTER_ERROR_TRANSLATION Procedure

This procedure registers a custom translation of an Oracle error code and `SQLSTATE` in a SQL translation profile.

Syntax

```
DBMS_SQL_TRANSLATOR.REGISTER_ERROR_TRANSLATION (
  profile_name      IN  VARCHAR2,
  error_code       IN  PLS_INTEGER,
  translated_code   IN  PLS_INTEGER DEFAULT NULL,
  translated_sqlstate IN VARCHAR2 DEFAULT NULL,
  enable           IN  BOOLEAN DEFAULT TRUE);
```

Parameters

Table 179-20 REGISTER_ERROR_TRANSLATION Procedure Parameters

Parameter	Description
<code>profile_name</code>	Name of profile
<code>error_code</code>	Oracle error code
<code>translated_code</code>	Translated error code
<code>translated_sqlstate</code>	Translated <code>SQLSTATE</code>
<code>enable</code>	Enable or disable the translation

Exceptions

Table 179-21 REGISTER_ERROR_TRANSLATION Procedure Exceptions

Exception	Description
<code>BAD_ARGUMENT</code>	Bad argument is passed to the PL/SQL interface
<code>INSUFFICIENT_PRIVILEGE</code>	User has insufficient privilege for the operation
<code>NO_SUCH_USER</code>	Profile owner does not exist
<code>NO_SUCH_PROFILE</code>	Profile does not exist

Usage Notes

- When the Oracle Database translates an Oracle error code using a translation profile, it searches for the registered custom translation first, and only invokes the translator package if no match is found.
- When a translation is registered in a profile, it may be disabled. Oracle Database does not search for disabled translations.
- The old translation of the error code and `SQLSTATE`, if present, is replaced with the new translation.
- To deregister a translation, use the [DEREGISTER_ERROR_TRANSLATION Procedure](#).

Examples

```
BEGIN
    DBMS_SQL_TRANSLATOR.REGISTER_ERROR_TRANSLATION(
        profile_name => 'tsql_application',
        error_code   => 1,
        translated_code => 2601);
END;
```

179.6.10 REGISTER_SQL_TRANSLATION Procedure

This procedure registers a custom translation of a SQL statement in a SQL translation profile.

Syntax

```
DBMS_SQL_TRANSLATOR.REGISTER_SQL_TRANSLATION (
    profile_name     IN VARCHAR2,
    sql_text         IN CLOB,
    translated_text  IN CLOB DEFAULT NULL,
    enable           IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 179-22 REGISTER_SQL_TRANSLATION Procedure Parameters

Parameter	Description
profile_name	Name of profile
sql_text	SQL statement
translated_text	Translated SQL statement
enable	Enable or disable the translation

Exceptions

Table 179-23 REGISTER_SQL_TRANSLATION Procedure Exceptions

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEGE	User has insufficient privilege for the operation
NO_SUCH_USER	Profile owner does not exist
NO_SUCH_PROFILE	Profile does not exist

Usage Notes

- When the Oracle Database translates a statement using a translation profile, it searches for the registered custom translation first, and only invokes the translator package if no match is found.
- When a translation is registered in a profile, it may be disabled. Oracle Database does not search for disabled translations.

- When `translated_text` is `NULL`, no translation is required and the original statement is used.
- The old translation of the SQL statement, if present, is replaced with the new translation.
- To deregister a translation, use the [DEREGISTER_SQL_TRANSLATION Procedure](#).

Examples

```
BEGIN
  DBMS_SQL_TRANSLATOR.REGISTER_SQL_TRANSLATION(
    profile_name => 'tsql_application',
    sql_text     => 'select top 5 * from emp',
    translated_text => 'SELECT * FROM emp WHERE rownum <= :SYS_N_001');
END;
```

179.6.11 SET_ATTRIBUTE Procedure

This procedure sets an attribute of a SQL translation profile.

Syntax

```
DBMS_SQL_TRANSLATOR.SET_ATTRIBUTE (
  profile_name  IN  VARCHAR2,
  attribute_name IN  VARCHAR2,
  attribute_value IN VARCHAR2;)
```

Parameters

Table 179-24 *SET_ATTRIBUTE Procedure Parameters*

Parameter	Description
<code>profile_name</code>	Name of profile
<code>attribute_name</code>	Name of attribute
<code>attribute_value</code>	Value of attribute

Exceptions

Table 179-25 *SET_ATTRIBUTE Procedure Exceptions*

Exception	Description
<code>BAD_ARGUMENT</code>	Bad argument is passed to the PL/SQL interface
<code>INSUFFICIENT_PRIVILEGE</code>	User has insufficient privilege for the operation
<code>NO_SUCH_USER</code>	Profile owner does not exist
<code>NO_SUCH_PROFILE</code>	Profile does not exist

Usage Notes

See [Constants](#)

179.6.12 SQL_HASH Function

This procedure computes the hash value of a SQL statement in the session's SQL translation profile.

Syntax

```
DBMS_SQL_TRANSLATOR.SQL_HASH (  
    sql_text          IN CLOB)  
RETURN NUMBER DETERMINISTIC;
```

Parameters

Table 179-26 SQL_HASH Function Parameters

Parameter	Description
sql_text	SQL statement

Return Values

Returns hash value of the SQL statement in the SQL translation profile

Exceptions

Table 179-27 SQL_HASH Function Exceptions

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface

Examples

```
DECLARE  
    sqltext CLOB;  
    txltext CLOB;  
    sqlhash NUMBER;  
BEGIN  
    sqltext := 'SELECT TOP 1 * FROM emp';  
    sqlhash := DBMS_SQL_TRANSLATOR.SQL_HASH (sqltext);  
    SELECT translated_text INTO txltext  
    FROM user_sql_translations  
    WHERE sql_hash = sqlhash  
    AND DBMS_LOB.COMPARE (sql_text, sqltext) = 0;  
END;
```

179.6.13 SQL_ID Function

This procedure computes the SQL identifier of a SQL statement in a SQL translation profile.

Syntax

```
DBMS_SQL_TRANSLATOR.SQL_ID (  
    sql_text          IN CLOB)  
RETURN VARCHAR2 DETERMINISTIC;
```

Parameters

Table 179-28 SQL_ID Function Parameters

Parameter	Description
sql_text	SQL statement

Return Values

Returns the SQL ID of the SQL statement in the SQL translation profile

Exceptions

Table 179-29 SQL_ID Function Exceptions

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface

Examples

```

DECLARE
  sqltext CLOB;
  sqlid   VARCHAR2(13);
BEGIN
  sqltext := 'SELECT TOP 1 * FROM emp';
  sqlid   := DBMS_SQL_TRANSLATOR.SQL_ID (sqltext);
END;

```

179.6.14 TRANSLATE_ERROR Procedure

This procedure translates an Oracle error code and an ANSI SQLSTATE using the session's SQL translation profile

Syntax

```

DBMS_SQL_TRANSLATOR.TRANSLATE_ERROR (
  error_code          IN          PLS_INTEGER,
  translated_code     OUT         PLS_INTEGER,
  translated_sqlstate OUT NOCOPY  VARCHAR2);

```

Parameters

Table 179-30 TRANSLATE_ERROR Procedure Parameters

Parameter	Description
error_code	Oracle error code
translated_code	Translated error code
translated_sqlstate	Translated SQLSTATE

Exceptions

Table 179-31 TRANSLATE_ERROR Procedure Exceptions

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEGE	User has insufficient privilege for the operation
NO_SUCH_USER	Profile owner does not exist
NO_SUCH_PROFILE	Profile does not exist
NO_TRANSLATION_FOUND	No translation of the SQL statement or error code is found

Examples

```

DECLARE
    translated_code      BINARY_INTEGER;
    translated_sqlstate  VARCHAR2(5);
BEGIN
    DBMS_SQL_TRANSLATOR.TRANSLATE_ERROR(
        error_code       => 1,
        translated_code  => translated_code,
        translated_sqlstate => translated_sqlstate);
END;
```

179.6.15 TRANSLATE_SQL Procedure

This procedure translates a SQL statement using a SQL translation profile.

Syntax

```

DBMS_SQL_TRANSLATOR.TRANSLATE_SQL (
    sql_text          IN          CLOB,
    translated_text   OUT NOCOPY CLOB);
```

Parameters

Table 179-32 TRANSLATE_SQL Procedure Parameters

Parameter	Description
sql_text	SQL statement
translated_text	Translated SQL statement

Exceptions

Table 179-33 TRANSLATE_SQL Procedure Exceptions

Exception	Description
BAD_ARGUMENT	Bad argument is passed to the PL/SQL interface
INSUFFICIENT_PRIVILEGE	User has insufficient privilege for the operation
NO_SUCH_USER	Profile owner does not exist

Table 179-33 (Cont.) TRANSLATE_SQL Procedure Exceptions

Exception	Description
NO_SUCH_PROFILE	Profile does not exist

Examples

```
ALTER SESSION SET SQL_TRANSLATION_PROFILE = tsql_application;
```

```
DECLARE
    translated_text CLOB;
BEGIN
    DBMS_SQL_TRANSLATOR.TRANSLATE_SQL(
        sql_text      => 'select top 5 * from emp',
        translated_text => translated_text);
END;
```

DBMS_SQLDIAG

The DBMS_SQLDIAG package provides an interface to the SQL Diagnosability functionality.

This chapter contains the following topics:

- [DBMS_SQLDIAG Overview](#)
- [DBMS_SQLDIAG Security Model](#)
- [DBMS_SQLDIAG Constants](#)
- [Summary of DBMS_SQLDIAG Subprograms](#)

See Also:

Oracle Database Administrator's Guide for more information about "Managing Diagnostic Data"

180.1 DBMS_SQLDIAG Overview

In the rare case that a SQL statement fails with a critical error, you can run the SQL Repair Advisor to try to repair the failed statement by using the DBMS_SQLDIAG package subprograms.

The SQL Repair Advisor analyzes the statement and in many cases recommends a patch to repair the statement. If you implement the recommendation, the applied SQL patch circumvents the failure by causing the query optimizer to choose an alternate execution plan for future executions.

See Also:

Oracle Database Administrator's Guide for more information about how to run the SQL Repair Advisor using the DBMS_SQLDIAG package subprograms.

180.2 DBMS_SQLDIAG Security Model

You must have the `ADVISOR` role to execute the DBMS_SQLDIAG package.

180.3 DBMS_SQLDIAG Constants

DBMS_SQLDIAG defines constants to use when specifying parameter values.

These constants are shown in the following tables:

- [Table 180-1](#) describes the name of SQL repair advisor as seen by the advisor framework

- [Table 180-2](#) describes SQLDIAG advisor task scope parameter values
- [Table 180-3](#) describes SQLDIAG advisor `time_limit` constants
- [Table 180-4](#) describes possible formats for a report
- [Table 180-5](#) describes possible levels of detail in the report
- [Table 180-6](#) describes possible report sections (comma delimited)
- [Table 180-7](#) describes possible values for the `problem_type` parameter of the `CREATE_DIAGNOSIS_TASK` Functions
- [Table 180-8](#) describes possible values for the `_sql_findings_mode` parameter

Table 180-1 DBMS_SQLDIAG Constants - SQLDIAG Advisor Name

Constant	Type	Value	Description
ADV_SQL_DIAG_NAME	VARCHAR2 (18)	SQL Repair Advisor	Name of SQL repair advisor as seen by the advisor framework

Table 180-2 DBMS_SQLDIAG Constants - SQLDIAG Advisor Task Scope Parameter Values

Constant	Type	Value	Description
SCOPE_COMPREHENSIVE	VARCHAR2 (13)	COMPREHENSIVE	Detailed analysis of the problem which may take more time to execute
SCOPE_LIMITED	VARCHAR2 (7)	LIMITED	Brief analysis of the problem

Table 180-3 DBMS_SQLDIAG Constants - SQLDIAG Advisor time_limit Constants

Constant	Type	Value	Description
TIME_LIMIT_DEFAULT	NUMBER	1800	Default time limit for analysis of the problem

Table 180-4 DBMS_SQLDIAG Constants - Report Type (possible values) Constants

Constant	Type	Value	Description
TYPE_HTML	VARCHAR2 (4)	HTML	Report from the REPORT_DIAGNOSIS_TASK Function in HTML form
TYPE_TEXT	VARCHAR2 (4)	TEXT	Report from the REPORT_DIAGNOSIS_TASK Function in text form

Table 180-4 (Cont.) DBMS_SQLDIAG Constants - Report Type (possible values) Constants

Constant	Type	Value	Description
TYPE_XML	VARCHAR2 (3)	XML	Report from the REPORT_DIAGNOSIS_TASK Function in XML form

Table 180-5 DBMS_SQLDIAG Constants - Report Level (possible values) Constants

Constant	Type	Value	Description
LEVEL_ALL	VARCHAR2 (3)	ALL	Complete report including annotations about statements skipped over
LEVEL_BASIC	VARCHAR2 (5)	BASIC	Shows information about every statement analyzed, including recommendations not implemented
LEVEL_TYPICAL	VARCHAR2 (7)	TYPICAL	Simple report shows only information about the actions taken by the advisor.

Table 180-6 DBMS_SQLDIAG Constants - Report Section (possible values) Constants

Constant	Type	Value	Description
SECTION_ALL	VARCHAR2 (3)	ALL	All statements
SECTION_ERRORS	VARCHAR2 (6)	ERRORS	Statements with errors
SECTION_FINDINGS	VARCHAR2 (8)	FINDINGS	Tuning findings
SECTION_INFORMATION	VARCHAR2 (11)	INFORMATION	General information
SECTION_PLANS	VARCHAR2 (5)	PLANS	Explain plans
SECTION_SUMMARY	VARCHAR2 (7)	SUMMARY	Summary information

Table 180-7 DBMS_SQLDIAG Constants - Problem Type Constants

Constant	Type	Value	Description
PROBLEM_TYPE_PERFORMANCE	NUMBER	1	User suspects this is a performance problem
PROBLEM_TYPE_WRONG_RESULTS	NUMBER	2	User suspects the query is giving inconsistent results
PROBLEM_TYPE_COMPILATION_ERROR	NUMBER	3	User sees a crash in compilation

Table 180-7 (Cont.) DBMS_SQLDIAG Constants - Problem Type Constants

Constant	Type	Value	Description
PROBLEM_TYPE_EXECUTION_ERR OR	NUMBER	4	User sees a crash in execution
PROBLEM_TYPE_ALT_PLAN_GEN	NUMBER	5	User to explore all alternative plans

Table 180-8 DBMS_SQLDIAG Constants - Findings Filter Constants

Constant	Type	Value	Description
SQLDIAG_FINDINGS_ALL	NUMBER	1	Show all possible findings
SQLDIAG_FINDINGS_VALIDAT ION	NUMBER	2	Show status of validation rules over structures
SQLDIAG_FINDINGS_FEATURE S	NUMBER	3	Show only features used by the query
SQLDIAG_FINDINGS_FILTER_ PLANS	NUMBER	4	Show the alternative plans generated by the advisor
SQLDIAG_FINDINGS_CR_DIFF	NUMBER	5	Show difference between two plans
SQLDIAG_FINDINGS_MASK_VA RIANT	NUMBER	6	Mask info for testing
SQLDIAG_FINDINGS_OBJ_FEA TURES	NUMBER	7	Show features usage history
SQLDIAG_FINDINGS_BASIC_I NFO	NUMBER	8	Show the alternative plans generated by the advisor

180.4 Summary of DBMS_SQLDIAG Subprograms

This table lists the DBMS_SQLDIAG subprograms and briefly describes them.

Table 180-9 DBMS_SQLDIAG Package Subprograms

Subprogram	Description
ACCEPT_SQL_PATCH Function & Procedure	Accepts a recommended SQL patch as recommended by the specified SQL diagnosis task
ALTER_SQL_PATCH Procedure	Alters specific attributes of an existing SQL patch object
CANCEL_DIAGNOSIS_TASK Procedure	Cancels a diagnostic task
CREATE_DIAGNOSIS_TASK Functions	Creates a diagnostic task in order to diagnose a single SQL statement

Table 180-9 (Cont.) DBMS_SQLDIAG Package Subprograms

Subprogram	Description
CREATE_SQL_PATCH Function	Creates an SQL patch based on a set of user specified hints for specific statements identified by SQL text.
CREATE_STGTAB_SQLPATCH Procedure	Creates the staging table used for transporting SQL patches from one system to another
DROP_DIAGNOSIS_TASK Procedure	Drops a diagnostic task
DROP_SQL_PATCH Procedure	Drops the named SQL patch from the database
EXECUTE_DIAGNOSIS_TASK Procedure	Executes a diagnostic task
EXPLAIN_SQL_TESTCASE Function	Explains a SQL test case
EXPORT_SQL_TESTCASE Procedures	Exports a SQL test case to a directory
EXPORT_SQL_TESTCASE_DIR_BY_INC Function	Generates a SQL Test Case corresponding to the incident ID passed as an argument.
EXPORT_SQL_TESTCASE_DIR_BY_TXT Function	Generates a SQL Test Case corresponding to the SQL passed as an argument
GET_FIX_CONTROL Function	Returns the value of fix control for a given bug number
GET_SQL Function	Imports a SQL test case
IMPORT_SQL_TESTCASE Procedures	Imports a SQL test case into a schema
INCIDENTID_2_SQL Procedure	Initializes a <code>sql_setrow</code> from an incident ID
INTERRUPT_DIAGNOSIS_TASK Procedure	Interrupts a diagnostic task
LOAD_SQLSET_FROM_TCB Function	Loads a <code>SQLSET</code> from Test Case Builder (TCB) file
PACK_STGTAB_SQLPATCH Procedure	SQL patches into the staging table created by the CREATE_STGTAB_SQLPATCH Procedure
REPLAY_SQL_TESTCASE Function	Reports on a diagnostic task
REPORT_SQL Function	Generates a diagnostic report in HTML format for a specific SQL statement.
REPORT_DIAGNOSIS_TASK Function	Reports on a diagnostic task
RESET_DIAGNOSIS_TASK Procedure	Resets a diagnostic task
RESUME_DIAGNOSIS_TASK Procedure	Resumes a diagnostic task
SET_DIAGNOSIS_TASK_PARAMETER Procedure	Sets a diagnosis task parameter
SQL_DIAGNOSE_AND_REPAIR Function	Diagnoses a given SQL statement for a given SQL ID for the given problem type.

Table 180-9 (Cont.) DBMS_SQLDIAG Package Subprograms

Subprogram	Description
UNPACK_STGTAB_SQLPATCH Procedure	Unpacks from the staging table populated by a call to the PACK_STGTAB_SQLPATCH Procedure , using the patch data stored in the staging table to create patches on this system

180.4.1 ACCEPT_SQL_PATCH Function & Procedure

This procedure accepts a recommended SQL patch as recommended by the specified SQL diagnosis task.

Syntax

```
DBMS_SQLDIAG.ACCEPT_SQL_PATCH (
    task_name      IN  VARCHAR2,
    object_id      IN  NUMBER := NULL,
    name           IN  VARCHAR2 := NULL,
    description    IN  VARCHAR2 := NULL,
    category       IN  VARCHAR2 := NULL,
    task_owner     IN  VARCHAR2 := NULL,
    replace        IN  BOOLEAN := FALSE,
    force_match    IN  BOOLEAN := FALSE)
RETURN VARCHAR2;
```

```
DBMS_SQLDIAG.ACCEPT_SQL_PATCH (
    task_name      IN  VARCHAR2,
    object_id      IN  NUMBER := NULL,
    name           IN  VARCHAR2 := NULL,
    description    IN  VARCHAR2 := NULL,
    category       IN  VARCHAR2 := NULL,
    task_owner     IN  VARCHAR2 := NULL,
    replace        IN  BOOLEAN := FALSE,
    force_match    IN  BOOLEAN := FALSE);
```

Parameters

Table 180-10 ACCEPT_SQL_PATCH Function & Procedure Parameters

Parameter	Description
taskname	Name of the SQL diagnosis task
object_id	Identifier of the advisor framework object representing the SQL statement associated to the diagnosis task
name	Name of the patch. It cannot contain double quotation marks. The name is case sensitive. If not specified, the system will generate a unique name for the SQL patch.
description	User specified string describing the purpose of this SQL patch. Maximum size of description is 500.

Table 180-10 (Cont.) ACCEPT_SQL_PATCH Function & Procedure Parameters

Parameter	Description
category	Category name which must match the value of the <code>SQLDIAGNOSE_CATEGORY</code> parameter in a session for the session to use this patch. It defaults to the value <code>DEFAULT</code> . This is also the default of the <code>SQLDIAGNOSE_CATEGORY</code> parameter. The category must be a valid Oracle identifier. The category name specified is always converted to upper case. The combination of the normalized SQL text and category name create a unique key for a patch. An accept will fail if this combination is duplicated.
task_owner	Owner of the diagnosis task. This is an optional parameter that has to be specified to accept a SQL Patch associated to a diagnosis task owned by another user. The current user is the default value.
replace	If the patch already exists, it will be replaced if this argument is <code>TRUE</code> . It is an error to pass a name that is already being used for another signature/category pair, even with <code>replace</code> set to <code>TRUE</code> .
force_match	If <code>TRUE</code> this causes SQL Patches to target all SQL statements which have the same text after normalizing all literal values into bind variables. (Note that if a combination of literal values and bind values is used in a SQL statement, no bind transformation occurs.) This is analogous to the matching algorithm used by the <code>FORCE</code> option of the <code>CURSOR_SHARING</code> parameter. If <code>FALSE</code> , literals are not transformed. This is analogous to the matching algorithm used by the <code>EXACT</code> option of the <code>CURSOR_SHARING</code> parameter.

Return Values

Name of the SQL patch

Usage Notes

Requires `CREATE ANY SQL PROFILE` privilege

180.4.2 ALTER_SQL_PATCH Procedure

This procedure alters specific attributes of an existing SQL patch object.

Syntax

```
DBMS_SQLDIAG.ALTER_SQL_PATCH (
    name           IN VARCHAR2,
    attribute_name IN VARCHAR2,
    attribute_value IN VARCHAR2);
```

Parameters

Table 180-11 ALTER_SQL_PATCH Procedure Parameters

Parameter	Description
name	Name of SQL patch to alter.

Table 180-11 (Cont.) ALTER_SQL_PATCH Procedure Parameters

Parameter	Description
attribute_name	Name of SQL patch to alter. Possible values: <ul style="list-style-type: none"> STATUS -> can be set to ENABLED or DISABLED NAME -> can be reset to a valid name (must be a valid Oracle identifier and must be unique). DESCRIPTION -> can be set to any string of size no more than 500 CATEGORY -> can be reset to a valid category name (must be valid Oracle identifier and must be unique when combined with normalized SQL text) This parameter is mandatory and is case sensitive.
attribute_value	New value of the attribute. See attribute_name for valid attribute values. This parameter is mandatory.

Usage Notes

Requires ALTER ANY SQL PATCH privilege

180.4.3 CANCEL_DIAGNOSIS_TASK Procedure

This procedure cancels a diagnostic task.

Syntax

```
DBMS_SQLDIAG.CANCEL_DIAGNOSIS_TASK (
    taskname          IN  VARCHAR2);
```

Parameters

Table 180-12 CANCEL_DIAGNOSIS_TASK Procedure Parameters

Parameter	Description
taskname	Name of task

180.4.4 CREATE_DIAGNOSIS_TASK Functions

This function creates a diagnostic task in order to diagnose a single SQL statement. It returns a SQL diagnosis task unique name

Syntax

Prepares the diagnosis of a single statement given its text:

```
DBMS_SQLDIAG.CREATE_DIAGNOSIS_TASK (
    sql_text          IN  CLOB,
    bind_list         IN  sql_binds := NULL,
    user_name         IN  VARCHAR2 := NULL,
    scope             IN  VARCHAR2 := SCOPE_COMPREHENSIVE,
    time_limit        IN  NUMBER   := TIME_LIMIT_DEFAULT,
    task_name         IN  VARCHAR2 := NULL,
```

```

description      IN  VARCHAR2  := NULL,
problem_type     IN  NUMBER     := PROBLEM_TYPE_PERFORMANCE)
RETURN VARCHAR2;

```

Prepares the diagnosis of a single statement from the Cursor Cache given its identifier:

```

DBMS_SQLDIAG.CREATE_DIAGNOSIS_TASK (
  sql_id          IN  VARCHAR2,
  plan_hash_value IN  NUMBER   := NULL,
  scope           IN  VARCHAR2 := SCOPE_COMPREHENSIVE,
  time_limit      IN  NUMBER   := TIME_LIMIT_DEFAULT,
  task_name       IN  VARCHAR2 := NULL,
  description     IN  VARCHAR2 := NULL,
  problem_type    IN  NUMBER   := PROBLEM_TYPE_PERFORMANCE)
RETURN VARCHAR2;

```

Prepares the diagnosis of a Sqlset:

```

DBMS_SQLDIAG.CREATE_DIAGNOSIS_TASK (
  sqlset_name     IN  VARCHAR2,
  basic_filter    IN  VARCHAR2 := NULL,
  object_filter   IN  VARCHAR2 := NULL,
  rank1           IN  VARCHAR2 := NULL,
  rank2           IN  VARCHAR2 := NULL,
  rank3           IN  VARCHAR2 := NULL,
  result_percentage IN NUMBER := NULL,
  result_limit    IN  NUMBER   := NULL,
  scope           IN  VARCHAR2 := SCOPE_COMPREHENSIVE,
  time_limit      IN  NUMBER   := TIME_LIMIT_DEFAULT,
  task_name       IN  VARCHAR2 := NULL,
  description     IN  VARCHAR2 := NULL,
  plan_filter     IN  VARCHAR2 := 'MAX_ELAPSED_TIME',
  sqlset_owner    IN  VARCHAR2 := NULL,
  problem_type    IN  NUMBER   := PROBLEM_TYPE_PERFORMANCE) RETURN VARCHAR2;

```

Parameters

Table 180-13 CREATE_DIAGNOSIS_TASK Function Parameters

Parameter	Description
sql_text	Text of a SQL statement
bind_list	Set of bind values
user_name	Username for who the statement/sqlset will be diagnosed
scope	Diagnosis scope (limited/comprehensive)
time_limit	Maximum duration in seconds for the diagnosis session
task_name	Optional diagnosis task name
description	Maximum of 256 SQL diagnosis session description
problem_type	Determines the goal of the task. Possible values are: <ul style="list-style-type: none"> PROBLEM_TYPE_WRONG_RESULTS PROBLEM_TYPE_COMPILATION_ERROR PROBLEM_TYPE_EXECUTION_ERROR
sql_id	Identifier of the statement
plan_hash_value	Hash value of the SQL execution plan

Table 180-13 (Cont.) CREATE_DIAGNOSIS_TASK Function Parameters

Parameter	Description
sqlset_name	Sqlset name
basic_filter	SQL predicate to filter the SQL from the SQL tuning set (STS)
object_filter	Object filter
rank(i)	Order-by clause on the selected SQL
result_percentage	Percentage on the sum of a ranking measure
result_limit	Top L(imit) SQL from (filtered/ranked) SQL
plan_filter	Plan filter. It is applicable in case there are multiple plans (plan_hash_value). This filter allows selecting one plan (plan_hash_value) only. Possible values are: <ul style="list-style-type: none"> • LAST_GENERATED: plan with most recent timestamp • FIRST_GENERATED: opposite to LAST_GENERATED • LAST_LOADED: plan with most recent first_load_time stat info • FIRST_LOADED: opposite to LAST_LOADED • MAX_ELAPSED_TIME: plan with maximum elapsed time • MAX_BUFFER_GETS: plan with maximum buffer gets • MAX_DISK_READS: plan with maximum disk reads • MAX_DIRECT_WRITES: plan with maximum direct writes • MAX_OPTIMIZER_COST: plan with maximum optimum cost
sqlset_owner	Owner of the sqlset, or null for current schema owner

180.4.5 CREATE_SQL_PATCH Function

This function creates a SQL patch based on a set of user specified hints for specific statements identified by SQL text.

A SQL patch is usually created automatically by the SQL Repair Advisor to prevent any errors during the compilation or execution of a SQL statement. This function provides a way to manually create a SQL patch based on a set of hints that resolves the error.

Syntax

```
DBMS_SQLDIAG.CREATE_SQL_PATCH (
  sql_text      IN  CLOB,
  hint_text     IN  CLOB,
  name          IN  VARCHAR2  := NULL,
  description   IN  VARCHAR2  := NULL,
  category     IN  VARCHAR2  := NULL,
  validate     IN  BOOLEAN    := TRUE)
RETURN VARCHAR2;
```

```
DBMS_SQLDIAG.CREATE_SQL_PATCH (
  sql_id       IN  VARCHAR2,
  hint_text    IN  CLOB,
  name        IN  VARCHAR2  := NULL,
  description  IN  VARCHAR2  := NULL,
  category    IN  VARCHAR2  := NULL,
```

```

        validate          IN  BOOLEAN    := TRUE)
RETURN VARCHAR2;

```

Parameters

Table 180-14 CREATE_SQL_PATCH Function Parameters

Parameter	Description
sql_text	Text of the SQL statement
sql_id	The SQL identifier for the SQL statement
hint_text	Hints to include in the SQL patch
name	Optional SQL patch name
description	Description of the SQL patch
category	Category name
validate	Whether to validate the provided hints

Return Values

Both functions return the SQL patch name.

180.4.6 CREATE_STGTAB_SQLPATCH Procedure

This procedure creates the staging table used for transporting SQL patches from one system to another.

Syntax

```

DBMS_SQLDIAG.CREATE_STGTAB_SQLPATCH (
    table_name          IN  VARCHAR2,
    schema_name         IN  VARCHAR2 := NULL,
    tablespace_name     IN  VARCHAR2 := NULL);

```

Parameters

Table 180-15 CREATE_STGTAB_SQLPATCH Procedure Parameters

Parameter	Description
table_name	(Mandatory) Name of the table to create (case-sensitive)
schema_name	Schema to create the table in, or NULL for current schema (case-sensitive)
tablespace_name	Tablespace to store the staging table within, or NULL for current user's default tablespace (case-sensitive)

180.4.7 DROP_DIAGNOSIS_TASK Procedure

This procedure drops a diagnostic task.

Syntax

```
DBMS_SQLDIAG.DROP_DIAGNOSIS_TASK (  
    taskname          IN  VARCHAR2);
```

Parameters

Table 180-16 DROP_DIAGNOSIS_TASK Procedure Parameters

Parameter	Description
taskname	Name of task

180.4.8 DROP_SQL_PATCH Procedure

This procedure drops the named SQL patch from the database.

Syntax

```
DBMS_SQLDIAG.DROP_SQL_PATCH (  
    name          IN  VARCHAR2,  ignore  IN  BOOLEAN := FALSE);
```

Parameters

Table 180-17 DROP_SQL_PATCH Function & Procedure Parameters

Parameter	Description
name	Name of patch to be dropped. The name is case sensitive.
ignore	Ignore errors due to object not existing.

Usage Notes

Requires `DROP ANY SQL PATCH` privilege

180.4.9 EXECUTE_DIAGNOSIS_TASK Procedure

This procedure executes a diagnostic task.

Syntax

```
DBMS_SQLDIAG.EXECUTE_DIAGNOSIS_TASK (  
    taskname          IN  VARCHAR2);
```

Parameters

Table 180-18 EXECUTE_DIAGNOSIS_TASK Procedure Parameters

Parameter	Description
taskname	Name of task

180.4.10 EXPLAIN_SQL_TESTCASE Function

This procedure explains a SQL test case.

Syntax

```
DBMS_SQLDIAG.EXPLAIN_SQL_TESTCASE (
    sqlTestCase      IN  CLOB)
RETURN CLOB;
```

Parameters

Table 180-19 EXPLAIN_SQL_TESTCASE Function Parameters

Parameter	Description
sqlTestCase	XML document describing the SQL test case

180.4.11 EXPORT_SQL_TESTCASE Procedures

This procedure exports a SQL test case to a directory.

Syntax

This variant has to be provided with the SQL information.

```
DBMS_SQLDIAG.EXPORT_SQL_TESTCASE (
    directory          IN          VARCHAR2,
    sql_text           IN          CLOB,
    user_name          IN          VARCHAR2 := NULL,
    bind_list          IN          sql_binds := NULL,
    exportEnvironment  IN          BOOLEAN := TRUE,
    exportMetadata     IN          BOOLEAN := TRUE,
    exportData         IN          BOOLEAN := FALSE,
    exportPkgbody      IN          BOOLEAN := FALSE,
    samplingPercent    IN          NUMBER := 100,
    ctrlOptions        IN          VARCHAR2 := NULL,
    timeLimit          IN          NUMBER := 0,
    testcase_name     IN          VARCHAR2 := NULL,
    testcase           IN OUT NOCOPY CLOB,
    preserveSchemaMapping IN      BOOLEAN := FALSE,
    version            IN          VARCHAR2 := 'COMPATIBLE');
```

This variant extracts the SQL information from an incident file.

```
DBMS_SQLDIAG.EXPORT_SQL_TESTCASE (
    directory          IN          VARCHAR2,
    incident_id        IN          VARCHAR2,
```

```

exportEnvironment      IN          BOOLEAN := TRUE,
exportMetadata        IN          BOOLEAN := TRUE,
exportData            IN          BOOLEAN := FALSE,
exportPkgbody         IN          BOOLEAN := FALSE,
samplingPercent       IN          NUMBER := 100,
ctrlOptions           IN          VARCHAR2 := NULL,
timeLimit             IN          NUMBER :=
                        DBMS_SQLDIAG.TIME_LIMIT_DEFAULT,
testcase_name         IN          VARCHAR2 := NULL,
testcase              IN OUT NOCOPY CLOB,
preserveSchemaMapping IN          BOOLEAN := FALSE)
version               IN          VARCHAR2 := 'COMPATIBLE';

```

This variant allow the SQL Test case to be generated from a cursor present in the cursor cache. Use V\$SQL to get the SQL identifier and the SQL hash value.

```

DBMS_SQLDIAG.EXPORT_SQL_TESTCASE (
  directory            IN          VARCHAR2,
  sql_id               IN          VARCHAR2,
  plan_hash_value      IN          NUMBER := NULL,
  exportEnvironment    IN          BOOLEAN := TRUE,
  exportMetadata       IN          BOOLEAN := TRUE,
  exportData           IN          BOOLEAN := FALSE,
  exportPkgbody        IN          BOOLEAN := FALSE,
  samplingPercent      IN          NUMBER := 100,
  ctrlOptions          IN          VARCHAR2 := NULL,
  timeLimit            IN          NUMBER :=
                        DBMS_SQLDIAG.TIME_LIMIT_DEFAULT,
  testcase_name        IN          VARCHAR2 := NULL,
  testcase             IN OUT NOCOPY CLOB,
  preserveSchemaMapping IN          BOOLEAN := FALSE)
  version              IN          VARCHAR2 := 'COMPATIBLE';

```

Parameters

Table 180-20 EXPORT_SQL_TESTCASE Procedure Parameters

Parameter	Description
directory	Directory to store the various generated files
sql_text	Text of the SQL statement to export
incident_id	Incident ID containing the offending SQL
sql_id	Identifier of the statement in the cursor cache
username	Name of the user schema to use to parse the SQL, defaults to SYS
bind_list	List of bind values associated to the statement
exportEnvironment	TRUE if the compilation environment should be exported
exportMetadata	TRUE if the definition of the objects referenced in the SQL should be exported
exportData	TRUE if the data of the objects referenced in the SQL should be exported
exportPkgbody	TRUE if the body of the packages referenced in the SQL are exported

Table 180-20 (Cont.) EXPORT_SQL_TESTCASE Procedure Parameters

Parameter	Description
samplingPercent	If is TRUE, specify the sampling percentage to use to create the dump file

Table 180-20 (Cont.) EXPORT_SQL_TESTCASE Procedure Parameters

Parameter	Description
ctrlOptions	<p>Opaque control parameters. For example, to execute three times, set ctrlOptions with the following string: '<parameter name="mexec_count">3</parameter>'.</p> <ul style="list-style-type: none"> name="capture" - BASIC (default) or WITH_RUNTIME_INFO. This parameter defines the mode of TCB capture. <p>BASIC: runs as Oracle release 11g TCB and captures all the information that is captured in that release as well as AWR reports, SQL monitor reports and parameter information.</p> <p>WITH_RUNTIME_INFO: TCB captures runtime information for the SQL, such as dynamic sampling data, list of binds, Dynamic Plan info, along with information captured under BASIC mode.</p> <p>Note this must be the same value as used in the IMPORT_SQL_TESTCASE Procedures.</p> name="mexec_count"—Value is any positive number (N). This parameter tells TCB to execute the statement for N time and capture runtime info at end of each execution. name="stat_history_since"—Value is date. The object statistics history is exported using this parameter. Statistics history after date specified will be exported. name="compress"—This option is used to compress the SQL Test Case Builder output files into a zip file. The possible values are: <ul style="list-style-type: none"> YES NO <p>The default value is NO.</p> name="diag_event"—This option is used to specify the level of trace information to include in the SQL Test Case Builder output. The possible values are: <ul style="list-style-type: none"> ADS COMPILER SQLEXEC_LOW SQLEXEC_MEDIUM SQLEXEC_HIGH SQLEXEC_HIGHEST <p>The default value is ADS + COMPILER.</p> name="problem_type"—This option is used to assign an issue type for a SQL Test Case Builder test case. For example, if a test case is related to performance regression issue, then you can assign the value of PERFORMANCE to the problem_type option. The possible values are : <ul style="list-style-type: none"> PERFORMANCE WRONG_RESULTS COMPILATION_ERROR EXECUTION_ERROR <p>The default value is PERFORMANCE.</p>

Table 180-20 (Cont.) EXPORT_SQL_TESTCASE Procedure Parameters

Parameter	Description
timeLimit	How much time should we spend exporting the SQL test case
testcaseName	An optional name for the SQL test case. This is used to prefix all the generated scripts
testcase	Resulting testcase
preserveSchemaMapping	TRUE if the schema (or schemas) are not re-mapped from the original environment to the test environment
version	Version of database objects to be extracted. This option is only valid for EXPORT. Database objects or attributes incompatible with the version will not be extracted. <ul style="list-style-type: none"> COMPATIBLE - (default) the version of the metadata corresponds to the database compatibility level and the compatibility release level for feature (as given in the V\$COMPATIBILITY view). Database compatibility must be set to 9.2 or higher. LATEST - the version of the metadata that specifies the current database version. A specific database version. For example, if '10.0.0', this cannot be lower than Oracle Database release 10.0.0.

Usage Notes

- A SQL test case generates a set of files needed to help reproduce a SQL failure on a different machine. It contains:
 - a dump file containing schemas objects and statistics (.dmp)
 - the explain plan for the statements (in advanced mode)
 - diagnostic information gathered on the offending statement
 - an import script to execute to reload the objects
 - a SQL script to replay system statistics of the source
 - a table of contents file describing the SQL test case
 - metadata. (xxxxmain.xml)
 - a README.txt file that explain the usage of the TCB
 - the outlines used by the statement (ol.xml)
 - a list of parameters set in the exporting db/env (prmpimp.sql)
 - a SQL monitor report, if any (smrpt.html)
 - an AWR report, if any (awrrpt.html)
 - a list of binds used in this statement (bndlst.xml)
- You should not run Test Case Builder (TCB) under user SYS. Instead, use another user who can be granted the DBA privilege.
- The default setting for TCB is that data is not exported. However, in some cases data is required, such as to diagnose an outcome with a result that is not optimal. To export data,

call `EXPORT_SQL_TESTCASE` with `exportData=>TRUE` and the data will be imported by default, unless turned OFF by `importData=>FALSE`.

- TCB includes PL/SQL package spec by default, but not the PL/SQL package body. However, you may need to have the package body as well, for example, to invoke the PL/SQL functions, or because you have a Virtual Private Database (VPD) function defined in a package. To export a PL/SQL package body, call `EXPORT_SQL_TESTCASE` with `exportPkgbody=>TRUE`. To import a PL/SQL package body, call [IMPORT_SQL_TESTCASE Procedures](#) with `importPkgbody=>TRUE`.
- To export objects statistics history, the database compatibility should be set to 12.0 or higher.
- This procedure does not export data and statistics on a Global Temporary Table (GTT).

Examples

The user can specify multiple parameters in the `ctrlOptions` encapsulated either by using the `<parameters>` parent tag or without the parent tag.

Using the `<parameters>` tag

```
<parameters>
<parameter name="capture">with_runtime_info</parameter>
<parameter name="mexec_count">1</parameter>
</parameters>
```

Without the `<parameters>` tag

```
<parameter name="capture">with_runtime_info</parameter>
<parameter name="mexec_count">1</parameter>
```

The `compress` option that you can specify in the `ctrlOptions` parameter:

```
opt := '<parameters>
      <parameter name="capture">with_runtime_info</parameter>
      <parameter name="compress">yes</parameter>
      </parameters>';
```

The `diag_event` option that you can specify in the `ctrlOptions` parameter:

```
opt := '<parameters>
      <parameter name="capture">with_runtime_info</parameter>
      <parameter name="compress">yes</parameter>
      </parameters>';
```

The `problem_type` option that you can specify in the `ctrlOptions` parameter:

```
opt := '<parameters>
      <parameter name="capture">with_runtime_info</parameter>
      <parameter name="compress">yes</parameter>
      </parameters>';
```

180.4.12 EXPORT_SQL_TESTCASE_DIR_BY_INC Function

This function generates a SQL test case corresponding to the incident ID passed as an argument. It creates a set of scripts and dump file in the directory passed as an argument.

Syntax

```
DBMS_SQLDIAG.EXPORT_SQL_TESTCASE_DIR_BY_INC (
    incident_id      IN    NUMBER,
    directory        IN    VARCHAR2,
    exportEnvironment IN  VARCHAR2 := 'TRUE',
    exportMetadata   IN  VARCHAR2 := 'TRUE',
    exportData       IN  VARCHAR2 := 'FALSE',
    samplingPercent  IN  VARCHAR2 := '100',
    ctrlOptions      IN  VARCHAR2 := NULL
    version          IN  VARCHAR2 := 'COMPATIBLE')
RETURN BOOLEAN;
```

Parameters

Table 180-21 EXPORT_SQL_TESTCASE_DIR_BY_INC Function Parameters

Parameter	Description
incident_id	Incident ID containing the offending SQL. For more information about Incidents, see <i>Oracle Database Performance Tuning Guide</i> .
directory	Directory path to the generated files
exportEnvironment	TRUE if the compilation environment should be exported
exportMetadata	TRUE if the definition of the objects referenced in the SQL should be exported
exportData	TRUE if the data of the objects referenced in the SQL should be exported
samplingPercent	If is TRUE, specify the sampling percentage to use to create the dump file
ctrlOptions	<p>Opaque control parameters. For example, to execute three times, set ctrlOptions with the following string: '<parameter name="mexec_count">3</parameter>'.</p> <ul style="list-style-type: none"> capture - BASIC (default) or WITH_RUNTIME_INFO. This parameter defines the mode of TCB capture. <ul style="list-style-type: none"> BASIC: runs as Oracle release 11g TCB and captures all the information that is captured in that release as well as AWR reports, SQL monitor reports and parameter information. WITH_RUNTIME_INFO: TCB captures runtime information for the SQL, such as dynamic sampling data, list of binds, Dynamic Plan info, along with information captured under BASIC mode. name=mexec_count - Value is any positive number (N). This parameter tells TCB to execute the statement for N time and capture runtime info at end of each execution. name=stat_history_since - Value is date. The object statistics history is exported using this parameter. Statistics history after date specified will be exported.

Table 180-21 (Cont.) EXPORT_SQL_TESTCASE_DIR_BY_INC Function Parameters

Parameter	Description
version	<p>Version of database objects to be extracted. This option is only valid for EXPORT. Database objects or attributes incompatible with the version will not be extracted.</p> <ul style="list-style-type: none"> COMPATIBLE - (default) the version of the metadata corresponds to the database compatibility level and the compatibility release level for feature (as given in the V\$COMPATIBILITY view). Database compatibility must be set to 9.2 or higher. LATEST - the version of the metadata that specifies the current database version. A specific database version. For example, if '10.0.0', this cannot be lower than Oracle Database release 10.0.0.

180.4.13 EXPORT_SQL_TESTCASE_DIR_BY_TXT Function

This function generates a SQL Test Case corresponding to the SQL passed as an argument. It creates a set of scripts and dump files in the directory passed as an argument.

Syntax

```
DBMS_SQLDIAG.EXPORT_SQL_TESTCASE_DIR_BY_TXT (
  incident_id      IN   NUMBER,
  directory        IN   VARCHAR2,
  sql_text         IN   CLOB,
  user_name        IN   VARCHAR2 := 'SYS',
  exportEnvironment IN VARCHAR2 := 'TRUE',
  exportMetadata   IN   VARCHAR2 := 'TRUE',
  exportData       IN   VARCHAR2 := 'FALSE',
  samplingPercent  IN   VARCHAR2 := '100',
  ctrlOptions      IN   VARCHAR2 := NULL,
  version          IN   VARCHAR2 := 'COMPATIBLE')
RETURN BOOLEAN;
```

Parameters

Table 180-22 EXPORT_SQL_TESTCASE_DIR_BY_TXT Function Parameters

Parameter	Description
incident_id	Incident ID containing the offending SQL
directory	Directory to store the various generated files
sql_text	Text of the SQL statement to explain
username	Name of the user schema to use to parse the SQL, defaults to SYS
exportEnvironment	TRUE if the compilation environment should be exported
exportMetadata	TRUE if the definition of the objects referenced in the SQL should be exported
exportData	TRUE if the data of the objects referenced in the SQL should be exported

Table 180-22 (Cont.) EXPORT_SQL_TESTCASE_DIR_BY_TXT Function Parameters

Parameter	Description
samplingPercent	If is TRUE, specify the sampling percentage to use to create the dump file
ctrlOptions	<p>Opaque control parameters. For example, to execute three times, set ctrlOptions with the following string: '<parameter name="mexec_count">3</parameter>'.</p> <ul style="list-style-type: none"> capture - BASIC (default) or WITH_RUNTIME_INFO. This parameter defines the mode of TCB capture. <ul style="list-style-type: none"> BASIC: runs as Oracle Release 11g TCB and captures all the information that is captured in that release as well as AWR reports, SQL monitor reports and parameter information. WITH_RUNTIME_INFO: TCB captures runtime information for the SQL, such as dynamic sampling data, list of binds, Dynamic Plan info, along with information captured under BASIC mode. name=mexec_count - Value is any positive number (N). This parameter tells TCB to execute the statement for N time and capture runtime info at end of each execution. name=stat_history_since - Value is date. The object statistics history is exported using this parameter. Statistics history after date specified will be exported.
version	<p>Version of database objects to be extracted. This option is only valid for EXPORT. Database objects or attributes incompatible with the version will not be extracted.</p> <ul style="list-style-type: none"> COMPATIBLE - (default) the version of the metadata corresponds to the database compatibility level and the compatibility release level for feature (as given in the V\$COMPATIBILITY view). Database compatibility must be set to 9.2 or higher. LATEST - the version of the metadata that specifies the current database version. A specific database version. For example, if '10.0.0', this cannot be lower than Oracle Database Release 10.0.0.

180.4.14 GET_FIX_CONTROL Function

This function returns the value of fix control for a given bug number.

Syntax

```
DBMS_SQLDIAG.GET_FIX_CONTROL (
    bug_number IN NUMBER)
RETURN NUMBER;
```

Parameters**Table 180-23 GET_FIX_CONTROL Function Parameters**

Parameter	Description
bug_number	Bug number

180.4.15 GET_SQL Function

This function loads a `sql_setrow` from the trace file associated to an the given incident ID.

Syntax

```
DBMS_SQLDIAG.GET_SQL (
    incident_id IN    VARCHAR2)
    RETURN SQLSET_ROW;
```

Parameters**Table 180-24 GET_SQL Function Parameters**

Parameter	Description
incident_id	Identifier of the incident

180.4.16 IMPORT_SQL_TESTCASE Procedures

This procedure imports a SQL test case into a schema.

Syntax

This variant requires a source directory and SQL Testcase metadata object (in XML format).

```
DBMS_SQLDIAG.IMPORT_SQL_TESTCASE (
    directory          IN    VARCHAR2,
    sqlTestCase        IN    CLOB,
    importEnvironment  IN    BOOLEAN    := TRUE,
    importMetadata     IN    BOOLEAN    := TRUE,
    importData         IN    BOOLEAN    := TRUE,
    importPkgbody      IN    BOOLEAN    := FALSE,
    importDiagnosis    IN    BOOLEAN    := TRUE,
    ignoreStorage      IN    BOOLEAN    := TRUE,
    ctrlOptions        IN    VARCHAR2   := NULL,
    preserveSchemaMapping IN    BOOLEAN    := FALSE);
```

This variant requires a source directory name of SQL Testcase metadata file.

```
DBMS_SQLDIAG.IMPORT_SQL_TESTCASE (
    directory          IN    VARCHAR2,
    filename           IN    VARCHAR2,
    importEnvironment  IN    BOOLEAN    := TRUE,
    importMetadata     IN    BOOLEAN    := TRUE,
    importData         IN    BOOLEAN    := TRUE,
```

```
importPkgbody          IN  BOOLEAN  := FALSE,
importDiagnosis        IN  BOOLEAN  := TRUE,
ignoreStorage          IN  BOOLEAN  := TRUE,
ctrlOptions            IN  VARCHAR2  := NULL,
preserveSchemaMapping  IN  BOOLEAN  := FALSE);
```

Parameters

Table 180-25 IMPORT_SQL_TESTCASE Procedure Parameters

Parameter	Description
directory	Directory containing test case files
filename	Name of a file containing an XML document describing the SQL test case
importEnvironment	TRUE if the compilation environment should be imported
importMetadata	TRUE if the definition of the objects referenced in the SQL should be imported
importData	TRUE if the data of the objects referenced in the SQL should be imported
importPkgbody	TRUE if the body of the packages referenced in the SQL are imported
importDiagnosis	TRUE if the diagnostic information associated to the task should be imported
ignoreStorage	TRUE if the storage attributes should be ignored
ctrlOptions	Opaque control parameters, of which only <code>capture</code> is valid for this subprogram. <ul style="list-style-type: none"> <code>capture - BASIC (default) or WITH_RUNTIME_INFO</code>. This parameter defines the mode of TCB capture. BASIC: runs as Oracle Release 11g TCB and captures all the information that is captured in that release as well as AWR reports, SQL monitor reports and parameter information. WITH_RUNTIME_INFO: TCB captures runtime information for the SQL, such as dynamic sampling data, list of binds, Dynamic Plan info, along with information captured under BASIC mode.
preserveSchemaMapping	TRUE if the schema (or schemas) are not re-mapped from the original environment to the test environment (schema mapping in the target database will be identical to the source database). Note that when an import is run with <code>preservesSchemaMapping</code> set to <code>TRUE</code> , if the objects in the schemas exists then the import will overwrite the existing objects.

Usage Notes

- A SQL test case generates a set of files needed to help reproduce a SQL failure on a different machine. It contains:
 - a dump file containing schemas objects and statistics (`.dmp`)
 - the explain plan for the statements (in advanced mode)
 - diagnostic information gathered on the offending statement
 - an import script to execute to reload the objects
 - a SQL script to replay system statistics of the source

- a table of contents file describing the SQL test case
 - metadata. (xxxxxmain.xml)
 - a README.txt file that explain the usage of the TCB
 - the outlines used by the statement (ol.xml)
 - a list of parameters set in the exporting db/env (prmimp.sql)
 - a SQL monitor report, if any (smrpt.html)
 - an AWR report, if any (awrrpt.html)
 - a list of binds used in this statement (bndlst.xml)
- You should not run Test Case Builder (TCB) under user SYS. Instead, use another user who can be granted the DBA privilege
 - The default setting for TCB is that data is not exported. However, in some cases data is required, such as to diagnose an outcome with a result that is not optimal. To export data, call [EXPORT_SQL_TESTCASE Procedures](#) with `exportData=>TRUE` and the data will be imported by default, unless turned OFF by `importData=>FALSE`.
 - TCB includes PL/SQL package spec by default, but not the PL/SQL package body. However, you may need to have the package body as well, for example, to invoke the PL/SQL functions, or because you have a Virtual Private Database (VPD) function defined in a package. To export a PL/SQL package body, call [EXPORT_SQL_TESTCASE Procedures](#) with `exportPkgbody=>TRUE`. To import a PL/SQL package body, call [IMPORT_SQL_TESTCASE Procedures](#) with `importPkgbody=>TRUE`.
 - The `capture` value used when invoking the [EXPORT_SQL_TESTCASE Procedures](#) must be used when calling this procedure.

180.4.17 INCIDENTID_2_SQL Procedure

This procedure initializes a `sql_setrow` from an incident ID.

Syntax

```
DBMS_SQLDIAG.INCIDENTID_2_SQL (
    incident_id    IN    VARCHAR2,
    sql_stmt      OUT   SQLSET_ROW,
    problem_type  OUT   NUMBER,
    err_code      OUT   BINARY_INTEGER,
    err_mesg      OUT   VARCHAR2);
```

Parameters

Table 180-26 INCIDENTID_2_SQL Procedure Parameters

Parameter	Description
<code>incident_id</code>	Identifier of the incident
<code>sql_stmt</code>	Resulting SQL

Table 180-26 (Cont.) INCIDENTID_2_SQL Procedure Parameters

Parameter	Description
problem_type	Tentative type of SQL problem (currently among PROBLEM_TYPE_COMPILATION_ERROR and PROBLEM_TYPE_EXECUTION_ERROR)
err_code	Error code if any otherwise it is set to NULL
err_msg	Error message if any otherwise it is set to NULL

180.4.18 INTERRUPT_DIAGNOSIS_TASK Procedure

This procedure interrupts a diagnostic task.

Syntax

```
DBMS_SQLDIAG.INTERRUPT_DIAGNOSIS_TASK (
    taskname          IN    VARCHAR2);
```

Parameters

Table 180-27 INTERRUPT_DIAGNOSIS_TASK Procedure Parameters

Parameter	Description
taskname	Name of task

180.4.19 LOAD_SQLSET_FROM_TCB Function

This function loads a `SQLSET` from a Test Case Builder file.

Syntax

```
DBMS_SQLDIAG.LOAD_SQLSET_FROM_TCB (
    directory          IN    VARCHAR2,
    filename           IN    VARCHAR2,
    sqlset_name        IN    VARCHAR2 DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 180-28 LOAD_SQLSET_FROM_TCB Function Parameters

Parameter	Description
directory	Name of directory
filename	Name of file
sqlset_name	Name of <code>SQLSET</code>

180.4.20 PACK_STGTAB_SQLPATCH Procedure

This procedure packs SQL patches into the staging table created by a call to the CREATE_STGTAB_SQLPATCH Procedure.

Syntax

```
DBMS_SQLDIAG.PACK_STGTAB_SQLPATCH (
    patch_name          IN  VARCHAR2 := '%',
    patch_category      IN  VARCHAR2 := 'DEFAULT',
    staging_table_name  IN  VARCHAR2,
    staging_schema_owner IN  VARCHAR2 := NULL);
```

Parameters

Table 180-29 PACK_STGTAB_SQLPATCH Procedure Parameters

Parameter	Description
patch_name	Name of patch to pack (% wildcards acceptable, case-sensitive)
patch_category	Category to which to pack patches (% wildcards acceptable, case-insensitive)
staging_table_name	(Mandatory) Name of the table to use (case-sensitive)
staging_schema_owner	Schema where the table resides, or NULL for current schema (case-sensitive)

Usage Notes

- **Requires:** ADMINISTER SQL PLAN MANAGEMENT OBJECT privilege and INSERT privilege on the staging table
- By default, we move all SQL patches in category DEFAULT. Note that the subprogram issues a COMMIT after packing each SQL patch, so if an error is raised in mid-execution, some patches may be in the staging table.

Related Topics

- [CREATE_STGTAB_SQLPATCH Procedure](#)
This procedure creates the staging table used for transporting SQL patches from one system to another.

180.4.21 REPLAY_SQL_TESTCASE Function

This function automates the reproduction of the SQL Test Case.

Syntax

```
DBMS_SQLDIAG.REPLAY_SQL_TESTCASE (
    directory          IN  VARCHAR2,
    filename           IN  VARCHAR2,
    ctrlOptions        IN  VARCHAR2 := NULL,
    format             IN  VARCHAR2 := 'TEXT')
RETURN CLOB;

DBMS_SQLDIAG.REPLAY_SQL_TESTCASE (
    directory          IN  VARCHAR2,
```

```

sqlTestCase      IN  CLOB,
ctrlOptions      IN  VARCHAR2  := NULL,
format           IN  VARCHAR2  := 'TEXT')
RETURN CLOB;

```

Parameters

Table 180-30 REPLAY_SQL_TESTCASE Function Parameters

Parameter	Description
directory	Directory containing test case files
filename	Name of a file containing an XML document describing the SQL test case
ctrlOptions	<p>Opaque control parameters. For example, to execute three times, set ctrlOptions with the following string: '<parameter name="mexec_count">3</parameter>'.</p> <ul style="list-style-type: none"> replay - EXPLAIN (default), OUTLINE, EXECUTION or OUTLINE EXECUTION. This parameter defines TCB replay functionality. <p>EXPLAIN: Replay explains the statement without using outlines</p> <p>OUTLINE: Replay uses outlines mode and explains the statement using outlines</p> <p>EXECUTION: Replay executes the statement without using outlines</p> <p>OUTLINE EXECUTION: Replay executes the statement using outlines</p> <p>Note that if the user gives an incorrect parameter value, then the replay runs in default mode and no error is thrown.</p> name=mexec_count - Value is any positive number (N). This parameter tells TCB to execute the statement for N time and capture runtime info at end of each execution.
sqlTestCase	SQL test case
format	Format of the replay report. Possible formats are: TEXT, XML and HTML..

Examples

TCB Replay Mode: Execute

```

SELECT /* tcbdynpl_1 */ /*+ gather_plan_statistics */ * FROM (SELECT * FROM emp where
emp.sal > 100) emp, dept WHERE emp.deptno = dept.deptno And emp.sal > 1000 /*
tcbdynpl_1 */

```

Explain Plan

Plan Hash Value : 2219294842

```

-----
| Id | Operation                                | Name          | Rows |
-----
|  0 | SELECT STATEMENT                          |               |    13 |
| * 1 |  HASH JOIN                                |               |    13 |
|  2 |    NESTED LOOPS                            |               |      |
|  3 |      NESTED LOOPS                          |               |    13 |
|  4 |        STATISTICS COLLECTOR                |               |      |
|  5 |          TABLE ACCESS FULL                | DEPT          |     4 |
| * 6 |            INDEX RANGE SCAN                | EMP_IDX_DEPTNO |      |
| * 7 |              TABLE ACCESS BY INDEX ROWID | EMP           |     3 |
-----

```

```

| * 8 | TABLE ACCESS FULL | EMP | 13 |
-----

Predicate Information (identified by operation id):
-----
* 1 - access("EMP"."DEPTNO"="DEPT"."DEPTNO")
* 6 - access("EMP"."DEPTNO"="DEPT"."DEPTNO")
* 7 - filter("EMP"."SAL">1000)
* 8 - filter("EMP"."SAL">1000)

Runtime Plan
Plan Hash Value : 2219294842

-----
| Id | Operation | Name | E-Card | A-Card |
-----
| 0 | SELECT STATEMENT | | | 0 |
| * 1 | HASH JOIN | | 13 | 0 |
| 2 | TABLE ACCESS FULL | DEPT | 4 | 0 |
| * 3 | TABLE ACCESS FULL | EMP | 13 | 0 |
-----

Predicate Information (identified by operation id):
-----
* 1 - access("EMP"."DEPTNO"="DEPT"."DEPTNO")
* 3 - filter("EMP"."SAL">1000)

REPLAY Note:
-----
- Replay used dynamic sampling
- Replay forced Dynamic plan

```

180.4.22 REPORT_SQL Function

Generates a diagnostic report in HTML format for a specific SQL statement.

Syntax

```

DBMS_SQLDIAG.REPORT_SQL (
    sql_id      IN  VARCHAR2,
    directory   IN  VARCHAR2,
    level       IN  VARCHAR2
)
RETURN CLOB;

```

Parameters

Table 180-31 DBMS_SQLDIAG.REPORT_SQL Parameters

Parameter	Description
sql_id	ID of the SQL statement.
directory	Directory object where the report is written. By default, this parameter is NULL and the report is returned as a CLOB, not written to disk.

Table 180-31 (Cont.) DBMS_SQLDIAG.REPORT_SQL Parameters

Parameter	Description
level	Three options: TYPICAL <ul style="list-style-type: none"> BASIC – Restricted report carrying only... ??? TYPICAL – The standard report. ALL – The extended report.

Usage Notes

By default, the level parameter is NULL and the report is returned as a CLOB, not written to disk.

Example 180-1

In this example, SQL_ID 'gtckcpxmp3ry7' is passed in, the directory is the standard Data Pump directory, and ALL detail is returned in the report.

```
declare my_report clob; begin my_report :=
dbms_sqldiag.report_sql('gtckcpxmp3ry7',directory=>'DATA_PUMP_DIR',level=>'ALL'); end;/
```

180.4.23 REPORT_DIAGNOSIS_TASK Function

This function reports on a diagnostic task. It returns a CLOB containing the desired report.

Syntax

```
DBMS_SQLDIAG.REPORT_DIAGNOSIS_TASK (
  taskname      IN  VARCHAR2,
  type          IN  VARCHAR2 := TYPE_TEXT,
  level         IN  VARCHAR2 := LEVEL_TYPICAL,
  section       IN  VARCHAR2 := SECTION_ALL,
  object_id     IN  NUMBER   := NULL,
  result_limit  IN  NUMBER   := NULL,
  owner_name    IN  VARCHAR2 := NULL)
RETURN CLOB;
```

Parameters

Table 180-32 REPORT_DIAGNOSIS_TASK Function Parameters

Parameter	Description
taskname	Name of task to report
type	Type of the report. Possible values are: TEXT, HTML, XML (see Table 180-4).
level	Format of the recommendations. Possible values are TYPICAL, BASIC, ALL (Table 180-5).
section	Particular section in the report. Possible values are: SUMMARY, FINDINGS, PLAN, INFORMATION, ERROR, ALL (Table 180-6).

Table 180-32 (Cont.) REPORT_DIAGNOSIS_TASK Function Parameters

Parameter	Description
object_id	Identifier of the advisor framework object that represents a given statement in a SQL Tuning Set (STS).
result_limit	Number of statements in a STS for which the report is generated
owner_name	Name of the task execution to use. If NULL, the report will be generated for the last task execution.

180.4.24 RESET_DIAGNOSIS_TASK Procedure

This procedure resets a diagnostic task.

Syntax

```
DBMS_SQLDIAG.RESET_DIAGNOSIS_TASK (
    taskname          IN  VARCHAR2);
```

Parameters

Table 180-33 RESET_DIAGNOSIS_TASK Procedure Parameters

Parameter	Description
taskname	Name of task

180.4.25 RESUME_DIAGNOSIS_TASK Procedure

This procedure resumes a diagnostic path.

Syntax

```
DBMS_SQLDIAG.RESUME_DIAGNOSIS_TASK (
    taskname          IN  VARCHAR2);
```

Parameters

Table 180-34 RESUME_DIAGNOSIS_TASK Procedure Parameters

Parameter	Description
taskname	Name of task

180.4.26 SET_DIAGNOSIS_TASK_PARAMETER Procedure

This procedure is called to update the value of a SQL diagnosis parameter of type VARCHAR2.

The task must be set to its initial state before calling this procedure. The diagnosis parameters that can be set by this procedure are:

- MODE: diag scope (comprehensive, limited)

- `_SQLDIAG_FINDING_MODE`: findings in the report (see "Table 180-8" for possible values)

Syntax

```
DBMS_SQLDIAG.SET_DIAGNOSIS_TASK_PARAMETER (
    taskname          IN   VARCHAR2,
    parameter         IN   VARCHAR2,  value          IN   NUMBER);
```

Parameters

Table 180-35 SET_DIAGNOSIS_TASK_PARAMETER Procedure Parameters

Parameter	Description
taskname	Identifier of the task to execute
parameter	Name of the parameter to set
value	New value of the specified parameter

180.4.27 SQL_DIAGNOSE_AND_REPAIR Function

Diagnoses a given SQL statement for a given SQL ID for the given problem type. This function creates an incident, populate incident metadata with required information like, SQL ID, SQL text, compilation environment, and so on. It also creates a diagnostic task, executes it and accepts SQL PATCH recommendation for a given SQL ID.

Syntax

```
DBMS_SQLDIAG.SQL_DIAGNOSE_AND_REPAIR (
    sql_text          IN   CLOB,
    bind_list         IN   sql_binds := NULL,
    scope             IN   VARCHAR2 := SCOPE_COMPREHENSIVE,
    time_limit        IN   NUMBER   := TIME_LIMIT_DEFAULT,
    problem_type      IN   NUMBER   := PROBLEM_TYPE_PERFORMANCE,
    auto_apply_patch  IN   VARCHAR2 := YES)
RETURN NUMBER;
```

```
DBMS_SQLDIAG.SQL_DIAGNOSE_AND_REPAIR (
    sql_id            IN   VARCHAR2,
    plan_hash_value   IN   NUMBER   := NULL,
    scope             IN   VARCHAR2 := SCOPE_COMPREHENSIVE,
    time_limit        IN   NUMBER   := TIME_LIMIT_DEFAULT,
    problem_type      IN   NUMBER   := PROBLEM_TYPE_PERFORMANCE,
    auto_apply_patch  IN   VARCHAR2 := YES)
RETURN NUMBER;
```

```
DBMS_SQLDIAG.SQL_DIAGNOSE_AND_REPAIR (
    incident_id       IN   VARCHAR2,
    scope             IN   VARCHAR2 := SCOPE_COMPREHENSIVE,
    time_limit        IN   NUMBER   := TIME_LIMIT_DEFAULT,
    problem_type      IN   NUMBER   := PROBLEM_TYPE_PERFORMANCE,
    auto_apply_patch  IN   VARCHAR2 := YES)
RETURN NUMBER;
```


Parameters

Table 180-36 SQL_DIAGNOSE_AND_REPAIR Function Parameters

Parameter	Description
sql_text	Text of the SQL statement.
sql_id	SQL ID of the SQL query.
plan_hash_value	The plan to be used for diagnosis. The default value is NULL.
bind_list	Binds to be used for diagnosis. The default value is NULL.
scope	The scope of diagnostic advisor. Possible values are: <ul style="list-style-type: none"> SCOPE_LIMITED—only index and plan analyze are invoked for a given SQL. SCOPE_COMPREHENSIVE—besides index and plan analyze, auto-tune is called first to tune the statement. The default value is SCOPE_COMPREHENSIVE.
time_limit	Time limit for diagnostic task. The default value is TIME_LIMIT_DEFAULT.
problem_type	Problem type that is being diagnosed. The following problem type are supported: <ul style="list-style-type: none"> PROBLEM_TYPE_PERFORMANCE—performance problem. PROBLEM_TYPE_WRONG_RESULTS—incorrect results. PROBLEM_TYPE_COMPILATION_ERROR—crash during compilation of the statement. PROBLEM_TYPE_EXECUTION_ERROR—crash during execution of the statement. The default value is PROBLEM_TYPE_PERFORMANCE.
auto_apply_patch	A value that decides if the recommended SQL patch needs to be accepted. Possible values are: <ul style="list-style-type: none"> YES—accepts the recommended SQL patch. NO—does not accepts recommended SQL patch automatically. User need to manually accept the SQL patch. The default value is YES.

180.4.28 UNPACK_STGTAB_SQLPATCH Procedure

This procedure unpacks from the staging table populated by a call to the PACK_STGTAB_SQLPATCH Procedure. It uses the patch data stored in the staging table to create patches on this system. Users can opt to replace existing patches with patch data when they exist already. In this case, note that it is only possible to replace

patches referring to the same statement if the names are the same (see the ACCEPT_SQL_PATCH Function & Procedure).

Syntax

```
DBMS_SQLDIAG.UPPACK_STGTAB_SQLPATCH (
    patch_name          IN  VARCHAR2 := '%',
    patch_category      IN  VARCHAR2 := '%',
    replace             IN  BOOLEAN,
    staging_table_name  IN  VARCHAR2,
    staging_schema_owner IN  VARCHAR2 := NULL);
```

Parameters

Table 180-37 UPPACK_STGTAB_SQLPATCH Procedure Parameters

Parameter	Description
patch_name	Name of patch to unpack (% wildcards acceptable, case-sensitive)
patch_category	Category from which to unpack patches (% wildcards acceptable, case-insensitive)
replace	Replace patches if they already exist. Note that patches cannot be replaced if there is one in the staging table with the same name as an active patch on different SQL. The subprogram raises an error if there an attempt to create a patch that already exists.
staging_table_name	(Mandatory) Name of the table to use (case-sensitive)
staging_schema_owner	Schema where the table resides, or NULL for current schema (case-sensitive)

Usage Notes

- **Requires:** ADMINISTER SQL MANAGEMENT OBJECT privilege and SELECT or READ privilege on the staging table
- By default, all SQL patches in the staging table are moved. The function commits after successfully loading each patch. If it fails in creating an individual patch, it raises an error and does not proceed to those remaining in the staging table.

Related Topics

- [PACK_STGTAB_SQLPATCH Procedure](#)
This procedure packs SQL patches into the staging table created by a call to the CREATE_STGTAB_SQLPATCH Procedure.
- [ACCEPT_SQL_PATCH Function & Procedure](#)
This procedure accepts a recommended SQL patch as recommended by the specified SQL diagnosis task.

181

DBMS_SQLPA

The DBMS_SQLPA package provides the interface to implement the SQL Performance Analyzer.

The chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_SQLPA Subprograms](#)

181.1 DBMS_SQLPA Overview

The DBMS_SQLPA package provides a capacity to help users predict the impact of system environment changes on the performance of a SQL workload. The interface lets users build and then compare two different versions of the workload performance, analyze the differences between the two versions, and unmask the SQL statements that might be impacted by the changes.

The package provides a task-oriented interface to implement the SQL Performance Analyzer. For example

1. You use the [CREATE_ANALYSIS_TASK Functions](#) to create an analysis task for a single statement or a group of SQL statements.
2. The [EXECUTE_ANALYSIS_TASK Function & Procedure](#) executes a previously created analysis task.
3. The [REPORT_ANALYSIS_TASK Function](#) displays the results of an analysis task.

181.2 DBMS_SQLPA Security Model

This package is available to PUBLIC and performs its own security checking. All analysis task interfaces (XXX_ANALYSIS_TASK) require privilege ADVISOR.

181.3 Summary of DBMS_SQLPA Subprograms

This table lists the DBMS_SQLPA subprograms and briefly describes them.

Table 181-1 DBMS_SQLPA Package Subprograms

Subprogram	Description
CANCEL_ANALYSIS_TASK Procedure	Cancels the currently executing task analysis of one or more SQL statements
CREATE_ANALYSIS_TASK Functions	Creates an advisor task to process and analyze one or more SQL statements
DROP_ANALYSIS_TASK Procedure	Drops a SQL analysis task

Table 181-1 (Cont.) DBMS_SQLPA Package Subprograms

Subprogram	Description
EXECUTE_ANALYSIS_TASK Function & Procedure	Executes a previously created analysis task
INTERRUPT_ANALYSIS_TASK Procedure	Interrupts the currently executing analysis task
REPORT_ANALYSIS_TASK Function	Displays the results of an analysis task
RESET_ANALYSIS_TASK Procedure	Resets the currently executing analysis task to its initial state
RESUME_ANALYSIS_TASK Procedure	Resumes a previously interrupted analysis task that was created to process a SQL tuning set.
SET_ANALYSIS_TASK_PARAMETER Procedures	Sets the SQL analysis task parameter value
SET_ANALYSIS_DEFAULT_PARAMETER Procedures	Sets the SQL analysis task parameter default value

181.3.1 CANCEL_ANALYSIS_TASK Procedure

This procedure cancels the currently executing analysis task. All intermediate result data is removed from the task.

Syntax

```
DBMS_SQLPA.CANCEL_ANALYSIS_TASK(
  task_name          IN VARCHAR2);
```

Parameters

Table 181-2 CANCEL_ANALYSIS_TASK Procedure Parameters

Parameter	Description
task_name	Name of the task to cancel

Examples

Canceling a task when there is a need to stop it executing and it is not required to view any already-completed results:

```
EXEC DBMS_SQLPA.CANCEL_ANALYSIS_TASK(:my_task);
```

181.3.2 CREATE_ANALYSIS_TASK Functions

These functions create an advisor task to process and analyze one or more SQL statements.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

You can use different forms of this function to:

- Create an analysis task for a single statement given its text.
- Create an analysis task for a single statement from the cursor cache given its identifier.
- Create an analysis task for a single statement from the workload repository given a range of snapshot identifiers.
- Create an analysis task for a SQL tuning set.

In all cases, the function creates an advisor task and sets its parameters.

Syntax

SQL text format. This form of the function is called to prepare the analysis of a single statement given its text.

```
DBMS_SQLPA.CREATE_ANALYSIS_TASK(  
    sql_text          IN CLOB,  
    bind_list         IN sql_binds := NULL,  
    parsing_schema    IN VARCHAR2  := NULL,  
    task_name         IN VARCHAR2  := NULL,  
    description       IN VARCHAR2  := NULL)  
RETURN VARCHAR2;
```

SQL ID format. This form of the function is called to prepare the analysis of a single statement from the cursor cache given its identifier.

```
DBMS_SQLPA.CREATE_ANALYSIS_TASK(  
    sql_id            IN VARCHAR2,  
    plan_hash_value   IN NUMBER     := NULL,  
    task_name         IN VARCHAR2  := NULL,  
    con_name          IN VARCHAR2   DEFAULT,  
    description       IN VARCHAR2  := NULL)  
RETURN VARCHAR2;
```

Workload Repository format. This form of the function is called to prepare the analysis of a single statement from the workload repository given a range of snapshot identifiers.

```
DBMS_SQLPA.CREATE_ANALYSIS_TASK(  
    dbid              IN NUMBER     DEFAULT,  
    begin_snap        IN NUMBER,  
    end_snap          IN NUMBER,  
    sql_id            IN VARCHAR2,
```

```

plan_hash_value IN NUMBER      := NULL,
task_name       IN VARCHAR2    := NULL,
description     IN VARCHAR2    := NULL)
con_name        IN VARCHAR2    DEFAULT,
RETURN VARCHAR2;

```

SQLSET format. This form of the function is called to prepare the analysis of a SQL tuning set.

```

DBMS_SQLPA.CREATE_ANALYSIS_TASK(
  sqlset_name     IN VARCHAR2,
  basic_filter    IN VARCHAR2 := NULL,
  con_name        IN VARCHAR2 DEFAULT,
  order_by        IN VARCHAR2 := NULL,
  top_sql         IN VARCHAR2 := NULL,
  task_name       IN VARCHAR2 := NULL,
  description     IN VARCHAR2 := NULL,
  sqlset_owner    IN VARCHAR2 := NULL)
RETURN VARCHAR2;

```

Parameters

Table 181-3 *CREATE_ANALYSIS_TASK* Function Parameters

Parameter	Description
sql_text	Text of a SQL statement
bind_list	A set of bind values
parsing_schema	Name of the schema where the statement can be compiled
task_name	Optional analysis task name
dbid	The DBID for imported or PDB-level AWR data. If NULL, then the current database DBID is used
con_name	Container for the SPA task. The semantics depend on the function format: For the SQL ID format, this parameter specifies the container from which the database fetches the SQL statement for using with SPA. SPA will analyze the statement in this container. If null, then the database uses the current PDB for SPA analysis. For the AWR format, this parameter specifies the container from whose AWR data the database fetches the SQL statement for using with SPA. SPA will analyze the statement in this container. If null, then the database uses the current PDB for SPA analysis. The following statements are true of all function formats: <ul style="list-style-type: none"> In a non-CDB, this parameter is ignored. In a PDB, this parameter must be null or match the container name of the PDB. Otherwise, error occurs. In a CDB root, this parameter must be null or match the container name of a container in this CDB. Otherwise, error occurs.
description	Description of the SQL analysis task to a maximum of 256 characters
sql_id	Identifier of a SQL statement
plan_hash_value	Hash value of the SQL execution plan
begin_snap	Begin snapshot identifier

Table 181-3 (Cont.) CREATE_ANALYSIS_TASK Function Parameters

Parameter	Description
end_snap	End snapshot identifier
sqlset_name	SQL tuning set name
basic_filter	SQL predicate to filter the SQL from the SQL tuning set
order_by	Order-by clause on the selected SQL
top_sql	Top N SQL after filtering and ranking
sqlset_owner	The owner of the SQL tuning set, or NULL for the current schema owner

Return Values

A SQL analysis task name that is unique by user (two different users can give the same name to their advisor tasks).

Examples

```
variable stmt_task VARCHAR2(64);
variable sts_task  VARCHAR2(64);

-- Sql text format
EXEC :stmt_task := DBMS_SQLPA.CREATE_ANALYSIS_TASK(
    sql_text => 'select quantity_sold from sales s, times t where s.time_id =
t.time_id and s.time_id = TO_DATE(''24-NOV-00'')');

-- Sql id format (cursor cache)
EXEC :stmt_task := DBMS_SQLPA.CREATE_ANALYSIS_TASK(
    sql_id    => 'ay1m3ssvtrh24');

-- Workload repository format
exec :stmt_task := DBMS_SQLPA.CREATE_ANALYSIS_TASK(
    begin_snap => 1,
    end_snap   => 2,
    sql_id     => 'ay1m3ssvtrh24');

-- Sql tuning set format (first we need to load an STS, then analyze it)
EXEC :sts_task := DBMS_SQLPA.CREATE_ANALYSIS_TASK( -
    sqlset_name => 'my_workload', -
    order_by    => 'BUFFER_GETS', -
    description => 'process workload ordered by buffer gets');
```

181.3.3 DROP_ANALYSIS_TASK Procedure

This procedure drops a SQL analysis task. The task and all its result data are deleted.

Syntax

```
DBMS_SQLPA.DROP_ANALYSIS_TASK(
    task_name      IN VARCHAR2);
```

Parameters

Table 181-4 DROP_ANALYSIS_TASK Procedure Parameters

Parameter	Description
task_name	The name of the analysis task to drop

181.3.4 EXECUTE_ANALYSIS_TASK Function & Procedure

This function and procedure executes a previously created analysis task, the function version returning the new execution name.

Syntax

```
DBMS_SQLPA.EXECUTE_ANALYSIS_TASK(
    task_name          IN VARCHAR2,
    execution_type     IN VARCHAR2          := 'test execute',
    execution_name     IN VARCHAR2          := NULL,
    execution_params   IN dbms_advisor.argList := NULL,
    execution_desc     IN VARCHAR2          := NULL)
RETURN VARCHAR2;
```

```
DBMS_SQLPA.EXECUTE_ANALYSIS_TASK(
    task_name          IN VARCHAR2,
    execution_type     IN VARCHAR2          := 'test execute',
    execution_name     IN VARCHAR2          := NULL,
    execution_params   IN dbms_advisor.argList := NULL,
    execution_desc     IN VARCHAR2          := NULL);
```

Parameters

Table 181-5 EXECUTE_ANALYSIS_TASK Function & Procedure Parameters

Parameter	Description
task_name	Identifier of the task to execute

Table 181-5 (Cont.) EXECUTE_ANALYSIS_TASK Function & Procedure Parameters

Parameter	Description
execution_type	Type of the action to perform by the function. If NULL it will default to the value of the <code>DEFAULT_EXECUTION_TYPE</code> parameter. Possible values are: <ul style="list-style-type: none"> [TEST] EXECUTE - test-execute every SQL statement and collect its execution plans and execution statistics. The resulting plans and statistics will be stored in the advisor framework. This is default. EXPLAIN PLAN - generate explain plan for every statement in the SQL workload. This is similar to the <code>EXPLAIN PLAN</code> command. The resulting plans will be stored in the advisor framework in association with the task. COMPARE [PERFORMANCE] - analyze and compare two versions of SQL performance data. The performance data is generated by test-executing or generating explain plan of the SQL statements. Use this option when two executions of type <code>EXPLAIN_PLAN</code> or <code>TEST_EXECUTE</code> already exist in the task CONVERT SQLSET - used to read the statistics captured in a SQL Tuning Set and model them as a task execution. This can be used when you wish to avoid executing the SQL statements because valid data for the experiment already exists in the SQL Tuning Set.
execution_name	A name to qualify and identify an execution. If not specified, it will be generated by the advisor and returned by function.
execution_params	List of parameters (name, value) for the specified execution. The execution parameters have effect only on the execution for which they are specified. They will override the values for the parameters stored in the task (set through the SET_ANALYSIS_DEFAULT_PARAMETER Procedures).
execution_desc	A 256-length string describing the execution

Usage Notes

SQL performance analyzer task can be executed multiples times without having to reset it. For example, when a task is created to perform a change impact analysis on a SQL workload, the created task has to be executed before making any change in the system environment to build a version of the workload that will be used as a reference for performance analysis. Once the change has been made, a second execution is required to build the post-change version of the workload. Finally, the task has to be executed a third time to let the advisor analyze and compare the performance of the workload in both versions.

Examples

1. Create a task with a purpose of change impact analysis

```
EXEC :tname := DBMS_SQLPA.CREATE_ANALYSIS_TASK(
    sqlset_name => 'my_sts');
```

2. Make baseline or the before change execution

```
EXEC DBMS_SQLPA.EXECUTE_ANALYSIS_TASK(
    task_name      => :tname,
    execution_type => 'test execute',
    execution_name => 'before_change');
```

3. Make change

...

4. Make the after change version of the workload performance

```
EXEC DBMS_SQLPA.EXECUTE_ANALYSIS_TASK(
    task_name      => :tname, -
    execution_type => 'test execute',
    execution_name => 'after_change')
```

5. Compare the two versions of the workload

By default we always compare the results of the two last executions. The SQL Performance Analyzer uses the `elapsed_time` as a default metric for comparison. Here we are changing it to `buffer_gets` instead.

```
EXEC DBMS_SQLPA.SET_ANALYSIS_TASK_PARAMETER(
    :tname, 'comparison_metric', 'buffer_gets');
EXEC DBMS_SQLPA.EXECUTE_ANALYSIS_TASK(
    task_name      => :tname, -
    execution_type => 'compare performance', -
    execution_name => 'after_change');
```

Use the following call if you would like to explicitly specify the two executions to compare as well as the comparison metric to use.

```
EXEC DBMS_SQLPA.EXECUTE_ANALYSIS_TASK(
    task_name      => :tname, -
    execution_type => 'compare performance',
    execution_params => dbms_advisor.arglist(
        'execution_name1',
        'before_change',
        'execution_name2',
        'after_change',
        'comparison_metric',
        'buffer_gets'));
```

181.3.5 INTERRUPT_ANALYSIS_TASK Procedure

This procedure interrupts the currently executing analysis task. All intermediate result data will not be removed from the task.

Syntax

```
DBMS_SQLPA.INTERRUPT_ANALYSIS_TASK(
    task_name      IN VARCHAR2);
```

Parameters

Table 181-6 INTERRUPT_ANALYSIS_TASK Procedure Parameters

Parameter	Description
task_name	Identifier of the analysis task to interrupt

Examples

```
EXEC DBMS_SQLPA.INTERRUPT_ANALYSIS_TASK(:my_task);
```

181.3.6 REPORT_ANALYSIS_TASK Function

This procedure displays the results of an analysis task.

Syntax

```
DBMS_SQLPA.REPORT_ANALYSIS_TASK(
    task_name      IN   VARCHAR2,
    type           IN   VARCHAR2      := 'TEXT',
    level          IN   VARCHAR2      := 'TYPICAL',
    section        IN   VARCHAR2      := 'SUMMARY',
    object_id      IN   NUMBER         := NULL,
    top_sql        IN   NUMBER         := 100,
    execution_name IN   VARCHAR2      := NULL,
    task_owner     IN   VARCHAR2      := NULL,
    order_by       IN   VARCHAR2      := NULL)
RETURN CLOB;
```

Parameters

Table 181-7 REPORT_ANALYSIS_TASK Function Parameters

Parameter	Description
task_name	Name of the task to report
type	Type of the report to produce. Possible values are TEXT (default), HTML, XML and ACTIVE (see Usage Notes).
level	Level of detail in the report: <ul style="list-style-type: none"> • ALL - details of all SQL • BASIC - currently the same as typical • CHANGED - only SQL with changed performance • CHANGED_PLANS - only SQL with plan changes • ERRORS - SQL with errors only • IMPROVED - only improved SQL • REGRESSED - only regressed SQL • TIMEOUT - only SQL which timed-out during execution • TYPICAL (default) - show information about every statement analyzed, including changing and errors • UNCHANGED - only SQL with unchanged performance • UNCHANGED_PLANS - only SQL with unchanged plans • UNSUPPORTED - only SQL not supported by SPAs

Table 181-7 (Cont.) REPORT_ANALYSIS_TASK Function Parameters

Parameter	Description
section	Optionally limit the report to a single section (ALL for all sections): <ul style="list-style-type: none"> SUMMARY (default) - workload summary only ALL - summary and details on SQL
object_id	Identifier of the advisor framework object that represents a given SQL in a tuning set (STS)
top_sql	Number of SQL statements in a STS for which the report is generated
execution_name	Name of the task execution to use. If NULL, the report will be generated for the last task execution.
task_owner	Owner of the relevant analysis task. Defaults to the current schema owner.
order_by	How to sort SQL statements in the report (summary and body). Possible values: <ul style="list-style-type: none"> CHANGE_DIFF - sort SQL statements by change difference in SQL performance in terms of the comparison Metric NULL (default) - order SQL statement by impact on workload SQL_IMPACT - order SQL statement by change impact on SQL WORKLOAD_IMPACT - same as NULL METRIC_DELTA - same as CHANGE_DIFF

Return Values

A CLOB containing the desired report.

Usage Notes

ACTIVE reports have a rich, interactive user interface similar to Enterprise Manager while not requiring any EM installation. The report file built is in HTML format so it can be interpreted by most modern browsers. The code powering the active report is downloaded transparently by the web browser when the report is first viewed, hence viewing it requires outside connectivity.

Examples

```
-- Get the whole report for the single statement case.
SELECT DBMS_SQLPA.REPORT_ANALYSIS_TASK(:stmt_task) from dual;

-- Show me the summary for the sts case.
SELECT DBMS_SQLPA.REPORT_ANALYSIS_TASK(:sts_task, 'TEXT', 'TYPICAL', 'SUMMARY')
FROM DUAL;

-- Show me the findings for the statement I'm interested in.
SELECT DBMS_SQLPA.REPORT_ANALYSIS_TASK(:sts_task, 'TEXT', 'TYPICAL', 'ALL', 5)
from dual;
```

181.3.7 RESET_ANALYSIS_TASK Procedure

This procedure is called on an analysis task that is not currently executing to prepare it for re-execution.

All intermediate result data will be deleted.

Syntax

```
DBMS_SQLPA.RESET_ANALYSIS_TASK(
  task_name          IN VARCHAR2);
```

Parameters**Table 181-8** RESET_ANALYSIS_TASK Procedure Parameters

Parameter	Description
task_name	Identifier of the analysis task to reset

Examples

```
-- reset and re-execute a task
EXEC DBMS_SQLPA.RESET_ANALYSIS_TASK(:sts_task);

-- re-execute the task
EXEC DBMS_SQLPA.EXECUTE_ANALYSIS_TASK(:sts_task);
```

181.3.8 RESUME_ANALYSIS_TASK Procedure

This procedure resumes a previously interrupted or `FAILED` (with a fatal error) task execution.

Syntax

```
DBMS_SQLPA.RESUME_ANALYSIS_TASK(
  task_name          IN VARCHAR2,
  basic_filter       IN VARCHAR2 := NULL);
```

Parameters**Table 181-9** RESUME_ANALYSIS_TASK Procedure Parameters

Parameter	Description
task_name	Identifier of the analysis task to resume
basic_filter	A SQL predicate to filter the SQL from the SQL tuning set. Note that this filter will be applied in conjunction with the basic filter (parameter <code>basic_filter</code>) that was specified when calling the CREATE_ANALYSIS_TASK Functions .

Usage Notes

Resuming a single SQL analysis task (a task that was created to analyze a single SQL statement as compared to a SQL Tuning Set) is not supported.

Examples

```
-- Interrupt the task
EXEC DBMS_SQLPA.INTERRUPT_ANALYSIS_TASK(:conc_task);

-- Once a task is interrupted, we can elect to reset it, resume it, or check
-- out its results and then decide. For this example we will just resume.
```

```
EXEC DBMS_SQLPA.RESUME_ANALYSIS_TASK(:conc_task);
```

181.3.9 SET_ANALYSIS_TASK_PARAMETER Procedures

This procedure sets the SQL analysis task parameter value.

Syntax

This form of the procedure updates the value of a SQL analysis parameter of type VARCHAR2.

```
DBMS_SQLPA.SET_ANALYSIS_TASK_PARAMETER(
  task_name          IN VARCHAR2,
  parameter          IN VARCHAR2,
  value              IN VARCHAR2,
  test_execute_dop  IN NUMBER DEFAULT 0,
  compare_resultset IN BOOLEAN DEFAULT TRUE);
```

This form of the procedure updates the value of a SQL analysis parameter of type NUMBER.

```
DBMS_SQLPA.SET_ANALYSIS_TASK_PARAMETER(
  task_name          IN VARCHAR2,
  parameter          IN VARCHAR2,
  value              IN NUMBER,
  test_execute_dop  IN NUMBER DEFAULT 0,
  compare_resultset IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 181-10 SET_ANALYSIS_TASK_PARAMETER Procedure Parameters

Parameter	Description
task_name	Identifier of the task to execute
parameter	Name of the parameter to set. The possible analysis parameters that can be set by this procedure are: <ul style="list-style-type: none"> APPLY_CAPTURED_COMPILEENV: indicates whether the advisor could use the compilation environment captured with the SQL statements. The default is 0 (that is, NO). BASIC_FILTER: basic filter for SQL tuning set CELL_SIMULATION_ENABLED: for more details, see the helper script tcellsim.sql in the ADMIN directory. COMPARISON_METRIC: specify an expression of execution statistics to use in performance comparison (Example: buffer_gets, cpu_time + buffer_gets * 10) DATABASE_LINK: can be set to the global name of a PUBLIC database link. When it is set, SQL Performance Analyzer will use the database link for all TEST EXECUTE and EXPLAIN PLAN operations by sending the SQL statements to the remote database to be processed remotely. The analysis results will still be stored on the local database. DAYS_TO_EXPIRE: number of days until the task is deleted DEFAULT_EXECUTION_TYPE: the task will default to this type of execution when none is specified by the EXECUTE_ANALYSIS_TASK Function & Procedure.

Table 181-10 (Cont.) SET_ANALYSIS_TASK_PARAMETER Procedure Parameters

Parameter	Description
parameter (contd.)	<ul style="list-style-type: none"> • DISABLE_MULTI_EXEC: SQL statements are executed multiple times and runtime statistics are then averaged. Set this parameter to TRUE to disable this capability. In this case, each SQL in the SQL tuning set is executed only once. • EXECUTE_TRIGGERS: Set this parameter to TRUE to execute all statement-level triggers in the FULLDML mode. If the parameter is set to FALSE, then the triggers will not be executed even in FULLDML mode of test execution. Any changes incurred due to potential execution of triggers are always rolled back by SPA. The default value of this parameter is FALSE. • EXECUTION_DAYS_TO_EXPIRE: number of days until the task's executions will be deleted (without deleting the task) • EXECUTE_FULLDML: TRUE to execute DML statement fully, including acquiring row locks and modifying rows; FALSE (default) to execute only the query part of the DML without modifying data. When TRUE, SQL Performance Analyzer will issue a rollback following DML execution to prevent persistent changes from being made by the DML. • EXECUTION_NAME1: name of the first task execution to analyze • EXECUTION_NAME2: name of the second task execution to analyze • LOCAL_TIME_LIMIT: per-statement time out (seconds) • METRIC_DELTA_THRESHOLD: threshold of the difference between the SQL performance metric before and after the change. The default value is zero. • NUM_ROWS_TO_FETCH: specifies the number of rows to be fetched for an SQL query. You can use one of the following values: <ul style="list-style-type: none"> – ALL_ROWS: Fetches all the rows for an SQL query – AVERAGE: Number of result rows is calculated as the ratio of total rows processed and total executions for each SQL in the STS – AUTO: Number of result rows is determined using the value of <code>optimizer_mode</code> parameter of the optimizer environment captured in the STS. If the value of <code>optimizer_mode</code> is ALL_ROWS, then all result rows will be fetched. If its value is FIRST_ROWS_n, then n result rows will be fetched by the SPA. – A valid number: Fetches the exact number of rows specified by in the SQL query <p>The default value is ALL_ROWS.</p> • PLAN_FILTER: plan filter for SQL tuning set (see SELECT_SQLSET for possible values) • PLAN_LINES_COMPARISON: <ul style="list-style-type: none"> - ALWAYS --line by line comparison of plans in all scenarios.- AUTO -Line by Line comparison of plans only if <code>phv2</code> is not available and <code>phv1</code> is different- NONE (default) - line by line comparison of plans only if <code>phv</code> is unknown

Table 181-10 (Cont.) SET_ANALYSIS_TASK_PARAMETER Procedure Parameters

Parameter	Description
	<ul style="list-style-type: none"> RANK_MEASURE1: first ranking measure for SQL tuning set RANK_MEASURE2: second possible ranking measure for SQL tuning set RANK_MEASURE3: third possible ranking measure for SQL tuning set REPLACE_SYSDATE_WITH: Returns a fixed date for all calls to SYSDATE within the SPA task execution. You can use one of the following values: <ul style="list-style-type: none"> CURRENT_SYSDATE: SYSDATE calls return the current date. SQLSET_SYSDATE: SYSDATE calls return the value of the column LAST_EXEC_START_TIME in the STS The default value is CURRENT_SYSDATE. RESUME_FILTER: a extra filter for SQL tuning sets besides BASIC_FILTER SQL_IMPACT_THRESHOLD: threshold of a change impact on a SQL statement. Same as the previous parameter, but at the level of the SQL statement. SQL_LIMIT: maximum number of SQL statements to process SQL_PERCENTAGE: percentage filter of SQL tuning set statements SQLSET_NAME: name of the SQL tuning set to associate to the specified task or task execution. This parameter is mainly using in comparing two SQL tuning sets using SPA. SQLSET_OWNER: owner of the SQL tuning set specified using task parameter SQLSET_NAME. TIME_LIMIT: global time out (seconds) WORKLOAD_IMPACT_THRESHOLD: threshold of a SQL statement impact on a workload. Statements which workload change impact is below the absolute value of this threshold will be ignored and not considered for improvement or regression. CON_DBID_MAPPING: provide a mapping of multitenant container database (CDB) IDs. When it is set, SQL Performance Analyzer uses the new CDB ID when it finds a match for the old CDB ID and executes the SQL in that container.
parameter (contd.)	
value	New value of the specified parameter
test_execute_dop	Specifies the requested level of concurrency with which a SPA task should be executed. Values 0 or 1 indicate that the SPA task will run with no additional processes as it used to run in releases prior to Oracle Database 18c Release. A value of n (higher than 1) means that n background SPA processes are being requested to concurrently process the input workload.

Table 181-10 (Cont.) SET_ANALYSIS_TASK_PARAMETER Procedure Parameters

Parameter	Description
<code>compare_resultset</code>	<p>Directs SPA to detect if the result-sets between the two trials being compared are different. If differences are seen in the result-sets of any SQL statement between the two trials being compared, the SPA comparison report will indicate this for every such SQL statement.</p> <ul style="list-style-type: none"> • If set to <code>TRUE</code> the result set comparison will be performed • If set to <code>FALSE</code> result set comparison will not be performed.

Usage Notes

The actual number of processes granted might be equal to or lower than the number requested using the `test_execute_dop` parameter. This parameter applies only to `test-execute` or `explain plan type` of trials that process a SQL Tuning set.

Examples

To request two concurrent processes to execute the SPA task:

```
dbms_sqlpa.set_analysis_task_parameter(:tname,'TEST_EXECUTE_DOP',2)
```

To enable result-set validation

```
exec
dbms_sqlpa.set_analysis_task_parameter(:atname,'COMPARE_RESULTSET','TRUE')
```

To disable result-set validation:

```
exec
dbms_sqlpa.set_analysis_task_parameter(:atname,'COMPARE_RESULTSET','FALSE')
```

181.3.10 SET_ANALYSIS_DEFAULT_PARAMETER Procedures

This procedure sets the SQL analysis task parameter default value.

Syntax

This form of the procedure updates the default value of an analyzer parameter of type `VARCHAR2`.

```
DBMS_SQLPA.SET_ANALYSIS_DEFAULT_PARAMETER(
  parameter IN VARCHAR2,
  value     IN VARCHAR2);
```

This form of the procedure updates the default value of an analyzer parameter of type `NUMBER`.

```
DBMS_SQLPA.SET_ANALYSIS_DEFAULT_PARAMETER(
    parameter IN VARCHAR2,
    value     IN NUMBER);
```

Parameters

Table 181-11 SET_ANALYSIS_DEFAULT_PARAMETER Procedure Parameters

Parameter	Description
parameter	<p>Name of the parameter to set. The possible analysis parameters that can be set by this procedure are:</p> <ul style="list-style-type: none"> • APPLY_CAPTURED_COMPILEENV: indicates whether the advisor could use the compilation environment captured with the SQL statements. The default is 0 (that is, NO). • BASIC_FILTER: basic filter for SQL tuning set • COMPARISON_METRIC: specify an expression of execution statistics to use in performance comparison (Example: <code>buffer_gets, cpu_time + buffer_gets * 10</code>) • DATABASE_LINK: can be set to the global name of a PUBLIC database link. When it is set, SQL Performance Analyzer will use the database link for all <code>TEST EXECUTE</code> and <code>EXPLAIN PLAN</code> operations by sending the SQL statements to the remote database to be processed remotely. The analysis results will still be stored on the local database. • DAYS_TO_EXPIRE: number of days until the task is deleted • DEFAULT_EXECUTION_TYPE: the task will default to this type of execution when none is specified by the EXECUTE_ANALYSIS_TASK Function & Procedure. • EXECUTE_FULLDML: <code>TRUE</code> to execute DML statement fully, including acquiring row locks and modifying rows; <code>FALSE</code> (default) to execute only the query part of the DML without modifying data. When <code>TRUE</code>, SQL Performance Analyzer will issue a rollback following DML execution to prevent persistent changes from being made by the DML. • EXECUTION_DAYS_TO_EXPIRE: number of days until the tasks's executions will be deleted (without deleting the task) • EXECUTION_NAME1: name of the first task execution to analyze • EXECUTION_NAME2: name of the second task execution to analyze • LOCAL_TIME_LIMIT: per-statement time out (seconds)

Table 181-11 (Cont.) SET_ANALYSIS_DEFAULT_PARAMETER Procedure Parameters

Parameter	Description
parameter (contd.)	<ul style="list-style-type: none"> • PLAN_FILTER: plan filter for SQL tuning set (see SELECT_SQLSET for possible values) • RANK_MEASURE1: first ranking measure for SQL tuning set • RANK_MEASURE2: second possible ranking measure for SQL tuning set • RANK_MEASURE3: third possible ranking measure for SQL tuning set • RESUME_FILTER: a extra filter for SQL tuning sets besides BASIC_FILTER • SQL_IMPACT_THRESHOLD: threshold of a change impact on a SQL statement. Same as the previous parameter, but at the level of the SQL statement. • SQL_LIMIT: maximum number of SQL statements to process • SQL_PERCENTAGE: percentage filter of SQL tuning set statements • TIME_LIMIT: global time out (seconds) • WORKLOAD_IMPACT_THRESHOLD: threshold of a SQL statement impact on a workload. Statements which workload change impact is below the absolute value of this threshold will be ignored and not considered for improvement or regression.
value	New value of the specified parameter

DBMS_SQLQ

The `DBMS_SQLQ` package provides the interface for configuring quarantine thresholds for execution plans of SQL statements. If any of the Resource Manager thresholds is equal to or less than the quarantine threshold specified in a SQL statement's quarantine configuration, then the SQL statement is not allowed to run, if it uses the execution plan specified in its quarantine configuration.

This chapter contains the following topics:

- [DBMS_SQLQ Overview](#)
- [Summary of DBMS_SQLQ Subprograms](#)

182.1 DBMS_SQLQ Overview

The `DBMS_SQLQ` package provides the interface for configuring quarantine thresholds for execution plans of SQL statements. If any of the Resource Manager thresholds is equal to or less than the quarantine threshold specified in a SQL statement's quarantine configuration, then the SQL statement is not allowed to run, if it uses the execution plan specified in its quarantine configuration.

You can use the `DBMS_SQLQ` package subprograms to:

- create quarantine configurations for execution plans of SQL statements and specify quarantine thresholds for their resource consumption
- query quarantine thresholds specified in quarantine configurations
- delete quarantine configurations
- transfer quarantine configurations from one database to another

182.2 Summary of DBMS_SQLQ Subprograms

This table lists the `DBMS_SQLQ` subprograms and briefly describes them.

Table 182-1 DBMS_SQLQ Package Subprograms

Procedure	Description
ALTER_QUARANTINE Procedure	Specifies a quarantine threshold in a quarantine configuration for execution plans of a SQL statement
CREATE_QUARANTINE_BY_SQL_ID Function	Creates a quarantine configuration for execution plans of a SQL statement using SQL ID
CREATE_QUARANTINE_BY_SQL_TEXT Function	Creates a quarantine configuration for execution plans of a SQL statement using SQL text
CREATE_STGTAB_QUARANTINE Procedure	Creates a staging table to store quarantine configurations
DROP_QUARANTINE Procedure	Deletes a quarantine configuration

Table 182-1 (Cont.) DBMS_SQLQ Package Subprograms

Procedure	Description
GET_PARAM_VALUE_QUARANTINE Function	Returns the value for a quarantine threshold specified in a quarantine configuration
PACK_STGTAB_QUARANTINE Function	Adds one or more quarantine configurations to a staging table
UNPACK_STGTAB_QUARANTINE Function	Creates quarantine configurations in a database from a staging table

182.2.1 ALTER_QUARANTINE Procedure

This procedure specifies a quarantine threshold for a resource in a quarantine configuration for execution plans of a SQL statement.

Syntax

```
DBMS_SQLQ.ALTER_QUARANTINE (
    quarantine_name    IN VARCHAR2,
    parameter_name     IN VARCHAR2,
    parameter_value    IN VARCHAR2);
```

Parameters

Table 182-2 ALTER_QUARANTINE Procedure Parameters

Parameter	Description
quarantine_name	Name of the quarantine configuration.
parameter_name	Name of the resource for which quarantine threshold needs to be specified. You can specify any one of the following values: <ul style="list-style-type: none"> CPU_TIME: CPU time ELAPSED_TIME: Elapsed time IO_MEGABYTES: I/O in megabytes IO_REQUESTS: Number of physical I/O requests IO_LOGICAL: Number of logical I/O requests ENABLED: Flag to enable or disable the quarantine configuration. Specify YES to enable it and NO to disable it. The default value is YES. AUTOPURGE: Flag to enable or disable automatic purging of the quarantine configuration. If it is set to YES, the quarantine configuration is automatically purged after 53 weeks, if not used. If it is set to NO, the quarantine configuration is never purged. The default value is YES.

Table 182-2 (Cont.) ALTER_QUARANTINE Procedure Parameters

Parameter	Description
parameter_value	Quarantine threshold for the resource specified in parameter_name.

Examples

In the following example, the quarantine threshold specified for CPU time is 5 seconds and elapsed time is 10 seconds for the quarantine configuration

SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4.

```
BEGIN

  DBMS_SQLQ.ALTER_QUARANTINE (
    QUARANTINE_NAME => 'SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4',
    PARAMETER_NAME  => 'CPU_TIME',
    PARAMETER_VALUE => '5');

  DBMS_SQLQ.ALTER_QUARANTINE (
    QUARANTINE_NAME => 'SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4',
    PARAMETER_NAME  => 'ELAPSED_TIME',
    PARAMETER_VALUE => '10');

END;
/
```

When the SQL statement is executed using the execution plan specified in the quarantine configuration, and if the Resource Manager threshold for CPU time is 5 seconds or less, or elapsed time is 10 seconds or less, then the SQL statement is not allowed to run.

182.2.2 CREATE_QUARANTINE_BY_SQL_ID Function

This function creates a quarantine configuration for execution plans of a SQL statement based on SQL ID.

Syntax

```
DBMS_SQLQ.CREATE_QUARANTINE_BY_SQL_ID (
  sql_id          IN VARCHAR2,
  plan_hash_value IN NUMBER DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 182-3 CREATE_QUARANTINE_BY_SQL_ID Function Parameters

Parameter	Description
sql_id	SQL ID of the SQL statement.

Table 182-3 (Cont.) CREATE_QUARANTINE_BY_SQL_ID Function Parameters

Parameter	Description
plan_hash_value	Hash value of the execution plan of the SQL statement. Default value is NULL. When it is NULL, the quarantine configuration applies to all the execution plans of the SQL statement.

Return Value

Name of the quarantine configuration.

Examples

The following example creates a quarantine configuration for the SQL statement having the SQL ID of 8vu7s907prbgr. The quarantine configuration applies to all the execution plans of the SQL statement.

```
DECLARE
    quarantine_config VARCHAR2(30);
BEGIN
    quarantine_config := DBMS_SQLQ.CREATE_QUARANTINE_BY_SQL_ID(SQL_ID =>
'8vu7s907prbgr');
END;
/
```

The following example creates a quarantine configuration for the execution plan having the hash value of 3488063716 for the SQL statement having the SQL ID of 8vu7s907prbgr.

```
DECLARE
    quarantine_config VARCHAR2(30);
BEGIN
    quarantine_config := DBMS_SQLQ.CREATE_QUARANTINE_BY_SQL_ID(SQL_ID =>
'8vu7s907prbgr', PLAN_HASH_VALUE => '3488063716');
END;
/
```

182.2.3 CREATE_QUARANTINE_BY_SQL_TEXT Function

This function creates a quarantine configuration for execution plans of a SQL statement based on SQL text.

Syntax

```
DBMS_SQLQ.CREATE_QUARANTINE_BY_SQL_TEXT (
    sql_text          IN CLOB,
    plan_hash_value  IN NUMBER DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 182-4 CREATE_QUARANTINE_BY_SQL_TEXT Function Parameters

Parameter	Description
sql_text	SQL statement.
plan_hash_value	Hash value of the execution plan of the SQL statement. Default value is NULL. When it is NULL, the quarantine configuration applies to all the execution plans of the SQL statement.

Return Value

Name of the quarantine configuration.

Examples

The following example creates a quarantine configuration that applies to all the execution plans of the SQL statement 'select count(*) from emp'.

```
DECLARE
  quarantine_config VARCHAR2(30);
BEGIN
  quarantine_config := DBMS_SQLQ.CREATE_QUARANTINE_BY_SQL_TEXT(SQL_TEXT =>
to_clob('select count(*) from emp'));
END;
/
```

The following example creates a quarantine configuration for the execution plan having the hash value of 3488063716 for the SQL statement having the SQL text of 'select count(*) from emp'.

```
DECLARE
  quarantine_config VARCHAR2(30);
BEGIN
  quarantine_config := DBMS_SQLQ.CREATE_QUARANTINE_BY_SQL_TEXT(SQL_TEXT =>
to_clob('select count(*) from emp'), PLAN_HASH_VALUE => '3488063716');
END;
/
```

182.2.4 CREATE_STGTAB_QUARANTINE Procedure

This procedure creates a staging table to store the quarantine configurations, so that the staging table can be exported from the current database and imported into another database, thus enabling the quarantine configurations to be used across databases.

Syntax

```
DBMS_SQLQ.CREATE_STGTAB_QUARANTINE (
  staging_table_name   IN VARCHAR2,
  staging_table_owner  IN VARCHAR2 DEFAULT NULL,
  tablespace_name     IN VARCHAR2 DEFAULT NULL);
```


Parameters

Table 182-5 CREATE_STGTAB_QUARANTINE Procedure Parameters

Parameter	Description
staging_table_name	Name of the staging table.
staging_table_owner	Name of the schema owner of the staging table. Default value is NULL, which means the database user executing this procedure is set as the staging table owner.
tablespace_name	Name of the tablespace in which the staging table needs to be created. Default value is NULL, which means the staging table is created in the default tablespace of the database.

Examples

The following example creates the staging table `TBL_STG_QUARANTINE` in the default tablespace of the database and sets its table owner to the database user executing this procedure.

```
BEGIN
  DBMS_SQLQ.CREATE_STGTAB_QUARANTINE(STAGING_TABLE_NAME => 'TBL_STG_QUARANTINE');
END;
/
```

182.2.5 DROP_QUARANTINE Procedure

This procedure deletes a quarantine configuration.

Syntax

```
DBMS_SQLQ.DROP_QUARANTINE(quarantine_name IN VARCHAR2);
```

Parameters

Table 182-6 DROP_QUARANTINE Procedure Parameters

Parameter	Description
quarantine_name	Name of the quarantine configuration to delete.

Examples

The following example deletes the quarantine configuration having the name `SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4`.

```
BEGIN
  DBMS_SQLQ.DROP_QUARANTINE('SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4');
END;
/
```

182.2.6 GET_PARAM_VALUE_QUARANTINE Function

This function returns the quarantine threshold for a resource specified in a quarantine configuration.

Syntax

```
DBMS_SQLQ.GET_PARAM_VALUE_QUARANTINE (  
    quarantine_name    IN VARCHAR2,  
    parameter_name    IN VARCHAR2)  
RETURN VARCHAR2;
```

Parameters

Table 182-7 GET_PARAM_VALUE_QUARANTINE Function Parameters

Parameter	Description
quarantine_name	Name of the quarantine configuration.
parameter_name	Resource for which the quarantine threshold needs to be retrieved.

Return Value

Returns the quarantine threshold for a resource specified in a quarantine configuration.

Examples

The following example returns the quarantine threshold for CPU time specified in the quarantine configuration having the name `SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4`.

```
DECLARE  
    quarantine_config_setting_value VARCHAR2(30);  
BEGIN  
    quarantine_config_setting_value := DBMS_SQLQ.GET_PARAM_VALUE_QUARANTINE(  
        QUARANTINE_NAME =>  
'SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4',  
        PARAMETER_NAME => 'CPU_TIME');  
END;  
/
```

182.2.7 PACK_STGTAB_QUARANTINE Function

This function adds one or more quarantine configurations into a staging table.

Syntax

```
DBMS_SQLQ.PACK_STGTAB_QUARANTINE (  
    staging_table_name    IN VARCHAR2,  
    staging_table_owner  IN VARCHAR2 DEFAULT NULL,  
    name                  IN VARCHAR2 DEFAULT '%',  
    sql_text              IN VARCHAR2 DEFAULT '%',
```

```

    enabled          IN VARCHAR2 DEFAULT NULL)
RETURN NUMBER;
```

Parameters

Table 182-8 PACK_STGTAB_QUARANTINE Function Parameters

Parameter	Description
staging_table_name	Name of the staging table in which the quarantine configurations need to be added.
staging_table_owner	Name of the schema owner of the staging table. Default value is NULL, which means the database user executing this procedure is set as the staging table owner.
name	Name of the quarantine configuration. Its value is case-sensitive and it accepts wildcard characters.
sql_text	SQL statement text. Its value is case-sensitive and it accepts wildcard characters.
enabled	Flag indicating whether the quarantine configuration should be enabled or disabled. If it is set to YES, then the quarantine configuration is enabled, else it is disabled. Default value is NULL, which means the quarantine configuration is disabled by default.

Return Value

Number of quarantine configurations added to the staging table.

Examples

The following example adds all the quarantine configurations having the names starting with SQL_QUARANTINE_ into the staging table TBL_STG_QUARANTINE.

```

DECLARE
    quarantine_configs NUMBER;
BEGIN
    quarantine_configs := DBMS_SQLQ.PACK_STGTAB_QUARANTINE (
        STAGING_TABLE_NAME => 'TBL_STG_QUARANTINE',
        NAME => 'SQL_QUARANTINE_%');
END;
/
```

182.2.8 UNPACK_STGTAB_QUARANTINE Function

This function creates quarantine configurations in a database from a staging table.

Syntax

```

DBMS_SQLQ.UNPACK_STGTAB_QUARANTINE (
    staging_table_name  IN VARCHAR2,
    staging_table_owner IN VARCHAR2 DEFAULT NULL,
    name               IN VARCHAR2 DEFAULT '%',
```

```

    sql_text          IN VARCHAR2 DEFAULT '%',
    enabled           IN VARCHAR2 DEFAULT NULL)
RETURN NUMBER;
```

Parameters

Table 182-9 UNPACK_STGTAB_QUARANTINE Function Parameters

Parameter	Description
staging_table_name	Name of the staging table from which the quarantine configurations need to be created in the database.
staging_table_owner	Name of the schema owner of the staging table. Default value is <code>NULL</code> , which means the database user executing this procedure is set as the staging table owner.
name	Name of the quarantine configuration. Its value is case-sensitive and it accepts wildcard characters.
sql_text	SQL statement text. Its value is case-sensitive and it accepts wildcard characters.
enabled	Flag indicating whether the quarantine configuration should be enabled or disabled. If its value is <code>YES</code> , then the quarantine configuration is enabled, else it is disabled. Default value is <code>NULL</code> , which means the quarantine configuration is disabled by default.

Return Value

Number of quarantine configurations created in the database from the staging table.

Examples

The following example creates the quarantine configurations in the database from all the quarantine configurations stored in the staging table `TBL_STG_QUARANTINE`.

```

DECLARE
    quarantine_configs NUMBER;
BEGIN
    quarantine_configs := DBMS_SQLQ.UNPACK_STGTAB_QUARANTINE (
        STAGING_TABLE_NAME => 'TBL_STG_QUARANTINE');
END;
```

DBMS_SQLSET

The `DBMS_SQLSET` package provides an interface to manage SQL tuning sets.

This package provides the same subprograms, although in some cases with slightly different names, as the SQL tuning set subprograms in `DBMS_SQLTUNE`. The difference is that `DBMS_SQLSET` does not require the Oracle Tuning Pack.

This chapter contains the following topics:

- [DBMS_SQLSET Overview](#)
- [DBMS_SQLSET Security Model](#)
- [DBMS_SQLSET Data Structures](#)
- [Summary of DBMS_SQLSET Subprograms](#)

183.1 DBMS_SQLSET Overview

Use this package to manage SQL tuning sets.



Note:

All `DBMS_SQLSET` subprograms have equivalents in the `DBMS_SQLTUNE` package.

SQL tuning sets store SQL statements along with the following information:

- The execution context, such as the parsing schema name and bind values
- Execution statistics such as average elapsed time and execution count
- Execution plans, which are the sequence of operations that the database performs to run SQL statements
- Row source statistics such as the number of rows processed for each operation executed within the plan

You can create SQL tuning sets by filtering or ranking SQL statements from several sources:

- The shared SQL area using the [SELECT_CURSOR_CACHE Function](#)
- Top SQL statements from the Automatic Workload Repository using the [SELECT_WORKLOAD_REPOSITORY Function](#)
- Other SQL tuning sets using the [SELECT_SQLSET Function](#)
- SQL Performance Analyzer task comparison results using the [SELECT_SQLPA_TASK Function](#)
- SQL Trace files using the [SELECT_SQL_TRACE Function](#)
- A user-defined workload

The complete group of subprograms listed in [Summary of DBMS_SQLSET Subprograms](#) facilitates this functionality. As examples:

- The [CREATE_SQLSET Procedure and Function](#) creates a SQL tuning set object in the database.
- The [LOAD_SQLSET Procedure](#) populates the SQL tuning set with a set of selected SQL.
- The [CAPTURE_CURSOR_CACHE Procedure](#) collects SQL statements from the shared SQL area over a specified time interval, attempting to build a realistic picture of database workload.

183.2 DBMS_SQLSET Security Model

This package is available to `PUBLIC` and performs its own security checking.

SQL tuning set subprograms require either the `ADMINISTER SQL TUNING SET` or the `ADMINISTER ANY SQL TUNING SET` privilege. Users having the `ADMINISTER SQL TUNING SET` privilege can only create and modify a SQL tuning set that they own. The `ADMINISTER ANY SQL TUNING SET` privilege allows users to manipulate all SQL tuning sets, even those owned by other users. For example, you can use [CREATE_SQLSET Procedure and Function](#) to create a SQL tuning set to be owned by a different user. In this case, the different user need not have the `ADMINISTER SQL TUNING SET` privilege to manipulate the SQL tuning set.

183.3 DBMS_SQLSET Data Structures

The `SELECT_*` subprograms in the `DBMS_SQLTUNE` package return objects of the `SQLSET_ROW` type.

Object Types

- [SQLSET_ROW Object Type](#)

183.3.1 SQLSET_ROW Object Type

The `SQLSET_ROW` object models the content of a SQL tuning set for the user.

Logically, a SQL tuning set is a collection of `SQLSET_ROW` objects. Each `SQLSET_ROW` contains a single SQL statement along with its execution context, statistics, binds, and plan. The `SELECT_*` subprograms each model a data source as a collection of `SQLSET_ROW` objects, with each object uniquely identified by (`sql_id`, `plan_hash_value`). Similarly, the `LOAD_SQLSET` procedure takes as input a cursor whose row type is `SQLSET_ROW`, treating each `SQLSET_ROW` in isolation according to the policies requested by the user.

Several subprograms package accept basic filters on the content of a SQL tuning set or data source. These filters are expressed in terms of the attributes within the `SQLSET_ROW` as defined.

Syntax

```
CREATE TYPE sqlset_row AS object (  
    sql_id                VARCHAR(13),
```

```

force_matching_signature NUMBER,
sql_text                 CLOB,
object_list              sql_objects,
bind_data                RAW(2000),
parsing_schema_name     VARCHAR2(30),
module                   VARCHAR2(48),
action                   VARCHAR2(32),
elapsed_time            NUMBER,
cpu_time                 NUMBER,
buffer_gets              NUMBER,
disk_reads               NUMBER,
direct_writes            NUMBER,
rows_processed           NUMBER,
fetches                  NUMBER,
executions               NUMBER,
end_of_fetch_count       NUMBER,
optimizer_cost           NUMBER,
optimizer_env            RAW(2000),
priority                 NUMBER,
command_type             NUMBER,
first_load_time          VARCHAR2(19),
stat_period              NUMBER,
active_stat_period       NUMBER,
other                    CLOB,
plan_hash_value          NUMBER,
sql_plan                 sql_plan_table_type,
bind_list                sql_binds,
con_dbid                 NUMBER,
last_exec_start_time     VARCHAR2(19))

```

Attributes

Table 183-1 SQLSET_ROW Attributes

Attribute	Description
sql_id	Unique SQL ID.
forcing_matching_signature	Signature with literals, case, and whitespace removed.
sql_text	Full text for the SQL statement.
object_list	Currently not implemented.
bind_data	Bind data as captured for this SQL. Note that you cannot stipulate an argument for this parameter and also for <code>bind_list</code> - they are mutually exclusive.
parsing_schema_name	Schema where the SQL is parsed.
module	Last application module for the SQL.
action	Last application action for the SQL.
elapsed_time	Sum total elapsed time for this SQL statement.
cpu_time	Sum total CPU time for this SQL statement.
buffer_gets	Sum total number of buffer gets.

Table 183-1 (Cont.) SQLSET_ROW Attributes

Attribute	Description
disk_reads	Sum total number of disk reads.
direct_writes	Sum total number of direct path writes.
rows_processed	Sum total number of rows processed by this SQL.
fetches	Sum total number of fetches.
executions	Total executions of this SQL statement.
end_of_fetch_count	Number of times the SQL statement was fully executed with all of its rows fetched.
optimizer_cost	Optimizer cost for this SQL.
optimizer_env	Optimizer environment for this SQL statement.
priority	User-defined priority (1,2,3).
command_type	Statement type, such as INSERT or SELECT.
first_load_time	Load time of the parent cursor.
stat_period	Period of time (seconds) when the statistics of this SQL statement were collected.
active_stat_period	Effective period of time (in seconds) during which the SQL statement was active.
other	Other column for user-defined attributes.
plan_hash_value	Plan hash value of the plan.
sql_plan	Execution plan for the SQL statement.
bind_list	List of user-specified binds for the SQL statement. This is used for user-specified workloads. Note that you cannot stipulate an argument for this parameter and also for bind_data: they are mutually exclusive.
con_dbid	DBID of the PDB or CDB root.
last_exec_start_time	Most recent execution start time of this SQL statement.

183.4 Summary of DBMS_SQLSET Subprograms

This table lists the DBMS_SQLSET subprograms and briefly describes them.

Table 183-2 DBMS_SQLSET Package Subprograms

Subprogram	Description
ADD_REFERENCE Function	This procedure adds a new reference to an existing SQL tuning set to indicate its use by a client.
CAPTURE_CURSOR_CACHE Procedure	This procedure captures a workload from the shared SQL area into a SQL tuning set.
CREATE_SQLSET Procedure and Function	This procedure or function creates a SQL tuning set object in the database.

Table 183-2 (Cont.) DBMS_SQLSET Package Subprograms

Subprogram	Description
CREATE_STGTAB Procedure	This procedure creates a staging table through which SQL tuning sets are imported and exported.
DELETE_SQLSET Procedure	This procedure deletes a set of SQL statements from a SQL tuning set.
DROP_SQLSET Procedure	This procedure drops a SQL tuning set if it is not active.
LOAD_SQLSET Procedure	This procedure populates the SQL tuning set with a set of selected SQL statements. You can call the procedure multiple times to add new SQL statements or replace attributes of existing statements.
PACK_STGTAB Procedure	This procedure copies one or more SQL tuning sets from their location in the SYS schema to a staging table created by the CREATE_STGTAB procedure.
REMAP_STGTAB Procedure	This procedure changes the tuning set names and owners in the staging table so that they can be unpacked with different values.
REMOVE_REFERENCE Procedure	This procedure deactivates a SQL tuning set to indicate that it is no longer used by the client.
SELECT_CURSOR_CACHE Function	This function collects SQL statements from the workload repository.
SELECT_SQL_TRACE Function	This table function reads the content of one or more trace files and returns the SQL statements it finds in the format of <code>sqlset_row</code> .
SELECT_SQLPA_TASK Function	This function collects SQL statements from a SQL Performance Analyzer comparison task.
SELECT_SQLSET Function	This is a table function that reads the contents of a SQL tuning set.
SELECT_WORKLOAD_REPOSITORY Function	This function collects SQL statements from the workload repository.
UNPACK_STGTAB Procedure	This procedure copies one or more SQL tuning sets from their location in the staging table into the SQL tuning sets schema, making them proper SQL tuning sets.
UPDATE_SQLSET Procedures	This overloaded procedure updates selected fields for SQL statements in a SQL tuning set.

183.4.1 ADD_REFERENCE Function

This procedure adds a new reference to an existing SQL tuning set to indicate its use by a client.

Syntax

```
DBMS_SQLSET.ADD_REFERENCE (
    sqlset_name IN VARCHAR2,
    description IN VARCHAR2 := NULL,
    sqlset_owner IN VARCHAR2 :=NULL)
RETURN NUMBER;
```

Parameters

The parameters are identical for `DBMS_SQLTUNE.ADD_SQLSET_REFERENCE` and `DBMS_SQLSET.ADD_REFERENCE`.

Table 183-3 ADD_SQLSET_REFERENCE and ADD_REFERENCE Function Parameters

Parameter	Description
<code>sqlset_name</code>	Specifies the name of the SQL tuning set.
<code>description</code>	Provides an optional description of the usage of SQL tuning set. The description is truncated if longer than 256 characters.
<code>sqlset_owner</code>	Specifies the owner of the SQL tuning set, or <code>NULL</code> for the current schema owner.

Return Values

The identifier of the added reference.

Usage Notes

Adding a reference to a SQL tuning set prevents the tuning set from being modified while it is being used. Invoking SQL Tuning Advisor on the SQL tuning set adds a reference automatically, so use `ADD_REFERENCE` only when the automatically generated reference is not sufficient. The `ADD_REFERENCE` function returns a reference ID that you can later supply to the `REMOVE_SQLSET_REFERENCE` procedure. Query the `DBA_SQLSET_REFERENCES` view to find all references to a specified SQL tuning set.

Examples

This example generates a reference to the SQL tuning set named `my_workload` and stores it in the `b_rid` variable.

```
VARIABLE b_rid NUMBER;
EXEC :b_rid := DBMS_SQLSET.ADD_REFERENCE(sqlset_name => 'my_workload',
description => 'my sts ref');
```

183.4.2 CAPTURE_CURSOR_CACHE Procedure

This procedure captures a workload from the shared SQL area into a SQL tuning set.

The procedure polls the cache multiple times over a time period, and updates the workload data stored there. It can execute over as long a period as required to capture an entire system workload.

Syntax

```
DBMS_SQLSET.CAPTURE_CURSOR_CACHE (
    sqlset_name      IN VARCHAR2,
    time_limit       IN POSITIVE := 1800,
    repeat_interval  IN POSITIVE := 300,
    capture_option   IN VARCHAR2 := 'MERGE',
    capture_mode     IN NUMBER    := MODE_REPLACE_OLD_STATS,
    basic_filter     IN VARCHAR2 := NULL,
    sqlset_owner     IN VARCHAR2 := NULL,
    recursive_sql    IN VARCHAR2 := HAS_RECURSIVE_SQL);
```

Parameters

The parameters are the same for both `DBMS_SQLTUNE.CAPTURE_CURSOR_CACHE_SQLSET` and `DBMS_SQLSET.CAPTURE_CURSOR_CACHE`.

Table 183-4 CAPTURE_CURSOR_CACHE_SQLSET and CAPTURE_CURSOR_CACHE Procedure Parameters

Parameter	Description
<code>sqlset_name</code>	Specifies the SQL tuning set name
<code>time_limit</code>	Defines the total amount of time, in seconds, to execute.
<code>repeat_interval</code>	Defines the amount of time, in seconds, to pause between sampling.
<code>capture_option</code>	Specifies whether to insert new statements, update existing statements, or both. Values are <code>INSERT</code> , <code>UPDATE</code> , or <code>MERGE</code> . The values are the same as for <code>load_option</code> in <code>load_sqlset</code> .
<code>capture_mode</code>	Specifies the capture mode (<code>UPDATE</code> and <code>MERGE</code> capture options). Possible values: <ul style="list-style-type: none"> <code>MODE_REPLACE_OLD_STATS</code> — Replaces statistics when the number of executions is greater than the number stored in the SQL tuning set <code>MODE_ACCUMULATE_STATS</code> — Adds new values to current values for SQL that is already stored. Note that this mode detects if a statement has been aged out, so the final value for a statistics is the sum of the statistics of all cursors that statement existed under.
<code>basic_filter</code>	Defines a filter to apply to the shared SQL area for each sample. If <code>basic_filter</code> is not set by the caller, then the subprogram captures only statements of type <code>CREATE TABLE</code> , <code>INSERT</code> , <code>SELECT</code> , <code>UPDATE</code> , <code>DELETE</code> , and <code>MERGE</code> .
<code>sqlset_owner</code>	Specifies the owner of the SQL tuning set or <code>NULL</code> for current schema owner

Table 183-4 (Cont.) CAPTURE_CURSOR_CACHE_SQLSET and CAPTURE_CURSOR_CACHE Procedure Parameters

Parameter	Description
<code>recursive_sql</code>	Defines a filter that includes recursive SQL in the SQL tuning set (<code>HAS_RECURSIVE_SQL</code>) or excludes it (<code>NO_RECURSIVE_SQL</code>).

Examples

In this example capture takes place over a 30-second period, polling the cache once every five seconds. This captures all statements run during that period but not before or after. If the same statement appears a second time, the process replaces the stored statement with the new occurrence.

Note that in production systems the time limit and repeat interval would be set much higher. You should tune the `time_limit` and `repeat_interval` parameters based on the workload time and shared SQL area turnover properties of your system.

```
EXEC DBMS_SQLSET.CAPTURE_CURSOR_CACHE( -
                                     sqlset_name    =>
'my_workload', -
                                     time_limit     => 30, -
                                     repeat_interval => 5);
```

In the following call you accumulate execution statistics as you go. This option produces an accurate picture of the cumulative activity of each cursor, even across age-outs, but it is more expensive than the previous example.

```
EXEC DBMS_SQLSET.CAPTURE_CURSOR_CACHE( -
                                     sqlset_name    => 'my_workload', -
                                     time_limit     => 30, -
                                     repeat_interval => 5, -
                                     capture_mode    =>
DBMS_SQLSET.MODE_ACCUMULATE_STATS);
```

This call performs a very inexpensive capture where you only insert new statements and do not update their statistics once they have been inserted into the SQL tuning set

```
EXEC DBMS_SQLSET.CAPTURE_CURSOR_CACHE( -
                                     sqlset_name    => 'my_workload', -
                                     time_limit     => 30, -
                                     repeat_interval => 5, -
                                     capture_option  => 'INSERT');
```

183.4.3 CREATE_SQLSET Procedure and Function

This procedure or function creates a SQL tuning set object in the database.

Syntax

```
DBMS_SQLSET.CREATE_SQLSET (  
    sqlset_name IN VARCHAR2,  
    description IN VARCHAR2 := NULL  
    sqlset_owner IN VARCHAR2 := NULL);
```

```
DBMS_SQLSET.CREATE_SQLSET (  
    sqlset_name IN VARCHAR2 := NULL,  
    description IN VARCHAR2 := NULL,  
    sqlset_owner IN VARCHAR2 := NULL)  
RETURN VARCHAR2;
```

Parameters

Table 183-5 CREATE_SQLSET Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of the created SQL tuning set. The name is the name passed to the function. If no name is passed to the function, then the function generates an automatic name.
description	Provides an optional description of the SQL tuning set.
sqlset_owner	Specifies the owner of the SQL tuning set, or NULL for the current schema owner.

Return Values

Specifies the name of the created SQL tuning set. The name is the name passed to the function. If no name is passed to the function, then the function generates an automatic name.

Examples

```
EXEC DBMS_SQLSET.CREATE_SQLSET(-  
    sqlset_name => 'my_workload', -  
    description => 'complete application workload');
```

183.4.4 CREATE_STGTAB Procedure

This procedure creates a staging table through which SQL tuning sets are imported and exported.

Syntax

```
DBMS_SQLSET.CREATE_STGTAB (
    table_name          IN VARCHAR2,
    schema_name        IN VARCHAR2 := NULL,
    tablespace_name    IN VARCHAR2 := NULL,
    db_version         IN NUMBER   := NULL);
```

Parameters

Table 183-6 CREATE_STGTAB_SQLSET and CREATE_STGTAB Procedure Parameters

Parameter	Description
table_name	Specifies the of the table to create. The name is case sensitive.
schema_name	Defines the schema in which to create the table, or NULL for the current schema. The name is case sensitive.
tablespace_name	Specifies the tablespace in which to store the staging table, or NULL for the default tablespace of the current user. The name is case sensitive.
db_version	Specifies the database version that determines the format of the staging table. You can also create an older database version staging table to export an STS to an older database version. Use one of the following values: <ul style="list-style-type: none"> • NULL (default) — Specifies the current database version. • STS_STGTAB_10_2_VERSION — Specifies the 10.2 database version. • STS_STGTAB_11_1_VERSION — Specifies the 11.1 database version. • STS_STGTAB_11_2_VERSION — Specifies the 11.2 database version. • STS_STGTAB_12_1_VERSION — Specifies the 12.1 database version. • STS_STGTAB_12_2_VERSION — Specifies the 12.2 database version.

Examples

Create a staging table for packing and eventually exporting a SQL tuning sets:

```
EXEC DBMS_SQLSET.CREATE_STGTAB(table_name => 'STGTAB_SQLSET');
```

Create a staging table to pack a SQL tuning set in Oracle Database 12c Release 1 (12.1.0.2) format:

```
BEGIN
    DBMS_SQLSET.CREATE_STGTAB (
        table_name => 'STGTAB_SQLSET_121'
    ,    db_version => DBMS_SQLSET.STS_STGTAB_12_1_VERSION );
END;
```

183.4.5 DELETE_SQLSET Procedure

This procedure deletes a set of SQL statements from a SQL tuning set.

Syntax

```
DBMS_SQLSET.DELETE_SQLSET (
  sqlset_name   IN  VARCHAR2,
  basic_filter  IN  VARCHAR2 := NULL,
  sqlset_owner  IN  VARCHAR2 := NULL);
```

Parameters

Table 183-7 DELETE_SQLSET Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of the SQL tuning set.
basic_filter	Specifies the SQL predicate to filter the SQL from the SQL tuning set. This basic filter is used as a where clause on the SQL tuning set content to select a desired subset of SQL from the SQL tuning set.
sqlset_owner	Specifies the owner of the SQL tuning set, or NULL for current schema owner.

Examples

```
-- Delete all statements in a sql tuning set.
EXEC DBMS_SQLSET.DELETE_SQLSET(sqlset_name => 'my_workload');

-- Delete all statements in a sql tuning set which ran for less than a second
EXEC DBMS_SQLSET.DELETE_SQLSET(sqlset_name => 'my_workload', -
                                basic_filter => 'elapsed_time < 1000000');
```

183.4.6 DROP_SQLSET Procedure

This procedure drops a SQL tuning set if it is not active.

Syntax

```
DBMS_SQLSET.DROP_SQLSET (
  sqlset_name   IN  VARCHAR2,
  sqlset_owner  IN  VARCHAR2 := NULL);
```

Parameters

Table 183-8 DROP_SQLSET Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of the SQL tuning set.

Table 183-8 (Cont.) DROP_SQLSET Procedure Parameters

Parameter	Description
sqlset_owner	Specifies the owner of the SQL tuning set, or NULL for current schema owner.

Usage Notes

You cannot drop a SQL tuning set when it is referenced by one or more clients.

Examples

```
-- Drop the sqlset.
EXEC DBMS_SQLSET.DROP_SQLSET ('my_workload');
```

183.4.7 LOAD_SQLSET Procedure

This procedure populates the SQL tuning set with a set of selected SQL statements. You can call the procedure multiple times to add new SQL statements or replace attributes of existing statements.

Syntax

```
DBMS_SQLSET.LOAD_SQLSET (
  sqlset_name      IN VARCHAR2,
  populate_cursor  IN sqlset_cursor,
  load_option      IN VARCHAR2 := 'INSERT',
  update_option    IN VARCHAR2 := 'REPLACE',
  update_condition IN VARCHAR2 := NULL,
  update_attributes IN VARCHAR2 := NULL,
  ignore_null      IN BOOLEAN := TRUE,
  commit_rows      IN POSITIVE := NULL,
  sqlset_owner     IN VARCHAR2 := NULL);
```

Parameters

Table 183-9 LOAD_SQLSET Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of SQL tuning set to be loaded.
populate_cursor	Specifies the cursor reference to the SQL tuning set to be loaded.
load_option	Specifies which statements are loaded into the SQL tuning set. The possible values are: <ul style="list-style-type: none"> INSERT (default) — Adds only new statements. UPDATE — Updates existing the SQL statements and ignores any new statements. MERGE — Inserts new statements and updates the information of the existing ones.

Table 183-9 (Cont.) LOAD_SQLSET Procedure Parameters

Parameter	Description
update_option	<p>Specifies how existing SQL statements are updated.</p> <p>This parameter is considered only if <code>load_option</code> is specified with <code>UPDATE</code> or <code>MERGE</code> as an option. The possible values are:</p> <ul style="list-style-type: none"> • <code>REPLACE</code> (default) — Updates the statement using the new statistics, bind list, object list, and so on. • <code>ACCUMULATE</code> — Combines attributes when possible (for example, statistics such as <code>elapsed_time</code>), and otherwise replaces the existing values (for example, module and action) with the provided values. The SQL statement attributes that can be accumulated are: <code>elapsed_time</code>, <code>buffer_gets</code>, <code>direct_writes</code>, <code>disk_reads</code>, <code>row_processed</code>, <code>fetches</code>, <code>executions</code>, <code>end_of_fetch_count</code>, <code>stat_period</code> and <code>active_stat_period</code>.
update_condition	<p>Specifies when to perform the update.</p> <p>The procedure only performs the update when the specified condition is satisfied. The condition can refer to either the data source or destination. The condition must use the following prefixes to refer to attributes from the source or the destination:</p> <ul style="list-style-type: none"> • <code>OLD</code> — Refers to statement attributes from the SQL tuning set (destination). • <code>NEW</code> — Refers to statement attributes from the input statements (source).
update_attributes	<p>Specifies the list of SQL statement attributes to update during a merge or update.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • <code>NULL</code> (default) — Specifies the content of the input cursor except the execution context. On other terms, it is equivalent to <code>ALL</code> without execution contexts such as module and action. • <code>BASIC</code> — Specifies statistics and binds only. • <code>TYPICAL</code> — Specifies <code>BASIC</code> with SQL plans (without row source statistics) and without an object reference list. • <code>ALL</code> — Specifies all attributes, including the execution context attributes such as module and action. • List of comma separated attribute names to update: <ul style="list-style-type: none"> – <code>EXECUTION_CONTEXT</code> – <code>EXECUTION_STATISTICS</code> – <code>SQL_BINDS</code> – <code>SQL_PLAN</code> – <code>SQL_PLAN_STATISTICS</code> (similar to <code>SQL_PLAN</code> with added row source statistics)
ignore_null	<p>Specifies whether to update attributes when the new value is <code>NULL</code>.</p> <p>If <code>TRUE</code>, then the procedure does not update an attribute when the new value is <code>NULL</code>. That is, do not override with <code>NULL</code> values unless intentional.</p>

Table 183-9 (Cont.) LOAD_SQLSET Procedure Parameters

Parameter	Description
<code>commit_rows</code>	Specifies whether to commit statements after DML. If a value is provided, then the load commits after each specified number of statements is inserted. If <code>NULL</code> is provided, then the load commits only once, at the end of the operation. Providing a value for this argument enables you to monitor the progress of a SQL tuning set load operation in the <code>DBA_SQLSET</code> views. The <code>STATEMENT_COUNT</code> value increases as new SQL statements are loaded.
<code>sqlset_owner</code>	Defines the owner of the SQL tuning set, or the current schema owner (or <code>NULL</code> for the current owner).

Exceptions

- This procedure returns an error when `sqlset_name` is invalid, or a corresponding SQL tuning set does not exist, or the `populate_cursor` is incorrect and cannot be executed.
- Exceptions are also raised when invalid filters are provided. Filters can be invalid either because they don't parse (for example, they refer to attributes not in `sqlset_row`), or because they violate the user's privileges.

Usage Notes

Rows in the input `populate_cursor` must be of type `SQLSET_ROW`.

Examples

In this example, you create and populate a SQL tuning set with all shared SQL area statements with an elapsed time of 5 seconds or more, excluding statements that belong to `SYS` schema. You select all attributes of the SQL statements and load them in the tuning set using the default mode. The default mode loads only new statements because the SQL tuning set is empty.

```
-- create the tuning set
EXEC DBMS_SQLSET.CREATE_SQLSET('my_workload');

-- populate the tuning set from the shared SQL area
DECLARE
  cur DBMS_SQLSET.SQLSET_CURSOR;
BEGIN
  OPEN cur FOR
    SELECT VALUE(P)
      FROM table(
        DBMS_SQLSET.SELECT_CURSOR_CACHE(
          'parsing_schema_name <> 'SYS' AND elapsed_time > 5000000',
          NULL, NULL, NULL, NULL, 1, NULL,
          'ALL')) P;

  DBMS_SQLSET.LOAD_SQLSET(sqlset_name => 'my_workload',
                          populate_cursor => cur);
```

```
END;
/
```

Now you want to augment this information with what is stored in the workload repository (AWR). You populate the tuning set with 'ACCUMULATE' as your `update_option` because it is assumed the cursors currently in the cache have aged out since the snapshot was taken.

You omit the `elapsed_time` filter because it is assumed that any statement captured in AWR is important, but still you throw away the SYS-parsed cursors to avoid recursive SQL.

```
DECLARE
  cur DBMS_SQLSET.SQLSET_CURSOR;
BEGIN
  OPEN cur FOR
    SELECT VALUE(P)
      FROM table(
        DBMS_SQLSET.SELECT_WORKLOAD_REPOSITORY(1,2,
                                                'parsing_schema_name <>'
                                                'SYS',
                                                NULL, NULL, NULL, NULL,
                                                1,
                                                NULL,
                                                'ALL')) P;

  DBMS_SQLSET.LOAD_SQLSET(sqlset_name      => 'my_workload',
                          populate_cursor => cur,
                          load_option     => 'MERGE',
                          update_option   => 'ACCUMULATE');
END;
```

The following example is a simple load that only inserts new statements from the workload repository, skipping existing ones (in the SQL tuning set). Note that 'INSERT' is the default value for the `load_option` argument of the `LOAD_SQLSET` procedure.

```
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
    SELECT VALUE(P)
      FROM table(DBMS_SQLSET.SELECT_WORKLOAD_REPOSITORY(1,2)) P;
  DBMS_SQLSET.LOAD_SQLSET(sqlset_name => 'my_workload', populate_cursor =>
cur);
END;
/
```

The next example demonstrates a load with `UPDATE` option. This updates statements that already exist in the SQL tuning set but does not add new ones. By default, old statistics are replaced by their new values.

```
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
```

```

SELECT VALUE(P)
FROM table(DBMS_SQLSET.SELECT_CURSOR_CACHE) P;

DBMS_SQLSET.LOAD_SQLSET(sqlset_name      => 'my_workload',
                        populate_cursor => cur,
                        load_option     => 'UPDATE');

END;
/

```

183.4.8 PACK_STGTAB Procedure

This procedure copies one or more SQL tuning sets from their location in the SYS schema to a staging table created by the CREATE_STGTAB procedure.

Syntax

```

DBMS_SQLSET.PACK_STGTAB (
  sqlset_name      IN VARCHAR2,
  sqlset_owner     IN VARCHAR2 := NULL,
  staging_table_name IN VARCHAR2,
  staging_schema_owner IN VARCHAR2 := NULL,
  db_version       IN NUMBER   := NULL);

```

Parameters

The parameters are identical for the DBMS_SQLTUNE.PACK_STGTAB_SQLSET and DBMS_SQLSET.PACK_STGTAB procedures.

Table 183-10 PACK_STGTAB_SQLSET and PACK_STGTAB Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of the SQL tuning set to pack. The name is case sensitive. Wildcard characters (%) are permitted.
sqlset_owner	Specifies the category from which to pack SQL tuning sets. The name is case sensitive. Wildcard characters (%) are permitted.
staging_table_name	Specifies the name of the table to use. The value is case sensitive.
staging_schema_owner	Specifies the schema where the table resides, or NULL for the current schema. The value is case sensitive.
db_version	Specifies the database version that determines the format of the staging table. You can also create an older database version staging table to export an STS to an older database version. Use any of the following values: <ul style="list-style-type: none"> NULL (default) — Specifies the current database version. STS_STGTAB_10_2_VERSION — Specifies the 10.2 database version. STS_STGTAB_11_1_VERSION — Specifies the 11.1 database version. STS_STGTAB_11_2_VERSION — Specifies the 11.2 database version.

Usage Notes

- To move more than one SQL tuning set, call this procedure multiple times. You can then move the populated staging table to a destination database using any method, such as a database link or Oracle Data Pump, and then unpack the SQL tuning set in the destination database.
- This function issues a `COMMIT` after packing each SQL tuning set. If an error is raised mid-execution, then clear the staging table by deleting its rows.

Examples

Put all SQL tuning sets on the database in the staging table:

```
BEGIN
  DBMS_SQLSET.PACK_STGTAB(
    sqlset_name      => '%'
  ,   sqlset_owner   => '%'
  ,   staging_table_name => 'STGTAB_SQLSET');
END;
```

Put only those SQL tuning sets owned by the current user in the staging table:

```
BEGIN
  DBMS_SQLSET.PACK_STGTAB(
    sqlset_name      => '%'
  ,   staging_table_name => 'STGTAB_SQLSET');
END;
```

Pack a specific SQL tuning set:

```
BEGIN
  DBMS_SQLSET.PACK_STGTAB(
    sqlset_name      => 'my_workload'
  ,   staging_table_name => 'STGTAB_SQLSET');
END;
```

Pack a second SQL tuning set:

```
BEGIN
  DBMS_SQLSET.PACK_STGTAB(
    sqlset_name      => 'workload_subset'
  ,   staging_table_name => 'STGTAB_SQLSET');
END;
```

Pack the STS `my_workload_subset` into a staging table `stgtab_sqlset` created for Oracle Database 11g Release 2 (11.2):

```
BEGIN
  DBMS_SQLSET.PACK_STGTAB(
    sqlset_name      => 'workload_subset'
  ,   staging_table_name => 'STGTAB_SQLSET'
```

```
, db_version => DBMS_SQLSET.STS_STGTAB_11_2_VERSION);
END;
```

183.4.9 REMAP_STGTAB Procedure

This procedure changes the tuning set names and owners in the staging table so that they can be unpacked with different values.

Syntax

```
DBMS_SQLSET.REMAP_STGTAB (
    old_sqlset_name      IN VARCHAR2,
    old_sqlset_owner     IN VARCHAR2 := NULL,
    new_sqlset_name      IN VARCHAR2 := NULL,
    new_sqlset_owner     IN VARCHAR2 := NULL,
    staging_table_name   IN VARCHAR2,
    staging_schema_owner IN VARCHAR2 := NULL,
    old_con_dbid         IN NUMBER   := NULL,
    new_con_dbid         IN NUMBER   := NULL);
);
```

Parameters

The parameters are identical for the DBMS_SQLTUNE.REMAP_STGTAB_SQLSET and DBMS_SQLSET.REMAP_SQLSET procedures.

Table 183-11 REMAP_STGTAB_SQLSET and REMAP_SQLSET Procedure Parameters

Parameter	Description
old_sqlset_name	Specifies the name of the tuning set to target for a remap operation. Wildcard characters (%) are not supported.
old_sqlset_owner	Specifies the new name of the tuning set owner to target for a remap operation. NULL for current schema owner
new_sqlset_name	Specifies the new name for the tuning set, or NULL to keep the same tuning set name.
new_sqlset_owner	Specifies the new owner for the tuning set, or NULL to keep the same owner name.
staging_table_name	Specifies the name of the table on which to perform the remap operation. The value is case sensitive.
staging_schema_owner	Specifies the name of staging table owner, or NULL for the current schema owner. The value is case sensitive.
old_con_dbid	Specifies the old container DBID to be remapped to a new container DBID. Specify NULL to use the same container DBID. You must provide both old_con_dbid and new_con_dbid for the remap to succeed.
new_con_dbid	Specifies the new container DBID to replace with the old container DBID. Specify NULL to use the same container DBID. You must provide both old_con_dbid and new_con_dbid for the remap to succeed.

Usage Notes

Call this procedure multiple times to remap more than one tuning set name or owner. This procedure only handles one tuning set per call.

Examples

```

-- Change the name of an STS in the staging table before unpacking it.
BEGIN
  DBMS_SQLSET.REMAP_STGTAB(
    old_sqlset_name =>
'my_workload'
    , old_sqlset_owner => 'SH'
    , new_sqlset_name =>
'imp_workload'
    , staging_table_name => 'STGTAB_SQLSET');

-- Change the owner of an STS in the staging table before unpacking it.
  DBMS_SQLSET.REMAP_STGTAB(
    old_sqlset_name => 'imp_workload'
    , old_sqlset_owner => 'SH'
    , new_sqlset_owner => 'SYS'
    , staging_table_name => 'STGTAB_SQLSET');
END;

```

183.4.10 REMOVE_REFERENCE Procedure

This procedure deactivates a SQL tuning set to indicate that it is no longer used by the client.

Syntax

```

DBMS_SQLSET.REMOVE_REFERENCE (
  sqlset_name   IN VARCHAR2,
  reference_id  IN NUMBER,
  sqlset_owner  IN VARCHAR2 := NULL,
  force_remove IN NUMBER   := 0);

```

Parameters

The parameters are identical for the `DBMS_SQLTUNE.REMOVE_SQLSET_REFERENCE` and `DBMS_SQLSET.REMOVE_REFERENCE` procedures.

Table 183-12 REMOVE_SQLSET_REFERENCE and REMOVE_REFERENCE Procedure Parameters

Parameter	Description
<code>sqlset_name</code>	Specifies the name of the SQL tuning set.
<code>reference_id</code>	Specifies the identifier of the reference to remove.
<code>sqlset_owner</code>	Specifies the owner of the SQL tuning set (or <code>NULL</code> for the current schema owner).

Table 183-12 (Cont.) REMOVE_SQLSET_REFERENCE and REMOVE_REFERENCE Procedure Parameters

Parameter	Description
<code>force_remove</code>	Specifies whether references can be removed for other users (1) or whether they cannot be removed (0). Setting this parameter to 1 only takes effect when the user has the ADMINISTER ANY SQL TUNING SET privilege. Otherwise, the database only removes references owned by the user.

Examples

You can remove references on a given SQL tuning set when you finish using it and want to make it writable again. The following example removes the reference to `my_workload`:

```
EXEC DBMS_SQLSET.REMOVE_REFERENCE(sqlset_name => 'my_workload', -
                                reference_id => :rid);
```

Use the `DBA_SQLSET_REFERENCES` view to find all references to a given SQL tuning set.

183.4.11 SELECT_CURSOR_CACHE Function

This function collects SQL statements from the shared SQL area.

Syntax

```
DBMS_SQLSET.SELECT_CURSOR_CACHE (
  basic_filter      IN  VARCHAR2 := NULL,
  object_filter    IN  VARCHAR2 := NULL,
  ranking_measure1 IN  VARCHAR2 := NULL,
  ranking_measure2 IN  VARCHAR2 := NULL,
  ranking_measure3 IN  VARCHAR2 := NULL,
  result_percentage IN  NUMBER   := 1,
  result_limit     IN  NUMBER   := NULL,
  attribute_list   IN  VARCHAR2 := 'TYPICAL',
  recursive_sql   IN  VARCHAR2 := HAS_RECURSIVE_SQL)
RETURN sys.sqlset PIPELINED;
```

Parameters

Table 183-13 SELECT_CURSOR_CACHE Function Parameters

Parameter	Description
<code>basic_filter</code>	Specifies the SQL predicate that filters the SQL from the shared SQL area defined on attributes of the <code>SQLSET_ROW</code> . If <code>basic_filter</code> is not set by the caller, then the subprogram captures only statements of the type CREATE TABLE, INSERT, SELECT, UPDATE, DELETE, and MERGE.

Table 183-13 (Cont.) SELECT_CURSOR_CACHE Function Parameters

Parameter	Description
<code>object_filter</code>	Currently not supported.
<code>ranking_measure(n)</code>	Defines an <code>ORDER BY</code> clause on the selected SQL.
<code>result_percentage</code>	Specifies a filter that picks the top <i>n</i> % according to the supplied ranking measure. The value applies only if one ranking measure is supplied.
<code>result_limit</code>	Defines the top limit SQL from the filtered source ranked by the ranking measure.
<code>attribute_list</code>	Specifies the list of SQL statement attributes to return in the result. Possible values are: <ul style="list-style-type: none"> • <code>TYPICAL</code> — Specifies <code>BASIC</code> plus SQL plan (without row source statistics) and without object reference list (default). • <code>BASIC</code> — Specifies all attributes (such as execution statistics and binds) except the plans. The execution context is always part of the result. • <code>ALL</code> — Specifies all attributes. • Comma-separated list of attribute names. This values returns only a subset of SQL attributes: <ul style="list-style-type: none"> – <code>EXECUTION_STATISTICS</code> – <code>BIND_LIST</code> – <code>OBJECT_LIST</code> – <code>SQL_PLAN</code> – <code>SQL_PLAN_STATISTICS</code> — Similar to <code>SQL_PLAN</code> plus row source statistics
<code>recursive_sql</code>	Specifies that the filter must include recursive SQL in the SQL tuning set (<code>HAS_RECURSIVE_SQL</code> , which is the default) or exclude it (<code>NO_RECURSIVE_SQL</code>).

Return Values

This function returns a one `SQLSET_ROW` per `SQL_ID` or `PLAN_HASH_VALUE` pair found in each data source.

Usage Notes

- Filters provided to this function are evaluated as part of a SQL run by the current user. As such, they are executed with that user's security privileges and can contain any constructs and subqueries that user can access, but no more.
- Users need privileges on the shared SQL area views.

Example 183-1 Statements with 500 or More Buffer Gets

This query obtains the SQL IDs and SQL text for statements with 500 buffer gets:

```
SELECT SQL_ID, SQL_TEXT
FROM TABLE(DBMS_SQLSET.SELECT_CURSOR_CACHE('buffer_gets > 500'))
ORDER BY sql_id;
```

Example 183-2 All Information About a Statement

The following query obtains all information about the SQL statement with the SQL ID 4rm4183czbs7j:

```
SELECT * FROM TABLE(DBMS_SQLSET.SELECT_CURSOR_CACHE('sql_id =
''4rm4183czbs7j''));
```

Example 183-3 Multiple Plans for a SQL Statement

A data source may store multiple plans for each SQL statement. The output of the SELECT_CURSOR_CACHE function is a SQL row set object that is uniquely identified by SQL ID and plan hash value. This example queries the plan hash values for the statement with the SQL ID ay1m3ssvtrh24:

```
SELECT sql_id, plan_hash_value
FROM table(DBMS_SQLSET.select_cursor_cache('sql_id =
''ay1m3ssvtrh24''))
ORDER BY sql_id, plan_hash_value;
```

Example 183-4 Processing All Statements in the Shared SQL Area

This example processes all statements in the shared SQL area:

```
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
    SELECT VALUE(p)
    FROM TABLE(DBMS_SQLSET.SELECT_CURSOR_CACHE) p;

  -- Process each statement in cursor (or pass cursor to load_sqlset).

  CLOSE cur;
END;
/
```

Example 183-5 Process Statements Not Parsed by SYS

This example processes all statements not parsed in the SYS schema:

```
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur for
    SELECT VALUE(p)
    FROM TABLE(
      DBMS_SQLSET.SELECT_CURSOR_CACHE('parsing_schema_name <>
''SYS'')) p;

  -- Process each statement (or pass cursor to load_sqlset).

  CLOSE cur;
```

```
end;  
/
```

Example 183-6 All Statements from an Application Module and Action

This example processes all statements from a specified application module and action:

```
DECLARE  
  cur sys_refcursor;  
BEGIN  
  OPEN cur FOR  
    SELECT VALUE(p)  
    FROM TABLE(  
      DBMS_SQLSET.SELECT_CURSOR_CACHE(  
        'module = 'MY_APPLICATION' and action = 'MY_ACTION'')) p;  
  
  -- Process each statement (or pass cursor to load_sqlset)  
  
  CLOSE cur;  
END;/
```

Example 183-7 All Statements Whose Elapsed Time Is At Least Five Seconds

This example processes all statements that ran for at least five seconds:

```
DECLARE  
  cur sys_refcursor;  
BEGIN  
  OPEN cur FOR  
    SELECT VALUE(P)  
    FROM table(DBMS_SQLSET.SELECT_CURSOR_CACHE('elapsed_time > 5000000')) P;  
  
  -- Process each statement (or pass cursor to load_sqlset)  
  
  CLOSE cur;  
END;  
/
```

Example 183-8 Statements Parsed in the APPS Schema

This example processes all SQL statements that were parsed in the APPS schema and had more than 100 buffer gets:

```
DECLARE  
  cur sys_refcursor;  
BEGIN  
  OPEN cur FOR  
    SELECT VALUE(p)  
    FROM TABLE(  
      DBMS_SQLSET.SELECT_CURSOR_CACHE(  
        'buffer_gets > 100 and parsing_schema_name = 'APPS''))p;  
  
  -- Process each statement (or pass cursor to load_sqlset)
```

```

    CLOSE cur;
END;
/

```

Example 183-9 Plans and SQL Statements

This example processes all SQL statements exceeding 5 seconds. It also selects the plans for these statements. For performance reasons, the example selects execution statistics and SQL binds. The `SQL_PLAN` attribute of `sqlset_row` is `NULL`.

```

-- select all statements exceeding 5 seconds in elapsed time, but also
-- select the plans (by default we only select execution stats and
-- binds
-- for performance reasons - in this case the SQL_PLAN attribute of
-- sqlset_row
-- is NULL)
DECLARE
    cur sys_refcursor;
BEGIN
    OPEN cur FOR
        SELECT VALUE(p)
        FROM TABLE(DBMS_SQLSET.SELECT_CURSOR_CACHE(
            basic_filter      => 'elapsed_time > 5000000',
            object_filter     => NULL,
            ranking_measure1  => NULL,
            ranking_measure2  => NULL,
            ranking_measure3  => NULL,
            result_percentage => 1,
            result_limit      => NULL,
            attribute_list    => 'EXECUTION_STATISTICS, SQL_BINDS, SQL_PLAN',
            recursive_sql     => HAS_RECURSIVE_SQL)) p;

    -- Process each statement (or pass cursor to load_sqlset)

    CLOSE cur;
END;/

```

Example 183-10 Top 100 Statements Ordered by Elapsed Time

This example selects the top 100 statements in the shared SQL area, ordered by elapsed time:

```

DECLARE
    cur sys_refcursor;
BEGIN
    OPEN cur FOR
        SELECT VALUE(p)
        FROM TABLE(DBMS_SQLSET.SELECT_CURSOR_CACHE(
            basic_filter      => NULL,
            object_filter     => NULL,
            ranking_measure_1 => 'ELAPSED_TIME',
            ranking_measure_2 => NULL,
            ranking_measure_3 => NULL,
            result_percentage => 1,

```

```

        result_limit      => 100,
        attribute_list    => 'TYPICAL',
        recursive_sql     => HAS_RECURSIVE_SQL))) p;

-- Process each statement (or pass cursor to load_sqlset)

CLOSE cur;
END;
/

```

Example 183-11 Statements Responsible for Most Buffer Gets

This example processes statements that cumulatively account for 90% of the buffer gets in the shared SQL area. The buffer gets of all statements added together is approximately 90% of the sum of all statements currently in the shared SQL area.

```

DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
    SELECT VALUE(P)
    FROM table(DBMS_SQLSET.SELECT_CURSOR_CACHE(
      basic_filter      => NULL,
      object_filter     => NULL,
      ranking_measure_1 => 'BUFFER_GETS',
      ranking_measure_2 => NULL,
      ranking_measure_3 => NULL,
      result_percentage => .9,
      result_limit      => NULL,
      attribute_list    => 'TYPICAL',
      recursive_sql     => HAS_RECURSIVE_SQL))) p;

-- Process each statement (or pass cursor to load_sqlset).

CLOSE cur;
END;
/

```

183.4.12 SELECT_SQL_TRACE Function

This table function reads the content of one or more trace files and returns the SQL statements it finds in the format of `sqlset_row`.

Syntax

```

DBMS_SQLSET.SELECT_SQL_TRACE (
  directory          IN VARCHAR2,
  file_name          IN VARCHAR2 := NULL,
  mapping_table_name IN VARCHAR2 := NULL,
  mapping_table_owner IN VARCHAR2 := NULL,
  select_mode        IN POSITIVE := SINGLE_EXECUTION,
  options            IN BINARY_INTEGER := LIMITED_COMMAND_TYPE,
  pattern_start      IN VARCHAR2 := NULL,

```

```

pattern_end          IN VARCHAR2 := NULL,
result_limit         IN POSITIVE := NULL)
RETURN sys.sqlset PIPELINED;

```

Parameters

Table 183-14 SELECT_SQL_TRACE Function Parameters

Parameter	Description
directory	Defines the directory object containing the trace files. This field is mandatory.
file_name	Specifies all or part of the name of the trace files. If NULL, then the function uses the current or most recent file in the specified location or path. '%' wildcards are supported for matching trace file names.
mapping_table_name	Specifies the mapping table name. Note that the mapping table name is case insensitive. If the mapping table name is NULL, then the function uses the mappings in the current database.
mapping_table_owner	Specifies the mapping table owner. If it is NULL, then the function uses the current user.
select_mode	Specifies the mode for selecting SQL from the trace. Possible values are: <ul style="list-style-type: none"> SINGLE_EXECUTION — Returns one execution of a SQL. This is the default. ALL_EXECUTIONS — Returns all executions.
options	Specifies which types of SQL statements are returned. <ul style="list-style-type: none"> LIMITED_COMMAND_TYPE — Returns the SQL statements with the command types CREATE, INSERT, SELECT, UPDATE, DELETE, and MERGE. This value is the default. ALL_COMMAND_TYPE — Returns the SQL statements with all command types.
pattern_start	Specifies the delimiting pattern of the trace file sections to consider. CURRENTLY INOPERABLE.
pattern_end	Specifies the closing delimiting pattern of the trace file sections to process. CURRENTLY INOPERABLE.
result_limit	Specifies the top SQL from the filtered source. Default to MAXSB4 if NULL.

Return Values

This function returns a `SQLSET_ROW` object.

Usage Notes

The ability to create a directory object for the system directory creates a potential security issue. For example, in a CDB, all containers write trace files to the same directory. A local user with `SELECT` privileges on this directory can read the contents of trace files belonging to any container.

To prevent this type of unauthorized access, copy the files from the default SQL trace directory into a different directory, and then create a directory object. Use the `PATH_PREFIX` clause of the `CREATE PLUGGABLE DATABASE` statement to ensure that all directory object paths associated with the PDB are restricted to the specified directory or its subdirectories.

Examples

The following code shows how to enable SQL trace for a few SQL statements and load the results into a SQL tuning set:

```
-- turn on the SQL trace in the capture database
ALTER SESSION SET EVENTS '10046 TRACE NAME CONTEXT FOREVER, LEVEL 4'

-- run sql statements
SELECT 1 FROM DUAL;
SELECT COUNT(*) FROM dba_tables WHERE table_name = :mytab;

ALTER SESSION SET EVENTS '10046 TRACE NAME CONTEXT OFF';

-- create mapping table from the capture database
CREATE TABLE mapping AS
SELECT object_id id, owner, substr(object_name, 1, 30) name
   FROM dba_objects
   WHERE object_type NOT IN ('CONSUMER GROUP', 'EVALUATION CONTEXT',
                             'FUNCTION', 'INDEXTYPE', 'JAVA CLASS',
                             'JAVA DATA', 'JAVA RESOURCE', 'LIBRARY',
                             'LOB', 'OPERATOR', 'PACKAGE',
                             'PACKAGE BODY', 'PROCEDURE', 'QUEUE',
                             'RESOURCE PLAN', 'TRIGGER', 'TYPE',
                             'TYPE BODY')

UNION ALL
SELECT user_id id, username owner, NULL name
   FROM dba_users;

-- create the directory object where the SQL traces are stored
CREATE DIRECTORY SQL_TRACE_DIR as '/home/foo/trace';

-- create the STS
EXEC DBMS_SQLSET.CREATE_SQLSET('my_sts', 'test purpose');

-- load the SQL statements into STS from SQL TRACE
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
  SELECT value(p)
     FROM TABLE(
       DBMS_SQLSET.SELECT_SQL_TRACE(
         directory=>'SQL_TRACE_DIR',
         file_name=>'%trc',
         mapping_table_name=>'mapping')) p;
  DBMS_SQLSET.LOAD_SQLSET('my_sts', cur);
  CLOSE cur;
END;
/
```

 **See Also:**

Oracle Database SQL Language Reference to learn more about the `PATH_PREFIX` clause

183.4.13 SELECT_SQLPA_TASK Function

This function collects SQL statements from a SQL Performance Analyzer comparison task.

 **See Also:**

Oracle Database Testing Guide for a `SELECT_SQLPA_TASK` example

Syntax

```
DBMS_SQLSET.SELECT_SQLPA_TASK(  
    task_name          IN VARCHAR2,  
    task_owner        IN VARCHAR2 := NULL,  
    execution_name     IN VARCHAR2 := NULL,  
    level_filter       IN VARCHAR2 := 'REGRESSED',  
    basic_filter       IN VARCHAR2 := NULL,  
    object_filter      IN VARCHAR2 := NULL,  
    attribute_list     IN VARCHAR2 := 'TYPICAL')  
RETURN sys.sqlset PIPELINED;
```

Parameters

Table 183-15 SELECT_SQLPA_TASK Function Parameters

Parameter	Description
<code>task_name</code>	Specifies the name of the SQL Performance Analyzer task.
<code>task_owner</code>	Specifies the owner of the SQL Performance Analyzer task. If <code>NULL</code> , then assume the current user.
<code>execution_name</code>	Specifies the name of the SQL Performance Analyzer task execution (type <code>COMPARE PERFORMANCE</code>) from which the provided filters will be applied. If <code>NULL</code> , then assume the most recent <code>COMPARE PERFORMANCE</code> execution.

Table 183-15 (Cont.) SELECT_SQLPA_TASK Function Parameters

Parameter	Description
level_filter	<p>Specifies which subset of SQL statements to include. Same format as DBMS_SQLPA.REPORT_ANALYSIS_TASK.LEVEL, with some possible strings removed.</p> <ul style="list-style-type: none"> IMPROVED includes only improved SQL. REGRESSED includes only regressed SQL (default). CHANGED includes only SQL with changed performance. UNCHANGED includes only SQL with unchanged performance. CHANGED_PLANS includes only SQL with plan changes. UNCHANGED_PLANS includes only SQL with unchanged plans. ERRORS includes only SQL with errors only. MISSING_SQL includes only missing SQL statements (across STS). NEW_SQL includes only new SQL statements (across STS).
basic_filter	Specifies the SQL predicate to filter the SQL in addition to the level filters.
object_filter	Currently not supported.
attribute_list	<p>Defines the SQL statement attributes to return in the result.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> TYPICAL — Returns BASIC plus the SQL plan (without row source statistics) and without an object reference list. This is the default. BASIC — Returns all attributes (such as execution statistics and binds) except the plans. The execution context is always part of the result. ALL — Returns all attributes. Comma-separated list of attribute names this allows to return only a subset of SQL attributes: EXECUTION_STATISTICS, SQL_BINDS, SQL_PLAN_STATISTICS (similar to SQL_PLAN + row source statistics).

Return Values

This function returns a SQL tuning set object.

Usage Notes

For example, you can use this function to create a SQL tuning set containing the subset of SQL statements that regressed during a SQL Performance Analyzer (SPA) experiment. You can also specify other arbitrary filters.

183.4.14 SELECT_SQLSET Function

This is a table function that reads the contents of a SQL tuning set.

Syntax

```
DBMS_SQLSET.SELECT_SQLSET (
  sqlset_name      IN   VARCHAR2,
  basic_filter     IN   VARCHAR2 := NULL,
  object_filter    IN   VARCHAR2 := NULL,
  ranking_measure1 IN   VARCHAR2 := NULL,
  ranking_measure2 IN   VARCHAR2 := NULL,
  ranking_measure3 IN   VARCHAR2 := NULL,
```

```

result_percentage IN NUMBER := 1,
result_limit     IN NUMBER := NULL)
attribute_list   IN VARCHAR2 := 'TYPICAL',
plan_filter      IN VARCHAR2 := NULL,
sqlset_owner     IN VARCHAR2 := NULL,
recursive_sql    IN VARCHAR2 := HAS_RECURSIVE_SQL)
RETURN sys.sqlset PIPELINED;

```

Parameters

Table 183-16 SELECT_SQLSET Function Parameters

Parameter	Description
sqlset_name	Specifies the name of the SQL tuning set to query.
basic_filter	Specifies the SQL predicate to filter the SQL from the SQL tuning set defined on attributes of the <code>SQLSET_ROW</code> .
object_filter	Currently not supported.
ranking_measure(n)	Specifies an <code>ORDER BY</code> clause on the selected SQL.
result_percentage	Specifies a filter that picks the top <i>n%</i> according to the supplied ranking measure. Note that this parameter applies only if one ranking measure is supplied.
result_limit	The top limit SQL from the filtered source, ranked by the ranking measure.
attribute_list	Defines the SQL statement attributes to return in the result. The possible values are: <ul style="list-style-type: none"> • <code>BASIC</code> — Returns all attributes (such as execution statistics and binds) except the plans. The execution context is included in the result. • <code>TYPICAL</code> — Returns <code>BASIC</code> plus the SQL plan, but without row source statistics and without the object reference list. This is the default. • <code>ALL</code> — Returns all attributes. • Comma-separated list of attribute names. This value enables the function to return only a subset of SQL attributes: <ul style="list-style-type: none"> – <code>EXECUTION_STATISTICS</code> – <code>SQL_BINDS</code> – <code>SQL_PLAN_STATISTICS</code> (similar to <code>SQL_PLAN</code> plus row source statistics)

Table 183-16 (Cont.) SELECT_SQLSET Function Parameters

Parameter	Description
<code>plan_filter</code>	<p>Specifies the plan filter.</p> <p>This parameter enables you to select a single plan when a statement has multiple plans. Possible values are:</p> <ul style="list-style-type: none"> • <code>LAST_GENERATED</code> — Returns the plan with the most recent timestamp. • <code>FIRST_GENERATED</code> — Returns the plan with the least recent timestamp. • <code>LAST_LOADED</code> — Returns the plan with the most recent <code>FIRST_LOAD_TIME</code> statistical information. • <code>FIRST_LOADED</code> — Returns the plan with the least recent <code>FIRST_LOAD_TIME</code> statistical information. • <code>MAX_ELAPSED_TIME</code> — Returns the plan with the maximum elapsed time. • <code>MAX_BUFFER_GETS</code> — Returns the plan with the maximum buffer gets. • <code>MAX_DISK_READS</code> — Returns the plan with the maximum disk reads. • <code>MAX_DIRECT_WRITES</code> — Returns the plan with the maximum direct writes. • <code>MAX_OPTIMIZER_COST</code> — Returns the plan with the maximum optimizer cost value.
<code>sqlset_owner</code>	Specifies the owner of the SQL tuning set, or <code>NULL</code> for the current schema owner.
<code>recursive_sql</code>	Specifies that the filter must include recursive SQL in the SQL tuning set (<code>HAS_RECURSIVE_SQL</code> , which is the default) or exclude it (<code>NO_RECURSIVE_SQL</code>).

Return Values

This function returns one `SQLSET_ROW` per `SQL_ID` or `PLAN_HASH_VALUE` pair found in each data source.

Usage Notes

Filters provided to this function are evaluated as part of a SQL run by the current user. As such, they are executed with that user's security privileges and can contain any constructs and subqueries that user can access, but no more.

Examples

```
-- select from a sql tuning set
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
    SELECT VALUE (P)
      FROM table(DBMS_SQLSET.SELECT_SQLSET('my_workload')) P;

  -- Process each statement (or pass cursor to load_sqlset)
```

```

    CLOSE cur;
END;
/

```

183.4.15 SELECT_WORKLOAD_REPOSITORY Function

This function collects SQL statements from the workload repository.

The overloaded forms enable you to collect SQL statements from the following sources:

- Snapshots between `begin_snap` and `end_snap`
- A workload repository baseline

Syntax

```

DBMS_SQLSET.SELECT_WORKLOAD_REPOSITORY (
  begin_snap      IN NUMBER,
  end_snap        IN NUMBER,
  basic_filter    IN VARCHAR2 := NULL,
  object_filter   IN VARCHAR2 := NULL,
  ranking_measure1 IN VARCHAR2 := NULL,
  ranking_measure2 IN VARCHAR2 := NULL,
  ranking_measure3 IN VARCHAR2 := NULL,
  result_percentage IN NUMBER := 1,
  result_limit    IN NUMBER := NULL,
  attribute_list  IN VARCHAR2 := 'TYPICAL',
  recursive_sql   IN VARCHAR2 := HAS_RECURSIVE_SQL,
  dbid            IN NUMBER := NULL)
RETURN sys.sqlset PIPELINED;

```

```

DBMS_SQLSET.SELECT_WORKLOAD_REPOSITORY (
  baseline_name   IN VARCHAR2,
  basic_filter    IN VARCHAR2 := NULL,
  object_filter   IN VARCHAR2 := NULL,
  ranking_measure1 IN VARCHAR2 := NULL,
  ranking_measure2 IN VARCHAR2 := NULL,
  ranking_measure3 IN VARCHAR2 := NULL,
  result_percentage IN NUMBER := 1,
  result_limit    IN NUMBER := NULL,
  attribute_list  IN VARCHAR2 := 'TYPICAL',
  recursive_sql   IN VARCHAR2 := HAS_RECURSIVE_SQL,
  dbid            IN NUMBER := NULL)
RETURN sys.sqlset PIPELINED;

```

Parameters

Table 183-17 SELECT_WORKLOAD_REPOSITORY Function Parameters

Parameter	Description
<code>begin_snap</code>	Defines the beginning AWR snapshot (non-inclusive).
<code>end_snap</code>	Defines the ending AWR snapshot (inclusive).

Table 183-17 (Cont.) SELECT_WORKLOAD_REPOSITORY Function Parameters

Parameter	Description
baseline_name	Specifies the name of the AWR baseline period.
basic_filter	Specifies the SQL predicate to filter the SQL from the workload repository. The filter is defined on attributes of the <code>SQLSET_ROW</code> . If <code>basic_filter</code> is not set by the caller, then the subprogram captures only statements of type <code>CREATE TABLE</code> , <code>INSERT</code> , <code>SELECT</code> , <code>UPDATE</code> , <code>DELETE</code> , and <code>MERGE</code> .
object_filter	Currently not supported.
ranking_measure(n)	Defines an <code>ORDER BY</code> clause on the selected SQL.
result_percentage	Specifies a filter that picks the top <i>n</i> % according to the supplied ranking measure. Note that this percentage applies only if one ranking measure is given.
result_limit	Specifies the top limit SQL from the source according to the supplied ranking measure.
attribute_list	Specifies the SQL statement attributes to return in the result. The possible values are: <ul style="list-style-type: none"> • <code>TYPICAL</code> — Returns <code>BASIC</code> plus SQL plan (without row source statistics) and without object reference list. This is the default. • <code>BASIC</code> — Returns all attributes (such as execution statistics and binds) are returned except the plans. The execution context is always part of the result. • <code>ALL</code> — Returns all attributes • Comma-separated list of attribute names this allows to return only a subset of SQL attributes: <code>EXECUTION_STATISTICS</code>, <code>SQL_BINDS</code>, <code>SQL_PLAN_STATISTICS</code> (similar to <code>SQL_PLAN</code> plus row source statistics).
recursive_sql	Specifies the filter that includes recursive SQL in the SQL tuning set (<code>HAS_RECURSIVE_SQL</code>) or excludes it (<code>NO_RECURSIVE_SQL</code>).
dbid	Specifies the DBID for imported or PDB-level AWR data. If <code>NULL</code> , then the function uses the current database DBID.

Return Values

This function returns one `SQLSET_ROW` per `SQL_ID` or `PLAN_HASH_VALUE` pair found in each data source.

Usage Notes

Filters provided to this function are evaluated as part of a SQL run by the current user. As such, they are executed with that user's security privileges and can contain any constructs and subqueries that user can access, but no more.

Examples

```
-- select statements from snapshots 1-2
DECLARE
  cur sys_refcursor;
BEGIN
```

```

OPEN cur FOR
  SELECT VALUE (P)
  FROM table(DBMS_SQLSET.SELECT_WORKLOAD_REPOSITORY(1,2)) P;

-- Process each statement (or pass cursor to load_sqlset)

CLOSE cur;
END;
/

```

183.4.16 UNPACK_STGTAB Procedure

This procedure copies one or more SQL tuning sets from their location in the staging table into the SQL tuning sets schema, making them proper SQL tuning sets.

Syntax

```

DBMS_SQLSET.UNPACK_STGTAB (
  sqlset_name          IN VARCHAR2 := '%',
  sqlset_owner         IN VARCHAR2 := NULL,
  replace              IN BOOLEAN,
  staging_table_name   IN VARCHAR2,
  staging_schema_owner IN VARCHAR2 := NULL);

```

Parameters

The parameters are identical for DBMS_SQLTUNE.UNPACK_STGTAB_SQLSET and DBMS_SQLSET.UNPACK_STGTAB.

Table 183-18 UNPACK_STGTAB_SQLSET and UNPACK_STGTAB Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of the tuning set to unpack (not null). Wildcard characters (%) are supported to unpack multiple tuning sets in a single call. For example, specify % to unpack all tuning sets from the staging table.
sqlset_owner	Specifies the name of tuning set owner, or NULL for the current schema owner. Wildcard characters (%) are supported.
replace	Specifies whether to replace an existing SQL tuning set. If FALSE, then this procedure raises errors when you try to create a tuning set that already exists.
staging_table_name	Specifies the name of the staging table, moved after a call to the DBMS_SQLTUNE.PACK_STGTAB_SQLSET or DBMS_SQLSET.PACK_STGTAB procedure (case-sensitive).
staging_schema_owner	Specifies the name of staging table owner, or NULL for the current schema owner (case-sensitive).

Examples

```
-- unpack all STS in the staging table
EXEC DBMS_SQLSET.UNPACK_STGTAB(sqlset_name      => '%', -
                               sqlset_owner     => '%', -
                               replace          => FALSE, -
                               staging_table_name => 'STGTAB_SQLSET');

-- errors can arise during STS unpack when a STS in the staging table has the
-- same name/owner as STS on the system. In this case, users should call
-- remap_stgtab_sqlset to patch the staging table and with which to call
unpack
-- Replace set to TRUE.
EXEC DBMS_SQLSET.UNPACK_STGTAB(sqlset_name      => '%', -
                               sqlset_owner     => '%', -
                               replace          => TRUE, -
                               staging_table_name => 'STGTAB_SQLSET');
```

183.4.17 UPDATE_SQLSET Procedures

This overloaded procedure updates selected fields for SQL statements in a SQL tuning set.

Syntax

```
DBMS_SQLSET.UPDATE_SQLSET (
  sqlset_name      IN  VARCHAR2,
  sql_id           IN  VARCHAR2,
  plan_hash_value  IN  NUMBER := NULL,
  attribute_name   IN  VARCHAR2,
  attribute_value  IN  VARCHAR2 := NULL,
  sqlset_owner     IN  VARCHAR2 := NULL);
```

```
DBMS_SQLSET.UPDATE_SQLSET (
  sqlset_name      IN  VARCHAR2,
  sql_id           IN  VARCHAR2,
  plan_hash_value  IN  NUMBER := NULL,
  attribute_name   IN  VARCHAR2,
  attribute_value  IN  NUMBER := NULL,
  sqlset_owner     IN  VARCHAR2 := NULL);
```

Parameters

Table 183-19 UPDATE_SQLSET Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of the SQL tuning set.
sql_id	Specifies the identifier of the SQL statement to be updated.
plan_hash value	Specifies the hash value of the execution plan for a SQL statement. Use this parameter when you want to update the attribute for a specific plan for a statement, but not all plans for the statement.

Table 183-19 (Cont.) UPDATE_SQLSET Procedure Parameters

Parameter	Description
attribute_name	<p>Specifies the name of the attribute to be modified.</p> <p>You can update the text field for <code>MODULE</code>, <code>ACTION</code>, <code>PARSING_SCHEMA_NAME</code>, and <code>OTHER</code>. The only numerical field that you can update is <code>PRIORITY</code>.</p> <p>If a statement has multiple plans, then the procedure changes the attribute value for all plans.</p>
attribute_value	<p>Specifies the new value of the attribute.</p>

DBMS_SQLTUNE

The `DBMS_SQLTUNE` package is the interface for tuning SQL on demand. The related package `DBMS_AUTO_SQLTUNE` package provides the interface for SQL Tuning Advisor run as an automated task.

The chapter contains the following topics:

- [DBMS_SQLTUNE Overview](#)
- [DBMS_SQLTUNE Security Model](#)
- [DBMS_SQLTUNE Data Structures](#)
- [DBMS_SQLTUNE Subprogram Groups](#)
- [Summary of DBMS_SQLTUNE Subprograms](#)



See Also:

["DBMS_AUTO_SQLTUNE Overview"](#)

184.1 DBMS_SQLTUNE Overview

The `DBMS_SQLTUNE` package provides a number of interrelated areas of functionality.

This section contains the following topics:

- [DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#)
- [DBMS_SQLTUNE SQL Profile Subprograms](#)
- [DBMS_SQLTUNE SQL Tuning Set Subprograms](#)

SQL Tuning Advisor

SQL Tuning Advisor is one of a suite of advisors, a set of expert systems that identifies and helps resolve database performance problems. Specifically, SQL Tuning Advisor automates tuning of problematic SQL statements. It takes one or more SQL statements as input and gives precise advice on how to tune the statements. The advisor provides the advice in the form of SQL actions for tuning the SQL along with their expected performance benefit.

The group of [DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) provide a task-oriented interface that enables you to access the advisor. You can call the following subprograms in the order given to use some of SQL Tuning Advisor's features:

1. [CREATE_TUNING_TASK Functions](#) creates a tuning task for tuning one or more SQL statements.
2. The [EXECUTE_TUNING_TASK Function and Procedure](#) executes a previously created tuning task.

3. The [REPORT_TUNING_TASK Function](#) displays the results of a tuning task.
4. You use the [SCRIPT_TUNING_TASK Function](#) to create a SQL*Plus script which can then be executed to implement a set of Advisor recommendations

SQL Profile Subprograms

SQL Tuning Advisor may recommend the creation of a SQL profile to improve the performance of a statement. SQL profiles consist of auxiliary statistics specific to the statement. The query optimizer makes estimates about cardinality, selectivity, and cost that can sometimes be off by a significant amount, resulting in poor execution plans. The SQL profile addresses this problem by collecting additional information using sampling and partial execution techniques to adjust these estimates.

The group of [DBMS_SQLTUNE SQL Profile Subprograms](#) provides a mechanism for delivering statistics to the optimizer that targets one particular SQL statement, and helps the optimizer make good decisions for that statement by giving it the most accurate statistical information possible. For example:

- You can use the [ACCEPT_SQL_PROFILE Procedure and Function](#) to accept a SQL profile recommended by SQL Tuning Advisor.
- You can alter the `STATUS`, `NAME`, `DESCRIPTION`, and `CATEGORY` attributes of an existing SQL profile with the [ALTER_SQL_PROFILE Procedure](#).
- You can drop a SQL profile with the [DROP_SQL_PROFILE Procedure](#).

SQL Tuning Sets

SQL tuning sets store SQL statements along with the following information:

- The execution context, such as the parsing schema name and bind values
- Execution statistics such as average elapsed time and execution count
- Execution plans, which are the sequence of operations that the database performs to run SQL statements
- Row source statistics such as the number of rows processed for each operation executed within the plan

You can create SQL tuning sets by filtering or ranking SQL statements from several sources:

- The shared SQL area using the [SELECT_CURSOR_CACHE Function](#)
- Top SQL statements from the Automatic Workload Repository using the [SELECT_WORKLOAD_REPOSITORY Function](#)
- Other SQL tuning sets using the [SELECT_SQLSET Function](#)
- SQL Performance Analyzer task comparison results using the [SELECT_SQLPA_TASK Function](#)
- SQL Trace files using the [SELECT_SQL_TRACE Function](#)
- A user-defined workload

The complete group of [DBMS_SQLTUNE SQL Tuning Set Subprograms](#) facilitates this functionality. As examples:

- The [CREATE_SQLSET Procedure and Function](#) creates a SQL tuning set object in the database.

- The [LOAD_SQLSET Procedure](#) populates the SQL tuning set with a set of selected SQL.
- The [CAPTURE_CURSOR_CACHE_SQLSET Procedure](#) collects SQL statements from the shared SQL area over a specified time interval, attempting to build a realistic picture of database workload.

 **Note:**

When manipulating SQL tuning sets, you can use [DBMS_SQLSET](#) as an alternative to `DBMS_SQLTUNE`.

Import and Export of SQL Tuning Sets and SQL Profiles

Use `DBMS_SQLTUNE` subprograms to move SQL profiles and SQL tuning sets from one system to another using a common programmatic model. In both cases, you create a staging table on the source database and populate this staging table with the relevant data. You then move that staging table to the destination system following the method of your choice (such as Oracle Data Pump, or a database link), where it is used to reconstitute the objects in their original form. The following steps are implemented by means of subprograms included in this package:

1. To create the staging table on the source system, call the [CREATE_STGTAB_SQLPROF Procedure](#) or the [CREATE_STGTAB_SQLSET Procedure](#).
2. To populate the staging table with information from the source system, call the [PACK_STGTAB_SQLPROF Procedure](#) or [PACK_STGTAB_SQLSET Procedure](#).
3. Move the staging table to the destination system.
4. To re-create the object on the new system, call the [UNPACK_STGTAB_SQLPROF Procedure](#) or the [UNPACK_STGTAB_SQLSET Procedure](#).

 **See Also:**

Oracle Database SQL Tuning Guide for more information about programmatic flow

Automatic Tuning Task Functions

The automated system task `SYS_AUTO_SQL_TUNING_TASK` is created by the database as part of the catalog scripts. This task automatically chooses a set of high-load SQL from AWR and runs SQL Tuning Advisor on this SQL. The automated task performs the same comprehensive analysis as any other SQL Tuning task.

You can obtain a report on the activity of the Automatic SQL Tuning task through the `DBMS_AUTO_SQLTUNE.REPORT_AUTO_TUNING_TASK` API.

 **See Also:**

[DBMS_AUTO_SQLTUNE](#) for the list of subprograms that you can use to manage the automated SQL tuning task.

Real-Time SQL Monitoring

Real-time SQL Monitoring enables DBAs or performance analysts to monitor the execution of long-running SQL statements while they are executing. Both cursor statistics (such as CPU times and IO times) and execution plan statistics (such as number of output rows, memory and temp space used) are updated in almost real time during statement execution. The `V$SQL_MONITOR` and `V$SQL_PLAN_MONITOR` views expose these statistics. In addition, `DBMS_SQLTUNE` provides the `REPORT_SQL_MONITOR` and `REPORT_SQL_MONITOR_LIST` functions to report monitoring information.

Note:

`DBMS_SQL_MONITOR` also contains the `REPORT_SQL_MONITOR` and `REPORT_SQL_MONITOR_LIST` functions.

Tuning a Standby Database Workload

In some cases, a standby database can assume a reporting role in addition to its data protection role. The standby database can have its own workload of queries, some of which may require tuning. You can issue SQL Tuning Advisor statements on a standby database, which is read-only. A standby-to-primary database link enables `DBMS_SQLTUNE` to write data to and read data from the primary database. The procedures that are eligible for tuning standby workloads include the `database_link_to` parameter.

184.2 DBMS_SQLTUNE Security Model

This package is available to `PUBLIC` and performs its own security checking.

Note the following:

- Because SQL Tuning Advisor relies on the advisor framework, all tuning task interfaces (`*_TUNING_TASK`) require the `ADVISOR` privilege.
- SQL tuning set subprograms (`*_SQLSET`) require either of the following privileges:
 - `ADMINISTER SQL TUNING SET`
You can only create and modify a SQL tuning set that you own.
 - `ADMINISTER ANY SQL TUNING SET`
You can operate on all SQL tuning sets, even those owned by other users.
- In earlier releases, three different privileges were needed to invoke subprograms involving SQL profiles:
 - `CREATE ANY SQL PROFILE`
 - `ALTER ANY SQL PROFILE`
 - `DROP ANY SQL PROFILE`

The preceding privileges have been deprecated in favor of `ADMINISTER SQL MANAGEMENT OBJECT`.

184.3 DBMS_SQLTUNE Data Structures

The `SELECT_*` subprograms in the `DBMS_SQLTUNE` package return objects of the `SQLSET_ROW` type.

Object Types

- [SQLSET_ROW Object Type](#)

184.3.1 SQLSET_ROW Object Type

The `SQLSET_ROW` object models the content of a SQL tuning set for the user.

Logically, a SQL tuning set is a collection of `SQLSET_ROW` objects. Each `SQLSET_ROW` contains a single SQL statement along with its execution context, statistics, binds, and plan. The `SELECT_*` subprograms each model a data source as a collection of `SQLSET_ROW` objects, with each object uniquely identified by `(sql_id, plan_hash_value)`. Similarly, the `LOAD_SQLSET` procedure takes as input a cursor whose row type is `SQLSET_ROW`, treating each `SQLSET_ROW` in isolation according to the policies requested by the user.

Several subprograms package accept basic filters on the content of a SQL tuning set or data source. These filters are expressed in terms of the attributes within the `SQLSET_ROW` as defined.

Syntax

```
CREATE TYPE sqlset_row AS object (
  sql_id                VARCHAR(13),
  force_matching_signature NUMBER,
  sql_text              CLOB,
  object_list          sql_objects,
  bind_data            RAW(2000),
  parsing_schema_name  VARCHAR2(30),
  module               VARCHAR2(48),
  action               VARCHAR2(32),
  elapsed_time         NUMBER,
  cpu_time             NUMBER,
  buffer_gets          NUMBER,
  disk_reads           NUMBER,
  direct_writes        NUMBER,
  rows_processed       NUMBER,
  fetches              NUMBER,
  executions           NUMBER,
  end_of_fetch_count   NUMBER,
  optimizer_cost       NUMBER,
  optimizer_env        RAW(2000),
  priority             NUMBER,
  command_type         NUMBER,
  first_load_time      VARCHAR2(19),
  stat_period          NUMBER,
  active_stat_period   NUMBER,
  other                CLOB,
  plan_hash_value      NUMBER,
```

```

sql_plan          sql_plan_table_type,
bind_list         sql_binds,
con_dbid         NUMBER,
last_exec_start_time  VARCHAR2(19))

```

Attributes

Table 184-1 SQLSET_ROW Attributes

Attribute	Description
sql_id	Unique SQL ID.
forcing_matching_signature	Signature with literals, case, and whitespace removed.
sql_text	Full text for the SQL statement.
object_list	Currently not implemented.
bind_data	Bind data as captured for this SQL. Note that you cannot stipulate an argument for this parameter and also for <code>bind_list</code> - they are mutually exclusive.
parsing_schema_name	Schema where the SQL is parsed.
module	Last application module for the SQL.
action	Last application action for the SQL.
elapsed_time	Sum total elapsed time for this SQL statement.
cpu_time	Sum total CPU time for this SQL statement.
buffer_gets	Sum total number of buffer gets.
disk_reads	Sum total number of disk reads.
direct_writes	Sum total number of direct path writes.
rows_processed	Sum total number of rows processed by this SQL.
fetches	Sum total number of fetches.
executions	Total executions of this SQL statement.
end_of_fetch_count	Number of times the SQL statement was fully executed with all of its rows fetched.
optimizer_cost	Optimizer cost for this SQL.
optimizer_env	Optimizer environment for this SQL statement.
priority	User-defined priority (1,2,3).
command_type	Statement type, such as <code>INSERT</code> or <code>SELECT</code> .
first_load_time	Load time of the parent cursor.
stat_period	Period of time (seconds) when the statistics of this SQL statement were collected.
active_stat_period	Effective period of time (in seconds) during which the SQL statement was active.
other	Other column for user-defined attributes.
plan_hash_value	Plan hash value of the plan.
sql_plan	Execution plan for the SQL statement.

Table 184-1 (Cont.) SQLSET_ROW Attributes

Attribute	Description
<code>bind_list</code>	List of user-specified binds for the SQL statement. This is used for user-specified workloads. Note that you cannot stipulate an argument for this parameter and also for <code>bind_data</code> : they are mutually exclusive.
<code>con_dbid</code>	DBID of the PDB or CDB root.
<code>last_exec_start_time</code>	Most recent execution start time of this SQL statement.

184.4 DBMS_SQLTUNE Subprogram Groups

DBMS_SQLTUNE subprograms are grouped by function.

- [DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#)
- [DBMS_SQLTUNE SQL Profile Subprograms](#)
- [DBMS_SQLTUNE SQL Tuning Set Subprograms](#)
- [DBMS_SQLTUNE Real-Time SQL Monitoring Subprograms](#)
- [DBMS_SQLTUNE SQL Performance Reporting Subprograms](#)

184.4.1 DBMS_SQLTUNE SQL Tuning Advisor Subprograms

This subprogram group provides an interface to manage SQL tuning tasks.

Table 184-2 SQL Tuning Task Subprograms

Subprogram	Description
" CANCEL_TUNING_TASK Procedure "	Cancels the currently executing tuning task
" CREATE_SQL_PLAN_BASELINE Procedure "	Creates a SQL plan baseline for an existing plan
" CREATE_TUNING_TASK Functions "	Creates a tuning of a single statement or SQL tuning set for either SQL Tuning Advisor
" DROP_TUNING_TASK Procedure "	Drops a SQL tuning task
" EXECUTE_TUNING_TASK Function and Procedure "	Executes a previously created tuning task
" IMPLEMENT_TUNING_TASK Procedure "	Implements a set of SQL profile recommendations made by SQL Tuning Advisor
" INTERRUPT_TUNING_TASK Procedure "	Interrupts the currently executing tuning task
" REPORT_AUTO_TUNING_TASK Function "	Displays a report from the automatic tuning task, reporting on a range of executions
" REPORT_TUNING_TASK Function "	Displays the results of a tuning task
" RESET_TUNING_TASK Procedure "	Resets the currently executing tuning task to its initial state
" RESUME_TUNING_TASK Procedure "	Resumes a previously interrupted task that was created to process a SQL tuning set

Table 184-2 (Cont.) SQL Tuning Task Subprograms

Subprogram	Description
" SCHEDULE_TUNING_TASK Function "	Creates a tuning task and schedules its execution as a scheduler job
" SCRIPT_TUNING_TASK Function "	Creates a SQL*Plus script which can then be executed to implement a set of SQL Tuning Advisor recommendations
" SET_TUNING_TASK_PARAMETER Procedures "	Updates the value of a SQL tuning parameter of type VARCHAR2 or NUMBER

"[Summary of DBMS_SQLTUNE Subprograms](#)" contains a complete listing of all subprograms in the package.

184.4.2 DBMS_SQLTUNE SQL Profile Subprograms

This subprogram group provides an interface to manage SQL profiles.

Table 184-3 SQL Profile Subprograms

Subprogram	Description
ACCEPT_ALL_SQL_PROFILES Procedure	Accepts all SQL profiles recommended by a specific execution of a tuning task
ACCEPT_SQL_PROFILE Procedure and Function	Creates a SQL profile for the specified tuning task
ALTER_SQL_PROFILE Procedure	Alters specific attributes of an existing SQL profile object
CREATE_STGTAB_SQLPROF Procedure	Creates the staging table used for copying SQL profiles from one system to another
DROP_SQL_PROFILE Procedure	Drops the named SQL profile from the database
PACK_STGTAB_SQLPROF Procedure	Moves profile data out of the SYS schema into the staging table
REMAP_STGTAB_SQLPROF Procedure	Changes the profile data values kept in the staging table prior to performing an unpack operation
SQLTEXT_TO_SIGNATURE Function	Returns a SQL text's signature
UNPACK_STGTAB_SQLPROF Procedure	Uses the profile data stored in the staging table to create profiles on this system

"[Summary of DBMS_SQLTUNE Subprograms](#)" contains a complete listing of all subprograms in the package.

184.4.3 DBMS_SQLTUNE SQL Tuning Set Subprograms

This subprogram group provides an interface to manage SQL tuning sets.

Table 184-4 SQL Tuning Set Subprograms

Subprogram	Description
ADD_SQLSET_REFERENCE Function	Adds a new reference to an existing SQL tuning set to indicate its use by a client
CAPTURE_CURSOR_CACHE_SQLSET Procedure	Over a specified time interval incrementally captures a workload from the shared SQL area into a SQL tuning set
CREATE_SQLSET Procedure and Function	Creates a SQL tuning set object in the database
CREATE_STGTAB_SQLSET Procedure	Creates a staging table through which SQL Tuning Sets are imported and exported
DELETE_SQLSET Procedure	Deletes a set of SQL statements from a SQL tuning set
DROP_SQLSET Procedure	Drops a SQL tuning set if it is not active
LOAD_SQLSET Procedure	Populates the SQL tuning set with a set of selected SQL
PACK_STGTAB_SQLSET Procedure	Copies tuning sets out of the SYS schema into the staging table
REMAP_STGTAB_SQLSET Procedure	Changes the tuning set names and owners in the staging table so that they can be unpacked with different values than they had on the host system
REMOVE_SQLSET_REFERENCE Procedure	Deactivates a SQL tuning set to indicate it is no longer used by the client
SELECT_CURSOR_CACHE Function	Collects SQL statements from the shared SQL area
SELECT_SQL_TRACE Function	Reads the content of one or more trace files and returns the SQL statements it finds in the format of <code>sqlset_row</code>
SELECT_SQLPA_TASK Function	Collects SQL statements from a SQL performance analyzer comparison task
SELECT_SQLSET Function	Collects SQL statements from an existing SQL tuning set
SELECT_WORKLOAD_REPOSITORY Function	Collects SQL statements from the workload repository
UNPACK_STGTAB_SQLSET Procedure	Copies one or more SQL tuning sets from the staging table
UPDATE_SQLSET Procedures	Updates whether selected string fields for a SQL statement in a SQL tuning set or the set numerical attributes of a SQL in a SQL tuning set

The [Summary of DBMS_SQLTUNE Subprograms](#) contains a complete listing of all subprograms in the package.

184.4.4 DBMS_SQLTUNE Real-Time SQL Monitoring Subprograms

This subprogram group provides function to report on monitoring data collected in `V$SQL_MONITOR` and `V$SQL_PLAN_MONITOR`.

Table 184-5 Real-Time SQL Monitoring Subprograms

Subprogram	Description
REPORT_SQL_MONITOR Function	Reports on Real-Time SQL Monitoring
REPORT_SQL_MONITOR_LIST Function	Builds a report for all or a subset of statements monitored by Oracle Database
REPORT_SQL_MONITOR_LIST_XML Function	Builds an XML report for all or a subset of statements monitored by Oracle Database

184.4.5 DBMS_SQLTUNE SQL Performance Reporting Subprograms

This subprogram group provides detailed reports on SQL performance using statistics from the shared SQL area and automatic workload repository (AWR).

Table 184-6 SQL Performance Reporting Subprograms

Subprogram	Description
REPORT_SQL_DETAIL Function	This function reports on a specific SQL ID.
REPORT_SQL_MONITOR Function	This function builds a report (text, simple HTML, active HTML, XML) for the monitoring information collected on behalf of the targeted statement execution.
REPORT_SQL_MONITOR_LIST Function	This function builds a report for all or a sub-set of statements monitored by Oracle. For each statement, the subprogram gives key information and associated global statistics.
REPORT_TUNING_TASK Function	This function displays the results of a tuning task.
REPORT_TUNING_TASK_XML Function	This function displays an XML report of a tuning task.

184.5 Summary of DBMS_SQLTUNE Subprograms

This table lists the DBMS_SQLTUNE subprograms and briefly describes them.

Table 184-7 DBMS_SQLTUNE Package Subprograms

Subprogram	Description	Group
ACCEPT_ALL_SQL_PROFILES Procedure	Accepts all SQL profiles recommended by a particular execution of a particular tuning task	DBMS_SQLTUNE SQL Profile Subprograms
ACCEPT_SQL_PROFILE Procedure and Function	Creates a SQL profile for the specified tuning task	DBMS_SQLTUNE SQL Profile Subprograms
ADD_SQLSET_REFERENCE Function	Adds a new reference to an existing SQL tuning set to indicate its use by a client	DBMS_SQLTUNE SQL Tuning Set Subprograms
ALTER_SQL_PROFILE Procedure	Alters specific attributes of an existing SQL profile object	DBMS_SQLTUNE SQL Profile Subprograms

Table 184-7 (Cont.) DBMS_SQLTUNE Package Subprograms

Subprogram	Description	Group
CANCEL_TUNING_TASK Procedure	Cancels the currently executing tuning task	DBMS_SQLTUNE SQL Tuning Advisor Subprograms
CAPTURE_CURSOR_CACHE_SQLSET Procedure	Over a specified time interval incrementally captures a workload from the shared SQL area into a SQL tuning set	DBMS_SQLTUNE SQL Tuning Set Subprograms
CREATE_SQL_PLAN_BASELINE Procedure	Creates a SQL plan baseline for an existing plan	DBMS_SQLTUNE SQL Tuning Advisor Subprograms
CREATE_SQLSET Procedure and Function	Creates a SQL tuning set object in the database	DBMS_SQLTUNE SQL Tuning Set Subprograms
CREATE_STGTAB_SQLPROF Procedure	Creates the staging table used for copying SQL profiles from one system to another	DBMS_SQLTUNE SQL Profile Subprograms
CREATE_STGTAB_SQLSET Procedure	Creates a staging table through which SQL tuning sets are imported and exported	DBMS_SQLTUNE SQL Tuning Set Subprograms
CREATE_TUNING_TASK Functions	Creates a tuning of a single statement or SQL tuning set for either SQL Tuning Advisor	DBMS_SQLTUNE SQL Tuning Advisor Subprograms
DELETE_SQLSET Procedure	Deletes a set of SQL statements from a SQL tuning set	DBMS_SQLTUNE SQL Tuning Set Subprograms
DROP_SQL_PROFILE Procedure	Drops the named SQL profile from the database	DBMS_SQLTUNE SQL Profile Subprograms
DROP_SQLSET Procedure	Drops a SQL tuning set if it is not active	DBMS_SQLTUNE SQL Tuning Set Subprograms
DROP_TUNING_TASK Procedure	Drops a SQL tuning task	DBMS_SQLTUNE SQL Tuning Advisor Subprograms
EXECUTE_TUNING_TASK Function and Procedure	Executes a previously created tuning task	DBMS_SQLTUNE SQL Tuning Advisor Subprograms
IMPLEMENT_TUNING_TASK Procedure	implements a set of SQL profile recommendations made by SQL Tuning Advisor	DBMS_SQLTUNE SQL Tuning Advisor Subprograms
INTERRUPT_TUNING_TASK Procedure	Interrupts the currently executing tuning task	DBMS_SQLTUNE SQL Tuning Advisor Subprograms
LOAD_SQLSET Procedure	Populates the SQL tuning set with a set of selected SQL	DBMS_SQLTUNE SQL Tuning Set Subprograms
PACK_STGTAB_SQLPROF Procedure	Moves profile data out of the SYS schema into the staging table	DBMS_SQLTUNE SQL Profile Subprograms
PACK_STGTAB_SQLSET Procedure	Moves tuning sets out of the SYS schema into the staging table	DBMS_SQLTUNE SQL Tuning Set Subprograms

Table 184-7 (Cont.) DBMS_SQLTUNE Package Subprograms

Subprogram	Description	Group
REMAP_STGTAB_SQLPROF Procedure	Changes the profile data values kept in the staging table prior to performing an unpack operation	DBMS_SQLTUNE SQL Profile Subprograms
REMAP_STGTAB_SQLSET Procedure	Changes the tuning set names and owners in the staging table so that they can be unpacked with different values than they had on the host system	DBMS_SQLTUNE SQL Tuning Set Subprograms
REMOVE_SQLSET_REFERENCE Procedure	Deactivates a SQL tuning set to indicate it is no longer used by the client	DBMS_SQLTUNE SQL Tuning Set Subprograms
REPORT_AUTO_TUNING_TASK Function	Displays a report from the automatic tuning task, reporting on a range of subtasks	DBMS_SQLTUNE SQL Tuning Set Subprograms
REPORT_SQL_DETAIL Function	Reports on a specific SQL ID	DBMS_SQLTUNE SQL Performance Reporting Subprograms
REPORT_SQL_MONITOR Function	Builds a report (text, simple HTML, active HTML, XML) for the monitoring information collected on behalf of the targeted statement execution	DBMS_SQLTUNE Real-Time SQL Monitoring Subprograms
REPORT_SQL_MONITOR_LIST Function	Builds a report for all or a subset of statements monitored by Oracle Database. For each statement, the subprogram gives key information and associated global statistics	DBMS_SQLTUNE Real-Time SQL Monitoring Subprograms
REPORT_SQL_MONITOR_LIST_XML Function	Equivalent to the <code>REPORT_SQL_MONITOR_LIST</code> function, except that it returns <code>XMLType</code>	DBMS_SQLTUNE Real-Time SQL Monitoring Subprograms
REPORT_TUNING_TASK Function	Displays the results of a tuning task	DBMS_SQLTUNE SQL Performance Reporting Subprograms
REPORT_TUNING_TASK_XML Function	Displays an XML report of a tuning task	DBMS_SQLTUNE SQL Performance Reporting Subprograms
RESET_TUNING_TASK Procedure	Resets the currently executing tuning task to its initial state	DBMS_SQLTUNE SQL Tuning Advisor Subprograms
RESUME_TUNING_TASK Procedure	Resumes a previously interrupted task that was created to process a SQL tuning set	DBMS_SQLTUNE SQL Tuning Advisor Subprograms

Table 184-7 (Cont.) DBMS_SQLTUNE Package Subprograms

Subprogram	Description	Group
SCHEDULE_TUNING_TASK Function	Creates a SQL tuning task and schedule its execution as a scheduler job	DBMS_SQLTUNE SQL Tuning Advisor Subprograms
SCRIPT_TUNING_TASK Function	Creates a SQL*Plus script which can then be executed to implement a set of SQL Tuning Advisor recommendations	DBMS_SQLTUNE SQL Tuning Advisor Subprograms
SELECT_CURSOR_CACHE Function	Collects SQL statements from the shared SQL area	DBMS_SQLTUNE SQL Tuning Set Subprograms
SELECT_SQL_TRACE Function	Reads the content of one or more trace files and returns the SQL statements it finds in the format of <code>sqlset_row</code>	DBMS_SQLTUNE SQL Tuning Set Subprograms
SELECT_SQLPA_TASK Function	Collects SQL statements from a SQL Performance Analyzer comparison task	DBMS_SQLTUNE SQL Tuning Set Subprograms
SELECT_SQLSET Function	Collects SQL statements from an existing SQL tuning set	DBMS_SQLTUNE SQL Tuning Set Subprograms
SELECT_WORKLOAD_REPOSITORY Function	Collects SQL statements from the workload repository	DBMS_SQLTUNE SQL Tuning Set Subprograms
SET_TUNING_TASK_PARAMETER Procedures	Updates the value of a SQL tuning parameter of type VARCHAR2 or NUMBER	DBMS_SQLTUNE SQL Tuning Advisor Subprograms
SQLTEXT_TO_SIGNATURE Function	Returns a SQL text's signature	DBMS_SQLTUNE SQL Profile Subprograms
UNPACK_STGTAB_SQLPROFILE Procedure	Uses the profile data stored in the staging table to create profiles on this system	DBMS_SQLTUNE SQL Profile Subprograms
UNPACK_STGTAB_SQLSET Procedure	Moves one or more SQL tuning sets from the staging table	DBMS_SQLTUNE SQL Tuning Set Subprograms
UPDATE_SQLSET Procedures	Updates selected fields for a SQL statement in a SQL tuning set	DBMS_SQLTUNE SQL Tuning Set Subprograms

184.5.1 ACCEPT_ALL_SQL_PROFILES Procedure

This procedure accepts all SQL profiles recommended by a specific execution of a tuning task, and sets the attributes of the SQL profiles according to the parameter values passed by the user.



See Also:

[DBMS_SQLTUNE SQL Profile Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.ACCEPT_ALL_SQL_PROFILES (
  task_name          IN VARCHAR2,
  category           IN VARCHAR2 := NULL,
  replace            IN BOOLEAN  := FALSE,
  force_match        IN BOOLEAN  := FALSE,
  profile_type       IN VARCHAR2 := REGULAR_PROFILE,
  autotune_period    IN NUMBER   := NULL,
  execution_name     IN VARCHAR2 := NULL,
  task_owner         IN VARCHAR2 := NULL,
  description        IN VARCHAR2 := NULL,
  database_link_to   IN VARCHAR2 := NULL);
```

Parameters

Table 184-8 ACCEPT_ALL_SQL_PROFILES Procedure Parameters

Parameter	Description
task_name	The (mandatory) name of the SQL tuning task
category	This is the category name which must match the value of the <code>SQLTUNE_CATEGORY</code> parameter in a session for the session to use this SQL profile. It defaults to the value "DEFAULT". This is also the default of the <code>SQLTUNE_CATEGORY</code> parameter. The category must be a valid Oracle identifier. The category name specified is always converted to upper case. The combination of the normalized SQL text and category name creates a unique key for a SQL profile. An <code>ACCEPT_SQL_PROFILE</code> fails if this combination is duplicated.
replace	If the profile already exists, it is replaced if this argument is <code>TRUE</code> . It is an error to pass a name that is already being used for another signature/category pair, even with <code>replace</code> set to <code>TRUE</code> .
force_match	If <code>TRUE</code> this causes SQL profiles to target all SQL statements which have the same text after normalizing all literal values into bind variables. (Note that if a combination of literal values and bind values is used in a SQL statement, no bind transformation occurs.) This is analogous to the matching algorithm used by the <code>FORCE</code> option of the <code>cursor_sharing</code> parameter. If <code>FALSE</code> , literals are not transformed. This is analogous to the matching algorithm used by the <code>EXACT</code> option of the <code>cursor_sharing</code> parameter.
profile_type	Options: <ul style="list-style-type: none"> <code>REGULAR_PROFILE</code> - profile without a change to parallel execution (Default, equivalent to <code>NULL</code>). Note that if the SQL statement currently has a parallel execution plan, the regular profile will cause the optimizer to choose a different, but still parallel, execution plan. <code>PX_PROFILE</code> - regular profile with a change to parallel execution

Table 184-8 (Cont.) ACCEPT_ALL_SQL_PROFILES Procedure Parameters

Parameter	Description
<code>autotune_period</code>	<p>The time period for the automatic SQL tuning. This setting applies only to the automatic SQL Tuning Advisor task. Possible values are as follows:</p> <ul style="list-style-type: none"> • null or negative value (default) - all or full. The result includes all task executions. • 0 - result of the current or most recent task execution. • 1 - result for the most recent 24-hour period. • 7 - result for the most recent 7-day period. <p>The procedure interprets any other value as the time of the most recent task execution minus the value of this argument.</p>
<code>execution_name</code>	Name of the task execution to use. If null, then the procedure generates the report for the most recent task execution.
<code>task_owner</code>	Owner of the tuning task. This is an optional parameter that must be specified to accept a SQL profile associated to a tuning task owned by another user. The current user is the default value.
<code>description</code>	A user specified string describing the purpose of the SQL profile. The description is truncated if longer than 256 characters. The maximum size is 500 characters.
<code>database_link_to</code>	<p>Name of a database link that exists on a standby database. The link specifies the connection to a primary database. By default, the value is null, which means that the SQL Tuning Advisor session is local.</p> <p>Use <code>DBMS_SQLTUNE</code> to tune high-load SQL statements running on a standby database in an Active Data Guard scenario. When you execute <code>REPORT_TUNING_TASK</code> locally on the standby database, the function uses the database link to obtain the data from the primary database, and then constructs it locally on the standby database.</p> <p>The <code>database_link_to</code> parameter must specify a private database link. This link must be owned by <code>SYS</code> and accessed by the default privileged user <code>SYS\$UMF</code>. The following sample statement creates a link named <code>lnk_to_pri</code>:</p> <pre>CREATE DATABASE LINK lnk_to_pri CONNECT TO SYS\$UMF IDENTIFIED BY password USING 'inst1';</pre>

Security Model

The `ADMINISTER SQL MANAGEMENT OBJECT` privilege is required. The `CREATE ANY SQL PROFILE` privilege is deprecated.

184.5.2 ACCEPT_SQL_PROFILE Procedure and Function

This subprogram creates a SQL profile recommended by SQL Tuning Advisor.

The SQL text is normalized for matching purposes although it is stored in the data dictionary in denormalized form for readability. SQL text is provided through a reference to the SQL

Tuning task. If the referenced SQL statement does not exist, then the database reports an error.



See Also:

[DBMS_SQLTUNE SQL Profile Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.ACCEPT_SQL_PROFILE (
    task_name      IN  VARCHAR2,
    object_id      IN  NUMBER   := NULL,
    name           IN  VARCHAR2 := NULL,
    description    IN  VARCHAR2 := NULL,
    category       IN  VARCHAR2 := NULL);
task_owner      IN  VARCHAR2 := NULL,
replace         IN  BOOLEAN   := FALSE,
force_match     IN  BOOLEAN   := FALSE,
profile_type    IN  VARCHAR2 := REGULAR_PROFILE);
```

```
DBMS_SQLTUNE.ACCEPT_SQL_PROFILE (
    task_name      IN  VARCHAR2,
    object_id      IN  NUMBER   := NULL,
    name           IN  VARCHAR2 := NULL,
    description    IN  VARCHAR2 := NULL,
    category       IN  VARCHAR2 := NULL;
    task_owner     IN  VARCHAR2 := NULL,
    replace        IN  BOOLEAN   := FALSE,
    force_match    IN  BOOLEAN   := FALSE,
    profile_type   IN  VARCHAR2 := REGULAR_PROFILE,
    database_link_to IN  VARCHAR2 := NULL)
RETURN VARCHAR2;
```

Parameters

Table 184-9 ACCEPT_SQL_PROFILE Procedure and Function Parameters

Parameter	Description
task_name	The (mandatory) name of the SQL tuning task
object_id	The identifier of the advisor framework object representing the SQL statement associated with the tuning task
name	The name of the SQL profile. It cannot contain double quotation marks. The name is case sensitive. If not specified, the system generates a unique name for the SQL profile.
description	A user specified string describing the purpose of the SQL profile. The description is truncated if longer than 256 characters. The maximum size is 500 characters.

Table 184-9 (Cont.) ACCEPT_SQL_PROFILE Procedure and Function Parameters

Parameter	Description
category	The category name. This name must match the value of the <code>SQLTUNE_CATEGORY</code> parameter in a session for the session to use this SQL profile. It defaults to the value "DEFAULT". This is also the default of the <code>SQLTUNE_CATEGORY</code> parameter. The category must be a valid Oracle identifier. The category name specified is always converted to upper case. The combination of the normalized SQL text and category name creates a unique key for a SQL profile. An <code>ACCEPT_SQL_PROFILE</code> fails if this combination is duplicated.
task_owner	Owner of the tuning task. This is an optional parameter that has to be specified to accept a SQL profile associated to a tuning task owned by another user. The current user is the default value.
replace	If the profile already exists, it is replaced if this argument is <code>TRUE</code> . It is an error to pass a name that is already being used for another signature/category pair, even with <code>replace</code> set to <code>TRUE</code> .
force_match	If <code>TRUE</code> this causes SQL profiles to target all SQL statements which have the same text after normalizing all literal values into bind variables. (Note that if a combination of literal values and bind values is used in a SQL statement, no bind transformation occurs.) This is analogous to the matching algorithm used by the <code>FORCE</code> option of the <code>cursor_sharing</code> parameter. If <code>FALSE</code> , literals are not transformed. This is analogous to the matching algorithm used by the <code>EXACT</code> option of the <code>cursor_sharing</code> parameter.
profile_type	Options: <ul style="list-style-type: none"> • <code>REGULAR_PROFILE</code> - profile without a change to parallel execution (Default, equivalent to <code>NULL</code>). Note that if the SQL statement currently has a parallel execution plan, the regular profile will cause the optimizer to choose a different, but still parallel, execution plan. • <code>PX_PROFILE</code> - regular profile with a change to parallel execution

Table 184-9 (Cont.) ACCEPT_SQL_PROFILE Procedure and Function Parameters

Parameter	Description
database_link_to	<p>Name of a database link that exists on a standby database. The link specifies the connection to a primary database. By default, the value is null, which means that the SQL Tuning Advisor session is local.</p> <p>Use DBMS_SQLTUNE to tune high-load SQL statements running on a standby database in an Active Data Guard scenario. When you execute REPORT_TUNING_TASK locally on the standby database, the function uses the database link to obtain the data from the primary database, and then constructs it locally on the standby database.</p> <p>The database_link_to parameter must specify a private database link. This link must be owned by SYS and accessed by the default privileged user SYS\$UMF. The following sample statement creates a link named lnk_to_pri:</p> <pre>CREATE DATABASE LINK lnk_to_pri CONNECT TO SYS\$UMF IDENTIFIED BY password USING 'inst1';</pre>

Return Values

The name of the SQL profile.

Usage Notes

The ADMINISTER SQL MANAGEMENT OBJECT privilege is required. The CREATE ANY SQL PROFILE privilege is deprecated.

Examples

You use both the procedure and the function versions of the subprogram in the same way except you must specify a return value to invoke the function. Here we give examples of the procedure only.

In this example, you tune a single SQL statement from the workload repository and you create the SQL profile recommended by SQL Tuning Advisor.

```
VARIABLE stmt_task VARCHAR2(64);
VARIABLE sts_task VARCHAR2(64);

-- create a tuning task tune the statement
EXEC :stmt_task := DBMS_SQLTUNE.CREATE_TUNING_TASK(
    begin_snap => 1, -
    end_snap   => 2, -
    sql_id     => 'ay1m3ssvtrh24');

-- execute the resulting task
EXEC DBMS_SQLTUNE.EXECUTE_TUNING_TASK(:stmt_task);
```

```
EXEC DBMS_SQLTUNE.ACCEPT_SQL_PROFILE(:stmt_task);
```

Note that you do not have to specify the ID (that is, `object_id`) for the advisor framework object created by SQL Tuning Advisor to represent the tuned SQL statement.

You might also want to accept the recommended SQL profile in a different category, (for example, `TEST`), so that it is not used by default.

```
EXEC DBMS_SQLTUNE.ACCEPT_SQL_PROFILE (
    task_name => :stmt_task, -
    category  => 'TEST');
```

You can use command `ALTER SESSION SET SQLTUNE_CATEGORY = 'TEST'` to see how this profile behaves.

The following call creates a SQL profile that targets any SQL statement with the same `force_matching_signature` as the tuned statement.

```
EXEC DBMS_SQLTUNE.ACCEPT_SQL_PROFILE (task_name => :stmt_task, -
                                       force_match => TRUE);
```

In the following example, you tune a SQL tuning set, and you create a SQL profile for only one of the SQL statements in the SQL tuning set. The SQL statement is represented by an advisor framework object with ID equal to 5. You must pass an object ID to the `ACCEPT_SQL_PROFILE` procedure because there are potentially many SQL profiles for the tuning task. This object ID is given along with the report.

```
EXEC :sts_task := DBMS_SQLTUNE.CREATE_TUNING_TASK ( -
    sqlset_name => 'my_workload', -
    rank1      => 'ELAPSED_TIME', -
    time_limit => 3600,           -
    description => 'my workload ordered by elapsed time');

-- execute the resulting task
EXEC DBMS_SQLTUNE.EXECUTE_TUNING_TASK(:sts_task);

-- create the profile for the sql statement corresponding to object_id = 5.
EXEC DBMS_SQLTUNE.ACCEPT_SQL_PROFILE (
    task_name => :sts_task, -
    object_id => 5);
```

184.5.3 ADD_SQLSET_REFERENCE Function

This procedure adds a new reference to an existing SQL tuning set to indicate its use by a client.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.ADD_SQLSET_REFERENCE (
  sqlset_name IN VARCHAR2,
  description IN VARCHAR2 := NULL)
RETURN NUMBER;
```

Parameters

The parameters are identical for `DBMS_SQLTUNE.ADD_SQLSET_REFERENCE` and `DBMS_SQLSET.ADD_REFERENCE`.

Table 184-10 ADD_SQLSET_REFERENCE and ADD_REFERENCE Function Parameters

Parameter	Description
<code>sqlset_name</code>	Specifies the name of the SQL tuning set.
<code>description</code>	Provides an optional description of the usage of SQL tuning set. The description is truncated if longer than 256 characters.
<code>sqlset_owner</code>	Specifies the owner of the SQL tuning set, or <code>NULL</code> for the current schema owner.

Return Values

The identifier of the added reference.

Examples

You can add reference to a SQL tuning set. This prevents the tuning set from being modified while it is being used. References are automatically added when you invoke SQL Tuning Advisor on the SQL tuning set, so you should use this function for custom purposes only. The function returns a reference ID that is used to remove it later. You use the `REMOVE_SQLSET_REFERENCE` procedure to delete references to a SQL tuning set.

```
VARIABLE rid NUMBER;
EXEC :rid := DBMS_SQLTUNE.ADD_SQLSET_REFERENCE( -
```

```
sqlset_name => 'my_workload', -
description => 'my sts reference');
```

You can use the `DBA_SQLSET_REFERENCES` view to find all references on a given SQL tuning set.

184.5.4 ALTER_SQL_PROFILE Procedure

This procedure alters specific attributes of an existing SQL profile object.

The following attributes can be altered (using these attribute names):

- `STATUS` can be set to `ENABLED` or `DISABLED`.
- `NAME` can be reset to a valid name which must be a valid Oracle identifier and must be unique.
- `DESCRIPTION` can be set to any string of size no more than 500 characters.
- `CATEGORY` can be reset to a valid category name which must be a valid Oracle identifier and must be unique when combined with normalized SQL text).



See Also:

[DBMS_SQLTUNE SQL Profile Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.ALTER_SQL_PROFILE (
  name           IN  VARCHAR2,
  attribute_name IN  VARCHAR2,
  value          IN  VARCHAR2);
```

Parameters

Table 184-11 ALTER_SQL_PROFILE Procedure Parameters

Parameter	Description
<code>name</code>	The (mandatory) name of the existing SQL profile to alter
<code>attribute_name</code>	The (mandatory) attribute name to alter (case insensitive) using valid attribute names
<code>value</code>	The (mandatory) new value of the attribute using valid attribute values

Usage Notes

Requires the `ALTER ANY SQL PROFILE` privilege.

Examples

```
-- Disable a profile, so it is not be used by any sessions.
EXEC DBMS_SQLTUNE.ALTER_SQL_PROFILE ( name           => :pname, -
```

```

                                attribute_name => 'STATUS', -
                                value           => 'DISABLED');

-- Enable it back:
EXEC DBMS_SQLTUNE.ALTER_SQL_PROFILE ( name           => :pname, -
                                attribute_name => 'STATUS', -
                                value           => 'ENABLED');

-- Change the category of the profile so it is used only by sessions
-- with category set to TEST.
-- Use ALTER SESSION SET SQLTUNE_CATEGORY = 'TEST' to see how this
profile
-- behaves.
EXEC DBMS_SQLTUNE.ALTER_SQL_PROFILE ( name           => :pname, -
                                attribute_name => 'CATEGORY', -
                                value           => 'TEST');

-- Change it back:
EXEC DBMS_SQLTUNE.ALTER_SQL_PROFILE ( name           => :pname, -
                                attribute_name => 'CATEGORY', -
                                value           => 'DEFAULT');

```

184.5.5 CANCEL_TUNING_TASK Procedure

This procedure cancels the currently executing tuning task. All intermediate result data is deleted.



See Also:

[DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.CANCEL_TUNING_TASK (
    task_name          IN VARCHAR2);
```

Parameters

Table 184-12 CANCEL_TUNING_TASK Procedure Parameters

Parameter	Description
task_name	Specifies the name of the task to cancel

Examples

You cancel a task when you need to stop it executing and do not require to view any already-completed results.

```
EXEC DBMS_SQLTUNE.CANCEL_TUNING_TASK(:my_task);
```

184.5.6 CAPTURE_CURSOR_CACHE_SQLSET Procedure

This procedure captures a workload from the shared SQL area into a SQL tuning set.

The procedure polls the cache multiple times over a time period, and updates the workload data stored there. It can execute over as long a period as required to capture an entire system workload.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.CAPTURE_CURSOR_CACHE_SQLSET (
  sqlset_name      IN VARCHAR2,
  time_limit       IN POSITIVE := 1800,
  repeat_interval  IN POSITIVE := 300,
  capture_option   IN VARCHAR2 := 'MERGE',
  capture_mode     IN NUMBER    := MODE_REPLACE_OLD_STATS,
  basic_filter     IN VARCHAR2 := NULL,
  sqlset_owner     IN VARCHAR2 := NULL,
  recursive_sql    IN VARCHAR2 := HAS_RECURSIVE_SQL);
```

Parameters

The parameters are the same for both `DBMS_SQLTUNE.CAPTURE_CURSOR_CACHE_SQLSET` and `DBMS_SQLSET.CAPTURE_CURSOR_CACHE`.

Table 184-13 CAPTURE_CURSOR_CACHE_SQLSET and CAPTURE_CURSOR_CACHE Procedure Parameters

Parameter	Description
<code>sqlset_name</code>	Specifies the SQL tuning set name
<code>time_limit</code>	Defines the total amount of time, in seconds, to execute.
<code>repeat_interval</code>	Defines the amount of time, in seconds, to pause between sampling.
<code>capture_option</code>	Specifies whether to insert new statements, update existing statements, or both. Values are <code>INSERT</code> , <code>UPDATE</code> , or <code>MERGE</code> . The values are the same as for <code>load_option</code> in <code>load_sqlset</code> .

Table 184-13 (Cont.) CAPTURE_CURSOR_CACHE_SQLSET and CAPTURE_CURSOR_CACHE Procedure Parameters

Parameter	Description
capture_mode	Specifies the capture mode (UPDATE and MERGE capture options). Possible values: <ul style="list-style-type: none"> MODE_REPLACE_OLD_STATS — Replaces statistics when the number of executions is greater than the number stored in the SQL tuning set MODE_ACCUMULATE_STATS — Adds new values to current values for SQL that is already stored. Note that this mode detects if a statement has been aged out, so the final value for a statistics is the sum of the statistics of all cursors that statement existed under.
basic_filter	Defines a filter to apply to the shared SQL area for each sample. If basic_filter is not set by the caller, then the subprogram captures only statements of type CREATE TABLE, INSERT, SELECT, UPDATE, DELETE, and MERGE.
sqlset_owner	Specifies the owner of the SQL tuning set or NULL for current schema owner
recursive_sql	Defines a filter that includes recursive SQL in the SQL tuning set (HAS_RECURSIVE_SQL) or excludes it (NO_RECURSIVE_SQL).

Examples

In this example capture takes place over a 30-second period, polling the cache once every five seconds. This captures all statements run during that period but not before or after. If the same statement appears a second time, the process replaces the stored statement with the new occurrence.

Note that in production systems the time limit and repeat interval would be set much higher. You should tune the time_limit and repeat_interval parameters based on the workload time and shared SQL area turnover properties of your system.

```
EXEC DBMS_SQLTUNE.CAPTURE_CURSOR_CACHE_SQLSET( -
                                     sqlset_name      =>
'my_workload', -
                                     time_limit       => 30, -
                                     repeat_interval => 5);
```

In the following call you accumulate execution statistics as you go. This option produces an accurate picture of the cumulative activity of each cursor, even across age-outs, but it is more expensive than the previous example.

```
EXEC DBMS_SQLTUNE.CAPTURE_CURSOR_CACHE_SQLSET( -
                                     sqlset_name      => 'my_workload', -
                                     time_limit       => 30, -
                                     repeat_interval => 5, -
                                     capture_mode     =>
dbms_sqлтune.MODE_ACCUMULATE_STATS);
```


This call performs a very inexpensive capture where you only insert new statements and do not update their statistics once they have been inserted into the SQL tuning set

```
EXEC DBMS_SQLTUNE.CAPTURE_CURSOR_CACHE_SQLSET( -
                                     sqlset_name      => 'my_workload', -
                                     time_limit       => 30, -
                                     repeat_interval  => 5, -
                                     capture_option   => 'INSERT');
```

184.5.7 CREATE_SQL_PLAN_BASELINE Procedure

This procedure creates a SQL plan baseline for an execution plan. It can be used in the context of an Alternative Plan Finding made by SQL Tuning Advisor.



See Also:

[DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.CREATE_SQL_PLAN_BASELINE (
  task_name          IN VARCHAR2,
  object_id         IN NUMBER      := NULL,
  plan_hash_value   IN NUMBER,
  owner_name        IN VARCHAR2   := NULL,
  database_link_to  IN VARCHAR2   := NULL);
```

Parameters

Table 184-14 CREATE_SQL_PLAN_BASELINE Procedure Parameters

Parameter	Description
task_name	Name of the task for which to get a script
object_id	Object ID to which the SQL corresponds
plan_hash_value	Plan to create plan baseline
owner_name	Owner of the relevant tuning task. Defaults to the current schema owner.

Table 184-14 (Cont.) CREATE_SQL_PLAN_BASELINE Procedure Parameters

Parameter	Description
database_link_to	<p>Name of a database link that exists on a standby database.</p> <p>The link specifies the connection to a primary database. By default, the value is null, which means that the SQL Tuning Advisor session is local.</p> <p>Use DBMS_SQLTUNE to tune high-load SQL statements running on a standby database in an Active Data Guard scenario. When you execute REPORT_TUNING_TASK locally on the standby database, the function uses the database link to obtain the data from the primary database, and then constructs it locally on the standby database.</p> <p>The database_link_to parameter must specify a private database link. This link must be owned by SYS and accessed by the default privileged user SYS\$UMF. The following sample statement creates a link named lnk_to_pri:</p> <pre>CREATE DATABASE LINK lnk_to_pri CONNECT TO SYS\$UMF IDENTIFIED BY password USING 'inst1';</pre>

184.5.8 CREATE_SQLSET Procedure and Function

This procedure or function creates a SQL tuning set object in the database.

Syntax

```
DBMS_SQLTUNE.CREATE_SQLSET (
  sqlset_name IN VARCHAR2,
  description IN VARCHAR2 := NULL
  sqlset_owner IN VARCHAR2 := NULL);
```

```
DBMS_SQLTUNE.CREATE_SQLSET (
  sqlset_name IN VARCHAR2 := NULL,
  description IN VARCHAR2 := NULL,
  sqlset_owner IN VARCHAR2 := NULL)
RETURN VARCHAR2;
```

Parameters

Table 184-15 CREATE_SQLSET Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of the created SQL tuning set. The name is the name passed to the function. If no name is passed to the function, then the function generates an automatic name.
description	Provides an optional description of the SQL tuning set.
sqlset_owner	Specifies the owner of the SQL tuning set, or NULL for the current schema owner.

Examples

```
EXEC DBMS_SQLTUNE.CREATE_SQLSET(-
  sqlset_name => 'my_workload', -
  description => 'complete application workload');
```

184.5.9 CREATE_STGTAB_SQLPROF Procedure

This procedure creates the staging table used for copying SQL profiles from one system to another.



See Also:

[DBMS_SQLTUNE SQL Profile Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.CREATE_STGTAB_SQLPROF (
  table_name          IN VARCHAR2,
  schema_name        IN VARCHAR2 := NULL,
  tablespace_name     IN VARCHAR2 := NULL);
```

Parameters

Table 184-16 CREATE_STGTAB_SQLPROF Procedure Parameters

Parameter	Description
table_name	The name of the table to create (case-insensitive unless double quoted).
schema_name	The schema to create the table in, or NULL for the current schema (case-insensitive unless double quoted).
tablespace_name	The tablespace to store the staging table within, or NULL for the default tablespace of the current user (case-insensitive unless double quoted).

Usage Notes

- Call this procedure once before issuing a call to the [PACK_STGTAB_SQLPROF Procedure](#).
- To put different SQL profiles in different staging tables, you can call this procedure multiple times.
- This is a DDL operation, so it does not occur within a transaction.

Examples

Create a staging table to store profile data that can be moved to another system.

```
EXEC DBMS_SQLTUNE.CREATE_STGTAB_SQLPROF (table_name => 'PROFILE_STGTAB');
```

184.5.10 CREATE_STGTAB_SQLSET Procedure

This procedure creates a staging table through which SQL tuning sets are imported and exported.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.CREATE_STGTAB_SQLSET (
    table_name          IN VARCHAR2,
    schema_name        IN VARCHAR2 := NULL,
    tablespace_name    IN VARCHAR2 := NULL,
    db_version         IN NUMBER   := NULL);
```

Parameters

Table 184-17 CREATE_STGTAB_SQLSET and CREATE_STGTAB Procedure Parameters

Parameter	Description
table_name	Specifies the of the table to create. The name is case sensitive.
schema_name	Defines the schema in which to create the table, or NULL for the current schema. The name is case sensitive.
tablespace_name	Specifies the tablespace in which to store the staging table, or NULL for the default tablespace of the current user. The name is case sensitive.
db_version	Specifies the database version that determines the format of the staging table. You can also create an older database version staging table to export an STS to an older database version. Use one of the following values: <ul style="list-style-type: none"> NULL (default) — Specifies the current database version. STS_STGTAB_10_2_VERSION — Specifies the 10.2 database version. STS_STGTAB_11_1_VERSION — Specifies the 11.1 database version. STS_STGTAB_11_2_VERSION — Specifies the 11.2 database version. STS_STGTAB_12_1_VERSION — Specifies the 12.1 database version. STS_STGTAB_12_2_VERSION — Specifies the 12.2 database version.

Security Model

You must have CREATE TABLE permissions in the specified schema and tablespace.

Usage Notes

- Call this procedure once before packing the SQL set.

- To have different tuning sets in different staging tables, you can call this procedure multiple times.
- This is a DDL operation, so it does not occur within a transaction.
- The staging table contains nested table columns and indexes, so it should not be renamed.

Examples

Create a staging table for packing and eventually exporting a SQL tuning sets

```
EXEC DBMS_SQLTUNE.CREATE_STGTAB_SQLSET(table_name => 'STGTAB_SQLSET');
```

Create a staging table to pack a SQL tuning set in Oracle Database 11g Release 2 (11.2) format

```
BEGIN
  DBMS_SQLTUNE.CREATE_STGTAB_SQLSET(
    table_name => 'STGTAB_SQLSET'
  ,   db_version => DBMS_SQLTUNE.STS_STGTAB_11_2_VERSION );
END;
```

184.5.11 CREATE_TUNING_TASK Functions

This function creates a SQL Tuning Advisor task.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

You can use different forms of this function to:

- Create a tuning task for a single statement given its text.
- Create a tuning task for a single statement from the shared SQL area given its identifier.
- Create a tuning task for a single statement from the workload repository given a range of snapshot identifiers.
- Create a tuning task for a SQL tuning set.
- Create a tuning task for SQL Performance Analyzer.

In all cases, the function mainly creates a SQL Tuning Advisor task and sets its parameters.

**See Also:**

[DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) for other subprograms in this group

Syntax**SQL text format:**

```
DBMS_SQLTUNE.CREATE_TUNING_TASK (
  sql_text          IN CLOB,
  bind_list         IN sql_binds := NULL,
  user_name         IN VARCHAR2  := NULL,
  scope             IN VARCHAR2  := SCOPE_COMPREHENSIVE,
  time_limit        IN NUMBER     := TIME_LIMIT_DEFAULT,
  task_name         IN VARCHAR2  := NULL,
  description       IN VARCHAR2  := NULL,
  con_name          IN VARCHAR2  := NULL,
  database_link_to IN VARCHAR2  := NULL)
RETURN VARCHAR2;
```

SQL ID format:

```
DBMS_SQLTUNE.CREATE_TUNING_TASK (
  sql_id           IN VARCHAR2,
  plan_hash_value  IN NUMBER     := NULL,
  scope           IN VARCHAR2  := SCOPE_COMPREHENSIVE,
  time_limit      IN NUMBER     := TIME_LIMIT_DEFAULT,
  task_name       IN VARCHAR2  := NULL,
  description     IN VARCHAR2  := NULL,
  con_name        IN VARCHAR2  := NULL,
  database_link_to IN VARCHAR2  := NULL)
RETURN VARCHAR2;
```

AWR format:

```
DBMS_SQLTUNE.CREATE_TUNING_TASK (
  begin_snap       IN NUMBER,
  end_snap         IN NUMBER,
  sql_id           IN VARCHAR2,
  plan_hash_value  IN NUMBER     := NULL,
  scope           IN VARCHAR2  := SCOPE_COMPREHENSIVE,
  time_limit      IN NUMBER     := TIME_LIMIT_DEFAULT,
  task_name       IN VARCHAR2  := NULL,
  description     IN VARCHAR2  := NULL,
  con_name        IN VARCHAR2  := NULL,
  dbid            IN NUMBER     := NULL,
  database_link_to IN VARCHAR2  := NULL)
RETURN VARCHAR2;
```

SQL tuning set format:

```
DBMS_SQLTUNE.CREATE_TUNING_TASK (
  sqlset_name      IN VARCHAR2,
  basic_filter     IN VARCHAR2 := NULL,
  object_filter    IN VARCHAR2 := NULL,
  rank1            IN VARCHAR2 := NULL,
  rank2            IN VARCHAR2 := NULL,
  rank3            IN VARCHAR2 := NULL,
  result_percentage IN NUMBER   := NULL,
  result_limit     IN NUMBER   := NULL,
  scope            IN VARCHAR2 := SCOPE_COMPREHENSIVE,
  time_limit       IN NUMBER   := TIME_LIMIT_DEFAULT,
  task_name        IN VARCHAR2 := NULL,
  description      IN VARCHAR2 := NULL,
  plan_filter      IN VARCHAR2 := 'MAX_ELAPSED_TIME',
  sqlset_owner     IN VARCHAR2 := NULL,
  database_link_to IN VARCHAR2 := NULL)
RETURN VARCHAR2;
```

SQL Performance Analyzer format:

```
DBMS_SQLTUNE.CREATE_TUNING_TASK (
  spa_task_name     IN VARCHAR2,
  spa_task_owner    IN VARCHAR2 := NULL,
  spa_compare_exec  IN VARCHAR2 := NULL,
  basic_filter      IN VARCHAR2 := NULL,
  time_limit        IN NUMBER   := TIME_LIMIT_DEFAULT,
  task_name         IN VARCHAR2 := NULL,
  description       IN VARCHAR2 := NULL)
RETURN VARCHAR2;
```

Parameters

Table 184-18 *CREATE_TUNING_TASK Function Parameters*

Parameter	Description
sql_text	Specifies the text of a SQL statement.
begin_snap	Specifies the begin snapshot identifier.
end_snap	Specifies the end snapshot identifier.
sql_id	Specifies the identifier of a SQL statement.
bind_list	Defines an ordered list of bind values in ANYDATA type. NOTE: This parameter is not supported on a standby database.
plan_hash_value	Specifies the hash value of the SQL execution plan.
sqlset_name	Specifies the SQL tuning set name.
basic_filter	Specifies the predicate used to filter the SQL from the SQL tuning set.
object_filter	Specifies the object filter.
rank(i)	Specifies an ORDER BY clause on the selected SQL statement.

Table 184-18 (Cont.) CREATE_TUNING_TASK Function Parameters

Parameter	Description
result_percentage	Specifies the percentage on the sum of a ranking measure.
result_limit	Specifies the top L(limit) SQL from the filtered or ranked SQL.
user_name	Specifies the user name for whom the statement is to be tuned.
scope	Specifies the tuning scope: <ul style="list-style-type: none"> LIMITED: SQL Tuning Advisor produces recommendations based on statistical checks, access path analysis, and SQL structure analysis. SQL profile recommendations are not generated. COMPREHENSIVE: SQL Tuning Advisor carries out all the analysis it performs under limited scope plus SQL profiling.
time_limit	Specifies the maximum duration in seconds for the tuning session.
task_name	Specifies an optional tuning task name.
description	Provides a description of the SQL tuning session, up to a maximum of 256 characters.
plan_filter	Specifies the plan filter. It is applicable when multiple plans (plan_hash_value) are associated with the same statement. This filter allows for selecting one plan (plan_hash_value) only. Possible values are: <ul style="list-style-type: none"> LAST_GENERATED: most recent timestamp FIRST_GENERATED: earliest timestamp, the opposite to LAST_GENERATED LAST_LOADED: most recent first_load_time statistics information FIRST_LOADED: earliest first_load_time statistics information, the opposite to LAST_LOADED MAX_ELAPSED_TIME: maximum elapsed time MAX_BUFFER_GETS: maximum buffer gets MAX_DISK_READS: maximum disk reads MAX_DIRECT_WRITES: maximum direct writes MAX_OPTIMIZER_COST: maximum optimizer cost
sqlset_owner	Specifies the owner of the SQL tuning set, or NULL for the current schema owner.
spa_task_name	Specifies the name of the SQL Performance Analyzer task whose regressions are to be tuned.
spa_task_owner	Specifies the owner of specified SQL Performance Analyzer task or NULL for current user.
spa_compare_exec	Specifies the execution name of the Compare Performance trial of SQL Performance Analyzer task. If NULL, then the advisor uses the most recent execution of the given SQL Performance Analyzer task, of type COMPARE PERFORMANCE.
dbid	Specifies the DBID for imported or PDB-level AWR data. If NULL, then the current database DBID is used.

Table 184-18 (Cont.) CREATE_TUNING_TASK Function Parameters

Parameter	Description
<code>con_name</code>	<p>Specifies the container for the tuning task. The semantics depend on the function format:</p> <ul style="list-style-type: none"> For the SQL text format, this parameter specifies the container in which SQL Tuning Advisor tunes the SQL statement. If null (default), then SQL Tuning Advisor uses the current container. For the SQL ID format, this parameter specifies the container from which the database fetches the SQL statement for tuning. SQL Tuning Advisor tunes the statement in this container. If null, then the database uses the current PDB for tuning, fetches the statement from the cursor cache of all valid containers executing the SQL statement, and tunes the most expensive statement in its container. For the AWR format, this parameter specifies the container from whose AWR data the database fetches the SQL statement for tuning. SQL Tuning Advisor tunes the statement in this container. If null, then the database uses the current PDB for tuning, fetches the statement from the AWR of all valid containers that have this SQL statement, and tunes the most expensive statement in its container. <p>The following statements are true of all function formats:</p> <ul style="list-style-type: none"> In a non-CDB, this parameter is ignored. In a PDB, this parameter must be null or match the container name of the PDB. Otherwise, an error occurs. In a CDB root, this parameter must be null or match the container name of a container in this CDB. Otherwise, an error occurs.
<code>database_link_to</code>	<p>The link specifies the connection to a primary database. By default, the value is null, which means that the SQL Tuning Advisor session is local. Use <code>DBMS_SQLTUNE</code> to tune high-load SQL statements running on a standby database in an Active Data Guard scenario. When you execute <code>REPORT_TUNING_TASK</code> locally on the standby database, the function uses the database link to obtain the data from the primary database, and then constructs it locally on the standby database.</p> <p>The <code>database_link_to</code> parameter must specify a private database link. This link must be owned by <code>SYS</code> and accessed by the default privileged user <code>SYS\$UMF</code>. The following sample statement creates a link named <code>lnk_to_pri</code>:</p> <pre>CREATE DATABASE LINK lnk_to_pri CONNECT TO SYS\$UMF IDENTIFIED BY password USING 'inst1';</pre>

Return Values

A SQL tuning task name that is unique by user (two different users can give the same name to their advisor tasks).

Usage Notes

With regard to the form of this subprogram that takes a SQL tuning set, filters provided to this function are evaluated as part of a SQL run by the current user. As such, they are executed

with that user's security privileges and can contain any constructs and subqueries that user can access, but no more.

Example 184-1 Examples

The following examples assume the following variable definitions:

```
VARIABLE stmt_task      VARCHAR2(64);  
VARIABLE sts_task       VARCHAR2(64);  
VARIABLE spa_tune_task  VARCHAR2(64);
```

Example 184-2 Create Tuning Task with SQL Text Format

```
EXEC :stmt_task := DBMS_SQLTUNE.CREATE_TUNING_TASK( -  
    sql_text => 'SELECT quantity_sold FROM sales s, times t WHERE  
s.time_id = t.time_id AND s.time_id = TO_DATE(''24-NOV-00'')');
```

Example 184-3 Create Tuning Task with SQL ID Format

```
EXEC :stmt_task := DBMS_SQLTUNE.CREATE_TUNING_TASK(sql_id =>  
'ay1m3ssvtrh24');  
  
EXEC :stmt_task := DBMS_SQLTUNE.CREATE_TUNING_TASK(sql_id =>  
'ay1m3ssvtrh24', -  
    scope => 'LIMITED');  
  
EXEC :stmt_task := DBMS_SQLTUNE.CREATE_TUNING_TASK(sql_id =>  
'ay1m3ssvtrh24', -  
    time_limit => 600);
```

Example 184-4 Create Tuning Task with AWR Snapshot Format

```
EXEC :stmt_task := DBMS_SQLTUNE.CREATE_TUNING_TASK(begin_snap => 1, -  
    end_snap => 2, sql_id => 'ay1m3ssvtrh24');
```

Example 184-5 Create Tuning Task with SQL Tuning Set Format

This example creates a task that tunes SQL statements in order by buffer gets, and also sets a time limit of one hour. The default ranking measure is elapsed time.

```
EXEC :sts_task := DBMS_SQLTUNE.CREATE_TUNING_TASK( -  
    sqlset_name => 'my_workload', -  
    rank1       => 'BUFFER_GETS', -  
    time_limit  => 3600, -  
    description => 'tune my workload ordered by buffer gets');
```

Example 184-6 Create Tuning Task with SPA Task Format

This example tunes the SQL statement that were reported as having regressed from the compare performance execution of the SQL Performance Analyzer task named `task_123`.

```
EXEC :spa_tune_task := DBMS_SQLTUNE.CREATE_TUNING_TASK(
    spa_task_name      => 'task_123',
    spa_task_owner    => 'SCOTT',
    spa_compare_exec  => 'exec1');
```

Example 184-7 Creating SQL Tuning Task on Standby Database

This example creates a tuning task on the standby database. The `tune_stby_wkld` task uses the `lnk_to_primary` database link to write data to the primary database, which is open read/write.

```
VAR tname VARCHAR2(30);
VAR query VARCHAR2(500);
EXEC :tname := 'tune_stby_wkld';
EXEC :query := 'SELECT /*+ FULL(t)*/ coll FROM table1 t WHERE coll=9000';
EXEC :tname := DBMS_SQLTUNE.CREATE_TUNING_TASK(sql_text => :query,-
    task_name => :tname, database_link_to => 'lnk_to_primary');
```

184.5.12 DELETE_SQLSET Procedure

This procedure deletes a set of SQL statements from a SQL tuning set.

Syntax

```
DBMS_SQLTUNE.DELETE_SQLSET (
    sqlset_name   IN   VARCHAR2,
    basic_filter  IN   VARCHAR2 := NULL,
    sqlset_owner  IN   VARCHAR2 := NULL);
```

Parameters

Table 184-19 DELETE_SQLSET Procedure Parameters

Parameter	Description
<code>sqlset_name</code>	Specifies the name of the SQL tuning set.
<code>basic_filter</code>	Specifies the SQL predicate to filter the SQL from the SQL tuning set. This basic filter is used as a where clause on the SQL tuning set content to select a desired subset of SQL from the SQL tuning set.
<code>sqlset_owner</code>	Specifies the owner of the SQL tuning set, or <code>NULL</code> for current schema owner.

Examples

```
-- Delete all statements in a sql tuning set.
EXEC DBMS_SQLTUNE.DELETE_SQLSET(sqlset_name => 'my_workload');
```

```
-- Delete all statements in a sql tuning set which ran for less than a
second
EXEC DBMS_SQLTUNE.DELETE_SQLSET(sqlset_name => 'my_workload', -
                                basic_filter => 'elapsed_time <
1000000');
```

184.5.13 DROP_SQL_PROFILE Procedure

This procedure drops the named SQL profile from the database.



See Also:

[DBMS_SQLTUNE SQL Profile Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.DROP_SQL_PROFILE (
    name          IN VARCHAR2,
    ignore        IN BOOLEAN := FALSE);
```

Parameters

Table 184-20 DROP_SQL_PROFILE Procedure Parameters

Parameter	Description
name	The (mandatory) name of SQL profile to be dropped. The name is case sensitive.
ignore	Ignores errors due to object not existing

Usage Notes

Requires the `DROP ANY SQL PROFILE` privilege.

Examples

```
-- Drop the profile:
EXEC DBMS_SQLTUNE.DROP_SQL_PROFILE(:pname);
```

184.5.14 DROP_SQLSET Procedure

This procedure drops a SQL tuning set if it is not active.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.DROP_SQLSET (  
  sqlset_name   IN  VARCHAR2,  
  sqlset_owner  IN  VARCHAR2 := NULL);
```

Parameters

Table 184-21 DROP_SQLSET Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of the SQL tuning set.
sqlset_owner	Specifies the owner of the SQL tuning set, or NULL for current schema owner.

Usage Notes

You cannot drop a SQL tuning set when it is referenced by one or more clients.

Examples

```
-- Drop the sqlset.  
EXEC DBMS_SQLTUNE.DROP_SQLSET ('my_workload');
```

184.5.15 DROP_TUNING_TASK Procedure

This procedure drops a SQL tuning task. The task and all its result data are deleted.



See Also:

[DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.DROP_TUNING_TASK (
  task_name          IN VARCHAR2);
```

Parameters**Table 184-22 DROP_TUNING_TASK Procedure Parameters**

Parameter	Description
task_name	Specifies name of the tuning task to drop.

184.5.16 EXECUTE_TUNING_TASK Function and Procedure

This function and procedure executes a previously created tuning task. Both the function and the procedure run in the context of a new task execution. The difference is that the function version returns that new execution name.

**See Also:**

[DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.EXECUTE_TUNING_TASK (
  task_name          IN VARCHAR2,
  execution_name     IN VARCHAR2           := NULL,
  execution_params   IN dbms_advisor.argList := NULL,
  execution_desc     IN VARCHAR2           := NULL,
  database_link_to   IN VARCHAR2           := NULL)
RETURN VARCHAR2;
```

```
DBMS_SQLTUNE.EXECUTE_TUNING_TASK (
  task_name          IN VARCHAR2,
  execution_name     IN VARCHAR2           := NULL,
  execution_params   IN dbms_advisor.argList := NULL,
  execution_desc     IN VARCHAR2           := NULL,
  database_link_to   IN VARCHAR2           := NULL);
```

Parameters**Table 184-23 EXECUTE_TUNING_TASK Function & Procedure Parameters**

Parameter	Description
task_name	Name of the tuning task to execute.

Table 184-23 (Cont.) EXECUTE_TUNING_TASK Function & Procedure Parameters

Parameter	Description
<code>execution_name</code>	A name to qualify and identify an execution. If not specified, it is generated by the advisor and returned by function.
<code>execution_params</code>	List of parameters (name, value) for the specified execution. The execution parameters have effect only on the execution for which they are specified. They override the values for the parameters stored in the task (set through the SET_TUNING_TASK_PARAMETER Procedures).
<code>execution_desc</code>	A 256-length string describing the execution.
<code>database_link_to</code>	<p>Name of a database link that exists on a standby database. The link specifies the connection to a primary database. By default, the value is null, which means that the SQL Tuning Advisor session is local.</p> <p>Use <code>DBMS_SQLTUNE</code> to tune high-load SQL statements running on a standby database in an Active Data Guard scenario. When you execute <code>REPORT_TUNING_TASK</code> locally on the standby database, the function uses the database link to obtain the data from the primary database, and then constructs it locally on the standby database.</p> <p>The <code>database_link_to</code> parameter must specify a private database link. This link must be owned by <code>SYS</code> and accessed by the default privileged user <code>SYS\$UMF</code>. The following sample statement creates a link named <code>lnk_to_pri</code>:</p> <pre>CREATE DATABASE LINK lnk_to_pri CONNECT TO SYS\$UMF IDENTIFIED BY password USING 'inst1';</pre>

Usage Notes

A tuning task can be executed multiples times without having to reset it.

Examples

```
EXEC DBMS_SQLTUNE.EXECUTE_TUNING_TASK(:stmt_task);
```

184.5.17 IMPLEMENT_TUNING_TASK Procedure

This procedure implements a set of SQL profile recommendations made by SQL Tuning Advisor.

Executing `IMPLEMENT_TUNING_TASK` is equivalent to executing the [SCRIPT_TUNING_TASK Function](#) and then running the script.



See Also:

[DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.IMPLEMENT_TUNING_TASK(
    task_name          IN  VARCHAR2,
    rec_type           IN  VARCHAR2 := REC_TYPE_SQL_PROFILES,
    owner_name         IN  VARCHAR2 := NULL,
    execution_name     IN  VARCHAR2 := NULL,
    database_link_to   IN  VARCHAR2 := NULL);
```

Parameters

Table 184-24 IMPLEMENT_TUNING_TASK Procedure Parameters

Parameter	Description
task_name	Name of the tuning task for which to implement recommendations.
rec_type	Filter the types of recommendations to implement. Only 'PROFILES' is supported.
owner_name	Owner of the relevant tuning task or NULL for the current user.
execution_name	Name of the task execution to use. If NULL, then the procedure implements recommendations from the last task execution.
database_link_to	Name of a database link that exists on a standby database. The link specifies the connection to a primary database. By default, the value is null, which means that the SQL Tuning Advisor session is local. Use DBMS_SQLTUNE to tune high-load SQL statements running on a standby database in an Active Data Guard scenario. When you execute REPORT_TUNING_TASK locally on the standby database, the function uses the database link to obtain the data from the primary database, and then constructs it locally on the standby database. The database_link_to parameter must specify a private database link. This link must be owned by SYS and accessed by the default privileged user SYS\$UMF. The following sample statement creates a link named lnk_to_pri: <pre>CREATE DATABASE LINK lnk_to_pri CONNECT TO SYS\$UMF IDENTIFIED BY password USING 'inst1';</pre>

184.5.18 INTERRUPT_TUNING_TASK Procedure

This procedure interrupts the currently executing tuning task. The task ends its operations as it would at normal exit so that the user can access the intermediate results.



See Also:

[DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.INTERRUPT_TUNING_TASK (  
    task_name          IN VARCHAR2);
```

Parameters

Table 184-25 INTERRUPT_TUNING_TASK Procedure Parameters

Parameter	Description
task_name	Name of the tuning task to interrupt

Examples

```
EXEC DBMS_SQLTUNE.INTERRUPT_TUNING_TASK(:my_task);
```

184.5.19 LOAD_SQLSET Procedure

This procedure populates the SQL tuning set with a set of selected SQL statements. You can call the procedure multiple times to add new SQL statements or replace attributes of existing statements.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.LOAD_SQLSET (  
    sqlset_name        IN VARCHAR2,  
    populate_cursor    IN sqlset_cursor,  
    load_option         IN VARCHAR2 := 'INSERT',  
    update_option       IN VARCHAR2 := 'REPLACE',  
    update_condition   IN VARCHAR2 := NULL,
```

```

update_attributes IN VARCHAR2 := NULL,
ignore_null      IN BOOLEAN  := TRUE,
commit_rows     IN POSITIVE  := NULL,
sqlset_owner    IN VARCHAR2 := NULL);

```

Parameters

Table 184-26 LOAD_SQLSET Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of SQL tuning set to be loaded.
populate_cursor	Specifies the cursor reference to the SQL tuning set to be loaded.
load_option	Specifies which statements are loaded into the SQL tuning set. The possible values are: <ul style="list-style-type: none"> INSERT (default) — Adds only new statements. UPDATE — Updates existing the SQL statements and ignores any new statements. MERGE — Inserts new statements and updates the information of the existing ones.
update_option	Specifies how existing SQL statements are updated. This parameter is considered only if load_option is specified with UPDATE or MERGE as an option. The possible values are: <ul style="list-style-type: none"> REPLACE (default) — Updates the statement using the new statistics, bind list, object list, and so on. ACCUMULATE — Combines attributes when possible (for example, statistics such as elapsed_time), and otherwise replaces the existing values (for example, module and action) with the provided values. The SQL statement attributes that can be accumulated are: elapsed_time, buffer_gets, direct_writes, disk_reads, row_processed, fetches, executions, end_of_fetch_count, stat_period and active_stat_period.
update_condition	Specifies when to perform the update. The procedure only performs the update when the specified condition is satisfied. The condition can refer to either the data source or destination. The condition must use the following prefixes to refer to attributes from the source or the destination: <ul style="list-style-type: none"> OLD — Refers to statement attributes from the SQL tuning set (destination). NEW — Refers to statement attributes from the input statements (source).

Table 184-26 (Cont.) LOAD_SQLSET Procedure Parameters

Parameter	Description
update_attributes	<p>Specifies the list of SQL statement attributes to update during a merge or update.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> • NULL (default) — Specifies the content of the input cursor except the execution context. On other terms, it is equivalent to ALL without execution contexts such as module and action. • BASIC — Specifies statistics and binds only. • TYPICAL — Specifies BASIC with SQL plans (without row source statistics) and without an object reference list. • ALL — Specifies all attributes, including the execution context attributes such as module and action. • List of comma separated attribute names to update: <ul style="list-style-type: none"> – EXECUTION_CONTEXT – EXECUTION_STATISTICS – SQL_BINDS – SQL_PLAN – SQL_PLAN_STATISTICS (similar to SQL_PLAN with added row source statistics)
ignore_null	<p>Specifies whether to update attributes when the new value is NULL.</p> <p>If TRUE, then the procedure does not update an attribute when the new value is NULL. That is, do not override with NULL values unless intentional.</p>
commit_rows	<p>Specifies whether to commit statements after DML.</p> <p>If a value is provided, then the load commits after each specified number of statements is inserted. If NULL is provided, then the load commits only once, at the end of the operation.</p> <p>Providing a value for this argument enables you to monitor the progress of a SQL tuning set load operation in the DBA_SQLSET views. The STATEMENT_COUNT value increases as new SQL statements are loaded.</p>
sqlset_owner	<p>Defines the owner of the SQL tuning set, or the current schema owner (or NULL for the current owner).</p>

Exceptions

- This procedure returns an error when `sqlset_name` is invalid, or a corresponding SQL tuning set does not exist, or the `populate_cursor` is incorrect and cannot be executed.
- Exceptions are also raised when invalid filters are provided. Filters can be invalid either because they don't parse (for example, they refer to attributes not in `sqlset_row`), or because they violate the user's privileges.

Usage Notes

Rows in the input `populate_cursor` must be of type `SQLSET_ROW`.

Examples

In this example, you create and populate a SQL tuning set with all shared SQL area statements with an elapsed time of 5 seconds or more excluding statements that belong to SYS schema (to simulate an application user workload). You select all attributes of the SQL statements and load them in the tuning set using the default mode, which loads only new statements, since the SQL tuning set is empty.

```
-- create the tuning set
EXEC DBMS_SQLTUNE.CREATE_SQLSET('my_workload');
-- populate the tuning set from the shared SQL area
DECLARE
  cur DBMS_SQLTUNE.SQLSET_CURSOR;
BEGIN
  OPEN cur FOR
    SELECT VALUE(P)
      FROM table(
        DBMS_SQLTUNE.SELECT_CURSOR_CACHE(
          'parsing_schema_name <> ''SYS'' AND elapsed_time > 5000000',
          NULL, NULL, NULL, NULL, 1, NULL,
          'ALL')) P;

  DBMS_SQLTUNE.LOAD_SQLSET(sqlset_name => 'my_workload',
    populate_cursor => cur);
END;
/
```

Suppose now you wish to augment this information with what is stored in the workload repository (AWR). You populate the tuning set with 'ACCUMULATE' as your `update_option` because it is assumed the cursors currently in the cache had aged out since the snapshot was taken.

You omit the `elapsed_time` filter because it is assumed that any statement captured in AWR is important, but still you throw away the SYS-parsed cursors to avoid recursive SQL.

```
DECLARE
  cur DBMS_SQLTUNE.SQLSET_CURSOR;
BEGIN
  OPEN cur FOR
    SELECT VALUE(P)
      FROM table(
        DBMS_SQLTUNE.SELECT_WORKLOAD_REPOSITORY(1,2,
          'parsing_schema_name
<> ''SYS'',
          NULL, NULL, NULL, NULL,
          1,
          NULL,
          'ALL')) P;

  DBMS_SQLTUNE.LOAD_SQLSET(sqlset_name      => 'my_workload',
    populate_cursor => cur,
    Using DBMS_SQLTUNE
    load_option => 'MERGE',
```

```

update_option => 'ACCUMULATE');
END;

```

The following example is a simple load that only inserts new statements from the workload repository, skipping existing ones (in the SQL tuning set). Note that 'INSERT' is the default value for the `load_option` argument of the `LOAD_SQLSET` procedure.

```

DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
  SELECT VALUE(P)
  FROM table(DBMS_SQLTUNE.SELECT_WORKLOAD_REPOSITORY(1,2)) P;
  DBMS_SQLTUNE.LOAD_SQLSET(sqlset_name => 'my_workload', populate_cursor =>
cur);
END;
/

```

The next example demonstrates a load with `UPDATE` option. This updates statements that already exist in the SQL tuning set but does not add new ones. By default, old statistics are replaced by their new values.

```

DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
  SELECT VALUE(P)
  FROM table(DBMS_SQLTUNE.SELECT_CURSOR_CACHE) P;

  DBMS_SQLTUNE.LOAD_SQLSET(sqlset_name      => 'my_workload',
                           populate_cursor => cur,
                           load_option     => 'UPDATE');
END;
/

```

184.5.20 PACK_STGTAB_SQLPROF Procedure

This procedure copies profile data from the `sys.` schema into the staging table.



See Also:

[DBMS_SQLTUNE SQL Profile Subprograms](#) for other subprograms in this group

Syntax

```

DBMS_SQLTUNE.PACK_STGTAB_SQLPROF (
  profile_name      IN VARCHAR2 := '%',
  profile_category  IN VARCHAR2 := 'DEFAULT',

```

```
staging_table_name    IN VARCHAR2,
staging_schema_owner  IN VARCHAR2 := NULL);
```

Parameters

Table 184-27 PACK_STGTAB_SQLPROF Procedure Parameters

Parameter	Description
profile_name	The name of the profile to pack (% wildcards acceptable, case-sensitive)
profile_category	The category to pack profiles from (% wildcards acceptable, case-sensitive)
staging_table_name	The name of the table to use (case-insensitive unless double quoted). Required.
staging_schema_owner	The schema where the table resides, or NULL for current schema (case-insensitive unless double quoted)

Security Model

This procedure requires `ADMINISTER SQL MANAGEMENT OBJECT` privilege and `INSERT` privilege on the staging table.

Usage Notes

This function issues a `COMMIT` after packing each SQL profile. If an error is raised mid-execution, then clear the staging table by deleting its rows.

Examples

Put only those profiles in the `DEFAULT` category into the staging table. This corresponds to all profiles used by default on this system.

```
EXEC DBMS_SQLTUNE.PACK_STGTAB_SQLPROF (staging_table_name =>
'PROFILE_STGTAB');
```

This is another example where you put all profiles into the staging table. Note this moves profiles that are not currently being used by default but are in other categories, such as for testing purposes.

```
EXEC DBMS_SQLTUNE.PACK_STGTAB_SQLPROF (profile_category => '%', -
staging_table_name =>
'PROFILE_STGTAB');
```

184.5.21 PACK_STGTAB_SQLSET Procedure

This procedure copies one or more SQL tuning sets from their location in the SYS schema to a staging table created by the CREATE_STGTAB_SQLSET procedure.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.PACK_STGTAB_SQLSET (
  sqlset_name          IN VARCHAR2,
  sqlset_owner         IN VARCHAR2 := NULL,
  staging_table_name   IN VARCHAR2,
  staging_schema_owner IN VARCHAR2 := NULL,
  db_version           IN NUMBER   := NULL);
```

Examples

Put all SQL tuning sets on the database in the staging table:

```
BEGIN
  DBMS_SQLTUNE.PACK_STGTAB_SQLSET(
    sqlset_name      => '%'
  , sqlset_owner    => '%'
  , staging_table_name => 'STGTAB_SQLSET');
END;
```

Put only those SQL tuning sets owned by the current user in the staging table:

```
BEGIN
  DBMS_SQLTUNE.PACK_STGTAB_SQLSET(
    sqlset_name      => '%'
  , staging_table_name => 'STGTAB_SQLSET');
END;
```

Pack a specific SQL tuning set:

```
BEGIN
  DBMS_SQLTUNE.PACK_STGTAB_SQLSET(
    sqlset_name      => 'my_workload'
  , staging_table_name => 'STGTAB_SQLSET');
END;
```

Pack a second SQL tuning set:

```
BEGIN
  DBMS_SQLTUNE.PACK_STGTAB_SQLSET(
    sqlset_name      => 'workload_subset'
  ,   staging_table_name => 'STGTAB_SQLSET');
END;
```

Pack the STS `my_workload_subset` into a staging table `stgtab_sqlset` created for Oracle Database 11g Release 1 (11.2):

```
BEGIN
  DBMS_SQLTUNE.PACK_STGTAB_SQLSET(
    sqlset_name      => 'workload_subset'
  ,   staging_table_name => 'STGTAB_SQLSET'
  ,   db_version      => DBMS_SQLTUNE.STS_STGTAB_11_2_VERSION);
END;
```

184.5.22 REMAP_STGTAB_SQLPROF Procedure

This procedure changes the profile data values kept in the staging table prior to performing an unpack operation.

You can use this procedure to change the category of a profile. You can also use it to change the name of a profile if one already exists on the system with the same name.



See Also:

[DBMS_SQLTUNE SQL Profile Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.REMAP_STGTAB_SQLPROF (
  old_profile_name      IN VARCHAR2,
  new_profile_name      IN VARCHAR2 := NULL,
  new_profile_category  IN VARCHAR2 := NULL,
  staging_table_name    IN VARCHAR2,
  staging_schema_owner  IN VARCHAR2 := NULL);
```

Parameters

Table 184-28 REMAP_STGTAB_SQLPROF Procedure Parameters

Parameter	Description
<code>old_profile_name</code>	The name of the profile to target for a remap operation (case-sensitive)

Table 184-28 (Cont.) REMAP_STGTAB_SQLPROF Procedure Parameters

Parameter	Description
<code>new_profile_name</code>	The new name of the profile, or <code>NULL</code> to remain the same (case-sensitive)
<code>new_profile_category</code>	The new category for the profile, or <code>NULL</code> to remain the same (case-sensitive)
<code>staging_table_name</code>	The name of the table on which to perform the remap operation (case-sensitive). Required.
<code>staging_schema_owner</code>	The schema where the table resides, or <code>NULL</code> for current schema (case-sensitive)

Security Model

This procedure requires the `UPDATE` privilege on the staging table.

Examples

Change the name of a profile before we unpack, to avoid conflicts

```
BEGIN
  DBMS_SQLTUNE.REMAP_STGTAB_SQLPROF(
    old_profile_name => :pname
  ,   new_profile_name => 'IMP' || :pname
  ,   staging_table_name => 'PROFILE_STGTAB');
END;
```

Change the SQL profile in the staging table to be 'TEST' category before we import it. This way users can test the profile on the new system before it is active.

```
BEGIN
  DBMS_SQLTUNE.REMAP_STGTAB_SQLPROF(
    old_profile_name => :pname
  ,   new_profile_category => 'TEST'
  ,   staging_table_name => 'PROFILE_STGTAB');
END;
```

184.5.23 REMAP_STGTAB_SQLSET Procedure

This procedure changes the tuning set names and owners in the staging table so that they can be unpacked with different values.



See Also:

[DBMS_SQLTUNE SQL Profile Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.REMAP_STGTAB_SQLSET (
    old_sqlset_name      IN VARCHAR2,
    old_sqlset_owner    IN VARCHAR2 := NULL,
    new_sqlset_name     IN VARCHAR2 := NULL,
    new_sqlset_owner    IN VARCHAR2 := NULL,
    staging_table_name  IN VARCHAR2,
    staging_schema_owner IN VARCHAR2 := NULL,
    old_con_dbid        IN NUMBER   := NULL,
    new_con_dbid        IN NUMBER   := NULL);
);
```

Parameters

The parameters are identical for the DBMS_SQLTUNE.REMAP_STGTAB_SQLSET and DBMS_SQLSET.REMAP_SQLSET procedures.

Table 184-29 REMAP_STGTAB_SQLSET and REMAP_SQLSET Procedure Parameters

Parameter	Description
old_sqlset_name	Specifies the name of the tuning set to target for a remap operation. Wildcard characters (%) are not supported.
old_sqlset_owner	Specifies the new name of the tuning set owner to target for a remap operation. NULL for current schema owner
new_sqlset_name	Specifies the new name for the tuning set, or NULL to keep the same tuning set name.
new_sqlset_owner	Specifies the new owner for the tuning set, or NULL to keep the same owner name.
staging_table_name	Specifies the name of the table on which to perform the remap operation. The value is case sensitive.
staging_schema_owner	Specifies the name of staging table owner, or NULL for the current schema owner. The value is case sensitive.
old_con_dbid	Specifies the old container DBID to be remapped to a new container DBID. Specify NULL to use the same container DBID. You must provide both old_con_dbid and new_con_dbid for the remap to succeed.
new_con_dbid	Specifies the new container DBID to replace with the old container DBID. Specify NULL to use the same container DBID. You must provide both old_con_dbid and new_con_dbid for the remap to succeed.

Usage Notes

Call this procedure multiple times to remap more than one tuning set name or owner. This procedure only handles one tuning set per call.

Examples

```
-- Change the name of an STS in the staging table before unpacking it.
BEGIN
```

```

    DBMS_SQLTUNE.REMAP_STGTAB_SQLSET(
        old_sqlset_name =>
'my_workload'
    ,   old_sqlset_owner => 'SH'
    ,   new_sqlset_name =>
'imp_workload'
    ,   staging_table_name => 'STGTAB_SQLSET');

-- Change the owner of an STS in the staging table before unpacking it.
DBMS_SQLTUNE.REMAP_STGTAB_SQLSET(
    old_sqlset_name => 'imp_workload'
    ,   old_sqlset_owner => 'SH'
    ,   new_sqlset_owner => 'SYS'
    ,   staging_table_name => 'STGTAB_SQLSET');
END;
```

184.5.24 REMOVE_SQLSET_REFERENCE Procedure

This procedure deactivates a SQL tuning set to indicate that it is no longer used by the client.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```

DBMS_SQLTUNE.REMOVE_SQLSET_REFERENCE (
    sqlset_name   IN  VARCHAR2,
    reference_id  IN  NUMBER,
    sqlset_owner  IN  VARCHAR2 := NULL,
    force_remove  IN  NUMBER   := 0);
```

Parameters

The parameters are identical for the `DBMS_SQLTUNE.REMOVE_SQLSET_REFERENCE` and `DBMS_SQLSET.REMOVE_REFERENCE` procedures.

Table 184-30 REMOVE_SQLSET_REFERENCE and REMOVE_REFERENCE Procedure Parameters

Parameter	Description
<code>sqlset_name</code>	Specifies the name of the SQL tuning set.
<code>reference_id</code>	Specifies the identifier of the reference to remove.
<code>sqlset_owner</code>	Specifies the owner of the SQL tuning set (or <code>NULL</code> for the current schema owner).

Table 184-30 (Cont.) REMOVE_SQLSET_REFERENCE and REMOVE_REFERENCE Procedure Parameters

Parameter	Description
<code>force_remove</code>	Specifies whether references can be removed for other users (1) or whether they cannot be removed (0). Setting this parameter to 1 only takes effect when the user has the ADMINISTER ANY SQL TUNING SET privilege. Otherwise, the database only removes references owned by the user.

Examples

You can remove references on a given SQL tuning set when you finish using it and want to make it writable again. The following example removes the reference to `my_workload`:

```
EXEC DBMS_SQLTUNE.REMOVE_SQLSET_REFERENCE( -
    sqlset_name => 'my_workload', -
    reference_id => :rid,
    sqlset_owner => NULL,
    force_remove => 0);
```

To find all references to a given SQL tuning set, query the `DBA_SQLSET_REFERENCES` view.

184.5.25 REPORT_AUTO_TUNING_TASK Function

This function displays a report from the automatic tuning task.

This function reports on a range of task executions, whereas the [REPORT_TUNING_TASK Function](#) reports on a single execution. Note that this function is deprecated with Oracle Database 11g Release 2 (11.2) in favor of `DBMS_AUTO_SQLTUNE.REPORT_AUTO_TUNING_TASK`.



See Also:

- [DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group
- [REPORT_AUTO_TUNING_TASK Function](#)

Syntax

```
DBMS_SQLTUNE.REPORT_AUTO_TUNING_TASK(
    begin_exec    IN VARCHAR2 := NULL,
    end_exec      IN VARCHAR2 := NULL,
    type          IN VARCHAR2 := TYPE_TEXT,
    level         IN VARCHAR2 := LEVEL_TYPICAL,
    section       IN VARCHAR2 := SECTION_ALL,
```

```

    object_id    IN NUMBER    := NULL,
    result_limit IN NUMBER    := NULL)
RETURN CLOB;

```

Parameters

Table 184-31 REPORT_AUTO_TUNING_TASK Function Parameters

Parameter	Description
begin_exec	Specifies the name of the execution from which to begin the report. NULL retrieves a report on the most recent run.
end_exec	Specifies the name of the execution at which to end the report. NULL retrieves a report on the most recent run.
type	Specifies the type of the report to produce. Possible values are TYPE_TEXT which produces a text report
level	Specifies the level of detail in the report: <ul style="list-style-type: none"> LEVEL_BASIC: simple version of the report. Just show info about the actions taken by the advisor. LEVEL_TYPICAL: show information about every statement analyzed, including requests not implemented. LEVEL_ALL: highly detailed report level, also provides annotations about statements skipped over.
section	Limits the report to a single section (ALL for all sections): <ul style="list-style-type: none"> SECTION_SUMMARY - summary information SECTION_FINDINGS - tuning findings SECTION_PLAN - explain plans SECTION_INFORMATION - general information SECTION_ERROR - statements with errors SECTION_ALL - all statements
object_id	Specifies the advisor framework object ID that represents a single statement to restrict reporting to. Specify NULL for all statements. Only valid for reports that target a single execution.
result_limit	Specifies the maximum number of SQL statements to show in the report.

Return Values

A CLOB containing the desired report.

184.5.26 REPORT_SQL_DETAIL Function

This function builds a report for a specific SQLID. For each SQLID it gives various statistics and details as obtained from the v\$sql views and AWR.

See Also:

[DBMS_SQLTUNE SQL Performance Reporting Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.REPORT_SQL_DETAIL (
  sql_id                IN  VARCHAR2    DEFAULT NULL,
  sql_plan_hash_value  IN  NUMBER       DEFAULT NULL,
  start_time           IN  DATE         DEFAULT NULL,
  duration             IN  NUMBER       DEFAULT NULL,
  inst_id             IN  NUMBER       DEFAULT NULL,
  dbid                IN  NUMBER       DEFAULT NULL,
  event_detail        IN  VARCHAR2     DEFAULT 'YES',
  bucket_max_count    IN  NUMBER       DEFAULT 128,
  bucket_interval     IN  NUMBER       DEFAULT NULL,
  top_n               IN  NUMBER       DEFAULT 10,
  report_level        IN  VARCHAR2     DEFAULT 'TYPICAL',
  type                IN  VARCHAR2     DEFAULT 'ACTIVE',
  data_source         IN  VARCHAR2     DEFAULT 'AUTO',
  end_time            IN  DATE         DEFAULT NULL,
  duration_stats      IN  NUMBER       DEFAULT NULL,
  con_name            IN  VARCHAR2     DEFAULT NULL)
RETURN CLOB;
```

Parameters

Table 184-32 REPORT_SQL_DETAIL Function Parameters

Parameter	Description
sql_id	SQLID for which monitoring information should be displayed. If NULL (the default), display statistics for the SQLID of the last SQL statement executed in the current session.
sql_plan_hash_value	Displays SQL statistics and details for a specific plan_hash_value. If NULL (default), displays statistics and details for all plans of the SQL_ID.
start_time	If specified, shows SQL activity (from GV\$ACTIVE_SESSION_HISTORY) starting at this time. On Oracle RAC, the minimum start_time is the earliest sample_time of the in-memory ASH buffers across all instances. If NULL (default), one hour before the current time.
duration	Duration of activity in seconds for the report. If NULL (default) uses a value of 1 hour.
inst_id	Target instance to get SQL details from. If NULL, uses data from all instances. If 0 or -1, uses current instance.
dbid	DBID from which to get SQL details. If NULL, uses current DBID.
event_detail	When set to 'NO', the activity is aggregated by wait_class only. Use 'YES' (the default) to aggregate by (wait_class, event_name).
bucket_max_count	If specified, this should be the maximum number of histogram buckets created in the report. If not specified, a value of 128 is used.
bucket_interval	If specified, this represents the exact time interval in seconds, of all histogram buckets. If specified, bucket_max_count is ignored.
top_n	Controls the number of entries to display per dimension in the top dimensions section. If not specified, a default value of 10 is used.

Table 184-32 (Cont.) REPORT_SQL_DETAIL Function Parameters

Parameter	Description
report_level	<p>Level of detail for the report, either 'BASIC', 'TYPICAL' or 'ALL'. Default assumes 'TYPICAL'. Their meanings are explained below.</p> <p>In addition, individual report sections can also be enabled or disabled by using a +/- <i>section_name</i>. Several sections are defined:</p> <ul style="list-style-type: none"> 'TOP' - Show top values for the ASH dimensions for a SQL statement; ON by default 'SPM' - Show existing plan baselines for a SQL statement; OFF by default 'MISMATCH' - Show reasons for creating new child cursors (sharing criteria violations); OFF by default. 'STATS' - Show SQL execution statistics per plan from GV\$SQLAREA_PLAN_HASH; ON by default 'ACTIVITY' - Show top activity from ASH for each plan of a SQL statement; ON by default 'ACTIVITY_ALL' - Show top activity from ASH for each line of the plan for a SQL statement; OFF by default 'HISTOGRAM' - Show activity histogram for each plan of a SQL statement (plan time line histogram); ON by default 'SESSIONS' - Show activity for top sessions for each plan of a SQL statement; OFF by default 'MONITOR' - Show show one monitored SQL execution per execution plan; ON by default 'XPLAN' - Show execution plans; ON by default 'BINDS' - show captured bind data; ON by default <p>In addition, SQL text can be specified at different levels:</p> <ul style="list-style-type: none"> -SQL_TEXT - No SQL text in report +SQL_TEXT - OK with partial SQL text up to the first 2000 chars as stored in GV\$SQL_MONITOR -SQL_FULLTEXT - No full SQL text (+SQL_TEXT) +SQL_FULLTEXT - Show full SQL text (default value) <p>The meanings of the three top-level report levels are:</p> <ul style="list-style-type: none"> NONE - minimum possible BASIC - SQL_TEXT+STATS+ACTIVITY+HISTOGRAM TYPICAL - SQL_FULLTEXT+TOP+STATS+ACTIVITY+HISTOGRAM+XPLAN+MONITOR ALL - everything <p>Only one of these 4 levels can be specified and, if it is, it has to be at the start of the REPORT_LEVEL string</p>
type	<p>Report format: 'ACTIVE' by default. Can also be 'XML' (see Usage Notes).</p>
data_source	<p>Determines the data source of SQL data based on one of the following values:</p> <ul style="list-style-type: none"> MEMORY: The data source is GV\$ view DISK: The data source is DBA_HIST_* view AUTO: Automatically determines the data source based on the time frame (default)

Table 184-32 (Cont.) REPORT_SQL_DETAIL Function Parameters

Parameter	Description
<code>end_time</code>	If specified, shows SQL activity from <code>start_time</code> to <code>end_time</code> . If NULL (default), shows SQL activity for <code>systimestamp</code> .
<code>duration_stats</code>	Duration of additional SQL execution statistics from AWR (in hours), for the report. If NULL (default), then the duration of 24 hours is considered.
<code>con_name</code>	Name of the multitenant container database (CDB).

Security Model

The invoker needs the `EXECUTE` privilege on the `DBMS_XPLAN` package.

Return Values

A CLOB containing the desired report.

Usage Notes

- `ACTIVE` reports have a rich, interactive user interface similar to Enterprise Manager while not requiring any EM installation. The report file built is in HTML format, so it can be interpreted by most modern browsers. The code powering the active report is downloaded transparently by the web browser when the report is first viewed, hence viewing it requires outside connectivity.
- The invoker needs the `SELECT` or `READ` privilege on the following views:
 - `V$SESSION`
 - `DBA_ADVISOR_FINDINGS`
 - `V$DATABASE`
 - `GV$ASH_INFO`
 - `GV$ACTIVE_SESSION_HISTORY`
 - `GV$SQLAREA_PLAN_HASH`
 - `GV$SQL`
 - `DBA_HIST_SNAPSHOT`
 - `DBA_HIST_WR_CONTROL`
 - `DBA_HIST_ACTIVE_SESS_HISTORY`
 - `DBA_HIST_SQLSTAT`
 - `DBA_HIST_SQL_BIND_METADATA`
 - `DBA_HIST_SQLTEXT`
 - `DBA_SQL_PLAN_BASELINES`
 - `DBA_SQL_PROFILES`
 - `DBA_ADVISOR_TASKS`
 - `DBA_SERVICES`

- DBA_USERS
- DBA_OBJECTS
- DBA_PROCEDURES

184.5.27 REPORT_SQL_HISTORY Function

This function generates a query history details report for a given execution in cases where the user has the required viewing privileges.

Syntax

```
DBMS_SQLTUNE.REPORT_SQL_HISTORY(
    sql_id          IN varchar2  default NULL,
    session_id     IN number     default NULL,
    session_serial IN number     default NULL,
    sql_exec_start IN date       default NULL,
    sql_exec_id    IN number     default NULL,
    inst_id        IN number     default NULL,
    instance_id_filter IN number default NULL,
    base_path      IN varchar2   default NULL,
    report_level   IN varchar2   default 'TYPIC
    type          IN varchar2   default 'TEXT'
    sql_plan_hash_value IN number default NULL,
    con_name      IN varchar2   default NULL,
    report_id     IN number     default NULL)
RETURN CLOB;
```

Parameters

Table 184-33 REPORT_SQL_HISTORY Function Parameters

Parameter	Description
sql_id	SQL ID for for execution.
session_id	ID of the session in which the execution ran.
session_serial	Serial number of the session in which execution ran.
sql_exec_start	SQL execution start time.
sql_exec_id	SQL execution ID.
inst_id	Instance ID on which the SQL ran.
base_path	Base path URL.
report_level	Report level: 'NONE', 'BASIC', 'TYPICAL' or 'ALL'.
type	Report type: 'TEXT', 'HTML', 'XML' or 'ACTIVE'.
sql_plan_hash_value	Plan hash value of the SQL execution.
con_name	PDB Container Name.
report_id	ID of the report in the auto-report repository.

184.5.28 REPORT_SQL_HISTORY_LIST Function

This function generates a query history list report for all executions in the given user session, or across sessions for a privileged user (who holds SYS user or DBA privileges).

Syntax

```
FUNCTION DBMS_SQLTUNE.REPORT_SQL_HISTORY_LIST(
    sql_id                IN varchar2    default NULL,
    session_id           IN number      default NULL,
    session_serial       IN number      default NULL,
    inst_id              IN number      default NULL,
    max_sqltext_length  IN number      default NULL,
    top_n_count          IN number      default NULL,
    top_n_rankby        IN varchar2    default
'last_active_time',
    report_level         IN varchar2    default 'TYPICAL',
    base_path            IN varchar2    default NULL,
    type                 IN varchar2    default 'TEXT',
    con_name             IN varchar2    default NULL)
RETURN CLOB;
```

Parameters

Table 184-34 REPORT_SQL_HISTORY_LIST Function Parameters

Parameter	Description
sql_id	SQL ID to filter by.
session_id	Session ID to filter by.
session_serial	Session serial number to filter by.
inst_id	Database instance ID.
max_sqltext_length	Maximum SQL text length to display.
top_n_count	Top-N SQL statement history.
top_n_rankby	Rank by last active time.
report_level	Report level: 'NONE', 'BASIC', 'TYPICAL', or 'ALL'.
base_path	Base path URL.
type	Report type: 'TEXT', 'HTML', 'XML', or 'ACTIVE'.
con_name	PDB container name.

184.5.29 REPORT_SQL_MONITOR Function

This function builds a report (text, simple HTML, active HTML, XML) for the monitoring information collected on behalf of the targeted statement execution.



See Also:

[Real-Time SQL Monitoring](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.REPORT_SQL_MONITOR (
  sql_id                IN VARCHAR2  DEFAULT NULL,
  dbop_name             IN VARCHAR2  DEFAULT NULL,
  dbop_exec_id         IN NUMBER     DEFAULT NULL,
  session_id           IN NUMBER     DEFAULT NULL,
  session_serial       IN NUMBER     DEFAULT NULL,
  sql_exec_start       IN DATE       DEFAULT NULL,
  sql_exec_id          IN NUMBER     DEFAULT NULL,
  inst_id              IN NUMBER     DEFAULT NULL,
  start_time_filter    IN DATE       DEFAULT NULL,
  end_time_filter      IN DATE       DEFAULT NULL,
  instance_id_filter   IN NUMBER     DEFAULT NULL,
  parallel_filter      IN VARCHAR2   DEFAULT NULL,
  plan_line_filter     IN NUMBER     DEFAULT NULL,
  event_detail         IN VARCHAR2   DEFAULT 'YES',
  bucket_max_count    IN NUMBER     DEFAULT 128,
  bucket_interval     IN NUMBER     DEFAULT NULL,
  base_path            IN VARCHAR2   DEFAULT NULL,
  last_refresh_time    IN DATE       DEFAULT NULL,
  report_level         IN VARCHAR2   DEFAULT 'TYPICAL',
  type                 IN VARCHAR2   DEFAULT 'TEXT',
  sql_plan_hash_value  IN NUMBER     DEFAULT NULL,
  con_name             IN VARCHAR2   DEFAULT NULL,
  report_id           IN NUMBER     DEFAULT NULL)
RETURN CLOB;
```

Parameters

Table 184-35 REPORT_SQL_MONITOR Function Parameters

Parameter	Description
sql_id	SQL_ID for which monitoring information should be displayed. Use NULL (the default) to report on the last statement monitored by Oracle.
dbop_name	DBOP_NAME for which monitoring information of the composite database operation is displayed.
dbop_exec_id	Execution ID for the composite database operation for which monitoring information is displayed.

Table 184-35 (Cont.) REPORT_SQL_MONITOR Function Parameters

Parameter	Description
session_id	If not NULL, this parameters targets only the sub-set of statements executed by the specified session. Default is NULL. Use USERENV('SID') for current session.
session_serial	In addition to the session_id parameter, one can also specify its session serial to ensure that the desired session incarnation is targeted. This parameter is ignored when session_id is NULL.
sql_exec_start	This parameter, along with sql_exec_id, is only applicable when sql_id is also specified. Jointly, they can be used to display monitoring information associated to any execution of the statement identified by sql_id, assuming that this statement was monitored. When NULL (the default), the last monitored execution of SQL sql_id is shown.
sql_exec_id	This parameter, along with sql_exec_start, is only applicable when sql_id is also specified. Jointly, they can be used to display monitoring information associated to any execution of the statement identified by sql_id, assuming that this statement was monitored. When NULL (the default), the last monitored execution of SQL sql_id is shown.
inst_id	Only considers statements started on the specified instance. Use -1 to target the login instance. NULL (default) targets all instances.
start_time_filter	If not NULL, the report considers only the activity (from GV\$ACTIVE_SESSION_HISTORY) recorded after the specified date. If NULL, the reported activity starts when the execution of the targeted SQL statement has started.
end_time_filter	If not NULL, the report shows only the activity (from GV\$ACTIVE_SESSION_HISTORY) collected before the date end_time_filter. If NULL, the reported activity ends when the targeted SQL statement execution has ended or is the current time if the statement is still executing.
instance_id_filter	Only applies when the execution runs parallel across multiple Oracle Real Application Cluster (Oracle RAC) instances. This parameter allows to only report the activity of the specified instance. Use a NULL value (the default) to include the activity on all instances where the parallel query was executed.

Table 184-35 (Cont.) REPORT_SQL_MONITOR Function Parameters

Parameter	Description
parallel_filter	<p>Applies only to parallel execution and allows reporting the activity of only a subset of the processes involved in the parallel execution (Query Coordinator and/or Parallel eXecution servers). The value of this parameter can be:</p> <ul style="list-style-type: none"> • NULL to target all processes • [qc][servers(<svr_grp>[,] <svr_set>[,] <srv_num>)]: 'qc' stands for query coordinator and servers() stipulate which PX servers to consider. <p>The following examples show how to target a subset of the parallel processes:</p> <ul style="list-style-type: none"> • qc: targets only the query coordinator • servers(1): targets all parallel execution servers in group number 1. Note that statement running parallel have one main server group (group number 1) plus one additional group for each nested sub-query running parallel. • servers(,2): targets all parallel execution servers from any group but only running in set 1 of each group (each group has at most two set of parallel execution servers) • servers(1,1): consider only group 1, set 1 • servers(1,2,4): consider only group 1, set 2, server number 4. This reports for a single parallel server process • qc servers(1,2,4): same as above by also including the query coordinator
event_detail	<p>When value is 'YES' (the default), reported activity from GV\$ACTIVE_SESSION_HISTORY is aggregated by (wait_class, event_name). Use 'NO' to only aggregate by wait_class.</p>
bucket_max_count	<p>If specified, this should be the maximum number of histogram buckets created in the report</p>
bucket_interval	<p>If specified, this represents the exact time interval in seconds, of all histogram buckets. If specified, bucket_max_count is ignored.</p>
base_path	<p>URL path for flex HTML resources since flex HTML format is required to access external files (java scripts and the flash SWF file itself)</p>
last_refresh_time	<p>If not NULL (default is NULL), the time when the report was last retrieved (see SYSDATE attribute of the report tag). Use this option to display the report of a running query, and when the report is refreshed on a regular basis. This optimizes the size of the report since only the new or changed information is returned. In particular, the following are optimized:</p> <ul style="list-style-type: none"> • SQL text is not returned when this option is specified • activity histogram starts at the bucket that intersect at that time. The entire content of the bucket is returned, even if last_refresh_time is after the start of that bucket

Table 184-35 (Cont.) REPORT_SQL_MONITOR Function Parameters

Parameter	Description
report_level	<p>Level of detail for the report: 'NONE', 'BASIC', 'TYPICAL' or 'ALL'. Default assumes 'TYPICAL'.</p> <p>In addition, individual report sections can also be enabled or disabled by using a +/- <i>section_name</i>. Several sections are defined:</p> <ul style="list-style-type: none"> 'XPLAN' - Show explain plan; ON by default 'PLAN' - Show plan monitoring statistics; ON by default 'SESSIONS' - Show session details. Applies only to parallel queries; ON by default 'INSTANCE' - Show instance details. Applies only to parallel and cross instance; ON by default 'PARALLEL' - An umbrella parameter for specifying sessions+instance details 'ACTIVITY' - Show activity summary at global level, plan line level and session or instance level (if applicable); ON by default 'BINDS' - Show bind information when available; ON by default 'METRICS' - Show metric data (CPU, I/Os, ...) over time; ON by default 'ACTIVITY_HISTOGRAM' - Show an histogram of the overall query activity; ON by default 'PLAN_HISTOGRAM' - Show activity histogram at plan line level; OFF by default 'OTHER' - Other info; ON by default <p>In addition, SQL text can be specified at different levels:</p> <ul style="list-style-type: none"> SQL_TEXT - No SQL text in report +SQL_TEXT - OK with partial SQL text up to the first 2000 chars as stored in GV\$SQL_MONITOR -SQL_FULLTEXT - No full SQL text (+SQL_TEXT) +SQL_FULLTEXT - Show full SQL text (default value)
report_level (contd.)	<p>The meanings of the three top-level report levels are:</p> <ul style="list-style-type: none"> NONE - minimum possible +BASIC - SQL_TEXT-PLAN-XPLAN-SESSIONS-INSTANCE-ACTIVITY_HISTOGRAM-PLAN_HISTOGRAM-METRICS TYPICAL - everything but PLAN_HISTOGRAM ALL - everything <p>Only one of these 4 levels can be specified and, if it is, it has to be at the start of the REPORT_LEVEL string</p>
type	Report format, 'TEXT' by default. Can be 'TEXT', 'HTML', 'XML' or 'ACTIVE' (see Usage Notes).
sql_plan_hash_value	Target only those SQL executions with the specified plan_hash_value. Default is NULL.
con_name	Name of the multitenant container database (CDB).
report_id	ID of the report in auto-report repository. Report IDs can be found in DBA_HIST_REPORTS.

Return Values

A CLOB containing the desired report.

Usage Notes

- The target SQL statement for this report can be:
 - The most recent SQL statement monitored by Oracle Database. This is the default behavior, so there is no need to specify any parameter.
 - The most recent SQL statement executed by a specific session and monitored by Oracle. The session is identified by its session id and optionally its serial number. For example, use `session_id =>` for the current session or `session_id => 20, session_serial => 103` for session ID 20, serial number 103.
 - The most recent execution of a specific statement identified by its `sql_id`.
 - A specific execution of a SQL statement identified by its execution key (`sql_id, sql_exec_start` and `sql_exec_id`).
- This report produces performance data exposed by several fixed views, listed below. For this reason, the invoker of the report function must have privilege to select data from these fixed views (such as the `SELECT_CATALOG` role).
 - `GV$SQL_MONITOR`
 - `GV$SQL_PLAN_MONITOR`
 - `GV$SQL_PLAN`
 - `GV$ACTIVE_SESSION_HISTORY`
 - `GV$SESSION_LONGOPS`
 - `GV$SQL`
- The `bucket_max_count` and `bucket_interval` parameters control the activity histogram. By default, the maximum number of buckets is set to 128. The database derives the `bucket_interval` value based on this count. The `bucket_interval` (value is in seconds) is computed such that it is the smallest possible power of 2 value (starting at 1 second) without exceeding the maximum number of buckets. For example, if the query has executed for 600 seconds, then the database selects a `bucket_interval` of 8 seconds (a power of two). The database chooses the value of 8 because $600/8 = 74$, which is less than 128 buckets maximum. Smaller than 8 seconds would be 4 seconds, which would lead to more buckets than the 128 maximum. If `bucket_interval` is specified, then the database uses the specified value instead of deriving it from `bucket_max_count`.
- `ACTIVE` reports have a rich, interactive user interface similar to Enterprise Manager, while not requiring any EM installation.

The report file is in HTML format. The code powering the active report is downloaded transparently by the web browser when the report is first viewed. Therefore, viewing the report requires outside connectivity.

 **See Also:**

Oracle Database SQL Tuning Guide for more information about SQL real-time monitoring.

184.5.30 REPORT_SQL_MONITOR_LIST Function

This function builds a report for all or a subset of statements monitored by Oracle Database. For each statement, the subprogram gives key information and associated global statistics.

Use the [REPORT_SQL_MONITOR Function](#) to get detailed monitoring information for a single SQL statement.

 **See Also:**

[Real-Time SQL Monitoring](#) for other subprograms in this group

Syntax

```

DBMS_SQLTUNE.REPORT_SQL_MONITOR_LIST (
  sql_id                IN VARCHAR2  DEFAULT NULL,
  session_id            IN NUMBER    DEFAULT NULL,
  session_serial        IN NUMBER    DEFAULT NULL,
  inst_id               IN NUMBER    DEFAULT NULL,
  active_since_date     IN DATE      DEFAULT NULL,
  active_since_sec      IN NUMBER    DEFAULT NULL,
  active_before_date    IN DATE      DEFAULT NULL,
  last_refresh_time     IN DATE      DEFAULT NULL,
  dbop_name             IN VARCHAR2  DEFAULT NULL,
  monitor_type          IN NUMBER    DEFAULT MONITOR_TYPE_ALL,
  max_sqltext_length    IN NUMBER    DEFAULT NULL,
  top_n_count           IN NUMBER    DEFAULT NULL,
  top_n_rankby          IN VARCHAR2  DEFAULT 'LAST_ACTIVE_TIME',
  report_level          IN VARCHAR2  DEFAULT 'TYPICAL',
  auto_refresh          IN NUMBER    DEFAULT NULL,
  base_path             IN VARCHAR2  DEFAULT NULL,
  type                  IN VARCHAR2  DEFAULT 'TEXT',
  con_name              IN VARCHAR2  DEFAULT NULL,
  top_n_detail_count    IN NUMBER    DEFAULT NULL)
RETURN CLOB;

```


Parameters

Table 184-36 REPORT_SQL_MONITOR_LIST Function Parameters

Parameter	Description
sql_id	SQL_ID for which monitoring information should be displayed. Use NULL (the default) to report on the last statement monitored by Oracle.
session_id	If not NULL, then this parameter targets only the subset of statements executed by the specified session. Default is NULL. Use -1 or USERENV('SID') for current session.
session_serial	In addition to the session_id parameter, you can also specify its session serial to ensure that the desired session incarnation is targeted. This parameter is ignored when session_id is NULL.
inst_id	Only considers statements started on the specified instance. Use -1 to target the login instance. NULL (default) targets all instances.
active_since_date	If not NULL (default), returns only monitored statements active since the specified time. This includes all statements that are still executing along with all statements that have completed their execution after the specified date and time.
active_since_sec	Same as active_since_date but with the date specified relative to the current SYSDATE minus a specified number of seconds. For example, use 3600 to apply a limit of 1 hour.
active_before_date	If not NULL (default), returns only monitored statements that have been active before the specified date and time.
last_refresh_time	If not NULL (default), the date and time when the list report was last retrieved. This optimizes the case where an application shows the list and refreshes the report on a regular basis (such as once every 5 seconds). In this case, the report shows detail about the execution of monitored queries that active since the specified last_refresh_time. For other queries, the report returns the execution key (sql_id, sql_exec_start, sql_exec_id). For queries with a first refresh time after the specified date, the function returns only the SQL execution key and statistics.
dbop_name	DB operation name. Specify NULL to display all the monitored DB operations.
monitor_type	Type of the SQL Monitor operation. Specify one of the following values: <ul style="list-style-type: none"> MONITOR_TYPE_SQL - Returns only SQL statements MONITOR_TYPE_DBOP - Returns only database operations MONITOR_TYPE_ALL - Returns SQL statements as well as database operations
max_sqltext_length	Maximum length of the SQL text. Default is NULL (no limit).
top_n_count	Limits the number of top-N SQL statements that need to be included in the report.

Table 184-36 (Cont.) REPORT_SQL_MONITOR_LIST Function Parameters

Parameter	Description
<code>top_n_rankby</code>	Specifies the attribute to rank the SQL statements. Specify this value when <code>top_n_count</code> value is not NULL. The ranking of an SQL statement is done based on one of the following values: <ul style="list-style-type: none"> • <code>LAST_ACTIVE_TIME</code> - Last active date and time (top N most recent) • <code>DURATION</code> - Total duration of execution • <code>DB_TIME</code> - DB time used • <code>CPU_TIME</code> - CPU time used • <code>IO_REQUESTS</code> - Number of I/O requests • <code>IO_BYTES</code> - Number of I/O bytes
<code>report_level</code>	Level of detail for the report. The level is one of the following: <ul style="list-style-type: none"> • <code>BASIC</code> - SQL text up to 200 characters • <code>TYPICAL</code> - include full SQL text assuming that cursor has not aged out, in which case the SQL text is included up to 2000 characters • <code>ALL</code> - currently the same as <code>TYPICAL</code>
<code>auto_refresh</code>	Currently non-operational, reserved for future use.
<code>base_path</code>	URL path for flex HTML resources because flex HTML format is required to access external files (java scripts and the flash SWF file itself).
<code>type</code>	Report format: <code>TEXT</code> (default), <code>HTML</code> , or <code>XML</code> .
<code>con_name</code>	Name of the multitenant container database (CDB)
<code>top_n_detail_count</code>	Limits the number of top-N SQL statements for which the SQL monitor details need to be included in the report.

Return Values

A report for the list of SQL statements that have been monitored. The report type is text, XML, or HTML.

Usage Notes

You must have the privilege to access the following fixed views: `GV$SQL_MONITOR` and `GV$SQL`.

**See Also:**

Oracle Database SQL Tuning Guide for more information about SQL real-time monitoring.

184.5.31 REPORT_TUNING_TASK Function

This function displays the results of a tuning task. By default the report is in text format.



See Also:

[DBMS_SQLTUNE SQL Performance Reporting Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.REPORT_TUNING_TASK (
  task_name          IN   VARCHAR2,
  type               IN   VARCHAR2  := 'TEXT',
  level              IN   VARCHAR2  := 'TYPICAL',
  section            IN   VARCHAR2  := ALL,
  object_id          IN   NUMBER     := NULL,
  result_limit       IN   NUMBER     := NULL,
  owner_name         IN   VARCHAR2  := NULL,
  execution_name     IN   VARCHAR2  := NULL,
  database_link_to  IN   VARCHAR2  := NULL)
RETURN CLOB;
```

Parameters

Table 184-37 REPORT_TUNING_TASK Function Parameters

Parameter	Description
task_name	Name of the tuning task.
type	Type of the report to produce. Possible values are <code>TEXT</code> which produces a text report.
level	Level of detail in the report: <ul style="list-style-type: none"> <code>BASIC</code>: simple version of the report. Just show info about the actions taken by the advisor. <code>TYPICAL</code>: show information about every statement analyzed, including requests not implemented. <code>ALL</code>: highly detailed report level, also provides annotations about statements skipped over.
section	Section of the report to include. You can limit the report to any of the following single sections (<code>ALL</code> for all sections): <ul style="list-style-type: none"> <code>SUMMARY</code> - Summary information <code>FINDINGS</code> - Tuning findings <code>PLAN</code> - Explain plans <code>INFORMATION</code> - General information <code>ERROR</code> - Statements with errors <code>ALL</code> - All statements

Table 184-37 (Cont.) REPORT_TUNING_TASK Function Parameters

Parameter	Description
object_id	Advisor framework object ID that represents a single statement to restrict reporting to. NULL for all statements. Only valid for reports that target a single execution.
result_limit	Maximum number of SQL statements to show in the report.
owner_name	Owner of the relevant tuning task. The default is the current schema owner.
execution_name	Name of the task execution to use. If NULL, then the function generates the report for the last task execution.
database_link_to	Name of a database link that exists on a standby database. The link specifies the connection to a primary database. By default, the value is null, which means that the SQL Tuning Advisor session is local. Use DBMS_SQLTUNE to tune high-load SQL statements running on a standby database in an Active Data Guard scenario. When you execute REPORT_TUNING_TASK locally on the standby database, the function uses the database link to obtain the data from the primary database, and then constructs it locally on the standby database. The database_link_to parameter must specify a private database link. This link must be owned by SYS and accessed by the default privileged user SYS\$UMF. The following sample statement creates a link named lnk_to_pri: <pre>CREATE DATABASE LINK lnk_to_pri CONNECT TO SYS\$UMF IDENTIFIED BY password USING 'inst1';</pre>

Return Values

A CLOB containing the desired report.

Examples

```
-- Display the report for a single statement.
SELECT DBMS_SQLTUNE.REPORT_TUNING_TASK(:stmt_task)
FROM DUAL;

-- Display the summary for a SQL tuning set.
SELECT DBMS_SQLTUNE.REPORT_TUNING_TASK(:sts_task, 'TEXT', 'TYPICAL',
'SUMMARY')
FROM DUAL;

-- Display the findings for a specific statement.
SELECT DBMS_SQLTUNE.REPORT_TUNING_TASK(:sts_task, 'TEXT',
'TYPICAL','FINDINGS', 5)
FROM DUAL;
```

184.5.32 REPORT_TUNING_TASK_XML Function

This function displays an XML report of a tuning task.



See Also:

[DBMS_SQLTUNE SQL Performance Reporting Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.REPORT_TUNING_TASK_LIST_XML(
  task_name      IN   VARCHAR2      := NULL,
  level          IN   VARCHAR2      := LEVEL_TYPICAL,
  section        IN   VARCHAR2      := SECTION_ALL,
  object_id      IN   NUMBER         := NULL,
  result_limit   IN   NUMBER         := 160,
  owner_name     IN   VARCHAR2      := NULL,
  execution_name IN   VARCHAR2      := NULL,
  autotune_period IN NUMBER         := NULL,
  report_tag     IN   VARCHAR2      := NULL)
RETURN XMLTYPE;
```

Parameters

Table 184-38 REPORT_TUNING_TASK_XML Function Parameters

Parameter	Description
task_name	Name of the tuning task.
level	Level of detail in the report: <ul style="list-style-type: none"> BASIC: simple version of the report. Just show info about the actions taken by the advisor. TYPICAL: show information about every statement analyzed, including requests not implemented. ALL: highly detailed report level, also provides annotations about statements skipped over.
section	Section of the report to include. You can limit the report to any of the following single sections (ALL for all sections): <ul style="list-style-type: none"> SUMMARY - Summary information ALL - All statements
object_id	Advisor framework object ID that represents a single statement to restrict reporting to. NULL for all statements. Only valid for reports that target a single execution.

Table 184-38 (Cont.) REPORT_TUNING_TASK_XML Function Parameters

Parameter	Description
result_limit	The number of statements in a SQL tuning set or snapshot range for which the report is generated. The default is 160 (20 statements * 8 categories). The categories are as follows: <ul style="list-style-type: none"> • Profile • Index • Restructure SQL • Alternate plan • Statistics • Errors • Information • No findings
owner_name	Owner of the relevant tuning task. The default is the current schema owner.
execution_name	Name of the task execution to use. If <code>NULL</code> , then the function generates the report for the most recent task execution.
autotune_period	The time period for the automatic SQL tuning. This setting applies only to the automatic SQL Tuning Advisor task. Possible values are as follows: <ul style="list-style-type: none"> • Null or negative value (default) — All or full. The result includes all task executions. • 0 — Result of the current or most recent task execution. • 1 — Result for the most recent 24-hour period. • 7 — Result for the most recent 7-day period. The procedure interprets any other value as the time of the most recent task execution minus the value of this argument.
report_tag	The name of the root XML tag. By default, the tag is the report reference generated by the reporting framework.

Return Values

A `CLOB` containing the desired report.

184.5.33 RESET_TUNING_TASK Procedure

This procedure is called on a tuning task that is not currently executing to prepare it for re-execution.



See Also:

[DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.RESET_TUNING_TASK(
  task_name          IN VARCHAR2);
```

Parameters

Table 184-39 RESET_TUNING_TASK Procedure Parameters

Parameter	Description
task_name	The name of the tuning task to reset

Examples

```
-- reset and re-execute a task
EXEC DBMS_SQLTUNE.RESET_TUNING_TASK(:sts_task);

-- re-execute the task
EXEC DBMS_SQLTUNE.EXECUTE_TUNING_TASK(:sts_task);
```

184.5.34 RESUME_TUNING_TASK Procedure

This procedure resumes a previously interrupted task that was created to process a SQL tuning set.



See Also:

[DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.RESUME_TUNING_TASK(
  task_name          IN VARCHAR2,
  basic_filter       IN VARCHAR2 := NULL);
```

Parameters

Table 184-40 RESUME_TUNING_TASK Procedure Parameters

Parameter	Description
task_name	The name of the tuning task to resume.
basic_filter	A SQL predicate to filter the SQL from the SQL tuning set. Note that this filter is applied in conjunction with the parameter <code>basic_filteri</code> when calling CREATE_TUNING_TASK Functions .

Usage Notes

Resuming a single SQL tuning task (a task that was created to tune a single SQL statement as compared to a SQL tuning set) is not supported.

Examples

```
-- Interrupt the task
EXEC DBMS_SQLTUNE.INTERRUPT_TUNING_TASK(:conc_task);

-- Once a task is interrupted, we can elect to reset it, resume it, or
check
-- out its results and then decide. For this example we will just
resume.

EXEC DBMS_SQLTUNE.RESUME_TUNING_TASK(:conc_task);
```

184.5.35 SCHEDULE_TUNING_TASK Function

This function creates a tuning task for a single SQL statement and schedules a DBMS_SCHEDULER job to execute the tuning task. One form of the function finds the information about the statement to be tuned in the shared SQL area, whereas the other finds the information in AWR.



See Also:

[DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) for other subprograms in this group

Syntax

Shared SQL Area Format:

```
DBMS_SQLTUNE.SCHEDULE_TUNING_TASK(
  sql_id          IN VARCHAR2,
  plan_hash_value IN NUMBER           := NULL,
  start_date      IN TIMESTAMP WITH TIME ZONE := NULL,
  scope           IN VARCHAR2         :=
SCOPE_COMPREHENSIVE,
  time_limit      IN NUMBER           := TIME_LIMIT_DEFAULT,
  task_name       IN VARCHAR2         := NULL,
  description     IN VARCHAR2         := NULL,
  con_name        IN VARCHAR2         := NULL)
RETURN VARCHAR2;
```

AWR Format:

```
DBMS_SQLTUNE.SCHEDULE_TUNING_TASK(
  begin_snap      IN NUMBER,
  end_snap        IN NUMBER,
```



```

sql_id          IN VARCHAR2,
plan_hash_value IN NUMBER           := NULL,
start_date     IN TIMESTAMP WITH TIME ZONE := NULL,
scope         IN VARCHAR2         := SCOPE_COMPREHENSIVE,
time_limit    IN NUMBER           := TIME_LIMIT_DEFAULT,
task_name     IN VARCHAR2         := NULL,
description   IN VARCHAR2         := NULL,
con_name      IN VARCHAR2         := NULL,
dbid         IN NUMBER           := NULL)
RETURN VARCHAR2;

```

Parameters

Table 184-41 SCHEDULE_TUNING_TASK Function Parameters

Parameter	Description
begin_snap	The beginning snapshot identifier. The range is exclusive, which means that SQL statements in this snapshot ID are not included.
end_snap	The end snapshot identifier. The range is inclusive, which means that SQL statements in this snapshot ID are included.
sql_id	The SQL ID of the statement to be tuned.
plan_hash_value	The plan hash value of the statement to be tuned. For example, the tuning job fetches captured binds for this SQL plan.
start_date	The date on which the schedule becomes valid. If null, then SQL Tuning Advisor immediately executes the task.
scope	The scope of the tuning job: limited, or comprehensive.
time_limit	The maximum duration in seconds for the SQL tuning session.
task_name	Optional SQL tuning task name.
description	Description of the SQL tuning session. The description can contain a maximum of 256 characters.
con_name	The container from which SQL Tuning Advisor accesses the SQL statement information.
dbid	DBID for imported or PDB-level AWR data. If NULL, then the current database DBID is used.

Security Model

The caller must possess the `CREATE JOB` privilege for the job.

Return Values

A SQL tuning task name that is unique for each user. Multiple users can assign the same name to their advisor tasks.

Usage Notes

- The task is scheduled only once.
- The name of the scheduler job is created as follows:
`sqltune_job_taskid_orahash(systemtimestamp)`.

184.5.36 SCRIPT_TUNING_TASK Function

This function creates a SQL*Plus script which can then be executed to implement a set of SQL Tuning Advisor recommendations.



See Also:

[DBMS_SQLTUNE SQL Tuning Advisor Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.SCRIPT_TUNING_TASK (
  task_name          IN VARCHAR2,
  rec_type           IN VARCHAR2  := REC_TYPE_ALL,
  object_id          IN NUMBER    := NULL,
  result_limit       IN NUMBER    := NULL,
  owner_name         IN VARCHAR2  := NULL,
  execution_name     IN VARCHAR2  := NULL,
  database_link_to   IN VARCHAR2  := NULL)
RETURN CLOB;
```

Parameters

Table 184-42 SCRIPT_TUNING_TASK Function Parameters

Parameter	Description
task_name	Name of the tuning task for which to apply a script.
rec_type	Filter the script by types of recommendations to include. You can use any subset of the following values, separated by commas: 'ALL:' 'PROFILES' 'STATISTICS' 'INDEXES'. For example, a script with profiles and statistics would use the filter 'PROFILES, STATISTICS'.
object_id	Optionally filters by a single object ID.
result_limit	Optionally shows commands for only top <i>n</i> SQL (ordered by object_id and ignored if an object_id is also specified).
owner_name	Owner of the relevant tuning task. Defaults to the current schema owner.
excution_name	Name of the task execution to use. If NULL, the script is generated for the last task execution.

Table 184-42 (Cont.) SCRIPT_TUNING_TASK Function Parameters

Parameter	Description
database_link_to	<p>Name of a database link that exists on a standby database. The link specifies the connection to a primary database. By default, the value is null, which means that the SQL Tuning Advisor session is local.</p> <p>Use DBMS_SQLTUNE to tune high-load SQL statements running on a standby database in an Active Data Guard scenario. When you execute REPORT_TUNING_TASK locally on the standby database, the function uses the database link to obtain the data from the primary database, and then constructs it locally on the standby database.</p> <p>The database_link_to parameter must specify a private database link. This link must be owned by SYS and accessed by the default privileged user SYS\$UMF. The following sample statement creates a link named lnk_to_pri:</p> <pre>CREATE DATABASE LINK lnk_to_pri CONNECT TO SYS\$UMF IDENTIFIED BY password USING 'inst1';</pre>

Return Values

Returns a script in the form of a CLOB.

Usage Notes

- After the script is returned, check it before executing it.
- Wrap with a call to DBMS_ADVISOR.CREATE_FILE to put it into a file.

Examples

```
SET LINESIZE 140

-- Get a script for all actions recommended by the task.
SELECT DBMS_SQLTUNE.SCRIPT_TUNING_TASK(:stmt_task) FROM DUAL;

-- Get a script of only the sql profiles we should create.
SELECT DBMS_SQLTUNE.SCRIPT_TUNING_TASK(:stmt_task, 'PROFILES') FROM DUAL;

-- Get a script of only stale / missing stats
SELECT DBMS_SQLTUNE.SCRIPT_TUNING_TASK(:stmt_task, 'STATISTICS') FROM DUAL;

-- Get a script with recommendations about only one SQL statement when we
have
-- tuned an entire STS.
SELECT DBMS_SQLTUNE.SCRIPT_TUNING_TASK(:sts_task, 'ALL', 5) FROM DUAL;
```

184.5.37 SELECT_CURSOR_CACHE Function

This function collects SQL statements from the shared SQL area.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.SELECT_CURSOR_CACHE (
  basic_filter      IN   VARCHAR2 := NULL,
  object_filter    IN   VARCHAR2 := NULL,
  ranking_measure1 IN   VARCHAR2 := NULL,
  ranking_measure2 IN   VARCHAR2 := NULL,
  ranking_measure3 IN   VARCHAR2 := NULL,
  result_percentage IN  NUMBER   := 1,
  result_limit     IN   NUMBER   := NULL,
  attribute_list   IN   VARCHAR2 := NULL,
  recursive_sql    IN   VARCHAR2 := HAS_RECURSIVE_SQL)
RETURN sys.sqlset PIPELINED;
```

Parameters

Table 184-43 SELECT_CURSOR_CACHE Function Parameters

Parameter	Description
<code>basic_filter</code>	Specifies the SQL predicate that filters the SQL from the shared SQL area defined on attributes of the <code>SQLSET_ROW</code> . If <code>basic_filter</code> is not set by the caller, then the subprogram captures only statements of the type <code>CREATE TABLE</code> , <code>INSERT</code> , <code>SELECT</code> , <code>UPDATE</code> , <code>DELETE</code> , and <code>MERGE</code> .
<code>object_filter</code>	Currently not supported.
<code>ranking_measure(n)</code>	Defines an <code>ORDER BY</code> clause on the selected SQL.
<code>result_percentage</code>	Specifies a filter that picks the top <i>n</i> % according to the supplied ranking measure. The value applies only if one ranking measure is supplied.
<code>result_limit</code>	Defines the top limit SQL from the filtered source ranked by the ranking measure.

Table 184-43 (Cont.) SELECT_CURSOR_CACHE Function Parameters

Parameter	Description
<code>attribute_list</code>	<p>Specifies the list of SQL statement attributes to return in the result.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> • <code>TYPICAL</code> — Specifies <code>BASIC</code> plus SQL plan (without row source statistics) and without object reference list (default). • <code>BASIC</code> — Specifies all attributes (such as execution statistics and binds) except the plans. The execution context is always part of the result. • <code>ALL</code> — Specifies all attributes. • Comma-separated list of attribute names. <p>This values returns only a subset of SQL attributes:</p> <ul style="list-style-type: none"> – <code>EXECUTION_STATISTICS</code> – <code>BIND_LIST</code> – <code>OBJECT_LIST</code> – <code>SQL_PLAN</code> – <code>SQL_PLAN_STATISTICS</code> — Similar to <code>SQL_PLAN</code> plus row source statistics
<code>recursive_sql</code>	<p>Specifies that the filter must include recursive SQL in the SQL tuning set (<code>HAS_RECURSIVE_SQL</code>, which is the default) or exclude it (<code>NO_RECURSIVE_SQL</code>).</p>

Return Values

This function returns a one `SQLSET_ROW` per `SQL_ID` or `PLAN_HASH_VALUE` pair found in each data source.

Usage Notes

- Filters provided to this function are evaluated as part of a SQL run by the current user. As such, they are executed with that user's security privileges and can contain any constructs and subqueries that user can access, but no more.
- Users need privileges on the shared SQL area views.

Examples

```
-- Get sql ids and sql text for statements with 500 buffer gets.
SELECT sql_id, sql_text
FROM table(DBMS_SQLTUNE.SELECT_CURSOR_CACHE('buffer_gets > 500'))
ORDER BY sql_id;

-- Get all the information we have about a particular statement.
SELECT *
FROM table(DBMS_SQLTUNE.SELECT_CURSOR_CACHE('sql_id = ''4rm4183czbs7j''));

-- Notice that some statements can have multiple plans. The output of the
-- SELECT_XXX table functions is unique by (sql_id, plan_hash_value). This
-- is
-- because a data source can store multiple plans per sql statement.
SELECT sql_id, plan_hash_value
FROM table(dbms_sqltune.select_cursor_cache('sql_id = ''ay1m3ssvtrh24''))
```

```

ORDER BY sql_id, plan_hash_value;

-- PL/SQL examples: load_sqlset is called after opening a cursor,
along the
-- lines given below

-- Select all statements in the shared SQL area.
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
    SELECT value(P)
    FROM table(DBMS_SQLTUNE.SELECT_CURSOR_CACHE) P;

  -- Process each statement (or pass cursor to load_sqlset).

  CLOSE cur;
END;/

-- Look for statements not parsed by SYS.
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur for
    SELECT VALUE(P)
    FROM table(
      DBMS_SQLTUNE.SELECT_CURSOR_CACHE('parsing_schema_name <>
''SYS''')) P;

  -- Process each statement (or pass cursor to load_sqlset).

  CLOSE cur;
end;/

-- All statements from a particular module/action.
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
    SELECT VALUE(P)
    FROM table(
      DBMS_SQLTUNE.SELECT_CURSOR_CACHE(
        'module = ''MY_APPLICATION'' and action = ''MY_ACTION''')) P;

  -- Process each statement (or pass cursor to load_sqlset)

  CLOSE cur;
END;/

-- all statements that ran for at least five seconds
DECLARE
  cur sys_refcursor;

```

```
BEGIN
  OPEN cur FOR
    SELECT VALUE(P)
      FROM table(DBMS_SQLTUNE.SELECT_CURSOR_CACHE('elapsed_time > 5000000')) P;

  -- Process each statement (or pass cursor to load_sqlset)

  CLOSE cur;
end;/

-- select all statements that pass a simple buffer_gets threshold and
-- are coming from an APPS user
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
    SELECT VALUE(P)
      FROM table(
        DBMS_SQLTUNE.SELECT_CURSOR_CACHE(
          'buffer_gets > 100 and parsing_schema_name = ''APPS'''))P;

  -- Process each statement (or pass cursor to load_sqlset)

  CLOSE cur;
end;/

-- select all statements exceeding 5 seconds in elapsed time, but also
-- select the plans (by default we only select execution stats and binds
-- for performance reasons - in this case the SQL_PLAN attribute of
sqlset_row
-- is NULL)
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
    SELECT VALUE(P)
      FROM table(dbms_sqltune.select_cursor_cache(
        'elapsed_time > 5000000', NULL, NULL, NULL, NULL, 1, NULL,
        'EXECUTION_STATISTICS, SQL_BINDS, SQL_PLAN')) P;

  -- Process each statement (or pass cursor to load_sqlset)

  CLOSE cur;
END;/

-- Select the top 100 statements in the shared SQL area ordering by
elapsed_time.
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
    SELECT VALUE(P)
```

```

        FROM table(DBMS_SQLTUNE.SELECT_CURSOR_CACHE(NULL,
                                                    NULL,
                                                    'ELAPSED_TIME', NULL,
NULL,
                                                    1,
                                                    100)) P;

-- Process each statement (or pass cursor to load_sqlset)

CLOSE cur;
end;/

-- Select the set of statements which cumulatively account for 90% of
the
-- buffer gets in the shared SQL area. This means that the buffer
gets of all
-- of these statements added up is approximately 90% of the sum of all
-- statements currently in the cache.
DECLARE
    cur sys_refcursor;
BEGIN
    OPEN cur FOR
        SELECT VALUE(P)
        FROM table(DBMS_SQLTUNE.SELECT_CURSOR_CACHE(NULL,
                                                    NULL,
                                                    'BUFFER_GETS', NULL,
NULL,
                                                    .9)) P;

-- Process each statement (or pass cursor to load_sqlset).

CLOSE cur;
END;
/

```

184.5.38 SELECT_SQL_TRACE Function

This table function reads the content of one or more trace files and returns the SQL statements it finds in the format of `sqlset_row`.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```

DBMS_SQLTUNE.SELECT_SQL_TRACE (
    directory          IN VARCHAR2,
    file_name         IN VARCHAR2 := NULL,

```



```

mapping_table_name      IN VARCHAR2 := NULL,
mapping_table_owner     IN VARCHAR2 := NULL, ,
select_mode             IN POSITIVE := SINGLE_EXECUTION,
options                 IN BINARY_INTEGER := LIMITED_COMMAND_TYPE,
pattern_start          IN VARCHAR2 := NULL,
pattern_end             IN VARCHAR2 := NULL,
result_limit           IN POSITIVE := NULL)
RETURN sys.sqlset PIPELINED;

```

Parameters

Table 184-44 SELECT_SQL_TRACE Function Parameters

Parameter	Description
directory	Defines the directory object containing the trace files. This field is mandatory.
file_name	Specifies all or part of the name of the trace files. If NULL, then the function uses the current or most recent file in the specified location or path. '%' wildcards are supported for matching trace file names.
mapping_table_name	Specifies the mapping table name. Note that the mapping table name is case insensitive. If the mapping table name is NULL, then the function uses the mappings in the current database.
mapping_table_owner	Specifies the mapping table owner. If it is NULL, then the function uses the current user.
select_mode	Specifies the mode for selecting SQL from the trace. Possible values are: <ul style="list-style-type: none"> SINGLE_EXECUTION — Returns one execution of a SQL. This is the default. ALL_EXECUTIONS — Returns all executions.
options	Specifies which types of SQL statements are returned. <ul style="list-style-type: none"> LIMITED_COMMAND_TYPE — Returns the SQL statements with the command types CREATE, INSERT, SELECT, UPDATE, DELETE, and MERGE. This value is the default. ALL_COMMAND_TYPE — Returns the SQL statements with all command types.
pattern_start	Specifies the delimiting pattern of the trace file sections to consider. CURRENTLY INOPERABLE.
pattern_end	Specifies the closing delimiting pattern of the trace file sections to process. CURRENTLY INOPERABLE.
result_limit	Specifies the top SQL from the filtered source. Default to MAXSB4 if NULL.

Return Values

This function returns a `SQLSET_ROW` object.

Usage Notes

The ability to create a directory object for the system directory creates a potential security issue. For example, in a CDB, all containers write trace files to the same directory. A local user with `SELECT` privileges on this directory can read the contents of trace files belonging to any container.

To prevent this type of unauthorized access, copy the files from the default SQL trace directory into a different directory, and then create a directory object. Use the `PATH_PREFIX` clause of the `CREATE PLUGGABLE DATABASE` statement to ensure that all directory object paths associated with the PDB are restricted to the specified directory or its subdirectories.

Examples

The following code shows how to enable SQL trace for a few SQL statements and load the results into a SQL tuning set:

```
-- turn on the SQL trace in the capture database
ALTER SESSION SET EVENTS '10046 TRACE NAME CONTEXT FOREVER, LEVEL 4'

-- run sql statements
SELECT 1 FROM DUAL;
SELECT COUNT(*) FROM dba_tables WHERE table_name = :mytab;

ALTER SESSION SET EVENTS '10046 TRACE NAME CONTEXT OFF';

-- create mapping table from the capture database
CREATE TABLE mapping AS
SELECT object_id id, owner, substr(object_name, 1, 30) name
   FROM dba_objects
   WHERE object_type NOT IN ('CONSUMER GROUP', 'EVALUATION CONTEXT',
                             'FUNCTION', 'INDEXTYPE', 'JAVA CLASS',
                             'JAVA DATA', 'JAVA RESOURCE', 'LIBRARY',
                             'LOB', 'OPERATOR', 'PACKAGE',
                             'PACKAGE BODY', 'PROCEDURE', 'QUEUE',
                             'RESOURCE PLAN', 'TRIGGER', 'TYPE',
                             'TYPE BODY')

UNION ALL
SELECT user_id id, username owner, NULL name
   FROM dba_users;

-- create the directory object where the SQL traces are stored
CREATE DIRECTORY SQL_TRACE_DIR as '/home/foo/trace';

-- create the STS
EXEC DBMS_SQLTUNE.CREATE_SQLSET('my_sts', 'test purpose');

-- load the SQL statements into STS from SQL TRACE
DECLARE
   cur sys_refcursor;
BEGIN
   OPEN cur FOR
   SELECT value(p)
      FROM TABLE(
         DBMS_SQLTUNE.SELECT_SQL_TRACE(
            directory=>'SQL_TRACE_DIR',
            file_name=>'%trc',
            mapping_table_name=>'mapping')) p;
   DBMS_SQLTUNE.LOAD_SQLSET('my_sts', cur);
   CLOSE cur;
```

```
END;
/
```

 **See Also:**

Oracle Database SQL Language Reference to learn more about the `PATH_PREFIX` clause

184.5.39 SELECT_SQLPA_TASK Function

This function collects SQL statements from a SQL Performance Analyzer comparison task.

 **See Also:**

- [DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group
- *Oracle Database Testing Guide* for a `SELECT_SQLPA_TASK` example

Syntax

```
DBMS_SQLTUNE.SELECT_SQLPA_TASK (
  task_name          IN VARCHAR2,
  task_owner         IN VARCHAR2 := NULL,
  execution_name     IN VARCHAR2 := NULL,
  level_filter       IN VARCHAR2 := 'REGRESSED',
  basic_filter       IN VARCHAR2 := NULL,
  object_filter      IN VARCHAR2 := NULL,
  attribute_list     IN VARCHAR2 := 'TYPICAL')
RETURN sys.sqlset PIPELINED;
```

Parameters

Table 184-45 SELECT_SQLPA_TASK Function Parameters

Parameter	Description
<code>task_name</code>	Specifies the name of the SQL Performance Analyzer task.
<code>task_owner</code>	Specifies the owner of the SQL Performance Analyzer task. If <code>NULL</code> , then assume the current user.
<code>execution_name</code>	Specifies the name of the SQL Performance Analyzer task execution (type <code>COMPARE PERFORMANCE</code>) from which the provided filters will be applied. If <code>NULL</code> , then assume the most recent <code>COMPARE PERFORMANCE</code> execution.

Table 184-45 (Cont.) SELECT_SQLPA_TASK Function Parameters

Parameter	Description
level_filter	<p>Specifies which subset of SQL statements to include. Same format as DBMS_SQLPA.REPORT_ANALYSIS_TASK.LEVEL, with some possible strings removed.</p> <ul style="list-style-type: none"> IMPROVED includes only improved SQL. REGRESSED includes only regressed SQL (default). CHANGED includes only SQL with changed performance. UNCHANGED includes only SQL with unchanged performance. CHANGED_PLANS includes only SQL with plan changes. UNCHANGED_PLANS includes only SQL with unchanged plans. ERRORS includes only SQL with errors only. MISSING_SQL includes only missing SQL statements (across STS). NEW_SQL includes only new SQL statements (across STS).
basic filter	Specifies the SQL predicate to filter the SQL in addition to the level filters.
object_filter	Currently not supported.
attribute_list	<p>Defines the SQL statement attributes to return in the result.</p> <p>Possible values are:</p> <ul style="list-style-type: none"> TYPICAL — Returns BASIC plus the SQL plan (without row source statistics) and without an object reference list. This is the default. BASIC — Returns all attributes (such as execution statistics and binds) except the plans. The execution context is always part of the result. ALL — Returns all attributes. Comma-separated list of attribute names this allows to return only a subset of SQL attributes: EXECUTION_STATISTICS, SQL_BINDS, SQL_PLAN_STATISTICS (similar to SQL_PLAN + row source statistics).

Return Values

This function returns a SQL tuning set object.

Usage Notes

For example, you can use this function to create a SQL tuning set containing the subset of SQL statements that regressed during a SQL Performance Analyzer (SPA) experiment. You can also specify other arbitrary filters.

184.5.40 SELECT_SQLSET Function

This is a table function that reads the contents of a SQL tuning set.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.SELECT_SQLSET (
  sqlset_name      IN  VARCHAR2,
  basic_filter     IN  VARCHAR2 := NULL,
  object_filter    IN  VARCHAR2 := NULL,
  ranking_measure1 IN  VARCHAR2 := NULL,
  ranking_measure2 IN  VARCHAR2 := NULL,
  ranking_measure3 IN  VARCHAR2 := NULL,
  result_percentage IN NUMBER := 1,
  result_limit     IN  NUMBER := NULL)
attribute_list    IN  VARCHAR2 := NULL,
plan_filter       IN  VARCHAR2 := NULL,
sqlset_owner      IN  VARCHAR2 := NULL,
recursive_sql     IN  VARCHAR2 := HAS_RECURSIVE_SQL)
RETURN sys.sqlset PIPELINED;
```

Parameters

Table 184-46 SELECT_SQLSET Function Parameters

Parameter	Description
sqlset_name	Specifies the name of the SQL tuning set to query.
basic_filter	Specifies the SQL predicate to filter the SQL from the SQL tuning set defined on attributes of the SQLSET_ROW.
object_filter	Currently not supported.
ranking_measure(n)	Specifies an ORDER BY clause on the selected SQL.
result_percentage	Specifies a filter that picks the top <i>n</i> % according to the supplied ranking measure. Note that this parameter applies only if one ranking measure is supplied.
result_limit	The top limit SQL from the filtered source, ranked by the ranking measure.
attribute_list	Defines the SQL statement attributes to return in the result. The possible values are: <ul style="list-style-type: none"> • BASIC — Returns all attributes (such as execution statistics and binds) except the plans. The execution context is included in the result. • TYPICAL — Returns BASIC plus the SQL plan, but without row source statistics and without the object reference list. This is the default. • ALL — Returns all attributes. • Comma-separated list of attribute names. This value enables the function to return only a subset of SQL attributes: <ul style="list-style-type: none"> – EXECUTION_STATISTICS – SQL_BINDS – SQL_PLAN_STATISTICS (similar to SQL_PLAN plus row source statistics)

Table 184-46 (Cont.) SELECT_SQLSET Function Parameters

Parameter	Description
<code>plan_filter</code>	<p>Specifies the plan filter.</p> <p>This parameter enables you to select a single plan when a statement has multiple plans. Possible values are:</p> <ul style="list-style-type: none"> • <code>LAST_GENERATED</code> — Returns the plan with the most recent timestamp. • <code>FIRST_GENERATED</code> — Returns the plan with the least recent timestamp. • <code>LAST_LOADED</code> — Returns the plan with the most recent <code>FIRST_LOAD_TIME</code> statistical information. • <code>FIRST_LOADED</code> — Returns the plan with the least recent <code>FIRST_LOAD_TIME</code> statistical information. • <code>MAX_ELAPSED TIME</code> — Returns the plan with the maximum elapsed time. • <code>MAX_BUFFER_GETS</code> — Returns the plan with the maximum buffer gets. • <code>MAX_DISK_READS</code> — Returns the plan with the maximum disk reads. • <code>MAX_DIRECT_WRITES</code> — Returns the plan with the maximum direct writes. • <code>MAX_OPTIMIZER_COST</code> — Returns the plan with the maximum optimizer cost value.
<code>sqlset_owner</code>	Specifies the owner of the SQL tuning set, or <code>NULL</code> for the current schema owner.
<code>recursive_sql</code>	Specifies that the filter must include recursive SQL in the SQL tuning set (<code>HAS_RECURSIVE_SQL</code> , which is the default) or exclude it (<code>NO_RECURSIVE_SQL</code>).

Return Values

This function returns one `SQLSET_ROW` per `SQL_ID` or `PLAN_HASH_VALUE` pair found in each data source.

Usage Notes

Filters provided to this function are evaluated as part of a SQL run by the current user. As such, they are executed with that user's security privileges and can contain any constructs and subqueries that user can access, but no more.

Examples

```
-- select from a sql tuning set
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
    SELECT VALUE (P)
      FROM table(dbms_sqltune.select_sqlset('my_workload')) P;

  -- Process each statement (or pass cursor to load_sqlset)

  CLOSE cur;
END;
/
```

184.5.41 SELECT_WORKLOAD_REPOSITORY Function

This function collects SQL statements from the workload repository.

The overloaded forms enable you to collect SQL statements from the following sources:

- Snapshots between `begin_snap` and `end_snap`
- A workload repository baseline

Syntax

```
DBMS_SQLTUNE.SELECT_WORKLOAD_REPOSITORY (
  begin_snap      IN NUMBER,
  end_snap        IN NUMBER,
  basic_filter     IN VARCHAR2 := NULL,
  object_filter   IN VARCHAR2 := NULL,
  ranking_measure1 IN VARCHAR2 := NULL,
  ranking_measure2 IN VARCHAR2 := NULL,
  ranking_measure3 IN VARCHAR2 := NULL,
  result_percentage IN NUMBER := 1,
  result_limit     IN NUMBER := NULL,
  attribute_list  IN VARCHAR2 := NULL,
  recursive_sql   IN VARCHAR2 := HAS_RECURSIVE_SQL,
  dbid            IN NUMBER := NULL)
RETURN sys.sqlset PIPELINED;
```

```
DBMS_SQLTUNE.SELECT_WORKLOAD_REPOSITORY (
  baseline_name   IN VARCHAR2,
  basic_filter     IN VARCHAR2 := NULL,
  object_filter   IN VARCHAR2 := NULL,
  ranking_measure1 IN VARCHAR2 := NULL,
  ranking_measure2 IN VARCHAR2 := NULL,
  ranking_measure3 IN VARCHAR2 := NULL,
  result_percentage IN NUMBER := 1,
  result_limit     IN NUMBER := NULL,
  attribute_list  IN VARCHAR2 := NULL,
  recursive_sql   IN VARCHAR2 := HAS_RECURSIVE_SQL,
  dbid            IN NUMBER := NULL)
RETURN sys.sqlset PIPELINED;
```

Parameters

Table 184-47 SELECT_WORKLOAD_REPOSITORY Function Parameters

Parameter	Description
<code>begin_snap</code>	Defines the beginning AWR snapshot (non-inclusive).
<code>end_snap</code>	Defines the ending AWR snapshot (inclusive).
<code>baseline_name</code>	Specifies the name of the AWR baseline period.

Table 184-47 (Cont.) SELECT_WORKLOAD_REPOSITORY Function Parameters

Parameter	Description
<code>basic_filter</code>	Specifies the SQL predicate to filter the SQL from the workload repository. The filter is defined on attributes of the <code>SQLSET_ROW</code> . If <code>basic_filter</code> is not set by the caller, then the subprogram captures only statements of type <code>CREATE TABLE</code> , <code>INSERT</code> , <code>SELECT</code> , <code>UPDATE</code> , <code>DELETE</code> , and <code>MERGE</code> .
<code>object_filter</code>	Currently not supported.
<code>ranking_measure(n)</code>	Defines an <code>ORDER BY</code> clause on the selected SQL.
<code>result_percentage</code>	Specifies a filter that picks the top <i>n</i> % according to the supplied ranking measure. Note that this percentage applies only if one ranking measure is given.
<code>result_limit</code>	Specifies the top limit SQL from the source according to the supplied ranking measure.
<code>attribute_list</code>	Specifies the SQL statement attributes to return in the result. The possible values are: <ul style="list-style-type: none"> <code>TYPICAL</code> — Returns <code>BASIC</code> plus SQL plan (without row source statistics) and without object reference list. This is the default. <code>BASIC</code> — Returns all attributes (such as execution statistics and binds) are returned except the plans. The execution context is always part of the result. <code>ALL</code> — Returns all attributes Comma-separated list of attribute names this allows to return only a subset of SQL attributes: <code>EXECUTION_STATISTICS</code>, <code>SQL_BINDS</code>, <code>SQL_PLAN_STATISTICS</code> (similar to <code>SQL_PLAN</code> plus row source statistics).
<code>recursive_sql</code>	Specifies the filter that includes recursive SQL in the SQL tuning set (<code>HAS_RECURSIVE_SQL</code>) or excludes it (<code>NO_RECURSIVE_SQL</code>).
<code>dbid</code>	Specifies the DBID for imported or PDB-level AWR data. If <code>NULL</code> , then the function uses the current database DBID.

Return Values

This function returns one `SQLSET_ROW` per `SQL_ID` or `PLAN_HASH_VALUE` pair found in each data source.

Usage Notes

Filters provided to this function are evaluated as part of a SQL run by the current user. As such, they are executed with that user's security privileges and can contain any constructs and subqueries that user can access, but no more.

Examples

```
-- select statements from snapshots 1-2
DECLARE
  cur sys_refcursor;
BEGIN
  OPEN cur FOR
    SELECT VALUE (P)
```



```

        FROM table(dbms_sqltune.select_workload_repository(1,2)) P;

    -- Process each statement (or pass cursor to load_sqlset)

    CLOSE cur;
END;
/

```

184.5.42 SET_TUNING_TASK_PARAMETER Procedures

This procedure updates the value of a SQL tuning parameter of type `VARCHAR2` or `NUMBER`.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```

DBMS_SQLTUNE.SET_TUNING_TASK_PARAMETER (
    task_name          IN  VARCHAR2,
    parameter          IN  VARCHAR2,
    value              IN  VARCHAR2,
    database_link_to  IN  VARCHAR2);

```

```

DBMS_SQLTUNE.SET_TUNING_TASK_PARAMETER (
    task_name          IN  VARCHAR2,
    parameter          IN  VARCHAR2,
    value              IN  NUMBER,
    database_link_to  IN  VARCHAR2);
);

```

Parameters

Table 184-48 SET_TUNING_TASK_PARAMETER Procedure Parameters

Parameter	Description
task_name	Identifier of the task to execute

Table 184-48 (Cont.) SET_TUNING_TASK_PARAMETER Procedure Parameters

Parameter	Description
parameter	<p>Name of the parameter to set. The possible tuning parameters that can be set by this procedure using the parameter in the form VARCHAR2:</p> <ul style="list-style-type: none"> • APPLY_CAPTURED_COMPILEENV: indicates whether the advisor could use the compilation environment captured with the SQL statements. The default is 0 (that is, NO). • BASIC_FILTER: basic filter for SQL tuning set • DAYS_TO_EXPIRE: number of days until the task is deleted • DEFAULT_EXECUTION_TYPE: the task defaults to this type of execution when none is specified by the EXECUTE_TUNING_TASK Function and Procedure • EXECUTION_DAYS_TO_EXPIRE: number of days until the tasks's executions is deleted (without deleting the task) • LOCAL_TIME_LIMIT: per-statement time out (seconds) • MODE: tuning scope (comprehensive, limited) • OBJECT_FILTER: object filter for SQL tuning set • PLAN_FILTER: plan filter for SQL tuning set (see SELECT_SQLSET for possible values) • RANK_MEASURE1: first ranking measure for SQL tuning set • RANK_MEASURE2: second possible ranking measure for SQL tuning set • RANK_MEASURE3: third possible ranking measure for SQL tuning set • RESUME_FILTER: a extra filter for SQL tuning sets besides BASIC_FILTER • SQL_LIMIT: maximum number of SQL statements to tune • SQL_PERCENTAGE: percentage filter of SQL tuning set statements • TEST_EXECUTE: FULL/AUTO/OFF. <ul style="list-style-type: none"> * FULL - test-execute for as much time as necessary, up to the local time limit for the SQL (or the global task time limit if no SQL time limit is set) * AUTO - test-execute for an automatically-chosen time proportional to the tuning time * OFF - do not test-execute • TIME_LIMIT: global time out (seconds) • USERNAME: username under which the statement is parsed
value	New value of the specified parameter

Table 184-48 (Cont.) SET_TUNING_TASK_PARAMETER Procedure Parameters

Parameter	Description
database_link_to	<p>Name of a database link that exists on a standby database.</p> <p>The link specifies the connection to a primary database. By default, the value is null, which means that the SQL Tuning Advisor session is local.</p> <p>Use DBMS_SQLTUNE to tune high-load SQL statements running on a standby database in an Active Data Guard scenario. When you execute REPORT_TUNING_TASK locally on the standby database, the function uses the database link to obtain the data from the primary database, and then constructs it locally on the standby database.</p> <p>The database_link_to parameter must specify a private database link. This link must be owned by SYS and accessed by the default privileged user SYS\$UMF. The following sample statement creates a link named lnk_to_pri:</p> <pre>CREATE DATABASE LINK lnk_to_pri CONNECT TO SYS\$UMF IDENTIFIED BY password USING 'inst1';</pre>

Usage Notes

When setting automatic tuning task parameters, use the [SET_AUTO_TUNING_TASK_PARAMETER Procedures](#) in the [DBMS_AUTO_SQLTUNE](#) package.

184.5.43 SQLTEXT_TO_SIGNATURE Function

This function returns a SQL text's signature. The signature can be used to identify SQL text in dba_sql_profiles.

**See Also:**

[DBMS_SQLTUNE SQL Profile Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.SQLTEXT_TO_SIGNATURE (
  sql_text      IN CLOB,
  force_match  IN BOOLEAN := FALSE)
RETURN NUMBER;
```

Parameters

Table 184-49 SQLTEXT_TO_SIGNATURE Function Parameters

Parameter	Description
sql_text	SQL text whose signature is required. Required.
force_match	If TRUE, this returns a signature that supports SQL matching with literal values transformed into bind variables. If FALSE, returns the signature based on the text with literals not transformed

Return Values

This function returns the signature of the specified SQL text.

184.5.44 UNPACK_STGTAB_SQLPROF Procedure

This procedure copies profile data stored in the staging table to create profiles on the system.



See Also:

[DBMS_SQLTUNE SQL Profile Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.UNPACK_STGTAB_SQLPROF (
  profile_name          IN VARCHAR2 := '%',
  profile_category     IN VARCHAR2 := 'DEFAULT',
  replace              IN BOOLEAN,
  staging_table_name    IN VARCHAR2,
  staging_schema_owner IN VARCHAR2 := NULL);
```

Parameters

Table 184-50 UNPACK_STGTAB_SQLPROF Procedure Parameters

Parameter	Description
profile_name	The name of the profile to unpack (% wildcards acceptable, case-sensitive)
profile_category	The category from which to unpack profiles (% wildcards acceptable, case-sensitive)
replace	The option to replace profiles if they already exist. Note that profiles cannot be replaced if one in the staging table has the same name as an active profile in a different SQL statement. If FALSE, this function raises errors if you try to create a profile that already exists
staging_table_name	The name of the table on which to perform the remap operation (case-insensitive unless double quoted). Required.

Table 184-50 (Cont.) UNPACK_STGTAB_SQLPROF Procedure Parameters

Parameter	Description
staging_schem a_owner	The schema where the table resides, or NULL for current schema (case-insensitive unless double quoted)

Usage Notes

Using this procedure requires the `CREATE ANY SQL PROFILE` privilege and the `SELECT` privilege on staging table.

Examples

```
-- Unpack all profiles stored in a staging table.
BEGIN
  DBMS_SQLTUNE.UNPACK_STGTAB_SQLPROF(
    replace           => FALSE
  ,   staging_table_name => 'PROFILE_STGTAB');
END;

-- If there is a failure during the unpack operation, you can find the
-- profile
-- that caused the error and perform a remap_stgtab_sqlprof operation
-- targeting it.
-- You can resume the unpack operation by setting replace to TRUE so that
-- the profiles that were already created are replaced.
BEGIN
  DBMS_SQLTUNE.UNPACK_STGTAB_SQLPROF(
    replace           => TRUE
  ,   staging_table_name => 'PROFILE_STGTAB');
END;
```

184.5.45 UNPACK_STGTAB_SQLSET Procedure

This procedure copies one or more SQL tuning sets from their location in the staging table into the SQL tuning sets schema, making them proper SQL tuning sets.

**See Also:**

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.UNPACK_STGTAB_SQLSET (
  sqlset_name      IN VARCHAR2 := '%',
  sqlset_owner     IN VARCHAR2 := NULL,
  replace          IN BOOLEAN,
```

```
staging_table_name IN VARCHAR2,  
staging_schema_owner IN VARCHAR2 := NULL);
```

Parameters

The parameters are identical for DBMS_SQLTUNE.UNPACK_STGTAB_SQLSET and DBMS_SQLSET.UNPACK_STGTAB.

Table 184-51 UNPACK_STGTAB_SQLSET and UNPACK_STGTAB Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of the tuning set to unpack (not null). Wildcard characters (%) are supported to unpack multiple tuning sets in a single call. For example, specify % to unpack all tuning sets from the staging table.
sqlset_owner	Specifies the name of tuning set owner, or NULL for the current schema owner. Wildcard characters (%) are supported.
replace	Specifies whether to replace an existing SQL tuning set. If FALSE, then this procedure raises errors when you try to create a tuning set that already exists.
staging_table_name	Specifies the name of the staging table, moved after a call to the DBMS_SQLTUNE.PACK_STGTAB_SQLSET or DBMS_SQLSET.PACK_STGTAB procedure (case-sensitive).
staging_schema_owner	Specifies the name of staging table owner, or NULL for the current schema owner (case-sensitive).

Examples

```
-- unpack all STS in the staging table  
EXEC DBMS_SQLTUNE.UNPACK_STGTAB_SQLSET(sqlset_name      => '%', -  
                                       sqlset_owner    => '%', -  
                                       replace          => FALSE, -  
                                       staging_table_name =>  
'STGTAB_SQLSET');  
  
-- errors can arise during STS unpack when a STS in the staging table  
-- has the  
-- same name/owner as STS on the system. In this case, users should  
-- call  
-- remap_stgtab_sqlset to patch the staging table and with which to  
-- call unpack  
-- Replace set to TRUE.  
EXEC DBMS_SQLTUNE.UNPACK_STGTAB_SQLSET(sqlset_name      => '%', -  
                                       sqlset_owner    => '%', -  
                                       replace          => TRUE, -  
                                       staging_table_name =>  
'STGTAB_SQLSET');
```

184.5.46 UPDATE_SQLSET Procedures

This overloaded procedure updates selected fields for SQL statements in a SQL tuning set.



See Also:

[DBMS_SQLTUNE SQL Tuning Set Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_SQLTUNE.UPDATE_SQLSET (
  sqlset_name      IN  VARCHAR2,
  sql_id           IN  VARCHAR2,
  attribute_name   IN  VARCHAR2,
  attribute_value  IN  VARCHAR2 := NULL);
```

```
DBMS_SQLTUNE.UPDATE_SQLSET (
  sqlset_name      IN  VARCHAR2,
  sql_id           IN  VARCHAR2,
  attribute_name   IN  VARCHAR2,
  attribute_value  IN  NUMBER := NULL);
```

Parameters

Table 184-52 UPDATE_SQLSET Procedure Parameters

Parameter	Description
sqlset_name	Specifies the name of the SQL tuning set.
sql_id	Specifies the identifier of the SQL statement to be updated.
plan_hash value	Specifies the hash value of the execution plan for a SQL statement. Use this parameter when you want to update the attribute for a specific plan for a statement, but not all plans for the statement.
attribute_name	Specifies the name of the attribute to be modified. You can update the text field for MODULE, ACTION, PARSING_SCHEMA_NAME, and OTHER. The only numerical field that you can update is PRIORITY. If a statement has multiple plans, then the procedure changes the attribute value for all plans.
attribute_value	Specifies the new value of the attribute.

185

DBMS_STAT_FUNCS

The `DBMS_STAT_FUNCS` package provides statistical functions.

This chapter contains the following topic:

- [Summary of DBMS_STAT_FUNCS Subprograms](#)

185.1 Summary of DBMS_STAT_FUNCS Subprograms

This table lists and briefly describes the `DBMS_STAT_FUNCS` subprograms.

Table 185-1 DBMS_STAT_FUNCS Package Subprograms

Subprogram	Description
EXPONENTIAL_DIST_FIT Procedure	Tests how well a sample of values fits an exponential distribution
NORMAL_DIST_FIT Procedure	Tests how well a sample of values fits a normal distribution
POISSON_DIST_FIT Procedure	Tests how well a sample of values fits a Poisson distribution
SUMMARY Procedure	Summarizes a numerical column of a table
UNIFORM_DIST_FIT Procedure	Tests how well a sample of values fits a uniform distribution
WEIBULL_DIST_FIT Procedure	Tests how well a sample of values fits a Weibull distribution

185.1.1 EXPONENTIAL_DIST_FIT Procedure

This procedure tests how well a sample of values fits an exponential distribution.

Syntax

```
DBMS_STAT_FUNCS.EXPONENTIAL_DIST_FIT (  
  ownername      IN   VARCHAR2,  
  tablename      IN   VARCHAR2,  
  columnname     IN   VARCHAR2,  
  test_type      IN   VARCHAR2 DEFAULT 'KOLMOGOROV_SMIRNOV',  
  lambda         IN   NUMBER,  
  mu             IN   NUMBER,  
  sig            OUT  NUMBER);
```

Parameters

Table 185-2 EXPONENTIAL_DIST_FIT Procedure Parameters

Parameter	Description
<code>ownername</code>	The schema where the table resides.

Table 185-2 (Cont.) EXPONENTIAL_DIST_FIT Procedure Parameters

Parameter	Description
tablename	The table where the column resides.
columnname	The column of the table against which to run the test.
test_type	The type of test to use: 'CHI_SQUARED', 'KOLMOGOROV_SMIRNOV' or 'ANDERSON_DARLING'.
lambda	The scale parameter.
mu	The location parameter.
sig	The goodness of fit value, based on test type. A small value indicates a significant difference between the sample and the exponential distribution. A number close to 1 indicates a close match.

185.1.2 NORMAL_DIST_FIT Procedure

This procedure tests how well a sample of values fits a normal distribution.

Syntax

```
DBMS_STAT_FUNCS.NORMAL_DIST_FIT (
  ownername   IN   VARCHAR2,
  tablename   IN   VARCHAR2,
  columnname  IN   VARCHAR2,
  test_type   IN   VARCHAR2 DEFAULT 'SHAPIRO_WILKS',
  mean        IN   NUMBER,
  stdev       IN   NUMBER,
  sig         OUT  NUMBER);
```

Parameters

Table 185-3 NORMAL_DIST_FIT Procedure Parameters

Parameter	Description
ownername	The schema where the table resides.
tablename	The table where the column resides.
columnname	The column of the table against which to run the test.
test_type	The type of test to use: 'CHI_SQUARED', 'KOLMOGOROV_SMIRNOV', 'ANDERSON_DARLING' or 'SHAPIRO_WILKS'.
mean	The mean of the distribution against which to compare.
stdev	The standard deviation of the distribution against which to compare.
sig	The goodness of fit value, based on test type. A small value indicates a significant difference between the sample and the normal distribution. A number close to 1 indicates a close match.

185.1.3 POISSON_DIST_FIT Procedure

This procedure tests how well a sample of values fits a Poisson distribution.

Syntax

```
DBMS_STAT_FUNCS.POISSON_DIST_FIT (
  ownername   IN   VARCHAR2,
  tablename   IN   VARCHAR2,
  columnname  IN   VARCHAR2,
  test_type   IN   VARCHAR2 DEFAULT 'KOLMOGOROV_SMIRNOV',
  lambda      IN   NUMBER,
  sig         OUT  NUMBER);
```

Parameters

Table 185-4 POISSON_DIST_FIT Procedure Parameters

Parameter	Description
ownername	The schema where the table resides.
tablename	The table where the column resides.
columnname	The column of the table against which to run the test.
test_type	The type of test to use: 'KOLMOGOROV_SMIRNOV' or 'ANDERSON_DARLING'.
lambda	The lambda parameter is the shape parameter.
sig	The goodness of fit value, based on test type. A small value indicates a significant difference between the sample and the Poisson distribution. A number close to 1 indicates a close match.

185.1.4 SUMMARY Procedure

This procedure summarizes the numerical column specified in the `columnname` of `tablename`.

The summary is returned as a Summary Type. Note that most of the output of `SUMMARY` can be obtained with currently available SQL.

Syntax

```
DBMS_STAT_FUNCS.SUMMARY (
  ownername   IN   VARCHAR2,
  tablename   IN   VARCHAR2,
  columnname  IN   VARCHAR2,
  sigma_value IN   NUMBER DEFAULT 3,
  s           OUT  SummaryType);
```

Parameters

Table 185-5 SUMMARY Procedure Parameters

Parameter	Description
ownername	The schema where the table resides.

Table 185-5 (Cont.) SUMMARY Procedure Parameters

Parameter	Description
tablename	The table where the column resides.
columnname	The column of the table to be summarized.
sigma_value	The number of sigmas for the set of extreme values, defaults to 3.
s	The Record containing summary information about given column.

Definition of SummaryType

```
TYPE n_arr IS VARRAY(5) of NUMBER;
TYPE num_table IS TABLE of NUMBER;
TYPE summaryType IS RECORD (
    count          NUMBER,
    min            NUMBER,
    max           NUMBER,
    range         NUMBER,
    mean          NUMBER,
    cmode         num_table,
    variance      NUMBER,
    stddev        NUMBER,
    quantile_5    NUMBER,
    quantile_25   NUMBER,
    median        NUMBER,
    quantile_75   NUMBER,
    quantile_95   NUMBER,
    plus_x_sigma  NUMBER,
    minus_x_sigma NUMBER,
    extreme_values num_table,
    top_5_values  n_arr,
    bottom_5_values n_arr);
```

185.1.5 UNIFORM_DIST_FIT Procedure

This procedure tests well a sample of values fits a uniform distribution.

Syntax

```
DBMS_STAT_FUNCS.UNIFORM_DIST_FIT (
    ownername IN VARCHAR2,
    tablename IN VARCHAR2,
    columnname IN VARCHAR2,
    var_type IN VARCHAR2 DEFAULT 'CONTINUOUS',
    test_type IN VARCHAR2 DEFAULT 'KOLMOGOROV_SMIRNOV',
    paramA IN NUMBER,
    paramB IN NUMBER,
    sig OUT NUMBER);
```

Parameters

Table 185-6 UNIFORM_DIST_FIT Procedure Parameters

Parameter	Description
ownername	The schema where the table resides.
tablename	The table where the column resides.
columnname	The column of the table against which to run the test.
var_type	The type of distribution: 'CONTINUOUS' (the default) or 'DISCRETE'
test_type	The type of test to use: 'CHI_SQUARED', 'KOLMOGOROV_SMIRNOV' or 'ANDERSON_DARLING'.
paramA	Parameter A estimated from the sample (the location parameter).
paramB	Parameter B estimated from the sample (the scale parameter).
sig	The goodness of fit value, based on test type. A small value indicates a significant difference between the sample and the uniform distribution. A number close to 1 indicates a close match.

185.1.6 WEIBULL_DIST_FIT Procedure

This procedure tests how well a sample of values fits a Weibull distribution.

Syntax

```
DBMS_STAT_FUNCS.WEIBULL_DIST_FIT (
  ownername   IN   VARCHAR2,
  tablename   IN   VARCHAR2,
  columnname  IN   VARCHAR2,
  test_type   IN   VARCHAR2 DEFAULT 'KOLMOGOROV_SMIRNOV',
  alpha       IN   NUMBER,
  mu          IN   NUMBER,
  beta        IN   NUMBER,
  sig         OUT  NUMBER);
```

Parameters

Table 185-7 WEIBULL_DIST_FIT Procedure Parameters

Parameter	Description
ownername	The schema where the table resides.
tablename	The table where the column resides.
columnname	The column of the table against which to run the test.
test_type	The type of test to use: 'CHI_SQUARED', 'KOLMOGOROV_SMIRNOV' or 'ANDERSON_DARLING'.
alpha	The scale parameter.
mu	The location parameter.
beta	The slope/shape parameter.

Table 185-7 (Cont.) WEIBULL_DIST_FIT Procedure Parameters

Parameter	Description
sig	The goodness of fit value, based on test type. A small value indicates a significant difference between the sample and the Weibull distribution. A number close to 1 indicates a close match.

DBMS_STATS

With the `DBMS_STATS` package you can view and modify optimizer statistics gathered for database objects.

Users can also collect statistics on Global Temporary Tables (GTTs) using the `DBMS_STATS` package. However, `DBMS_STATS` cannot collect statistics on Private Temporary Tables (PTTs).

This chapter contains the following topics:

- [DBMS_STATS Overview](#)
- [DBMS_STATS Deprecated Subprograms](#)
- [DBMS_STATS Types](#)
- [DBMS_STATS Constants](#)
- [DBMS_STATS Operational Notes](#)
- [DBMS_STATS Data Structures](#)
- [Summary of DBMS_STATS Subprograms](#)

See Also:

- *Oracle Database SQL Tuning Guide*
- *Oracle Database Administrator's Guide*

186.1 DBMS_STATS Overview

To improve performance, the database enables you to collect optimizer statistics.

Note:

By default, the database collects statistics automatically, so this package is intended only for specialized cases.

Optimizer statistics can reside in the data dictionary or in a table created in the user's schema. You can also collect and manage user-defined statistics for tables and domain indexes using this package. For example, if you invoke the `DELETE_COLUMN_STATS` procedure on a column for which an association is defined, the database deletes both user-defined and standard statistics for this column.

Only optimizer statistics stored in the data dictionary have an effect on the cost-based optimizer. You can also use `DBMS_STATS` to gather statistics in parallel.

Optimizer Statistics Advisor inspects the statistics gathering process, automatically diagnoses problems in the existing practices for gathering statistics, and then generates a report of findings and recommendations. The advisor task runs automatically in the maintenance window. However, you can also run the job on demand.

**See Also:**

Oracle Database SQL Tuning Guide to learn how to manage optimizer statistics

186.2 DBMS_STATS Deprecated Subprograms

Oracle recommends that you do not use deprecated subprograms. Support for deprecated features is for backward compatibility only.

Starting with Oracle Database 11g Release 2 (11.2), the following subprograms are obsolete:

- [GET_PARAM Function](#)
Instead, use [GET_PREFS Function](#)
- [SET_PARAM Procedure](#)
Instead, use [SET_GLOBAL_PREFS Procedure](#)
- [RESET_PARAM_DEFAULTS Procedure](#)
Instead use [RESET_GLOBAL_PREF_DEFAULTS Procedure](#)

The following subprogram is deprecated with Oracle Database 12c and later:

- [GENERATE_STATS](#)

This procedure is replaced by the [GATHER_INDEX_STAT](#) procedure.

**See Also:**

"[GATHER_INDEX_STATS Procedure](#)"

186.3 DBMS_STATS Types

Histograms

Types for the minimum and maximum values and histogram endpoints include the following:

```
TYPE numarray IS VARRAY(2050) OF NUMBER;  
TYPE datearray IS VARRAY(2050) OF DATE;  
TYPE chararray IS VARRAY(2050) OF VARCHAR2(4000);  
TYPE rawarray IS VARRAY(2050) OF RAW(2000);  
TYPE fltarray IS VARRAY(2050) OF BINARY_FLOAT;  
TYPE dblarray IS VARRAY(2050) OF BINARY_DOUBLE;
```

Stale Tables

Types for listing stale tables include the following:

```

TYPE ObjectElem IS RECORD (
  ownname    VARCHAR2(30),    -- owner
  objtype    VARCHAR2(6),    -- 'TABLE' or 'INDEX'
  objname    VARCHAR2(30),    -- table/index
  partname   VARCHAR2(30),    -- partition
  subpartname VARCHAR2(30));  -- subpartition
TYPE ObjectTab IS TABLE OF ObjectElem;

```

Statistics Difference Reports

Use the following type to displays a statistics difference report:

```

TYPE DiffRepElem IS RECORD (
  report      CLOB,          -- stats difference report
  maxdiffpct NUMBER);      -- max stats difference (percentage)
TYPE DiffRepTab IS TABLE OF DiffRepElem;

```

Optimizer Statistics Advisor

The following type represents database objects for which you can gather statistics:

```

TYPE ObjectElem IS RECORD (
  ownname      dbms_quoted_id, -- owner
  objtype      VARCHAR2(6), -- 'TABLE' or 'INDEX'
  objname      dbms_quoted_id, -- table/index
  partname     dbms_quoted_id, -- partition
  subpartname  dbms_quoted_id -- subpartition
);
TYPE ObjectTab IS TABLE OF ObjectElem;

```



Note:

Make sure to maintain `satisfy_obj_filter` when the `ObjectElem` type is changed

The following type represents an operation:

```

TYPE StatsAdvOpr IS RECORD (
  name  VARCHAR2(64), -- name of the operation
  param VARCHAR2(4000)
); -- XML containing parameters and their values
TYPE StatsAdvOprTab IS TABLE OF StatsAdvOpr;

```

The following type represents a filter list:

```

TYPE StatsAdvFilter IS RECORD (
  rulename VARCHAR2(64), -- rule name
  objlist  ObjectTab,    -- object filter list
  oprlist  StatsAdvOprTab, -- operation filter list

```



```
include BOOLEAN);      -- include/exclude elements in the list
TYPE StatsAdvFilterTab IS TABLE OF StatsAdvFilter;
```

186.4 DBMS_STATS Constants

The `DBMS_STATS` package defines several constants to use specifying parameter values.

Table 186-1 DBMS_STATS Constants

Name	Type	Description
<code>ADD_GLOBAL_PREFS</code>	NUMBER	Copies global preferences
<code>AUTO_CASCADE</code>	BOOLEAN	Lets Oracle decide whether to collect statistics for indexes or not
<code>AUTO_DEGREE</code>	NUMBER	Lets Oracle select the degree of parallelism based on size of the object, number of CPUs and initialization parameters
<code>AUTO_INVALIDATE</code>	BOOLEAN	Lets Oracle decide when to invalidate dependent cursors
<code>AUTO_SAMPLE_SIZE</code>	NUMBER	Indicates that auto-sample size algorithms should be used
<code>PURGE_ALL</code>	TIMESTAMP WITH TIME ZONE	A flag that can be passed to the PURGE_STATS Procedure and unconditionally deletes all the history statistics. The deletion uses <code>TRUNCATE</code> statements on the various dictionary statistics tables holding the history of statistics.
<code>RECLAIM_SYNOPSIS</code>	TIMESTAMP WITH TIME ZONE	A constant used for reclaiming synopsis table space.

186.5 DBMS_STATS Operational Notes

Observe these operational notes when using the `DBMS_STATS` package.

The `DBMS_STATS` subprograms perform the following general operations:

- [Gathering Optimizer Statistics](#)
- [Setting or Getting Statistics](#)
- [Deleting Statistics](#)
- [Transferring Statistics](#)
- [Locking or Unlocking Statistics](#)
- [Restoring and Purging Statistics History](#)
- [User-Defined Statistics](#)
- [Pending Statistics](#)
- [Comparing Statistics](#)

- [Extended Statistics](#)
- [Optimizer Statistics Advisor](#)

Most of the `DBMS_STATS` procedures include the three parameters `statown`, `stattab`, and `statid`. These parameters enable you to store statistics in your own tables (outside of the dictionary), which does not affect the optimizer. Therefore, you can maintain and experiment with sets of statistics.

The `stattab` parameter specifies the name of a table in which to hold statistics, and it is assumed that it resides in the same schema as the object for which statistics are collected (unless the `statown` parameter is specified). You can create multiple tables with different `stattab` identifiers to hold separate sets of statistics.

Additionally, you can maintain different sets of statistics within a single `stattab` by using the `statid` parameter, which avoids cluttering the user's schema.

For the `SET` and `GET` procedures, if `stattab` is not provided (that is, `NULL`), then the operation works directly on the dictionary statistics; therefore, you do not need to create these statistics tables if they only plan to modify the dictionary directly. However, if `stattab` is not `NULL`, then the `SET` or `GET` operation works on the specified user statistics table, and not the dictionary.

You can change the default values of some of the parameters of `DBMS_STATS` procedures using the [SET_DATABASE_PREFS Procedure](#), [SET_GLOBAL_PREFS Procedure](#), [SET_SCHEMA_PREFS Procedure](#) and [SET_TABLE_PREFS Procedure](#).

Most procedures in this package commit the current transaction, perform the operation, and then commit again.

Most of the procedures have a `force` parameter that enables you to override a lock on statistics. Whenever statistics in dictionary are modified, old versions of statistics are saved automatically for future restoring.

Gathering Optimizer Statistics

Use the following subprograms to gather certain classes of optimizer statistics, with possible performance improvements over the `ANALYZE` command:

- [GATHER_DATABASE_STATS Procedures](#)
- [GATHER_DICTIONARY_STATS Procedure](#)
- [GATHER_FIXED_OBJECTS_STATS Procedure](#)
- [GATHER_INDEX_STATS Procedure](#)
- [GATHER_SCHEMA_STATS Procedures](#)
- [GATHER_SYSTEM_STATS Procedure](#)
- [GATHER_TABLE_STATS Procedure](#)

The `GATHER_*` procedures also collect user-defined statistics for columns and domain indexes.

The `statown`, `stattab`, and `statid` parameters instruct the package to back up current statistics in the specified table before gathering new statistics.

Oracle also provides the following procedure for generating statistics for derived objects when you have sufficient statistics on related objects:

[GENERATE_STATS Procedure](#)

Setting or Getting Statistics

Use the following subprograms to store and retrieve individual column-related, index-related, and table-related statistics:

[PREPARE_COLUMN_VALUES Procedures](#)
[PREPARE_COLUMN_VALUES_NVARCHAR Procedure](#)
[PREPARE_COLUMN_VALUES_ROWID Procedure](#)

[SEED_COL_USAGE Procedure](#)
[SET_INDEX_STATS Procedures](#)
[SET_SYSTEM_STATS Procedure](#)
[SET_TABLE_STATS Procedure](#)

[GET_COLUMN_STATS Procedures](#)
[GET_INDEX_STATS Procedures](#)
[GET_SYSTEM_STATS Procedure](#)
[GET_TABLE_STATS Procedure](#)

In the special versions of the `SET_*_STATS` procedures for setting user-defined statistics, the following, if provided, are stored in the dictionary or user statistics table:

- User-defined statistics
- Owner of statistics type
- Name of statistics type

The user-defined statistics and the corresponding statistics type are inserted into the `USTATS$` dictionary table. You can specify user-defined statistics without specifying the statistics type name.

The special versions of the `GET_*_STATS` procedures return user-defined statistics and the statistics type owner and name as `OUT` arguments corresponding to the schema object specified. If user-defined statistics are not collected, `NULL` values are returned.

Deleting Statistics

The `DELETE_*` procedures delete both user-defined statistics and the standard statistics for the given schema object.

[DELETE_COLUMN_STATS Procedure](#)
[DELETE_DATABASE_STATS Procedure](#)
[DELETE_DICTIONARY_STATS Procedure](#)
[DELETE_FIXED_OBJECTS_STATS Procedure](#)
[DELETE_INDEX_STATS Procedure](#)
[DELETE_SCHEMA_STATS Procedure](#)
[DELETE_SYSTEM_STATS Procedure](#)
[DELETE_TABLE_STATS Procedure](#)

Note that `DELETE_TABLE_STATS`, `DELETE_DICTIONARY_STATS`, `DELETE_DATABASE_STATS` and `DELETE_SCHEMA_STATS` have a parameter `stat_category` which specifies which statistics to delete. The parameter accepts multiple values separated by comma. The supported values are `'OBJECT_STATS'` (table statistics, column statistics and index statistics) and `'SYNOPSIS'` (auxiliary statistics created when statistics are incrementally maintained). The default is `'OBJECT_STATS, SYNOPSIS'`.

Transferring Statistics

Use the following procedures for creating and dropping the user statistics table.

[CREATE_STAT_TABLE Procedure](#)

[DROP_STAT_TABLE Procedure](#)

Use the following procedures to transfer statistics

- from the dictionary to a user statistics table ([EXPORT_*](#))
- from a user statistics table to the dictionary ([IMPORT_*](#))

[EXPORT_COLUMN_STATS Procedure](#)

[EXPORT_DATABASE_STATS Procedure](#)

[EXPORT_DICTIONARY_STATS Procedure](#)

[EXPORT_FIXED_OBJECTS_STATS Procedure](#)

[EXPORT_INDEX_STATS Procedure](#)

[EXPORT_SCHEMA_STATS Procedure](#)

[EXPORT_SYSTEM_STATS Procedure](#)

[EXPORT_TABLE_STATS Procedure](#)

[IMPORT_COLUMN_STATS Procedure](#)

[IMPORT_DATABASE_STATS Procedure](#)

[IMPORT_DICTIONARY_STATS Procedure](#)

[IMPORT_FIXED_OBJECTS_STATS Procedure](#)

[IMPORT_INDEX_STATS Procedure](#)

[IMPORT_SCHEMA_STATS Procedure](#)

[IMPORT_SYSTEM_STATS Procedure](#)

[IMPORT_TABLE_STATS Procedure](#)

 **Note:**

Oracle does not support export or import of statistics across databases of different character sets.

Locking or Unlocking Statistics

Use the following procedures to lock and unlock statistics on objects.

[LOCK_PARTITION_STATS Procedure](#)

[LOCK_SCHEMA_STATS Procedure](#)

[LOCK_TABLE_STATS Procedure](#)

[UNLOCK_PARTITION_STATS Procedure](#)

[UNLOCK_SCHEMA_STATS Procedure](#)

[UNLOCK_TABLE_STATS Procedure](#)

The `LOCK_*` procedures either freeze the current set of the statistics or to keep the statistics untouched. When statistics on a table are locked, all the statistics depending on the table, including table statistics, column statistics, histograms and statistics on all dependent indexes, are considered to be locked.

Restoring and Purging Statistics History

Use the following procedures to restore statistics as of a specified timestamp. This is useful in case newly collected statistics leads to some sub-optimal execution plans and the administrator wants to revert to the previous set of statistics.

[RESET_GLOBAL_PREF_DEFAULTS Procedure](#)
[RESTORE_DATABASE_STATS Procedure](#)
[RESTORE_DICTIONARY_STATS Procedure](#)
[RESTORE_FIXED_OBJECTS_STATS Procedure](#)
[RESTORE_SCHEMA_STATS Procedure](#)
[RESTORE_SYSTEM_STATS Procedure](#)
[RESTORE_TABLE_STATS Procedure](#)

Whenever statistics in dictionary are modified, old versions of statistics are saved automatically for future restoring. The old statistics are purged automatically at regular intervals based on the statistics history retention setting and the time of recent statistics gathering performed in the system. Retention is configurable using the [ALTER_STATS_HISTORY_RETENTION Procedure](#).

The other `DBMS_STATS` procedures related to restoring statistics are:

- [PURGE_STATS Procedure](#): This procedure lets you manually purge old versions beyond a time stamp.
- [GET_STATS_HISTORY_RETENTION Function](#): This function gets the current statistics history retention value.
- [GET_STATS_HISTORY_AVAILABILITY Function](#): This function gets the oldest time stamp where statistics history is available. Users cannot restore statistics to a time stamp older than the oldest time stamp.

`RESTORE_*` operations are not supported for user defined statistics.

User-Defined Statistics

The `DBMS_STATS` package supports operations on user-defined statistics. When a domain index or column is associated with a statistics type (using the `associate` statement), operations on the index or column manipulate user-defined statistics. For example, gathering statistics for a domain index (for which an association with a statistics type exists) using the [GET_INDEX_STATS Procedures](#) invokes the user-defined statistics collection method of the associated statistics type. Similarly, delete, transfer, import, and export operations manipulate user-defined statistics.

`SET_*` and `GET_*` operations for user-defined statistics are also supported using a special version of the `SET` and `GET` interfaces for columns and indexes.

`EXPORT_*`, `IMPORT_*` and `RESTORE_*` operations are not supported for user defined statistics.

Pending Statistics

The package gathers statistics and stores it in the dictionary by default. User's can store these statistics in the system's private area instead of the dictionary by turning the `PUBLISH` option to `FALSE` using the `SET*PREFS` procedures. The default value for `PUBLISH` is `TRUE`. The statistics stored in private area are not used by Cost Based Optimizer unless parameter `optimizer_use_pending_statistics` is set to `TRUE`. The

default value of this parameter is `FALSE` and this boolean parameter can be set at the session/system level. Users can verify the impact of the new statistics on query plans by using the pending statistics on a session.

Pending statistics provide a mechanism to verify the impact of the new statistics on query plans before making them available for general use. There are two scenarios to verify the query plans:

- Export the pending statistics (use the [EXPORT_PENDING_STATS Procedure](#)) to a test system, then run the query workload and check the performance or plans.
- Set `optimizer_use_pending_statistics` to `TRUE` in a session on the system where pending statistics have been gathered, run the workload, and check the performance or plans.

After the performance or query plans have been verified, you can publish the pending statistics using the [PUBLISH_PENDING_STATS Procedure](#) if the performance is acceptable, or delete the pending statistics using [DELETE_PENDING_STATS Procedure](#) if it is not.

Pending statistics can be published, exported, or deleted. The following procedures are provided to manage pending statistics:

- [DELETE_PENDING_STATS Procedure](#)
- [EXPORT_PENDING_STATS Procedure](#)
- [PUBLISH_PENDING_STATS Procedure](#)

Comparing Statistics

You can use the `DIFF_TABLE_STATS_*` statistics to compare statistics for a table from two different sources. The statistics can be from:

- Two different user statistics tables
- A single user statistics table containing two sets of statistics that can be identified using `statids`
- A user statistics table and dictionary history
- Pending statistics

The functions also compare the statistics of the dependent objects (indexes, columns, partitions). They display statistics of the objects from both sources if the difference between those statistics exceeds a certain threshold. The threshold can be specified as an argument to the function, with a default of 10%. The database uses the statistics corresponding to the first source (`stattab1` or `time1`) as a basis for computing the differential percentage.

Extended Statistics

This package enables you to collect statistics for column groups and expressions. The statistics collected for column groups and expressions are called "extended statistics".

Statistics on column groups are used by optimizer for accounting correlation between columns. For example, if a query has predicates `c1=1` and `c2=1` and if there are statistics on column group (c1, c2), the optimizer uses these statistics for estimating the combined cardinality of the predicates. The optimizer uses the expression statistics to estimate cardinality of predicates on those expressions. The extended statistics are similar to column statistics. The procedures that take columns names accept extended statistics names in place of column names.

Related subprograms:

- [CREATE_EXTENDED_STATS Function](#)
- [DROP_EXTENDED_STATS Procedure](#)
- [SHOW_EXTENDED_STATS_NAME Function](#)
- [REPORT_COL_USAGE Function](#)
- [SEED_COL_USAGE Procedure](#)
- [RESET_COL_USAGE Procedure](#)

Optimizer Statistics Advisor

Optimizer Statistics Advisor is built-in diagnostic software that helps use to use best practices to manage optimizer statistics. The advisor analyzes how you are currently gathering statistics (using manual scripts, explicitly setting parameters, and so on), the effectiveness of existing statistics gathering jobs, and the quality of the gathered statistics. The advisor generates findings for any issues it finds. Based on these findings, the advisor provides recommendations, which it stores in `DBA_ADVISOR_RECOMMENDATIONS`.

The advisor organizes rules into the following classes:

- **System**
This class checks the preferences for statistics collection, status of the automated statistics gathering job, use of SQL plan directives, and so on. Rules in this class have the value `SYSTEM` in `V$STATS_ADVISOR_RULES.RULE_TYPE`.
- **Operation**
This class checks whether statistics collection uses the defaults, test statistics are created using the `SET_*_STATS` procedures, and so on. Rules in this class have the value `OPERATION` in `V$STATS_ADVISOR_RULES.RULE_TYPE`.
- **Object**
This class checks for the quality of the statistics, staleness of statistics, unnecessary collection of statistics, and so on. Rules in this class have the value `OBJECT` in `V$STATS_ADVISOR_RULES.RULE_TYPE`.

All Optimizer Statistics Advisor subprograms require the `ADVISOR` privilege. All procedures and functions execute using the invoker's privilege for the operation instead of the task owner's privilege. For example, if a user without the `ANALYZE ANY DICTIONARY` privilege creates a task `t1`, and if a DBA then executes this task, then the task execution checks for `SYS` objects. Another example is a task that is executed by `user1`, interrupted, and then resumed by `user2`. In this case, the checks of the resumed execution are based on the privilege of `user2` rather than `user1`.

You can use the following subprograms to manage Optimizer Statistics Advisor:

- [CANCEL_ADVISOR_TASK Procedure](#)
- [CONFIGURE_ADVISOR_FILTER Function](#)
- [CONFIGURE_ADVISOR_OBJ_FILTER Function](#)
- [CONFIGURE_ADVISOR_OPR_FILTER Functions](#)
- [CONFIGURE_ADVISOR_RULE_FILTER Function](#)
- [CREATE_ADVISOR_TASK Function](#)

- [DROP_ADVISOR_TASK Procedure](#)
- [EXECUTE_ADVISOR_TASK Function](#)
- [GET_ADVISOR_OPR_FILTER Procedure](#)
- [GET_ADVISOR_RECS Function](#)
- [IMPLEMENT_ADVISOR_TASK Function](#)
- [INTERRUPT_ADVISOR_TASK Procedure](#)
- [REPORT_ADVISOR_TASK Function](#)
- [RESET_ADVISOR_TASK Procedure](#)
- [RESUME_ADVISOR_TASK Procedure](#)
- [SCRIPT_ADVISOR_TASK Function](#)
- [SET_ADVISOR_TASK_PARAMETER Procedure](#)

**See Also:**

Oracle Database SQL Tuning Guide to learn how to analyze statistics using Optimizer Statistics Advisor

186.6 DBMS_STATS Data Structures

The `DBMS_STATS` package defines a `RECORD` type.

RECORD Types

- [STAT_REC Record Type](#)

186.6.1 DBMS_STATS STAT_REC Record Type

This record type is provided for users in case they want to set column statistics manually. Its fields allow specifying column min/max values, as well as a histogram for a column.

Syntax

```
TYPE STATREC IS RECORD (  
    epc    NUMBER,  
    minval RAW(2000),  
    maxval RAW(2000),  
    bkvals NUMARRAY,  
    novals NUMARRAY,  
    chvals CHARARRAY,  
    eavals RAWARRAY,  
    rpcnts NUMARRAY,  
    eavs   NUMBER);
```


Fields of the Record type COMPARISON_TYPE (STAT_REC Attributes)**Table 186-2 STAT_REC Attributes**

Field	Description
epc	Number of buckets in histogram
minval	Minimum value
maxval	Maximum value
bkvals	Array of bucket numbers
novals	Array of normalized end point values
chvals	Array of dumped end point values
eavals	Array of end point actual values
rpcnts	Array of end point value frequencies
eavs	A number indicating whether actual end point values are needed in the histogram. If using the PREPARE_COLUMN_VALUES Procedures , this field will be automatically filled.

186.7 Summary of DBMS_STATS Subprograms

This table lists the DBMS_STATS subprograms and briefly describes them.

Table 186-3 DBMS_STATS Package Subprograms

Subprogram	Description
ALTER_STATS_HISTORY_RETENTION Procedure	Changes the statistics history retention value
CANCEL_ADVISOR_TASK Procedure	Cancels an Optimizer Statistics Advisor execution
CONFIGURE_ADVISOR_FILTER Function	Configures the filter list for an Optimizer Statistics Advisor task
CONFIGURE_ADVISOR_OBJ_FILTER Function	Configures an object filter for an Optimizer Statistics Advisor task
CONFIGURE_ADVISOR_OPR_FILTER Functions	Configures an operation filter for an Optimizer Statistics Advisor task
CONFIGURE_ADVISOR_RULE_FILTER Function	Configures a rule filter for an Optimizer Statistics Advisor task
CREATE_ADVISOR_TASK Function	Creates an advisor task for the Optimizer Statistics Advisor
CONVERT_RAW_VALUE Procedures	Converts the internal representation of a minimum value, maximum value, or histogram endpoint actual value into a datatype-specific value
CONVERT_RAW_VALUE_NVARCHAR Procedure	Converts the internal representation of a minimum value, maximum value, or histogram endpoint actual value into a datatype-specific value
CONVERT_RAW_VALUE_ROWID Procedure	Converts the internal representation of a minimum value, maximum value, or histogram endpoint actual value into a datatype-specific value

Table 186-3 (Cont.) DBMS_STATS Package Subprograms

Subprogram	Description
COPY_TABLE_STATS Procedure	Copies the statistics of the source [sub] partition to the destination [sub] partition after scaling
CREATE_EXTENDED_STATS Function	Creates a virtual column for a user specified column group or an expression in a table
CREATE_STAT_TABLE Procedure	Creates a table with name <code>stattab</code> in <code>ownname</code> 's schema which is capable of holding statistics
DELETE_COLUMN_STATS Procedure	Deletes column-related statistics
DELETE_DATABASE_PREFS Procedure	Deletes the statistics preferences of all the tables
DELETE_DATABASE_STATS Procedure	Deletes statistics for the entire database
DELETE_DICTIONARY_STATS Procedure	Deletes statistics for all dictionary schemas ('SYS', 'SYSTEM' and database component schemas)
DELETE_FIXED_OBJECTS_STATS Procedure	Deletes statistics of all fixed tables
DELETE_INDEX_STATS Procedure	Deletes index-related statistics
DELETE_PENDING_STATS Procedure	Deletes the private statistics that have been collected but have not been published
DELETE_PROCESSING_RATE Procedure	Deletes the processing rate of a given statistics source. If the source is not specified, it deletes the statistics of all the sources
DELETE_SCHEMA_PREFS Procedure	Deletes the statistics preferences of all the tables owned by the specified owner name
DELETE_SCHEMA_STATS Procedure	Deletes schema-related statistics
DELETE_SYSTEM_STATS Procedure	Deletes system statistics
DELETE_TABLE_PREFS Procedure	Deletes statistics preferences of the specified table in the specified schema
DELETE_TABLE_STATS Procedure	Deletes table-related statistics
DIFF_TABLE_STATS_IN_HISTORY Function	Compares statistics for a table from two timestamps in past and compare the statistics as of that timestamps
DIFF_TABLE_STATS_IN_PENDING Function	Compares pending statistics and statistics as of a timestamp or statistics from dictionary
DIFF_TABLE_STATS_IN_STATTAB Function	Compares statistics for a table from two different sources
DROP_ADVISOR_TASK Procedure	Drops the specified Optimizer Statistics Advisor task
DROP_EXTENDED_STATS Procedure	Drops the statistics entry that is created for the user specified extension
DROP_STAT_TABLE Procedure	Drops a user statistics table created by <code>CREATE_STAT_TABLE</code>
EXECUTE_ADVISOR_TASK Function	Executes a previously created Optimizer Statistics Advisor task

Table 186-3 (Cont.) DBMS_STATS Package Subprograms

Subprogram	Description
EXPORT_COLUMN_STAT S Procedure	Retrieves statistics for a particular column and stores them in the user statistics table identified by <code>stattab</code>
EXPORT_DATABASE_PR EFS Procedure	Exports the statistics preferences of all the tables
EXPORT_DATABASE_ST ATS Procedure	Retrieves statistics for all objects in the database and stores them in the user statistics table identified by <code>statown.stattab</code>
EXPORT_DICTIONARY_S TATS Procedure	Retrieves statistics for all dictionary schemas ('SYS', 'SYSTEM' and RDBMS component schemas) and stores them in the user statistics table identified by <code>stattab</code>
EXPORT_FIXED_OBJECT S_STATS Procedure	Retrieves statistics for fixed tables and stores them in the user statistics table identified by <code>stattab</code>
EXPORT_INDEX_STATS Procedure	Retrieves statistics for a particular index and stores them in the user statistics table identified by <code>stattab</code>
EXPORT_PENDING_STAT S Procedure	Exports the statistics gathered and stored as pending
EXPORT_SCHEMA_PREF S Procedure	Exports the statistics preferences of all the tables owned by the specified owner name
EXPORT_SCHEMA_STAT S Procedure	Retrieves statistics for all objects in the schema identified by <code>ownname</code> and stores them in the user statistics table identified by <code>stattab</code>
EXPORT_SYSTEM_STAT S Procedure	Retrieves system statistics and stores them in the user statistics table
EXPORT_TABLE_PREFS Procedure	Exports statistics preferences of the specified table in the specified schema into the specified statistics table
EXPORT_TABLE_STATS Procedure	Retrieves statistics for a particular table and stores them in the user statistics table
FLUSH_DATABASE_MONI TORING_INFO Procedure	Flushes in-memory monitoring information for all the tables to the dictionary
GATHER_DATABASE_ST ATS Procedures	Gathers statistics for all objects in the database
GATHER_DICTIONARY_S TATS Procedure	Gathers statistics for dictionary schemas 'SYS', 'SYSTEM' and schemas of RDBMS components
GATHER_FIXED_OBJECT S_STATS Procedure	Gathers statistics of fixed objects
GATHER_INDEX_STATS Procedure	Gathers index statistics
GATHER_PROCESSING_ RATE Procedure	Starts the job of gathering the processing rates which end after <code>interval</code> defined in minutes
GATHER_SCHEMA_STAT S Procedures	Gathers statistics for all objects in a schema
GATHER_SYSTEM_STAT S Procedure	Gathers system statistics
GATHER_TABLE_STATS Procedure	Gathers table and column (and index) statistics

Table 186-3 (Cont.) DBMS_STATS Package Subprograms

Subprogram	Description
GENERATE_STATS Procedure	Generates object statistics from previously collected statistics of related objects
GET_ADVISOR_OPR_FILTER Procedure	Creates an operation filter for an Optimizer Statistics Advisor operation
GET_ADVISOR_RECS Function	Generates a recommendation report for the specified item
GET_COLUMN_STATS Procedures	Gets all column-related information
GET_INDEX_STATS Procedures	Gets all index-related information
GET_PARAM Function	Gets the default value of parameters of DBMS_STATS procedures (see DBMS_STATS Deprecated Subprograms)
GET_PREFS Function	Gets the default value of the specified preference
GET_STATS_HISTORY_AVAILABILITY Function	Gets the oldest timestamp where statistics history is available
GET_STATS_HISTORY_RETENTION Function	Returns the current statistics history retention value
GET_SYSTEM_STATS Procedure	Gets system statistics from <code>stattab</code> , or from the dictionary if <code>stattab</code> is NULL
GET_TABLE_STATS Procedure	Gets all table-related information
IMPLEMENT_ADVISOR_TASK Function	Implements the recommendations made by Optimizer Statistics Advisor
IMPORT_COLUMN_STATS Procedure	Retrieves statistics for a particular column from the user statistics table identified by <code>stattab</code> and stores them in the dictionary
IMPORT_DATABASE_PREFS Procedure	Imports the statistics preferences of all the tables
IMPORT_DATABASE_STATS Procedure	Retrieves statistics for all objects in the database from the user statistics table and stores them in the dictionary
IMPORT_DICTIONARY_STATS Procedure	Retrieves statistics for all dictionary schemas ('SYS', 'SYSTEM' and RDBMS component schemas) from the user statistics table and stores them in the dictionary
IMPORT_FIXED_OBJECTS_STATS Procedure	Retrieves statistics for fixed tables from the user statistics table identified by <code>stattab</code> and stores them in the dictionary
IMPORT_INDEX_STATS Procedure	Retrieves statistics for a particular index from the user statistics table identified by <code>stattab</code> and stores them in the dictionary
IMPORT_SCHEMA_PREFS Procedure	Imports the statistics preferences of all the tables owned by the specified owner name
IMPORT_SCHEMA_STATS Procedure	Retrieves statistics for all objects in the schema identified by <code>ownname</code> from the user statistics table and stores them in the dictionary
IMPORT_SYSTEM_STATS Procedure	Retrieves system statistics from the user statistics table and stores them in the dictionary
IMPORT_TABLE_PREFS Procedure	Sets the statistics preferences of the specified table in the specified schema

Table 186-3 (Cont.) DBMS_STATS Package Subprograms

Subprogram	Description
IMPORT_TABLE_STATS Procedure	Retrieves statistics for a particular table from the user statistics table identified by <code>stattab</code> and stores them in the dictionary
INTERRUPT_ADVISOR_TASK Procedure	Interrupts a currently executing Optimizer Statistics Advisor task.
LOCK_PARTITION_STATS Procedure	Locks statistics for a partition
LOCK_SCHEMA_STATS Procedure	Locks the statistics of all tables of a schema
LOCK_TABLE_STATS Procedure	Locks the statistics on the table
MERGE_COL_USAGE Procedure	Merges column usage information from a source database, by means of a <code>dblink</code> , into the local database
PREPARE_COLUMN_VALUES Procedures	Converts user-specified minimum, maximum, and histogram endpoint datatype-specific values into Oracle's internal representation for future storage using the SEED_COL_USAGE Procedure
PREPARE_COLUMN_VALUES_NVARCHAR Procedure	Converts user-specified minimum, maximum, and histogram endpoint datatype-specific values into Oracle's internal representation for future storage using the SEED_COL_USAGE Procedure
PREPARE_COLUMN_VALUES_ROWID Procedure	Converts user-specified minimum, maximum, and histogram endpoint datatype-specific values into Oracle's internal representation for future storage using the SEED_COL_USAGE Procedure
PUBLISH_PENDING_STATS Procedure	Publishes the statistics gathered and stored as pending
PURGE_STATS Procedure	Purges old versions of statistics saved in the dictionary
REMAP_STAT_TABLE Procedure	Remaps the names of objects in the user statistics table
REPORT_ADVISOR_TASK Function	Reports the results of an Optimizer Advisor Task.
REPORT_COL_USAGE Function	Reports the recorded column (group) usage information
REPORT_GATHER_AUTO_STATS Function	Runs the auto statistics gathering job in reporting mode
REPORT_GATHER_DATABASE_STATS Functions	Runs the GATHER_DATABASE_STATS Procedures in reporting mode.
REPORT_GATHER_DICTIONARY_STATS Functions	Runs the GATHER_DICTIONARY_STATS Procedure in reporting mode
REPORT_GATHER_FIXED_OBJECTS_STATS Function	Runs the GATHER_FIXED_OBJECTS_STATS Procedure in reporting mode
REPORT_GATHER_SCHEMA_STATS Functions	Runs the GATHER_SCHEMA_STATS Procedures in reporting mode
REPORT_GATHER_TABLE_STATS Function	Runs the GATHER_TABLE_STATS Procedure in reporting mode

Table 186-3 (Cont.) DBMS_STATS Package Subprograms

Subprogram	Description
REPORT_STATS_OPERATIONS Function	Generates a report of all statistics operations that take place between two timestamps which may or may not have been provided
RESET_ADVISOR_TASK Procedure	Resets an Optimizer Statistics Advisor task execution to its initial state. Only reset a task that is not currently executing
RESET_COL_USAGE Procedure	Resets the recorded column (group) usage information
RESET_GLOBAL_PREF_DEFAULTS Procedure	Resets the default values of all parameters to Oracle recommended values
RESET_PARAM_DEFAULTS Procedure	Resets global preferences to default values (see DBMS_STATS Deprecated Subprograms)
RESTORE_DICTIONARY_STATS Procedure	Restores statistics of all dictionary tables (tables of 'SYS', 'SYSTEM' and RDBMS component schemas) as of a specified timestamp
RESTORE_FIXED_OBJECTS_STATS Procedure	Restores statistics of all fixed tables as of a specified timestamp
RESTORE_SCHEMA_STATS Procedure	Restores statistics of all tables of a schema as of a specified timestamp
RESTORE_SYSTEM_STATS Procedure	Restores statistics of all tables of a schema as of a specified timestamp
RESTORE_TABLE_STATS Procedure	Restores statistics of a table as of a specified timestamp (<i>as_of_timestamp</i>), as well as statistics of associated indexes and columns
RESUME_ADVISOR_TASK Procedure	Resumes an interrupted task. It only resumes the execution that was most recently interrupted
SCRIPT_ADVISOR_TASK Function	Retrieves the script that implements the recommended actions for the problems found by Optimizer Statistics Advisor
SEED_COL_USAGE Procedure	Iterates over the SQL statements in the specified SQL tuning set, compiles them and seeds column usage information for the columns that appear in these statements
SET_ADVISOR_TASK_PARAMETER Procedure	Updates the value of an Optimizer Statistics Advisor task parameter
SET_COLUMN_STATS Procedures	Sets column-related information
SET_DATABASE_PREFS Procedure	Sets the statistics preferences of all the tables
SET_GLOBAL_PREFS Procedure	Sets the global statistics preferences
SET_INDEX_STATS Procedures	Sets index-related information
SET_PARAM Procedure	Sets default values for parameters of DBMS_STATS procedures (see DBMS_STATS Deprecated Subprograms)
SET_PROCESSING_RATE Procedure	Sets the value of rate of processing for a given operation
SET_SCHEMA_PREFS Procedure	Sets the statistics preferences of all the tables owned by the specified owner name

Table 186-3 (Cont.) DBMS_STATS Package Subprograms

Subprogram	Description
SET_SYSTEM_STATS Procedure	Sets system statistics
SET_TABLE_PREFS Procedure	Sets the statistics preferences of the specified table in the specified schema
SET_TABLE_STATS Procedure	Sets table-related information
SHOW_EXTENDED_STAT_S_NAME Function	Returns the name of the virtual column that is created for the user-specified extension
TRANSFER_STATS Procedure	Transfers statistics for specified table(s) from a remote database specified by <code>dblink</code> to the local database
UNLOCK_PARTITION_STATS Procedure	Unlocks the statistics for a partition
UNLOCK_SCHEMA_STATS Procedure	Unlocks the statistics on all the tables in schema
UNLOCK_TABLE_STATS Procedure	Unlocks the statistics on the table
UPGRADE_STAT_TABLE Procedure	Upgrades user statistics on an older table

186.7.1 ALTER_STATS_HISTORY_RETENTION Procedure

This procedure changes the statistics history retention value.

Statistics history retention is used by both the automatic purge and [PURGE_STATS Procedure](#).

Syntax

```
DBMS_STATS.ALTER_STATS_HISTORY_RETENTION (
    retention      IN      NUMBER);
```

Parameters

Table 186-4 ALTER_STATS_HISTORY_RETENTION Procedure Parameters

Parameter	Description
<code>retention</code>	<p>The retention time in days. The statistics history will be retained for at least these many number of days. The valid range is [1,365000]. Also you can use the following values for special purposes:</p> <ul style="list-style-type: none"> -1: Statistics history is never purged by automatic purge 0: Old statistics are never saved. The automatic purge will delete all statistics history NULL: Change statistics history retention to default value

Usage Notes

To run this procedure, you must have the SYSDBA or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privilege.

Exceptions

ORA-20000: Insufficient privileges

186.7.2 CANCEL_ADVISOR_TASK Procedure

This procedure cancels an Optimizer Statistics Advisor execution. The advisor removes all intermediate results of the current execution from the task.

Syntax

```
DBMS_STATS.CANCEL_ADVISOR_TASK (  
    task_name IN VARCHAR2);
```

Parameters

Table 186-5 CANCEL_ADVISOR_TASK Procedure Parameters

Parameter	Description
task_name	The name of the Optimizer Statistics Advisor task.

Security Model

Note the following:

- To execute this subprogram, you must have the ADVISOR privilege.
- You must be the owner of the task.
- This subprogram executes using invoker's rights.

Consider a case in which a task is executed by one user, interrupted, and then resumed by a different user. In this case, Optimizer Statistics Advisor bases its checks of the resumed execution on the privilege of the user who resumed the task.

Exceptions

- ORA-20000: Insufficient privileges
- ORA-20001: Invalid input values
- ORA-20012: Optimizer Statistics Advisor errors

Usage Notes

To be canceled or interrupted, the specified task must be currently executing.

Example 186-1 Canceling an Optimizer Statistics Advisor

In this example, you start a SQL*Plus session, and then create and execute an advisor task named `my_task`:

```
DECLARE
  v_tname  VARCHAR2(128) := 'my_task';
  v_ename  VARCHAR2(128) := NULL;
BEGIN
  -- create a task
  v_tname := DBMS_STATS.CREATE_ADVISOR_TASK(v_tname);

  -- execute the task
  v_ename := DBMS_STATS.EXECUTE_ADVISOR_TASK(v_tname);
END;
/
```

In a separate terminal, you start a second SQL*Plus session, and then execute the following program:

```
EXEC DBMS_STATS.CANCEL_ADVISOR_TASK('my_task');
```

The first session returns an ORA-13632 to indicate the cancelation of the task:

```
ORA-13632: The user cancelled the current operation.
```

186.7.3 CONFIGURE_ADVISOR_FILTER Function

This function configures the filter list for an Optimizer Statistics Advisor task. Filters are useful for excluding irrelevant findings from a report.

Syntax

```
DBMS_STATS.CONFIGURE_ADVISOR_FILTER (
  task_name          IN   VARCHAR2,
  stats_adv_opr_type IN   VARCHAR2,
  configuration_type IN   VARCHAR2,
  filter             IN   StatsAdvFilterTab := NULL)
RETURN CLOB;
```

Parameters

Table 186-6 CONFIGURE_ADVISOR_FILTER Function Parameters

Parameter	Description
<code>task_name</code>	The name of the Optimizer Statistics Advisor task.
<code>stats_adv_opr_type</code>	The type of operation to configure. Possible values are EXECUTE, REPORT, SCRIPT, and IMPLEMENT. The function permits you to specify a combination of operation types by using the plus (+) operator, for example, EXECUTE +REPORT. If this parameter is null, then the filter applies to all types of advisor operations.

Table 186-6 (Cont.) CONFIGURE_ADVISOR_FILTER Function Parameters

Parameter	Description
<code>configuration_type</code>	The type of configuration. Possible values are as follows: <ul style="list-style-type: none"> • SET: Sets the specified filter list values. The submitted filter overrides existing filter values. • CLEAR: Clears the existing values for the specified filter. • SHOW: Shows the current values of the specified filter.
<code>filter</code>	The list of filter items for the script.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- This subprogram executes using invoker's rights.

Return Values

This function returns a CLOB that contains the configuration of the provided filter in XML format.

Exceptions

- `ORA-20000`: Insufficient privileges
- `ORA-20001`: Invalid input values
- `ORA-20012`: Optimizer Statistics Advisor errors

Usage Notes

To provide fine-grained control and a unified interface across all procedures, `DBMS_STATS` provides the `StatsAdvFilter` type. You can use this data type to instantiate and construct a table of filters. You can then pass a parameter of type `StatsAdvFilter` to `CONFIGURE_ADVISOR_FILTER` along with a Boolean variable that specifies either of the following:

- **Inclusion list**
Only include these objects in the check.
- **Exclusion list**
Do not include these objects in the check.

You can also pass in a parameter specifying whether to replace the existing list. This list only filters object-level and operation-level items. The advisor always checks system-level rules.

You can create the following types of filters:

- **Rule filter**
This filter takes a rule name as input. Obtain rule names from the `V$STATS_ADVISOR_RULES` view.

- Operation filter

This filter is an exact match filter that takes in the name of the operation and an XML string representation of all the parameter values in the call. To obtain the XML, see the notes section of the `DBA_OPTSTAT_OPERATIONS` view. To obtain the filter for an operation, use `DBMS_STATS.GET_ADVISOR_OPR_FILTER`.

- Object filter

This filter accept an owner name and an object name. Wildcards (%) are supported in the owner name and object name. When an object name is null or %, it means a filter for all the objects in the specified schema. If the owner name is also null or %, it means a default filter for all objects in the system.

If none of the filters is specified, then the function recognizes the filter as setting the global default value of filtering (include or exclude). During the check, if no filter has been specified for a rule, operation, or object, then the function uses the default value to determine whether to include or exclude it.

Example 186-2 Enabling and Disabling Rules

You may want to turn off checks for all rules except for a specific rule. In this example, you want to check whether SQL plan directives have been disabled.

```

DECLARE
  v_task_name    VARCHAR2(128)           := 'my_task';
  v_ret          VARCHAR2(128);
  filter         DBMS_STATS.StatsAdvFilter := null;
  filterTab     DBMS_STATS.StatsAdvFilterTab := null;
  v_counter      NUMBER                 := 0;
  v_filterReport CLOB;
BEGIN
  -- Create the advisor task
  v_ret := DBMS_STATS.CREATE_ADVISOR_TASK(v_task_name);

  -- Initialize the filter table
  filterTab := DBMS_STATS.StatsAdvFilterTab();

  -- First filter: set filters to be FALSE by default
  filter.include := FALSE;

  -- Add this filter to the filter table
  v_counter := v_counter + 1;
  filterTab.extend;
  filterTab(v_counter) := filter;

  -- Second filter: turn on filter for one rule
  filter.include := TRUE;
  filter.rulename := 'TurnOnSQLPlanDirective';

  -- Add the SQL plan directive filter to the filter table
  v_counter := v_counter + 1;
  filterTab.extend;
  filterTab(v_counter) := filter;

  v_filterReport := DBMS_STATS.CONFIGURE_ADVISOR_FILTER(
                    task_name           => v_task_name,

```

```
        stats_adv_opr_type => NULL,  
        configuration_type => 'SET',  
        filter              => filterTab);  
  
    -- Drop the task  
    DBMS_STATS.DROP_ADVISOR_TASK(v_task_name);  
END;
```

Example 186-3 Configuring an Operations Filter

In this example, your shop uses customized scripts to gather statistics for a table. If you do not want to see a specific statistics operation in the report, then you can specify an operations filter.

```
DECLARE  
    v_task_name    VARCHAR2(128)           := 'my_task';  
    v_ret          VARCHAR2(128);  
    filter         DBMS_STATS.StatsAdvFilter := null;  
    filterTab      DBMS_STATS.StatsAdvFilterTab := null;  
    opr            DBMS_STATS.StatsAdvOpr;  
    oprTab         DBMS_STATS.StatsAdvOprTab;  
    v_oprCnt       NUMBER                   := 0;  
    TYPE numTab IS TABLE OF NUMBER;  
    opr_tab        numTab;  
    v_filterReport CLOB;  
  
BEGIN  
    -- Create the advisor task  
    v_ret := DBMS_STATS.CREATE_ADVISOR_TASK(v_task_name);  
  
    -- Initialize filter table  
    filterTab := DBMS_STATS.StatsAdvFilterTab();  
  
    -- Initialize operations filter  
    oprTab := DBMS_STATS.StatsAdvOprTab();  
  
    SELECT ID  
        BULK COLLECT INTO opr_tab  
    FROM   WRI$_OPTSTAT_OPR  
    WHERE  OPERATION = 'set_table_stats'  
    AND    TARGET = 'HR.EMPLOYEES';  
  
    -- Populate the operations table  
    FOR i IN 1..opr_tab.count LOOP  
  
        -- Use the procedure GET_ADVISOR_OPR_FILTER to construct  
        -- an operation filter  
        DBMS_STATS.GET_ADVISOR_OPR_FILTER(opr_tab(i), opr);  
  
        v_oprCnt := v_oprCnt + 1;  
        oprTab.extend;  
        oprTab(v_oprCnt) := opr;  
  
    END LOOP;  
  
    filter.include := FALSE;
```

```
filter.oprlist := oprTab;

-- Add to filter table
filterTab.extend;
filterTab(1) := filter;

v_filterReport := DBMS_STATS.CONFIGURE_ADVISOR_FILTER(
    task_name          => v_task_name,
    stats_adv_opr_type => NULL,
    configuration_type => 'SET',
    filter              => filterTab);

-- Drop the task
DBMS_STATS.DROP_ADVISOR_TASK(v_task_name);

END;
```

Example 186-4 Reporting on a Specific Schema

In this example, you want to generate a report only for the `sh` schema. Also, you want to skip the `sh.products` table. You create an object filter as follows:

```
DECLARE
    v_task_name      VARCHAR2(128)           := 'my_task';
    v_ret            VARCHAR2(128);
    filter           DBMS_STATS.StatsAdvFilter := null;
    filterTab        DBMS_STATS.StatsAdvFilterTab := null;
    v_filterReport   CLOB;
    v_counter        NUMBER                   := 0;
    obj              DBMS_STATS.ObjectElem;
    objTab           DBMS_STATS.ObjectTab;
    v_objCnt         NUMBER                   := 0;
BEGIN
    -- Create the advisor task
    v_ret := DBMS_STATS.CREATE_ADVISOR_TASK(v_task_name);

    -- Initialize filter table
    filterTab := DBMS_STATS.StatsAdvFilterTab();

    -- Set object filter to be off by default
    filter.include := FALSE;

    objTab := DBMS_STATS.ObjectTab();

    obj.ownname := NULL;
    obj.objname := NULL;

    -- Add to the object table

    v_objCnt := v_objCnt + 1;
    objTab.extend;
    objTab(v_objCnt) := obj;

    filter.objlist := objTab;
```

```
-- Add the object filter to the filter table
v_counter := v_counter + 1;
filterTab.extend;
filterTab(v_counter) := filter;

-- In filter 1, turn on the check only for schema SH

filter.include := TRUE;

objTab := DBMS_STATS.ObjectTab();
v_objCnt := 0;

obj.ownname := 'SH';
obj.objname := NULL;

-- add to the object table
v_objCnt := v_objCnt + 1;
objTab.extend;
objTab(v_objCnt) := obj;

filter.objlist := objTab;

-- Add the object filter to the filter table
v_counter := v_counter + 1;
filterTab.extend;
filterTab(v_counter) := filter;

-- In filter 2, exclude the check for object sh.products

filter.include := FALSE;

objTab := dbms_stats.ObjectTab();
v_objCnt := 0;

-- Specify another object filter for sh.products
obj.ownname := 'SH';
obj.objname := 'PRODUCTS';

-- Add to the object table
v_objCnt := v_objCnt + 1;
objTab.extend;
objTab(v_objCnt) := obj;

filter.objlist := objTab;

-- Add the object filter to the filter table
v_counter := v_counter + 1;
filterTab.extend;
filterTab(v_counter) := filter;

v_filterReport :=
DBMS_STATS.CONFIGURE_ADVISOR_FILTER(
    task_name          => v_task_name,
```

```

stats_adv_opr_type => NULL,
configuration_type => 'SET',
filter              => filterTab);

-- Drop the task
DBMS_STATS.DROP_ADVISOR_TASK(v_task_name);
END;
```

186.7.4 CONFIGURE_ADVISOR_OBJ_FILTER Function

This function configures an object filter for an Optimizer Statistics Advisor task.

Syntax

```

DBMS_STATS.CONFIGURE_ADVISOR_OBJ_FILTER (
  task_name          IN VARCHAR2,
  stats_adv_opr_type IN VARCHAR2,
  rule_name          IN VARCHAR2,
  ownname            IN VARCHAR2,
  tablename          IN VARCHAR2,
  action             IN VARCHAR2)
RETURN CLOB;
```

Parameters

Table 186-7 CONFIGURE_ADVISOR_OBJ_FILTER Function Parameters

Parameter	Description
task_name	The name of the Optimizer Statistics Advisor task.
stats_adv_opr_type	The type of operation to configure. Possible values are EXECUTE, REPORT, SCRIPT, and IMPLEMENT. See " CONFIGURE_ADVISOR_RULE_FILTER Function ".
rule_name	The name of the rule to configure. If null, the function applies the filter to all operation-level rules.
ownname	The owner name of the operation target. If null, the function applies the filter to all owner names.
tablename	The table name of the operation target.
action	The configuration action to take for the specified rule. See " CONFIGURE_ADVISOR_RULE_FILTER Function ".

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- This subprogram executes using invoker's rights.

Return Values

This function returns an XML CLOB that contains the updated values of the filter.

Exceptions

- **ORA-20000:** Insufficient privileges
- **ORA-20001:** Invalid input values
- **ORA-20012:** Optimizer Statistics Advisor errors

186.7.5 CONFIGURE_ADVISOR_OPR_FILTER Functions

This overloaded function configures an operation filter for an Optimizer Statistics Advisor task.

Syntax

```
DBMS_STATS.CONFIGURE_ADVISOR_OPR_FILTER (
  task_name          IN VARCHAR2,
  stats_adv_opr_type IN VARCHAR2,
  rule_name          IN VARCHAR2,
  operation_name     IN VARCHAR2,
  action             IN VARCHAR2)
RETURN CLOB;
```

```
DBMS_STATS.CONFIGURE_ADVISOR_OPR_FILTER (
  task_name          IN VARCHAR2,
  stats_adv_opr_type IN VARCHAR2,
  rule_name          IN VARCHAR2,
  operation_name     IN VARCHAR2,
  ownname           IN VARCHAR2,
  tabname           IN VARCHAR2,
  action            IN VARCHAR2)
RETURN CLOB;
```

```
DBMS_STATS.CONFIGURE_ADVISOR_OPR_FILTER (
  task_name          IN VARCHAR2,
  stats_adv_opr_type IN VARCHAR2,
  rule_name          IN VARCHAR2,
  operation_id       IN NUMBER,
  action            IN VARCHAR2)
RETURN CLOB;
```

Parameters

Table 186-8 CONFIGURE_ADVISOR_OPR_FILTER Function Parameters

Parameter	Description
task_name	The name of the Optimizer Statistics Advisor task.

Table 186-8 (Cont.) CONFIGURE_ADVISOR_OPR_FILTER Function Parameters

Parameter	Description
stats_adv_opr_type	The type of operation to configure. Possible values are EXECUTE, REPORT, SCRIPT, and IMPLEMENT. See " CONFIGURE_ADVISOR_RULE_FILTER Function ".
rule_name	The name of the rule to configure. If null, the function applies the filter to all operation-level rules.
operation_name	The name of the operation. For example, an operation name could be gather_table_stats. This value cannot be null.
operation_id	The ID of the operation to configure. The filter applies to any operation with the same signature as the specified operation ID. If two operations have the same signature, then they have the same value for every parameter. View the operation ID in DBA_OPSTAT_OPERATIONS.ID. This value cannot be null.
ownname	The owner name of the operation target. This value cannot be null.
tabname	The table name of the operation target.
action	The configuration action to take for the specified rule. See " CONFIGURE_ADVISOR_RULE_FILTER Function ".

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- This subprogram executes using invoker's rights.

Return Values

This function returns an XML CLOB that contains the updated values of the filter.

Exceptions

- ORA-20000: Insufficient privileges
- ORA-20001: Invalid input values
- ORA-20012: Optimizer Statistics Advisor errors

Example 186-5 Excluding Operations for Gathering Table Statistics

In this example, your goal is to exclude operations that gather table statistics in the `hr` schema. User account `stats` has been granted the `DBA` role, `ADVISOR` privilege, and `SELECT ON DBA_OPTSTAT_OPERATIONS` privilege. You perform the following steps:

1. Log in to the database as `stats`.
2. Drop any existing task named `opt_adv_task1`.

```
DECLARE
  v_tname VARCHAR2(32767);
BEGIN
  v_tname := 'opt_adv_task1';
```

```

        DBMS_STATS.DROP_ADVISOR_TASK(v_tname);
    END;
/

```

3. Create a procedure named `opr_filter` that configures a task to advise on all operations *except* those that gather statistics for tables in the `hr` schema.

```

CREATE OR REPLACE PROCEDURE opr_filter(p_tname IN VARCHAR2) IS
    v_retc CLOB;
BEGIN
    -- For all rules, prevent the advisor from operating
    -- on the operations selected in the following query
    FOR rec IN
        (SELECT ID FROM DBA_OPTSTAT_OPERATIONS WHERE OPERATION =
'gather_table_stats' AND TARGET LIKE 'HR.%')
    LOOP
        v_retc := DBMS_STATS.CONFIGURE_ADVISOR_OPR_FILTER(
            task_name          => p_tname
            , stats_adv_opr_type => NULL
            , rule_name         => NULL
            , operation_id      => rec.id
            , action            => 'DISABLE');
    END LOOP;
END;
/
SHOW ERRORS

```

4. Create a task named `opt_adv_task1`, and then execute the `opr_filter` procedure for this task.

```

DECLARE
    v_tname VARCHAR2(32767);
    v_ret   VARCHAR2(32767);
BEGIN
    v_tname := 'opt_adv_task1';
    v_ret   := DBMS_STATS.CREATE_ADVISOR_TASK(v_tname);
    opr_filter(v_tname);
END;
/

```

5. Execute the task `opt_adv_task1`.

```

DECLARE
    v_tname VARCHAR2(32767);
    v_ret   VARCHAR2(32767);
begin
    v_tname := 'opt_adv_task1';
    v_ret   := DBMS_STATS.EXECUTE_ADVISOR_TASK(v_tname);
END;
/

```

6. Print the report.

```
SPOOL /tmp/rep.txt
SET LONG 1000000
COLUMN report FORMAT A200
SET LINESIZE 250
SET PAGESIZE 1000

SELECT DBMS_STATS.REPORT_ADVISOR_TASK(
        task_name      => 'opt_adv_task1'
      , execution_name => NULL
      , type           => 'TEXT'
      , section        => 'ALL'
    ) AS report
FROM   DUAL;
SPOOL OFF
```

See Also:

- *Oracle Database Reference* to learn more about `DBA_OPTSTAT_OPERATIONS`
- *Oracle Database SQL Tuning Guide* to learn how to manage Optimizer Statistics Advisor

186.7.6 CONFIGURE_ADVISOR_RULE_FILTER Function

This function configures a rule filter for an Optimizer Statistics Advisor task.

Syntax

```
DBMS_STATS.CONFIGURE_ADVISOR_RULE_FILTER (
    task_name      IN   VARCHAR2,
    stats_adv_opr_Type IN VARCHAR2,
    rule_name      IN   VARCHAR2,
    action         IN   VARCHAR2)
RETURN CLOB;
```

Parameters

Table 186-9 SCRIPT_ADVISOR_TASK Function Parameters

Parameter	Description
task_name	The name of the Optimizer Statistics Advisor task.
stats_adv_opr_type	The type of operation to configure. Possible values are EXECUTE, REPORT, SCRIPT, and IMPLEMENT. You can specify a combination of operation types, for example, EXECUTE +REPORT. If this parameter is null, then the filter applies to all types of Optimizer Statistics Advisor operations.
rule_name	The name of the rule to configure. If null, the function applies the filter to all rules.

Table 186-9 (Cont.) SCRIPT_ADVISOR_TASK Function Parameters

Parameter	Description
action	The configuration action to take for the specified rule. Possible values are: <ul style="list-style-type: none"> • ENABLE: Enables the filter • DISABLE: Disables the filter • DELETE: Deletes the filter • SHOW: Shows the current filter value

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- This subprogram executes using invoker's rights.

Return Values

This function returns an XML CLOB that contains the updated values of the filter.

Exceptions

- ORA-20000: Insufficient privileges
- ORA-20001: Invalid input values
- ORA-20012: Optimizer Statistics Advisor errors

186.7.7 CONVERT_RAW_VALUE Procedures

This procedure converts the internal representation of a minimum value, maximum value, or histogram endpoint actual value into a datatype-specific value.

The `minval`, `maxval`, and `eavals` fields of the `StatRec` structure as filled in by `GET_COLUMN_STATS` or `PREPARE_COLUMN_VALUES` are appropriate values for input.

Syntax

```
DBMS_STATS.CONVERT_RAW_VALUE (
    rawval    RAW,
    resval OUT BINARY_FLOAT);
```

```
DBMS_STATS.CONVERT_RAW_VALUE (
    rawval    RAW,
    resval OUT BINARY_DOUBLE);
```

```
DBMS_STATS.CONVERT_RAW_VALUE (
    rawval    RAW,
    resval OUT DATE);
```

```
DBMS_STATS.CONVERT_RAW_VALUE (
    rawval    RAW,
    resval OUT NUMBER);
```

```
DBMS_STATS.CONVERT_RAW_VALUE (
    rawval    RAW,
    resval OUT VARCHAR2);
```

Parameters

Table 186-10 CONVERT_RAW_VALUE Procedure Parameters

Parameter	Description
rawval	Raw representation of a column minimum, maximum, histogram end point actual value
resval	Converted, type-specific value

Usage Notes

No special privilege or role is needed to invoke this procedure.

186.7.8 CONVERT_RAW_VALUE_NVARCHAR Procedure

This procedure converts the internal representation of a a minimum value, maximum value, or histogram end point actual value.

The `minval`, `maxval` and `eavals` fields of the `StatRec` structure as filled in by `GET_COLUMN_STATS` or `PREPARE_COLUMN_VALUES` are appropriate values for input.

Syntax

```
DBMS_STATS.CONVERT_RAW_VALUE_NVARCHAR (
    rawval    RAW,
    resval OUT NVARCHAR2);
```

Parameters

Table 186-11 CONVERT_RAW_VALUE_NVARCHAR Procedure Parameters

Parameter	Description
rawval	The raw representation of a column minimum or maximum datatype-specific output parameters
resval	The converted, type-specific value

Usage Notes

No special privilege or role is needed to invoke this procedure.

186.7.9 CONVERT_RAW_VALUE_ROWID Procedure

This procedure converts the internal representation of a a minimum value, maximum value, or histogram end point actual value.

The `minval`, `maxval` and `eavals` fields of the `StatRec` structure as filled in by `GET_COLUMN_STATS` or `PREPARE_COLUMN_VALUES` are appropriate values for input.

Syntax

```
DBMS_STATS.CONVERT_RAW_VALUE_ROWID (
    rawval    RAW,
    resval OUT ROWID);
```

Pragmas

```
pragma restrict_references(convert_raw_value_rowid, WNDS, RNDS, WNPS, RNPS);
```

Parameters**Table 186-12 CONVERT_RAW_VALUE_ROWID Procedure Parameters**

Parameter	Description
rawval	The raw representation of a column minimum or maximum datatype-specific output parameters
resval	The converted, type-specific value

Usage Notes

No special privilege or role is needed to invoke this procedure.

186.7.10 COPY_TABLE_STATS Procedure

This procedure copies statistics of all dependent object such as columns and local indexes. If the statistics for source are not available then nothing is copied. It can optionally scale the statistics (such as the number of blks, or number of rows) based on the given `scale_factor`.

Syntax

```
DBMS_STATS.COPY_TABLE_STATS (
    ownname          VARCHAR2,
    tabname          VARCHAR2,
    srcpartname      VARCHAR2,
    dstpartname      VARCHAR2,
    scale_factor     VARCHAR2 DEFAULT 1,
    flags            NUMBER DEFAULT 0,
    force            BOOLEAN DEFAULT FALSE);
```

Parameters**Table 186-13 COPY_TABLE_STATS Procedure Parameters**

Parameter	Description
ownname	Schema of the table of source and destination [sub] partitions
tabname	Table name of source and destination [sub] partitions
srcpartname	Source [sub] partition
dstpartname	Destination [sub] partition
scale_factor	Scale factor to scale nblks, nrows etc. in dstpartname

Table 186-13 (Cont.) COPY_TABLE_STATS Procedure Parameters

Parameter	Description
flags	For internal Oracle use.
force	When value of this argument is <code>TRUE</code> copy statistics even if the destination [sub]partition is locked

Security Model

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Invalid [sub]partition name

ORA-20001: Bad input value

Usage Notes

This procedure updates the minimum and maximum values of destination partition for the first partitioning column as follows:

- If the partitioning type is `HASH`, then the minimum and maximum values of the destination partition are same as that of the source partition.
- If the partitioning type is `LIST`, then the behavior depends on the setting of the destination partition:
 - If the destination partition is a `NOT DEFAULT` partition, then the following statements are true:
 - * The minimum value of the destination partition is set to the minimum value of the value list that describes the destination partition.
 - * The maximum value of the destination partition is set to the maximum value of the value list that describes the destination partition.
 - Alternatively, if the destination partition is a `DEFAULT` partition, then the following statements are true:
 - * The minimum value of the destination partition is set to the minimum value of the source partition.
 - * The maximum value of the destination partition is set to the maximum value of the source partition.
- If the partitioning type is `RANGE`, then the following statements are true:
 - The minimum value of the destination partition is set to the high bound of previous partition unless the destination partition is the first partition. For the first partition, the minimum value is set to the high bound of the destination partition.
 - The maximum value of the destination partition is set to the high bound of the destination partition unless the high bound of the destination partition is

MAXVALUE, in which case the maximum value of the destination partition is set to the high bound of the previous partition.

- If the source partition column's minimum value is equal to its maximum value, and if both are equal to the source partition's lower bound, and if it has a single distinct value, then the destination partition column's minimum and maximum values are both set to the destination partition's lower bound. This is done for all partitioning columns.

If the above condition does not apply, second and subsequent partitioning columns are updated as follows. The destination partition column's maximum value is set to the greater of the destination partition upper bound and the source partition column's maximum value, with one exception. If the destination partition is D and its preceding partition is $D-1$ and the key column to be adjusted is C_n , the maximum value for C_n is set to the upper bound of D (ignoring the maximum value of the source partition column) provided that the upper bounds of the previous key column C_{n-1} are the same in partitions D and $D-1$.

- If the minimum and maximum values are different for a column after modifications, and if the number of distinct values is less than 1, then the number of distinct values is updated as 2.
- If the source or destination is a partition of a composite partitioned table, then this procedure does not copy statistics of the underlying subpartitions.

186.7.11 CREATE_ADVISOR_TASK Function

This function creates an advisor task for the Optimizer Statistics Advisor.

Syntax

```
DBMS_STATS.CREATE_ADVISOR_TASK (
    task_name    IN    VARCHAR2    := NULL)
RETURN VARCHAR2;
```

Parameters

Table 186-14 CREATE_ADVISOR_TASK Function Parameters

Parameter	Description
task_name	Name of the task. If the task name is already specified, then the function uses the specified task name. Otherwise, the function generates a new task name automatically.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- This subprogram executes using invoker's rights.

Return Values

This function returns the unique name of the Optimizer Statistics Advisor task.

Exceptions

ORA-20000: Insufficient privileges / creating extension is not supported

ORA-20001: Error when processing extension

ORA-20012: Optimizer Statistics Advisor errors

Example 186-6 Creating and Executing a Task

This example creates an Optimizer Statistics Advisor task named `my_task`, and then executes it.

```

DECLARE
  v_tname  VARCHAR2(128) := 'my_task';
BEGIN
  -- create a task
  v_tname := DBMS_STATS.CREATE_ADVISOR_TASK(v_tname);
  -- execute the task
  v_tname := DBMS_STATS.EXECUTE_ADVISOR_TASK(v_tname);
END;
```



Note:

Oracle Database SQL Tuning Guide to learn how manage Optimizer Statistics Advisor

186.7.12 CREATE_EXTENDED_STATS Function

This function creates a column statistics entry in the system for a user-specified column group or an expression in a table.

The database gathers statistics for this extension when a user-initiated or automatic statistics gathering job gathers statistics for the table. Statistics for such an extension are called **extended statistics**. This function returns the name of this newly created entry for the extension.

This second form of this function creates statistics extensions based on the column group usage recorded by the [SEED_COL_USAGE Procedure](#). This function returns a report of extensions created.

Syntax

```

DBMS_STATS.CREATE_EXTENDED_STATS (
  ownname  VARCHAR2,
  tabname  VARCHAR2,
  extension VARCHAR2)
RETURN VARCHAR2;
```

```

DBMS_STATS.CREATE_EXTENDED_STATS (
  ownname  VARCHAR2,
  tabname  VARCHAR2)
RETURN CLOB;
```

Parameters

Table 186-15 CREATE_EXTENDED_STATS Function Parameters

Parameter	Description
ownname	Owner name of a table
tabname	Name of the table
extension	Can be either a column group or an expression. Suppose the specified table has columns <code>c1</code> , <code>c2</code> . An example column group is "(<code>c1</code> , <code>c2</code>)". An example expression is "(<code>c1</code> + <code>c2</code>)".

Return Values

This function returns the name of this newly created entry for the extension.

Exceptions

ORA-20000: Insufficient privileges / creating extension is not supported

ORA-20001: Error when processing extension

ORA-20007: Extension already exists

ORA-20008: Reached the upper limit on number of extensions

Usage Notes

To invoke this procedure you must be owner of the table, or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table, or have either the `ANALYZE ANY DICTIONARY` or `SYSDBA` privilege.

The extension has the following restrictions:

- The extension cannot contain a virtual column.
- Extensions cannot be created on tables owned by `SYS`.
- Extensions cannot be created on cluster tables, index organized tables, temporary tables, or external tables.
- The total number of extensions in a table cannot be greater than a maximum of (20, 10% of number of non-virtual columns in the table).
- The number of columns in a column group must be in the range [2, 32].
- A column cannot appear more than once in a column group.
- The extension can contain an expression only if a corresponding virtual column has been created.
- An expression must contain at least one column.
- An expression cannot contain a subquery.
- The `COMPATIBLE` parameter must be 11.0.0.0.0 or greater.

186.7.13 CREATE_STAT_TABLE Procedure

This procedure creates a table with name `stattab` in `ownname`'s schema which is capable of holding statistics. The columns and types that compose this table are not relevant as it should be accessed solely through the procedures in this package.

Syntax

```
DBMS_STATS.CREATE_STAT_TABLE (
  ownname          VARCHAR2,
  stattab          VARCHAR2,
  tblspace         VARCHAR2 DEFAULT NULL,
  global_temporary BOOLEAN DEFAULT FALSE);
```

Parameters

Table 186-16 CREATE_STAT_TABLE Procedure Parameters

Parameter	Description
<code>ownname</code>	Name of the schema
<code>stattab</code>	Name of the table to create. This value should be passed as the <code>stattab</code> parameter to other procedures when the user does not want to modify the dictionary statistics directly.
<code>tblspace</code>	Tablespace in which to create the statistics tables. If none is specified, then they are created in the user's default tablespace.
<code>global_temporary</code>	Whether or not the table should be created as a global temporary table

Security Model

To invoke this procedure you need whichever privileges are required for creating a table in the specified schema.

Exceptions

ORA-20000: Table already exists or insufficient privileges

ORA-20001: Tablespace does not exist

186.7.14 DELETE_COLUMN_STATS Procedure

This procedure deletes column-related statistics.

Syntax

```
DBMS_STATS.DELETE_COLUMN_STATS (
  ownname          VARCHAR2,
  tabname          VARCHAR2,
  colname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  stattab          VARCHAR2 DEFAULT NULL,
  statid           VARCHAR2 DEFAULT NULL,
```

```

cascade_parts BOOLEAN DEFAULT TRUE,
statown       VARCHAR2 DEFAULT NULL,
no_invalidate BOOLEAN DEFAULT to_no_invalidate_type (
                    get_param('NO_INVALIDATE')),
force         BOOLEAN DEFAULT FALSE,
col_stat_type VARCHAR2 DEFAULT 'ALL';

```

Parameters

Table 186-17 DELETE_COLUMN_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema
tablename	Name of the table to which this column belongs
colname	Name of the column or extension
partname	Name of the table partition for which to delete the statistics. If the table is partitioned and if partname is NULL, then global column statistics are deleted.
stattab	User statistics table identifier describing from where to delete the statistics. If stattab is NULL, then the statistics are deleted directly from the dictionary.
statid	Identifier (optional) to associate with these statistics within stattab (Only pertinent if stattab is not NULL).
cascade_parts	If the table is partitioned and if partname is NULL, then setting this to true causes the deletion of statistics for this column for all underlying partitions as well.
statown	Schema containing stattab (if different than ownname)
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. The default can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
force	When value of this argument is TRUE, deletes column statistics even if locked
col_stat_type	Type of column statistics to be deleted. This argument takes the following values: <ul style="list-style-type: none"> HISTOGRAM - delete column histogram only ALL - delete base column statistics and histogram

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20005: Object statistics are locked

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.15 DELETE_DATABASE_PREFS Procedure

This procedure deletes the statistics preferences set for all non-system tables. You can include system tables by passing `TRUE` for the `add_sys` parameter.

Syntax

```
DBMS_STATS.DELETE_DATABASE_PREFS (
    pname          IN   VARCHAR2,
    add_sys        IN   BOOLEAN DEFAULT FALSE);
```

Parameters

Table 186-18 DELETE_DATABASE_PREFS Procedure Parameters

Parameter	Description
<code>pname</code>	<p>Preference name. The existing value for following preferences can be deleted and default preference values will be used:</p> <ul style="list-style-type: none"> • APPROXIMATE_NDV_ALGORITHM • AUTO_STAT_EXTENSIONS • CASCADE • DEGREE • ESTIMATE_PERCENT • GLOBAL_TEMP_TABLE_STATS • GRANULARITY • INCREMENTAL • INCREMENTAL_LEVEL • INCREMENTAL_STALENESS • METHOD_OPT • NO_INVALIDATE • OPTIONS • PREFERENCE_OVERRIDES_PARAMETER • PUBLISH • STALE_PERCENT • STAT_CATEGORY • TABLE_CACHED_BLOCKS
<code>add_sys</code>	Determines whether <code>SYS</code> tables will be included.

Table 186-19 Statistics Preferences

Preference	Description
APPROXIMATE_NDV_ALGORITHM	<p>Specifies the synopsis generation algorithm. A synopsis is special type of statistic that tracks the number of distinct values (NDV) for each column in a partition. Consider a synopsis as an internal management structure that samples distinct values.</p> <p>You can specify the following preferences:</p> <ul style="list-style-type: none"> REPEAT OR HYPERLOGLOG This is the default. If INCREMENTAL is enabled on the table, then the database preserves the format of any existing synopses that use the adaptive sampling algorithm. However, the database creates any new synopses in HyperLogLog format. This approach is attractive when existing performance is acceptable, and you do not want to incur the performance cost of reformatting legacy content. ADAPTIVE SAMPLING The database uses the adaptive sampling algorithm for all synopses. This is the most conservative option. HYPERLOGLOG The database uses the HyperLogLog algorithm for all new and stale synopses. In contrast to adaptive sampling, the HyperLogLog algorithm uses a randomization technique. The advantages of HyperLogLog over adaptive sampling are: <ul style="list-style-type: none"> The accuracy of the new algorithm is similar to the original algorithm. The memory required is significantly lower, which typically leads to huge reductions in synopsis size.
AUTO_STAT_EXTENSIONS	<p>Controls the automatic creation of extensions when database statistics are gathered.</p> <p>You can set the following values:</p> <ul style="list-style-type: none"> ON — When applicable, a SQL plan directive can trigger the creation of column group statistics based on usage of columns in the predicates in the workload. OFF — The database does not create column group statistics automatically. The database creates them only when the CREATE_EXTENDED_STATS function is executed, or when extended statistics are specified explicitly in the METHOD_OPT clause of DBMS_STATS. This is the default.
CASCADE	Determines whether index statistics are collected as part of gathering table statistics.
DEGREE	Determines degree of parallelism used for gathering statistics.
ESTIMATE_PERCENT	Determines the percentage of rows to estimate.
GLOBAL_TEMP_TABLE_STATS	Controls whether the statistics gathered for a global temporary table should be stored as shared statistics or session statistics.
GRANULARITY	Determines the granularity of statistics to collect. This value is only relevant for partitioned tables.
INCREMENTAL	Determines whether the global statistics of a partitioned table will be maintained without doing a full table scan.
INCREMENTAL_LEVEL	Controls which synopses to collect when INCREMENTAL preference is set to TRUE.

Table 186-19 (Cont.) Statistics Preferences

Preference	Description
INCREMENTAL_STALENESS	<p>Specifies when a partition or subpartition is considered stale. This parameter takes an enumeration of values, such as 'USE_STALE_PERCENT' and 'USE_LOCKED_STATS'. You can also specify multiple values, such as 'USE_STALE_PERCENT,USE_LOCKED_STATS,ALLOW_MIXED_FORMAT'.</p> <p>The parameter accepts the following values:</p> <ul style="list-style-type: none"> • USE_STALE_PERCENT—A partition or subpartition is not considered stale when DML changes are below the threshold set by the STALE_PERCENT preference. For example, assume that STALE_PERCENT is 10. You specify USE_STALE_PERCENT for INCREMENTAL_STALENESS. The partition has 5% DML changes. The database does not regather statistics. Assume a different case in which STALE_PERCENT is 10. You specify USE_STALE_PERCENT for INCREMENTAL_STALENESS. However, in this case the partition is locked and has 20% of DML changes. Because the partition is locked, the database does not regather statistics. • USE_LOCKED_STATS—Locked partitions or subpartitions statistics are never considered stale, regardless of DML changes. For example, assume that STALE_PERCENT is 10. You specify 'USE_LOCKED_STATS, USE_STALE_PERCENT'. The partition, which is locked, has 20% DML changes. The partition is not considered stale. The database uses existing statistics to derive global statistics. • ALLOW_MIXED_FORMAT—Adaptive sampling synopses and HyperLogLog synopses are permitted to coexist. • NULL—A partition or subpartition is considered stale when it has any DML changes. For example, assume that STALE_PERCENT is 10. You specify the value 'NULL' for INCREMENTAL_STALENESS. The partition has 5% of DML changes. The database regathers statistics. <p>Note that the following two executions are different:</p> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', 'NULL');</pre> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', null);</pre> <p>The first execution uses single quotes to set the preference to the value NULL, whereas the second sets the preference to the default, which is ALLOW_MIXED_FORMAT.</p>

Table 186-19 (Cont.) Statistics Preferences

Preference	Description
METHOD_OPT	Controls column statistics collection and histogram creation. When setting preference on global, schema, database or dictionary level, only 'FOR ALL' syntax is allowed.
NO_INVALIDATE	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. The default can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
OPTIONS	Determines the <code>options</code> parameter used in the GATHER_TABLE_STATS Procedure .
PREFERENCE_OVERRIDES_PARAMETER	Determines whether to override the input value of a parameter with the preference value of that parameter for a statistics operation. Possible values are: <ul style="list-style-type: none"> TRUE — Ignores input parameter values, and uses the value of the corresponding preference. FALSE — Obeys input parameter values. Specifying this preference does not change the order of precedence of table, global, and default.
PUBLISH	Determines whether the database publishes newly gathered statistics after the gathering job completes. You can gather statistics without publishing them immediately. This technique enables you to test new statistics before publishing them.
STALE_PERCENT	Determines the percentage of rows in a table that have to change before the statistics on that table are deemed stale and should be regathered.
STAT_CATEGORY	Specifies which statistics to import or export, accepting multiple values separated by a comma. Values supported: <ul style="list-style-type: none"> OBJECT_STATS — table statistics, column statistics and index statistics (default) SYNOPSIS — information to support incremental statistics REALTIME_STATS — Specifies only real-time statistics. MODELS — supports import, export, and deletion for regression models in real-time stats. The value 'OBJECT_STATS, SYNOPSIS, REALTIME_STATS, MODELS' specifies table statistics, column statistics, index statistics, and synopsis. The default value is 'OBJECT_STATS, SYNOPSIS, REALTIME_STATS, MODELS'.

Table 186-19 (Cont.) Statistics Preferences

Preference	Description
TABLE_CACHED_BLOCKS	Specifies the average number of blocks assumed to be cached in the buffer cache when calculating the index clustering factor. The preference applies only when gathering statistics using DBMS_STATS. Index statistics gathered during CREATE INDEX or REBUILD INDEX operations will use the default value 1.

Security Model

To run this procedure, you must have the SYSDBA role or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privileges.

Exceptions

ORA-20000: Insufficient privileges

ORA-20001: Invalid or illegal input values

Usage Notes

All pname arguments are of type VARCHAR2 and values are enclosed in quotes, even when they represent numbers.

Example 186-7 Examples

```
DBMS_STATS.DELETE_DATABASE_PREFS('CASCADE', FALSE);
DBMS_STATS.DELETE_DATABASE_PREFS('ESTIMATE_PERCENT', TRUE);
```



See Also:

Oracle Database SQL Tuning Guide to learn how to manage optimizer statistics preferences

186.7.16 DELETE_DATABASE_STATS Procedure

This procedure deletes statistics for all the tables in a database.

Syntax

```
DBMS_STATS.DELETE_DATABASE_STATS (
  stattab      VARCHAR2 DEFAULT NULL,
  statid       VARCHAR2 DEFAULT NULL,
  statown      VARCHAR2 DEFAULT NULL,
  no_invalidate  BOOLEAN  DEFAULT to_no_invalidate_type (
                                     get_param('NO_INVALIDATE')),
  force        BOOLEAN  DEFAULT FALSE,
  stat_category VARCHAR2 DEFAULT DEFAULT_DEL_STAT_CATEGORY);
```

Parameters

Table 186-20 DELETE_DATABASE_STATS Procedure Parameters

Parameter	Description
stattab	User statistics table identifier describing from where to delete the statistics. If stattab is NULL, then the statistics are deleted directly in the dictionary.
statid	Identifier (optional) to associate with these statistics within stattab (Only pertinent if stattab is not NULL)
statown	Schema containing stattab (if different from current schema)
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> • TRUE: Dependent cursors are not invalidated. • FALSE: Dependent cursors are marked for immediate invalidation. • AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>The default can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
force	When the value of this argument is TRUE, deletes statistics of tables in a database even if they are locked
stat_category	Statistics to delete. It accepts multiple values separated by comma: <ul style="list-style-type: none"> • OBJECT_STATS — table statistics, column statistics and index statistics • SYNOPSES — information to support incremental statistics • REALTIME_STATS — specifies only real-time statistics. • MODELS — supports import, export, and deletion for regression models in real-time stats. <p>The default is 'OBJECT_STATS, SYNOPSES, REALTIME_STATS, MODELS'</p>

Exceptions

ORA-20000: Object does not exist or insufficient privileges

Usage Notes

To run this procedure, you need to have the SYSDBA role or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privileges.

186.7.17 DELETE_DICTIONARY_STATS Procedure

This procedure deletes statistics for all dictionary schemas ('SYS', 'SYSTEM' and RDBMS component schemas).

Syntax

```
DBMS_STATS.DELETE_DICTIONARY_STATS (
  statab          VARCHAR2 DEFAULT NULL,
  statid          VARCHAR2 DEFAULT NULL,
  statown         VARCHAR2 DEFAULT NULL,
  no_invalidate   BOOLEAN  DEFAULT to_no_invalidate_type (
                                get_param('NO_INVALIDATE')),
  stattype        VARCHAR2 DEFAULT 'ALL',
  force           BOOLEAN  DEFAULT FALSE,
  stat_category   VARCHAR2 DEFAULT DEFAULT_DEL_STAT_CATEGORY);
```

Parameters

Table 186-21 DELETE_DICTIONARY_STATS Procedure Parameters

Parameter	Description
statab	User statistics table identifier describing from where to delete the statistics. If statab is NULL, then the statistics are deleted directly in the dictionary.
statid	Identifier (optional) to associate with these statistics within statab (Only pertinent if statab is not NULL)
statown	Schema containing statab (if different from current schema)
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. The default can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
stattype	Statistics type
force	When the value of this argument is TRUE, deletes statistics of tables in a database even if they are locked

Table 186-21 (Cont.) DELETE_DICTIONARY_STATS Procedure Parameters

Parameter	Description
stat_category	<p>Statistics to delete. It accepts multiple values separated by comma:</p> <ul style="list-style-type: none"> • OBJECT_STATS — table statistics, column statistics and index statistics • SYNOPSES — information to support incremental statistics • REALTIME_STATS — Specifies only real-time statistics. • MODELS — supports import, export, and deletion for regression models in real-time stats. <p>The default is 'OBJECT_STATS, SYNOPSES, REALTIME_STATS, MODELS'</p>

Usage Notes

You must have the SYSDBA or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privilege to execute this procedure.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20002: Bad user statistics table, may need to upgrade it

186.7.18 DELETE_FIXED_OBJECTS_STATS Procedure

This procedure deletes statistics of all fixed tables.

Syntax

```
DBMS_STATS.DELETE_FIXED_OBJECTS_STATS (
    statab          VARCHAR2 DEFAULT NULL,
    statid          VARCHAR2 DEFAULT NULL,
    statown         VARCHAR2 DEFAULT NULL,
    no_invalidate  BOOLEAN  DEFAULT to_no_invalidate_type (
                                get_param('NO_INVALIDATE')),
    force           BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 186-22 DELETE_FIXED_OBJECTS_STATS Procedure Parameters

Parameter	Description
statab	The user statistics table identifier describing from where to delete the current statistics. If statab is NULL, the statistics will be deleted directly in the dictionary.
statid	The (optional) identifier to associate with these statistics within statab. This only applies if statab is not NULL.
statown	Schema containing statab (if different from current schema)

Table 186-22 (Cont.) DELETE_FIXED_OBJECTS_STATS Procedure Parameters

Parameter	Description
no_invalidate	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> • TRUE: Dependent cursors are not invalidated. • FALSE: Dependent cursors are marked for immediate invalidation. • AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>The default can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
force	<p>Ignores the statistics lock on objects and deletes the statistics if set to TRUE</p>

Usage Notes

You must have the SYSDBA or ANALYZE ANY DICTIONARY system privilege to execute this procedure.

Exceptions

ORA-20000: Insufficient privileges

ORA-20002: Bad user statistics table, may need to upgrade it

186.7.19 DELETE_INDEX_STATS Procedure

This procedure deletes index-related statistics.

Syntax

```
DBMS_STATS.DELETE_INDEX_STATS (
  ownname          VARCHAR2,
  indname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  stattab         VARCHAR2 DEFAULT NULL,
  statid          VARCHAR2 DEFAULT NULL,
  cascade_parts   BOOLEAN   DEFAULT TRUE,
  statown         VARCHAR2 DEFAULT NULL,
  no_invalidate   BOOLEAN   DEFAULT to_no_invalidate_type (
                                get_param('NO_INVALIDATE')),
  stattype        VARCHAR2 DEFAULT 'ALL',
  force           BOOLEAN   DEFAULT FALSE);
stat_category    VARCHAR2 DEFAULT DEFAULT_DEL_STAT_CATEGORY);
```

Parameters

Table 186-23 DELETE_INDEX_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema

Table 186-23 (Cont.) DELETE_INDEX_STATS Procedure Parameters

Parameter	Description
indname	Name of the index
partname	Name of the index partition for which to delete the statistics. If the index is partitioned and if <code>partname</code> is <code>NULL</code> , then index statistics are deleted at the global level.
stattab	User statistics table identifier describing from where to delete the statistics. If <code>stattab</code> is <code>NULL</code> , then the statistics are deleted directly from the dictionary.
statid	Identifier (optional) to associate with these statistics within <code>stattab</code> (Only pertinent if <code>stattab</code> is not <code>NULL</code>)
cascade_parts	If the index is partitioned and if <code>partname</code> is <code>NULL</code> , then setting this to <code>TRUE</code> causes the deletion of statistics for this index for all underlying partitions as well
statown	Schema containing <code>stattab</code> (if different than <code>ownname</code>)
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> <code>TRUE</code>: Dependent cursors are not invalidated. <code>FALSE</code>: Dependent cursors are marked for immediate invalidation. <code>AUTO</code>: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>The default can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
stattype	Statistics type
force	When value of this argument is <code>TRUE</code> , deletes index statistics even if locked
stat_category	Statistics to delete. It accepts multiple values separated by comma: <ul style="list-style-type: none"> <code>OBJECT_STATS</code> — table statistics, column statistics and index statistics <code>SYNOPSIS</code> — information to support incremental statistics <code>REALTIME_STATS</code> — Specifies only real-time statistics. <code>MODELS</code> — supports import, export, and deletion for regression models in real-time stats. <p>The default is 'OBJECT_STATS, SYNOPSIS, REALTIME_STATS, MODELS'</p>

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20005: Object statistics are locked

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.20 DELETE_PENDING_STATS Procedure

This procedure is used to delete the pending statistics that have been collected but have not been published.

Syntax

```
DBMS_STATS.DELETE_PENDING_STATS (  
    ownname      IN  VARCHAR2  DEFAULT USER,  
    tablename    IN  VARCHAR2);
```

Parameters

Table 186-24 DELETE_PENDING_STATS Procedure Parameters

Parameter	Description
ownname	Owner name
tablename	Table name

Security Model

To run this procedure, you need to have the same privilege for gathering statistics on the tables that will be affected by this procedure. The default owner is the user who runs the procedure.

Exceptions

ORA-20000: Insufficient privileges

Usage Notes

If the parameter `tablename` is `NULL` delete applies to all tables of the specified schema.

Examples

```
DBMS_STATS.DELETE_PENDING_STATS('SH', 'SALES');
```

186.7.21 DELETE_PROCESSING_RATE Procedure

This procedure deletes the processing rate of a given statistics source. If the source is not specified, it deletes the statistics of all the sources.

Syntax

```
DBMS_STATS.DELETE_PROCESSING_RATE (  
    stat_source  IN  VARCHAR2  DEFAULT NULL);
```

Parameters

Table 186-25 DELETE_PROCESSING_RATE Procedure Parameters

Parameter	Description
stat_source	Source of processing rates: <ul style="list-style-type: none"> 'MANUAL': values set by the user manually using the SET_PROCESSING_RATE Procedure 'CALIBRATION': values collected by the calibration GATHER_PROCESSING_RATE Procedure run explicitly by the user 'FEEDBACK': values obtained by time feedback

Usage Notes

You require the `OPTIMIZER_PROCESSING_RATE` role to run this procedure since `AUTO DOP` uses processing rates to determine the optimal degree of parallelism for a SQL statement.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or illegal input value

186.7.22 DELETE_SCHEMA_PREFS Procedure

This procedure is used to delete the statistics preferences of all the tables owned by the specified owner name.

Syntax

```
DBMS_STATS.DELETE_SCHEMA_PREFS (
    ownname   IN   VARCHAR2,
    pname     IN   VARCHAR2);
```

Parameters

Table 186-26 DELETE_SCHEMA_PREFS Procedure Parameters

Parameter	Description
ownname	Owner name

Table 186-26 (Cont.) DELETE_SCHEMA_PREFS Procedure Parameters

Parameter	Description
pname	<p>Preference name. The existing value for following preferences can be deleted and default preference values will be used:</p> <ul style="list-style-type: none"> • APPROXIMATE_NDV_ALGORITHM • AUTO_STAT_EXTENSIONS • CASCADE • DEGREE • ESTIMATE_PERCENT • GLOBAL_TEMP_TABLE_STATS • GRANULARITY • INCREMENTAL • INCREMENTAL_LEVEL • INCREMENTAL_STALENESS • METHOD_OPT • NO_INVALIDATE • OPTIONS • PREFERENCE_OVERRIDES_PARAMETER • PUBLISH • STALE_PERCENT • TABLE_CACHED_BLOCKS

Table 186-27 Statistics Preferences

Preference	Description
APPROXIMATE_NDV_ALGORITHM	<p>Specifies the synopsis generation algorithm. A synopsis is special type of statistic that tracks the number of distinct values (NDV) for each column in a partition. You can consider a synopsis as an internal management structure that samples distinct values.</p> <p>You can set the following values:</p> <ul style="list-style-type: none"> • REPEAT OR HYPERLOGLOG <p>This is the default. If INCREMENTAL is enabled on the table, then the database preserves the format of any existing synopses that use the adaptive sampling algorithm. However, the database creates any new synopses in HyperLogLog format.</p> • ADAPTIVE SAMPLING <p>The database uses the adaptive sampling algorithm for all synopses.</p> • HYPERLOGLOG <p>The database uses the HyperLogLog algorithm for all new and stale synopses.</p>

Table 186-27 (Cont.) Statistics Preferences

Preference	Description
AUTO_STAT_EXTENSIONS	<p>Controls the automatic creation of extensions when database statistics are gathered.</p> <p>You can set the following values:</p> <ul style="list-style-type: none"> • ON — When applicable, a SQL plan directive can trigger the creation of column group statistics based on usage of columns in the predicates in the workload. • OFF— The database does not create column group statistics automatically. The database creates them only when the <code>CREATE_EXTENDED_STATS</code> function is executed, or when extended statistics are specified explicitly in the <code>METHOD_OPT</code> clause of <code>DBMS_STATS</code>. This is the default.
CASCADE	<p>Determines whether index statistics are collected as part of gathering table statistics.</p>
COORDINATOR_TRIGGER_SHARD	<p>User of each shard uses this preference to determine whether to allow shard coordinator to interact with the statistics gathering in each shards.</p> <p>While gathering the statistics in shard coordinator, if the statistics in one of the shards are not up to date, the shard coordinator will try to trigger the statistics gathering in that shard. By using this preference, user can execute or ignore that command from the shard coordinator.</p> <p>You can set the following values:</p> <ul style="list-style-type: none"> • TRUE—Allows the shard coordinator trigger the statistics gathering on sharded table in local shard if the statistics on local shard are stale. • FALSE—Ignores the statistics gathering command triggered from the shard coordinator. <p>The default value is <code>FALSE</code>.</p>
DEGREE	<p>Determines the degree of parallelism used for gathering statistics.</p>
ESTIMATE_PERCENT	<p>The value determines the percentage of rows to estimate.</p>
METHOD_OPT	<p>Controls column statistics collection and histogram creation. When setting preferences at the global, schema, database, or dictionary level, only <code>FOR ALL</code> syntax is allowed.</p>

Table 186-27 (Cont.) Statistics Preferences

Preference	Description
NO_INVALIDATE	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> • TRUE: Dependent cursors are not invalidated. • FALSE: Dependent cursors are marked for immediate invalidation. • AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>The default can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
GRANULARITY	The value determines granularity of statistics to collect (only pertinent if the table is partitioned)
PUBLISH	This value determines whether or not newly gathered statistics will be published once the gather job has completed.
INCREMENTAL	This value determines whether or not the global statistics of a partitioned table will be maintained without doing a full table scan.
INCREMENTAL_LEVEL	This value controls what synopses to collect when INCREMENTAL preference is set to TRUE.

Table 186-27 (Cont.) Statistics Preferences

Preference	Description
INCREMENTAL_STALENESS	<p>Specifies when a partition or subpartition is considered stale. This parameter takes an enumeration of values, such as 'USE_STALE_PERCENT' and 'USE_LOCKED_STATS'. You can also specify multiple values, such as 'USE_STALE_PERCENT,USE_LOCKED_STATS,ALLOW_MIXED_FORMAT'.</p> <p>The parameter accepts the following values:</p> <ul style="list-style-type: none"> • USE_STALE_PERCENT—A partition or subpartition is not considered stale when DML changes are below the threshold set by the <code>STALE_PERCENT</code> preference. <ul style="list-style-type: none"> For example, assume that <code>STALE_PERCENT</code> is 10. You specify <code>USE_STALE_PERCENT</code> for <code>INCREMENTAL_STALENESS</code>. The partition has 5% DML changes. The database does not regather statistics. Assume a different case in which <code>STALE_PERCENT</code> is 10. You specify <code>USE_STALE_PERCENT</code> for <code>INCREMENTAL_STALENESS</code>. However, in this case the partition is locked and has 20% of DML changes. Because the partition is locked, the database does not regather statistics. • USE_LOCKED_STATS—Locked partitions or subpartitions statistics are never considered stale, regardless of DML changes. <ul style="list-style-type: none"> For example, assume that <code>STALE_PERCENT</code> is 10. You specify 'USE_LOCKED_STATS, USE_STALE_PERCENT'. The partition, which is locked, has 20% DML changes. The partition is not considered stale. The database uses existing statistics to derive global statistics. • ALLOW_MIXED_FORMAT—Adaptive sampling synopses and HyperLogLog synopses are permitted to coexist. • NULL—A partition or subpartition is considered stale when it has any DML changes. <ul style="list-style-type: none"> For example, assume that <code>STALE_PERCENT</code> is 10. You specify the value 'NULL' for <code>INCREMENTAL_STALENESS</code>. The partition has 5% of DML changes. The database regathers statistics. <p>Note that the following two executions are different:</p> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', 'NULL');</pre> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', null);</pre>

Table 186-27 (Cont.) Statistics Preferences

Preference	Description
ROOT_TRIGGER_PDB	<p>The first execution uses single quotes to set the preference to the value <code>NULL</code>, whereas the second sets the preference to the default, which is <code>ALLOW_MIXED_FORMAT</code>.</p> <p>The application PDB user, uses this preference to determine whether to allow the application root to interact with the statics gathering in PDB.</p> <p>During the statistics gathering of a metadata linked table in the application root, if the statistics in a PDB are in stale state, the application root triggers the statistics gathering for the particular PDB. Using this preference, the user can either execute or ignore the command from the application root.</p> <p>You can set the following values:</p> <ul style="list-style-type: none"> • <code>TRUE</code>—Allows the application root trigger the statistics gathering on metadata linked table in application PDB if the statistics on PDB are stale. • <code>FALSE</code>—Ignores the statistics gathering command triggered from application root. <p>The default value is <code>FALSE</code>.</p>
STALE_PERCENT	<p>This value determines the percentage of rows in a table that have to change before the statistics on that table are deemed stale and should be regathered.</p>
GLOBAL_TEMP_TABLE_STATS	<p>This controls whether the statistics gathered for a global temporary table should be stored as shared statistics or session statistics.</p>
TABLE_CACHED_BLOCKS	<p>Specifies the average number of blocks assumed to be cached in the buffer cache when calculating the index clustering factor. The preference applies only when gathering statistics using <code>DBMS_STATS</code>. Index statistics gathered during <code>CREATE INDEX</code> or <code>REBUILD INDEX</code> operations will use the default value 1.</p>
OPTIONS	<p>Determines the <code>options</code> parameter used in the GATHER_TABLE_STATS Procedure.</p>

 **Note:**

CDB root, different from application root, never triggers statistics gathering on the PDBs and it is not controlled by this preference.

Security Model

To run this procedure, you must be the object owner, or have the `SYSDBA` privilege, or have the `ANALYZE ANY` system privilege.

Exceptions

ORA-20000: Insufficient privileges / Schema "<schema>" does not exist

ORA-20001: Invalid or Illegal input values

Usage Notes

All arguments are of type VARCHAR2 and values are enclosed in quotes, even when they represent numbers.

Examples

```
DBMS_STATS.DELETE_SCHEMA_PREFS('SH', 'CASCADE');
DBMS_STATS.DELETE_SCHEMA_PREFS('SH', 'ESTIMATE_PERCENT');
DBMS_STATS.DELETE_SCHEMA_PREFS('SH', 'DEGREE');
```



See Also:

Oracle Database SQL Tuning Guide to learn how to manage optimizer statistics preferences

186.7.23 DELETE_SCHEMA_STATS Procedure

This procedure deletes statistics for an entire schema.

Syntax

```
DBMS_STATS.DELETE_SCHEMA_STATS (
  ownname          VARCHAR2,
  statab           VARCHAR2 DEFAULT NULL,
  statid           VARCHAR2 DEFAULT NULL,
  statown          VARCHAR2 DEFAULT NULL,
  no_invalidate    BOOLEAN DEFAULT to_no_invalidate_type (
                                     get_param('NO_INVALIDATE')),
  force            BOOLEAN DEFAULT FALSE,
  stat_category    VARCHAR2 DEFAULT DEFAULT_DEL_STAT_CATEGORY);
```

Parameters

Table 186-28 DELETE_SCHEMA_STATS Procedure Parameters

Parameter	Description
ownname	Specifies the name of the schema.
statab	Identifies the table where statistics are stored. If statab is NULL, then the procedure deletes statistics directly from the data dictionary.
statid	Specifies the identifier (optional) associated with these statistics within statab. This parameter is only relevant if statab is not NULL.

Table 186-28 (Cont.) DELETE_SCHEMA_STATS Procedure Parameters

Parameter	Description
statown	Specifies the schema containing <code>stattab</code> (if different than <code>ownname</code>).
no_invalidate	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> • <code>TRUE</code>: Dependent cursors are not invalidated. • <code>FALSE</code>: Dependent cursors are marked for immediate invalidation. • <code>AUTO</code>: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
force	Indicates whether to force the deletion for locked statistics. When the value is <code>TRUE</code> , this procedure deletes table statistics even if locked.
stat_category	<p>Specifies which statistics to process. The following values are supported:</p> <ul style="list-style-type: none"> • <code>OBJECT_STATS</code> — Specifies table statistics, column statistics, and index statistics. • <code>SYNOPSIS</code> — Specifies metadata for incremental statistics. • <code>REALTIME_STATS</code> — Specifies only real-time statistics. • <code>MODELS</code> — supports import, export, and deletion for regression models in real-time stats. <p>You can specify a list of comma-delimited values. For example, <code>'OBJECT_STATS, SYNOPSIS'</code> specifies table statistics, column statistics, index statistics, and synopses. The default value is <code>'OBJECT_STATS, SYNOPSIS, REALTIME_STATS, MODELS'</code>.</p>

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

186.7.24 DELETE_SYSTEM_STATS Procedure

This procedure deletes workload statistics (collected using the `'INTERVAL'` or `'START'` and `'STOP'` options) and resets the default to `noworkload` statistics (collected using `'NOWORKLOAD'` option), if `stattab` is not specified. If `stattab` is specified, the subprogram deletes all system statistics with the associated `statid` from the `stattab`.

Syntax

```
DBMS_STATS.DELETE_SYSTEM_STATS (
    stattab      VARCHAR2 DEFAULT NULL,
    statid       VARCHAR2 DEFAULT NULL,
    statown      VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-29 DELETE_SYSTEM_STATS Procedure Parameters

Parameter	Description
stattab	Identifier of the user statistics table where the statistics will be saved
statid	Optional identifier associated with the statistics saved in the stattab
statown	Schema containing stattab (if different from current schema)

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20002: Bad user statistics table; may need to be upgraded

Usage Notes

To run this procedure, you need the GATHER_SYSTEM_STATISTICS role.

186.7.25 DELETE_TABLE_PREFS Procedure

This procedure deletes the optimizer statistics preferences of the specified table in the specified schema.

Syntax

```
DBMS_STATS.DELETE_TABLE_PREFS (
  ownname   IN  VARCHAR2,
  tablename IN  VARCHAR2,
  pname     IN  VARCHAR2);
```

Parameters

Table 186-30 DELETE_TABLE_PREFS Procedure Parameters

Parameter	Description
ownname	Owner name
tablename	Table name

Table 186-30 (Cont.) DELETE_TABLE_PREFS Procedure Parameters

Parameter	Description
pname	<p>Preference name. The existing value for following preferences can be deleted and default preference values will be used:</p> <ul style="list-style-type: none"> • APPROXIMATE_NDV_ALGORITHM • AUTO_STAT_EXTENSIONS • CASCADE • DEGREE • ESTIMATE_PERCENT • GRANULARITY • GLOBAL_TEMP_STATS • INCREMENTAL • INCREMENTAL_LEVEL • INCREMENTAL_STALENESS • METHOD_OPT • NO_INVALIDATE • OPTIONS • PREFERENCE_OVERRIDES_PARAMETER • PUBLISH • STALE_PERCENT • STAT_CATEGORY • TABLE_CACHED_BLOCKS

Table 186-31 Statistics Preferences

Preference	Description
APPROXIMATE_NDV_ALGORITHM	<p>Specifies the synopsis generation algorithm. A synopsis is special type of statistic that tracks the number of distinct values (NDV) for each column in a partition. Consider a synopsis as an internal management structure that samples distinct values.</p> <p>You can specify the following preferences:</p> <ul style="list-style-type: none"> • REPEAT OR HYPERLOGLOG This is the default. If INCREMENTAL is enabled on the table, then the database preserves the format of any existing synopses that use the adaptive sampling algorithm. However, the database creates any new synopses in HyperLogLog format. This approach is attractive when existing performance is acceptable, and you do not want to incur the performance cost of reformatting legacy content. • ADAPTIVE SAMPLING The database uses the adaptive sampling algorithm for all synopses. This is the most conservative option. • HYPERLOGLOG The database uses the HyperLogLog algorithm for all new and stale synopses. In contrast to adaptive sampling, the HyperLogLog algorithm uses a randomization technique. The advantages of HyperLogLog over adaptive sampling are: <ul style="list-style-type: none"> – The accuracy of the new algorithm is similar to the original algorithm. – The memory required is significantly lower, which typically leads to huge reductions in synopsis size.
AUTO_STAT_EXTENSIONS	<p>Controls the automatic creation of extensions when database statistics are gathered.</p> <p>You can set the following values:</p> <ul style="list-style-type: none"> • ON — When applicable, a SQL plan directive can trigger the creation of column group statistics based on usage of columns in the predicates in the workload. • OFF— The database does not create column group statistics automatically. The database creates them only when the CREATE_EXTENDED_STATS function is executed, or when extended statistics are specified explicitly in the METHOD_OPT clause of DBMS_STATS. This is the default.
CASCADE	Determines whether index statistics are collected as part of gathering table statistics.
DEGREE	Determines the degree of parallelism used for gathering statistics.
ESTIMATE_PERCENT	Determines the percentage of rows to estimate.
GRANULARITY	Determines granularity of statistics to collect. This value is only relevant for partitioned tables.

Table 186-31 (Cont.) Statistics Preferences

Preference	Description
GLOBAL_TEMP_TABLE_STATS	Controls whether the statistics gathered for a global temporary table should be stored as shared statistics or session statistics.
INCREMENTAL	This value determines whether or not the global statistics of a partitioned table will be maintained without doing a full table scan.
INCREMENTAL_LEVEL	This value controls what synopses to collect when INCREMENTAL preference is set to TRUE.

Table 186-31 (Cont.) Statistics Preferences

Preference	Description
INCREMENTAL_STALENESS	<p>Specifies when a partition or subpartition is considered stale. This parameter takes an enumeration of values, such as 'USE_STALE_PERCENT' and 'USE_LOCKED_STATS'. You can also specify multiple values, such as 'USE_STALE_PERCENT,USE_LOCKED_STATS,ALLOW_MIXED_FORMAT'.</p> <p>The parameter accepts the following values:</p> <ul style="list-style-type: none"> • USE_STALE_PERCENT—A partition or subpartition is not considered stale when DML changes are below the threshold set by the <code>STALE_PERCENT</code> preference. For example, assume that <code>STALE_PERCENT</code> is 10. You specify <code>USE_STALE_PERCENT</code> for <code>INCREMENTAL_STALENESS</code>. The partition has 5% DML changes. The database does not regather statistics. Assume a different case in which <code>STALE_PERCENT</code> is 10. You specify <code>USE_STALE_PERCENT</code> for <code>INCREMENTAL_STALENESS</code>. However, in this case the partition is locked and has 20% of DML changes. Because the partition is locked, the database does not regather statistics. • USE_LOCKED_STATS—Locked partitions or subpartitions statistics are never considered stale, regardless of DML changes. For example, assume that <code>STALE_PERCENT</code> is 10. You specify 'USE_LOCKED_STATS, USE_STALE_PERCENT'. The partition, which is locked, has 20% DML changes. The partition is not considered stale. The database uses existing statistics to derive global statistics. • ALLOW_MIXED_FORMAT—Adaptive sampling synopses and HyperLogLog synopses are permitted to coexist. • NULL—A partition or subpartition is considered stale when it has any DML changes. For example, assume that <code>STALE_PERCENT</code> is 10. You specify the value 'NULL' for <code>INCREMENTAL_STALENESS</code>. The partition has 5% of DML changes. The database regathers statistics. <p>Note that the following two executions are different:</p> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', 'NULL');</pre> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', null);</pre>

Table 186-31 (Cont.) Statistics Preferences

Preference	Description
	The first execution uses single quotes to set the preference to the value <code>NULL</code> , whereas the second sets the preference to the default, which is <code>ALLOW_MIXED_FORMAT</code> .
<code>METHOD_OPT</code>	Controls column statistics collection and histogram creation. When setting preference at the global, schema, database, or dictionary level, only <code>'FOR ALL'</code> syntax is allowed.
<code>NO_INVALIDATE</code>	The value controls the invalidation of dependent cursors of the tables for which statistics are being gathered.
<code>OPTIONS</code>	Determines the <code>options</code> parameter used in the GATHER_TABLE_STATS Procedure .
<code>PREFERENCE_OVERRIDES_PARAMETER</code>	Determines whether to override the input value of a parameter with the preference value of that parameter for a statistics operation. Possible values are: <ul style="list-style-type: none"> <code>TRUE</code> — Ignores input parameter values, and uses the value of the corresponding preference. <code>FALSE</code> — Obeys input parameter values. Specifying this preference does not change the order of precedence of table, global, and default.
<code>PUBLISH</code>	Determines whether newly gathered statistics will be published after the statistics gathering job has completed.
<code>STALE_PERCENT</code>	Determines the percentage of rows in a table that have to change before the statistics on that table are deemed stale and should be regathered.
<code>STAT_CATEGORY</code>	Specifies which statistics to import or export, accepting multiple values separated by a comma. Values supported: <ul style="list-style-type: none"> <code>OBJECT_STATS</code> — table statistics, column statistics and index statistics (default) <code>SYNOPSIS</code> — information to support incremental statistics <code>REALTIME_STATS</code> — specifies only real-time statistics. <code>MODELS</code> — supports import, export, and deletion for regression models in real-time stats. The value <code>'OBJECT_STATS, SYNOPSIS'</code> specifies table statistics, column statistics, index statistics, and synopsis. The default value is <code>'OBJECT_STATS, SYNOPSIS, REALTIME_STATS, MODELS'</code> .
<code>TABLE_CACHED_BLOCKS</code>	Specifies the average number of blocks assumed to be cached in the buffer cache when calculating the index clustering factor. The preference applies only when gathering statistics using <code>DBMS_STATS</code> . Index statistics gathered during <code>CREATE INDEX</code> or <code>REBUILD INDEX</code> operations will use the default value 1.

Exceptions

ORA-20000: Insufficient privileges

ORA-20001: Invalid or Illegal input values

Usage Notes

- To run this procedure, you need to connect as owner of the table, be granted `ANALYZE` privilege on the table, or `ANALYZE ANY` system privilege.
- All arguments are of type `VARCHAR2` and values are enclosed in quotes, even when they represent numbers.

Examples

```
DBMS_STATS.DELETE_TABLE_PREFS('SH', 'SALES', 'CASCADE');
DBMS_STATS.DELETE_TABLE_PREFS('SH', 'SALES', 'DEGREE');
```



See Also:

Oracle Database SQL Tuning Guide to learn how to manage optimizer statistics preferences

186.7.26 DELETE_TABLE_STATS Procedure

This procedure deletes table-related statistics.

Syntax

```
DBMS_STATS.DELETE_TABLE_STATS (
  ownname          VARCHAR2,
  tablename        VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  statab          VARCHAR2 DEFAULT NULL,
  statid          VARCHAR2 DEFAULT NULL,
  cascade_parts   BOOLEAN   DEFAULT TRUE,
  cascade_columns BOOLEAN   DEFAULT TRUE,
  cascade_indexes BOOLEAN   DEFAULT TRUE,
  statown         VARCHAR2 DEFAULT NULL,
  no_invalidate  BOOLEAN   DEFAULT to_no_invalidate_type (
                                get_param('NO_INVALIDATE')),
  force          BOOLEAN   DEFAULT FALSE,
  stat_category  VARCHAR2  DEFAULT DEFAULT_DEL_STAT_CATEGORY);
```

Parameters

Table 186-32 DELETE_TABLE_STATS Procedure Parameters

Parameter	Description
<code>ownname</code>	Specifies the name of the schema.
<code>tablename</code>	Specifies the name of the table to which this column belongs.
<code>partname</code>	Specifies the name of the table partition or subpartition from which to get the statistics. If the table is partitioned and if <code>partname</code> is <code>NULL</code> , then the statistics are retrieved from the global table level.

Table 186-32 (Cont.) DELETE_TABLE_STATS Procedure Parameters

Parameter	Description
stattab	Identifies the user statistics table where statistics will be retrieved. If stattab is NULL, then the procedure retrieves statistics directly from the dictionary.
statid	Specifies the identifier (optional) associated with these statistics within stattab. This parameter is only relevant if stattab is not NULL.
cascade_parts	Specifies whether the procedure should operate on underlying partitions. If the table is partitioned, and if partname is NULL, then specifying TRUE deletes statistics for underlying partitions.
cascade_columns	Indicates whether to invoke the DELETE_COLUMN_STATS procedure. If TRUE, then this procedure calls DELETE_COLUMN_STATS for all underlying columns.
cascade_indexes	Indicates whether to invoke the DELETE_INDEX_STATS procedure. If TRUE, then this procedure calls DELETE_INDEX_STATS for all underlying columns.
statown	Specifies the schema containing stattab (if different than ownname).
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
force	Indicates whether to force the deletion for locked statistics. When the value is TRUE, this procedure deletes table statistics even if locked.
stat_category	Specifies which statistics to process. The following values are supported: <ul style="list-style-type: none"> OBJECT_STATS — specifies table statistics, column statistics, and index statistics. SYNOPSIS — specifies metadata for incremental statistics. REALTIME_STATS — specifies only real-time statistics. MODELS — supports import, export, and deletion for regression models in real-time stats. <p>You can specify a list of comma-delimited values. For example, 'OBJECT_STATS, SYNOPSIS' specifies table statistics, column statistics, index statistics, and synopses.</p> <p>The default value is 'OBJECT_STATS, SYNOPSIS, REALTIME_STATS, MODELS'.</p>

Security Model

To invoke this procedure you must be owner of the table or have the ANALYZE ANY privilege. For objects owned by SYS, you must be either the owner of the table or have either the ANALYZE ANY DICTIONARY privilege or the SYSDBA privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20002: Bad user statistics table, may need to upgrade it

ORA-20005: Object statistics are locked

186.7.27 DIFF_TABLE_STATS_IN_HISTORY Function

This function compares statistics for a table as of two specified timestamps.

Syntax

```
DBMS_STATS.DIFF_TABLE_STATS_IN_HISTORY(
  ownname      IN  VARCHAR2,
  tablename    IN  VARCHAR2,
  time1        IN  TIMESTAMP WITH TIME ZONE,
  time2        IN  TIMESTAMP WITH TIME ZONE DEFAULT NULL,
  pctthreshold IN  NUMBER                      DEFAULT 10)
RETURN DiffRepTab pipelined;
```

Parameters

Table 186-33 DIFF_TABLE_STATS_IN_HISTORY Function Parameters

Parameter	Description
ownname	Specifies the owner of the table. Specify NULL for current schema.
tablename	Specifies the table for which statistics are to be compared.
time1	Specifies the first timestamp for comparison.
time2	Specifies the second timestamp for comparison.
pctthreshold	Specifies the threshold limit. The function reports differences in statistics only if the change percentage exceeds this limit. The default value is 10.

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Usage Notes

If the second timestamp is `NULL`, then the function compares the current statistics in the data dictionary with the statistics as of the first timestamp.

186.7.28 DIFF_TABLE_STATS_IN_PENDING Function

This function compares pending statistics to either the current statistics in the data dictionary, or user-specified historical statistics.

Syntax

```
DBMS_STATS.DIFF_TABLE_STATS_IN_PENDING(
  ownname      IN  VARCHAR2,
  tablename    IN  VARCHAR2,
```



```

        timestamp      IN  TIMESTAMP WITH TIME ZONE,
        pctthreshold   IN  NUMBER  DEFAULT 10)
RETURN DiffRepTab pipelined;

```

Parameters

Table 186-34 DIFF_TABLE_STATS_IN_PENDING Function Parameters

Parameter	Description
ownname	Owner of the table. Specify NULL for the current schema.
tablename	Table for which statistics are to be compared.
timestamp	Timestamp in the statistics history that corresponds to the desired statistics. If the timestamp is NULL, then this function compares the current statistics in the dictionary with the pending statistics (default).
pctthreshold	Limit for reporting. The function reports difference in statistics only if it exceeds the specified limit. The default value is 10.

Security Model

To invoke this procedure you must be owner of the table, or you must have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table, or you must have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.29 DIFF_TABLE_STATS_IN_STATTAB Function

This function compares table statistics from two sources.

The function can obtain statistics from the following sources:

- Two user statistics tables
- A single user statistics table containing two sets of statistics that can be identified using `statids`
- A user statistics table and dictionary

The function also compares the statistics of the dependent objects: indexes, columns, and partitions. It displays statistics of the objects from both sources when the difference between those statistics exceeds a certain threshold (%). You can specify this threshold as an argument to the function. The function uses the statistics corresponding to the first source (`stattab1` or `time1`) as the basis for computing the difference percentage.

Syntax

```

DBMS_STATS.DIFF_TABLE_STATS_IN_STATTAB (
  ownname      IN  VARCHAR2,
  tablename    IN  VARCHAR2,
  stattab1     IN  VARCHAR2,
  stattab2     IN  VARCHAR2 DEFAULT NULL,
  pctthreshold IN  NUMBER  DEFAULT 10,
  statid1     IN  VARCHAR2 DEFAULT NULL,
  statid2     IN  VARCHAR2 DEFAULT NULL,

```

```

    statablown    IN  VARCHAR2 DEFAULT NULL,
    statab2own   IN  VARCHAR2 DEFAULT NULL)
RETURN DiffRepTab pipelined;

```

Parameters

Table 186-35 DIFF_TABLE_STATS_IN_STATTAB Function Parameters

Parameter	Description
ownname	Specifies the owner of the table. Specify <code>NULL</code> for current schema.
tablename	Specifies the table for which statistics are to be compared.
statab1	Specifies the user statistics table 1.
statab2	Specifies the user statistics table 2. If <code>NULL</code> , the function compares statistics in <code>statab1</code> with current statistics in the data dictionary. This is the default. To compare two sets within the statistics table, specify the same table as <code>statab1</code> (see <code>statid</code> below).
pctthreshold	Specifies the percent thresholds for comparison. The function reports difference in statistics only if it exceeds this limit. The default value is 10.
statid1	(optional) Identifies statistics set within <code>statab1</code> .
statid2	(optional) Identifies statistics set within <code>statab2</code> .
statablown	Specifies the schema containing <code>statab1</code> (if other than <code>ownname</code>).
statab2own	Specifies the schema containing <code>statab2</code> (if other than <code>ownname</code>).

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.30 DROP_ADVISOR_TASK Procedure

This procedure drops the specified Optimizer Statistics Advisor task.

Syntax

```

DBMS_STATS.DROP_ADVISOR_TASK (
    task_name IN VARCHAR2);

```

Parameters

Table 186-36 DROP_ADVISOR_TASK Procedure Parameters

Parameter	Description
task_name	The name of the Optimizer Statistics Advisor task.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- This subprogram executes using invoker's rights.

Exceptions

- `ORA-20000`: Insufficient privileges
- `ORA-20001`: Invalid input values
- `ORA-20012`: Optimizer Statistics Advisor errors

Example 186-8 Dropping an Optimizer Statistics Advisor Task

This example drops the Optimizer Statistics Advisor task named `my_task`:

```
EXEC DBMS_STATS.DROP_ADVISOR_TASK('my_task');
```

186.7.31 DROP_EXTENDED_STATS Procedure

This function drops the statistics entry that is created for the user specified extension.

This cancels the effects of the [CREATE_EXTENDED_STATS Function](#).

Syntax

```
DBMS_STATS.DROP_EXTENDED_STATS (
    ownname    VARCHAR2,
    tablename  VARCHAR2,
    extension  VARCHAR2);
```

Parameters

Table 186-37 DROP_EXTENDED_STATS Procedure Parameters

Parameter	Description
<code>ownname</code>	Owner name of a table
<code>tablename</code>	Name of the table
<code>extension</code>	Can be either a column group or an expression. Suppose the specified table has two column <code>c1</code> , <code>c2</code> . An example column group can be " <code>(c1, c2)</code> " and an example expression can be " <code>(c1 + c2)</code> ".

Exceptions

- `ORA-20000`: Insufficient privileges or extension does not exist
- `ORA-20001`: Error when processing extension

Usage Notes

- To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

- If no extended statistics set is created for the extension, this function throws an error.

186.7.32 DROP_STAT_TABLE Procedure

This procedure drops a user statistics table.

Syntax

```
DBMS_STATS.DROP_STAT_TABLE (
    ownname VARCHAR2,
    statab VARCHAR2);
```

Parameters

Table 186-38 DROP_STAT_TABLE Procedure Parameters

Parameter	Description
ownname	Name of the schema
statab	User statistics table identifier

Exceptions

ORA-20000: Table does not exists or insufficient privileges.

Usage Notes

To invoke this procedure you need the privileges for dropping the specified table.

186.7.33 EXECUTE_ADVISOR_TASK Function

This function executes a previously created Optimizer Statistics Advisor task.

Syntax

```
DBMS_STATS.EXECUTE_ADVISOR_TASK (
    task_name          IN  VARCHAR2,
    execution_name     IN  VARCHAR2 := NULL)
RETURN VARCHAR2;
```

Parameters

Table 186-39 EXECUTE_ADVISOR_TASK Parameters

Parameter	Description
task_name	Name of the Optimizer Statistics Advisor task.
execution_name	A name that qualifies and identifies an advisor execution. If not specified, then the advisor automatically generates it. If the specified execution conflicts with the name of an existing execution, then the function returns an error.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- You can execute this subprogram for `AUTO_STATS_ADVISOR_TASK`, which is predefined.
- This subprogram executes using invoker's rights.

The results of performing this task depend on the privileges of the executing user:

- `SYSTEM` level

Only users with both the `ANALYZE ANY` and `ANALYZE ANY DICTIONARY` privileges can perform this task on system-level rules.

- Operation level

The results depend on the following privileges:

- Users with both the `ANALYZE ANY` and `ANALYZE ANY DICTIONARY` privileges can perform this task for all statistics operations.
- Users with the `ANALYZE ANY` privilege but *not* the `ANALYZE ANY DICTIONARY` privilege can perform this task for statistics operations related to any schema except `SYS`.
- Users with the `ANALYZE ANY DICTIONARY` privilege but *not* the `ANALYZE ANY` privilege can perform this task for statistics operations related to their own schema and the `SYS` schema.
- Users with neither the `ANALYZE ANY` nor the `ANALYZE ANY DICTIONARY` privilege can only perform this operation for statistics operations relating to their own schema.

- Object level

Users can perform this task for any object for which they have statistics collection privileges.

Exceptions

- `ORA-20000`: Insufficient privileges
- `ORA-20001`: Invalid input values
- `ORA-20012`: Optimizer Statistics Advisor errors

Returns

This function returns the name of the new execution.

Usage Notes

The results of the execution depend on user privileges and the type of rules:

- System

To perform the operation on system-level rules, you must have both the `ANALYZE ANY` and `ANALYZE ANY DICTIONARY` privileges.

- **Operation**

If you have the `ANALYZE ANY` and `ANALYZE ANY DICTIONARY` privileges, then you can execute this function for all operations. If you have only the `ANALYZE ANY` privilege, then you can execute this function for operations related to any schemas except `SYS`. If you have only the `ANALYZE ANY DICTIONARY` privilege, then you can execute this function for operations related to any schemas, including `SYS`. If you have neither the `ANALYZE ANY` nor the `ANALYZE ANY DICTIONARY` privilege, then you can execute this function only for operations in your own schema.

- **Object**

If you have the privilege to collect statistics for an object, then you can execute this function for the object.

Example 186-9 Creating and Executing a Task

This example creates an Optimizer Statistics Advisor task named `my_task`, and then executes it.

```
DECLARE
  v_tname  VARCHAR2(128) := 'my_task';
BEGIN
  -- create a task
  v_tname := DBMS_STATS.CREATE_ADVISOR_TASK(v_tname);
  -- execute the task
  v_tname := DBMS_STATS.EXECUTE_ADVISOR_TASK(v_tname);
END;
```

186.7.34 EXPORT_COLUMN_STATS Procedure

This procedure exports statistics for a specified column and stores them in the user statistics table identified by `stattab`.

Syntax

```
DBMS_STATS.EXPORT_COLUMN_STATS (
  ownname  VARCHAR2,
  tablename VARCHAR2,
  colname  VARCHAR2,
  partname VARCHAR2 DEFAULT NULL,
  stattab  VARCHAR2,
  statid   VARCHAR2 DEFAULT NULL,
  statown  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-40 EXPORT_COLUMN_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema
tabname	Name of the table to which this column belongs
colname	Name of the column or extension
partname	Name of the table partition. If the table is partitioned and if partname is NULL, then global and partition column statistics are exported.
stattab	User statistics table identifier describing where to store the statistics
statid	Identifier (optional) to associate with these statistics within stattab
statown	Schema containing stattab (if different than ownname)

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

Usage Notes

Oracle Database does not support export or import of statistics across databases of different character sets.

186.7.35 EXPORT_DATABASE_PREFS Procedure

This procedure is used to export the statistics preferences of all the tables, excluding the tables owned by Oracle. These tables can be included by passing `TRUE` for the `add_sys` parameter.

Syntax

```
DBMS_STATS.EXPORT_DATABASE_PREFS (
  stattab      IN  VARCHAR2,
  statid       IN  VARCHAR2 DEFAULT NULL,
  statown      IN  VARCHAR2 DEFAULT NULL,
  add_sys      IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 186-41 EXPORT_DATABASE_PREFS Procedure Parameters

Parameter	Description
stattab	Statistics table name to where statistics should be exported

Table 186-41 (Cont.) EXPORT_DATABASE_PREFS Procedure Parameters

Parameter	Description
statid	(Optional) Identifier to associate with these statistics within statab
statown	Schema containing statab (if other than ownname)
add_sys	Value TRUE will include the Oracle-owned tables

Exceptions

ORA-20000: Insufficient privileges

Usage Notes

- To run this procedure, you need to have the SYSDBA role, or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privileges.
- All arguments are of type VARCHAR2 and values are enclosed in quotes.
- Oracle does not support export or import of statistics across databases of different character sets.

Examples

```
DBMS_STATS.EXPORT_DATABASE_PREFS('STATTAB', statown=>'SH');
```

186.7.36 EXPORT_DATABASE_STATS Procedure

This procedure exports statistics for all objects in the database and stores them in the user statistics tables identified by statown.statab.

Syntax

```
DBMS_STATS.EXPORT_DATABASE_STATS (
    statab          VARCHAR2,
    statid          VARCHAR2 DEFAULT NULL,
    statown         VARCHAR2 DEFAULT NULL,
    stat_category  VARCHAR2 DEFAULT DEFAULT_STAT_CATEGORY);
```

Parameters

Table 186-42 EXPORT_DATABASE_STATS Procedure Parameters

Parameter	Description
statab	User statistics table identifier describing where to store the statistics
statid	Identifier (optional) to associate with these statistics within statab
statown	Schema containing statab (if different from current schema)

Table 186-42 (Cont.) EXPORT_DATABASE_STATS Procedure Parameters

Parameter	Description
stat_category	<p>Specifies what statistics to import, accepting multiple values separated by a comma. Values supported:</p> <ul style="list-style-type: none"> • OBJECT_STATS — table statistics, column statistics and index statistics (default). • SYNOPSIS — information to support incremental statistics. • REALTIME_STATS — specifies only real-time statistics. <p>If 'OBJECT_STATS, SYNOPSIS' is specified, table statistics, column statistics, index statistics and synopsis are deleted.</p>

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

Usage Notes

Oracle Database does not support export or import of statistics across databases of different character sets.

186.7.37 EXPORT_DICTIONARY_STATS Procedure

This procedure exports statistics for all data dictionary schemas (`SYS`, `SYSTEM`, and RDBMS component schemas) and stores them in the user statistics table identified by `stattab`.

Syntax

```
DBMS_STATS.EXPORT_DICTIONARY_STATS (
  stattab          VARCHAR2,
  statid          VARCHAR2 DEFAULT NULL,
  statown         VARCHAR2 DEFAULT NULL,
  stat_category   VARCHAR2 DEFAULT DEFAULT_STAT_CATEGORY);
```

Parameters

Table 186-43 EXPORT_DICTIONARY_STATS Procedure Parameters

Parameter	Description
stattab	User statistics table identifier describing where to store the statistics
statid	Identifier (optional) to associate with these statistics within <code>stattab</code>
statown	Schema containing <code>stattab</code> (if different from current schema)

Table 186-43 (Cont.) EXPORT_DICTIONARY_STATS Procedure Parameters

Parameter	Description
<code>stat_category</code>	<p>Specifies what statistics to import, accepting multiple values separated by a comma. Values supported:</p> <ul style="list-style-type: none"> <code>OBJECT_STATS</code> — table statistics, column statistics and index statistics (default) <code>SYNOPSIS</code> — information to support incremental statistics <code>REALTIME_STATS</code> — specifies only real-time statistics. <p>If 'OBJECT_STATS, SYNOPSIS' is specified, table statistics, column statistics, index statistics and synopses are deleted.</p>

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20002: Bad user statistics table, may need to upgrade it

Usage Notes

Oracle Database does not support export or import of statistics across databases of different character sets.

186.7.38 EXPORT_FIXED_OBJECTS_STATS Procedure

This procedure exports statistics for fixed tables and stores them in the user statistics table identified by `stattab`.

Syntax

```
DBMS_STATS.EXPORT_FIXED_OBJECTS_STATS (
  stattab  VARCHAR2,
  statid   VARCHAR2 DEFAULT NULL,
  statown  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-44 EXPORT_FIXED_OBJECTS_STATS Procedure Parameters

Parameter	Description
<code>stattab</code>	User statistics table identifier describing where to store the statistics
<code>statid</code>	Identifier (optional) to associate with these statistics within <code>stattab</code>
<code>statown</code>	Schema containing <code>stattab</code> (if different from current schema)

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20002: Bad user statistics table, may need to upgrade it

Usage Notes

Oracle Database does not support export or import of statistics across databases of different character sets.

186.7.39 EXPORT_INDEX_STATS Procedure

This procedure retrieves statistics for a particular index and stores them in the user statistics table identified by `stattab`.

Syntax

```
DBMS_STATS.EXPORT_INDEX_STATS (
    ownname  VARCHAR2,
    indname  VARCHAR2,
    partname VARCHAR2 DEFAULT NULL,
    stattab  VARCHAR2,
    statid   VARCHAR2 DEFAULT NULL,
    statown  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-45 EXPORT_INDEX_STATS Procedure Parameters

Parameter	Description
<code>ownname</code>	Name of the schema
<code>indname</code>	Name of the index
<code>partname</code>	Name of the index partition. If the index is partitioned and if <code>partname</code> is <code>NULL</code> , then global and partition index statistics are exported.
<code>stattab</code>	User statistics table identifier describing where to store the statistics
<code>statid</code>	Identifier (optional) to associate with these statistics within <code>stattab</code>
<code>statown</code>	Schema containing <code>stattab</code> (if different than <code>ownname</code>)

Exceptions

ORA-20000: Object does not exist or insufficient privileges

Usage Notes

- To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.
- Oracle does not support export or import of statistics across databases of different character sets.

186.7.40 EXPORT_PENDING_STATS Procedure

This procedure is used to export the statistics gathered and stored as pending.

Syntax

```
DBMS_STATS.EXPORT_PENDING_STATS (
  ownname      IN  VARCHAR2  DEFAULT USER,
  tablename    IN  VARCHAR2,
  stattab      IN  VARCHAR2,
  statid       IN  VARCHAR2  DEFAULT NULL,
  statown      IN  VARCHAR2  DEFAULT USER);
```

Parameters

Table 186-46 EXPORT_PENDING_STATS Procedure Parameters

Parameter	Description
<code>ownname</code>	Owner name
<code>tablename</code>	Table name
<code>stattab</code>	Statistics table name to where to export the statistics
<code>statid</code>	(Optional) Identifier to associate with these statistics within <code>stattab</code>
<code>statown</code>	Schema containing <code>stattab</code> (if other than <code>ownname</code>)

Exceptions

ORA-20000: Object does not exist or insufficient privileges

Usage Notes

- If the parameter `tablename` is `NULL` then export applies to all tables of the specified schema.
- The default owner/schema is the user who runs the procedure.
- To run this procedure, you need to have the same privilege for gathering statistics on the tables that will be touched by this procedure.
- All arguments are of type `VARCHAR2` and values are enclosed in quotes.
- Oracle does not support export or import of statistics across databases of different character sets.

Examples

```
DBMS_STATS.EXPORT_PENDING_STATS(NULL, NULL, 'MY_STAT_TABLE');
```

186.7.41 EXPORT_SCHEMA_PREFS Procedure

This procedure is used to export the statistics preferences of all the tables owned by the specified owner name.

Syntax

```
DBMS_STATS.EXPORT_SCHEMA_PREFS (  
    ownname      IN  VARCHAR2,  
    statab       IN  VARCHAR2,  
    statid       IN  VARCHAR2 DEFAULT NULL,  
    statown      IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-47 EXPORT_SCHEMA_PREFS Procedure Parameters

Parameter	Description
ownname	Owner name
statab	Statistics table name to where to export the statistics
statid	(Optional) Identifier to associate with these statistics within statab
statown	Schema containing statab (if different than ownname)

Exceptions

ORA-20000: Object does not exist or insufficient privileges

Usage Notes

- To run this procedure, you need to connect as owner, or have the SYSDBA privilege, or have the ANALYZE ANY system privilege.
- All arguments are of type VARCHAR2 and values are enclosed in quotes.
- Oracle does not support export or import of statistics across databases of different character sets.

Examples

```
DBMS_STATS.EXPORT_SCHEMA_PREFS('SH', 'STAT');
```

186.7.42 EXPORT_SCHEMA_STATS Procedure

This procedure exports statistics for all objects in the schema identified by ownname and stores them in the user statistics tables identified by statab.

Syntax

```
DBMS_STATS.EXPORT_SCHEMA_STATS (  
    ownname      VARCHAR2,  
    statab       VARCHAR2,  
    statid       VARCHAR2 DEFAULT NULL,
```

```
statown          VARCHAR2 DEFAULT NULL,
stat_category    VARCHAR2 DEFAULT DEFAULT_STAT_CATEGORY);
```

Parameters

Table 186-48 EXPORT_SCHEMA_STATS Procedure Parameters

Parameter	Description
ownname	Specifies the name of the schema.
stattab	Identifies the user statistics table in which to store the exported statistics.
statid	Specifies the identifier (optional) associated with these statistics within stattab.
statown	Specifies the schema containing stattab (if different than ownname).
stat_category	<p>Specifies which statistics to process. The following values are supported:</p> <ul style="list-style-type: none"> OBJECT_STATS — specifies table statistics, column statistics, and index statistics SYNOPSIS — specifies metadata for incremental statistics REALTIME_STATS — specifies only real-time statistics <p>You can specify a list of comma-delimited values. For example, 'OBJECT_STATS, SYNOPSIS' specifies table statistics, column statistics, index statistics, and synopses.</p> <p>The default value is 'OBJECT_STATS, SYNOPSIS, REALTIME_STATS'.</p>

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

Usage Notes

Oracle Database does not support export or import of statistics across databases of different character sets.

186.7.43 EXPORT_SYSTEM_STATS Procedure

This procedure retrieves system statistics and stores them in the user statistics table, identified by `stattab`.

Syntax

```
DBMS_STATS.EXPORT_SYSTEM_STATS (
  stattab          VARCHAR2,
  statid           VARCHAR2 DEFAULT NULL,
  statown          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-49 EXPORT_SYSTEM_STATS Procedure Parameters

Parameter	Description
stattab	Identifier of the user statistics table that describes where the statistics will be stored
statid	Optional identifier associated with the statistics stored from the stattab
statown	Schema containing stattab (if different from current schema)

Security Model

To run this procedure, you must have the `GATHER_SYSTEM_STATISTICS` role.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20002: Bad user statistics table; may need to be upgraded

ORA-20003: Unable to export system statistics

Usage Notes

Oracle Database does not support the export or import of statistics across databases of different character sets.

186.7.44 EXPORT_TABLE_PREFS Procedure

This procedure is used to export the statistics preferences of the specified table in the specified schema into the specified statistics table.

Syntax

```
DBMS_STATS.EXPORT_TABLE_PREFS (
  ownname      IN  VARCHAR2,
  tablename    IN  VARCHAR2,
  stattab      IN  VARCHAR2,
  statid       IN  VARCHAR2 DEFAULT NULL,
  statown      IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-50 EXPORT_TABLE_PREFS Procedure Parameters

Parameter	Description
ownname	Owner name
tablename	Table name
stattab	Statistics table name where to export the statistics
statid	Optional identifier to associate with these statistics within stattab

Table 186-50 (Cont.) EXPORT_TABLE_PREFS Procedure Parameters

Parameter	Description
statown	Schema containing <code>stattab</code> (if other than <code>ownname</code>)

Exceptions

ORA-20000: Object does not exist or insufficient privileges

Usage Notes

- To run this procedure, you need to connect as owner of the table, or have the `ANALYZE ANY` system privilege.
- All arguments are of type `VARCHAR2` and values are enclosed in quotes.
- Oracle does not support export or import of statistics across databases of different character sets.

Examples

```
DBMS_STATS.EXPORT_TABLE_PREFS('SH', 'SALES', 'STAT');
```

186.7.45 EXPORT_TABLE_STATS Procedure

This procedure exports statistics for a specified table (including associated index statistics) and stores them in the user statistics table identified by `stattab`.

Syntax

```
DBMS_STATS.EXPORT_TABLE_STATS (
  ownname          VARCHAR2,
  tablename        VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  stattab          VARCHAR2,
  statid           VARCHAR2 DEFAULT NULL,
  cascade          BOOLEAN  DEFAULT TRUE,
  statown          VARCHAR2 DEFAULT NULL,
  stat_category    VARCHAR2 DEFAULT DEFAULT_STAT_CATEGORY);
```

Parameters

Table 186-51 EXPORT_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Specifies the name of the schema.
tablename	Specifies the name of the table.
partname	Specifies the name of the table partition. If the table is partitioned, and if <code>partname</code> is <code>NULL</code> , then the procedure exports global and partition statistics.

Table 186-51 (Cont.) EXPORT_TABLE_STATS Procedure Parameters

Parameter	Description
stattab	Specifies the identifier (optional) associated with these statistics within stattab.
statid	Specifies the identifier (optional) associated with these statistics within stattab.
cascade	Indicates whether to export column and index statistics. If TRUE, then the procedure exports column and index statistics for the specified table. This is the default.
statown	Specifies the schema containing stattab (if different than ownname).
stat_category	<p>Specifies which statistics to process. The following values are supported:</p> <ul style="list-style-type: none"> OBJECT_STATS — specifies table statistics, column statistics, and index statistics SYNOPSIS — specifies metadata for incremental statistics REALTIME_STATS — specifies only real-time statistics <p>You can specify a list of comma-delimited values. For example, 'OBJECT_STATS, SYNOPSIS' specifies table statistics, column statistics, index statistics, and synopses.</p> <p>The default value is 'OBJECT_STATS, SYNOPSIS, REALTIME_STATS'.</p>

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

Usage Notes

Oracle Database does not support export or import of statistics across databases of different character sets.

186.7.46 FLUSH_DATABASE_MONITORING_INFO Procedure

This procedure saves monitoring information for all tables in the dictionary. The database immediately updates corresponding entries in the `*_TAB_MODIFICATIONS`, `*_TAB_STATISTICS` and `*_IND_STATISTICS` views.

Syntax

```
DBMS_STATS.FLUSH_DATABASE_MONITORING_INFO;
```

Security Model

The `ANALYZE ANY` system privilege is required to run this procedure.

Exceptions

ORA-20000: Insufficient privileges

Usage Notes

Starting in Oracle Database 12c Release 2 (12.2), you do not need to call `FLUSH_DATABASE_MONITORING_INFO` to view the latest information in `*_TAB_STATISTICS` and `*_IND_STATISTICS` because these views show statistics cached in the SGA and stored on disk. Because the `GATHER_*_STATS` procedures internally save monitoring information to disk, it is not necessary to run this procedure before gathering statistics.



See Also:

Oracle Database SQL Tuning Guide to learn how to set optimizer statistics preferences

186.7.47 GATHER_DATABASE_STATS Procedures

This procedure gathers statistics for all objects in the database.

Syntax

```

DBMS_STATS.GATHER_DATABASE_STATS (
  estimate_percent NUMBER      DEFAULT to_estimate_percent_type
                               (get_param('ESTIMATE_PERCENT')),
  block_sample      BOOLEAN    DEFAULT FALSE,
  method_opt       VARCHAR2   DEFAULT get_param('METHOD_OPT'),
  degree           NUMBER     DEFAULT to_degree_type(get_param('DEGREE')),
  granularity      VARCHAR2   DEFAULT GET_PARAM('GRANULARITY'),
  cascade         BOOLEAN    DEFAULT to_cascade_type(get_param('CASCADE')),
  stattab         VARCHAR2   DEFAULT NULL,
  statid          VARCHAR2   DEFAULT NULL,
  options         VARCHAR2   DEFAULT 'GATHER',
  objlist         OUT         ObjectTab,
  statown        VARCHAR2   DEFAULT NULL,
  gather_sys      BOOLEAN    DEFAULT TRUE,
  no_invalidate   BOOLEAN    DEFAULT to_no_invalidate_type (
                               get_param('NO_INVALIDATE')),
  obj_filter_list ObjectTab  DEFAULT NULL);

```

```

DBMS_STATS.GATHER_DATABASE_STATS (
  estimate_percent NUMBER      DEFAULT to_estimate_percent_type
                               (get_param('ESTIMATE_PERCENT')),
  block_sample      BOOLEAN    DEFAULT FALSE,
  method_opt       VARCHAR2   DEFAULT get_param('METHOD_OPT'),
  degree           NUMBER     DEFAULT to_degree_type(get_param('DEGREE')),
  granularity      VARCHAR2   DEFAULT GET_PARAM('GRANULARITY'),
  cascade         BOOLEAN    DEFAULT to_cascade_type(get_param('CASCADE')),
  stattab         VARCHAR2   DEFAULT NULL,
  statid          VARCHAR2   DEFAULT NULL,
  options         VARCHAR2   DEFAULT 'GATHER',
  statown        VARCHAR2   DEFAULT NULL,
  gather_sys      BOOLEAN    DEFAULT TRUE,
  no_invalidate   BOOLEAN    DEFAULT to_no_invalidate_type (

```

```

                                get_param('NO_INVALIDATE')),
obj_filter_list ObjectTab DEFAULT NULL);

```

Parameters

Table 186-52 GATHER_DATABASE_STATS Procedure Parameters

Parameter	Description
estimate_percent	<p>Determines the percentage of rows to sample. The valid range is between 0.000001 and 100. Use the constant <code>DBMS_STATS.AUTO_SAMPLE_SIZE</code> to enable the database to determine the appropriate sample size for optimal statistics. This is the default.</p> <p>You can change the default value using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
block_sample	<p>Determines whether the database uses random block sampling (<code>TRUE</code>) or random row sampling (<code>FALSE</code>). The default is <code>FALSE</code>.</p> <p>Random block sampling is more efficient, but if the data is not randomly distributed on disk, then sample values may be somewhat correlated. This parameter is only relevant when estimating statistics.</p>
method_opt	<p>When setting preference on global, schema, database or dictionary level, only 'FOR ALL' syntax is allowed.:</p> <ul style="list-style-type: none"> • <code>FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause]</code> <code>size_clause</code> is defined as <code>size_clause := SIZE {integer REPEAT AUTO SKEWONLY}</code> <ul style="list-style-type: none"> - <code>integer</code> : Number of histogram buckets. Must be in the range [1,2048]. - <code>REPEAT</code> : Collects histograms only on the columns that already have histograms. - <code>AUTO</code> : Oracle determines the columns on which to collect histograms based on data distribution and the workload of the columns. - <code>SKEWONLY</code> : Oracle determines the columns on which to collect histograms based on the data distribution of the columns. <p>The default is <code>FOR ALL COLUMNS SIZE AUTO</code>. The value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>

Table 186-52 (Cont.) GATHER_DATABASE_STATS Procedure Parameters

Parameter	Description
degree	<p>Determines the degree of parallelism used for gathering statistics. The default for <code>degree</code> is <code>NULL</code>. <code>NULL</code> means to use the table default value specified by the <code>DEGREE</code> clause in the <code>CREATE TABLE</code> or <code>ALTER TABLE</code> statement. Change the default using the <code>SET_DATABASE_PREFS</code>, <code>SET_GLOBAL_PREFS</code>, <code>SET_SCHEMA_PREFS</code>, and <code>SET_TABLE_PREFS</code> procedures. <code>NULL</code> means use the table default value specified by the <code>DEGREE</code> clause in the <code>CREATE TABLE</code> or <code>ALTER TABLE</code> statement.</p> <p>Use the constant <code>DBMS_STATS.DEFAULT_DEGREE</code> to specify the default value based on the initialization parameters. The <code>AUTO_DEGREE</code> value determines the degree of parallelism automatically. The degree is between 1 (serial execution) and <code>DEFAULT_DEGREE</code> (the system default value based on number of CPUs and initialization parameters), according to the size of the object. When using <code>DEGREE=>NULL</code>, <code>DEGREE=>n</code>, or <code>DEGREE=>DBMS_STATS.DEFAULT_DEGREE</code>, the current implementation of <code>DBMS_STATS</code> may use serial execution when the size of the object does not warrant parallel execution.</p>
granularity	<p>Granularity of statistics to collect (only pertinent if the table is partitioned).</p> <p>'ALL' - Gathers all (subpartition, partition, and global) statistics</p> <p>'AUTO' - Determines the granularity based on the partitioning type. This is the default value.</p> <p>'DEFAULT' - Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. You should use the 'GLOBAL AND PARTITION' for this functionality. Note that the default value is now 'AUTO'.</p> <p>'GLOBAL' - Gathers global statistics</p> <p>'GLOBAL AND PARTITION' - Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object.</p> <p>'PARTITION' - Gathers partition-level statistics</p> <p>'SUBPARTITION' - Gathers subpartition-level statistics</p>
cascade	<p>Determines whether to collect index statistics as part of gathering table statistics.</p> <p>Specifying this option is equivalent to running the <code>GATHER_INDEX_STATS</code> procedure on each index of the table. Use the constant <code>DBMS_STATS.AUTO_CASCADE</code> to enable the database to determine whether index statistics need to be collected. This is the default. You can change the default using the <code>SET_DATABASE_PREFS</code>, <code>SET_GLOBAL_PREFS</code>, <code>SET_SCHEMA_PREFS</code>, and <code>SET_TABLE_PREFS</code> procedures.</p>
stattab	<p>User statistics table identifier describing where to save the current statistics.</p> <p>The statistics table is assumed to reside in the same schema as the object being analyzed, so there must be one such table in each schema to use this option.</p>

Table 186-52 (Cont.) GATHER_DATABASE_STATS Procedure Parameters

Parameter	Description
statid	Identifier (optional) to associate with these statistics within <code>stattab</code> .
options	<p>Specifies which objects require statistics to be gathered. Valid values are as follows:</p> <ul style="list-style-type: none"> • <code>GATHER</code> — Gathers statistics on all objects in the database. This is the default. • <code>GATHER AUTO</code> — Gathers all necessary statistics automatically. The database implicitly determines which objects need new statistics and determines how to gather those statistics. When <code>GATHER AUTO</code> is specified, the only additional valid parameters are <code>comp_id</code>, <code>no_invalidate</code>, <code>stattab</code>, <code>statid</code>, and <code>statown</code>; all other parameter settings will be ignored. Also, the database returns a list of objects processed. • <code>GATHER STALE</code> — Gathers statistics on stale objects by querying the <code>*_TAB_MODIFICATIONS</code> views. Also, the database returns a list of objects found to be stale. • <code>GATHER EMPTY</code> — Gathers statistics on objects that currently have no statistics. Also, the database returns a list of objects found to have no statistics. • <code>LIST AUTO</code> — Returns a list of objects to be processed with <code>GATHER AUTO</code>. • <code>LIST STALE</code> — Returns list of stale objects as determined by looking at the <code>*_TAB_MODIFICATIONS</code> views. • <code>LIST EMPTY</code> — Returns a list of objects that currently have no statistics.
objlist	List of objects found to be stale or empty
statown	Schema containing <code>stattab</code> (if different from current schema)
gather_sys	Gathers statistics on the objects owned by the <code>SYS</code> user.
no_invalidate	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> • <code>TRUE</code>: Dependent cursors are not invalidated. • <code>FALSE</code>: Dependent cursors are marked for immediate invalidation. • <code>AUTO</code>: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>If set to <code>TRUE</code>, then the database not invalidate dependent cursors. If set to <code>FALSE</code>, then the procedure invalidates dependent cursors immediately.</p>

Table 186-52 (Cont.) GATHER_DATABASE_STATS Procedure Parameters

Parameter	Description
obj_filter_list	A list of object filters. When provided, GATHER_DATABASE_STATS will gather statistics only on objects which satisfy at least one object filter in the list as needed. In a single object filter, we can specify the constraints on the object attributes. The attribute values specified in the object filter are case-insensitive unless double-quoted. Wildcard is allowed in the attribute values. Suppose non-NULL values s1, s2, ... are specified for attributes a1, a2, ... in one object filter. An object o is said to satisfy this object filter if (o.a1 like s1) or (o.a2 like s2) or ... is true.

Exceptions

ORA-20000: Insufficient privileges

ORA-20001: Bad input value

Usage Notes

To run this procedure, you need to have the SYSDBA role or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privileges.

If the GATHER AUTO option is used then frequency histograms will be created using a sample rather than a full scan. The following scenario shows where GATHER AUTO is used:

- A table is created like this: CREATE TABLE NEWTAB as SELECT * FROM
This will create statistics on NEWTAB but no histograms.
- Next, the DBA creates the histograms using GATHER AUTO on gather_table_stats.
- The FREQUENCY histograms on NEWTAB will be created using a sample rather than a full table scan.

186.7.48 GATHER_DICTIONARY_STATS Procedure

This procedure gathers statistics for dictionary schemas SYS, SYSTEM and schemas of RDBMS components.

Syntax

```
DBMS_STATS.GATHER_DICTIONARY_STATS (
  comp_id          VARCHAR2 DEFAULT NULL,
  estimate_percent NUMBER   DEFAULT to_estimate_percent_type
                        (get_param('ESTIMATE_PERCENT')),
  block_sample    BOOLEAN   DEFAULT FALSE,
  method_opt      VARCHAR2  DEFAULT get_param('METHOD_OPT'),
  degree          NUMBER    DEFAULT to_degree_type(get_param('DEGREE')),
  granularity     VARCHAR2  DEFAULT GET_PARAM('GRANULARITY'),
  cascade         BOOLEAN   DEFAULT to_cascade_type(get_param('CASCADE')),
  stattab        VARCHAR2  DEFAULT NULL,
  statid         VARCHAR2  DEFAULT NULL,
  options        VARCHAR2  DEFAULT 'GATHER AUTO',
  objlist        OUT       ObjectTab,
  statown        VARCHAR2  DEFAULT NULL,
```

```

no_invalidate      BOOLEAN  DEFAULT to_no_invalidate_type (
                                get_param('NO_INVALIDATE')),
obj_filter_list   ObjectTab DEFAULT NULL);

DBMS_STATS.GATHER_DICTIONARY_STATS (
  comp_id          VARCHAR2 DEFAULT NULL,
  estimate_percent NUMBER DEFAULT

to_estimate_percent_type(GET_PARAM('ESTIMATE_PERCENT')),
  block_sample     BOOLEAN DEFAULT FALSE,
  method_opt       VARCHAR2 DEFAULT GET_PARAM('METHOD_OPT'),
  degree           NUMBER DEFAULT to_degree_type(GET_PARAM('DEGREE')),
  granularity      VARCHAR2 DEFAULT GET_PARAM('GRANULARITY'),
  cascade          BOOLEAN DEFAULT to_cascade_type(GET_PARAM('CASCADE')),
  stattab          VARCHAR2 DEFAULT NULL,
  statid           VARCHAR2 DEFAULT NULL,
  options          VARCHAR2 DEFAULT 'GATHER AUTO',
  statown          VARCHAR2 DEFAULT NULL,
  no_invalidate    BOOLEAN DEFAULT
                                to_no_invalidate_type(get_param('NO_INVALIDATE')),
  obj_filter_list  ObjectTab DEFAULT NULL);

```

Parameters

Table 186-53 GATHER_DICTIONARY_STATS Procedure Parameters

Parameter	Description
comp_id	Component id of the schema to analyze. NULL results in the analysis of schemas for all RDBMS components. Refer to the COMP_ID column of DBA_REGISTRY view. The procedure always gather statistics on SYS and SYSTEM schemas regardless of this argument.
estimate_percent	Percentage of rows to estimate (NULL means compute). The valid range is [0.000001, 100]. Use the constant DBMS_STATS.AUTO_SAMPLE_SIZE to have Oracle determine the appropriate sample size for good statistics. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
block_sample	Determines whether or not to use random block sampling instead of random row sampling. Random block sampling is more efficient, but if the data is not randomly distributed on disk then the sample values may be somewhat correlated. Only pertinent when performing estimate statistics.

Table 186-53 (Cont.) GATHER_DICTIONARY_STATS Procedure Parameters

Parameter	Description
method_opt	<p>The method options. This parameter accepts the following values:</p> <ul style="list-style-type: none"> • FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause] size_clause is defined as size_clause := SIZE {integer REPEAT AUTO SKEWONLY} <ul style="list-style-type: none"> - integer : Number of histogram buckets. Must be in the range [1,2048]. - REPEAT : Collects histograms only on the columns that already have histograms. - AUTO : Oracle determines the columns on which to collect histograms based on data distribution and the workload of the columns. - SKEWONLY : Oracle determines the columns on which to collect histograms based on the data distribution of the columns. <p>The default is FOR ALL COLUMNS SIZE AUTO. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
degree	<p>Degree of parallelism. The default for degree is NULL. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure. NULL means use the table default value specified by the DEGREE clause in the CREATE TABLE or ALTER TABLE statement. Use the constant DBMS_STATS.DEFAULT_DEGREE to specify the default value based on the initialization parameters. The AUTO_DEGREE value determines the degree of parallelism automatically. This is between 1 (serial execution) and DEFAULT_DEGREE (the system default value based on number of CPUs and initialization parameters) according to the size of the object. When using DEGREE=>NULL, DEGREE=>n, or DEGREE=>DBMS_STATS.DEFAULT_DEGREE, the current implementation of DBMS_STATS may use serial execution if the size of the object does not warrant parallel execution.</p>

Table 186-53 (Cont.) GATHER_DICTIONARY_STATS Procedure Parameters

Parameter	Description
granularity	<p>Granularity of statistics to collect (only pertinent if the table is partitioned).</p> <p>'ALL' - Gathers all (subpartition, partition, and global) statistics</p> <p>'AUTO' - Determines the granularity based on the partitioning type. This is the default value.</p> <p>'DEFAULT' - Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. You should use the 'GLOBAL AND PARTITION' for this functionality. Note that the default value is now 'AUTO'.</p> <p>'GLOBAL' - Gathers global statistics</p> <p>'GLOBAL AND PARTITION' - Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object.</p> <p>'PARTITION' - Gathers partition-level statistics</p> <p>'SUBPARTITION' - gathers subpartition-level statistics</p>
cascade	<p>Gathers statistics on indexes also. Index statistics gathering will not be parallelized. Using this option is equivalent to running the GATHER_INDEX_STATS Procedure on each of the indexes in the schema in addition to gathering table and column statistics. Use the constant <code>DBMS_STATS.AUTO_CASCADE</code> to have Oracle determine whether index statistics to be collected or not. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
stattab	<p>User statistics table identifier describing where to save the current statistics</p>
statid	<p>The (optional) identifier to associate with these statistics within stattab</p>

Table 186-53 (Cont.) GATHER_DICTIONARY_STATS Procedure Parameters

Parameter	Description
options	<p>Specifies which objects require statistics to be gathered. Valid values are as follows:</p> <ul style="list-style-type: none"> • GATHER AUTO — Gathers all necessary statistics automatically. This is the default. The database implicitly determines which objects need new statistics and determines how to gather those statistics. When GATHER AUTO is specified, the only additional valid parameters are <code>comp_id</code>, <code>no_invalidate</code>, <code>stattab</code>, <code>statid</code>, and <code>statown</code>; all other parameter settings will be ignored. Also, the database returns a list of objects processed. • GATHER — Gathers statistics on all objects in the relevant schema. • GATHER STALE — Gathers statistics on stale objects by querying the <code>*_TAB_MODIFICATIONS</code> views. Also, the database returns a list of objects found to be stale. • GATHER EMPTY — Gathers statistics on objects that currently have no statistics. Also, the database returns a list of objects found to have no statistics. • LIST AUTO — Returns a list of objects to be processed with GATHER AUTO. • LIST STALE — Returns list of stale objects as determined by looking at the <code>*_TAB_MODIFICATIONS</code> views. • LIST EMPTY — Returns a list of objects that currently have no statistics.
objlist	The list of objects found to be stale or empty.
statown	Schema containing <code>stattab</code> , if different from the current schema.
no_invalidate	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> • TRUE: Dependent cursors are not invalidated. • FALSE: Dependent cursors are marked for immediate invalidation. • AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
obj_filter_list	<p>A list of object filters. When provided, this will gather statistics only on objects which satisfy at least one object filter in the list as needed. In a single object filter, we can specify the constraints on the object attributes. The attribute values specified in the object filter are case-insensitive unless double-quoted. Wildcard is allowed in the attribute values. Suppose non-NULL values <code>s1</code>, <code>s2</code>, ... are specified for attributes <code>a1</code>, <code>a2</code>, ... in one object filter. An object <code>o</code> is said to satisfy this object filter if (<code>o.a1</code> like <code>s1</code>) and (<code>o.a2</code> like <code>s2</code>) and ... is true. See Applying an Object Filter List.</p>

Usage Notes

You must have the SYSDBA or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privilege to execute this procedure.

If the GATHER AUTO option is used then frequency histograms will be created using a sample rather than a full scan. The following scenario shows where GATHER AUTO is used:

- A table is created like this: `CREATE TABLE NEWTAB as SELECT * FROM`
This will create statistics on NEWTAB but no histograms.
- Next, the DBA creates the histograms using GATHER AUTO on gather_table_stats.
- The FREQUENCY histograms on NEWTAB will be created using a sample rather than a full table scan.

Exceptions

ORA-20000: Index does not exist or insufficient privileges

ORA-20001: Bad input value

ORA-20002: Bad user statistics table, may need to upgrade it

186.7.49 GATHER_FIXED_OBJECTS_STATS Procedure

This procedure gathers statistics for all fixed objects (dynamic performance tables).

Syntax

```
DBMS_STATS.GATHER_FIXED_OBJECTS_STATS (
  statab          VARCHAR2 DEFAULT NULL,
  statid          VARCHAR2 DEFAULT NULL,
  statown         VARCHAR2 DEFAULT NULL,
  no_invalidate  BOOLEAN   DEFAULT to_no_invalidate_type (
                                     get_param('NO_INVALIDATE')));
```

Parameters

Table 186-54 GATHER_FIXED_OBJECTS_STATS Procedure Parameters

Parameter	Description
statab	User statistics table identifier describing where to save the current statistics
statid	Identifier to associate with these statistics within statab (optional)
statown	Schema containing statab (if different from current schema)

Table 186-54 (Cont.) GATHER_FIXED_OBJECTS_STATS Procedure Parameters

Parameter	Description
no_invalidate	Does not invalidate the dependent cursors if set to TRUE. The procedure invalidates the dependent cursors immediately if set to FALSE. Use DBMS_STATS.AUTO_INVALIDATE. to have Oracle decide when to invalidate dependent cursors. This is the default. The default can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .

Usage Notes

You must have the SYSDBA or ANALYZE ANY DICTIONARY system privilege to execute this procedure.

Exceptions

ORA-20000: Insufficient privileges

ORA-20001: Bad input value

ORA-20002: Bad user statistics table, may need to upgrade it

186.7.50 GATHER_INDEX_STATS Procedure

This procedure gathers index statistics. It attempts to parallelize as much of the work as possible.

Restrictions are described in the individual parameters. This operation will not parallelize with certain types of indexes, including cluster indexes, domain indexes, and bitmap join indexes. The `granularity` and `no_invalidate` arguments are not relevant to these types of indexes.

Syntax

```
DBMS_STATS.GATHER_INDEX_STATS (
  ownname          VARCHAR2,
  indname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  estimate_percent NUMBER   DEFAULT to_estimate_percent_type
                                     (GET_PARAM('ESTIMATE_PERCENT')),
  stattab          VARCHAR2 DEFAULT NULL,
  statid           VARCHAR2 DEFAULT NULL,
  statown          VARCHAR2 DEFAULT NULL,
  degree           NUMBER   DEFAULT to_degree_type(get_param('DEGREE')),
  granularity      VARCHAR2 DEFAULT GET_PARAM('GRANULARITY'),
  no_invalidate    BOOLEAN  DEFAULT to_no_invalidate_type
                                     (GET_PARAM('NO_INVALIDATE')),
  force            BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 186-55 GATHER_INDEX_STATS Procedure Parameters

Parameter	Description
ownname	Schema of index to analyze
indname	Name of index
partname	Name of partition
estimate_percent	Percentage of rows to estimate (NULL means compute). The valid range is [0.000001, 100]. Use the constant <code>DBMS_STATS.AUTO_SAMPLE_SIZE</code> to have Oracle determine the appropriate sample size for good statistics. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
stattab	User statistics table identifier describing where to save the current statistics
statid	Identifier (optional) to associate with these statistics within <code>stattab</code>
statown	Schema containing <code>stattab</code> (if different than <code>ownname</code>)
degree	Degree of parallelism. The default for <code>degree</code> is NULL. The default value can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure . NULL means use the table default value specified by the <code>DEGREE</code> clause in the <code>CREATE TABLE</code> or <code>ALTER TABLE</code> statement. Use the constant <code>DBMS_STATS.DEFAULT_DEGREE</code> to specify the default value based on the initialization parameters. The <code>AUTO_DEGREE</code> value determines the degree of parallelism automatically. This is between 1 (serial execution) and <code>DEFAULT_DEGREE</code> (the system default value based on number of CPUs and initialization parameters) according to the size of the object. When using <code>DEGREE=>NULL</code> , <code>DEGREE=>n</code> , or <code>DEGREE=>DBMS_STATS.DEFAULT_DEGREE</code> , the current implementation of <code>DBMS_STATS</code> may use serial execution if the size of the object does not warrant parallel execution.

Table 186-55 (Cont.) GATHER_INDEX_STATS Procedure Parameters

Parameter	Description
granularity	Granularity of statistics to collect (only pertinent if the table is partitioned). 'ALL' - Gathers all (subpartition, partition, and global) statistics 'AUTO' - Determines the granularity based on the partitioning type. This is the default value. 'DEFAULT' - Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. You should use the 'GLOBAL AND PARTITION' for this functionality. Note that the default value is now 'AUTO'. 'GLOBAL' - Gathers global statistics 'GLOBAL AND PARTITION' - Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object. 'PARTITION' - Gathers partition-level statistics 'SUBPARTITION' - Gathers subpartition-level statistics.
no_invalidate	Does not invalidate the dependent cursors if set to TRUE. The procedure invalidates the dependent cursors immediately if set to FALSE. Use DBMS_STATS.AUTO_INVALIDATE. to have Oracle decide when to invalidate dependent cursors. This is the default. The default can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
force	Gather statistics on object even if it is locked

Exceptions

ORA-20000: Index does not exist or insufficient privileges

ORA-20001: Bad input value

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.51 GATHER_PROCESSING_RATE Procedure

This procedure starts the job of gathering the processing rates which end after an `interval` defined in minutes.

Syntax

```
DBMS_STATS.GATHER_PROCESSING_RATE (
    gathering_mode    IN    VARCHAR2    DEFAULT 'START',
    interval          IN    NUMBER      DEFAULT NULL);
```

Parameters

Table 186-56 GATHER_PROCESSING_RATE Procedure Parameters

Parameter	Description
gathering_mode	Mode: 'START' or 'END'. The mode is based on the Active Session History (ASH) data when invoked with 'START' option. It stops gathering when invoked with 'END' option. When invoked with 'START', 'interval' option can be specified optionally. If interval is not specified, its default value is set to 60 minutes.
interval	Time interval (number of minutes) for which the processing must be gathered

Usage Notes

- You require the `OPTIMIZER_PROCESSING_RATE` role to run this procedure.
- `AUTO DOP` uses processing rates to determine the optimal degree of parallelism for a SQL statement.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or illegal input value

186.7.52 GATHER_SCHEMA_STATS Procedures

This procedure gathers statistics for all objects in a schema.

Syntax

```
DBMS_STATS.GATHER_SCHEMA_STATS (
    ownname          VARCHAR2,
    estimate_percent NUMBER   DEFAULT to_estimate_percent_type
                        (get_param('ESTIMATE_PERCENT')),
    block_sample     BOOLEAN  DEFAULT FALSE,
    method_opt       VARCHAR2 DEFAULT get_param('METHOD_OPT'),
    degree           NUMBER   DEFAULT to_degree_type(get_param('DEGREE')),
    granularity      VARCHAR2 DEFAULT GET_PARAM('GRANULARITY'),
    cascade          BOOLEAN  DEFAULT to_cascade_type(get_param('CASCADE')),
    stattab         VARCHAR2 DEFAULT NULL,
    statid           VARCHAR2 DEFAULT NULL,
    options          VARCHAR2 DEFAULT 'GATHER',
    objlist          OUT      ObjectTab,
    statown         VARCHAR2 DEFAULT NULL,
    no_invalidate    BOOLEAN  DEFAULT to_no_invalidate_type (
                        get_param('NO_INVALIDATE')),
    force            BOOLEAN  DEFAULT FALSE,
    obj_filter_list  ObjectTab DEFAULT NULL);
```

```
DBMS_STATS.GATHER_SCHEMA_STATS (
    ownname          VARCHAR2,
    estimate_percent NUMBER   DEFAULT to_estimate_percent_type
                        (get_param('ESTIMATE_PERCENT')),
    block_sample     BOOLEAN  DEFAULT FALSE,
```

```

method_opt      VARCHAR2 DEFAULT get_param('METHOD_OPT'),
degree          NUMBER  DEFAULT to_degree_type(get_param('DEGREE')),
granularity     VARCHAR2 DEFAULT GET_PARAM('GRANULARITY'),
cascade        BOOLEAN  DEFAULT to_cascade_type(get_param('CASCADE')),
stattab        VARCHAR2 DEFAULT NULL,
statid         VARCHAR2 DEFAULT NULL,
options        VARCHAR2 DEFAULT 'GATHER',
statown        VARCHAR2 DEFAULT NULL,
no_invalidate  BOOLEAN  DEFAULT to_no_invalidate_type (
                    get_param('NO_INVALIDATE')),
force          BOOLEAN  DEFAULT FALSE,
obj_filter_list ObjectTab DEFAULT NULL);

```

Parameters

Table 186-57 GATHER_SCHEMA_STATS Procedure Parameters

Parameter	Description
ownname	Schema to analyze (NULL means current schema)
estimate_percent	<p>Determines the percentage of rows to sample.</p> <p>The valid range is between 0.000001 and 100. Use the constant <code>DBMS_STATS.AUTO_SAMPLE_SIZE</code> to enable the database to determine the appropriate sample size for optimal statistics. This is the default.</p> <p>You can change the default value using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
block_sample	Whether or not to use random block sampling instead of random row sampling. Random block sampling is more efficient, but if the data is not randomly distributed on disk, then the sample values may be somewhat correlated. Only pertinent when doing an estimate statistics.
method_opt	<p>Accepts:</p> <ul style="list-style-type: none"> • <code>FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause]</code> <code>size_clause</code> is defined as <code>size_clause := SIZE {integer REPEAT AUTO SKEWONLY}</code> <ul style="list-style-type: none"> - <code>integer</code>: Number of histogram buckets. Must be in the range [1,2048]. - <code>REPEAT</code>: Collects histograms only on the columns that already have histograms - <code>AUTO</code>: Oracle determines the columns on which to collect histograms based on data distribution and the workload of the columns. - <code>SKEWONLY</code>: Oracle determines the columns on which to collect histograms based on the data distribution of the columns. <p>The default is <code>FOR ALL COLUMNS SIZE AUTO</code>. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>

Table 186-57 (Cont.) GATHER_SCHEMA_STATS Procedure Parameters

Parameter	Description
degree	Degree of parallelism. The default for <code>degree</code> is <code>NULL</code> . The default value can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure . <code>NULL</code> means use the table default value specified by the <code>DEGREE</code> clause in the <code>CREATE TABLE</code> or <code>ALTER TABLE</code> statement. Use the constant <code>DBMS_STATS.DEFAULT_DEGREE</code> to specify the default value based on the initialization parameters. The <code>AUTO_DEGREE</code> value determines the degree of parallelism automatically. This is between 1 (serial execution) and <code>DEFAULT_DEGREE</code> (the system default value based on number of CPUs and initialization parameters) according to the size of the object. When using <code>DEGREE=>NULL</code> , <code>DEGREE=>n</code> , or <code>DEGREE=>DBMS_STATS.DEFAULT_DEGREE</code> , the current implementation of <code>DBMS_STATS</code> may use serial execution if the size of the object does not warrant parallel execution.
granularity	Granularity of statistics to collect (only pertinent if the table is partitioned). ' <code>ALL</code> ' - Gathers all (subpartition, partition, and global) statistics ' <code>AUTO</code> ' - Determines the granularity based on the partitioning type. This is the default value. ' <code>DEFAULT</code> ' - Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. You should use the ' <code>GLOBAL AND PARTITION</code> ' for this functionality. Note that the default value is now ' <code>AUTO</code> '. ' <code>GLOBAL</code> ' - Gathers global statistics ' <code>GLOBAL AND PARTITION</code> ' - Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object. ' <code>PARTITION</code> ' - Gathers partition-level statistics ' <code>SUBPARTITION</code> ' - Gathers subpartition-level statistics.
cascade	Gather statistics on the indexes as well. Using this option is equivalent to running the GATHER_INDEX_STATS Procedure on each of the indexes in the schema in addition to gathering table and column statistics. Use the constant <code>DBMS_STATS.AUTO_CASCADE</code> to have Oracle determine whether index statistics to be collected or not. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
stattab	User statistics table identifier describing where to save the current statistics
statid	Identifier (optional) to associate with these statistics within <code>stattab</code>

Table 186-57 (Cont.) GATHER_SCHEMA_STATS Procedure Parameters

Parameter	Description
options	<p>Specifies which objects require statistics to be gathered. Valid values are as follows:</p> <ul style="list-style-type: none"> GATHER — Gathers statistics on all objects in the schema. This is the default. GATHER AUTO — Gathers all necessary statistics automatically. The database implicitly determines which objects need new statistics and determines how to gather those statistics. When GATHER AUTO is specified, the only additional valid parameters are comp_id, no_invalidate, statab, statid, and statown; all other parameter settings will be ignored. Also, the database returns a list of objects processed. GATHER STALE — Gathers statistics on stale objects by querying the *_TAB_MODIFICATIONS views. Also, the database returns a list of objects found to be stale. GATHER EMPTY — Gathers statistics on objects that currently have no statistics. Also, the database returns a list of objects found to have no statistics. LIST AUTO — Returns a list of objects to be processed with GATHER AUTO. LIST STALE — Returns list of stale objects as determined by looking at the *_TAB_MODIFICATIONS views. LIST EMPTY — Returns a list of objects that currently have no statistics.
objlist	List of objects found to be stale or empty
statown	Schema containing statab (if different than ownname)
no_invalidate	Does not invalidate the dependent cursors if set to TRUE. The procedure invalidates the dependent cursors immediately if set to FALSE. Use DBMS_STATS.AUTO_INVALIDATE. to have Oracle decide when to invalidate dependent cursors. This is the default. The default can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
force	Gather statistics on objects even if they are locked
obj_filter_list	A list of object filters. When provided, GATHER_SCHEMA_STATS will gather statistics only on objects which satisfy at least one object filter in the list as needed. In a single object filter, we can specify the constraints on the object attributes. The attribute values specified in the object filter are case- insensitive unless double-quoted. Wildcard is allowed in the attribute values. Suppose non-NULL values s1, s2, ... are specified for attributes a1, a2, ... in one object filter. An object o is said to satisfy this object filter if (o.a1 like s1) and (o.a2 like s2) and ... is true.

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

If the `GATHER AUTO` option is used then frequency histograms will be created using a sample rather than a full scan. The following scenario shows where `GATHER AUTO` is used:

- A table is created like this: `CREATE TABLE NEWTAB as SELECT * FROM`
This will create statistics on `NEWTAB` but no histograms.
- Next, the DBA creates the histograms using `GATHER AUTO` on `gather_table_stats`.
- The `FREQUENCY` histograms on `NEWTAB` will be created using a sample rather than a full table scan.

Exceptions

ORA-20000: Schema does not exist or insufficient privileges

ORA-20001: Bad input value

Examples

Applying an Object Filter List

The following example specifies that the tables `SH.SALES` and `SH.COSTS`, if stale, will have statistics gathered upon them.

```
DECLARE
    filter_lst DBMS_STATS.OBJECTTAB := DBMS_STATS.OBJECTTAB();
BEGIN
    filter_lst.extend(2);
    filter_lst(1).ownname := 'SH';
    filter_lst(1).objname := 'SALES';
    filter_lst(2).ownname := 'SH';
    filter_lst(2).objname := 'COSTS';
    DBMS_STATS.GATHER_SCHEMA_STATS(ownname=>'SH',obj_filter_list=>filter_lst);
END;
```

186.7.53 GATHER_SYSTEM_STATS Procedure

This procedure gathers system statistics.

Syntax

```
DBMS_STATS.GATHER_SYSTEM_STATS (
    gathering_mode    VARCHAR2 DEFAULT 'NOWORKLOAD',
    interval          INTEGER   DEFAULT NULL,
    stattab          VARCHAR2  DEFAULT NULL,
    statid           VARCHAR2  DEFAULT NULL,
    statown          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 186-58 GATHER_SYSTEM_STATS Procedure Parameters

Parameter	Description
gathering_mode	<p>Specifies the mode in which the database gathers system statistics. Possible values are:</p> <ul style="list-style-type: none"> • NOWORKLOAD The database captures performance characteristics of the I/O system. Gathering may take a few minutes and depends on the size of the database. During this period, the database estimates the average read seek time and transfer speed for the I/O system. This mode is suitable for the all workloads. To fine tune system statistics for the workload, use START and STOP or the INTERVAL option. If you gather both NOWORKLOAD and workload-specific statistics (statistics collected using INTERVAL or START and STOP), the optimizer uses the workload statistics. Collected components include cpuspeednw, ioseektim, and iotfrspeed. • INTERVAL The database captures system activity during a specified interval in minutes. This parameter works in combination with the interval parameter. The database creates or updates system statistics in the dictionary or stattab. You can use GATHER_SYSTEM_STATS (gathering_mode=>'STOP') to stop gathering earlier than scheduled. Collected components include maxthr, slavethr, cpuspeed, sreadtim, mreadtim, and mbrc. • START STOP The database captures system activity during specified start and stop times and refreshes the dictionary or stattab with statistics for the elapsed period. The database ignores the INTERVAL value. Collected components include maxthr, slavethr, cpuspeed, sreadtim, mreadtim, and mbrc. • EXADATA In this mode, gathered system statistics take into account the unique capabilities of Oracle Exadata, such as large I/O size and high I/O throughput. The database sets multiblock read count and I/O throughput statistics along with CPU speed.
interval	Specifies the number of minutes in which to gather system statistics. This parameter applies only when gathering_mode='INTERVAL' .
stattab	Specifies the table in which the database stores the statistics.
statid	Specifies an optional identifier associated with the statistics saved in stattab .
statown	Specifies the schema containing stattab , if different from the current schema.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid input value

ORA-20002: Bad user statistics table; may need to be upgraded

ORA-20003: Unable to gather system statistics

ORA-20004: Error in the INTERVAL mode: system parameter job_queue_processes must be >0

Usage Notes

To run this procedure, you must have the GATHER_SYSTEM_STATISTICS role.

Examples

Assume that you want to perform database application processing OLTP transactions during the day and run reports at night.

To collect daytime system statistics, gather statistics for 720 minutes. Store the statistics in the MYSTATS table.

```
BEGIN
  DBMS_STATS.GATHER_SYSTEM_STATS (
    interval => 720,
    statab   => 'mystats',
    statid   => 'OLTP');
END;
```

To collect nighttime system statistics, gather statistics for 720 minutes. Store the statistics in the MYSTATS table.

```
BEGIN
  DBMS_STATS.GATHER_SYSTEM_STATS (
    interval => 720,
    statab   => 'mystats',
    statid   => 'OLAP');
END;
```

Update the dictionary with the gathered statistics.

```
VARIABLE jobno number;
BEGIN
  DBMS_JOB.SUBMIT (:jobno, 'DBMS_STATS.IMPORT_SYSTEM_STATS
    ('mystats','OLTP');'
    sysdate, 'sysdate + 1');
  COMMIT;
END;

BEGIN
  DBMS_JOB.SUBMIT (:jobno, 'DBMS_STATS.IMPORT_SYSTEM_STATS
    ('mystats','OLAP');'
    sysdate + 0.5, 'sysdate + 1');
  COMMIT;
END;
```

186.7.54 GATHER_TABLE_STATS Procedure

This procedure gathers table, column, and index statistics. It attempts to parallelize as much work as possible, but there are some restrictions, which are described in the individual parameters.

Syntax

```
DBMS_STATS.GATHER_TABLE_STATS (
  ownname          VARCHAR2,
  tabname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  estimate_percent NUMBER   DEFAULT to_estimate_percent_type
                        (get_param('ESTIMATE_PERCENT')),
  block_sample     BOOLEAN  DEFAULT FALSE,
  method_opt       VARCHAR2 DEFAULT get_param('METHOD_OPT'),
  degree           NUMBER   DEFAULT to_degree_type(get_param('DEGREE')),
  granularity      VARCHAR2 DEFAULT GET_PARAM('GRANULARITY'),
  cascade          BOOLEAN  DEFAULT to_cascade_type(get_param('CASCADE')),
  statab           VARCHAR2 DEFAULT NULL,
  statid           VARCHAR2 DEFAULT NULL,
  statown          VARCHAR2 DEFAULT NULL,
  no_invalidate    BOOLEAN  DEFAULT to_no_invalidate_type (
                        get_param('NO_INVALIDATE')),
  stattype         VARCHAR2 DEFAULT 'DATA',
  force            BOOLEAN  DEFAULT FALSE,
  context          DBMS_STATS.CCONTEXT DEFAULT NULL, -- non operative
  options          VARCHAR2 DEFAULT get_param('OPTIONS');
```

Parameters

Table 186-59 GATHER_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Schema containing the table.
tabname	Name of the table.
partname	Name of the partition.
estimate_percent	Determines the percentage of rows to sample. The valid range is between 0.000001 and 100. Use the constant <code>DBMS_STATS.AUTO_SAMPLE_SIZE</code> to enable the database to determine the appropriate sample size for optimal statistics. This is the default. You can change the default value using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
block_sample	Determines whether the database uses random block sampling (<code>TRUE</code>) or random row sampling (<code>FALSE</code>). The default is <code>FALSE</code> . Random block sampling is more efficient, but if the data is not randomly distributed on disk, then sample values may be somewhat correlated. This parameter is only relevant when estimating statistics.

Table 186-59 (Cont.) GATHER_TABLE_STATS Procedure Parameters

Parameter	Description
method_opt	<p>METHOD_OPT - When setting preference on global, schema, database or dictionary level, only 'FOR ALL' syntax is allowed. Other than that, method_opt accepts either of the following options, or both in combination:</p> <ul style="list-style-type: none"> • FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause] • FOR COLUMNS [column_clause] [size_clause] <p>size_clause is defined as size_clause := SIZE {integer REPEAT AUTO SKEWONLY}</p> <p>column_clause is defined as column_clause := column_name extension name extension</p> <ul style="list-style-type: none"> - integer: Number of histogram buckets. Must be in the range [1,2048]. - REPEAT: Collects histograms only on the columns that already have histograms - AUTO: Oracle determines the columns on which to collect histograms based on data distribution and the workload of the columns. - SKEWONLY: Oracle determines the columns on which to collect histograms based on the data distribution of the columns. - column_name: Name of a column - extension: can be either a column group in the format of (column_name, Column_name [, ...]) or an expression <p>The default is FOR ALL COLUMNS SIZE AUTO. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
degree	<p>Determines the degree of parallelism used for gathering statistics.</p> <p>The default for degree is NULL. NULL means to use the table default value specified by the DEGREE clause in the CREATE TABLE or ALTER TABLE statement. Change the default using the SET_DATABASE_PREFS, SET_GLOBAL_PREFS, SET_SCHEMA_PREFS, and SET_TABLE_PREFS procedures. NULL means use the table default value specified by the DEGREE clause in the CREATE TABLE or ALTER TABLE statement.</p> <p>Use the constant DBMS_STATS.DEFAULT_DEGREE to specify the default value based on the initialization parameters. The AUTO_DEGREE value determines the degree of parallelism automatically. The degree is between 1 (serial execution) and DEFAULT_DEGREE (the system default value based on number of CPUs and initialization parameters), according to the size of the object. When using DEGREE=>NULL, DEGREE=>n, or DEGREE=>DBMS_STATS.DEFAULT_DEGREE, the current implementation of DBMS_STATS may use serial execution when the size of the object does not warrant parallel execution.</p>

Table 186-59 (Cont.) GATHER_TABLE_STATS Procedure Parameters

Parameter	Description
granularity	<p>Granularity of statistics to collect (only pertinent if the table is partitioned).</p> <p>'ALL' - Gathers all (subpartition, partition, and global) statistics</p> <p>'APPROX_GLOBAL AND PARTITION' - similar to 'GLOBAL AND PARTITION' but in this case the global statistics are aggregated from partition level statistics. This option will aggregate all statistics except the number of distinct values for columns and number of distinct keys of indexes. The existing histograms of the columns at the table level are also aggregated. The aggregation will use only partitions with statistics, so to get accurate global statistics, users should make sure to have statistics for all partitions. Global statistics are gathered if partname is NULL or if the aggregation cannot be performed (for example, if statistics for one of the partitions is missing).</p> <p>'AUTO' - Determines the granularity based on the partitioning type. This is the default value.</p> <p>'DEFAULT' - Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. You should use the 'GLOBAL AND PARTITION' for this functionality. Note that the default value is now 'AUTO'.</p> <p>'GLOBAL' - Gathers global statistics</p> <p>'GLOBAL AND PARTITION' - Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object.</p> <p>'PARTITION' - Gathers partition-level statistics</p> <p>'SUBPARTITION' - Gathers subpartition-level statistics.</p>
cascade	<p>Determines whether to collect index statistics as part of gathering table statistics.</p> <p>Specifying this option is equivalent to running the GATHER_INDEX_STATS procedure on each index of the table. Use the constant DBMS_STATS.AUTO_CASCADE to enable the database to determine whether index statistics need to be collected. This is the default. You can change the default using the SET_DATABASE_PREFS, SET_GLOBAL_PREFS, SET_SCHEMA_PREFS, and SET_TABLE_PREFS procedures.</p>
stattab	User statistics table identifier describing where to save the current statistics
statid	Identifier (optional) to associate with these statistics within stattab
statown	Schema containing stattab (if different than ownname)

Table 186-59 (Cont.) GATHER_TABLE_STATS Procedure Parameters

Parameter	Description
no_invalidate	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>If set to TRUE, then the database not invalidate dependent cursors. If set to FALSE, then the procedure invalidates dependent cursors immediately.</p>
stattype	<p>Statistics type. The only value allowed is DATA.</p>
force	<p>Gather statistics of table even if it is locked</p>
context	<p>Not used.</p>
options	<p>Determines the options parameter used in the GATHER_TABLE_STATS procedure. The preference takes the following values:</p> <ul style="list-style-type: none"> GATHER — Gathers statistics for all objects in the table. This is the default. GATHER AUTO — Oracle recommends using GATHER AUTO to gather necessary statistics, such as histograms, after a table has been bulk loaded and acquired online statistics. This is applicable only to tables that are not using INCREMENTAL statistics. <p>For partitioned tables using INCREMENTAL statistics, GATHER_TABLE_STATS with GATHER AUTO will gather statistics for a table if it is marked stale or has no statistics. In addition, statistics will be gathered for partitions and sub-partitions that are marked stale or have no statistics.</p> <p>For tables not using INCREMENTAL statistics, GATHER_TABLE_STATS with GATHER AUTO may gather statistics for partitions and sub-partitions, even if they are not marked stale.</p>

Usage Notes

To invoke this procedure you must be owner of the table, or you need the ANALYZE ANY privilege. For objects owned by SYS, you need to be either the owner of the table, or you need the ANALYZE ANY DICTIONARY privilege or the SYSDBA privilege.

Index statistics collection can be parallelized except for cluster, domain and join indexes.

If the GATHER AUTO option is used then frequency histograms will be created using a sample rather than a full scan. The following scenario shows where GATHER AUTO is used:

- A table is created like this: `CREATE TABLE NEWTAB as SELECT * FROM`
This will create statistics on NEWTAB but no histograms.
- Next, the DBA creates the histograms using `GATHER AUTO on gather_table_stats`.

- The FREQUENCY histograms on NEWTAB will be created using a sample rather than a full table scan.

Exceptions

ORA-20000: Table does not exist or insufficient privileges

ORA-20001: Bad input value

Examples

An extension can be either a column group (see Example 1) or an expression (see Example 2).

Example 1

```
DBMS_STATS.GATHER_TABLE_STATS(
    'SH', 'SALES', method_opt => 'FOR COLUMNS (empno, deptno)');
```

Example 2

```
DBMS_STATS.GATHER_TABLE_STATS(
    'SH', 'SALES', method_opt => 'FOR COLUMNS (sal+comm)');
```

186.7.55 GENERATE_STATS Procedure

This **deprecated procedure** generates object statistics from previously collected statistics of related objects. The currently supported objects are b-tree and bitmap indexes.



Note:

This subprogram has been deprecated and replaced by improved technology. It is maintained only for purposes of backward compatibility. As an alternative, use the GATHER_INDEX_STAT procedure. See "[GATHER_INDEX_STATS Procedure](#)".

Syntax

```
DBMS_STATS.GENERATE_STATS (
    ownname    VARCHAR2,
    objname    VARCHAR2,
    organized  NUMBER DEFAULT 7,
    force      BOOLEAN default FALSE);
```

Parameters

Table 186-60 GENERATE_STATS Procedure Parameters

Parameter	Description
ownname	Schema of object
objname	Name of object

Table 186-60 (Cont.) GENERATE_STATS Procedure Parameters

Parameter	Description
organized	Amount of ordering associated between the index and its underlying table. A heavily organized index would have consecutive index keys referring to consecutive rows on disk for the table (the same block). A heavily disorganized index would have consecutive keys referencing different table blocks on disk. This parameter is only used for b-tree indexes. The number can be in the range of 0-10, with 0 representing a completely organized index and 10 a completely disorganized one.
force	If TRUE, generates statistics for the target object even if it is locked

Usage Notes

To invoke this procedure you must be owner of the table, or you need the ANALYZE ANY privilege. For objects owned by SYS, you need to be either the owner of the table, or you need the ANALYZE ANY DICTIONARY privilege or the SYSDBA privilege.

For fully populated schemas, the gather procedures should be used instead when more accurate statistics are desired.

Exceptions

ORA-20000: Unsupported object type of object does not exist

ORA-20001: Invalid option or invalid statistics

186.7.56 GET_ADVISOR_OPR_FILTER Procedure

This procedure creates an operation filter for an Optimizer Statistics Advisor task.

Syntax

```
DBMS_STATS.GET_ADVISOR_OPR_FILTER (
  opr_id          IN          NUMBER,
  opr_filter      IN OUT NOCOPY StatsAdvOpr);
```

Parameters

Table 186-61 GET_ADVISOR_OPR_FILTER Procedure Parameters

Parameter	Description
opr_id	The ID of the statistics operation stored in the DBA_OPTSTAT_OPERATIONS view.
opr_filter	The Optimizer Statistics Advisor filter that is generated based on the specified statistics operation.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- This subprogram executes using invoker's rights.

Exceptions

- `ORA-20000`: Insufficient privileges
- `ORA-20001`: Invalid input values
- `ORA-20012`: Optimizer Statistics Advisor errors

Usage Notes

You can specify the filter using either the operation ID or the filter ID, but not both at the same time.

186.7.57 GET_ADVISOR_RECS Function

This function generates a recommendation report for the specified item.

Syntax

```
DBMS_STATS.GET_ADVISOR_RECS (
  ownname      IN   VARCHAR2,
  tablename    IN   VARCHAR2,
  rec          IN   VARCHAR2,
  type         IN   VARCHAR2   := 'TEXT')
RETURN CLOB;
```

Parameters

Table 186-62 GET_ADVISOR_RECS Function Parameters

Parameter	Description
<code>ownname</code>	The owner of the table.
<code>tablename</code>	The name of the table.
<code>rec</code>	<p>The Optimizer Statistics Advisor recommendation.</p> <ul style="list-style-type: none"> • <code>INCREMENTAL</code> When only a small number of range partitions are modified, this option improves the performance of statistics gathering dramatically. However, it requires additional space to store synopses for maintaining incremental statistics. The report analyzes this trade-off. • <code>CONCURRENT</code> The report recommends either setting the <code>CONCURRENT</code> preference, or specifying <code>AUTO_DEGREE</code> for individual tables. If the system resources and usage satisfies the conditions, the advisor always recommends setting <code>CONCURRENT</code> first. The advisor only recommends <code>AUTO_DEGREE</code> when statistics gathering on an individual table take a long time and the <code>CONCURRENT</code> preference is already set.

Table 186-62 (Cont.) GET_ADVISOR_RECS Function Parameters

Parameter	Description
type	Type of the report: TEXT, HTML, or XML.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must have the privileges to gather statistics for the objects for which recommendations are generated.
- You must be the owner of the task.
- This subprogram executes using invoker's rights.

Usage Notes

The advisor does not make recommendations for manual statistics gathering. The database only make recommendations for automatic statistics gathering jobs, with the main goal of finishing the job within the maintenance window. As long as the automatic job finishes, the database does not make further recommendations.

Exceptions

- `ORA-20000`: Insufficient privileges
- `ORA-20001`: Invalid input values
- `ORA-20012`: Optimizer Statistics Advisor errors

186.7.58 GET_COLUMN_STATS Procedures

These overloaded procedures get column-related statistics. In the user-defined statistics version, the procedure returns the type of statistics stored.

Syntax

```
DBMS_STATS.GET_COLUMN_STATS (
  ownname          VARCHAR2,
  tabname          VARCHAR2,
  colname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  statab           VARCHAR2 DEFAULT NULL,
  statid           VARCHAR2 DEFAULT NULL,
  distcnt OUT      NUMBER,
  density OUT      NUMBER,
  nullcnt OUT      NUMBER,
  srec OUT         StatRec,
  avgclen OUT      NUMBER,
  statown          VARCHAR2 DEFAULT NULL,
  realtime_stats  BOOLEAN iDEFAULT TRUE);
```

Use the following for user-defined statistics:

```
DBMS_STATS.GET_COLUMN_STATS (
  ownname          VARCHAR2,
  tablename        VARCHAR2,
  colname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  statab           VARCHAR2 DEFAULT NULL,
  statid           VARCHAR2 DEFAULT NULL,
  ext_stats        OUT RAW,
  stattyown        OUT VARCHAR2 DEFAULT NULL,
  stattyname       OUT VARCHAR2 DEFAULT NULL,
  statown          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-63 GET_COLUMN_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema
tablename	Specifies the name of the table to which this column belongs.
colname	Specifies the name of the column or extension.
partname	Specifies the name of the table partition from which to get the statistics. If the table is partitioned, and if partname is NULL, then the procedure retrieves statistics at the global table level.
statab	Specifies the statistics table ID describing where to retrieve the statistics. If statab is NULL, then the procedure retrieves statistics directly from the data dictionary.
statid	Specifies an optional identifier associated with these statistics within statab. This parameter is only relevant when statab is not NULL.
ext_stats	Specifies the user-defined statistics.
stattyown	Specifies the schema of the statistics type.
stattyname	Specifies the name of the statistics type.
distcnt	Specifies the number of distinct values.
density	Specifies the column density.
nullcnt	Specifies the number of NULL values.
srec	Specifies the structure holding the internal representation of the column minimum, maximum, and histogram values.
avgclen	Specifies the average length of the column (in bytes).
statown	Specifies the schema containing statab (if different than ownname).
realtime_stats	Specifies whether to include real-time statistics. The default value is TRUE. When realtime_stats is FALSE, the database only includes optimizer statistics that were gathered by the GATHER_*_STATS procedures.

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be the owner of the table, or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges or no statistics have been stored for requested object

Usage Notes

Before invoking this procedure, ensure that the table exists.

186.7.59 GET_INDEX_STATS Procedures

This overloaded procedure gets all index-related statistics. In the form of this procedure that deals with user-defined statistics, the statistics type returned is the type stored, in addition to the user-defined statistics.

Syntax

```
DBMS_STATS.GET_INDEX_STATS (
  ownname          VARCHAR2,
  indname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  stattab         VARCHAR2 DEFAULT NULL,
  statid          VARCHAR2 DEFAULT NULL,
  numrows         OUT NUMBER,
  numlblks        OUT NUMBER,
  numdist         OUT NUMBER,
  avglblk         OUT NUMBER,
  avgdblks        OUT NUMBER,
  clstfct         OUT NUMBER,
  indlevel        OUT NUMBER,
  statown         VARCHAR2 DEFAULT NULL);
```

```
DBMS_STATS.GET_INDEX_STATS (
  ownname          VARCHAR2,
  indname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  stattab         VARCHAR2 DEFAULT NULL,
  statid          VARCHAR2 DEFAULT NULL,
  numrows         OUT NUMBER,
  numlblks        OUT NUMBER,
  numdist         OUT NUMBER,
  avglblk         OUT NUMBER,
  avgdblks        OUT NUMBER,
  clstfct         OUT NUMBER,
  indlevel        OUT NUMBER,
  statown         VARCHAR2 DEFAULT NULL,
  guessq          OUT NUMBER);
```

Use the following form of the procedure for user-defined statistics:

```
DBMS_STATS.GET_INDEX_STATS (
  ownname          VARCHAR2,
  indname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  statab           VARCHAR2 DEFAULT NULL,
  statid           VARCHAR2 DEFAULT NULL,
  ext_stats        OUT  RAW,
  stattyown        OUT  VARCHAR2 DEFAULT NULL,
  stattyname       OUT  VARCHAR2 DEFAULT NULL,
  statown          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-64 GET_INDEX_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema
indname	Name of the index
partname	Name of the index partition for which to get the statistics. If the index is partitioned and if <code>partname</code> is <code>NULL</code> , then the statistics are retrieved for the global index level.
statab	User statistics table identifier describing from where to retrieve the statistics. If <code>statab</code> is <code>NULL</code> , then the statistics are retrieved directly from the dictionary.
statid	Identifier (optional) to associate with these statistics within <code>statab</code> (Only pertinent if <code>statab</code> is not <code>NULL</code>)
ext_stats	User-defined statistics
stattyown	Schema of the statistics type
stattyname	Name of the statistics type
numrows	Number of rows in the index (partition)
numlblks	Number of leaf blocks in the index (partition)
numdist	Number of distinct keys in the index (partition)
avglblk	Average integral number of leaf blocks in which each distinct key appears for this index (partition)
avgdblk	Average integral number of data blocks in the table pointed to by a distinct key for this index (partition)
clstfct	Clustering factor for the index (partition)
indlevel	Height of the index (partition)
statown	Schema containing <code>statab</code> (if different than <code>ownname</code>)
guessq	Guess quality for the index (partition)

Security Model

Before invoking this procedure, ensure that the table exists. To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`,

you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges or no statistics have been stored for requested object

Usage Notes

- The optimizer uses the cached data to estimate number of cached blocks for index or statistics table access. The database calculates the total cost of the operation by combining the I/O cost of reading not cached blocks from disk, the CPU cost of getting cached blocks from the buffer cache, and the CPU cost of processing the data.
- The database maintains `cachedblk` and `cachehit` at all times. However, the database uses the corresponding caching statistics for optimization as part of the table and index statistics only when the user calls the `DBMS_STATS.GATHER_[TABLE/INDEX/SCHEMA/DATABASE]_STATS` procedure for automatic mode or `DBMS_STATS.GATHER_SYSTEM_STATS` for manual mode. To prevent the user from utilizing inaccurate and unreliable data, the optimizer computes a “confidence factor” for each `cachehit` and a `cachedblk` for each object. If the confidence factor for the value meets confidence criteria, then the database uses this value; otherwise, the database uses defaults.
- The automatic maintenance algorithm for object caching statistics assumes that only one major database workload exists. The algorithm adjusts statistics to this workload, ignoring other "minor" workloads. If this assumption is false, then you must use manual mode for maintaining object caching statistics.
- The object caching statistics maintenance algorithm for automatic mode prevents you from using statistics in the following situations:
 - When not enough data has been analyzed, such as when an object has been recently created
 - When the system does not have one major workload resulting in averages not corresponding to real values

See Also:

Oracle Database SQL Tuning Guide to learn how to manage optimizer statistics

186.7.60 GET_PARAM Function

This function returns the default value of parameters of DBMS_STATS procedures.



Note:

This subprogram has been replaced by improved technology and is maintained only for purposes of backward compatibility. In this case, use the [GET_PREFS Function](#).

See also [DBMS_STATS Deprecated Subprograms](#).

Syntax

```
DBMS_STATS.GET_PARAM (  
    pname      IN  VARCHAR2)  
RETURN VARCHAR2;
```

Parameters

Table 186-65 GET_PARAM Function Parameters

Parameter	Description
pname	Parameter name

Exceptions

ORA-20001: Invalid input values

186.7.61 GET_PREFS Function

This function returns the default value of the specified preference.

Syntax

```
DBMS_STATS.GET_PREFS (  
    pname      IN  VARCHAR2,  
    ownname    IN  VARCHAR2 DEFAULT NULL,  
    tablename  IN  VARCHAR2 DEFAULT NULL)  
RETURN VARCHAR2;
```

Parameters

Table 186-66 GET_PREFS Function Parameters

Parameter	Description
pname	<p>Preference name. The possible values are:</p> <ul style="list-style-type: none"> • APPROXIMATE_NDV_ALGORITHM • AUTO_STAT_EXTENSIONS • AUTO_TASK_STATUS • AUTO_TASK_MAX_RUN_TIME • AUTO_TASK_INTERVAL • CASCADE • CONCURRENT • DEGREE • ESTIMATE_PERCENT • GLOBAL_TEMP_TABLE_STATS • GRANULARITY • INCREMENTAL • INCREMENTAL_STALENESS • INCREMENTAL_LEVEL • METHOD_OPT • NO_INVALIDATE • OPTIONS • PREFERENCE_OVERRIDES_PARAMETER • PUBLISH • STALE_PERCENT • STAT_CATEGORY • TABLE_CACHED_BLOCKS • WAIT_TIME_TO_UPDATE_STATUS
ownname	Owner name
tabname	Table name

Table 186-67 Preference Descriptions

Preference Name	Description
APPROXIMATE_NDV_ALGORITHM	<p>Specifies the synopsis generation algorithm. A synopsis is special type of statistic that tracks the number of distinct values (NDV) for each column in a partition. Consider a synopsis as an internal management structure that samples distinct values.</p> <p>You can specify the following preferences:</p> <ul style="list-style-type: none"> REPEAT OR HYPERLOGLOG <p>This is the default. If INCREMENTAL is enabled on the table, then the database preserves the format of any existing synopses that use the adaptive sampling algorithm. However, the database creates any new synopses in HyperLogLog format. This approach is attractive when existing performance is acceptable, and you do not want to incur the performance cost of reformatting legacy content.</p> ADAPTIVE SAMPLING <p>The database uses the adaptive sampling algorithm for all synopses. This is the most conservative option.</p> HYPERLOGLOG <p>The database uses the HyperLogLog algorithm for all new and stale synopses. In contrast to adaptive sampling, the HyperLogLog algorithm uses a randomization technique. The advantages of HyperLogLog over adaptive sampling are:</p> <ul style="list-style-type: none"> The accuracy of the new algorithm is similar to the original algorithm. The memory required is significantly lower, which typically leads to huge reductions in synopsis size.
AUTO_STAT_EXTENSIONS	<p>Controls the automatic creation of extensions when database statistics are gathered.</p> <p>You can set the following values:</p> <ul style="list-style-type: none"> ON — When applicable, a SQL plan directive can trigger the creation of column group statistics based on usage of columns in the predicates in the workload. OFF — The database does not create column group statistics automatically. The database creates them only when the CREATE_EXTENDED_STATS function is executed, or when extended statistics are specified explicitly in the METHOD_OPT clause of DBMS_STATS. This is the default.
AUTO_TASK_STATUS	<p>Enables or disables the high-frequency automatic optimizer statistics collection. Values are:</p> <ul style="list-style-type: none"> ON — Enables high-frequency automatic optimizer statistics collection. OFF — Disables high-frequency automatic optimizer statistics collection. This is the default.

Table 186-67 (Cont.) Preference Descriptions

Preference Name	Description
AUTO_TASK_MAX_RUN_TIME	Configures the maximum run time in seconds of an execution of high-frequency automatic optimizer statistics collection. The maximum value is 3600 (equal to 1 hour), which is the default.
AUTO_TASK_INTERVAL	Specifies the interval in seconds between executions of high-frequency automatic optimizer statistics collection. The default value is 3600 but Oracle sets it differently for some platforms and Oracle Database releases.
CASCADE	Determines whether index statistics are collected as part of gathering table statistics.
CONCURRENT	Determines whether statistics are gathered concurrently on multiple objects, or serially, one object at a time. Valid values are: <ul style="list-style-type: none"> MANUAL — Concurrency is enabled only for manual statistics gathering. AUTOMATIC — Concurrency is enabled only for the automatic statistics gathering. ALL — Concurrency is enabled for both manual and automatic statistics gathering. OFF — Concurrency is disabled for both manual and automatic statistics.
DEGREE	Determines degree of parallelism used for gathering statistics.
ESTIMATE_PERCENT	Determines the percentage of rows to sample. The valid range is between 0.000001 and 100. Use the constant <code>DBMS_STATS.AUTO_SAMPLE_SIZE</code> to enable the database to determine the appropriate sample size for optimal statistics. This is the default.
GLOBAL_TEMP_TABLE_STATS	Controls whether the statistics gathered for a global temporary table should be stored as shared statistics or session statistics. This preference takes two values: <ul style="list-style-type: none"> SHARED — All sessions see the same set of statistics SESSION — Statistics gathered by the <code>GATHER_TABLE_STATS</code> procedure on a global temporary table are session-specific. Thus, the database only uses them for queries issued in the same session as the statistics gathering process. The database deletes session-specific statistics when a session terminates.

Table 186-67 (Cont.) Preference Descriptions

Preference Name	Description
GRANULARITY	<p>Determines the granularity of statistics to collect. This preference is only relevant for partitioned tables.</p> <p>The following values are valid:</p> <ul style="list-style-type: none"> • ALL — Gathers all statistics: subpartition, partition, and global. • AUTO — Determines the granularity based on the partitioning type. This is the default value. • DEFAULT — Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. Use GLOBAL AND PARTITION for this functionality. • GLOBAL — Gathers global statistics. • GLOBAL AND PARTITION — Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object. • PARTITION — Gathers partition-level statistics. • SUBPARTITION — Gathers subpartition-level statistics.
INCREMENTAL	<p>Determines whether the global statistics for a partitioned table are maintained without performing a full table scan.</p> <p>When a table is partitioned, an application typically loads data into a new partition. As new partitions are added and data is loaded, global table statistics must be kept up to date. If the following conditions are met, then the database updates the global table statistics by scanning only the changed partitions instead of the entire table:</p> <ul style="list-style-type: none"> • The INCREMENTAL value for the partitioned table is set to TRUE. • The PUBLISH value for the partitioned table is set to TRUE. • The user specifies AUTO_SAMPLE_SIZE for ESTIMATE_PERCENT and AUTO for GRANULARITY when gathering statistics on the table. <p>If the INCREMENTAL value for the partitioned table was set to FALSE (default value), then the database uses a full table scan to maintain the global statistics. This technique is a much more resource-intensive and time-consuming operation for large tables.</p>

Table 186-67 (Cont.) Preference Descriptions

Preference Name	Description
INCREMENTAL_LEVEL	<p>Controls which synopses to collect when INCREMENTAL preference is set to TRUE. It takes the following values:</p> <ul style="list-style-type: none"> • PARTITION — Gathers partition-level synopses. This is the default value. If PARTITION is set on a nonpartitioned table, then the database does not gather synopses. • TABLE — Gathers table-level synopses. Specify this value when you want to exchange this table with a partition. Before the exchange, you can run GATHER_TABLE_STATS on this table with INCREMENTAL set to TRUE and INCREMENTAL_LEVEL to TABLE. The result is that the database gathers table-level synopses on this table. After the exchange, the partition has synopses that come from the table-level synopses of the table before the exchange. You can only use preference value in the SET_TABLE_PREFS procedure: this value is not allowed in the other SET_*_PREFS procedures.

Table 186-67 (Cont.) Preference Descriptions

Preference Name	Description
INCREMENTAL_STALENESS	<p>Specifies when a partition or subpartition is considered stale. This parameter takes an enumeration of values, such as 'USE_STALE_PERCENT' and 'USE_LOCKED_STATS'. You can also specify multiple values, such as 'USE_STALE_PERCENT,USE_LOCKED_STATS,ALLOW_MIXED_FORMAT'.</p> <p>The parameter accepts the following values:</p> <ul style="list-style-type: none"> <p>USE_STALE_PERCENT—A partition or subpartition is not considered stale when DML changes are below the threshold set by the STALE_PERCENT preference.</p> <p>For example, assume that STALE_PERCENT is 10. You specify USE_STALE_PERCENT for INCREMENTAL_STALENESS. The partition has 5% DML changes. The database does not regather statistics.</p> <p>Assume a different case in which STALE_PERCENT is 10. You specify USE_STALE_PERCENT for INCREMENTAL_STALENESS. However, in this case the partition is locked and has 20% of DML changes. Because the partition is locked, the database does not regather statistics.</p> <p>USE_LOCKED_STATS—Locked partitions or subpartitions statistics are never considered stale, regardless of DML changes.</p> <p>For example, assume that STALE_PERCENT is 10. You specify 'USE_LOCKED_STATS, USE_STALE_PERCENT'. The partition, which is locked, has 20% DML changes. The partition is not considered stale. The database uses existing statistics to derive global statistics.</p> <p>ALLOW_MIXED_FORMAT—Adaptive sampling synopses and HyperLogLog synopses are permitted to coexist.</p> <p>NULL—A partition or subpartition is considered stale when it has any DML changes.</p> <p>For example, assume that STALE_PERCENT is 10. You specify the value 'NULL' for INCREMENTAL_STALENESS. The partition has 5% of DML changes. The database regathers statistics.</p>

Table 186-67 (Cont.) Preference Descriptions

Preference Name	Description
METHOD_OPT	<p>Note that the following two executions are different:</p> <pre data-bbox="859 407 1317 495">EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', 'NULL');</pre> <pre data-bbox="859 564 1292 653">EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', null);</pre> <p>The first execution uses single quotes to set the preference to the value NULL, whereas the second sets the preference to the default, which is ALLOW_MIXED_FORMAT.</p> <p>Controls column statistics collection and histogram creation. When setting preferences at the global, schema, database, or dictionary level, only FOR ALL syntax is allowed:</p> <ul data-bbox="859 963 1373 1024" style="list-style-type: none"> • FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause] <p>The size_clause is defined as size_clause := SIZE {integer REPEAT AUTO SKEWONLY}</p> <p>integer — Specifies the number of histogram buckets. The number must be between 1 and 2048.</p> <p>REPEAT — Collects histograms only on the columns that already have histograms.</p> <p>AUTO — Determines the columns on which to collect histograms based on data distribution and the workload of the columns.</p> <p>SKEWONLY — Determines the columns on which to collect histograms based on the data distribution of the columns.</p> <p>The default is FOR ALL COLUMNS SIZE AUTO. You can change the value using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>

Table 186-67 (Cont.) Preference Descriptions

Preference Name	Description
NO_INVALIDATE	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>If set to TRUE, then the database not invalidate dependent cursors. If set to FALSE, then the procedure invalidates dependent cursors immediately.</p>
OPTIONS	<p>Determines the <code>options</code> parameter used in the <code>GATHER_TABLE_STATS</code> procedure. The preference takes the following values:</p> <ul style="list-style-type: none"> GATHER — Gathers statistics for all objects in the table. This is the default. GATHER AUTO — Oracle recommends using GATHER AUTO to gather necessary statistics, such as histograms, after a table has been bulk loaded and acquired online statistics. This is applicable only to tables that are not using INCREMENTAL statistics. <p>For partitioned tables using INCREMENTAL statistics, GATHER_TABLE_STATS with GATHER AUTO will gather statistics for a table if it is marked stale or has no statistics. In addition, statistics will be gathered for partitions and sub-partitions that are marked stale or have no statistics.</p> <p>For tables not using INCREMENTAL statistics, GATHER_TABLE_STATS with GATHER AUTO may gather statistics for partitions and sub-partitions, even if they are not marked stale.</p>
PREFERENCE_OVERRIDES_PARAMETER	<p>Determines whether to override the input value of a parameter with the preference value of that parameter for a statistics operation. Possible values are:</p> <ul style="list-style-type: none"> TRUE — Ignores input parameter values, and uses the value of the corresponding preference. FALSE — Obeys input parameter values. <p>Specifying this preference does not change the order of precedence of table, global, and default.</p>
PUBLISH	<p>Determines whether the database publishes newly gathered statistics after the gathering job completes. You can gather statistics without publishing them immediately. This technique enables you to test new statistics before publishing them.</p>

Table 186-67 (Cont.) Preference Descriptions

Preference Name	Description
STALE_PERCENT	<p>Determines the percentage of rows in a table that must change before the statistics on that table are stale and need to be regathered.</p> <p>The valid domain for <code>stale_percent</code> is non-negative numbers. The default value is 10, which means that a table having more than 10% of changes is considered stale.</p>
STAT_CATEGORY	<p>Specifies which statistics to import or export, accepting multiple values separated by a comma. Values supported:</p> <ul style="list-style-type: none"> • <code>OBJECT_STATS</code> - table statistics, column statistics and index statistics (default) • <code>SYNOPSIS</code> - information to support incremental statistics • <code>REALTIME_STATS</code> — specifies only real-time statistics. <p>The value '<code>OBJECT_STATS, SYNOPSIS</code>' specifies table statistics, column statistics, index statistics, and synopses.</p>
TABLE_CACHED_BLOCKS	<p>Specifies the average number of blocks assumed to be cached in the buffer cache when calculating the index clustering factor. The preference applies only when gathering statistics using <code>DBMS_STATS</code>. Index statistics gathered during <code>CREATE INDEX</code> or <code>REBUILD INDEX</code> operations will use the default value 1.</p>
WAIT_TIME_TO_UPDATE_STATS	<p>Specifies the number of minutes before timing out for locks and pins required for updating statistics. It accepts values in the range 0 to 65535. The default value is 15 minutes. The value 0 gets the locks and pins in no-wait mode.</p>

Security Model

No special privilege or role is needed to invoke this procedure. To gather statistics concurrently, however, you must either have the DBA role, or have the following privileges in addition to privileges that are required for gathering statistics: `CREATE JOB`, `MANAGE SCHEDULER`, and `MANAGE ANY QUEUE`.

Exceptions

- `ORA-20000`: Unable to gather statistics concurrently: Resource Manager is not enabled.
- `ORA-20001`: Invalid input values

Usage Notes

Note the following guidelines:

- The `CONCURRENT` preference determines whether statistics are gathered concurrently when the user issues `GATHER_*_STATS` procedures. `DBMS_STATS` can

collect statistics for a single object in parallel based on the value of the `DEGREE` parameter. However, parallelism is limited to one object. The `CONCURRENT` preference extends the scope of parallelism to multiple database objects. This approach is primarily intended for multi-CPU systems, and may not be suitable for small databases on single-CPU computers.

To gather statistics concurrently, Resource Manager must be enabled, and the setting for the `JOB_QUEUE_PROCESSES` initialization parameter must be at least 4.

- If the `ownname` and `tabname` are provided, and if a preference has been entered for the table, then the function returns the preference as specified for the table. In all other cases, it returns the global preference if it has been specified, otherwise it returns the default value.

**See Also:**

Oracle Database SQL Tuning Guide to learn how to get optimizer statistics preferences

186.7.62 GET_STATS_HISTORY_AVAILABILITY Function

This function returns oldest timestamp where statistics history is available. Users cannot restore statistics to a timestamp older than this one.

Syntax

```
DBMS_STATS.GET_STATS_HISTORY_AVAILABILITY  
RETURN TIMESTAMP WITH TIMEZONE;
```

Usage Notes

No special privilege or role is needed to invoke this procedure.

186.7.63 GET_STATS_HISTORY_RETENTION Function

This function returns the current statistics history retention value.

Syntax

```
DBMS_STATS.GET_STATS_HISTORY_RETENTION  
RETURN NUMBER;
```

Usage Notes

No special privilege or role is needed to invoke this procedure.

186.7.64 GET_SYSTEM_STATS Procedure

This procedure gets system statistics from `stattab`, or from the dictionary if `stattab` is `NULL`.

Syntax

```
DBMS_STATS.GET_SYSTEM_STATS (  
    status OUT VARCHAR2,
```

```

dstart    OUT  DATE,
dstop     OUT  DATE,
pname     IN   VARCHAR2,
pvalue    OUT  NUMBER,
statab    IN   VARCHAR2 DEFAULT NULL,
statid    IN   VARCHAR2 DEFAULT NULL,
statown   IN   VARCHAR2 DEFAULT NULL);

```

Parameters

Table 186-68 GET_SYSTEM_STATS Procedure Parameters

Parameter	Description
status	Output is one of the following: <ul style="list-style-type: none"> COMPLETED: AUTOGATHERING: MANUALGATHERING: BADSTATS:
dstart	Date when statistics gathering started. If status = MANUALGATHERING, the start date is returned.
dstop	Date when statistics gathering stopped. <ul style="list-style-type: none"> If status = COMPLETE, the finish date is returned. If status = AUTOGATHERING, the future finish date is returned. If status = BADSTATS, the must-finished-by date is returned.
pname	The parameter name to get, which can have one of the following values: <ul style="list-style-type: none"> iotfrspeed - I/O transfer speed in bytes for each millisecond ioseektim - seek time + latency time + operating system overhead time, in milliseconds sreadtim - average time to read single block (random read), in milliseconds mreadtim - average time to read an mbrc block at once (sequential read), in milliseconds cpuspeed - average number of CPU cycles for each second, in millions, captured for the workload (statistics collected using 'INTERVAL' or 'START' and 'STOP' options) cpuspeednw - average number of CPU cycles for each second, in millions, captured for the no-workload (statistics collected using 'NOWORKLOAD' option. mbrc - average multiblock read count for sequential read, in blocks maxthr - maximum I/O system throughput, in bytes/second slavethr - average slave I/O throughput, in bytes/second
pvalue	Parameter value to get
statab	Identifier of the user statistics table where the statistics will be obtained. If statab is NULL, the statistics will be obtained from the dictionary.
statid	Optional identifier associated with the statistics saved in the statab

Table 186-68 (Cont.) GET_SYSTEM_STATS Procedure Parameters

Parameter	Description
statown	Schema containing statab (if different from current schema)

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20002: Bad user statistics table; may need to be upgraded

ORA-20003: Unable to gather system statistics

ORA-20004: Parameter does not exist

Usage Notes

To run this procedure, you need the GATHER_SYSTEM_STATISTICS role.

186.7.65 GET_TABLE_STATS Procedure

This overloaded procedure gets all table-related statistics.

Syntax

```
DBMS_STATS.GET_TABLE_STATS (
  ownname          VARCHAR2,
  tabname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  statab           VARCHAR2 DEFAULT NULL,
  statid           VARCHAR2 DEFAULT NULL,
  numrows          OUT NUMBER,
  numblks          OUT NUMBER,
  avgrlen          OUT NUMBER,
  statown          VARCHAR2 DEFAULT NULL,
  realtime_stats   BOOLEAN DEFAULT TRUE);
```

```
DBMS_STATS.GET_TABLE_STATS (
  ownname          VARCHAR2,
  tabname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  statab           VARCHAR2 DEFAULT NULL,
  statid           VARCHAR2 DEFAULT NULL,
  numrows          OUT NUMBER,
  numblks          OUT NUMBER,
  avgrlen          OUT NUMBER,
  statown          VARCHAR2 DEFAULT NULL,
  im_imcu_count   OUT NUMBER,
  im_block_count  OUT NUMBER,
```

```

scanrate          OUT NUMBER,
realtime_stats    BOOLEAN DEFAULT TRUE);

DBMS_STATS.GET_TABLE_STATS (
  ownname          VARCHAR2,
  tabname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  statab          VARCHAR2 DEFAULT NULL,
  statid          VARCHAR2 DEFAULT NULL,
  numrows         OUT NUMBER,
  numblks         OUT NUMBER,
  avgrlen         OUT NUMBER,
  cachedblk       OUT NUMBER,
  cachehit        OUT NUMBER,
  realtime_stats  BOOLEAN DEFAULT TRUE);

```

Parameters

Table 186-69 GET_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Specifies the name of the schema.
tabname	Specifies the name of the table to which this column belongs.
partname	Specifies the name of the table partition from which to get the statistics. If the table is partitioned and if <code>partname</code> is <code>NULL</code> , then the statistics are retrieved from the global table level.
statab	Specifies the user statistics table ID. This ID describes where to retrieve the statistics. If <code>statab</code> is <code>NULL</code> , then the procedure gathers statistics directly from the data dictionary.
statid	Specifies the optional ID associates with these statistics within <code>statab</code> . This ID is only relevant when <code>statab</code> is not <code>NULL</code> .
numrows	Specifies the number of rows in the table or partition.
numblks	Specifies the number of blocks in the table or partition.
avgrlen	Specifies the average row length for the table or partition.
statown	Specifies the schema containing <code>statab</code> (if different from <code>ownname</code>).
im_imcu_count	Specifies the number of In-Memory Compression Units (IMCUs) in the table or partition.
im_block_count	Specifies the number of In-Memory blocks in the table or partition. An In-Memory block corresponds to a specific data block on disk. If the table is fully populated in the IM column store, then the number of In-Memory blocks equals the number of data blocks.
scanrate	Specifies the rate, in MB/s, at which the database scans external tables. This parameter is relevant only for external tables.

Table 186-69 (Cont.) GET_TABLE_STATS Procedure Parameters

Parameter	Description
<code>realtime_stats</code>	Specifies whether to include real-time statistics. The default value is <code>TRUE</code> . When <code>realtime_stats</code> is <code>FALSE</code> , the database only includes optimizer statistics that were gathered by the <code>GATHER_*_STATS</code> procedures.
<code>cachedblk</code>	For internal use only.
<code>cachehit</code>	For internal use only.

Security Model

Before invoking this procedure, ensure that the table exists. To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table, or have the `ANALYZE ANY DICTIONARY` or `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges or no statistics have been stored for requested object

ORA-20002: Bad user statistics table; may need to upgrade it

Usage Notes

- The optimizer uses the cached data to estimate number of cached blocks for index or statistics table access. The database calculates the total cost of the operation by combining the I/O cost of reading not cached blocks from disk, the CPU cost of getting cached blocks from the buffer cache, and the CPU cost of processing the data.
- The database maintains `cachedblk` and `cachehit` at all times. However, the database uses the corresponding caching statistics for optimization as part of the table and index statistics only when the user calls the `DBMS_STATS.GATHER*_STATS` procedure for automatic mode or `DBMS_STATS.GATHER_SYSTEM_STATS` for manual mode. To prevent the user from utilizing inaccurate and unreliable data, the optimizer computes a “confidence factor” for each `cachehit` and a `cachedblk` for each object. If the confidence factor for the value meets confidence criteria, then the database uses this value; otherwise, the database uses defaults.
- The automatic maintenance algorithm for object caching statistics assumes that only one major database workload exists. The algorithm adjusts statistics to this workload, ignoring other “minor” workloads. If this assumption is false, then you must use manual mode for maintaining object caching statistics.
- The object caching statistics maintenance algorithm for automatic mode prevents you from using statistics in the following situations
 - When not enough data has been analyzed, such as when an object has been recently created
 - When the system does not have one major workload resulting in averages not corresponding to real values
- The database does not support export or import of statistics across databases of different character sets.

**See Also:**

Oracle Database SQL Tuning Guide to learn how to manage optimizer statistics preferences

186.7.66 IMPLEMENT_ADVISOR_TASK Function

This function implements the recommendations made by Optimizer Statistics Advisor.

Syntax

```
DBMS_STATS.IMPLEMENT_ADVISOR_TASK (
  task_name          IN   VARCHAR2,
  execution_name     IN   VARCHAR2   := NULL,
  level              IN   VARCHAR2   := 'TYPICAL')
RETURN CLOB;
```

Parameters

Table 186-70 IMPLEMENT_ADVISOR_TASK Function Parameters

Parameter	Description
task_name	The name of the Optimizer Statistics Advisor task.
execution_name	A name that qualifies and identifies an advisor execution. If not specified, then the advisor automatically generates it. If the specified execution conflicts with the name of an existing execution, then the function returns an error.
level	The level of the implementation. Possible values are <ul style="list-style-type: none"> ALL: Ignores the filters and implements all recommendations. TYPICAL: Implements the recommendations according to the filters in place.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- You can execute this subprogram for `AUTO_STATS_ADVISOR_TASK`, which is predefined.
- This subprogram executes using invoker's rights.

The results of performing this task depend on the privileges of the executing user:

- SYSTEM level
 - Only users with both the `ANALYZE ANY` and `ANALYZE ANY DICTIONARY` privileges can perform this task on system-level rules.
- Operation level

The results depend on the following privileges:

- Users with both the `ANALYZE ANY` and `ANALYZE ANY DICTIONARY` privileges can perform this task for all statistics operations.
 - Users with the `ANALYZE ANY` privilege but *not* the `ANALYZE ANY DICTIONARY` privilege can perform this task for statistics operations related to any schema except `SYS`.
 - Users with the `ANALYZE ANY DICTIONARY` privilege but *not* the `ANALYZE ANY` privilege can perform this task for statistics operations related to their own schema and the `SYS` schema.
 - Users with neither the `ANALYZE ANY` nor the `ANALYZE ANY DICTIONARY` privilege can only perform this operation for statistics operations relating to their own schema.
- Object level
Users can perform this task for any object for which they have statistics collection privileges.

Return Values

This function returns an XML CLOB that indicates which recommendations were successfully implemented.

Exceptions

- ORA-20000: Insufficient privileges
- ORA-20001: Invalid input values
- ORA-20012: Optimizer Statistics Advisor errors

Example 186-10 Implementing Optimizer Statistics Advisor Recommendations

This script illustrates a basic Optimizer Statistics Advisor session. It creates a task, executes it, generates a report, and then implements the recommendations.

```

DECLARE
  v_tname      VARCHAR2(128) := 'my_task';
  v_ename      VARCHAR2(128) := NULL;
  v_report     CLOB := null;
  v_script     CLOB := null;
  v_imp_result CLOB;
BEGIN
  -- create a task
  v_tname := DBMS_STATS.CREATE_ADVISOR_TASK(v_tname);

  -- execute the task
  v_ename := DBMS_STATS.EXECUTE_ADVISOR_TASK(v_tname);

  -- view the task report
  v_report := DBMS_STATS.REPORT_ADVISOR_TASK(v_tname);
  DBMS_OUTPUT.PUT_LINE(v_report);

  -- implement all recommendations
  v_imp_result := DBMS_STATS.IMPLEMENT_ADVISOR_TASK(v_tname);
END;
```

186.7.67 IMPORT_COLUMN_STATS Procedure

This procedure retrieves statistics for a particular column from the user statistics table identified by `stattab` and stores them in the dictionary.

Syntax

```
DBMS_STATS.IMPORT_COLUMN_STATS (
    ownname          VARCHAR2,
    tabname          VARCHAR2,
    colname          VARCHAR2,
    partname         VARCHAR2 DEFAULT NULL,
    stattab          VARCHAR2,
    statid           VARCHAR2 DEFAULT NULL,
    statown          VARCHAR2 DEFAULT NULL,
    no_invalidate    BOOLEAN DEFAULT to_no_invalidate_type (
                                get_param('NO_INVALIDATE')),
    force            BOOLEAN DEFAULT FALSE);
```

Parameters

Table 186-71 IMPORT_COLUMN_STATS Procedure Parameters

Parameter	Description
<code>ownname</code>	Name of the schema
<code>tabname</code>	Name of the table to which this column belongs
<code>colname</code>	Name of the column or extension
<code>partname</code>	Name of the table partition. If the table is partitioned and if <code>partname</code> is <code>NULL</code> , then global and partition column statistics are imported.
<code>stattab</code>	User statistics table identifier describing from where to retrieve the statistics
<code>statid</code>	Identifier to associate with these statistics within <code>stattab</code> (optional)
<code>statown</code>	Schema containing <code>stattab</code> (if different than <code>ownname</code>)
<code>no_invalidate</code>	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> <code>TRUE</code>: Dependent cursors are not invalidated. <code>FALSE</code>: Dependent cursors are marked for immediate invalidation. <code>AUTO</code>: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
<code>force</code>	If set to <code>TRUE</code> , imports statistics even if statistics are locked

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values in the user statistics table

ORA-20005: Object statistics are locked

Usage Notes

Oracle does not support export or import of statistics across databases of different character sets.

186.7.68 IMPORT_DATABASE_PREFS Procedure

This procedure is used to import the statistics preferences of all the tables, excluding the tables owned by Oracle. These tables can be included by passing `TRUE` for the `add_sys` parameter.

Syntax

```
DBMS_STATS.IMPORT_DATABASE_PREFS (
    statab      IN  VARCHAR2,
    statid      IN  VARCHAR2 DEFAULT NULL,
    statown     IN  VARCHAR2 DEFAULT NULL,
    add_sys     IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 186-72 IMPORT_DATABASE_PREFS Procedure Parameters

Parameter	Description
<code>statab</code>	Statistics table name where to import the statistics
<code>statid</code>	Optional identifier to associate with these statistics within <code>statab</code>
<code>statown</code>	Schema containing <code>statab</code> (if different than <code>ownname</code>)
<code>add_sys</code>	Value <code>TRUE</code> will include the Oracle-owned tables

Exceptions

ORA-20000: Insufficient privileges.

Usage Notes

- To run this procedure, you need to have the `SYSDBA` role, or both `ANALYZE ANY DICTIONARY` and `ANALYZE ANY` system privileges.
- Oracle does not support export or import of statistics across databases of different character sets.

Examples

```
DBMS_STATS.IMPORT_DATABASE_PREFS('STATTAB', statown=>'SH');
```

186.7.69 IMPORT_DATABASE_STATS Procedure

This procedure imports statistics for all objects in the database from the user statistics table and stores them in the data dictionary.

Syntax

```
DBMS_STATS.IMPORT_DATABASE_STATS (
  stattab          VARCHAR2,
  statid           VARCHAR2 DEFAULT NULL,
  statown          VARCHAR2 DEFAULT NULL,
  no_invalidate   BOOLEAN DEFAULT to_no_invalidate_type(
                                     get_param('NO_INVALIDATE')),
  force           BOOLEAN DEFAULT FALSE,
  stat_category   VARCHAR2 DEFAULT DEFAULT_STAT_CATEGORY);
```

Parameters

Table 186-73 IMPORT_DATABASE_STATS Procedure Parameters

Parameter	Description
stattab	Specifies the statistics table that contains the statistics to be imported.
statid	Identifier (optional) to associate with these statistics within stattab
statown	Schema containing stattab (if different from current schema)
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. The default can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
force	Overrides statistics locked at the object (table) level: <ul style="list-style-type: none"> TRUE - Ignores the statistics lock and imports the statistics FALSE - The statistics will be imported only if they are not locked
stat_category	Specifies what statistics to import, accepting multiple values separated by a comma. Values supported: <ul style="list-style-type: none"> OBJECT_STATS — table statistics, column statistics and index statistics SYNOPSIS — information to support incremental statistics REALTIME_STATS — specifies only real-time statistics. The default value is 'OBJECT_STATS, SYNOPSIS, MODELS'.

Security Model

You must have either the SYSDBA privilege or both the ANALYZE ANY DICTIONARY and ANALYZE ANY system privileges.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values in the user statistics table

Usage Notes

Oracle Database does not support export or import of statistics across databases of different character sets.

186.7.70 IMPORT_DICTIONARY_STATS Procedure

This procedure imports statistics for all data dictionary schemas (SYS, SYSTEM, and RDBMS component schemas) from the user statistics table and stores them in the dictionary.

Syntax

```
DBMS_STATS.IMPORT_DICTIONARY_STATS (
    statab          VARCHAR2,
    statid          VARCHAR2 DEFAULT NULL,
    statown         VARCHAR2 DEFAULT NULL,
    no_invalidate   BOOLEAN DEFAULT to_no_invalidate_type(
                                                get_param('NO_INVALIDATE')),
    force           BOOLEAN DEFAULT FALSE,
    stat_category   VARCHAR2 DEFAULT DEFAULT_STAT_CATEGORY);
```

Parameters

Table 186-74 IMPORT_DICTIONARY_STATS Procedure Parameters

Parameter	Description
statab	User statistics table identifier describing from where to retrieve the statistics
statid	The (optional) identifier to associate with these statistics within statab
statown	Schema containing statab (if different from current schema)
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>The default can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>

Table 186-74 (Cont.) IMPORT_DICTIONARY_STATS Procedure Parameters

Parameter	Description
<code>force</code>	<p>Overrides statistics lock at the object (table) level:</p> <ul style="list-style-type: none"> • <code>TRUE</code> - Ignores the statistics lock and imports the statistics. • <code>FALSE</code> - The statistics will be imported only if there is no lock.
<code>stat_category</code>	<p>Specifies what statistics to import, accepting multiple values separated by a comma. Values supported:</p> <ul style="list-style-type: none"> • <code>OBJECT_STATS</code> — table statistics, column statistics and index statistics • <code>SYNOPSIS</code> — information to support incremental statistics • <code>REALTIME_STATS</code> — Specifies only real-time statistics. <p>The default value is <code>'OBJECT_STATS, SYNOPSIS, REALTIME_STATS'</code>.</p>

Security Model

You must have either the `SYSDBA` privilege or both the `ANALYZE ANY DICTIONARY` and `ANALYZE ANY SYSTEM` privileges.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values in the user statistics table

ORA-20002: Bad user statistics table, may need to upgrade it

Usage Notes

Oracle Database does not support export or import of statistics across databases of different character sets.

186.7.71 IMPORT_FIXED_OBJECTS_STATS Procedure

This procedure imports statistics for fixed tables from the user statistics table and stores them in the data dictionary.

Syntax

```
DBMS_STATS.IMPORT_FIXED_OBJECTS_STATS (
    stattab          VARCHAR2,
    statid           VARCHAR2 DEFAULT NULL,
    statown         VARCHAR2 DEFAULT NULL,
    no_invalidate   BOOLEAN   DEFAULT to_no_invalidate_type(
                                                get_param('NO_INVALIDATE')),
    force           BOOLEAN   DEFAULT FALSE);
```

Parameters

Table 186-75 IMPORT_FIXED_OBJECTS_STATS Procedure Parameters

Parameter	Description
stattab	User statistics table identifier describing from where to retrieve the statistics
statid	Identifier (optional) to associate with these statistics within stattab
statown	Schema containing stattab (if different from current schema)
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>The default can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
force	Overrides statistics lock: <ul style="list-style-type: none"> TRUE - Ignores the statistics lock and imports the statistics FALSE - The statistics will be imported only if there is no lock

Security Model

You must have the SYSDBA or ANALYZE ANY DICTIONARY system privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values in the user statistics table

ORA-20002: Bad user statistics table, may need to upgrade it

Usage Notes

Oracle Database does not support export or import of statistics across databases of different character sets.

186.7.72 IMPORT_INDEX_STATS Procedure

This procedure retrieves statistics for a particular index from the user statistics table identified by stattab and stores them in the dictionary.

Syntax

```
DBMS_STATS.IMPORT_INDEX_STATS (
  ownname      VARCHAR2,
  indname      VARCHAR2,
  partname     VARCHAR2 DEFAULT NULL,
  stattab      VARCHAR2,
  statid       VARCHAR2 DEFAULT NULL,
```



```

statown      VARCHAR2 DEFAULT NULL,
no_invalidate BOOLEAN DEFAULT to_no_invalidate_type(
                get_param('NO_INVALIDATE')),
force        BOOLEAN DEFAULT FALSE);

```

Parameters

Table 186-76 IMPORT_INDEX_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema
indname	Name of the index
partname	Name of the index partition. If the index is partitioned and if partname is NULL, then global and partition index statistics are imported.
stattab	User statistics table identifier describing from where to retrieve the statistics
statid	Identifier (optional) to associate with these statistics within stattab
statown	Schema containing stattab (if different than ownname)
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
force	Imports statistics even if index statistics are locked

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values in the user statistics table

ORA-20005: Object statistics are locked

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Oracle does not support export or import of statistics across databases of different character sets.

186.7.73 IMPORT_SCHEMA_PREFS Procedure

This procedure is used to import the statistics preferences of all the tables owned by the specified owner name.

Syntax

```
DBMS_STATS.IMPORT_SCHEMA_PREFS (  
    ownname    IN  VARCHAR2,  
    stattab   IN  VARCHAR2,  
    statid    IN  VARCHAR2 DEFAULT NULL,  
    statown   IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-77 IMPORT_SCHEMA_PREFS Procedure Parameters

Parameter	Description
ownname	Owner name
stattab	Statistics table name from where to import the statistics
statid	(Optional) Identifier to associate with these statistics within stattab
statown	Schema containing stattab (if other than ownname)

Exceptions

ORA-20000: Object does not exist or insufficient privileges

Usage Notes

- To run this procedure, you need to connect as owner, or have the SYSDBA privilege, or have the ANALYZE ANY system privilege.
- All arguments are of type VARCHAR2 and values are enclosed in quotes.
- Oracle does not support export or import of statistics across databases of different character sets.

Examples

```
DBMS_STATS.IMPORT_SCHEMA_PREFS('SH', 'STAT');
```

186.7.74 IMPORT_SCHEMA_STATS Procedure

This procedure imports statistics for all objects in the schema identified by ownname from the user statistics table and stores them in the data dictionary.

Syntax

```
DBMS_STATS.IMPORT_SCHEMA_STATS (  
    ownname    VARCHAR2,  
    stattab   VARCHAR2,  
    statid    VARCHAR2 DEFAULT NULL,  
    statown   VARCHAR2 DEFAULT NULL,
```

```
no_invalidate    BOOLEAN DEFAULT to_no_invalidate_type(
                get_param('NO_INVALIDATE')),
force           BOOLEAN DEFAULT FALSE,
stat_category   VARCHAR2 DEFAULT DEFAULT_STAT_CATEGORY);
```

Parameters

Table 186-78 IMPORT_SCHEMA_STATS Procedure Parameters

Parameter	Description
ownname	Specifies the name of the schema.
stattab	Identifies the user table that stores the statistics to be imported.
statid	Specifies the ID associated with these statistics within stattab.
statown	Specifies the schema containing stattab (if different than ownname).
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
force	Specifies whether to override statistics locked at the object level. The possible values are as follows: <ul style="list-style-type: none"> TRUE — Ignores the statistics lock and imports the statistics. FALSE — Imports the statistics only if there is no lock. This is the default.
stat_category	Specifies which statistics to process. The following values are supported: <ul style="list-style-type: none"> OBJECT_STATS — specifies table statistics, column statistics, and index statistics SYNOPSIS — specifies metadata for incremental statistics REALTIME_STATS — specifies only real-time statistics <p>You can specify a list of comma-delimited values. For example, 'OBJECT_STATS, SYNOPSIS' specifies table statistics, column statistics, index statistics, and synopses.</p> <p>The default value is 'OBJECT_STATS, SYNOPSIS, REALTIME_STATS'.</p>

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values in the user statistics table

Usage Notes

Oracle Database does not support export or import of statistics across databases of different character sets.

186.7.75 IMPORT_SYSTEM_STATS Procedure

This procedure retrieves system statistics from the user statistics table, identified by `stattab`, and stores the statistics in the dictionary.

Syntax

```
DBMS_STATS.IMPORT_SYSTEM_STATS (
    stattab      VARCHAR2,
    statid       VARCHAR2 DEFAULT NULL,
    statown      VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-79 IMPORT_SYSTEM_STATS Procedure Parameters

Parameter	Description
<code>stattab</code>	Identifier of the user statistics table where the statistics will be retrieved
<code>statid</code>	Optional identifier associated with the statistics retrieved from the <code>stattab</code>
<code>statown</code>	Schema containing <code>stattab</code> (if different from current schema)

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values in the user statistics table

ORA-20002: Bad user statistics table; may need to be upgraded

ORA-20003: Unable to import system statistics

Usage Notes

To run this procedure, you need the `GATHER_SYSTEM_STATISTICS` role.

Oracle does not support export or import of statistics across databases of different character sets.

186.7.76 IMPORT_TABLE_PREFS Procedure

This procedure is used to set the statistics preferences of the specified table in the specified schema.

Syntax

```
DBMS_STATS.IMPORT_TABLE_PREFS (
    ownname      IN VARCHAR2,
```

```

tabname    IN  VARCHAR2,
stattab    IN  VARCHAR2,
statid     IN  VARCHAR2 DEFAULT NULL,
statown    IN  VARCHAR2 DEFAULT NULL);

```

Parameters

Table 186-80 IMPORT_TABLE_PREFS Procedure Parameters

Parameter	Description
ownname	Owner name
tabname	Table name
stattab	Statistics table name from where to import the statistics
statid	(Optional) Identifier to associate with these statistics within stattab
statown	Schema containing stattab (if other than ownname)

Exceptions

ORA-20000: Object does not exist or insufficient privileges

Usage Notes

- To run this procedure, you need to connect as owner of the table, or have the ANALYZE ANY system privilege.
- All arguments are of type VARCHAR2 and values are enclosed in quotes.
- Oracle does not support export or import of statistics across databases of different character sets.

Examples

```
DBMS_STATS.IMPORT_TABLE_PREFS('SH', 'SALES', 'STAT');
```

186.7.77 IMPORT_TABLE_STATS Procedure

This procedure import statistics for a specified table from the user statistics table identified by stattab and stores them in the data dictionary.

Syntax

```

DBMS_STATS.IMPORT_TABLE_STATS (
  ownname          VARCHAR2,
  tabname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  stattab          VARCHAR2,
  statid           VARCHAR2 DEFAULT NULL,
  cascade          BOOLEAN  DEFAULT TRUE,
  statown          VARCHAR2 DEFAULT NULL,
  no_invalidate    BOOLEAN  DEFAULT to_no_invalidate_type(
                                get_param('NO_INVALIDATE')),
  force            BOOLEAN  DEFAULT FALSE,
  stat_category    VARCHAR2 DEFAULT DEFAULT_STAT_CATEGORY);

```

Parameters

Table 186-81 IMPORT_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Specifies the name of the schema.
tabname	Specifies the name of the table.
partname	Name of the table partition. If the table is partitioned and if partname is NULL, then global and partition table statistics are imported.
stattab	Identifies the user statistics table that describes where to retrieve the statistics.
statid	Specifies the ID associated with these statistics within stattab.
cascade	Indicates whether to import column and index statistics for this table. The default is TRUE.
statown	Specifies the schema containing stattab (if different than ownname).
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure</p>
force	Specifies whether to override statistics locked at the object level. The possible values are as follows: <ul style="list-style-type: none"> TRUE — Ignores the statistics lock and imports the statistics. FALSE — Imports the statistics only if there is no lock. This is the default.
stat_category	Specifies which statistics to process. The following values are supported: <ul style="list-style-type: none"> OBJECT_STATS — specifies table statistics, column statistics, and index statistics SYNOPSIS — specifies metadata for incremental statistics REALTIME_STATS — specifies only real-time statistics <p>You can specify a list of comma-delimited values. For example, 'OBJECT_STATS, SYNOPSIS' specifies table statistics, column statistics, index statistics, and synopses.</p> <p>The default value is 'OBJECT_STATS, SYNOPSIS, REALTIME_STATS'.</p>

Security Model

To invoke this procedure you must be owner of the table or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table or have either the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values in the user statistics table

Usage Notes

Oracle Database does not support export or import of statistics across databases of different character sets.

186.7.78 INTERRUPT_ADVISOR_TASK Procedure

This procedure interrupts a currently executing Optimizer Statistics Advisor task.

The task ends its operations as it does when at a normal exit, at which point you can access intermediate results. You can also resume the task using the ["RESUME_ADVISOR_TASK Procedure"](#).

Syntax

```
DBMS_STATS.INTERRUPT_ADVISOR_TASK (  
    task_name IN VARCHAR2);
```

Parameters

Table 186-82 INTERRUPT_ADVISOR_TASK Procedure Parameters

Parameter	Description
task_name	The name of the Optimizer Statistics Advisor task.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- This subprogram executes using invoker's rights.

Consider a case in which a task is executed by one user, interrupted, and then resumed by a different user. In this case, Optimizer Statistics Advisor bases its checks of the resumed execution on the privilege of the user who resumed the task.

Exceptions

- ORA-20000: Insufficient privileges
- ORA-20001: Invalid input values
- ORA-20012: Optimizer Statistics Advisor errors

Example 186-11 Interrupting an Optimizer Statistics Advisor Task

In this example, you start a SQL*Plus session, and then create and execute an advisor task named `my_task`:

```
DECLARE  
    v_tname VARCHAR2(128) := 'my_task';  
    v_ename VARCHAR2(128) := NULL;
```

```

BEGIN
  -- create a task
  v_tname := DBMS_STATS.CREATE_ADVISOR_TASK(v_tname);

  -- execute the task
  v_ename := DBMS_STATS.EXECUTE_ADVISOR_TASK(v_tname);
END;
/

```

In a separate terminal, you start a second SQL*Plus session, and then execute the following program:

```

EXEC DBMS_STATS.INTERRUPT_ADVISOR_TASK('my_task');

```

The first session returns an ORA-13632 to indicate the cancelation of the task:

```

ORA-13638: The user interrupted the current operation.

```

186.7.79 LOCK_PARTITION_STATS Procedure

This procedure enables the user to lock statistics for a partition.

Syntax

```

DBMS_STATS.LOCK_PARTITION_STATS (
  ownname    VARCHAR2,
  tablename  VARCHAR2,
  partname   VARCHAR2);

```

Parameters

Table 186-83 LOCK_PARTITION_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema to lock
tablename	Name of the table
partname	[Sub]Partition name

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.80 LOCK_SCHEMA_STATS Procedure

This procedure locks the statistics of all tables of a schema.

Syntax

```
DBMS_STATS.LOCK_SCHEMA_STATS (  
    ownname    VARCHAR2);
```

Parameters

Table 186-84 LOCK_SCHEMA_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema to lock

Usage Notes

- To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.
- When statistics on a table are locked, all the statistics depending on the table, including table statistics, column statistics, histograms and statistics on all dependent indexes, are considered to be locked.
- The `SET_*`, `DELETE_*`, `IMPORT_*`, `GATHER_*` procedures that modify statistics in the dictionary of an individual table, index or column will raise an error if statistics of the object is locked.
- Procedures that operates on multiple objects (such as `GATHER_SCHEMA_STATS`) will skip modifying the statistics of an object if it is locked. Many procedures have force argument to override the lock.
- This procedure either freezes the current set of the statistics or keeps the statistics empty (uncollected) to use dynamic statistics.
- The locked or unlocked state is not exported along with the table statistics when using `EXPORT_*_STATS` procedures.
- Neither the [UNLOCK_SCHEMA_STATS Procedure](#) nor the [UNLOCK_TABLE_STATS Procedure](#) is designed to unlock statistics of corresponding partitions. When you invoke the [LOCK_TABLE_STATS Procedure](#), it sets the statistics lock bit at the table level. In that case, you cannot gather statistics on dependent objects such as partitions and indexes. By the same token, if table statistics are locked, the dependents are locked and you do not need to explicitly invoke the [LOCK_PARTITION_STATS Procedure](#).

186.7.81 LOCK_TABLE_STATS Procedure

This procedure locks the statistics on the table.

Syntax

```
DBMS_STATS.LOCK_TABLE_STATS (  
    ownname    VARCHAR2,  
    tabname    VARCHAR2);
```

Parameters

Table 186-85 LOCK_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema
tabname	Name of the table

Usage Notes

- To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.
- When statistics on a table are locked, all the statistics depending on the table, including table statistics, column statistics, histograms and statistics on all dependent indexes, are considered to be locked.
- The `SET_*`, `DELETE_*`, `IMPORT_*`, `GATHER_*` procedures that modify statistics in the dictionary of an individual table, index or column will raise an error if statistics of the object is locked.
- Procedures that operates on multiple objects (such as `GATHER_SCHEMA_STATS`) will skip modifying the statistics of an object if it is locked. Many procedures have force argument to override the lock.
- This procedure either freezes the current set of the statistics or keeps the statistics empty (uncollected) to use dynamic statistics.
- The locked or unlocked state is not exported along with the table statistics when using `EXPORT_*_STATS` procedures.
- Neither the [UNLOCK_SCHEMA_STATS Procedure](#) nor the [UNLOCK_TABLE_STATS Procedure](#) is designed to unlock statistics of corresponding partitions. When you invoke the [LOCK_TABLE_STATS Procedure](#), it sets the statistics lock bit at the table level. In that case, you cannot gather statistics on dependent objects such as partitions and indexes. By the same token, if table statistics are locked, the dependents are locked and you do not need to explicitly invoke the [LOCK_PARTITION_STATS Procedure](#).

186.7.82 MERGE_COL_USAGE Procedure

This procedure merges column usage information from a source database by means of a `dblink` into the local database.

If column usage information already exists for a given table or column `MERGE_COL_USAGE` will combine both the local and the remote information.

Syntax

```
DBMS_STATS.MERGE_COL_USAGE (
    dblink    IN    VARCHAR2);
```

Parameters

Table 186-86 MERGE_COL_USAGE Procedure Parameters

Parameter	Description
<code>dblink</code>	Name of <code>dblink</code>

Usage Notes

User must be `SYS` to execute this procedure. In addition, the user specified during the creation of the `dblink` is expected to have privileges to select from tables in the `SYS` schema.

Exceptions

ORA-20000: Insufficient privileges

ORA-20001: Parameter `dblink` cannot be `NULL`

ORA-20002: Unable to create a `TEMP` table

186.7.83 PREPARE_COLUMN_VALUES Procedures

These procedures convert user-specified minimum, maximum, and histogram endpoint actual values into Oracle's internal representation for future storage using `SET_COLUMN_STATS`.

Syntax

```
DBMS_STATS.PREPARE_COLUMN_VALUES (
    srec      IN OUT StatRec,
    charvals  CHARARRAY);
```

```
DBMS_STATS.PREPARE_COLUMN_VALUES (
    srec      IN OUT StatRec,
    datevals  DATEARRAY);
```

```
DBMS_STATS.PREPARE_COLUMN_VALUES (
    srec      IN OUT StatRec,
    dblvals   DBLARRAY);
```

```
DBMS_STATS.PREPARE_COLUMN_VALUES (
```

```

srec      IN OUT StatRec,
fltvals   FLTARRAY);

DBMS_STATS.PREPARE_COLUMN_VALUES (
srec      IN OUT StatRec,
numvals   NUMARRAY);

DBMS_STATS.PREPARE_COLUMN_VALUES (
srec      IN OUT StatRec,
rawvals   RAWARRAY);

```

Parameters

Table 186-87 PREPARE_COLUMN_VALUES Procedure Parameters

Parameter	Description
srec.epc	<p>Number of values specified in charvals, datevals, dblvals, fltvals, numvals, or rawvals. This value must be between 2 and 2050, inclusive, and it should be set to 2 for procedures which do not allow histogram information (nvarchar and rowid).</p> <p>The first corresponding array entry should hold the minimum value for the column, and the last entry should hold the maximum. If there are more than two entries, then all the others hold the remaining height-balanced or frequency histogram endpoint values (with in-between values ordered from next-smallest to next-largest). This value may be adjusted to account for compression, so the returned value should be left as is for a call to SET_COLUMN_STATS.</p>
srec.bkvals	<p>If you want a frequency or hybrid histogram, this array contains the number of occurrences of each distinct value specified in charvals, datevals, dblvals, fltvals, numvals, or rawvals. Otherwise, it is merely an output parameter, and it must be set to NULL when this procedure is called.</p>
srec.rpcnts	<p>If you want a hybrid histogram, this array contains the total frequency of values that are less than or equal to each distinct value specified in charvals, datevals, numvals, or rawvals. Otherwise, it is merely an output argument and must be set to NULL when this procedure is called.</p> <p>As an example, for a given array numvals with numvals(i)=4, rpcnts(i)=13 means that there are 13 rows in the column which are less than or equal to 4.</p> <p>Note:</p> <ul style="list-style-type: none"> • Whenever srec.rpcnts is populated, srec.bkvals must be populated as described above. • Whenever bkvals and/or rpcnts are populated, there should not be any duplicates in charvals, datevals, numvals, or rawvals.

Datatype-specific input parameters (use one) are shown in [Table 186-88](#).

Table 186-88 Datatype-Specific Input Parameters

Type	Description
charvals	The array of values when the column type is character-based. Up to the first 64 bytes of each string should be provided. Arrays must have between 2 and 2050 entries, inclusive. If the datatype is fixed CHAR, the strings must be space-padded to 15 characters for correct normalization.
datevals	Array of values when the column type is date-based
dblvals	Array of values when the column type is double-based
fltvals	Array of values when the column type is float-based
numvals	Array of values when the column type is numeric-based
rawvals	Array of values when the column type is RAW. Up to the first 64 bytes of each value should be provided.
nvmin, nvmax	Minimum and maximum values when the column type is national character set based. No histogram information can be provided for a column of this type. If the datatype is fixed CHAR, the strings must be space-padded to 15 characters for correct normalization.
rwmin, rwmax	Minimum and maximum values when the column type is rowid. No histogram information is provided for a column of this type.

Output Parameters

Table 186-89 PREPARE_COLUMN_VALUES Procedure Output Parameters

Parameter	Description
srec.minval	Internal representation of the minimum suitable for use in a call to SET_COLUMN_STATS
srec.maxval	Internal representation of the maximum suitable for use in a call to SET_COLUMN_STATS
srec.bkvals	Array suitable for use in a call to SET_COLUMN_STATS
srec.novals	Array suitable for use in a call to SET_COLUMN_STATS
srec.eavals	Array suitable for use in a call to SET_COLUMN_STATS
srec.rpcnts	Array suitable for use in a call to SET_COLUMN_STATS

Exceptions

ORA-20001: Invalid or inconsistent input values

Usage Notes

No special privilege or role is needed to invoke this procedure.

186.7.84 PREPARE_COLUMN_VALUES_NVARCHAR Procedure

This procedure converts user-specified minimum, maximum, and histogram endpoint actual values into Oracle's internal representation for future storage using the SET_COLUMN_STATS Procedures.

Syntax

```
DBMS_STATS.PREPARE_COLUMN_VALUES_NVARCHAR (
  srec      IN OUT StatRec,
  nvmin     NVARCHAR2,
  nvmax     NVARCHAR2);
```

Parameters

Table 186-90 PREPARE_COLUMN_VALUES_NVARCHAR Procedure Parameters

Parameter	Description
srec.epc	<p>Number of values specified in charvals, datevals, dblvals, fltvals, numvals, or rawvals. This value must be between 2 and 2050, inclusive, and it should be set to 2 for procedures which do not allow histogram information (nvarchar and rowid).</p> <p>The first corresponding array entry should hold the minimum value for the column, and the last entry should hold the maximum. If there are more than two entries, then all the others hold the remaining height-balanced or frequency histogram endpoint values (with in-between values ordered from next-smallest to next-largest). This value may be adjusted to account for compression, so the returned value should be left as is for a call to SET_COLUMN_STATS.</p>
srec.bkvals	<p>If you want a frequency or hybrid histogram, then this array contains the number of occurrences of each distinct value specified in charvals, datevals, dblvals, fltvals, numvals, or rawvals. Otherwise, it is merely an output parameter, and it must be set to NULL when this procedure is called.</p>
srec.rpcnts	<p>If you want a hybrid histogram, this array contains the total frequency of values that are less than or equal to each distinct value specified in charvals, datevals, numvals, or rawvals. Otherwise, it is merely an output argument and must be set to NULL when this procedure is called.</p> <p>As an example, for a given array numvals with numvals(i)=4, rpcnts(i)=13 means that there are 13 rows in the column which are less than or equal to 4.</p> <p>Note:</p> <ul style="list-style-type: none"> Whenever srec.rpcnts is populated, srec.bkvals must be populated as described above. Whenever bkvals and/or rpcnts are populated, there should not be any duplicates in charvals, datevals, numvals, or rawvals.

Datatype-specific input parameters (use one) are shown in [Table 186-88](#).

Table 186-91 PREPARE_COLUMN_VALUES_NVARCHAR Datatype-Specific Input Parameters

Type	Description
nvmin, nvmax	The minimum and maximum values when the column type is national character set based. No histogram information can be provided for a column of this type. If the datatype is fixed CHAR, the strings must be space-padded to 15 characters for correct normalization.

Output Parameters

Table 186-92 PREPARE_COLUMN_VALUES_NVARCHAR Procedure Output Parameters

Parameter	Description
srec.minval	Internal representation of the minimum suitable for use in a call to SET_COLUMN_STATS
srec.maxval	Internal representation of the maximum suitable for use in a call to SET_COLUMN_STATS
srec.bkvals	Array suitable for use in a call to SET_COLUMN_STATS.
srec.novals	Array suitable for use in a call to SET_COLUMN_STATS
srec.eavals	Array suitable for use in a call to SET_COLUMN_STATS
srec.rpcnts	Array suitable for use in a call to SET_COLUMN_STATS

Exceptions

ORA-20001: Invalid or inconsistent input values

Usage Notes

No special privilege or role is needed to invoke this procedure.

Related Topics

- [SET_COLUMN_STATS Procedures](#)
This procedure sets column-related information.

186.7.85 PREPARE_COLUMN_VALUES_ROWID Procedure

This procedure converts user-specified minimum, maximum, and histogram endpoint datatype-specific values into Oracle's internal representation for future storage using SET_COLUMN_STATS.

Syntax

```
DBMS_STATS.PREPARE_COLUMN_VALUES_ROWID (
    srec IN OUT StatRec,
    rwmn ROWID,
    rwmx ROWID);
```

Pragmas

```
pragma restrict_references(prepare_column_values_rowid, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 186-93 PREPARE_COLUMN_VALUES_ROWID Procedure Parameters

Parameter	Description
srec	<p>Values (IN):</p> <ul style="list-style-type: none"> • epc • bkvals • rpcnts <p>Values (OUT):</p> <ul style="list-style-type: none"> • minval • maxval • bkvals • novals • eavals • rpcnts
rwmin	Minimum value when the column type is <code>rowid</code> . No histogram information is provided for a column of this type.
rwmax	Maximum value when the column type is <code>rowid</code> . No histogram information is provided for a column of this type.

Table 186-94 StatRec Record Type Fields

Field	Description
epc (IN)	<p>Number of values specified in <code>charvals</code>, <code>datevals</code>, <code>dblvals</code>, <code>fltvals</code>, <code>numvals</code>, or <code>rawvals</code>. This value must be between 2 and 2050, inclusive, and it should be set to 2 for procedures which do not allow histogram information (<code>nvarchar</code> and <code>rowid</code>).</p> <p>The first corresponding array entry should hold the minimum value for the column, and the last entry should hold the maximum. If there are more than two entries, then all the others hold the remaining height-balanced or frequency histogram endpoint values (with in-between values ordered from next-smallest to next-largest). This value may be adjusted to account for compression, so the returned value should be left as is for a call to <code>SET_COLUMN_STATS</code>.</p>
bkvals (IN)	<p>If you want a frequency or hybrid histogram, this array contains the number of occurrences of each distinct value specified in <code>charvals</code>, <code>datevals</code>, <code>dblvals</code>, <code>fltvals</code>, <code>numvals</code>, or <code>rawvals</code>. Otherwise, it is merely an output parameter, and it must be set to <code>NULL</code> when this procedure is called.</p>

Table 186-94 (Cont.) StatRec Record Type Fields

Field	Description
rpents (IN)	<p>If you want a hybrid histogram, this array contains the total frequency of values that are less than or equal to each distinct value specified in charvals, datevals, numvals, or rawvals. Otherwise, it is merely an output argument and must be set to NULL when this procedure is called.</p> <p>As an example, for a given array numvals with numvals(i)=4, rpents(i)=13 means that there are 13 rows in the column which are less than or equal to 4.</p> <p>Note:</p> <ul style="list-style-type: none"> • Whenever srec.rpents is populated, srec.bkvals must be populated as described above. • Whenever bkvals and/or rpents are populated, there should not be any duplicates in charvals, datevals, numvals, or rawvals.
minval (OUT)	Internal representation of the minimum suitable for use in a call to SET_COLUMN_STATS.
maxval (OUT)	Internal representation of the maximum suitable for use in a call to SET_COLUMN_STATS.
bkvals (OUT)	Array suitable for use in a call to SET_COLUMN_STATS.
novals (OUT)	Array suitable for use in a call to SET_COLUMN_STATS.
eavals (OUT)	Array suitable for use in a call to SET_COLUMN_STATS.
rpents (OUT)	Array suitable for use in a call to SET_COLUMN_STATS.

Usage Notes

No special privilege or role is needed to invoke this procedure.

186.7.86 PUBLISH_PENDING_STATS Procedure

This procedure is used to publish the statistics gathered and stored as pending.

Syntax

```
DBMS_STATS.PUBLISH_PENDING_STATS (
    ownname          IN  VARCHAR2 DEFAULT USER,
    tabname          IN  VARCHAR2,
    no_invalidate    BOOLEAN DEFAULT
        TO_NO_INVALIDATE_TYPE(GET_PARAM('NO_INVALIDATE')),
    force            IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 186-95 PUBLISH_PENDING_STATS Procedure Parameters

Parameter	Description
ownname	Owner name

Table 186-95 (Cont.) PUBLISH_PENDING_STATS Procedure Parameters

Parameter	Description
tablename	Table name
no_invalidate	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
force	If TRUE, will override the lock

Security Model

To run this procedure, you must have the same privilege for gathering statistics on the tables that will be touched by this procedure.

Exceptions

ORA-20000: Insufficient privileges

Usage Notes

- If the parameter `tablename` is NULL then `publish` applies to all tables of the specified schema.
- The default owner/schema is the user who runs the procedure.

Examples

```
DBMS_STATS.PUBLISH_PENDING_STATS ('SH', null);
```

186.7.87 PURGE_STATS Procedure

This procedure purges old versions of statistics saved in the dictionary.

To run this procedure, you must have the `SYSDBA` or both `ANALYZE ANY DICTIONARY` and `ANALYZE ANY` system privilege.

Syntax

```
DBMS_STATS.PURGE_STATS(
    before_timestamp    TIMESTAMP WITH TIME ZONE);
```

Parameters

Table 186-96 PURGE_STATS Procedure Parameters

Parameter	Description
before_timestamp	Versions of statistics saved before this timestamp are purged. If NULL, it uses the purging policy used by automatic purge. The automatic purge deletes all history older than the older of (current time - statistics history retention) and (time of recent analyze in the system - 1). The statistics history retention value can be changed using ALTER_STATS_HISTORY_RETENTION Procedure. The default is 31 days.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values

Usage Notes

To invoke this procedure you need the ANALYZE ANY privilege and the ANALYZE ANY DICTIONARY privilege.

186.7.88 REMAP_STAT_TABLE Procedure

This procedure remaps the names of objects in the user statistics table. It allows you to import the statistics to objects with same definition but with different names.

Syntax

```
DBMS_STATS.REMAP_STAT_TABLE (
  ownname      IN   VARCHAR2,
  statab       IN   VARCHAR2,
  src_own      IN   VARCHAR2,
  src_tab      IN   VARCHAR2,
  tgt_own      IN   VARCHAR2,
  tgt_tab      IN   VARCHAR2);
```

Parameters

Table 186-97 REMAP_STAT_TABLE Procedure Parameters

Parameter	Description
ownname	Owner of the statistics table. NULL means the current schema.
statab	User statistics table identifier
src_own	Owner of the table to be renamed. This argument cannot be NULL.
src_tab	Name of the table to be renamed. If NULL, all tables are owned by src_own.

Table 186-97 (Cont.) REMAP_STAT_TABLE Procedure Parameters

Parameter	Description
tgt_own	New name of the owner of the table. The owner name is also updated for the dependent objects such as columns and indexes. Note that an index of src_tab not owned by src_own is not renamed. This argument cannot be NULL.
tgt_tab	New name of the table. This argument is valid only if src_tab is not NULL.

Exceptions

ORA-20000: Insufficient privileges

ORA-20001: Invalid input

Examples

The following statement remaps all objects of sh to shsave in user statistics table sh.ustat:

```
DBMS_STATS.REMAP_STAT_TABLE ('sh', 'ustat', 'sh', NULL, 'shsave', NULL);
```

The following statement can be used to import statistics into objects of shsave once the preceding remap procedure is completed:

```
DBMS_STATS.IMPORT_SCHEMA_STATS ('shsave', 'ustat', statown => 'sh');
```

The following statement remaps sh.customers to shsave.customers_sav:

```
DBMS_STATS.REMAP_STAT_TABLE ('sh', 'ustat', 'sh', 'customers', 'shsave', 'customers_sav');
```

186.7.89 REPORT_ADVISOR_TASK Function

This function reports the results of an Optimizer Statistics Advisor task.

Syntax

```
DBMS_STATS.REPORT_ADVISOR_TASK(
  task_name      IN   VARCHAR2,
  execution_name IN   VARCHAR2  := NULL,
  type           IN   VARCHAR2  := 'TEXT',
  section        IN   VARCHAR2  := 'ALL',
  level          IN   VARCHAR2  := 'TYPICAL')
RETURN CLOB;
```

Parameters

Table 186-98 REPORT_ADVISOR_TASK Function Parameters

Parameter	Description
task_name	The name of the Optimizer Statistics Advisor task.

Table 186-98 (Cont.) REPORT_ADVISOR_TASK Function Parameters

Parameter	Description
execution_name	A name that qualifies and identifies an advisor task execution. If not specified, the function uses the latest execution of the specified task.
type	The type of the Optimizer Statistics Advisor report. Possible values are TEXT, HTML, and XML.
section	A section in the report. Possible values are SUMMARY, FINDINGS, ERRORS, and ALL. You can specify combinations of different values can be using the plus (+) and minus (-) operator, as in 'SUMMARY +FINDINGS +ERRORS', and 'ALL -ERRORS'.
level	The format of the report. Possible values are BASIC, TYPICAL, ALL, and SHOW_HIDDEN. You can specify SHOW_HIDDEN together with the other three input values, as in 'BASIC +SHOW_HIDDEN' and 'TYPICAL +SHOW_HIDDEN'.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- You can execute this subprogram for `AUTO_STATS_ADVISOR_TASK`, which is predefined.
- This subprogram executes using invoker's rights.

The results of performing this task depend on the privileges of the executing user:

- **SYSTEM level**
Only users with both the `ANALYZE ANY` and `ANALYZE ANY DICTIONARY` privileges can perform this task on system-level rules.
- **Operation level**
The results depend on the following privileges:
 - Users with both the `ANALYZE ANY` and `ANALYZE ANY DICTIONARY` privileges can perform this task for all statistics operations.
 - Users with the `ANALYZE ANY` privilege but *not* the `ANALYZE ANY DICTIONARY` privilege can perform this task for statistics operations related to any schema except `SYS`.
 - Users with the `ANALYZE ANY DICTIONARY` privilege but *not* the `ANALYZE ANY` privilege can perform this task for statistics operations related to their own schema and the `SYS` schema.
 - Users with neither the `ANALYZE ANY` nor the `ANALYZE ANY DICTIONARY` privilege can only perform this operation for statistics operations relating to their own schema.
- **Object level**

Users can perform this task for any object for which they have statistics collection privileges.

Exceptions

- ORA-20000: Insufficient privileges
- ORA-20001: User input errors
- ORA-20012: Optimizer Statistics Advisor errors

Returns

This function returns a CLOB that contains the report.

Examples

(Optional) List and briefly describe the examples for using the API or subprogram here.

Example 186-12 Generating an HTML Report

This example creates a procedure named `myrep`, and then calls this procedure to generate an HTML report.

```
SET ECHO ON
SET FEEDBACK ON
SET SERVEROUTPUT ON
SET TRIMS ON
SET LINESIZE 300

EXECUTE DBMS_OUTPUT.ENABLE (buffer_size => 10000000);

CREATE OR REPLACE PROCEDURE myrep(p_tname VARCHAR2, p_ftype VARCHAR2, which
VARCHAR2)
IS
  v_report CLOB          := null;
  v_script CLOB          := null;
  v_ftype  VARCHAR2(400) := p_ftype;
  v_tname  VARCHAR2(400) := p_tname;
  v_len    NUMBER(10);
  v_ps    NUMBER(10) := 10000;
  v_pn    NUMBER(10) := 1;
  v_ret   VARCHAR2(32767);
BEGIN
  IF which = 'REPORT'
  THEN
    -- generate a report
    v_report := DBMS_STATS.REPORT_ADVISOR_TASK(
      task_name => v_tname,
      type      => v_ftype,
      section   => 'ALL',
      level     => 'ALL');
    v_len := DBMS_LOB.getlength(v_report);
    WHILE (v_pn < v_len)
    LOOP
      DBMS_OUTPUT.PUT_LINE(DBMS_LOB.SUBSTR(v_report, v_ps, v_pn));
      v_pn := v_pn + v_ps;
    END LOOP;
  END IF;
END;
```

```

        END LOOP;
    ELSE
        -- generate a script
        v_script := DBMS_STATS.SCRIPT_ADVISOR_TASK(v_tname);
        v_len := DBMS_LOB.getlength(v_script);
        WHILE (v_pn < v_len)
        LOOP
            DBMS_OUTPUT.PUT_LINE(DBMS_LOB.SUBSTR( v_script, v_ps, v_pn));
            v_pn := v_pn + v_ps;
        END LOOP;
    END IF;
END;
/

SHOW ERRORS

SPOOL report.txt
EXECUTE myrep('my_task','HTML','REPORT');
SPOOL OFF

```

Example 186-13 Generating a Textual Report for AUTO_STATS_ADVISOR_TASK

The following example invokes the `myrep` procedure created in the preceding example for `AUTO_STATS_ADVISOR_TASK`:

```
EXEC myrep('AUTO_STATS_ADVISOR_TASK','TEXT','REPORT');
```

The following sample output shows part of the report:

```

GENERAL INFORMATION
-----
Task Name       : AUTO_STATS_ADVISOR_TASK
Execution Name  : EXEC_97
Created         : 07-08-16 10:18:10
Last Modified   : 07-11-16 03:02:30
-----

SUMMARY
-----

For execution EXEC_97 of task AUTO_STATS_ADVISOR_TASK, the Statistics
Advisor
has 10 finding(s). The findings are related to the following rules:
COMPLETEAUTOJOB, MAINTAINSTATSHISTORY, USEDEFAULTPREFERENCE,
AVOIDSETPROCEDURES, USEDEFAULTPARAMS, USEGATHERSCHEMASTATS,
AVOIDSTALESTATS,
UNLOCKNONVOLATILETABLE, USEINCREMENTAL, AVOIDANALYZETABLE. Please
refer to the
finding section for detailed information.
-----

```

```

-----
FINDINGS
-----
--
Rule Name:          MaintainStatsHistory
Rule Description:   Maintain Statistics History

Finding:  Statistics history tables are too big.

Recommendation:  Check the other findings of this rule, as well as
the
                findings for the rules
AvoidFrequentStatsCollection,
                UseDefaultPreference, UseDefaultParams for possible
causes
                and
recommendations.
Rationale:  The size of the statistics history table could be big because
of
                violations of other rules.

-----

Rule Name:          UseDefaultPreference
Rule Description:   Use Default Preference for Stats Collection
Finding:  Global preference SYS_FLAGS is set to a non-default value '1'.

Recommendation:  Set the value of preference SYS_FLAGS to '0'.
Example:
-- Setting preference cascade to default value:
dbms_stats.set_global_prefs('CASCADE', NULL);

Rationale:  Preference SYS_FLAGS is for Oracle internal use only, setting
it
                to nondefault value '1' could cause unforeseen consequences.
.
.
.

```

186.7.90 REPORT_COL_USAGE Function

This function reports the recorded column (group) usage information.

Syntax

```

DBMS_STATS.REPORT_COL_USAGE (
    ownname   IN   VARCHAR2,
    tablename IN   VARCHAR2)
RETURN CLOB;

```


Parameters

Table 186-99 REPORT_COL_USAGE Function Parameters

Parameter	Description
ownname	Owner name. If NULL it reports column usage information for tables in all schemas in the database.
tablename	Table name. If NULL it reports column usage information for all tables of ownname.

Usage Notes

To run this procedure, you need to have the SYSDBA administrative privilege or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privileges.

186.7.91 REPORT_GATHER_AUTO_STATS Function

This function runs the auto statistics gathering job in reporting mode. That is, statistics are not actually collected, but all the objects that will be affected when auto statistics gathering is invoked are reported.

Syntax

```
DBMS_STATS.REPORT_GATHER_AUTO_STATS (  
    detail_level    VARCHAR2  DEFAULT 'TYPICAL',  
    format         VARCHAR2  DEFAULT 'TEXT')  
RETURN CLOB;
```

Parameters

Table 186-100 REPORT_GATHER_AUTO_STATS Function Parameters

Parameter	Description
detail_level	<p>Detail level for the content of the report</p> <ul style="list-style-type: none"> • BASIC: The report includes <ul style="list-style-type: none"> - operation ID - operation name - operation target object - start time - end time - completion status (such as: succeeded, failed) • TYPICAL: In addition to the information provided at level BASIC, the report includes individual target objects for which statistics are gathered in this operation. Specifically, with regard to operation related details: <ul style="list-style-type: none"> - total number of target objects - total number of successfully completed objects - total number of failed objects - total number of timed-out objects (applies to only auto statistics gathering) <p>With regard to target objects:</p> <ul style="list-style-type: none"> - owner and name of each target object - target object type (such as: table, index) - start time - end time - completion status • ALL: In addition to the information provided at level TYPICAL, the report includes further information on each target object. Specifically, with regard to operation-related details: <ul style="list-style-type: none"> - job name - session ID - parameter values - error message if the operation failed <p>With regard to target objects:</p> <ul style="list-style-type: none"> - job name - batching details - estimated cost - rank in the target list - columns for which histograms were collected - list of collected extended statistics (if any) - reason for including the object in the target list - additional error details if the task has failed. <p>Note that several fields (such as job name, estimated task cost) in the report are populated only when an operation is executed concurrently (CONCURRENT preference is turned on).</p>

Table 186-100 (Cont.) REPORT_GATHER_AUTO_STATS Function Parameters

Parameter	Description
format	Report format: <ul style="list-style-type: none"> • XML • HTML • TEXT (Default)

Usage Notes

Only user SYS can run the REPORT_GATHER_AUTO_STATS function.

186.7.92 REPORT_GATHER_DATABASE_STATS Functions

This function runs the GATHER_DATABASE_STATS function in reporting mode.

The database does not collect statistics, but reports all objects that would be affected when invoking GATHER_DATABASE_STATS. The input set of parameters is the same as in GATHER_DATABASE_STATS, with two extra parameters.

Syntax

```

DBMS_STATS.REPORT_GATHER_DATABASE_STATS (
    estimate_percent      IN      NUMBER      DEFAULT
to_estimate_percent_type (
    GET_PARAM('ESTIMATE_PERCENT')),
    block_sample         IN      BOOLEAN     DEFAULT FALSE,
    method_opt          IN      VARCHAR2    DEFAULT
    GET_PARAM('METHOD_OPT'),
    degree              IN      NUMBER      DEFAULT TO_DEGREE_TYPE(
        GET_PARAM('DEGREE')),
    granularity         IN      VARCHAR2    DEFAULT
    GET_PARAM('GRANULARITY'),
    cascade             IN      BOOLEAN     DEFAULT to_cascade_type (
        GET_PARAM('CASCADE')),
    statab              IN      VARCHAR2    DEFAULT NULL,
    statid              IN      VARCHAR2    DEFAULT NULL,
    options             IN      VARCHAR2    DEFAULT 'GATHER',
    statown             IN      VARCHAR2    DEFAULT NULL,
    gather_sys          IN      BOOLEAN     DEFAULT TRUE,
    no_invalidate       IN      BOOLEAN     DEFAULT TO_NO_INVALIDATE_TYPE
(
    GET_PARAM('NO_INVALIDATE')),
    gather_temp         IN      BOOLEAN     DEFAULT FALSE,
    gather_fixed        IN      BOOLEAN     DEFAULT FALSE,
    stattype            IN      VARCHAR2    DEFAULT DATA,
    obj_filter_list     IN      ObjectTab   DEFAULT NULL,
    detail_level        IN      VARCHAR2    DEFAULT 'TYPICAL',
    format              IN      VARCHAR2    DEFAULT 'TEXT')
RETURN CLOB;

```

Parameters

Table 186-101 REPORT_GATHER_DATABASE_STATS Function Parameters

Parameter	Description
estimate_percent	<p>The percentage of rows to use for the sample size. The valid range is between 0.000001 and 100. The null value means to compute.</p> <p>Use the constant <code>DBMS_STATS.AUTO_SAMPLE_SIZE</code> to enable the database to determine the appropriate sample size for good statistics. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
block_sample	<p>Whether or not to use random block sampling instead of random row sampling. Random block sampling is more efficient, but if the data is not randomly distributed on disk, then the sample values may be somewhat correlated. This parameter is only relevant when estimating statistics.</p>
method_opt	<p>Method options. This parameter accepts the following values: <code>FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause]</code>.</p> <p><code>size_clause</code> is defined as <code>size_clause := SIZE {integer REPEAT AUTO SKEWONLY}</code></p> <ul style="list-style-type: none"> - <code>integer</code>: Number of histogram buckets. Must be in the range [1,2048]. - <code>REPEAT</code>: Collects histograms only on the columns that already have histograms. - <code>AUTO</code>: Oracle determines the columns on which to collect histograms based on data distribution and the workload of the columns. - <code>SKEWONLY</code>: Oracle determines the columns on which to collect histograms based on the data distribution of the columns. <p>The default is <code>FOR ALL COLUMNS SIZE AUTO</code>. The value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
degree	<p>Degree of parallelism. The default for <code>degree</code> is <code>NULL</code>. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure. <code>NULL</code> means use the table default value specified by the <code>DEGREE</code> clause in the <code>CREATE TABLE</code> or <code>ALTER TABLE</code> statement. Use the constant <code>DBMS_STATS.DEFAULT_DEGREE</code> to specify the default value based on the initialization parameters. The <code>AUTO_DEGREE</code> value determines the degree of parallelism automatically. This is between 1 (serial execution) and <code>DEFAULT_DEGREE</code> (the system default value based on number of CPUs and initialization parameters) according to the size of the object. When using <code>DEGREE=>NULL</code>, <code>DEGREE=>n</code>, or <code>DEGREE=>DBMS_STATS.DEFAULT_DEGREE</code>, the current implementation of <code>DBMS_STATS</code> may use serial execution if the size of the object does not warrant parallel execution.</p>

Table 186-101 (Cont.) REPORT_GATHER_DATABASE_STATS Function Parameters

Parameter	Description
granularity	<p>Determines the granularity of statistics to collect. This preference is only relevant for partitioned tables.</p> <p>The following values are valid:</p> <ul style="list-style-type: none"> • ALL — Gathers all statistics: subpartition, partition, and global. • AUTO — Determines the granularity based on the partitioning type. This is the default value. • DEFAULT — Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. Use GLOBAL AND PARTITION for this functionality. • GLOBAL — Gathers global statistics. • GLOBAL AND PARTITION — Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object. • PARTITION — Gathers partition-level statistics. • SUBPARTITION — Gathers subpartition-level statistics.
cascade	<p>Gather statistics on the indexes as well. Using this option is equivalent to running the GATHER_INDEX_STATS Procedure on each of the indexes in the database in addition to gathering table and column statistics. Use the constant <code>DBMS_STATS.AUTO_CASCADE</code> to have Oracle determine whether index statistics to be collected or not. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
stattab	<p>User statistics table identifier describing where to save the current statistics.</p> <p>The database assumes that the statistics table resides in the same schema as the object being analyzed. Thus, to use this option, one such table must exist in each schema.</p>
statid	<p>Identifier (optional) to associate with these statistics within <code>stattab</code>.</p>

Table 186-101 (Cont.) REPORT_GATHER_DATABASE_STATS Function Parameters

Parameter	Description
options	<p>Further specification of which objects to gather statistics for:</p> <p>GATHER: Gathers statistics on all objects in the schema.</p> <p>GATHER AUTO: Gathers all necessary statistics automatically. Oracle implicitly determines which objects need new statistics, and determines how to gather those statistics. When GATHER AUTO is specified, the only additional valid parameters are <code>stattab</code>, <code>statid</code>, <code>objlist</code> and <code>statown</code>; all other parameter settings are ignored. Returns a list of processed objects.</p> <p>GATHER STALE: Gathers statistics on stale objects as determined by looking at the <code>*_tab_modifications</code> views. Also, return a list of objects found to be stale.</p> <p>GATHER EMPTY: Gathers statistics on objects which currently have no statistics. Return a list of objects found to have no statistics.</p> <p>LIST AUTO: Returns a list of objects to be processed with GATHER AUTO</p> <p>LIST STALE: Returns a list of stale objects as determined by looking at the <code>*_tab_modifications</code> views</p> <p>LIST EMPTY: Returns a list of objects which currently have no statistics</p>
statown	Schema containing <code>stattab</code> , if different from current schema.
gather_sys	Gathers statistics on the objects owned by the <code>SYS</code> user.
no_invalidate	Does not invalidate the dependent cursors if set to <code>TRUE</code> . The procedure invalidates the dependent cursors immediately if set to <code>FALSE</code> . Use <code>DBMS_STATS.AUTO_INVALIDATE</code> . to have Oracle decide when to invalidate dependent cursors. This is the default. The default can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
gather_temp	<p>Gathers statistics on global temporary tables when <code>TRUE</code>. The default is <code>FALSE</code>.</p> <p>The temporary table must be created with the <code>ON COMMIT PRESERVE ROWS</code> clause. Also, the statistics collected are based on the data in the session in which this procedure is run, but they are shared across all sessions.</p>
gather_fixed	<p>Gather statistics on fixed tables when <code>TRUE</code>. The default is <code>FALSE</code>.</p> <p>Only user <code>SYS</code> can collect statistics for fixed tables. The <code>ownname</code> must be <code>SYS</code> or null. When gathering statistics for fixed tables, the database ignores specified values for the following arguments:</p> <ul style="list-style-type: none"> • <code>estimate_percent</code> • <code>block_sample</code> • <code>stattab</code> • <code>statid</code> • <code>statown</code> <p>The database does not invalidate the dependent cursors on fixed tables on which stats is collected. This option is meant for internal use only.</p>

Table 186-101 (Cont.) REPORT_GATHER_DATABASE_STATS Function Parameters

Parameter	Description
stattype	<p>The type of statistics:</p> <ul style="list-style-type: none"> • DATA — Data statistics only • CACHE — Cache statistics only • ALL — All statistics
obj_filter_list	<p>A list of object filters. The attribute values specified in the object filter are case-insensitive unless double-quoted. Wildcards are allowed in the attribute values.</p> <p>When specified, GATHER_DATABASE_STATS gathers statistics only on objects that satisfy at least one object filter in the list as needed. In a single-object filter, the database can specify the constraints on the object attributes. For example, non-NULL values s1 and s2 are specified for attributes a1 and a2 in one object filter. An object o is said to satisfy this object filter when (o.a1 LIKE s1) AND (o.a2 LIKE s2) is true.</p>

Table 186-101 (Cont.) REPORT_GATHER_DATABASE_STATS Function Parameters

Parameter	Description
detail_level	<p>The level of detail for the content of the report. Valid values are as follows:</p> <ul style="list-style-type: none"> • BASIC: The report includes <ul style="list-style-type: none"> - operation ID - operation name - operation target object - start time - end time - completion status (such as: succeeded, failed) • TYPICAL: In addition to the information provided at level BASIC, the report includes individual target objects for which statistics are gathered in this operation. Specifically, with regard to operation related details: <ul style="list-style-type: none"> - total number of target objects - total number of successfully completed objects - total number of failed objects - total number of timed-out objects (applies to only auto statistics gathering) <p>With regard to target objects:</p> <ul style="list-style-type: none"> - owner and name of each target object - target object type (such as: table, index) - start time - end time - completion status • ALL: In addition to the information provided at level TYPICAL, the report includes further information on each target object. Specifically, with regard to operation-related details: <ul style="list-style-type: none"> - job name - session ID - parameter values - error message if the operation failed <p>With regard to target objects:</p> <ul style="list-style-type: none"> - job name - batching details - estimated cost - rank in the target list - columns for which histograms were collected - list of collected extended statistics (if any) - additional error details if the task has failed. <p>Note that several fields (such as job name, estimated task cost) in the report are populated only when an operation is executed concurrently (CONCURRENT preference is turned on).</p>

Table 186-101 (Cont.) REPORT_GATHER_DATABASE_STATS Function Parameters

Parameter	Description
format	The format of the report. Valid values are: <ul style="list-style-type: none"> XML HTML TEXT (Default)

Return Values

A CLOB object that contains the report

Exceptions

ORA-20000: Insufficient privileges

ORA-20001: Bad input value

Usage Notes

To run this procedure, you need to have the SYSDBA role or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privileges.

186.7.93 REPORT_GATHER_DICTIONARY_STATS Functions

This function runs the GATHER_DICTIONARY_STATS procedure in reporting mode.

The database does not collect statistics, but reports all objects affected when invoking GATHER_DICTIONARY_STATS. The detail level for the report is defined by the detail_level input parameter. See the descriptions of detail_level and format in [REPORT_GATHER_DICTIONARY_STATS Functions](#). For all other input parameters, see [GATHER_DICTIONARY_STATS Procedure](#).

Syntax

```
DBMS_STATS.REPORT_GATHER_DICTIONARY_STATS (
  comp_id          IN   VARCHAR2  DEFAULT NULL,
  estimate_percent IN   NUMBER     DEFAULT
TO_ESTIMATE_PERCENT_TYPE

  (GET_PARAM('ESTIMATE_PERCENT')),
  block_sample    IN   BOOLEAN    DEFAULT FALSE,
  method_opt      IN   VARCHAR2   DEFAULT
GET_PARAM('METHOD_OPT'),
  degree          IN   NUMBER     DEFAULT TO_DEGREE_TYPE
                                (GET_PARAM('DEGREE')),
  granularity     IN   VARCHAR2   DEFAULT
GET_PARAM('GRANULARITY'),
  cascade         IN   BOOLEAN    DEFAULT TO_CASCADE_TYPE
                                (GET_PARAM('CASCADE')),
  stattab         IN   VARCHAR2   DEFAULT NULL,
  options         IN   VARCHAR2   DEFAULT 'GATHER AUTO',
  no_invalidate   IN   BOOLEAN    DEFAULT TO_NO_INVALIDATE_TYPE
```

```

                                (GET_PARAM('NO_INVALIDATE')),
stattype                       IN    VARCHAR2    DEFAULT 'DATA',
obj_filter_list                 IN    ObjectTab    DEFAULT NULL,
detail_level                    IN    VARCHAR2    DEFAULT 'TYPICAL',
format                          IN    VARCHAR2    DEFAULT 'TEXT')
RETURN CLOB;

```

Parameters

Table 186-102 REPORT_GATHER_DICTIONARY_STATS Function Parameters

Parameter	Description
comp_id	Component ID of the schema to analyze. NULL results in analyzing schemas of all RDBMS components. Refer refer to the COMP_ID column of the DBA_REGISTRY view. The procedure always gather statistics on SYS and SYSTEM schemas regardless of this argument.
estimate_percent	Percentage of rows to sample (NULL means compute). The valid range is between 0.000001 and 100. Use the constant DBMS_STATS.AUTO_SAMPLE_SIZE to let the database determine the appropriate sample size for good statistics. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
block_sample	Determines whether to use random block sampling instead of random row sampling. Random block sampling is more efficient, but if the data is not randomly distributed on disk then the sample values may be somewhat correlated. Only pertinent when performing estimate statistics.
method_opt	<p>The method options. This parameter accepts the following values:</p> <ul style="list-style-type: none"> • FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause] size_clause is defined as size_clause := SIZE {integer REPEAT AUTO SKEWONLY} <ul style="list-style-type: none"> - integer: Number of histogram buckets. Must be in the range [1,2048]. - REPEAT: Collects histograms only on the columns that already have histograms. - AUTO: Oracle determines the columns on which to collect histograms based on data distribution and the workload of the columns. - SKEWONLY: Oracle determines the columns on which to collect histograms based on the data distribution of the columns. <p>The default is FOR ALL COLUMNS SIZE AUTO. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>

Table 186-102 (Cont.) REPORT_GATHER_DICTIONARY_STATS Function Parameters

Parameter	Description
degree	<p>Degree of parallelism. The default for <code>degree</code> is <code>NULL</code>. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure. <code>NULL</code> means use the table default value specified by the <code>DEGREE</code> clause in the <code>CREATE TABLE</code> or <code>ALTER TABLE</code> statement.</p> <p>Use the constant <code>DBMS_STATS.DEFAULT_DEGREE</code> to specify the default value based on initialization parameters. The <code>AUTO_DEGREE</code> value determines the degree of parallelism automatically. This is between 1 (serial execution) and <code>DEFAULT_DEGREE</code> (the system default value based on number of CPUs and initialization parameters) according to the size of the object. When using <code>DEGREE=>NULL</code>, <code>DEGREE=>n</code>, or <code>DEGREE=>DBMS_STATS.DEFAULT_DEGREE</code>, the current implementation of <code>DBMS_STATS</code> may use serial execution if the size of the object does not warrant parallel execution.</p>
granularity	<p>Determines the granularity of statistics to collect. This preference is only relevant for partitioned tables.</p> <p>The following values are valid:</p> <ul style="list-style-type: none"> • <code>ALL</code> — Gathers all statistics: subpartition, partition, and global. • <code>AUTO</code> — Determines the granularity based on the partitioning type. This is the default value. • <code>DEFAULT</code> — Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. Use <code>GLOBAL AND PARTITION</code> for this functionality. • <code>GLOBAL</code> — Gathers global statistics. • <code>GLOBAL AND PARTITION</code> — Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object. • <code>PARTITION</code> — Gathers partition-level statistics. • <code>SUBPARTITION</code> — Gathers subpartition-level statistics.
cascade	<p>Gathers statistics on indexes also. Index statistics gathering will not be parallelized. Using this option is equivalent to running the GATHER_INDEX_STATS Procedure on each of the indexes in the schema in addition to gathering table and column statistics. Use the constant <code>DBMS_STATS.AUTO_CASCADE</code> to have Oracle determine whether index statistics to be collected or not. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
stattab	<p>User statistics table identifier describing where to save the current statistics.</p>

Table 186-102 (Cont.) REPORT_GATHER_DICTIONARY_STATS Function Parameters

Parameter	Description
options	<p>Further specification of objects for which to gather statistics:</p> <ul style="list-style-type: none"> 'GATHER' - Gathers statistics on all objects in the schema 'GATHER AUTO' - Gathers all necessary statistics automatically. Oracle implicitly determines which objects need new statistics and determines how to gather those statistics. When 'GATHER AUTO' is specified, the only additional valid parameters are <code>comp_id</code>, <code>stattab</code>, <code>statid</code> and <code>statown</code>; all other parameter settings will be ignored. Also, returns a list of objects processed. 'GATHER STALE' - Gathers statistics on stale objects as determined by looking at the <code>*_tab_modifications</code> views. Also, returns a list of objects found to be stale. 'GATHER EMPTY' - Gathers statistics on objects which currently have no statistics. Also, returns a list of objects found to have no statistics. 'LIST AUTO' - Returns list of objects to be processed with 'GATHER AUTO' 'LIST STALE' - Returns list of stale objects as determined by looking at the <code>*_tab_modifications</code> views 'LIST EMPTY' - Returns list of objects which currently have no statistics
no_invalidate	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
stattype	<p>The type of statistics:</p> <ul style="list-style-type: none"> DATA — Data statistics only CACHE — Cache statistics only ALL — All statistics
obj_filter_list	<p>A list of object filters. When provided, this will gather statistics only on objects which satisfy at least one object filter in the list as needed. In a single object filter, we can specify the constraints on the object attributes. The attribute values specified in the object filter are case-insensitive unless double-quoted. Wildcard is allowed in the attribute values. Suppose non-NULL values <code>s1</code>, <code>s2</code>, ... are specified for attributes <code>a1</code>, <code>a2</code>, ... in one object filter. An object <code>o</code> is said to satisfy this object filter if (<code>o.a1 like s1</code>) and (<code>o.a2 like s2</code>) and ... is true.</p>
detail_level	<p>See the description in REPORT_GATHER_DICTIONARY_STATS Functions.</p>
format	<p>See the description in REPORT_GATHER_DICTIONARY_STATS Functions.</p>

Return Values

A CLOB object that contains the report

Usage Notes

You must have the SYSDBA or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privilege to execute this procedure.

Exceptions

ORA-20000: Index does not exist or insufficient privileges

ORA-20001: Bad input value

ORA-20002: Bad user statistics table, may need to upgrade it

186.7.94 REPORT_GATHER_FIXED_OBJ_STATS Function

This function runs the GATHER_FIXED_OBJECTS_STATS Procedure in reporting mode.

That is, statistics are not actually collected, but all the objects that will be affected when GATHER_FIXED_OBJ_STATS is invoked are reported. The input set of parameters are exactly the same as in GATHER_FIXED_OBJ_STATS with two extra parameters.

Syntax

```
DBMS_STATS.REPORT_GATHER_FIXED_OBJ_STATS (
  statab          IN  VARCHAR2 DEFAULT NULL,
  statid          IN  VARCHAR2 DEFAULT NULL,
  statown         IN  VARCHAR2 DEFAULT NULL,
  no_invalidate  IN  BOOLEAN  DEFAULT TO_NO_INVALIDATE_TYPE (
                                GET_PARAM('NO_INVALIDATE')),
  detail_level   IN  VARCHAR2  DEFAULT 'TYPICAL',
  format         IN  VARCHAR2  DEFAULT 'TEXT')
RETURN CLOB;
```

Parameters

Table 186-103 REPORT_GATHER_FIXED_OBJ_STATS Procedure Parameters

Parameter	Description
statab	User statistics table identifier describing where to save the current statistics
statid	Identifier to associate with these statistics within statab (optional)
statown	Schema containing statab (if different from current schema)

Table 186-103 (Cont.) REPORT_GATHER_FIXED_OBJ_STATS Procedure Parameters

Parameter	Description
no_invalidate	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none">• TRUE: Dependent cursors are not invalidated.• FALSE: Dependent cursors are marked for immediate invalidation.• AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>

Table 186-103 (Cont.) REPORT_GATHER_FIXED_OBJ_STATS Procedure Parameters

Parameter	Description
detail_level	<p>Detail level for the content of the report</p> <ul style="list-style-type: none"> • BASIC: The report includes <ul style="list-style-type: none"> - operation ID - operation name - operation target object - start time - end time - completion status (such as: succeeded, failed) • TYPICAL: In addition to the information provided at level BASIC, the report includes individual target objects for which statistics are gathered in this operation. Specifically, with regard to operation related details: <ul style="list-style-type: none"> - total number of target objects - total number of successfully completed objects - total number of failed objects - total number of timed-out objects (applies to only auto statistics gathering) <p>With regard to target objects:</p> <ul style="list-style-type: none"> - owner and name of each target object - target object type (such as: table, index) - start time - end time - completion status • ALL: In addition to the information provided at level TYPICAL, the report includes further information on each target object. Specifically, with regard to operation-related details: <ul style="list-style-type: none"> - job name - session ID - parameter values - error message if the operation failed <p>With regard to target objects:</p> <ul style="list-style-type: none"> - job name - batching details - estimated cost - rank in the target list - columns for which histograms were collected - list of collected extended statistics (if any) - additional error details if the task has failed. <p>Note that several fields (such as job name, estimated task cost) in the report are populated only when an operation is executed concurrently (CONCURRENT preference is turned on).</p>

Table 186-103 (Cont.) REPORT_GATHER_FIXED_OBJ_STATS Procedure Parameters

Parameter	Description
format	Report format: <ul style="list-style-type: none"> • XML • HTML • TEXT (Default)

Return Values

A CLOB object that contains the report

Usage Notes

You must have the SYSDBA or ANALYZE ANY DICTIONARY system privilege to execute this procedure.

Exceptions

ORA-20000: Insufficient privileges

ORA-20001: Bad input value

ORA-20002: Bad user statistics table, may need to upgrade it

Related Topics

- [GATHER_FIXED_OBJECTS_STATS Procedure](#)
This procedure gathers statistics for all fixed objects (dynamic performance tables).

186.7.95 REPORT_GATHER_SCHEMA_STATS Functions

This function runs the GATHER_SCHEMA_STATS procedure in reporting mode.

The database does not actually gather statistics, but reports all objects that would be affected when invoking GATHER_SCHEMA_STATS. The input set of parameters is exactly the same as in GATHER_SCHEMA_STATS, with two extra parameters.

Syntax

```
DBMS_STATS.REPORT_GATHER_SCHEMA_STATS (
  ownname          IN   VARCHAR2,
  estimate_percent IN   NUMBER          DEFAULT TO_ESTIMATE_PERCENT_TYPE (
                                GET_PARAM ('ESTIMATE_PERCENT')),
  block_sample     IN   BOOLEAN        DEFAULT FALSE,
  method_opt       IN   VARCHAR2       DEFAULT GET_PARAM ('METHOD_OPT'),
  degree           IN   NUMBER          DEFAULT TO_DEGREE_TYPE (
                                GET_PARAM ('DEGREE')),
  granularity      IN   VARCHAR2       DEFAULT GET_PARAM ('GRANULARITY'),
  cascade          IN   BOOLEAN        DEFAULT TO_CASCADE_TYPE (
                                GET_PARAM ('CASCADE')),
  stattab          IN   VARCHAR2       DEFAULT NULL,
  statid           IN   VARCHAR2       DEFAULT NULL,
  options          IN   VARCHAR2       DEFAULT 'GATHER',
  statown         IN   VARCHAR2       DEFAULT NULL,
  no_invalidate    IN   BOOLEAN        DEFAULT TO_NO_INVALIDATE_TYPE (
```



```

                                GET_PARAM ('NO_INVALIDATE')),
force                          IN   BOOLEAN      DEFAULT FALSE,
obj_filter_list                IN   ObjectTab    DEFAULT NULL,
detail_level                   IN   VARCHAR2     DEFAULT 'TYPICAL',
format                         IN   VARCHAR2     DEFAULT 'TEXT')
RETURN CLOB;

```

Parameters

Table 186-104 REPORT_GATHER_SCHEMA_STATS Function Parameters

Parameter	Description
ownname	Schema to analyze (NULL means current schema)
estimate_percent	Percentage of rows to estimate (NULL means compute): The valid range is [0.000001,100]. Use the constant DBMS_STATS.AUTO_SAMPLE_SIZE to have Oracle determine the appropriate sample size for good statistics. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
block_sample	Whether or not to use random block sampling instead of random row sampling. Random block sampling is more efficient, but if the data is not randomly distributed on disk, then the sample values may be somewhat correlated. Only pertinent when doing an estimate statistics.
method_opt	<p>Accepts:</p> <ul style="list-style-type: none"> • FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause] size_clause is defined as size_clause := SIZE {integer REPEAT AUTO SKEWONLY} <ul style="list-style-type: none"> - integer : Number of histogram buckets. Must be in the range [1,2048]. - REPEAT : Collects histograms only on the columns that already have histograms - AUTO : Oracle determines the columns on which to collect histograms based on data distribution and the workload of the columns. - SKEWONLY : Oracle determines the columns on which to collect histograms based on the data distribution of the columns. <p>The default is FOR ALL COLUMNS SIZE AUTO. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>

Table 186-104 (Cont.) REPORT_GATHER_SCHEMA_STATS Function Parameters

Parameter	Description
degree	Degree of parallelism. The default for degree is NULL. The default value can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure . NULL means use the table default value specified by the DEGREE clause in the CREATE TABLE or ALTER TABLE statement. Use the constant DBMS_STATS.DEFAULT_DEGREE to specify the default value based on the initialization parameters. The AUTO_DEGREE value determines the degree of parallelism automatically. This is between 1 (serial execution) and DEFAULT_DEGREE (the system default value based on number of CPUs and initialization parameters) according to the size of the object. When using DEGREE=>NULL, DEGREE=>n, or DEGREE=>DBMS_STATS.DEFAULT_DEGREE, the current implementation of DBMS_STATS may use serial execution if the size of the object does not warrant parallel execution.
granularity	Granularity of statistics to collect (only pertinent if the table is partitioned). 'ALL' - Gathers all (subpartition, partition, and global) statistics 'AUTO' - Determines the granularity based on the partitioning type. This is the default value. 'DEFAULT' - Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. You should use the 'GLOBAL AND PARTITION' for this functionality. Note that the default value is now 'AUTO'. 'GLOBAL' - Gathers global statistics 'GLOBAL AND PARTITION' - Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object. 'PARTITION' - Gathers partition-level statistics 'SUBPARTITION' - Gathers subpartition-level statistics.
cascade	Gather statistics on the indexes as well. Using this option is equivalent to running the GATHER_INDEX_STATS Procedure on each of the indexes in the schema in addition to gathering table and column statistics. Use the constant DBMS_STATS.AUTO_CASCADE to have Oracle determine whether index statistics to be collected or not. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
stattab	User statistics table identifier describing where to save the current statistics
statid	Identifier (optional) to associate with these statistics within stattab

Table 186-104 (Cont.) REPORT_GATHER_SCHEMA_STATS Function Parameters

Parameter	Description
options	<p>Further specification of which objects to gather statistics for:</p> <p>GATHER: Gathers statistics on all objects in the schema.</p> <p>GATHER AUTO: Gathers all necessary statistics automatically. Oracle implicitly determines which objects need new statistics, and determines how to gather those statistics. When GATHER AUTO is specified, the only additional valid parameters are ownname, statab, statid, objlist and statown; all other parameter settings are ignored. Returns a list of processed objects.</p> <p>GATHER STALE: Gathers statistics on stale objects as determined by looking at the *_tab_modifications views. Also, return a list of objects found to be stale.</p> <p>GATHER EMPTY: Gathers statistics on objects which currently have no statistics. also, return a list of objects found to have no statistics.</p> <p>LIST AUTO: Returns a list of objects to be processed with GATHER AUTO.</p> <p>LIST STALE: Returns list of stale objects as determined by looking at the *_tab_modifications views.</p> <p>LIST EMPTY: Returns list of objects which currently have no statistics.</p>
objlist	List of objects found to be stale or empty
statown	Schema containing statab (if different than ownname)
no_invalidate	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> • TRUE: Dependent cursors are not invalidated. • FALSE: Dependent cursors are marked for immediate invalidation. • AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
force	Gather statistics on objects even if they are locked
obj_filter_list	<p>A list of object filters. When provided, GATHER_SCHEMA_STATS will gather statistics only on objects which satisfy at least one object filter in the list as needed. In a single object filter, we can specify the constraints on the object attributes. The attribute values specified in the object filter are case- insensitive unless double-quoted. Wildcard is allowed in the attribute values. Suppose non-NULL values s1, s2, ... are specified for attributes a1, a2, ... in one object filter. An object o is said to satisfy this object filter if (o.a1 like s1) and (o.a2 like s2) and ... is true. See Applying an Object Filter List.</p>

Table 186-104 (Cont.) REPORT_GATHER_SCHEMA_STATS Function Parameters

Parameter	Description
detail_level	<p>Detail level for the content of the report</p> <ul style="list-style-type: none"> • BASIC: The report includes <ul style="list-style-type: none"> - operation ID - operation name - operation target object - start time - end time - completion status (such as: succeeded, failed) • TYPICAL: In addition to the information provided at level BASIC, the report includes individual target objects for which statistics are gathered in this operation. Specifically, with regard to operation related details: <ul style="list-style-type: none"> - total number of target objects - total number of successfully completed objects - total number of failed objects - total number of timed-out objects (applies to only auto statistics gathering) <p>With regard to target objects:</p> <ul style="list-style-type: none"> - owner and name of each target object - target object type (such as: table, index) - start time - end time - completion status • ALL: In addition to the information provided at level TYPICAL, the report includes further information on each target object. Specifically, with regard to operation-related details: <ul style="list-style-type: none"> - job name - session ID - parameter values - error message if the operation failed <p>With regard to target objects:</p> <ul style="list-style-type: none"> - job name - batching details - estimated cost - rank in the target list - columns for which histograms were collected - list of collected extended statistics (if any) - additional error details if the task has failed. <p>Note that several fields (such as job name, estimated task cost) in the report are populated only when an operation is executed concurrently (CONCURRENT preference is turned on).</p>

Table 186-104 (Cont.) REPORT_GATHER_SCHEMA_STATS Function Parameters

Parameter	Description
format	Report format: <ul style="list-style-type: none"> • XML • HTML • TEXT (Default)

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Schema does not exist or insufficient privileges

ORA-20001: Bad input value

Examples

Applying an Object Filter List

The following example specifies that any table with a "T" prefix in the `SAMPLE` schema or any table in the `HR` schema, if stale, will have statistics gathered upon it.

```

DECLARE
  filter_lst DBMS_STATS.OBJECTTAB := DBMS_STATS.OBJECTTAB();
BEGIN
  filter_lst.extend(2);
  filter_lst(1).ownname := 'SAMPLE';
  filter_lst(1).objname := 'T%';
  filter_lst(2).ownname := 'HR';
  DBMS_STATS.GATHER_SCHEMA_STATS(NULL, obj_filter_list => filter_lst,
    options => 'GATHER STALE');
END;
```

186.7.96 REPORT_GATHER_TABLE_STATS Function

This procedure runs the `GATHER_TABLE_STATS` Procedure in reporting mode.

That is, statistics are not actually collected, but all the objects that will be affected when `GATHER_TABLE_STATS` is invoked are reported.

Syntax

```

DBMS_STATS.REPORT_GATHER_TABLE_STATS (
  ownname          VARCHAR2,
  tabname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  estimate_percent NUMBER   DEFAULT to_estimate_percent_type
    (get_param('ESTIMATE_PERCENT')),
  block_sample     BOOLEAN  DEFAULT FALSE,
  method_opt       VARCHAR2 DEFAULT get_param('METHOD_OPT'),
```

```

degree          NUMBER  DEFAULT to_degree_type(get_param('DEGREE')),
granularity     VARCHAR2 DEFAULT GET_PARAM('GRANULARITY'),
cascade        BOOLEAN  DEFAULT to_cascade_type(get_param('CASCADE')),
stattab        VARCHAR2 DEFAULT NULL,
statid         VARCHAR2 DEFAULT NULL,
statown        VARCHAR2 DEFAULT NULL,
no_invalidate  BOOLEAN  DEFAULT to_no_invalidate_type (
                    get_param('NO_INVALIDATE')),
stattype       VARCHAR2 DEFAULT 'DATA',
force          BOOLEAN  DEFAULT FALSE)
detail_level   VARCHAR2 DEFAULT 'TYPICAL',  format          VARCHAR2 DEFAULT
'TEXT')
RETURN CLOB;

```

Parameters

Table 186-105 REPORT_GATHER_TABLE_STATS Function Parameters

Parameter	Description
ownname	Schema of table to analyze
tablename	Name of table
partname	Name of partition
estimate_percent	Percentage of rows to estimate (NULL means compute) The valid range is [0.000001,100]. Use the constant DBMS_STATS.AUTO_SAMPLE_SIZE to have Oracle determine the appropriate sample size for good statistics. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
block_sample	Whether or not to use random block sampling instead of random row sampling. Random block sampling is more efficient, but if the data is not randomly distributed on disk, then the sample values may be somewhat correlated. Only pertinent when doing an estimate statistics.

Table 186-105 (Cont.) REPORT_GATHER_TABLE_STATS Function Parameters

Parameter	Description
method_opt	<p>Accepts either of the following options, or both in combination:</p> <ul style="list-style-type: none"> • FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause] • FOR COLUMNS [column_clause] [size_clause] <p>size_clause is defined as size_clause := SIZE {integer REPEAT AUTO SKEWONLY}</p> <p>column_clause is defined as column_clause := column_name extension name extension</p> <ul style="list-style-type: none"> - integer : Number of histogram buckets. Must be in the range [1,2048]. - REPEAT : Collects histograms only on the columns that already have histograms - AUTO : Oracle determines the columns on which to collect histograms based on data distribution and the workload of the columns. - SKEWONLY : Oracle determines the columns on which to collect histograms based on the data distribution of the columns. - column_name : Name of a column - extension : can be either a column group in the format of (column_name, Colum_e_name [, ...]) or an expression <p>The default is FOR ALL COLUMNS SIZE AUTO. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
degree	<p>Degree of parallelism. The default for degree is NULL. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure. NULL means use the table default value specified by the DEGREE clause in the CREATE TABLE or ALTER TABLE statement. Use the constant DBMS_STATS.DEFAULT_DEGREE to specify the default value based on the initialization parameters. The AUTO_DEGREE value determines the degree of parallelism automatically. This is between 1 (serial execution) and DEFAULT_DEGREE (the system default value based on number of CPUs and initialization parameters) according to the size of the object. When using DEGREE=>NULL, DEGREE=>n, or DEGREE=>DBMS_STATS.DEFAULT_DEGREE, the current implementation of DBMS_STATS may use serial execution if the size of the object does not warrant parallel execution.</p>

Table 186-105 (Cont.) REPORT_GATHER_TABLE_STATS Function Parameters

Parameter	Description
granularity	<p>Granularity of statistics to collect (only pertinent if the table is partitioned).</p> <p>'ALL' - Gathers all (subpartition, partition, and global) statistics</p> <p>'APPROX_GLOBAL AND PARTITION' - similar to 'GLOBAL AND PARTITION' but in this case the global statistics are aggregated from partition level statistics. This option will aggregate all statistics except the number of distinct values for columns and number of distinct keys of indexes. The existing histograms of the columns at the table level are also aggregated. The aggregation will use only partitions with statistics, so to get accurate global statistics, users should make sure to have statistics for all partitions. Global statistics are gathered if <code>partname</code> is NULL or if the aggregation cannot be performed (for example, if statistics for one of the partitions is missing).</p> <p>'AUTO' - Determines the granularity based on the partitioning type. This is the default value.</p> <p>'DEFAULT' - Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. You should use the 'GLOBAL AND PARTITION' for this functionality. Note that the default value is now 'AUTO'.</p> <p>'GLOBAL' - Gathers global statistics</p> <p>'GLOBAL AND PARTITION' - Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object.</p> <p>'PARTITION' - Gathers partition-level statistics</p> <p>'SUBPARTITION' - Gathers subpartition-level statistics.</p>
cascade	<p>Gathers statistics on the indexes for this table. Using this option is equivalent to running the GATHER_INDEX_STATS Procedure on each of the table's indexes. Use the constant <code>DBMS_STATS.AUTO_CASCADE</code> to have Oracle determine whether index statistics are to be collected or not. This is the default. The default value can be changed using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
stattab	User statistics table identifier describing where to save the current statistics
statid	Identifier (optional) to associate with these statistics within <code>stattab</code>
statown	Schema containing <code>stattab</code> (if different than <code>ownname</code>)
no_invalidate	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> • TRUE: Dependent cursors are not invalidated. • FALSE: Dependent cursors are marked for immediate invalidation. • AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
stattype	Statistics type. The only value allowed is <code>DATA</code> .
force	Gather statistics of table even if it is locked

Table 186-105 (Cont.) REPORT_GATHER_TABLE_STATS Function Parameters

Parameter	Description
detail_level	<p>Detail level for the content of the report</p> <ul style="list-style-type: none"> • BASIC: The report includes <ul style="list-style-type: none"> - operation ID - operation name - operation target object - start time - end time - completion status (such as: succeeded, failed) • TYPICAL: In addition to the information provided at level BASIC, the report includes individual target objects for which statistics are gathered in this operation. Specifically, with regard to operation related details: <ul style="list-style-type: none"> - total number of target objects - total number of successfully completed objects - total number of failed objects - total number of timed-out objects (applies to only auto statistics gathering) <p>With regard to target objects:</p> <ul style="list-style-type: none"> - owner and name of each target object - target object type (such as: table, index) - start time - end time - completion status • ALL: In addition to the information provided at level TYPICAL, the report includes further information on each target object. Specifically, with regard to operation-related details: <ul style="list-style-type: none"> - job name - session ID - parameter values - error message if the operation failed <p>With regard to target objects:</p> <ul style="list-style-type: none"> - job name - batching details - estimated cost - rank in the target list - columns for which histograms were collected - list of collected extended statistics (if any) - additional error details if the task has failed. <p>Note that several fields (such as job name, estimated task cost) in the report are populated only when an operation is executed concurrently (CONCURRENT preference is turned on).</p>
format	<p>Report format:</p> <ul style="list-style-type: none"> • XML • HTML • TEXT (Default)

Return Values

A CLOB object that contains the report

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Related Topics

- [GATHER_TABLE_STATS Procedure](#)
This procedure gathers table, column, and index statistics. It attempts to parallelize as much work as possible, but there are some restrictions, which are described in the individual parameters.

186.7.97 REPORT_SINGLE_STATS_OPERATION Function

This function generates a report for the provided operation optionally in a particular pluggable database (PDB) in a multitenant environment.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

Syntax

```
DBMS_STATS.REPORT_SINGLE_STATS_OPERATIONS (
  opid          NUMBER,
  detail_level  VARCHAR2  DEFAULT 'TYPICAL',
  format        VARCHAR2  DEFAULT 'TEXT'
  container_id  NUMBER    DEFAULT NULL)
RETURN CLOB;
```

Parameters

Table 186-106 REPORT_SINGLE_STATS_OPERATION Function Parameters

Parameter	Description
opid	Operation ID

Table 186-106 (Cont.) REPORT_SINGLE_STATS_OPERATION Function Parameters

Parameter	Description
detail_level	<p>Detail level for the content of the report</p> <ul style="list-style-type: none"> • BASIC: The report includes <ul style="list-style-type: none"> - operation ID - operation name - operation target object - start time - end time - completion status (such as: succeeded, failed) • TYPICAL: In addition to the information provided at level BASIC, the report includes individual target objects for which statistics are gathered in this operation. Specifically, with regard to operation related details: <ul style="list-style-type: none"> - total number of target objects - total number of successfully completed objects - total number of failed objects - total number of timed-out objects (applies to only auto statistics gathering) <p>With regard to target objects:</p> <ul style="list-style-type: none"> - owner and name of each target object - target object type (such as: table, index) - start time - end time - completion status • ALL: In addition to the information provided at level TYPICAL, the report includes further information on each target object. Specifically, with regard to operation-related details: <ul style="list-style-type: none"> - job name - session ID - parameter values - error message if the operation failed <p>With regard to target objects:</p> <ul style="list-style-type: none"> - job name - batching details - estimated cost - rank in the target list - columns for which histograms were collected - list of collected extended statistics (if any) - reason for including the object in the target list (applies to only automatic statistics gathering operation tasks) - additional error details if the task has failed. <p>Note that several fields (such as job name, estimated task cost) in the report are populated only when an operation is executed concurrently (CONCURRENT preference is turned on).</p>

Table 186-106 (Cont.) REPORT_SINGLE_STATS_OPERATION Function Parameters

Parameter	Description
format	Report format: <ul style="list-style-type: none"> • XML • HTML • TEXT (Default)
container_id	ID of the pluggable database (PDB) on which this operation was performed. Note that in a multitenant environment, operation ID does not uniquely identify an operation. That is, different operations from distinct PDBs may have the same operation ID. Hence, in a multitenant environment, if a PDB ID is not provided, then the report may contain multiple operations. In a typical (non-CDB) database environment, operation ID is unique to each operation.

Usage Notes

To invoke this procedure you need the `ANALYZE ANY` privilege and the `ANALYZE ANY DICTIONARY` privilege.

186.7.98 REPORT_STATS_OPERATIONS Function

This function generates a report of all statistics operations that take place between two timestamps which may or may not have been provided.

It allows the scope of the report to be narrowed down so that report will include only auto statistics gathering runs. Furthermore, in a multitenant environment, users may optionally provide a set of pluggable database (PDB) IDs so that only statistics operations from the specified pluggable databases will be reported.

Syntax

```
DBMS_STATS.REPORT_STATS_OPERATIONS (
  detail_level      VARCHAR2 DEFAULT 'TYPICAL',
  format            VARCHAR2 DEFAULT 'TEXT',
  latestN           NUMBER DEFAULT NULL,
  since             TIMESTAMP WITH TIME ZONE DEFAULT NULL,
  until             TIMESTAMP WITH TIME ZONE DEFAULT NULL,
  auto_only         BOOLEAN DEFAULT FALSE,
  container_ids     DBMS_UTILITY.NUMBER_ARRAY DEFAULT DBMS_STATS.NULL_NUMTAB)
RETURN CLOB;
```

Parameters

Table 186-107 REPORT_STATS_OPERATIONS Function Parameters

Parameter	Description
detail_level	<p>Detail level for the content of the report</p> <ul style="list-style-type: none"> • BASIC: The report includes <ul style="list-style-type: none"> - operation ID - operation name - operation target object - start time - end time - completion status (such as: succeeded, failed) • TYPICAL: In addition to the information provided at level BASIC, the report includes individual target objects for which statistics are gathered in this operation. Specifically, with regard to operation related details: <ul style="list-style-type: none"> - total number of target objects - total number of successfully completed objects - total number of failed objects - total number of timed -out objects (applies to only auto statistics gathering) • ALL: In addition to the information provided at level TYPICAL, the report includes further information on each target object. Specifically, with regard to operation-related details: <ul style="list-style-type: none"> - job name (if the operation was run in a job) - session ID - parameter values - additional error details if the operation has failed
format	<p>Report format:</p> <ul style="list-style-type: none"> • XML • HTML • TEXT (Default)
latestN	<p>Restricts the report to contain only the latest N operations that took place between the provided time points (since and until). The default value is NULL, meaning that all qualifying operations will be reported.</p>
since	<p>The report will include only statistics operations that started after this timestamp.</p>
until	<p>The report will include only statistics operations that before after this timestamp.</p>
auto_only	<p>When TRUE, the report will contain only auto statistics gathering job runs.</p>
container_ids	<p>A multitenant environment contains one or more pluggable databases (PDBs). <code>container_ids</code> represents a set of PDB IDs so that only statistics operations from the specified PDBs are reported (applies to only multitenant environments).</p>

Usage Notes

To invoke this procedure you need the `ANALYZE ANY` privilege and the `ANALYZE ANY DICTIONARY` privilege.

Examples

Note that the type for `container_ids` input parameter is `DBMS_UTILITY.NUMBER_ARRAY` which is an associative PL/SQL array collection. Although associative array type allows for more flexible `harvals` table-like organization of entries, this function treats `container_ids` as a regular table collection with the first ID located at index 1 and the last id located at index `container_ids.count` without any empty array slot left between any two IDs. An example for 3 container ids is provided.

```
DECLARE
    conid_tab DBMS_UTILITY.NUMBER_ARRAY;
    report clob;
BEGIN
    conid_tab(1) := 124;
    conid_tab(2) := 63;
    conid_tab(3) := 98;
    report := DBMS_STATS.REPORT_STATS_OPERATIONS (container_ids => conid_tab);
END;
```

186.7.99 RESET_ADVISOR_TASK Procedure

This procedure resets an Optimizer Statistics Advisor task execution to its initial state. Only reset a task that is not currently executing.

Syntax

```
DBMS_STATS.RESET_ADVISOR_TASK (
    task_name IN VARCHAR2);
```

Parameters

Table 186-108 RESET_ADVISOR_TASK Procedure Parameters

Parameter	Description
<code>task_name</code>	The name of the Optimizer Statistics Advisor task.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- This subprogram executes using invoker's rights.

Exceptions

- `ORA-20000`: Insufficient privileges
- `ORA-20001`: Invalid input values

- ORA-20012: Optimizer Statistics Advisor errors

186.7.100 RESET_COL_USAGE Procedure

This procedure deletes the recorded column (group) usage information.

This procedure should only be used in very rare cases when the seed column usage needs to be initialized.

Syntax

```
DBMS_STATS.RESET_COL_USAGE (
  ownname   IN   VARCHAR2,
  tablename IN   VARCHAR2);
```

Parameters

Table 186-109 RESET_COL_USAGE Procedure Parameters

Parameter	Description
ownname	Owner name. If NULL it deletes column usage information for tables in all schemas in the database.
tablename	Table name. If NULL it deletes column usage information for all tables of ownname. If both the owner and tablename is NULL, the seed column usage is stopped if applicable. See :SEED_COL_USAGE Procedure for more information.

Usage Notes

To run this procedure, you need to have the SYSDBA administrative privilege, or both the ANALYZE ANY DICTIONARY and the ANALYZE ANY system privileges.

186.7.101 RESET_GLOBAL_PREF_DEFAULTS Procedure

This procedure sets global preference, such as CASCADE, ESTIMATE_PERCENT and GRANULARITY, to default values.

This reverses the global preferences set by the [SET_GLOBAL_PREFS Procedure](#).

Syntax

```
DBMS_STATS.RESET_GLOBAL_PREF_DEFAULTS;
```

Usage Notes

To invoke this procedure you need the ANALYZE ANY privilege and the ANALYZE ANY DICTIONARY privilege.

186.7.102 RESET_PARAM_DEFAULTS Procedure

This deprecated procedure resets the default values of all parameters to Oracle recommended values.

Note:

This subprogram has been replaced by improved technology and is maintained only for purposes of backward compatibility. Instead of this procedure, use the [RESET_GLOBAL_PREF_DEFAULTS Procedure](#).

See also . [DBMS_STATS Deprecated Subprograms](#)

Syntax

```
DBMS_STATS.RESET_PARAM_DEFAULTS;
```

186.7.103 RESTORE_DATABASE_STATS Procedure

This procedure restores statistics of all tables of the database as of a specified timestamp (as_of_timestamp).

Syntax

```
DBMS_STATS.RESTORE_DATABASE_STATS (
  as_of_timestamp      TIMESTAMP WITH TIME ZONE,
  force                BOOLEAN DEFAULT FALSE,
  no_invalidate        BOOLEAN DEFAULT to_no_invalidate_type
                      (GET_PARAM('NO_INVALIDATE')));
```

Parameters

Table 186-110 RESTORE_DATABASE_STATS Procedure Parameters

Parameter	Description
as_of_timestamp	The timestamp to which to restore statistics
force	Restores statistics even if their statistics are locked
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. You can change the default using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values

ORA-20006: Unable to restore statistics, statistics history not available

186.7.104 RESTORE_DICTIONARY_STATS Procedure

This procedure restores statistics of all dictionary tables (tables of 'SYS', 'SYSTEM' and RDBMS component schemas) as of a specified timestamp (`as_of_timestamp`).

Syntax

```
DBMS_STATS.RESTORE_DICTIONARY_STATS (
  as_of_timestamp      TIMESTAMP WITH TIME ZONE,
  force                BOOLEAN DEFAULT FALSE,
  no_invalidate       BOOLEAN DEFAULT to_no_invalidate_type
  (GET_PARAM('NO_INVALIDATE')));
```

Parameters

Table 186-111 RESTORE_DICTIONARY_STATS Procedure Parameters

Parameter	Description
<code>as_of_timestamp</code>	Timestamp to which to restore statistics
<code>force</code>	Restores statistics even if their statistics are locked
<code>no_invalidate</code>	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. You can change the default using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .

Usage Notes

To run this procedure, you must have the SYSDBA or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values

ORA-20006: Unable to restore statistics, statistics history not available

186.7.105 RESTORE_FIXED_OBJECTS_STATS Procedure

This procedure restores statistics of all fixed tables as of a specified timestamp (`as_of_timestamp`).

Syntax

```
DBMS_STATS.RESTORE_FIXED_OBJECTS_STATS(  
  as_of_timestamp      TIMESTAMP WITH TIME ZONE,  
  force                BOOLEAN DEFAULT FALSE,  
  no_invalidate        BOOLEAN DEFAULT to_no_invalidate_type  
                                     (GET_PARAM('NO_INVALIDATE')));
```

Parameters

Table 186-112 RESTORE_FIXED_OBJECTS_STATS Procedure Parameters

Parameter	Description
<code>as_of_timestamp</code>	The timestamp to which to restore statistics
<code>force</code>	Restores statistics even if their statistics are locked
<code>no_invalidate</code>	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> • <code>TRUE</code>: Dependent cursors are not invalidated. • <code>FALSE</code>: Dependent cursors are marked for immediate invalidation. • <code>AUTO</code>: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. You can change the default using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .

Usage Notes

To run this procedure, you must have the `SYSDBA` or `ANALYZE ANY DICTIONARY` system privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values

ORA-20006: Unable to restore statistics, statistics history not available

186.7.106 RESTORE_SCHEMA_STATS Procedure

This procedure restores statistics of all tables of a schema as of a specified timestamp (`as_of_timestamp`).

Syntax

```
DBMS_STATS.RESTORE_SCHEMA_STATS(  
  ownname              VARCHAR2,
```

```

as_of_timestamp    TIMESTAMP WITH TIME ZONE,
force              BOOLEAN DEFAULT FALSE,
no_invalidate     BOOLEAN DEFAULT to_no_invalidate_type

(GET_PARAM('NO_INVALIDATE')));

```

Parameters

Table 186-113 RESTORE_SCHEMA_STATS Procedure Parameters

Parameter	Description
ownname	Schema of the tables for which the statistics are to be restored
as_of_timestamp	The timestamp to which to restore statistics
force	Restores statistics even if their statistics are locked
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values

ORA-20006: Unable to restore statistics, statistics history not available

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.107 RESTORE_SYSTEM_STATS Procedure

This procedure restores system statistics as of a specified timestamp (`as_of_timestamp`).

Syntax

```

DBMS_STATS.RESTORE_SCHEMA_STATS (
    as_of_timestamp    TIMESTAMP WITH TIME ZONE);

```

Parameters

Table 186-114 RESTORE_SYSTEM_STATS Procedure Parameters

Parameter	Description
as_of_timestamp	The timestamp to which to restore statistics

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values

ORA-20006: Unable to restore statistics, statistics history not available

Usage Notes

To run this procedure, you need the GATHER_SYSTEM_STATISTICS role.

186.7.108 RESTORE_TABLE_STATS Procedure

This procedure restores statistics of a table as of a specified timestamp (as_of_timestamp). It also restores statistics of associated indexes and columns.

If the table statistics were locked at the specified timestamp the procedure will lock the statistics. The procedure will not restore user defined statistics.

Syntax

```
DBMS_STATS.RESTORE_TABLE_STATS (
  ownname          VARCHAR2,
  tablename        VARCHAR2,
  as_of_timestamp  TIMESTAMP WITH TIME ZONE,
  restore_cluster_index  BOOLEAN DEFAULT FALSE,
  force            BOOLEAN DEFAULT FALSE,
  no_invalidate    BOOLEAN DEFAULT to_no_invalidate_type
                                     (GET_PARAM('NO_INVALIDATE')));
```

Parameters

Table 186-115 RESTORE_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	The schema of the table for which the statistics are to be restored
tablename	The table name
as_of_timestamp	The timestamp to which to restore statistics
restore_cluster_index	If the table is part of a cluster, restore statistics of the cluster index if set to TRUE
force	Restores statistics even if the table statistics are locked. If the table statistics were not locked at the specified timestamp, it unlocks the statistics.

Table 186-115 (Cont.) RESTORE_TABLE_STATS Procedure Parameters

Parameter	Description
no_invalidate	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> • TRUE: Dependent cursors are not invalidated. • FALSE: Dependent cursors are marked for immediate invalidation. • AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent values

ORA-20006: Unable to restore statistics, statistics history not available

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.109 RESUME_ADVISOR_TASK Procedure

This procedure resumes an interrupted task. It only resumes the execution that was most recently interrupted.

Syntax

```
DBMS_STATS.RESUME_ADVISOR_TASK (
    task_name IN VARCHAR2);
```

Parameters

Table 186-116 RESUME_ADVISOR_TASK Procedure Parameters

Parameter	Description
task_name	The name of the Optimizer Statistics Advisor task.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.

- This subprogram executes using invoker's rights.

Consider a case in which a task is executed by one user, interrupted, and then resumed by a different user. In this case, Optimizer Statistics Advisor bases its checks of the resumed execution on the privilege of the user who resumed the task.

Exceptions

- ORA-20000: Insufficient privileges
- ORA-20001: Invalid input values
- ORA-20012: Optimizer Statistics Advisor errors

Example 186-14 Resuming an Interrupted Task

In this example, you start a SQL*Plus session, and then create and execute an advisor task named `my_task`:

```
DECLARE
  v_tname  VARCHAR2(128) := 'my_task';
  v_ename  VARCHAR2(128) := NULL;
BEGIN
  -- create a task
  v_tname := DBMS_STATS.CREATE_ADVISOR_TASK(v_tname);

  -- execute the task
  v_ename := DBMS_STATS.EXECUTE_ADVISOR_TASK(v_tname);
END;
/
```

In a separate terminal, you start a second SQL*Plus session, and then execute the following program:

```
XEC DBMS_STATS.INTERRUPT_ADVISOR_TASK('my_task');
```

The first session returns an ORA-13632 to indicate the cancelation of the task:

```
ORA-13638: The user interrupted the current operation.
```

In the second SQL*Plus session, you resume the task execution as follows:

```
XEC DBMS_STATS.RESUME_ADVISOR_TASK('my_task');
```

186.7.110 SCRIPT_ADVISOR_TASK Function

Retrieves the script that implements the recommended actions for the problems found by Optimizer Statistics Advisor.

The generated script contains PL/SQL statements that you can choose to execute. Preceding the commands for each action are comments that list the potential side effects. You can review the comments, and choose to execute only the desired sections.

Syntax

```
DBMS_STATS.SCRIPT_ADVISOR_TASK (
  task_name      IN   VARCHAR2,
  execution_name IN   VARCHAR2  := NULL,
  dir_name       IN   VARCHAR2  := NULL,
  level         IN   VARCHAR2  := 'TYPICAL')
RETURN CLOB;
```

Parameters

Table 186-117 SCRIPT_ADVISOR_TASK Function Parameters

Parameter	Description
task_name	The name of the Optimizer Statistics Advisor task.
execution_name	A name that qualifies and identifies an advisor execution. If not specified, then the advisor automatically generates it. If the specified execution conflicts with the name of an existing execution, then the function returns an error.
dir_name	Directory name to which to write the generated script. If the name is not specified (NULL), then the function includes the script in the returned CLOB. If the name is specified, then the function returns the script as a CLOB and as a new file in the specified directory.
level	The level of the script to generate. Possible values are <ul style="list-style-type: none"> ALL: Ignores the filter and generates a script for all findings TYPICAL: Generates a script according to the filters in place

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- You can execute this subprogram for `AUTO_STATS_ADVISOR_TASK`, which is predefined.
- This subprogram executes using invoker's rights.

The results of performing this task depend on the privileges of the executing user:

- SYSTEM level**
Only users with both the `ANALYZE ANY` and `ANALYZE ANY DICTIONARY` privileges can perform this task on system-level rules.

- Operation level**

The results depend on the following privileges:

- Users with both the `ANALYZE ANY` and `ANALYZE ANY DICTIONARY` privileges can perform this task for all statistics operations.
- Users with the `ANALYZE ANY` privilege but *not* the `ANALYZE ANY DICTIONARY` privilege can perform this task for statistics operations related to any schema except `SYS`.

- Users with the `ANALYZE ANY DICTIONARY` privilege but *not* the `ANALYZE ANY` privilege can perform this task for statistics operations related to their own schema and the `SYS` schema.
- Users with neither the `ANALYZE ANY` nor the `ANALYZE ANY DICTIONARY` privilege can only perform this operation for statistics operations relating to their own schema.
- Object level
Users can perform this task for any object for which they have statistics collection privileges.

Return Values

This function returns a CLOB that contains the script.

Exceptions

- ORA-20000: Insufficient privileges
- ORA-20001: Invalid input values
- ORA-20012: Optimizer Statistics Advisor errors

Example 186-15 Creating an Optimizer Statistics Advisor Script

This example creates a procedure named `myrep`, and then calls this procedure to print the script the implements the recommendations.

```
SET ECHO ON
SET FEEDBACK ON
SET SERVEROUTPUT ON
SET TRIMS ON
SET LINESIZE 300

EXECUTE DBMS_OUTPUT.ENABLE (buffer_size => 10000000);

CREATE OR REPLACE PROCEDURE myrep(p_tname VARCHAR2, p_fotype VARCHAR2, which
VARCHAR2)
IS
  v_report CLOB          := null;
  v_script CLOB          := null;
  v_fotype VARCHAR2(400) := p_fotype;
  v_tname  VARCHAR2(400) := p_tname;
  v_len    NUMBER(10);
  v_ps     NUMBER(10)    := 10000;
  v_pn     NUMBER(10)    := 1;
  v_ret    VARCHAR2(32767);
BEGIN
  IF which = 'REPORT'
  THEN
    -- generate a report
    v_report := DBMS_STATS.REPORT_ADVISOR_TASK(
      task_name => v_tname,
      type      => v_fotype,
      section   => 'ALL',
      level     => 'ALL');
    v_len := DBMS_LOB.getlength(v_report);
```



```
        WHILE (v_pn < v_len)
        LOOP
            DBMS_OUTPUT.PUT_LINE(DBMS_LOB.SUBSTR(v_report, v_ps, v_pn));
            v_pn := v_pn + v_ps;
        END LOOP;
    ELSE
        -- generate a script
        v_script := DBMS_STATS.SCRIPT_ADVISOR_TASK(v_tname);
        v_len := DBMS_LOB.getlength(v_script);
        WHILE (v_pn < v_len)
        LOOP
            DBMS_OUTPUT.PUT_LINE(DBMS_LOB.SUBSTR(v_script, v_ps, v_pn));
            v_pn := v_pn + v_ps;
        END LOOP;
    END IF;
END;
/

SHOW ERRORS

SPOOL report.txt
EXECUTE myrep('my_task','-','SCRIPT');
SPOOL OFF
```

**See Also:**

Oracle Database SQL Tuning Guide

186.7.111 SEED_COL_USAGE Procedure

This procedure seeds column usage information from a statements in the specified SQL tuning set, or in the database.

The procedure iterates over the SQL statements, compiles them, and then seeds column usage information for the columns that appear in these statements. You can monitor the workload on the system for given amount of time and seed the and seed the column usage information based on the columns that appear in statements executed during the monitoring window.

Syntax

```
DBMS_STATS.SEED_COL_USAGE (
    sqlset_name    IN    VARCHAR2,
    owner_name     IN    VARCHAR2,
    time_limit     IN    POSITIVE DEFAULT NULL);
```

Parameters

Table 186-118 SEED_COL_USAGE Procedure Parameters

Parameter	Description
sqlset_name	Name of the SQL tuning set that contains the statements to be monitored. If this parameter and owner_name are both null, then the procedure monitors all statements in the database for the specified time limit.
owner_name	Owner of the SQL tuning set that contains the statements to be monitored. If this parameter and sqlset_name are both null, then the procedure monitors all statements in the database for the specified time limit.
time_limit	Time limit (in seconds).

Security Model

To invoke this procedure you must have the `ANALYZE ANY` privilege and the `ANALYZE ANY DICTIONARY` privilege.

Exceptions

ORA-20000: Insufficient privileges

Usage Notes

This procedure also records group of columns. You can create extensions for the recorded group of columns using the [CREATE_EXTENDED_STATS Function](#) procedure. If `sqlset_name` and `owner_name` are NULL, then the procedure records the column (group) usage information for the statements executed in the system in next `time_limit` seconds.

This monitoring procedure records different information from the traditional column usage information that is visible in `SYS.COL_USAGE$`. The procedure stores information in `SYS.COL_GROUP_USAGE$`.

Examples

The following example turns on monitoring for 5 minutes or 300 seconds.

```
BEGIN
  DBMS_STATS.SEED_COL_USAGE (null,null,300);
END;
```

186.7.112 SET_ADVISOR_TASK_PARAMETER Procedure

This procedure updates the value of an Optimizer Statistics Advisor task parameter.

Syntax

```
DBMS_STATS.SET_ADVISOR_TASK_PARAMETER (
  task_name      IN   VARCHAR2,
  parameter      IN   VARCHAR2,
  value          IN   VARCHAR2);
```

Parameters

Table 186-119 SET_ADVISOR_TASK_PARAMETER Procedure Parameters

Parameter	Description
task_name	The name of the Optimizer Statistics Advisor task.
parameter	The name of the parameter to set. The function returns an error if the specified parameter does not exist.
value	The new value of the parameter.

Security Model

Note the following:

- To execute this subprogram, you must have the `ADVISOR` privilege.
- You must be the owner of the task.
- This subprogram executes using invoker's rights.

Exceptions

- `ORA-20000`: Insufficient privileges
- `ORA-20001`: Invalid input values
- `ORA-20012`: Optimizer Statistics Advisor errors



See Also:

Oracle Database SQL Tuning Guide to learn how to manage Optimizer Statistics Advisor

186.7.113 SET_COLUMN_STATS Procedures

This procedure sets column-related information.

In the version of this procedure that deals with user-defined statistics, the statistics type specified is the type to store in the dictionary, in addition to the actual user-defined statistics. If this statistics type is `NULL`, the statistics type associated with the index or column is stored.

Syntax

```
DBMS_STATS.SET_COLUMN_STATS (
  ownname      VARCHAR2,
  tabname      VARCHAR2,
  colname      VARCHAR2,
  partname     VARCHAR2 DEFAULT NULL,
  stattab      VARCHAR2 DEFAULT NULL,
  statid       VARCHAR2 DEFAULT NULL,
  distcnt      NUMBER DEFAULT NULL,
  density      NUMBER DEFAULT NULL,
```

```

nullcnt      NUMBER DEFAULT NULL,
srec         StatRec DEFAULT NULL,
avgclen     NUMBER DEFAULT NULL,
flags       NUMBER DEFAULT NULL,
statown     VARCHAR2 DEFAULT NULL,
no_invalidate BOOLEAN DEFAULT to_no_invalidate_type(
                get_param('NO_INVALIDATE')),
force       BOOLEAN DEFAULT FALSE);

```

Use the following for user-defined statistics:

```

DBMS_STATS.SET_COLUMN_STATS (
  ownname     VARCHAR2,
  tabname     VARCHAR2,
  colname     VARCHAR2,
  partname    VARCHAR2 DEFAULT NULL,
  statab     VARCHAR2 DEFAULT NULL,
  statid     VARCHAR2 DEFAULT NULL,
  ext_stats   RAW,
  statypown  VARCHAR2 DEFAULT NULL,
  statypname VARCHAR2 DEFAULT NULL,
  statown    VARCHAR2 DEFAULT NULL,
  no_invalidate BOOLEAN DEFAULT to_no_invalidate_type(
                get_param('NO_INVALIDATE')),
  force     BOOLEAN DEFAULT FALSE);

```

Parameters

Table 186-120 SET_COLUMN_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
tabname	Name of the table to which this column belongs.
colname	Name of the column or extension
partname	Name of the table partition in which to store the statistics. If the table is partitioned and partname is NULL, then the statistics are stored at the global table level.
statab	User statistics table identifier describing where to store the statistics. If statab is NULL, then the statistics are stored directly in the dictionary.
statid	Identifier (optional) to associate with these statistics within statab (Only pertinent if statab is not NULL)
ext_stats	User-defined statistics
statypown	Schema of the statistics type
statypname	Name of the statistics type
distcnt	Number of distinct values
density	Column density. If this value is NULL and if distcnt is not NULL, then density is derived from distcnt.
nullcnt	Number of NULLs
srec	StatRec structure filled in by a call to PREPARE_COLUMN_VALUES or GET_COLUMN_STATS
avgclen	Average length for the column (in bytes)

Table 186-120 (Cont.) SET_COLUMN_STATS Procedure Parameters

Parameter	Description
flags	For internal Oracle use (should be left as NULL)
statown	Schema containing <code>stattab</code> (if different than <code>ownname</code>)
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> • TRUE: Dependent cursors are not invalidated. • FALSE: Dependent cursors are marked for immediate invalidation. • AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. You can change the default using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
force	Sets the values even if statistics of the column are locked

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or inconsistent input values

ORA-20005: Object statistics are locked

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.114 SET_DATABASE_PREFS Procedure

This procedure sets the statistics preferences of all the tables, excluding the tables owned by the database. These tables can be included by passing `TRUE` for the `add_sys` parameter.

Syntax

```
DBMS_STATS.SET_DATABASE_PREFS (
  pname          IN  VARCHAR2,
  pvalue        IN  VARCHAR2,
  add_sys       IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 186-121 SET_DATABASE_PREFS Procedure Parameters

Parameter	Description
pname	Preference name. The existing value for following preferences can be set and default preference values will be used: <ul style="list-style-type: none">• APPROXIMATE_NDV_ALGORITHM• AUTO_STAT_EXTENSIONS• CASCADE• DEGREE• ESTIMATE_PERCENT• GLOBAL_TEMP_TABLE_STATS• GRANULARITY• INCREMENTAL• INCREMENTAL_STALENESS• INCREMENTAL_LEVEL• METHOD_OPT• NO_INVALIDATE• OPTIONS• PREFERENCE_OVERRIDES_PARAMETER• PUBLISH• STALE_PERCENT• STAT_CATEGORY• TABLE_CACHED_BLOCKS
pvalue	Preference value. If NULL is specified, it will set the Oracle default values
add_sys	Value TRUE will include the Oracle-owned tables

Table 186-122 Statistics Preferences

Preference	Description
APPROXIMATE_NDV_ALGORITHM	<p>Specifies the synopsis generation algorithm. A synopsis is special type of statistic that tracks the number of distinct values (NDV) for each column in a partition. Consider a synopsis as an internal management structure that samples distinct values.</p> <p>You can specify the following preferences:</p> <ul style="list-style-type: none"> REPEAT OR HYPERLOGLOG This is the default. If INCREMENTAL is enabled on the table, then the database preserves the format of any existing synopses that use the adaptive sampling algorithm. However, the database creates any new synopses in HyperLogLog format. This approach is attractive when existing performance is acceptable, and you do not want to incur the performance cost of reformatting legacy content. ADAPTIVE SAMPLING The database uses the adaptive sampling algorithm for all synopses. This is the most conservative option. HYPERLOGLOG The database uses the HyperLogLog algorithm for all new and stale synopses. In contrast to adaptive sampling, the HyperLogLog algorithm uses a randomization technique. The advantages of HyperLogLog over adaptive sampling are: <ul style="list-style-type: none"> The accuracy of the new algorithm is similar to the original algorithm. The memory required is significantly lower, which typically leads to huge reductions in synopsis size.
AUTO_STAT_EXTENSIONS	<p>Controls the automatic creation of extensions when database statistics are gathered.</p> <p>You can set the following values:</p> <ul style="list-style-type: none"> ON — When applicable, a SQL plan directive can trigger the creation of column group statistics based on usage of columns in the predicates in the workload. OFF — The database does not create column group statistics automatically. The database creates them only when the CREATE_EXTENDED_STATS function is executed, or when extended statistics are specified explicitly in the METHOD_OPT clause of DBMS_STATS. This is the default.
CASCADE	Determines whether to collect index statistics as part of gathering table statistics.
DEGREE	Determines the degree of parallelism used for gathering statistics.

Table 186-122 (Cont.) Statistics Preferences

Preference	Description
ESTIMATE_PERCENT	<p>Determines the percentage of rows to sample.</p> <p>The valid range is between 0.000001 and 100. Use the constant <code>DBMS_STATS.AUTO_SAMPLE_SIZE</code> to enable the database to determine the appropriate sample size for optimal statistics. This is the default.</p>
GLOBAL_TEMP_TABLE_STATS	<p>Controls whether the statistics gathered for a global temporary table should be stored as shared statistics or session statistics. This preference takes two values:</p> <ul style="list-style-type: none">• <code>SHARED</code> — All sessions see the same set of statistics• <code>SESSION</code> — Statistics gathered by the <code>GATHER_TABLE_STATS</code> procedure on a global temporary table are session-specific. Thus, the database only uses them for queries issued in the same session as the statistics gathering process. The database deletes session-specific statistics when a session terminates.
GRANULARITY	<p>Determines the granularity of statistics to collect. This preference is only relevant for partitioned tables.</p> <p>The following values are valid:</p> <ul style="list-style-type: none">• <code>ALL</code> — Gathers all statistics: subpartition, partition, and global.• <code>AUTO</code> — Determines the granularity based on the partitioning type. This is the default value.• <code>DEFAULT</code> — Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. Use <code>GLOBAL AND PARTITION</code> for this functionality.• <code>GLOBAL</code> — Gathers global statistics.• <code>GLOBAL AND PARTITION</code> — Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object.• <code>PARTITION</code> — Gathers partition-level statistics.• <code>SUBPARTITION</code> — Gathers subpartition-level statistics.

Table 186-122 (Cont.) Statistics Preferences

Preference	Description
INCREMENTAL	<p>Determines whether the global statistics for a partitioned table are maintained without performing a full table scan. When a table is partitioned, an application typically loads data into a new partition. As new partitions are added and data is loaded, global table statistics must be kept up to date. If the following conditions are met, then the database updates the global table statistics by scanning only the changed partitions instead of the entire table:</p> <ul style="list-style-type: none"> • The INCREMENTAL value for the partitioned table is set to TRUE. • The PUBLISH value for the partitioned table is set to TRUE. • The user specifies AUTO_SAMPLE_SIZE for ESTIMATE_PERCENT and AUTO for GRANULARITY when gathering statistics on the table. <p>If the INCREMENTAL value for the partitioned table was set to FALSE (default value), then the database uses a full table scan to maintain the global statistics. This technique is a much more resource-intensive and time-consuming operation for large tables.</p>
INCREMENTAL_LEVEL	<p>Controls which synopses to collect when INCREMENTAL preference is set to TRUE. It takes the following values:</p> <ul style="list-style-type: none"> • PARTITION — Gathers partition-level synopses. This is the default value. If PARTITION is set on a nonpartitioned table, then the database does not gather synopses. • TABLE — Gathers table-level synopses. Specify this value when you want to exchange this table with a partition. Before the exchange, you can run GATHER_TABLE_STATS on this table with INCREMENTAL set to TRUE and INCREMENTAL_LEVEL to TABLE. The result is that the database gathers table-level synopses on this table. After the exchange, the partition has synopses that come from the table-level synopses of the table before the exchange. You can only use preference value in the SET_TABLE_PREFS procedure: this value is not allowed in the other SET_*_PREFS procedures.

Table 186-122 (Cont.) Statistics Preferences

Preference	Description
INCREMENTAL_STALENESS	<p>Specifies when a partition or subpartition is considered stale. This parameter takes an enumeration of values, such as 'USE_STALE_PERCENT' and 'USE_LOCKED_STATS'. You can also specify multiple values, such as 'USE_STALE_PERCENT,USE_LOCKED_STATS,ALLOW_MIXED_FORMAT'.</p> <p>The parameter accepts the following values:</p> <ul style="list-style-type: none"> • USE_STALE_PERCENT—A partition or subpartition is not considered stale when DML changes are below the threshold set by the <code>STALE_PERCENT</code> preference. For example, assume that <code>STALE_PERCENT</code> is 10. You specify <code>USE_STALE_PERCENT</code> for <code>INCREMENTAL_STALENESS</code>. The partition has 5% DML changes. The database does not regather statistics. Assume a different case in which <code>STALE_PERCENT</code> is 10. You specify <code>USE_STALE_PERCENT</code> for <code>INCREMENTAL_STALENESS</code>. However, in this case the partition is locked and has 20% of DML changes. Because the partition is locked, the database does not regather statistics. • USE_LOCKED_STATS—Locked partitions or subpartitions statistics are never considered stale, regardless of DML changes. For example, assume that <code>STALE_PERCENT</code> is 10. You specify 'USE_LOCKED_STATS, USE_STALE_PERCENT'. The partition, which is locked, has 20% DML changes. The partition is not considered stale. The database uses existing statistics to derive global statistics. • ALLOW_MIXED_FORMAT—Adaptive sampling synopses and HyperLogLog synopses are permitted to coexist. • NULL—A partition or subpartition is considered stale when it has any DML changes. For example, assume that <code>STALE_PERCENT</code> is 10. You specify the value 'NULL' for <code>INCREMENTAL_STALENESS</code>. The partition has 5% of DML changes. The database regathers statistics. <p>Note that the following two executions are different:</p> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', 'NULL');</pre> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', null);</pre>

Table 186-122 (Cont.) Statistics Preferences

Preference	Description
METHOD_OPT	<p>The first execution uses single quotes to set the preference to the value <code>NULL</code>, whereas the second sets the preference to the default, which is <code>ALLOW_MIXED_FORMAT</code>.</p> <p>Controls column statistics collection and histogram creation. When setting preferences at the global, schema, database, or dictionary level, only <code>FOR ALL</code> syntax is allowed:</p> <ul style="list-style-type: none"> <code>FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause]</code> <p>The <code>size_clause</code> is defined as <code>size_clause := SIZE {integer REPEAT AUTO SKEWONLY}</code></p> <p><code>integer</code> — Specifies the number of histogram buckets. The number must be between 1 and 2048.</p> <p><code>REPEAT</code> — Collects histograms only on the columns that already have histograms.</p> <p><code>AUTO</code> — Determines the columns on which to collect histograms based on data distribution and the workload of the columns.</p> <p><code>SKEWONLY</code> — Determines the columns on which to collect histograms based on the data distribution of the columns.</p> <p>The default is <code>FOR ALL COLUMNS SIZE AUTO</code>. You can change the value using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
NO_INVALIDATE	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> <code>TRUE</code>: Dependent cursors are not invalidated. <code>FALSE</code>: Dependent cursors are marked for immediate invalidation. <code>AUTO</code>: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>If set to <code>TRUE</code>, then the database not invalidate dependent cursors. If set to <code>FALSE</code>, then the procedure invalidates dependent cursors immediately.</p>

Table 186-122 (Cont.) Statistics Preferences

Preference	Description
OPTIONS	<p>Specifies which objects require statistics to be gathered. Valid values are as follows:</p> <ul style="list-style-type: none"> GATHER — Gathers statistics on all objects in the database. This is the default. GATHER AUTO — Gathers all necessary statistics automatically. This is the default. <p>The database implicitly determines which objects need new statistics and determines how to gather those statistics. When GATHER AUTO is specified, the only additional valid parameters are <code>comp_id</code>, <code>no_invalidate</code>, <code>stattab</code>, <code>statid</code>, and <code>statown</code>; all other parameter settings will be ignored. Also, the database returns a list of objects processed.</p>
PREFERENCE_OVERRIDES_PARAMETER	<p>Determines whether to override the input value of a parameter with the preference value of that parameter for a statistics operation. Possible values are:</p> <ul style="list-style-type: none"> TRUE — Ignores input parameter values, and uses the value of the corresponding preference. FALSE — Obeys input parameter values. <p>Specifying this preference does not change the order of precedence of table, global, and default.</p>
PUBLISH	<p>Determines whether the database publishes newly gathered statistics after the gathering job completes. You can gather statistics without publishing them immediately. This technique enables you to test new statistics before publishing them.</p>
STALE_PERCENT	<p>Determines the percentage of rows in a table that must change before the statistics on that table are stale and need to be regathered.</p> <p>The valid domain for <code>stale_percent</code> is non-negative numbers. The default value is 10, which means that a table having more than 10% of changes is considered stale.</p>
STAT_CATEGORY	<p>Specifies which statistics to import or export, accepting multiple values separated by a comma. Values supported:</p> <ul style="list-style-type: none"> OBJECT_STATS — table statistics, column statistics and index statistics (default) SYNOPSIS — information to support incremental statistics REALTIME_STATS — specifies only real-time statistics. <p>The value 'OBJECT_STATS, SYNOPSIS' specifies table statistics, column statistics, index statistics, and synopses.</p>

Table 186-122 (Cont.) Statistics Preferences

Preference	Description
TABLE_CACHED_BLOCKS	Specifies the average number of blocks assumed to be cached in the buffer cache when calculating the index clustering factor. The preference applies only when gathering statistics using DBMS_STATS. Index statistics gathered during CREATE INDEX or REBUILD INDEX operations will use the default value 1.

Security Model

To run this procedure, you must have the SYSDBA role or both ANALYZE ANY DICTIONARY and ANALYZE ANY system privileges.

Exceptions

ORA-20000: Insufficient privileges

ORA-20001: Invalid or illegal input values

Usage Notes

Both arguments are of type VARCHAR2 and values are enclosed in quotes, even when they represent numbers.

Examples

```
DBMS_STATS.SET_DATABASE_PREFS('CASCADE', 'DBMS_STATS.AUTO_CASCADE');
DBMS_STATS.SET_DATABASE_PREFS('ESTIMATE_PERCENT', '9');
DBMS_STATS.SET_DATABASE_PREFS('DEGREE', '99');
```

**See Also:**

Oracle Database SQL Tuning Guide to learn how to set optimizer statistics preferences

186.7.115 SET_GLOBAL_PREFS Procedure

This procedure sets statistics preferences at the global level.

Syntax

```
DBMS_STATS.SET_GLOBAL_PREFS (
  pname      IN   VARCHAR2,
  pvalue     IN   VARCHAR2);
```

Parameters

Table 186-123 SET_GLOBAL_PREFS Procedure Parameters

Parameter	Description
pname	<p>Preference name. The default value for the following preferences can be set:</p> <ul style="list-style-type: none"> • APPROXIMATE_NDV_ALGORITHM • AUTO_STAT_EXTENSIONS • AUTO_TASK_STATUS • AUTO_TASK_MAX_RUN_TIME • AUTO_TASK_INTERVAL • AUTOSTATS_TARGET • CASCADE • CONCURRENT • DEGREE • ESTIMATE_PERCENT • GLOBAL_TEMP_TABLE_STATS • GRANULARITY • INCREMENTAL • INCREMENTAL_LEVEL • INCREMENTAL_STALENESS • METHOD_OPT • NO_INVALIDATE • OPTIONS • PREFERENCE_OVERRIDES_PARAMETER • PUBLISH • STALE_PERCENT • STAT_CATEGORY • TABLE_CACHED_BLOCKS • WAIT_TIME_TO_UPDATE_STATS
pvalue	<p>Preference value. If NULL is specified, it will set the Oracle default values</p>

Table 186-124 Global Statistics Preferences

Preference	Description
APPROXIMATE_NDV_ALGORITHM	<p>Specifies the synopsis generation algorithm. A synopsis is special type of statistic that tracks the number of distinct values (NDV) for each column in a partition. Consider a synopsis as an internal management structure that samples distinct values.</p> <p>You can specify the following preferences:</p> <ul style="list-style-type: none"> • REPEAT OR HYPERLOGLOG This is the default. If INCREMENTAL is enabled on the table, then the database preserves the format of any existing synopses that use the adaptive sampling algorithm. However, the database creates any new synopses in HyperLogLog format. This approach is attractive when existing performance is acceptable, and you do not want to incur the performance cost of reformatting legacy content. • ADAPTIVE SAMPLING The database uses the adaptive sampling algorithm for all synopses. This is the most conservative option. • HYPERLOGLOG The database uses the HyperLogLog algorithm for all new and stale synopses. In contrast to adaptive sampling, the HyperLogLog algorithm uses a randomization technique. The advantages of HyperLogLog over adaptive sampling are: <ul style="list-style-type: none"> – The accuracy of the new algorithm is similar to the original algorithm. – The memory required is significantly lower, which typically leads to huge reductions in synopsis size.
AUTO_STAT_EXTENSIONS	<p>Controls the automatic creation of extensions when database statistics are gathered.</p> <p>You can set the following values:</p> <ul style="list-style-type: none"> • ON — When applicable, a SQL plan directive can trigger the creation of column group statistics based on usage of columns in the predicates in the workload. • OFF— The database does not create column group statistics automatically. The database creates them only when the CREATE_EXTENDED_STATS function is executed, or when extended statistics are specified explicitly in the METHOD_OPT clause of DBMS_STATS. This is the default.

Table 186-124 (Cont.) Global Statistics Preferences

Preference	Description
AUTO_TASK_STATUS	Enables or disables the high-frequency automatic optimizer statistics collection. Values are: <ul style="list-style-type: none">• ON — Enables high-frequency automatic optimizer statistics collection.• OFF — Disables high-frequency automatic optimizer statistics collection. This is the default.
AUTO_TASK_MAX_RUN_TIME	Configures the maximum run time in seconds of an execution of high-frequency automatic optimizer statistics collection. The maximum value is 3600 (equal to 1 hour), which is the default.
AUTO_TASK_INTERVAL	Specifies the interval in seconds between executions of high-frequency automatic optimizer statistics collection. The minimum value is 60. The default is 900 (equal to 15 minutes).
AUTOSTATS_TARGET	Controls the objects considered for statistics collection. It takes the following values: <ul style="list-style-type: none">• 'ALL' - Statistics collected for all objects in system• 'ORACLE' - Statistics collected for all Oracle owned objects• 'AUTO' - Oracle decides on which objects to collect statistics This preference is applicable only for automatic statistics collection.
CASCADE	Determines whether to collect index statistics as part of gathering table statistics.

Table 186-124 (Cont.) Global Statistics Preferences

Preference	Description
CONCURRENT	<p>Determines whether statistics are gathered concurrently on multiple objects, or serially, one object at a time. Valid values are:</p> <ul style="list-style-type: none"> • MANUAL — Concurrency is enabled only for manual statistics gathering. • AUTOMATIC — Concurrency is enabled only for the automatic statistics gathering. • ALL — Concurrency is enabled for both manual and automatic statistics gathering. • OFF — Concurrency is disabled for both manual and automatic statistics. <p>Note the following guidelines: The CONCURRENT preference determines whether statistics are gathered concurrently when the user issues GATHER_*_STATS procedures. DBMS_STATS can collect statistics for a single object in parallel based on the value of the DEGREE parameter. However, parallelism is limited to one object. The CONCURRENT preference extends the scope of parallelism to multiple database objects. This approach is primarily intended for multi-CPU systems, and may not be suitable for small databases on single-CPU computers. To gather statistics concurrently, Resource Manager must be enabled, and the setting for the JOB_QUEUE_PROCESSES initialization parameter must be at least 4.</p>
DEGREE	<p>Determines the degree of parallelism used for gathering statistics.</p>
ESTIMATE_PERCENT	<p>Determines the percentage of rows to sample. The valid range is between 0.000001 and 100. Use the constant DBMS_STATS.AUTO_SAMPLE_SIZE to enable the database to determine the appropriate sample size for optimal statistics. This is the default.</p>
GLOBAL_TEMP_TABLE_STATS	<p>Controls whether the statistics gathered for a global temporary table should be stored as shared statistics or session statistics. This preference takes two values:</p> <ul style="list-style-type: none"> • SHARED — All sessions see the same set of statistics • SESSION — Statistics gathered by the GATHER_TABLE_STATS procedure on a global temporary table are session-specific. Thus, the database only uses them for queries issued in the same session as the statistics gathering process. The database deletes session-specific statistics when a session terminates.

Table 186-124 (Cont.) Global Statistics Preferences

Preference	Description
GRANULARITY	<p>Determines the granularity of statistics to collect. This preference is only relevant for partitioned tables.</p> <p>The following values are valid:</p> <ul style="list-style-type: none"> • ALL — Gathers all statistics: subpartition, partition, and global. • AUTO — Determines the granularity based on the partitioning type. This is the default value. • DEFAULT — Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. Use GLOBAL AND PARTITION for this functionality. • GLOBAL — Gathers global statistics. • GLOBAL AND PARTITION — Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object. • PARTITION — Gathers partition-level statistics. • SUBPARTITION — Gathers subpartition-level statistics.
INCREMENTAL	<p>Determines whether the global statistics for a partitioned table are maintained without performing a full table scan.</p> <p>When a table is partitioned, an application typically loads data into a new partition. As new partitions are added and data is loaded, global table statistics must be kept up to date. If the following conditions are met, then the database updates the global table statistics by scanning only the changed partitions instead of the entire table:</p> <ul style="list-style-type: none"> • The INCREMENTAL value for the partitioned table is set to TRUE. • The PUBLISH value for the partitioned table is set to TRUE. • The user specifies AUTO_SAMPLE_SIZE for ESTIMATE_PERCENT and AUTO for GRANULARITY when gathering statistics on the table. <p>If the INCREMENTAL value for the partitioned table was set to FALSE (default value), then the database uses a full table scan to maintain the global statistics. This technique is a much more resource-intensive and time-consuming operation for large tables.</p>

Table 186-124 (Cont.) Global Statistics Preferences

Preference	Description
INCREMENTAL_LEVEL	<p>Controls which synopses to collect when INCREMENTAL preference is set to TRUE. It takes the following values:</p> <ul style="list-style-type: none"> • PARTITION — Gathers partition-level synopses. This is the default value. If PARTITION is set on a nonpartitioned table, then the database does not gather synopses. • TABLE — Gathers table-level synopses. Specify this value when you want to exchange this table with a partition. Before the exchange, you can run GATHER_TABLE_STATS on this table with INCREMENTAL set to TRUE and INCREMENTAL_LEVEL to TABLE. The result is that the database gathers table-level synopses on this table. After the exchange, the partition has synopses that come from the table-level synopses of the table before the exchange. You can only use preference value in the SET_TABLE_PREFS procedure: this value is not allowed in the other SET_*_PREFS procedures.

Table 186-124 (Cont.) Global Statistics Preferences

Preference	Description
INCREMENTAL_STALENESS	<p>Specifies when a partition or subpartition is considered stale. This parameter takes an enumeration of values, such as 'USE_STALE_PERCENT' and 'USE_LOCKED_STATS'. You can also specify multiple values, such as 'USE_STALE_PERCENT,USE_LOCKED_STATS,ALLOW_MIXED_FORMAT'.</p> <p>The parameter accepts the following values:</p> <ul style="list-style-type: none"> • USE_STALE_PERCENT—A partition or subpartition is not considered stale when DML changes are below the threshold set by the STALE_PERCENT preference. <p>For example, assume that STALE_PERCENT is 10. You specify USE_STALE_PERCENT for INCREMENTAL_STALENESS. The partition has 5% DML changes. The database does not regather statistics.</p> <p>Assume a different case in which STALE_PERCENT is 10. You specify USE_STALE_PERCENT for INCREMENTAL_STALENESS. However, in this case the partition is locked and has 20% of DML changes. Because the partition is locked, the database does not regather statistics.</p> • USE_LOCKED_STATS—Locked partitions or subpartitions statistics are never considered stale, regardless of DML changes. <p>For example, assume that STALE_PERCENT is 10. You specify 'USE_LOCKED_STATS, USE_STALE_PERCENT'. The partition, which is locked, has 20% DML changes. The partition is not considered stale. The database uses existing statistics to derive global statistics.</p> • ALLOW_MIXED_FORMAT—Adaptive sampling synopses and HyperLogLog synopses are permitted to coexist. • NULL—A partition or subpartition is considered stale when it has any DML changes. <p>For example, assume that STALE_PERCENT is 10. You specify the value 'NULL' for INCREMENTAL_STALENESS. The partition has 5% of DML changes. The database regathers statistics.</p>

Table 186-124 (Cont.) Global Statistics Preferences

Preference	Description
	<p>Note that the following two executions are different:</p> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', 'NULL');</pre> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', null);</pre> <p>The first execution uses single quotes to set the preference to the value NULL, whereas the second sets the preference to the default, which is ALLOW_MIXED_FORMAT.</p>
METHOD_OPT	<p>Controls column statistics collection and histogram creation. It accepts either of the following options, or both in combination:</p> <ul style="list-style-type: none"> • FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause] <p>size_clause is defined as size_clause := SIZE {integer REPEAT AUTO SKEWONLY}</p> <ul style="list-style-type: none"> - integer: Number of histogram buckets. Must be in the range [1,2048]. - REPEAT : Collects histograms only on the columns that already have histograms - AUTO : Oracle determines the columns on which to collect histograms based on data distribution and the workload of the columns - SKEWONLY : Oracle determines the columns on which to collect histograms based on the data distribution of the columns - column_name: name of a column - extension : can be either a column group in the format of (column_name, columne_name [, ...]) or an expression <p>The default is FOR ALL COLUMNS SIZE AUTO.</p>

Table 186-124 (Cont.) Global Statistics Preferences

Preference	Description
NO_INVALIDATE	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> • TRUE: Dependent cursors are not invalidated. • FALSE: Dependent cursors are marked for immediate invalidation. • AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>If set to TRUE, then the database not invalidate dependent cursors. If set to FALSE, then the procedure invalidates dependent cursors immediately.</p>
OPTIONS	<p>Determines the <code>options</code> parameter used in the <code>GATHER_TABLE_STATS</code> procedure. The preference takes the following values:</p> <ul style="list-style-type: none"> • GATHER — Gathers statistics for all objects in the table. This is the default. • GATHER AUTO — Oracle recommends using <code>GATHER AUTO</code> to gather necessary statistics, such as histograms, after a table has been bulk loaded and acquired online statistics. This is applicable only to tables that are not using <code>INCREMENTAL</code> statistics. <p>For partitioned tables using <code>INCREMENTAL</code> statistics, <code>GATHER_TABLE_STATS</code> with <code>GATHER AUTO</code> will gather statistics for a table if it is marked stale or has no statistics. In addition, statistics will be gathered for partitions and sub-partitions that are marked stale or have no statistics.</p> <p>For tables not using <code>INCREMENTAL</code> statistics, <code>GATHER_TABLE_STATS</code> with <code>GATHER AUTO</code> may gather statistics for partitions and sub-partitions, even if they are not marked stale.</p>
PREFERENCE_OVERRIDES_PARAMETER	<p>Determines whether to override the input value of a parameter with the preference value of that parameter for a statistics operation. Possible values are:</p> <ul style="list-style-type: none"> • TRUE — Ignores input parameter values, and uses the value of the corresponding preference. • FALSE — Obey input parameter values. <p>Specifying this preference does not change the order of precedence of table, global, and default.</p>

Table 186-124 (Cont.) Global Statistics Preferences

Preference	Description
PUBLISH	<p>Determines whether the database publishes newly gathered statistics after the gathering job completes.</p> <p>You can gather statistics without publishing them immediately. This technique enables you to test new statistics before publishing them.</p>
STALE_PERCENT	<p>Determines the percentage of rows in a table that must change before the statistics on that table are stale and need to be regathered.</p> <p>The valid domain for <code>stale_percent</code> is non-negative numbers. The default value is 10, which means that a table having more than 10% of changes is considered stale.</p>
STAT_CATEGORY	<p>Specifies which statistics to import or export, accepting multiple values separated by a comma. Values supported:</p> <ul style="list-style-type: none"> • <code>OBJECT_STATS</code> — table statistics, column statistics and index statistics (default) • <code>SYNOPSIS</code> — information to support incremental statistics • <code>REALTIME_STATS</code> — specifies only real-time statistics. <p>The value '<code>OBJECT_STATS, SYNOPSIS</code>' specifies table statistics, column statistics, index statistics, and synopses.</p>
TABLE_CACHED_BLOCKS	<p>Specifies the average number of blocks assumed to be cached in the buffer cache when calculating the index clustering factor. The preference applies only when gathering statistics using <code>DBMS_STATS</code>. Index statistics gathered during <code>CREATE INDEX</code> or <code>REBUILD INDEX</code> operations will use the default value 1.</p>
WAIT_TIME_TO_UPDATE_STATS	<p>Specifies the number of minutes before timing out for locks and pins required for updating statistics. It accepts values in the range 0 to 65535. The default value is 15 minutes. The value 0 gets the locks and pins in no-wait mode.</p>

Security Model

To run this procedure, you must have the `SYSDBA` or both `ANALYZE ANY DICTIONARY` and `ANALYZE ANY` system privilege.

Exceptions

ORA-20000: Insufficient privileges

ORA-20001: Invalid or illegal input values

Usage Notes

- This setting is honored only if there is no preference specified for the table to be analyzed.
- Both arguments are of type `VARCHAR2` and values are enclosed in quotes, even when they represent numbers.

Example 186-16 Overriding Statistics Preferences at the Global Level

You use the `SET_GLOBAL_PREFS` procedure to set the `ESTIMATE_PERCENT` preference to 5 for every table in the database that does not have a table preference set. Because `sh.costs` does not have a preference set, the global setting applies to this table.

```
SQL> EXEC DBMS_STATS.SET_GLOBAL_PREFS ('ESTIMATE_PERCENT', '5');
```

PL/SQL procedure successfully completed.

You use `SET_TABLE_PREFS` to set the `PREFERENCE_OVERRIDES_PARAMETER` preference to true for the `sh.sales` table only.

```
SQL> EXEC  
DBMS_STATS.SET_TABLE_PREFS('sh','sales','PREFERENCE_OVERRIDES_PARAMETER','TRUE');
```

PL/SQL procedure successfully completed.

A script attempts to set `ESTIMATE_PERCENT` to 10 when gathering statistics for `sh.sales`. However, because `PREFERENCE_OVERRIDES_PARAMETER` is `TRUE` for this table, and because a global preference is defined, Oracle Database gathers statistics using the global setting of 5 rather than the specified setting of 10:

```
SQL> EXEC DBMS_STATS.GATHER_TABLE_STATS ('sh', 'costs',  
ESTIMATE_PERCENT=>10);
```

PL/SQL procedure successfully completed.

Example 186-17 Configuring High-Frequency Automatic Optimizer Statistics Collection

Oracle Database 19c introduces high-frequency automatic optimizer statistics collection. This lightweight task periodically gathers statistics for stale objects. The default interval is 15 minutes. In contrast to the automated statistics collection job, the high-frequency task does not perform actions such as purging statistics for non-existent objects or invoking Optimizer Statistics Advisor.

In this example, you enable high-frequency collection, set its maximum run time to a half hour, and then set the frequency interval to 10 minutes:

```
EXEC DBMS_STATS.SET_GLOBAL_PREFS('AUTO_TASK_STATUS','ON');  
EXEC DBMS_STATS.SET_GLOBAL_PREFS('AUTO_TASK_MAX_RUN_TIME','1800');  
EXEC DBMS_STATS.SET_GLOBAL_PREFS('AUTO_TASK_INTERVAL','600');
```


**See Also:**

Oracle Database SQL Tuning Guide to learn how to set optimizer statistics preferences

186.7.116 SET_INDEX_STATS Procedures

These procedures set index-related statistics.

The version of this procedure that accepts `ext_stats` sets statistics for use with domain indexes. The statistics type specified is the type to store in the dictionary, in addition to the actual user-defined statistics. If this statistics type is null, then the database stores the statistics type associated with the index or column.

Syntax

```
DBMS_STATS.SET_INDEX_STATS (
  ownname      VARCHAR2,
  indname      VARCHAR2,
  partname     VARCHAR2  DEFAULT NULL,
  statab       VARCHAR2  DEFAULT NULL,
  statid       VARCHAR2  DEFAULT NULL,
  numrows      NUMBER    DEFAULT NULL,
  numblks      NUMBER    DEFAULT NULL,
  numdist      NUMBER    DEFAULT NULL,
  avgblk       NUMBER    DEFAULT NULL,
  avgdblk      NUMBER    DEFAULT NULL,
  clstfct      NUMBER    DEFAULT NULL,
  indlevel     NUMBER    DEFAULT NULL,
  flags        NUMBER    DEFAULT NULL,
  statown      VARCHAR2  DEFAULT NULL,
  no_invalidate BOOLEAN   DEFAULT to_no_invalidate_type(
                                get_param('NO_INVALIDATE')),
  guessq       NUMBER    DEFAULT NULL,
  cachedblk    NUMBER    DEFAULT NULL,
  cachehit     NUMBER    DEFAULT NULL,
  force        BOOLEAN   DEFAULT FALSE);
```

Use the following syntax for user-defined domain index statistics:

```
DBMS_STATS.SET_INDEX_STATS (
  ownname      VARCHAR2,
  indname      VARCHAR2,
  partname     VARCHAR2  DEFAULT NULL,
  statab       VARCHAR2  DEFAULT NULL,
  statid       VARCHAR2  DEFAULT NULL,
  ext_stats    RAW,
  stattydown   VARCHAR2  DEFAULT NULL,
  stattyname   VARCHAR2  DEFAULT NULL,
  statown      VARCHAR2  DEFAULT NULL,
  no_invalidate BOOLEAN   DEFAULT to_no_invalidate_type(
```

```

                                get_param('NO_INVALIDATE')),
force          BOOLEAN  DEFAULT FALSE);

```

Parameters

Table 186-125 SET_INDEX_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema
indname	Name of the index
partname	Name of the index partition in which to store the statistics. If the index is partitioned and if <code>partname</code> is <code>NULL</code> , then the statistics are stored at the global index level.
stattab	User statistics table identifier describing where to store the statistics. If <code>stattab</code> is <code>NULL</code> , then the statistics are stored directly in the dictionary.
statid	Identifier (optional) to associate with these statistics within <code>stattab</code> (Only pertinent if <code>stattab</code> is not <code>NULL</code>)
ext_stats	User-defined statistics
stattypown	Schema of the statistics type
stattypname	Name of the statistics type
numrows	Number of rows in the index (partition)
numlblks	Number of leaf blocks in the index (partition)
numdist	Number of distinct keys in the index (partition)
avglblk	Average integral number of leaf blocks in which each distinct key appears for this index (partition). If not provided, then this value is derived from <code>numlblks</code> and <code>numdist</code> .
avgdblks	Average integral number of data blocks in the table pointed to by a distinct key for this index (partition). If not provided, then this value is derived from <code>clstfct</code> and <code>numdist</code> .
clstfct	See <code>clustering_factor</code> column of the <code>all_indexes</code> view for a description
indlevel	Height of the index (partition)
flags	For internal Oracle use (should be left as <code>NULL</code>)
statown	Schema containing <code>stattab</code> (if different than <code>ownname</code>)
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> • <code>TRUE</code>: Dependent cursors are not invalidated. • <code>FALSE</code>: Dependent cursors are marked for immediate invalidation. • <code>AUTO</code>: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
guessq	Guess quality. See the <code>pct_direct_access</code> column of the <code>all_indexes</code> view for a description.

Table 186-125 (Cont.) SET_INDEX_STATS Procedure Parameters

Parameter	Description
cachedblk	Internal use only. Do not set.
cachehit	Internal use only. Do not set.
force	Sets the values even if statistics of the index are locked

Security Model

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid input value

ORA-20005: Object statistics are locked

Usage Notes

- The Optimizer uses the cached data to estimate number of cached blocks for index or statistics table access. The total cost of the operation will be combined from the I/O cost of reading not cached blocks from disk, the CPU cost of getting cached blocks from the buffer cache, and the CPU cost of processing the data.
- Oracle maintains `cachedblk` and `cachehit` at all times but uses correspondent caching statistics for optimization as part of the table and index statistics only when the user calls `DBMS_STATS.GATHER_[TABLE/INDEX/SCHEMA/DATABASE]_STATS` procedure for auto mode or `DBMS_STATS.GATHER_SYSTEM_STATS` for manual mode. In order to prevent the user from utilizing inaccurate and unreliable data, the optimizer will compute a 'confidence factor' for each `cachehit` and a `cachedblk` for each object. If the 'confidence factor' for the value meets confidence criteria, this value will be used, otherwise the defaults will be used.
- The automatic maintenance algorithm for object caching statistics assumes that there is only one major workload for the system and adjusts statistics to this workload, ignoring other "minor" workloads. If this is not the case, you must use manual mode for maintaining object caching statistics.
- The object caching statistics maintenance algorithm for auto mode prevents you from using statistics in the following situations
 - When not enough data has been analyzed, such as when an object has been recently create
 - When the system does not have one major workload resulting in averages not corresponding to real values.



See Also:

Oracle Database SQL Tuning Guide to learn how to set artificial statistics

186.7.117 SET_PARAM Procedure

This deprecated procedure sets default values for parameters of DBMS_STATS procedures.



Note:

This subprogram has been replaced by improved technology and is maintained only for purposes of backward compatibility. In this case, use the [SET_GLOBAL_PREFS Procedure](#).

See also [DBMS_STATS Deprecated Subprograms](#).

You can use the `GET_PARAM` Function to get the current default value of a parameter.

Syntax

```
DBMS_STATS.SET_PARAM (
    pname      IN   VARCHAR2,
    pval       IN   VARCHAR2);
```

Parameters

Table 186-126 SET_PARAM Procedure Parameters

Parameter	Description
pname	<p>The parameter name The default value for following parameters can be set.</p> <ul style="list-style-type: none"> CASCADE - The default value for CASCADE set by SET_PARAM is not used by export/import procedures.It is used only by gather procedures. DEGREE ESTIMATE_PERCENT METHOD_OPT NO_INVALIDATE GRANULARITY AUTOSTATS_TARGET - This parameter is applicable only for auto statistics collection. The value of this parameter controls the objects considered for statistics collection (see pval)
pval	<p>The parameter value. If NULL is specified, it will set the default value determined by Oracle. When pname is AUTOSTATS_TARGET, the following are valid values:</p> <ul style="list-style-type: none"> 'ALL' - Statistics are collected for all objects in the system 'ORACLE' - Statistics are collected for all Oracle owned objects 'AUTO' - Oracle decides for which objects to collect statistics

Usage Notes

- To run this procedure, you must have the SYSDBA or both the ANALYZE ANY DICTIONARY and ANALYZE ANY system privileges.
- Note that both arguments are of type VARCHAR2 and the values need to be enclosed in quotes even when they represent numbers.
- Note also the difference between NULL and 'NULL':
 - When NULL is unquoted, this sets the parameter to the value Oracle recommends.
 - In the case of the quoted 'NULL', this sets the value of the parameter to NULL.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or illegal input value

Examples

```
DBMS_STATS.SET_PARAM('CASCADE', 'DBMS_STATS.AUTO_CASCADE');  
DBMS_STATS.SET_PARAM('ESTIMATE_PERCENT', '5');  
DBMS_STATS.SET_PARAM('DEGREE', 'NULL');
```

186.7.118 SET_PROCESSING_RATE Procedure

This procedure sets the value of rate of processing for a given operation.

Syntax

```
DBMS_STATS.SET_PROCESSING_RATE (  
  opname      IN   VARCHAR2,  
  procrate    IN   NUMBER);
```

Parameters

Table 186-127 SET_PROCESSING_RATE Procedure Parameters

Parameter	Description
opname	Name of the operation. Valid values are as follows: <ul style="list-style-type: none"> • AGGR • ALL • CPU • CPU_ACCESS • CPU_AGGR • CPU_BYTES_PER_SEC • CPU_FILTER • CPU_GBY • CPU_HASH_JOIN • CPU_JOIN • CPU_NL_JOIN • CPU_RANDOM_ACCESS • CPU_SEQUENTIAL_ACCESS • CPU_SM_JOIN • CPU_SORT • HASH • IO • IO_ACCESS • IO_BYTES_PER_SEC • IO_RANDOM_ACCESS • IO_SEQUENTIAL_ACCESS • MEMCMP • MEMCPY
procrate	Processing rate.

Security Model

You must have the `OPTIMIZER_PROCESSING_RATE` role to run this procedure.

Usage Notes

`AUTO DOP` uses processing rates to determine the optimal degree of parallelism for a SQL statement.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or illegal input value

186.7.119 SET_SCHEMA_PREFS Procedure

This procedure sets the statistics preferences of all tables owned by the specified user.

Syntax

```
DBMS_STATS.SET_SCHEMA_PREFS (
    ownname IN VARCHAR2,
    pname   IN VARCHAR2,
    pvalue  IN VARCHAR2);
```

Parameters

Table 186-128 SET_SCHEMA_PREFS Procedure Parameters

Parameter	Description
ownname	Owner name
pname	Preference name. You can set the default value for the following preferences: <ul style="list-style-type: none"> • AUTO_STAT_EXTENSIONS • CASCADE • DEGREE • ESTIMATE_PERCENT • GLOBAL_TEMP_TABLE_STATS • GRANULARITY • INCREMENTAL • INCREMENTAL_LEVEL • INCREMENTAL_STALENESS • METHOD_OPT • NO_INVALIDATE • OPTIONS • PREFERENCE_OVERRIDES_PARAMETER • PUBLISH • STALE_PERCENT • TABLE_CACHED_BLOCKS
pvalue	Preference value. If NULL is specified, it sets the database default value.

Table 186-129 Statistics Preferences

Preference	Description
AUTO_STAT_EXTENSIONS	<p>Specifies the synopsis generation algorithm. A synopsis is special type of statistic that tracks the number of distinct values (NDV) for each column in a partition. You can consider a synopsis as an internal management structure that samples distinct values.</p> <p>You can set the following preferences:</p> <ul style="list-style-type: none"> • REPEAT OR HYPERLOGLOG This is the default. If INCREMENTAL is enabled on the table, then the database preserves the format of any existing synopses that use the adaptive sampling algorithm. However, the database creates any new synopses in HyperLogLog format. This approach is attractive when existing performance is acceptable, and you do not want to incur the performance cost of reformatting legacy content. • ADAPTIVE SAMPLING The database uses the adaptive sampling algorithm for all synopses. This is the most conservative option. • HYPERLOGLOG The database uses the HyperLogLog algorithm for all new and stale synopses. In contrast to adaptive sampling, the HyperLogLog algorithm uses a randomization technique. The advantages of HyperLogLog over adaptive sampling are: <ul style="list-style-type: none"> – The accuracy of the new algorithm is similar to the original algorithm. – The memory required is significantly lower, which typically leads to huge reductions in synopsis size.
CASCADE	Determines whether index statistics are collected as part of gathering table statistics.
DEGREE	Determines degree of parallelism used for gathering statistics.
ESTIMATE_PERCENT	Determines the percentage of rows to estimate. The valid range is [0.000001,100]. Use the constant DBMS_STATS.AUTO_SAMPLE_SIZE to have Oracle determine the appropriate sample size for good statistics. This is the default.
GLOBAL_TEMP_TABLE_STATS	<p>This preference takes the following values:</p> <ul style="list-style-type: none"> • SHARED - All sessions see the same set of statistics • SESSION - Statistics gathered by the GATHER_TABLE_STATS Procedure on a global temporary table are session specific, and hence are only going to be used by the queries issued in the same session as the statistics gathering process. Session-specific statistics are deleted when a session is ended.

Table 186-129 (Cont.) Statistics Preferences

Preference	Description
GRANULARITY	<p>Determines the granularity of statistics to collect (only pertinent if the table is partitioned). Possible values are:</p> <p>'ALL' - Gathers all (subpartition, partition, and global) statistics</p> <p>'AUTO' - Determines the granularity based on the partitioning type. This is the default value.</p> <p>'DEFAULT' - gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. You should use the 'GLOBAL AND PARTITION' for this functionality. Note that the default value is now 'AUTO'.</p> <p>'GLOBAL' - Gathers global statistics</p> <p>'GLOBAL AND PARTITION' - gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object.</p> <p>'PARTITION' - gathers partition-level statistics</p> <p>'SUBPARTITION' - gathers subpartition-level statistics.</p>
INCREMENTAL	<p>Determines whether the global statistics of a partitioned table will be maintained without doing a full table scan. With partitioned tables it is very common to load new data into a new partition. As new partitions are added and data loaded, the global table statistics need to be kept up to date. Oracle will update the global table statistics by scanning only the partitions that have been changed instead of the entire table if the following conditions hold:</p> <ul style="list-style-type: none"> • INCREMENTAL value for the partitioned table is set to TRUE • PUBLISH value for the partitioned table is set to TRUE; • User specifies AUTO_SAMPLE_SIZE for ESTIMATE_PERCENT and AUTO for GRANULARITY when gathering statistics on the table <p>If the INCREMENTAL value for the partitioned table was set to FALSE (default value), a full table scan is used to maintain the global statistics which is a much more resource intensive and time-consuming operation for large tables.</p>

Table 186-129 (Cont.) Statistics Preferences

Preference	Description
INCREMENTAL_LEVEL	<p>Controls which synopses to collect when INCREMENTAL preference is set to TRUE. It takes two values:</p> <ul style="list-style-type: none">• TABLE - table level synopses are gathered. This is used when you want to exchange this table with a partition. You can run <code>GATHER_TABLE_STATS</code> on this table with <code>INCREMENTAL</code> to <code>TRUE</code> and <code>INCREMENTAL_LEVEL</code> to <code>TABLE</code> before the exchange. The result is that table level synopses are gathered on this table (currently Oracle supports only table level synopses on non-predestined tables). Once the exchange occurs, the partition will have synopses which come from the table level synopses of the table before exchange. This preference value can be only used in the SET_TABLE_PREFS Procedure. It is not allowed in the <code>SET_GLOBAL/DATABASE/SCHEMA_PREFS</code> procedures.• PARTITION - partition level synopses are gathered. This is the default value. If <code>PARTITION</code> is set on a non partitioned table, no synopses are gathered.

Table 186-129 (Cont.) Statistics Preferences

Preference	Description
INCREMENTAL_STALENESS	<p>Specifies when a partition or subpartition is considered stale. This parameter takes an enumeration of values, such as 'USE_STALE_PERCENT' and 'USE_LOCKED_STATS'. You can also specify multiple values, such as 'USE_STALE_PERCENT, USE_LOCKED_STATS, ALLOW_MIXED_FORMAT'.</p> <p>The parameter accepts the following values:</p> <ul style="list-style-type: none"> • USE_STALE_PERCENT—A partition or subpartition is not considered stale when DML changes are below the threshold set by the STALE_PERCENT preference. For example, assume that STALE_PERCENT is 10. You specify USE_STALE_PERCENT for INCREMENTAL_STALENESS. The partition has 5% DML changes. The database does not regather statistics. Assume a different case in which STALE_PERCENT is 10. You specify USE_STALE_PERCENT for INCREMENTAL_STALENESS. However, in this case the partition is locked and has 20% of DML changes. Because the partition is locked, the database does not regather statistics. • USE_LOCKED_STATS—Locked partitions or subpartitions statistics are never considered stale, regardless of DML changes. Assume that STALE_PERCENT is 10. You specify 'USE_LOCKED_STATS, USE_STALE_PERCENT'. The partition, which is locked, has 20% DML changes. The partition is not considered stale. The database uses existing statistics to derive global statistics. • ALLOW_MIXED_FORMAT—Partitions with synopses in adaptive sampling format are not considered stale, even when the APPROXIMATE_NDV_ALGORITHM preference is set to HYPERLOGLOG. The database uses existing synopses to derive global NDV. This is the default setting. • NULL—A partition or subpartition is considered stale when it has any DML changes. For example, assume that STALE_PERCENT is 10. You specify the value 'NULL' for INCREMENTAL_STALENESS. The partition has 5% of DML changes. The database regathers statistics. <p>Note that the following two executions are different:</p> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', 'NULL'); EXEC DBMS_STATS.SET_TABLE_PREFS</pre>

Table 186-129 (Cont.) Statistics Preferences

Preference	Description
	<pre>('sh', 'sales', 'INCREMENTAL_STALENESS', null);</pre>
METHOD_OPT	<p>The first execution uses single quotes to set the preference to the value NULL, whereas the second sets the preference to the default, which is ALLOW_MIXED_FORMAT.</p> <p>Controls column statistics collection and histogram creation. It accepts either of the following options, or both in combination:</p> <ul style="list-style-type: none"> • FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause] <p>size_clause is defined as size_clause := SIZE {integer REPEAT AUTO SKEWONLY}</p> <ul style="list-style-type: none"> - integer: Number of histogram buckets. Must be in the range [1,2048]. - REPEAT : Collects histograms only on the columns that already have histograms - AUTO : Oracle determines the columns on which to collect histograms based on data distribution and the workload of the columns - SKEWONLY : Oracle determines the columns on which to collect histograms based on the data distribution of the columns - column_name : name of a column - extension : can be either a column group in the format of (column_name, column_name [, ...]) or an expression <p>The default is FOR ALL COLUMNS SIZE AUTO.</p>
NO_INVALIDATE	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> • TRUE: Dependent cursors are not invalidated. • FALSE: Dependent cursors are marked for immediate invalidation. • AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>

Table 186-129 (Cont.) Statistics Preferences

Preference	Description
OPTIONS	<p>Determines the <code>options</code> parameter used in the <code>GATHER_TABLE_STATS</code> procedure. The preference takes the following values:</p> <ul style="list-style-type: none"> • <code>GATHER</code> — Gathers statistics for all objects in the table. This is the default. • <code>GATHER AUTO</code> — Oracle recommends using <code>GATHER AUTO</code> to gather necessary statistics, such as histograms, after a table has been bulk loaded and acquired online statistics. This is applicable only to tables that are not using <code>INCREMENTAL</code> statistics. <p>For partitioned tables using <code>INCREMENTAL</code> statistics, <code>GATHER_TABLE_STATS</code> with <code>GATHER AUTO</code> will gather statistics for a table if it is marked stale or has no statistics. In addition, statistics will be gathered for partitions and sub-partitions that are marked stale or have no statistics.</p> <p>For tables not using <code>INCREMENTAL</code> statistics, <code>GATHER_TABLE_STATS</code> with <code>GATHER AUTO</code> may gather statistics for partitions and sub-partitions, even if they are not marked stale.</p>
PREFERENCE_OVERRIDES_PARAMETER	<p>Determines whether to override the input value of a parameter with the preference value of that parameter for a statistics operation. Possible values are:</p> <ul style="list-style-type: none"> • <code>TRUE</code> — Ignores input parameter values, and uses the value of the corresponding preference. • <code>FALSE</code> — Obeys input parameter values. <p>Specifying this preference does not change the order of precedence of table, global, and default.</p>
PUBLISH	<p>Determines whether newly gathered statistics will be published after the statistics gathering job completes. In releases before Oracle Database 11g Release 1 (11.1), when a statistic gathering job completed, the new statistics were automatically published in the dictionary tables. In subsequent releases, you can gather statistics without publishing them immediately. Thus, you can test new statistics before publishing them.</p>
STALE_PERCENT	<p>Determines the percentage of rows in a table that have to change before the statistics on that table are deemed stale and should be regathered. The valid domain for <code>stale_percent</code> is non-negative numbers. The default value is 10%. Note that if you set <code>stale_percent</code> to zero the <code>AUTO STATS</code> gathering job will gather statistics for this table every time a row in the table is modified.</p>
TABLE_CACHED_BLOCKS	<p>Specifies the average number of blocks assumed to be cached in the buffer cache when calculating the index clustering factor. The preference applies only when gathering statistics using <code>DBMS_STATS</code>. Index statistics gathered during <code>CREATE INDEX</code> or <code>REBUILD INDEX</code> operations will use the default value 1.</p>

Security Model

To run this procedure, you must be the schema owner, or have the SYSDBA privilege, or have the ANALYZE ANY system privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or illegal input value

Usage Notes

Both arguments are of type VARCHAR2 and values are enclosed in quotes, even when they represent numbers.

Examples

```
DBMS_STATS.SET_SCHEMA_PREFS('SH','CASCADE','DBMS_STATS.AUTO_CASCADE');
DBMS_STATS.SET_SCHEMA_PREFS('SH','ESTIMATE_PERCENT','9');
DBMS_STATS.SET_SCHEMA_PREFS('SH','DEGREE','99');
```



See Also:

Oracle Database SQL Tuning Guide to learn how to set optimizer statistics preferences

186.7.120 SET_SYSTEM_STATS Procedure

This procedure sets systems statistics.

Syntax

```
DBMS_STATS.SET_SYSTEM_STATS (
  pname          VARCHAR2,
  pvalue         NUMBER,
  statab        IN  VARCHAR2 DEFAULT NULL,
  statid        IN  VARCHAR2 DEFAULT NULL,
  statown       IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 186-130 SET_SYSTEM_STATS Procedure Parameters

Parameter	Description
pname	The parameter name to get, which can have one of the following values: <ul style="list-style-type: none"> iotfrspeed—I/O transfer speed in bytes for each millisecond ioseektim - Seek time + latency time + operating system overhead time, in milliseconds sreadtim - Average time to read single block (random read), in milliseconds mreadtim - Average time to read an mbrc block at once (sequential read), in milliseconds cpuspeed - Average number of CPU cycles for each second, in millions, captured for the workload (statistics collected using 'INTERVAL' or 'START' and 'STOP' options) cpuspeednw - Average number of CPU cycles for each second, in millions, captured for the no-workload (statistics collected using 'NOWORKLOAD' option. mbrc - Average multiblock read count for sequential read, in blocks maxthr - Maximum I/O system throughput, in bytes/second slavethr - Average slave I/O throughput, in bytes/second
pvalue	Parameter value to get
stattab	Identifier of the user statistics table where the statistics will be obtained. If stattab is null, the statistics will be obtained from the dictionary.
statid	Optional identifier associated with the statistics saved in the stattab
statown	Schema containing stattab (if different from current schema)

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid input value

ORA-20002: Bad user statistics table; may need to be upgraded

ORA-20003: Unable to set system statistics

ORA-20004: Parameter does not exist

Usage Notes

To run this procedure, you need the GATHER_SYSTEM_STATISTICS role.

186.7.121 SET_TABLE_PREFS Procedure

This procedure sets the statistics preferences of the specified table in the specified schema.

Syntax

```
DBMS_STATS.SET_TABLE_PREFS (  
    ownname    IN  VARCHAR2,  
    tablename  IN  VARCHAR2,  
    pname      IN  VARCHAR2,  
    pvalue     IN  VARCHAR2);
```

Parameters

Table 186-131 SET_TABLE_PREFS Procedure Parameters

Parameter	Description
ownname	Owner name
tablename	Table name
pname	Preference name. You can set the default value for following preferences: <ul style="list-style-type: none">• APPROXIMATE_NDV_ALGORITHM• AUTO_STAT_EXTENSIONS• CASCADE• DEGREE• ESTIMATE_PERCENT• GRANULARITY• INCREMENTAL• INCREMENTAL_LEVEL• INCREMENTAL_STALENESS• METHOD_OPT• NO_INVALIDATE• OPTIONS• PREFERENCE_OVERRIDES_PARAMETER• PUBLISH• STALE_PERCENT• TABLE_CACHED_BLOCKS
pvalue	Preference value. If NULL is specified, it will set the Oracle default value.

Table 186-132 Statistics Preferences

Preference	Description
APPROXIMATE_NDV_ALGORITHM	<p>Specifies the synopsis generation algorithm. A synopsis is special type of statistic that tracks the number of distinct values (NDV) for each column in a partition. Consider a synopsis as an internal management structure that samples distinct values.</p> <p>You can specify the following preferences:</p> <ul style="list-style-type: none"> • REPEAT OR HYPERLOGLOG This is the default. If INCREMENTAL is enabled on the table, then the database preserves the format of any existing synopses that use the adaptive sampling algorithm. However, the database creates any new synopses in HyperLogLog format. This approach is attractive when existing performance is acceptable, and you do not want to incur the performance cost of reformatting legacy content. • ADAPTIVE SAMPLING The database uses the adaptive sampling algorithm for all synopses. This is the most conservative option. • HYPERLOGLOG The database uses the HyperLogLog algorithm for all new and stale synopses. In contrast to adaptive sampling, the HyperLogLog algorithm uses a randomization technique. The advantages of HyperLogLog over adaptive sampling are: <ul style="list-style-type: none"> – The accuracy of the new algorithm is similar to the original algorithm. – The memory required is significantly lower, which typically leads to huge reductions in synopsis size.
AUTO_STAT_EXTENSIONS	<p>Controls the automatic creation of extensions when database statistics are gathered.</p> <p>You can set the following values:</p> <ul style="list-style-type: none"> • ON — When applicable, a SQL plan directive can trigger the creation of column group statistics based on usage of columns in the predicates in the workload. • OFF— The database does not create column group statistics automatically. The database creates them only when the CREATE_EXTENDED_STATS function is executed, or when extended statistics are specified explicitly in the METHOD_OPT clause of DBMS_STATS. This is the default.
CASCADE	<p>Determines whether to collect index statistics as part of gathering table statistics.</p>

Table 186-132 (Cont.) Statistics Preferences

Preference	Description
CONCURRENT	<p>This preference determines whether statistics will be gathered concurrently on multiple objects, or serially, one object at a time:</p> <ul style="list-style-type: none">'MANUAL' - Concurrency will be turned on only for manual statistics gathering.'AUTOMATIC': Concurrency will be turned on only for the automatic statistics gathering.'ALL': Concurrency will be turned on for both manual and automatic statistics gathering.'OFF': Concurrency will be turned off for both manual and automatic statistics
DEGREE	<p>Determines degree of parallelism used for gathering statistics.</p>
ESTIMATE_PERCENT	<p>Determines the percentage of rows to estimate. The valid range is [0.000001,100]. Use the constant DBMS_STATS.AUTO_SAMPLE_SIZE to have Oracle determine the appropriate sample size for good statistics. This is the default.</p>
GLOBAL_TEMP_TABLE_STATS	<p>This controls whether the statistics gathered for a global temporary table should be stored as shared statistics or session statistics. It takes two values:</p> <ul style="list-style-type: none">SHARED - All sessions see the same set of statisticsSESSION - Statistics gathered by the GATHER_TABLE_STATS Procedure on a global temporary table are session specific, and hence are only going to be used by the queries issued in the same session as the statistics gathering process. Session-specific statistics are deleted when a session is ended.

Table 186-132 (Cont.) Statistics Preferences

Preference	Description
GRANULARITY	<p>Determines granularity of statistics to collect (only pertinent if the table is partitioned).</p> <p>'ALL' - Gathers all (subpartition, partition, and global) statistics</p> <p>'AUTO' - Determines the granularity based on the partitioning type. This is the default value.</p> <p>'DEFAULT' - Gathers global and partition-level statistics. This option is obsolete, and while currently supported, it is included in the documentation for legacy reasons only. You should use the 'GLOBAL AND PARTITION' for this functionality. Note that the default value is now 'AUTO'.</p> <p>'GLOBAL' - Gathers global statistics</p> <p>'GLOBAL AND PARTITION' - Gathers the global and partition level statistics. No subpartition level statistics are gathered even if it is a composite partitioned object.</p> <p>'PARTITION' - Gathers partition-level statistics</p> <p>'SUBPARTITION' - Gathers subpartition-level statistics.</p>
INCREMENTAL	<p>Determines whether or not the global statistics of a partitioned table will be maintained without doing a full table scan. With partitioned tables it is very common to load new data into a new partition. As new partitions are added and data loaded, the global table statistics need to be kept up to date. Oracle will update the global table statistics by scanning only the partitions that have been changed instead of the entire table if the following conditions hold:</p> <ul style="list-style-type: none"> • INCREMENTAL value for the partitioned table is set to TRUE; • PUBLISH value for the partitioned table is set to TRUE; • User specifies AUTO_SAMPLE_SIZE for ESTIMATE_PERCENT and AUTO for GRANULARITY when gathering statistics on the table. <p>If the INCREMENTAL value for the partitioned table was set to FALSE (default value), a full table scan is used to maintain the global statistics which is a much more resource intensive and time-consuming operation for large tables.</p>

Table 186-132 (Cont.) Statistics Preferences

Preference	Description
INCREMENTAL_LEVEL	<p>This value controls what synopses to collect when INCREMENTAL preference is set to TRUE It takes two values:</p> <ul style="list-style-type: none">• TABLE - table level synopses are gathered. This is used when you want to exchange this table with a partition. You can run GATHER_TABLE_STATS on this table with INCREMENTAL to TRUE and INCREMENTAL_LEVEL to TABLE before the exchange. The result is that table level synopses are gathered on this table (currently Oracle supports only table level synopses on non-predestined tables). Once the exchange occurs, the partition will have synopses which come from the table level synopses of the table before exchange. This preference value can be only used in the SET_TABLE_PREFS Procedure. It is not allowed in the SET_GLOBAL/DATABASE/SCHEMA_PREFS procedures.• PARTITION - partition level synopses are gathered. This is the default value. If PARTITION is set on a non partitioned table, no synopses are gathered.

Table 186-132 (Cont.) Statistics Preferences

Preference	Description
INCREMENTAL_STALENESS	<p>Specifies when a partition or subpartition is considered stale. This parameter takes an enumeration of values, such as 'USE_STALE_PERCENT' and 'USE_LOCKED_STATS'. You can also specify multiple values, such as 'USE_STALE_PERCENT,USE_LOCKED_STATS,ALLOW_MIXED_FORMAT'.</p> <p>The parameter accepts the following values:</p> <ul style="list-style-type: none"> • USE_STALE_PERCENT—A partition or subpartition is not considered stale when DML changes are below the threshold set by the STALE_PERCENT preference. For example, assume that STALE_PERCENT is 10. You specify USE_STALE_PERCENT for INCREMENTAL_STALENESS. The partition has 5% DML changes. The database does not regather statistics. Assume a different case in which STALE_PERCENT is 10. You specify USE_STALE_PERCENT for INCREMENTAL_STALENESS. However, in this case the partition is locked and has 20% of DML changes. Because the partition is locked, the database does not regather statistics. • USE_LOCKED_STATS—Locked partitions or subpartitions statistics are never considered stale, regardless of DML changes. For example, assume that STALE_PERCENT is 10. You specify 'USE_LOCKED_STATS, USE_STALE_PERCENT'. The partition, which is locked, has 20% DML changes. The partition is not considered stale. The database uses existing statistics to derive global statistics. • ALLOW_MIXED_FORMAT—Adaptive sampling synopses and HyperLogLog synopses are permitted to coexist. • NULL—A partition or subpartition is considered stale when it has any DML changes. For example, assume that STALE_PERCENT is 10. You specify the value 'NULL' for INCREMENTAL_STALENESS. The partition has 5% of DML changes. The database regathers statistics.

Table 186-132 (Cont.) Statistics Preferences

Preference	Description
	<p>Note that the following two executions are different:</p> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', 'NULL');</pre> <pre>EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'sales', 'INCREMENTAL_STALENESS', null);</pre> <p>The first execution uses single quotes to set the preference to the value NULL, whereas the second sets the preference to the default, which is ALLOW_MIXED_FORMAT.</p>
METHOD_OPT	<p>The value controls column statistics collection and histogram creation. It accepts either of the following options, or both in combination:</p> <ul style="list-style-type: none"> • FOR ALL [INDEXED HIDDEN] COLUMNS [size_clause] <p>size_clause is defined as size_clause := SIZE {integer REPEAT AUTO SKEWONLY}</p> <ul style="list-style-type: none"> - integer: Number of histogram buckets. Must be in the range [1,2048]. - REPEAT: Collects histograms only on the columns that already have histograms - AUTO: Oracle determines the columns on which to collect histograms based on data distribution and the workload of the columns - SKEWONLY: Oracle determines the columns on which to collect histograms based on the data distribution of the columns - column_name: name of a column - extension: can be either a column group in the format of (column_name, column_name [, ...]) or an expression <p>The default is FOR ALL COLUMNS SIZE AUTO.</p>

Table 186-132 (Cont.) Statistics Preferences

Preference	Description
NO_INVALIDATE	<p>Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values:</p> <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. <p>You can change the default using the SET_DATABASE_PREFS Procedure, SET_GLOBAL_PREFS Procedure, SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure.</p>
OPTIONS	<p>Determines the <code>options</code> parameter used in the <code>GATHER_TABLE_STATS</code> procedure. The preference takes the following values:</p> <ul style="list-style-type: none"> GATHER — Gathers statistics for all objects in the table. This is the default. GATHER AUTO — Oracle recommends using GATHER AUTO to gather necessary statistics, such as histograms, after a table has been bulk loaded and acquired online statistics. This is applicable only to tables that are not using INCREMENTAL statistics. <p>For partitioned tables using INCREMENTAL statistics, GATHER_TABLE_STATS with GATHER AUTO will gather statistics for a table if it is marked stale or has no statistics. In addition, statistics will be gathered for partitions and sub-partitions that are marked stale or have no statistics.</p> <p>For tables not using INCREMENTAL statistics, GATHER_TABLE_STATS with GATHER AUTO may gather statistics for partitions and sub-partitions, even if they are not marked stale.</p>
PREFERENCE_OVERRIDES_PARAMETER	<p>Determines whether to override the input value of a parameter with the preference value of that parameter for a statistics operation. Possible values are:</p> <ul style="list-style-type: none"> TRUE — Ignores input parameter values, and uses the value of the corresponding preference. FALSE — Obeys input parameter values. <p>Specifying this preference does not change the order of precedence of table, global, and default.</p>

Table 186-132 (Cont.) Statistics Preferences

Preference	Description
PUBLISH	Determines whether the database publishes newly gathered statistics after the gathering job completes. You can gather statistics without publishing them immediately. This technique enables you to test new statistics before publishing them.
STALE_PERCENT	Determines the percentage of rows in a table that must change before the statistics on that table are stale and need to be regathered. The valid domain for <code>stale_percent</code> is non-negative numbers. The default value is 10, which means that a table having more than 10% of changes is considered stale.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid or illegal input values

Usage Notes

- To run this procedure, you must connect as owner of the table or have the `ANALYZE ANY` system privilege.
- All arguments are of type `VARCHAR2` and values are enclosed in quotes, even when they represent numbers.

Examples

```
DBMS_STATS.SET_TABLE_PREFS('SH', 'SALES', 'CASCADE', 'DBMS_STATS.AUTO_CASCADE');
DBMS_STATS.SET_TABLE_PREFS('SH', 'SALES', 'ESTIMATE_PERCENT', '9');
DBMS_STATS.SET_TABLE_PREFS('SH', 'SALES', 'DEGREE', '99');
```

Example 186-18 Overriding Statistics Preferences

In this example, legacy scripts set `ESTIMATE_PERCENT` explicitly rather than using the recommended `AUTO_SAMPLE_SIZE`. Your goal is to prevent users from using these scripts to set preferences on the `sh.costs` table.

No preference for `ESTIMATE_PERCENT` is set for `sh.costs` or at the global level, so the preference defaults to `AUTO_SAMPLE_SIZE`:

```
SELECT DBMS_STATS.GET_PREFS ('ESTIMATE_PERCENT', 'sh','costs') AS
"STAT_PREFS" FROM DUAL;
```

```
STAT_PREFS
-----
DBMS_STATS.AUTO_SAMPLE_SIZE
```


By default, Oracle Database accepts preferences that are passed to the statistics gathering procedures. To override these parameters, use `SET_TABLE_PREFS` to set the `PREFERENCE_OVERRIDES_PARAMETER` preference to `TRUE` for the `costs` table only:

```
EXEC DBMS_STATS.SET_TABLE_PREFS ('sh', 'costs',
'PREFERENCE_OVERRIDES_PARAMETER', 'TRUE');
```

A user-created script attempts to set `estimate_percent` to 100 when gathering statistics for `sh.costs`.

```
EXEC DBMS_STATS.GATHER_TABLE_STATS('sh', 'costs',
ESTIMATE_PERCENT=>100);
```

However, because `PREFERENCE_OVERRIDES_PARAMETER` is `TRUE` for this table, Oracle Database gathers statistics using `AUTO_SAMPLE_SIZE`, which is the default, rather than the specified value of 100.

See Also:

Oracle Database SQL Tuning Guide to learn how to set optimizer statistics preferences

186.7.122 SET_TABLE_STATS Procedure

This procedure creates artificial table statistics for testing purposes.

Syntax

```
DBMS_STATS.SET_TABLE_STATS (
  ownname          VARCHAR2,
  tabname          VARCHAR2,
  partname         VARCHAR2 DEFAULT NULL,
  statab           VARCHAR2 DEFAULT NULL,
  statid           VARCHAR2 DEFAULT NULL,
  numrows          NUMBER   DEFAULT NULL,
  numblks          NUMBER   DEFAULT NULL,
  avgrlen          NUMBER   DEFAULT NULL,
  flags            NUMBER   DEFAULT NULL,
  statown          VARCHAR2 DEFAULT NULL,
  no_invalidate    BOOLEAN   DEFAULT to_no_invalidate_type (
                                get_param('NO_INVALIDATE')),
  cachedblk        NUMBER   DEFAULT NULL,
  cachehit         NUMBER   DEFAULT NULL,
  force            BOOLEAN   DEFAULT FALSE,
  im_imcu_count    NUMBER   DEFAULT NULL,
  im_block_count  NUMBER   DEFAULT NULL,
  scanrate         NUMBER   DEFAULT NULL);
```

Parameters

Table 186-133 SET_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
tablename	Name of the table.
partname	Name of the table partition in which to store the statistics. If the table is partitioned and <code>partname</code> is NULL, then the statistics are stored at the global table level.
stattab	Table in which to store the statistics. If <code>stattab</code> is NULL, then the database stores the statistics in the data dictionary.
statid	Identifier (optional) to associate with these statistics within <code>stattab</code> . This identifier is only relevant if <code>stattab</code> is not NULL.
numrows	Number of rows in the table or partition.
numblks	Number of blocks that the table or partition occupies.
avgrlen	Average row length for the table or partition.
flags	For internal use only. Do not set.
statown	Schema containing <code>stattab</code> (if different than <code>ownname</code>).
no_invalidate	Controls the invalidation of dependent cursors when statistics are gathered. The parameter takes the following values: <ul style="list-style-type: none"> TRUE: Dependent cursors are not invalidated. FALSE: Dependent cursors are marked for immediate invalidation. AUTO: This is the default value. Rolling invalidation is used to invalidate all dependent cursors over a period of time. The performance impact on the database is reduced especially in cases where a large number of cursors are invalidated. You can change the default using the SET_DATABASE_PREFS Procedure , SET_GLOBAL_PREFS Procedure , SET_SCHEMA_PREFS Procedure and SET_TABLE_PREFS Procedure .
cachedblk	For internal use only. Do not set.
cachehit	For internal use only. Do not set.
force	A flag that determines the behavior when statistics are locked. If TRUE, then the procedure sets the values even if the table statistics are locked. By default, the setting is FALSE.
im_imcu_count	The number of In-Memory Compression Units (IMCUs) in the table or partition.
im_block_count	The number of In-Memory blocks in the table or partition.
scanrate	The rate, in MB/s, at which the database scans external tables. This parameter is relevant only for external tables.

Security Model

To invoke this procedure you must be owner of the table, or have the `ANALYZE ANY` privilege. For objects owned by `SYS`, you must be either the owner of the table, or have the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Invalid input value

ORA-20002: Bad user statistics table; may need to upgrade it

ORA-20005: Object statistics are locked

Usage Notes

For testing purposes, you can manually create artificial statistics for a table, index, or the system using the `DBMS_STATS.SET_*_STATS` procedures. These procedures insert the artificial statistics into the data dictionary directly (when `stattab` is null) or into a user-created table.

Note:

The `DBMS_STATS.SET_*_STATS` procedures are intended for development testing only. Do not use them in a production database. If you set statistics in the data dictionary, then Oracle Database considers the set statistics as the “real” statistics, which means that statistics gathering jobs may not re-gather artificial statistics when they do not meet the criteria for staleness.

The most typical use cases for the `DBMS_STATS.SET_*_STATS` procedures are showing how execution plans change as the numbers of rows or blocks in a table change, or creating realistic statistics for temporary tables.

- The optimizer uses the cached data to estimate number of cached blocks for index or statistics table access. The database calculates the total cost of the operation by combining the I/O cost of reading not cached blocks from disk, the CPU cost of getting cached blocks from the buffer cache, and the CPU cost of processing the data.
- The database maintains `cachedblk` and `cachehit` at all times. However, the database uses the corresponding caching statistics for optimization as part of the table and index statistics only when the user calls the `DBMS_STATS.GATHER_[TABLE/INDEX/SCHEMA/DATABASE]_STATS` procedure for automatic mode or `DBMS_STATS.GATHER_SYSTEM_STATS` for manual mode. To prevent the user from utilizing inaccurate and unreliable data, the optimizer computes a “confidence factor” for each `cachehit` and a `cachedblk` for each object. If the confidence factor for the value meets confidence criteria, then the database uses this value; otherwise, the database uses defaults.
- The automatic maintenance algorithm for object caching statistics assumes that only one major database workload exists. The algorithm adjusts statistics to this workload, ignoring other “minor” workloads. If this assumption is false, then you must use manual mode for maintaining object caching statistics.
- The object caching statistics maintenance algorithm for automatic mode prevents you from using statistics in the following situations:
 - When not enough data has been analyzed, such as when an object has been recently created

- When the database does not have one major workload, resulting in averages that do not correspond to real values



See Also:

Oracle Database SQL Tuning Guide to learn how to set artificial statistics

186.7.123 SHOW_EXTENDED_STATS_NAME Function

This function returns the name of the statistics entry that is created for the user-specified extension. It raises an error if no extension has been created.

Syntax

```
DBMS_STATS.SHOW_EXTENDED_STATS_NAME (
    ownname    VARCHAR2,
    tabname    VARCHAR2,
    extension  VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 186-134 SHOW_EXTENDED_STATS_NAME Function Parameters

Parameter	Description
ownname	Owner name of a table
tabname	Name of the table
extension	Can be either a column group or an expression. Suppose the specified table has two column <i>c1</i> , <i>c2</i> . An example column group can be "(<i>c1</i> , <i>c2</i>)" and an example expression can be "(<i>c1</i> + <i>c2</i>)".

Exceptions

ORA-20000: Object does not exist or insufficient privileges

ORA-20001: Error when processing extension

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.124 TRANSFER_STATS Procedure

This procedure transfers statistics for specified table(s) from a remote database specified by `dblink` to the local database.

The statistics at the source database are retained. It likewise transfers statistics-related structures such as synopses and DML monitoring information.

Syntax

```
DBMS_STATS.TRANSFER_STATS (
  ownname      IN      VARCHAR2,
  tablename    IN      VARCHAR2,
  dblink       IN      VARCHAR2,  options      IN      NUMBER DEFAULT NULL);
```

Parameters**Table 186-135 TRANSFER_STATS Procedure Parameters**

Parameter	Description
ownname	Owner name of a table. If NULL all schemas in the database. If NULL, the procedure will transfer global preferences as well.
tablename	Name of the table. If NULL, all tables in OWNNAME.
dblink	Database link name
options	By default the procedure does not transfer the global preferences. Specifying ADD_GLOBAL_PREFS copies global preferences.

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.125 UNLOCK_PARTITION_STATS Procedure

This procedure enables the user to unlock statistics for a partition.

Syntax

```
DBMS_STATS.UNLOCK_PARTITION_STATS (
  ownname      VARCHAR2,
  tablename    VARCHAR2,
  partname     VARCHAR2);
```

Parameters**Table 186-136 UNLOCK_PARTITION_STATS Procedure Parameters**

Parameter	Description
ownname	Name of the schema to unlock
tablename	Name of the table
partname	[Sub]Partition name

Usage Notes

To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.

186.7.126 UNLOCK_SCHEMA_STATS Procedure

This procedure unlocks the statistics on all the tables in schema.

Syntax

```
DBMS_STATS.UNLOCK_SCHEMA_STATS (  
    ownname    VARCHAR2);
```

Parameters

Table 186-137 UNLOCK_SCHEMA_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema

Usage Notes

- To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.
- When statistics on a table is locked, all the statistics depending on the table, including table statistics, column statistics, histograms and statistics on all dependent indexes, are considered to be locked.
- The `SET_*`, `DELETE_*`, `IMPORT_*`, `GATHER_*` procedures that modify statistics in the dictionary of an individual table, index or column will raise an error if statistics of the object is locked.
- Procedures that operates on multiple objects (such as `GATHER_SCHEMA_STATS`) will skip modifying the statistics of an object if it is locked. Many procedures have force argument to override the lock.
- Neither the [UNLOCK_SCHEMA_STATS Procedure](#) nor the [UNLOCK_TABLE_STATS Procedure](#) is designed to unlock statistics of corresponding partitions. When you invoke the [LOCK_TABLE_STATS Procedure](#), it sets the statistics lock bit at the table level. In that case, you cannot gather statistics on dependent objects such as partitions and indexes. By the same token, if table statistics are locked, the dependents are locked and you do not need to explicitly invoke the [LOCK_PARTITION_STATS Procedure](#).

186.7.127 UNLOCK_TABLE_STATS Procedure

This procedure unlocks the statistics on the table.

Syntax

```
DBMS_STATS.UNLOCK_TABLE_STATS (  
    ownname    VARCHAR2,  
    tabname    VARCHAR2);
```

Parameters

Table 186-138 UNLOCK_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema
tabname	Name of the table

Usage Notes

- To invoke this procedure you must be owner of the table, or you need the `ANALYZE ANY` privilege. For objects owned by `SYS`, you need to be either the owner of the table, or you need the `ANALYZE ANY DICTIONARY` privilege or the `SYSDBA` privilege.
- When statistics on a table is locked, all the statistics depending on the table, including table statistics, column statistics, histograms and statistics on all dependent indexes, are considered to be locked.
- The `SET_*`, `DELETE_*`, `IMPORT_*`, `GATHER_*` procedures that modify statistics in the dictionary of an individual table, index or column will raise an error if statistics of the object is locked.
- Procedures that operates on multiple objects (such as `GATHER_SCHEMA_STATS`) will skip modifying the statistics of an object if it is locked. Many procedures have force argument to override the lock.
- Neither the [UNLOCK_SCHEMA_STATS Procedure](#) nor the [UNLOCK_TABLE_STATS Procedure](#) is designed to unlock statistics of corresponding partitions. When you invoke the [LOCK_TABLE_STATS Procedure](#), it sets the statistics lock bit at the table level. In that case, you cannot gather statistics on dependent objects such as partitions and indexes. By the same token, if table statistics are locked, the dependents are locked and you do not need to explicitly invoke the [LOCK_PARTITION_STATS Procedure](#).

186.7.128 UPGRADE_STAT_TABLE Procedure

This procedure upgrades a user statistics table from an older version.

Syntax

```
DBMS_STATS.UPGRADE_STAT_TABLE (
    ownname    VARCHAR2,
    stattab    VARCHAR2);
```

Parameters

Table 186-139 UPGRADE_STAT_TABLE Procedure Parameters

Parameter	Description
ownname	Name of the schema
stattab	Name of the table

Exceptions

ORA-20000: Unable to upgrade table

Usage Notes

To invoke this procedure you need the privileges to drop and create a table.

DBMS_STORAGE_MAP

With the `DBMS_STORAGE_MAP` package, you can communicate with the Oracle background process FMON to invoke mapping operations that populate mapping views. FMON communicates with operating and storage system vendor-supplied mapping libraries.

This chapter contains the following topics:

- [Overview](#)
- [Operational Notes](#)
- [Summary of DBMS_STORAGE_MAP Subprograms](#)

187.1 DBMS_STORAGE_MAP Overview

This terminology and descriptions will help you understand the `DBMS_STORAGE_MAP` API.

- Mapping libraries

Mapping libraries help you map the components of I/O processing stack elements. Examples of I/O processing components include files, logical volumes, and storage array I/O targets. The mapping libraries are identified in `filemap.ora`.

- Mapping files

A mapping file is a mapping structure that describes a file. It provides a set of attributes, including file size, number of extents that the file is composed of, and file type.

- Mapping elements and sub-elements

A mapping element is the abstract mapping structure that describes a storage component within the I/O stack. Examples of elements include mirrors, stripes, partitions, raid5, concatenated elements, and disks—structures that are the mapping building blocks. A mapping sub-element describes the link between an element and the next elements in the I/O mapping stack

- Mapping file extents

A mapping file extent describes a contiguous chunk of blocks residing on one element. This includes the device offset, the extent size, the file offset, the type (data or parity), and the name of the element where the extent resides. In the case of a raw device or volume, the file is composed of only one file extent component. A mapping file extent is different from Oracle extents.

See Also:

- *Oracle Database Administrator's Guide* for more information
- *Oracle Database Reference* for `V$MAP` views, including `V$MAP_FILE`, `V$MAP_ELEMENT`, `V$MAP_SUBELEMENT`, `V$MAP_FILE_EXTENT`

187.2 DBMS_STORAGE_MAP Operational Notes

Invoking the `MAP_ELEMENT`, `MAP_FILE`, and `MAP_ALL` functions when mapping information already exists will refresh the mapping, if configuration IDs are supported. If configuration IDs are not supported, invoking these functions again will rebuild the mapping.

See Also:

Oracle Database Administrator's Guide for a discussion of the configuration ID, an attribute of the element or file that is changed.

187.3 Summary of DBMS_STORAGE_MAP Subprograms

This table lists the `DBMS_STORAGE_MAP` subprograms and briefly describes them.

Table 187-1 DBMS_STORAGE_MAP Package Subprograms

Subprogram	Description
DROP_ALL Function	Drops all mapping information in the shared memory of the instance
DROP_ELEMENT Function	Drops the mapping information for the element defined by <code>elemname</code>
DROP_FILE Function	Drops the file mapping information defined by <code>filename</code>
LOCK_MAP Procedure	Locks the mapping information in the shared memory of the instance
MAP_ALL Function	Builds the entire mapping information for all types of Oracle files (except archive logs), including all directed acyclic graph (DAG) elements
MAP_ELEMENT Function	Builds mapping information for the element identified by <code>elemname</code>
MAP_FILE Function	Builds mapping information for the file identified by <code>filename</code>
MAP_OBJECT Function	Builds the mapping information for the Oracle object identified by the object name, owner, and type
RESTORE Function	Loads the entire mapping information from the data dictionary into the shared memory of the instance
SAVE Function	Saves information needed to regenerate the entire mapping into the data dictionary
UNLOCK_MAP Procedure	Unlocks the mapping information in the shared memory of the instance.

187.3.1 DROP_ALL Function

This function drops all mapping information in the shared memory of the instance.

Syntax

```
DBMS_STORAGE_MAP.DROP_ALL(
    dictionary_update IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 187-2 DROP_ALL Function Parameters

Parameter	Description
dictionary_update	If TRUE, mapping information in the data dictionary is updated to reflect the changes. The default value is TRUE; dictionary_update is an overloaded argument.

187.3.2 DROP_ELEMENT Function

This function drops the mapping information for the element defined by `elemname`.

Syntax

```
DBMS_STORAGE_MAP.DROP_ELEMENT(
    elemname          IN VARCHAR2,
    cascade           IN BOOLEAN,
    dictionary_update IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 187-3 DROP_ELEMENT Function Parameters

Parameter	Description
elemname	The element for which mapping information is dropped.
cascade	If TRUE, then DROP_ELEMENT is invoked recursively on all elements of the DAG defined by elemname, if possible.
dictionary_update	If TRUE, mapping information in the data dictionary is updated to reflect the changes. The default value is TRUE; dictionary_update is an overloaded argument.

187.3.3 DROP_FILE Function

This function drops the file mapping information defined by `filename`.

Syntax

```
DBMS_STORAGE_MAP.DROP_FILE(
    filename          IN VARCHAR2,
    cascade           IN BOOLEAN,
    dictionary_update IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 187-4 DROP_FILE Function Parameters

Parameter	Description
filename	The file for which file mapping information is dropped.
cascade	If TRUE, then the mapping DAGs for the elements where the file resides are also dropped, if possible.
dictionary_update	If TRUE, mapping information in the data dictionary is updated to reflect the changes. The default value is TRUE; dictionary_update is an overloaded argument.

187.3.4 LOCK_MAP Procedure

This procedure locks the mapping information in the shared memory of the instance.

This is useful when you need a consistent snapshot of the V\$MAP tables. Without locking the mapping information, V\$MAP_ELEMENT and V\$MAP_SUBELEMENT, for example, may be inconsistent.

Syntax

```
DBMS_STORAGE_MAP.LOCK_MAP;
```

187.3.5 MAP_ALL Function

This function builds the entire mapping information for all types of Oracle files (except archive logs), including all directed acyclic graph (DAG) elements. It obtains the latest mapping information because it explicitly synchronizes all mapping libraries.

Syntax

```
DBMS_STORAGE_MAP.MAP_ALL(  
    max_num_fileext IN NUMBER DEFAULT 100,  
    dictionary_update IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 187-5 MAP_ALL Function Parameters

Parameter	Description
max_num_fileext	Defines the maximum number of file extents to be mapped. This limits the amount of memory used when mapping file extents. The default value is 100; max_num_fileextent is an overloaded argument.
dictionary_update	If TRUE, mapping information in the data dictionary is updated to reflect the changes. The default value is TRUE; dictionary_update is an overloaded argument.

Usage Notes

You must explicitly call `MAP_ALL` in a cold startup scenario.

187.3.6 MAP_ELEMENT Function

This function builds mapping information for the element identified by `elemname`. It may not obtain the latest mapping information if the element being mapped, or any one of the elements within its I/O stack (if `cascade` is `TRUE`), is owned by a library that must be explicitly synchronized.

Syntax

```
DBMS_STORAGE_MAP.MAP_ELEMENT (
  elemname          IN VARCHAR2,
  cascade           IN BOOLEAN,
  dictionary_update IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 187-6 MAP_ELEMENT Function Parameters

Parameter	Description
<code>elemname</code>	The element for which mapping information is built.
<code>cascade</code>	If <code>TRUE</code> , all elements within the <code>elemname</code> I/O stack DAG are mapped.
<code>dictionary_update</code>	If <code>TRUE</code> , mapping information in the data dictionary is updated to reflect the changes. The default value is <code>TRUE</code> ; <code>dictionary_update</code> is an overloaded argument.

187.3.7 MAP_FILE Function

This function builds mapping information for the file identified by `filename`. Use this function if the mapping of one particular file has changed. The Oracle database server does not have to rebuild the entire mapping.

Syntax

```
DBMS_STORAGE_MAP.MAP_FILE (
  filename          IN VARCHAR2,
  filetype          IN VARCHAR2,
  cascade           IN BOOLEAN,
  max_num_fileextent IN NUMBER DEFAULT 100,
  dictionary_update IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 187-7 MAP_FILE Function Parameters

Parameter	Description
<code>filename</code>	The file for which mapping information is built.

Table 187-7 (Cont.) MAP_FILE Function Parameters

Parameter	Description
filetype	Defines the type of the file to be mapped. It can be "DATAFILE", "SPFILE", "TEMPFILE", "CONTROLFILE", "LOGFILE", or "ARCHIVEFILE".
cascade	Should be TRUE only if a storage reconfiguration occurred. For all other instances, such as file resizing (either through an ALTER SYSTEM command or DML operations on extended files), cascade can be set to FALSE because the mapping changes are limited to the file extents only. If TRUE, mapping DAGs are also built for the elements where the file resides.
max_num_fileextent	Defines the maximum number of file extents to be mapped. This limits the amount of memory used when mapping file extents. The default value is 100; max_num_fileextent is an overloaded argument.
dictionary_update	If TRUE, mapping information in the data dictionary is updated to reflect the changes. The default value is TRUE; dictionary_update is an overloaded argument.

Usage Notes

This function may not obtain the latest mapping information if the file being mapped, or any one of the elements within its I/O stack (if cascade is TRUE), is owned by a library that must be explicitly synchronized.

187.3.8 MAP_OBJECT Function

This function builds the mapping information for the Oracle object identified by the object name, owner, and type.

Syntax

```
DBMS_STORAGE_MAP.MAP_OBJECT(
  objname IN VARCHAR2,
  owner   IN VARCHAR2,
  objtype IN VARCHAR2);
```

Parameters

Table 187-8 MAP_OBJECT Function Parameters

Parameter	Description
objname	The name of the object.
owner	The owner of the object.
objtype	The type of the object.

187.3.9 RESTORE Function

This function loads the entire mapping information from the data dictionary into the shared memory of the instance.

You can invoke `RESTORE` only after a `SAVE` operation. You must explicitly call `RESTORE` in a warm startup scenario.

Syntax

```
DBMS_STORAGE_MAP.RESTORE;
```

187.3.10 SAVE Function

This function saves information needed to regenerate the entire mapping into the data dictionary.

Syntax

```
DBMS_STORAGE_MAP.SAVE;
```

187.3.11 UNLOCK_MAP Procedure

This procedure unlocks the mapping information in the shared memory of the instance.

Syntax

```
DBMS_STORAGE_MAP.UNLOCK_MAP;
```

DBMS_SYNC_REFRESH

The `DBMS_SYNC_REFRESH` package provides an interface to perform a synchronous refresh of materialized views.

See Also:

Oracle Database Data Warehousing Guide for more information on using `DBMS_SYNC_REFRESH`

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_SYNC_REFRESH Subprograms](#)

188.1 DBMS_SYNC_REFRESH Overview

Synchronous refresh is a refresh method introduced in Oracle Database Release 12c, which enables you to keep a set of tables and the materialized views defined on them to be always in sync.

See Also:

Oracle Database Data Warehousing Guide for more information about using synchronous refresh

188.2 DBMS_SYNC_REFRESH Security Model

The execute privilege for this package is granted to `PUBLIC`, so all users can execute the procedures in this package to perform synchronous refresh on objects owned by them. The database administrator can perform synchronous refresh operations on all tables and materialized views in the database.

In general, if a user without the `DBA` privilege wants to use synchronous refresh on another user's table, he must complete privileges to read from and write to that table, that is, the user must have the `SELECT` or `READ`, `INSERT`, `UPDATE`, and `DELETE` privileges on that table or materialized view. A couple of exceptions are:

- `PURGE_REFRESH_STATS` and `ALTER_REFRESH_STATS_RETENTION` Functions

These two functions implement the purge policy and can be used to change the default retention period. These functions can be only be executed by the database administrator.

- The `CAN_SYNCREF_TABLE` Function
This is an advisory function which examines the eligibility for sync refresh of all the materialized views associated with a specified table. Hence, this function requires the `SELECT` or `READ` privilege on all materialized views associated with the specified table.

188.3 Summary of DBMS_SYNC_REFRESH Subprograms

This table lists and briefly describes the `DBMS_SYNC_REFRESH` package subprograms.

Table 188-1 DBMS_SYNC_REFRESH Package Subprograms

Subprogram	Description
ABORT_REFRESH Procedure	Aborts a refresh.
ALTER_REFRESH_STATS_RETENTION Procedure	Alters the refresh history retention value, specified in days.
CAN_SYNCREF_TABLE Procedure	Advises on whether a table and its dependent materialized views are eligible for synchronous refresh.
EXECUTE_REFRESH Procedure	Executes synchronous refresh on the synchronous refresh groups.
GET_ALL_GROUP_IDS Function	Returns the group IDs of all the synchronous refresh groups in the database.
GET_GROUP_ID Function	Returns the group ID of a table or materialized view.
GET_GROUP_ID_LIST Function	Returns the group IDs of the tables in a given list of objects (tables or materialized views).
PREPARE_REFRESH Procedure	Prepares the sync refresh groups for refresh.
PREPARE_STAGING_LOG Procedure	Validates and collects statistics on the data in the staging log.
PURGE_REFRESH_STATS Procedure	Purges the refresh history of sync refreshes that took place within a time specified by a timestamp parameter.
REGISTER_MVIEWS	Registers materialized views for synchronous refresh.
REGISTER_PARTITION_OPERATION Procedure	Registers a partition maintenance operation on a partition of a base table.
UNREGISTER_MVIEWS	Unregisters materialized views from synchronous refresh.
UNREGISTER_PARTITION_OPERATION Procedure	Unregisters a partition maintenance operation on a partition of a base table.

188.3.1 ABORT_REFRESH Procedure

This procedure undoes all the changes made by `PREPARE_REFRESH` or `EXECUTE_REFRESH` for the specified sync refresh groups. It helps you to recover to a state where the tables and materialized views are usable and consistent in case they encounter unexpected errors.

This procedure is overloaded.

Syntax

```
DBMS_SYNC_REFRESH.ABORT_REFRESH (
    group_id      IN NUMBER);

DBMS_SYNC_REFRESH.ABORT_REFRESH (
    group_id_list IN DBMS_UTILITY.NUMBER_ARRAY);
```

Parameters**Table 188-2 ABORT_REFRESH Procedure Parameters**

Parameter	Description
group_id	The group ID of a sync refresh group.
group_id_list	An array of group IDs of the sync refresh groups to be aborted for sync refresh.

Usage Notes

If called after `PREPARE_REFRESH`, this procedure drops the outside tables created by it and unlocks the tables and materialized views in the sync refresh group.

If called after `EXECUTE_REFRESH` fails, this procedure restores the state of tables to before `EXECUTE_REFRESH` by undoing any partition exchanges which successfully finished.

This procedure releases the locks placed on the tables in the sync refresh group which were placed on them by the `PREPARE_REFRESH` procedure. See "[PREPARE_REFRESH Procedure](#)" for a description of these locks.

`ABORT_REFRESH` will work only if a `PREPARE_REFRESH` or `EXECUTE_REFRESH` statement has failed. It cannot be used after successful runs of those commands, and throws an error in such cases.

188.3.2 ALTER_REFRESH_STATS_RETENTION Procedure

This procedure alters the refresh history retention value, specified in days. It is intended for use in conjunction with `PURGE_REFRESH_HISTORY`. It also requires the `SYSDBA` privilege in addition to the privilege to execute it.

Syntax

```
DBMS_SYNC_REFRESH.ALTER_REFRESH_STATS_RETENTION (
    retention    IN NUMBER);
```

Parameters

Table 188-3 ALTER_REFRESH_STATS_RETENTION Procedure Parameters

Parameter	Description
retention	<p>The retention time in days. The refresh history will be retained for at least these many number of days. The valid range is 1 to 365,000.</p> <p>You can use the following values for special purposes:</p> <ul style="list-style-type: none"> • -1 - Refresh history is never purged by PREPARE_REFRESH. • 0 - Old refresh history is never saved. PREPARE_REFRESH will delete all refresh history. • NULL - Change refresh history retention to default value.

188.3.3 CAN_SYNCREF_TABLE Procedure

This procedure advises on whether a table and its dependent materialized views are eligible for sync refresh. It provides an explanation of its analysis. If not eligible, you can examine the reasons and take appropriate action if possible.

This procedure lists all of the table's dependent materialized views and whether they qualify for sync refresh. Note that a materialized view may qualify for sync refresh even though the base table may not.

The eligibility rules for materialized views for synchronous refresh are discussed in detail in *Oracle Database Data Warehousing Guide*.

You can invoke `CAN_SYNCREF_TABLE` in two ways. The first is to use a table, while the second is to create a VARRAY.

Syntax

```
DBMS_SYNC_REFRESH.CAN_SYNCREF_TABLE (
    schema_name    IN VARCHAR2,
    table_name     IN VARCHAR2,
    statement_id   IN VARCHAR2);

DBMS_SYNC_REFRESH.CAN_SYNCREF_TABLE (
    schema_name    IN VARCHAR2,
    table_name     IN VARCHAR2,
    output_array   IN OUT Sys.CanSyncRefTypeArray);
```

Note that only one of `statement_id` or `output_array` need be provided to `CAN_SYNCREF_TABLE`.

Parameters

Table 188-4 CAN_SYNCREF_TABLE Procedure Parameters

Parameter	Description
schema_name	The name of the schema of the base table.
table_name	The name of the base table.

Table 188-4 (Cont.) CAN_SYNCREF_TABLE Procedure Parameters

Parameter	Description
statement_id	A string (VARCHAR2 (30)) to identify the rows pertaining to an invocation of CAN_SYNCREF_TABLE when the output is directed to a table named SYNCREF_TABLE in the user's schema.
output_array	The output array into which CAN_SYNCREF_TABLE records the information on the eligibility of the base table and its dependent materialized views for synchronous refresh.

Using SYNCREF_TABLE

The output of CAN_SYNCREF_TABLE can be directed to a table named SYNCREF_TABLE. The user is responsible for creating the SYNCREF_TABLE; it can be dropped when it is no longer needed. Its structure is as follows:

```
CREATE TABLE SYNCREF_TABLE (
  statement_id  VARCHAR2(30),
  schema_name  VARCHAR2(30),
  table_name   VARCHAR2(30),
  mv_schema_name VARCHAR2(30),
  mv_name      VARCHAR2(30),
  eligible     VARCHAR2(1),
  seq_num      NUMBER,
  msg_number   NUMBER,
  message      VARCHAR2(4000));
```

Using a VARRAY

You can save the output of CAN_SYNCREF_TABLE in a PL/SQL VARRAY. The elements of this array are of type CanSyncRefMessage, which is predefined in the SYS schema, as shown in the following:

```
TYPE CanSyncRefMessage IS OBJECT (
  schema_name  VARCHAR2(30),
  table_name   VARCHAR2(30),
  mv_schema_name VARCHAR2(30),
  mv_name      VARCHAR2(30),
  eligible     VARCHAR2(1),
  seq_num      NUMBER,
  msg_number   NUMBER,
  message      VARCHAR2(4000));
```

The array type CanSyncRefArrayType, which is a varray of CanSyncRefMessage objects, is predefined in the SYS schema as follows:

```
TYPE CanSyncRefArrayType AS VARRAY(256) OF CanSyncRefMessage;
```

Each CanSyncRefMessage record provides a message concerning the eligibility of the base table or a dependent materialized view for synchronous refresh. The semantics of the fields is the same as that of the corresponding fields in the SYNCREF_TABLE. However, the SYNCREF_TABLE has a statement_id field which is absent in CanSyncRefMessage because no statement_id is supplied (because it is not required) when CAN_SYNCREF_TABLE is called with a VARRAY parameter.

188.3.4 EXECUTE_REFRESH Procedure

This procedure executes sync refresh on the sync refresh groups prepared by `DBMS_SYNC_REFRESH.PREPARE_REFRESH`. These groups are identified by their group IDs.

Note this procedure will only perform the refresh on those materialized views that have been registered for synch refresh; any other materialized views will become stale once this procedure completes.

For more information on how to monitor the status of the two synchronous refresh operations, `PREPARE_REFRESH` and `EXECUTE_REFRESH` and how to troubleshoot errors that might occur using the information in the catalog views, refer to "Trouble-Shooting Synchronous Refresh Operations" in *Oracle Database Data Warehousing Guide*.

This procedure is overloaded.

Syntax

```
DBMS_SYNC_REFRESH.EXECUTE_REFRESH (
    group_id    IN NUMBER);

DBMS_SYNC_REFRESH.EXECUTE_REFRESH (
    group_id_list  IN DBMS_UTILITY.NUMBER_ARRAY);
```

Parameters

Table 188-5 EXECUTE_REFRESH Procedure Parameters

Parameter	Description
<code>group_id</code>	The group ID of a sync refresh group.
<code>group_id_list</code>	An array of group IDs of the sync refresh groups to be executed for sync refresh.

Usage Notes

This procedure also releases the locks placed on the tables in the sync refresh group that were placed on them by the `PREPARE_REFRESH` procedure. See "[PREPARE_REFRESH Procedure](#)" for a description of these locks and *Oracle Database Reference* for information regarding the status of the refresh operation after `DBMS_SYNC_REFRESH.EXECUTE_REFRESH`.

188.3.5 GET_ALL_GROUP_IDS Function

This function returns the group IDs of all the sync refresh groups in the database.

Syntax

```
FUNCTION DBMS_SYNC_REFRESH.GET_ALL_GROUP_IDS
    RETURN DBMS_UTILITY.NUMBER_ARRAY;
```

Parameters

Table 188-6 GET_ALL_GROUP_IDS Function Parameter

Parameter	Description
<code>get_all_group_ids</code>	Returns the group IDs of all the sync refresh groups in the database.

188.3.6 GET_GROUP_ID Function

This function returns the group ID of a materialized view. The group ID identifies the sync refresh group the table belongs to. A sync refresh group is a group of related tables and their dependent materialized views which must be all refreshed together jointly to ensure consistency and correctness.

Syntax

```
DBMS_SYNC_REFRESH.GET_GROUP_ID (
    object_name_list IN VARCHAR2)
RETURN DBMS_UTILITY.NUMBER_ARRAY;
```

Parameters

Table 188-7 GET_GROUP_ID Function Parameter

Parameter	Description
<code>object_name_list</code>	The name of the materialized view. The name can be schema-qualified.

188.3.7 GET_GROUP_ID_LIST Function

This function returns the group IDs of the tables in a given list of objects (materialized views).

Syntax

```
DBMS_SYNC_REFRESH.GET_GROUP_ID_LIST (
    object_name_list IN VARCHAR2)
RETURN DBMS_UTILITY.NUMBER_ARRAY;
```

Parameters

Table 188-8 GET_GROUP_ID_LIST Function Parameter

Parameter	Description
<code>object_name_list</code>	A comma-separated list of object names (materialized views). Each name can be schema-qualified.

188.3.8 PREPARE_REFRESH Procedure

This procedure prepares for refresh the sync refresh groups identified by the group ID in the input.

A sync refresh group consists of a set of related tables and all materialized views dependent on those base tables. Note this procedure will only prepare for refresh those dependent materialized views that have been registered for synchronous refresh.

For more information on how to monitor the status of the two synchronous refresh operations, `PREPARE_REFRESH` and `EXECUTE_REFRESH` and how to troubleshoot errors that might occur using the information in the catalog views, refer to "Trouble-Shooting Synchronous Refresh Operations" in *Oracle Database Data Warehousing Guide*.

Syntax

```
DBMS_SYNC_REFRESH.PREPARE_REFRESH (
    group_id IN NUMBER)
RETURN DBMS_UTILITY.NUMBER_ARRAY;
```

Parameters

Table 188-9 PREPARE_REFRESH Procedure Parameters

Parameter	Description
<code>group_id</code>	The group ID of the sync refresh group to be prepared for sync refresh.

Usage Notes

This procedure plans the three phases of the sync refresh operation and executes the steps associated with the prepare phase itself. These steps include identifying the partitions of the fact tables and materialized views that have been changed, and computing their new values as a result of the changes. The new values of the partitions are stored in tables called outside tables that are exchanged into their corresponding partitions at the time of the `EXECUTE_REFRESH`.

Before running this procedure, the user must run `PREPARE_STAGING_LOG` on all tables in the group. This is required even for staging logs that do not have changes in them. The user must also register any partition operations on the tables in the group using the `REGISTER_PARTITION_OPERATION`.

One of the side effects of this procedure is that the tables being prepared are locked in this sense: the staging logs of the tables will be locked to prevent any DMLs from occurring and the registration of partition operations will be disabled. These locks will be in effect until you issue an `EXECUTE_REFRESH` statement. Alternatively, you can issue an `ABORT_REFRESH` operation to release these locks. Another side effect of this procedure is that it purges from the catalog records of earlier sync refresh operations; if they are older than the retention period, they are purged.

The degree of parallelism of the prepare refresh job is inherited from the session parameters which you can control with an `ALTER SESSION` statement.

The group ID of a table can be found using `GET_GROUP_ID(table_name)`. The group IDs of a list of tables can be found with `GET_GROUP_ID_LIST(table_name_list)`. The group IDs of all the lists of tables can be retrieved with `GET_ALL_GROUP_IDS`.

By default, synchronous refresh does not maintain global indexes belonging to the tables and materialized views in the sync refresh group. If you wish to do so, you can set event 31904, level 64 before executing `PREPARE_REFRESH`. This will cause the partition exchange DDL statements generated by `PREPARE_REFRESH` to have the `UPDATE INDEXES` clause appended to them, and when they are executed by `EXECUTE_REFRESH`, the global indexes will be maintained.

188.3.9 PREPARE_STAGING_LOG Procedure

This procedure collects statistics on the data in the staging log of the base table and validates the data in the log.

It can be run in several different modes ranging from the enforced mode in which strict checking of the data is done to trusted mode in which no checking is done. You should run this procedure after loading the staging log and before running `PREPARE_REFRESH`.

In the enforced mode, which is the default, this procedure will fill in the missing values of the columns of the rows being deleted or updated. An error is thrown if any violations of the staging-log rules are found. You can query the view `USER_SR_STLOG_EXCEPTIONS` to get details on the exceptions.

The notion of the staging log key is described in *Oracle Database Data Warehousing Guide*.

In the enforced mode, this procedure processes each delete/update row in the staging log as follows:

- It verifies the existence of the row in the base table using the key.
- For the rows being deleted (`DMLTYPE$$` is 'D'), it verifies a row with this key exists in the base table; if non-null non-key values are supplied in the staging log, it verifies the values match the corresponding columns in the base table; else an exception is logged in the exceptions table. If the values of any of the non-key columns are missing, it fills in those values from the row in the base table.
- For the rows being updated (`DMLTYPE$$` is 'UO' or 'UN'), it verifies a row with this key exists in the base table. In the old values row (`DMLTYPE$$` is 'UO'), it makes the same check and does the same processing as with rows being deleted. In the new values row (`DMLTYPE$$` is 'UN'), it checks that at least the value of one the columns differs from its old value; else an exception is logged.
- In the new values row (`DMLTYPE$$` is 'UN'), a null value in a column is interpreted as having the same value as the old value of the column except if the old value is non-null and the new value is null in which case, the new value of the column is interpreted as being null. This requires that the user must provide the old value of columns which are being updated to `NULL`.

In the default enforced mode, this procedure verifies that each key is specified for at most once for a delete or update operation. This means that the user, when doing the change consolidation, must consolidate delete-insert of the same row into an update operation with rows 'UO' and 'UN;' multiple updates must be consolidated into a single update; and null changes such as an insert-update-delete of the same row must not appear in the staging log.

The checking done in the enforced mode can be time-consuming. If you are confident in the integrity of the data, you can choose a lower level of checking. You can choose to:

- trust all the insert rows (DMLTYPE\$\$ is 'I') by choosing the `psl_mode` of `DBMS_SYNC_REFRESH.INSERT_TRUSTED`
- trust all the delete rows (DMLTYPE\$\$ is 'D') by choosing the `psl_mode` of `DBMS_SYNC_REFRESH.DELETE_TRUSTED`
- trust all the update rows (DMLTYPE\$\$ is 'UO' or 'UN') by choosing the `psl_mode` of `DBMS_SYNC_REFRESH.UPDATE_TRUSTED`
- trust all three types of DMLs by choosing the `psl_mode` of `DBMS_SYNC_REFRESH.TRUSTED`.

In addition, you can specify the `psl_mode` as a bitmask of the flags described above. For example, `DBMS_SYNC_REFRESH.INSERT_TRUSTED + DBMS_SYNC_REFRESH.DELETE_TRUSTED` will treat inserts and deletes to be trusted but not updates.

Syntax

```
DBMS_SYNC_REFRESH.PREPARE_STAGING_LOG (
    schema_name      IN VARCHAR2,
    base_table_name  IN VARCHAR2,
    psl_mode         IN NUMBER DEFAULT
    DBMS_SYNC_REFRESH.ENFORCED);
```

Parameters

Table 188-10 PREPARE_STAGING_LOG Procedure Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema of the base table.
<code>base_table_name</code>	The name of the base table.
<code>psl_mode</code>	The mode in which staging log preparation should be done. The possible values are: <ul style="list-style-type: none"> • <code>DBMS_SYNC_REFRESH.ENFORCED</code> (the default) • <code>DBMS_SYNC_REFRESH.INSERT_TRUSTED</code> • <code>DBMS_SYNC_REFRESH.DELETE_TRUSTED</code> • <code>DBMS_SYNC_REFRESH.UPDATE_TRUSTED</code> • <code>DBMS_SYNC_REFRESH.TRUSTED</code>

188.3.10 PURGE_REFRESH_STATS Procedure

This procedure purges the refresh history of sync refreshes that took place before the value specified by the `BEFORE_TIMESTAMP` parameter.

This procedure requires the `SYSDBA` privilege in addition to the privilege to execute it.

Syntax

```
DBMS_SYNC_REFRESH.PURGE_REFRESH_STATS (
    before_timestamp IN TIMESTAMP WITH TIME ZONE);
```

Parameters

Table 188-11 PURGE_REFRESH_STATS Procedure Parameter

Parameter	Description
<code>before_timestamp</code>	Records of sync refreshes saved before this timestamp are purged. If NULL, it uses the purging policy used by automatic purge. The automatic purge deletes all history older than (current time - refresh - history retention). The refresh history retention value can be changed using <code>ALTER_REFRESH_STATS_RETENTION</code> . The default is 31 days.

188.3.11 REGISTER_MVIEWS

This procedure registers a list of materialized views for synchronous refresh.

It checks each materialized view in the list for eligibility and places it in the sync refresh group it belongs to. A sync refresh group is a set of related tables and materialized views defined on top of them. Two tables are considered related if there is a referential constraint between them.

The eligibility rules of materialized views for synchronous refresh are described in detail in *Oracle Database Data Warehousing Guide*. The principal requirements are that the materialized view must be partitioned and its partition key must be derivable from the partition key of its fact table. The materialized view definition must specify the `USING TRUSTED CONSTRAINTS` clause because sync refresh trusts the foreign key and primary key relationships to perform various refresh optimizations. The materialized view's refresh policy must be specified as `ON DEMAND`.

You have an option to register only some of the materialized views associated with a table, and leave some unregistered. Oracle Corporation does not recommend this, and in such a case, the user has to maintain the unregistered ones using the PCT or complete refresh methods.

A staging table must have been created for each base table of each materialized view in the materialized view list (`mv_list`), or else an error is thrown.

If any of the materialized views are not eligible for sync refresh, an error is thrown and the registration of all materialized views in the materialized view list fails.

Syntax

```
DBMS_SYNC_REFRESH.REGISTER_MVIEWS (
    mv_list IN VARCHAR2);
```

Parameter

Table 188-12 REGISTER_MVIEWS Procedure Parameter

Parameter	Description
<code>mv_list</code>	A comma-delimited list of materialized views to register. These names are optionally schema-qualified.

188.3.12 REGISTER_PARTITION_OPERATION Procedure

This procedure registers a partition-maintenance operation (PMOP) on a partition of a base table.

Syntax

```
DBMS_SYNC_REFRESH.REGISTER_PARTITION_OPERATION (
    partition_op          IN VARCHAR2,
    schema_name          IN VARCHAR2,
    base_table_name      IN VARCHAR2,
    partition_name       IN VARCHAR2,
    outside_partn_table_schema IN VARCHAR2,
    outside_partn_table_name IN VARCHAR2);
```

Parameters

Table 188-13 REGISTER_PARTITION_OPERATION Procedure Parameters

Parameter	Description
partition_op	The name of the partition operation (DROP, EXCHANGE, or TRUNCATE).
schema_name	The name of the schema of the base table.
base_table_name	The name of the base table.
partition_name	The name of the partition to be changed; either exchanged with the outside partition table or dropped or truncated.
outside_partn_table_schema	The name of the schema of the outside partition table (required for EXCHANGE only).
outside_partn_table_name	The name of the outside partition table (required for EXCHANGE only).

Usage Notes

The three kinds of change operations that may be specified on partitions are DROP, TRUNCATE, and EXCHANGE.

If DROP is specified, then the partition will be dropped from the base table at the time of EXECUTE_REFRESH. If TRUNCATE is specified, then the data from the partition will be deleted but the partition itself will not be dropped. These operations provide a more efficient way of specifying the deletes of all the rows in a partition than specifying them individually in the staging log.

If EXCHANGE is specified, then the contents of the outside table is exchanged with contents of the specified partition of EXECUTE_REFRESH. This provides an alternative method to the user of providing the changes to the base tables instead of populating the staging log.

188.3.13 UNREGISTER_MVIEWS

This procedure unregisters a list of materialized views from synchronous refresh. Once a materialized view is unregistered, it can be maintained by the user with any of the traditional refresh methods, such as complete or PCT, refresh.

Syntax

```
DBMS_SYNC_REFRESH.UNREGISTER_MVIEWS (
    mv_list    IN VARCHAR20;
```

Parameter

Table 188-14 UNREGISTER_MVIEWS Parameter

Parameter	Description
mv_list	A comma-delimited list of materialized views to unregister. These names are optionally schema-qualified.

188.3.14 UNREGISTER_PARTITION_OPERATION Procedure

This procedure unregisters a partition-maintenance operation (PMOP) that had been previously registered with REGISTER_PARTITION_OPERATION on a base table. The three kinds of change operations that can be specified on partitions are DROP, TRUNCATE, and EXCHANGE.

Syntax

```
DBMS_SYNC_REFRESH.UNREGISTER_PARTITION_OPERATION (
    partition_op    IN VARCHAR2,
    schema_name     IN VARCHAR2,
    base_table_name IN VARCHAR2,
    partition_name  IN VARCHAR2);
```

Parameters

Table 188-15 UNREGISTER_PARTITION_OPERATION Procedure Parameters

Parameter	Description
partition_op	The name of the partition operation (DROP, EXCHANGE, or TRUNCATE).
schema_name	The name of the schema of the base table.
base_table_name	The name of the base table.
partition_name	The name of the partition to be changed; either exchanged with the outside partition table or dropped or truncated.

DBMS_TABLE_DATA

The `DBMS_TABLE_DATA` package provides procedures that can be used to retrieve the byte value of a single column, or a series of columns, in any table. These procedures, along with a publicly documented meta-data structure for columns, can be used to retrieve the row content for row data on which the hash or user signature is computed.

This chapter contains the following topics:

- [DBMS_TABLE_DATA Overview](#)
- [DBMS_TABLE_DATA Security Model](#)
- [Summary of DBMS_TABLE_DATA Subprograms](#)



See Also:

- *Oracle Database Administrator's Guide*
- *Oracle Database Concepts*
- *Oracle Database SQL Language Reference*
- *Oracle Database Reference*

189.1 DBMS_TABLE_DATA Overview

The `DBMS_TABLE_DATA` package can be used to retrieve the byte value of a single column, or a series of columns, in any table.

These procedures, along with a publicly documented meta-data structure for columns, can be used to retrieve the `row content` for row data on which the hash or user signature is computed.

The procedures provide platform-neutral binary values for columns.

The procedures give you fine-grained control over the scope of a digital signature or cryptographic hash in terms of the columns you extract and the order in which you assemble the results.

189.2 DBMS_TABLE_DATA Security Model

The `DBMS_TABLE_DATA` package is owned by `SYS` and is installed as part of database installation. The routines in the package are run with invokers' rights (run with the privileges of the current user). The current user needs `SELECT` privileges on the table to extract column data.

189.3 Summary of DBMS_TABLE_DATA Subprograms

The DBMS_TABLE_DATA package uses GET_BYTES_FOR_COLUMN, GET_BYTES_FOR_COLUMNS, and GET_BYTES_FOR_ROW subprograms to perform various functions.

Table 189-1 DBMS_TABLE_DATA Package Subprograms

Subprogram	Description
GET_BYTES_FOR_COLUMN Procedure	Returns the <code>column_data</code> in bytes for the particular column with name <code>column_name</code> for <code>row_id</code> row in the particular table identified by <code>schema_name.table_name</code> .
GET_BYTES_FOR_COLUMNS Procedure	Returns a concatenated array of column byte values in <code>column_data</code> in the order of columns specified in the <code>column_names</code> array.
GET_BYTES_FOR_ROW Procedure	Returns a concatenated array of column byte values in <code>column_data</code> in the order of column positions for the particular row identified by <code>row_id</code> .

189.3.1 GET_BYTES_FOR_COLUMN Procedure

This procedure returns the `column_data` in bytes for the particular column with name `column_name` for `row_id` row in the particular table identified by `schema_name.table_name`.

Syntax

```
DBMS_TABLE_DATA.GET_BYTES_FOR_COLUMN(
  schema_name      IN VARCHAR2,
  table_name       IN VARCHAR2,
  row_id           IN ROWID,
  column_name      IN VARCHAR2,
  column_data      IN OUT BLOB);
```

Parameters

Table 189-2 GET_BYTES_FOR_COLUMN Procedure Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema.
<code>table_name</code>	The name of the table.
<code>row_id</code>	The row id.
<code>column_name</code>	The column name.
<code>column_data</code>	The data in the column.

Usage Notes

All arguments are required.

189.3.2 GET_BYTES_FOR_COLUMNS Procedure

This procedure returns a concatenated array of column byte values in `column_data` in the order of columns specified in the `column_names` array.

Syntax

```
DBMS_TABLE_DATA.GET_BYTES_FOR_COLUMNS (
  schema_name      IN VARCHAR2,
  table_name       IN VARCHAR2,
  row_id           IN ROWID,
  column_names     IN VARCHAR2,
  column_data      IN OUT BLOB);
```

Parameters

Table 189-3 GET_BYTES_FOR_COLUMNS Procedure Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema.
<code>table_name</code>	The name of the table.
<code>row_id</code>	The row id.
<code>column_names</code>	The names of the columns.
<code>column_data</code>	The data in the columns.

Usage Notes

All arguments are required.

189.3.3 GET_BYTES_FOR_ROW Procedure

This procedure returns a concatenated array of column byte values in `column_data` in the order of column positions for the particular row identified by `row_id`.

Syntax

```
DBMS_TABLE_DATA.GET_BYTES_FOR_ROW (
  schema_name      IN VARCHAR2,
  table_name       IN VARCHAR2,
  row_id           IN ROWID,
  column_data      IN OUT BLOB);
```

Parameters

Table 189-4 GET_BYTES_FOR_ROW Procedure Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema.
<code>table_name</code>	The name of the table.
<code>row_id</code>	The row id.
<code>column_data</code>	The data in the row.

Usage Notes

All arguments are required.

DBMS_TDB

The `DBMS_TDB` package reports whether a database can be transported between platforms using the `RMAN CONVERT DATABASE` command.

The package verifies that databases on the current host platform are of the same endian format as the destination platform, and that the state of the current database does not prevent transport of the database.



See Also:

Oracle Database Backup and Recovery User's Guide regarding database transport using `CONVERT DATABASE`

This chapter contains the following topics:

- [Overview](#)
- [DBMS_TDB Security Model](#)
- [Constants](#)
- [Views](#)
- [Operational Notes](#)
- [Summary of DBMS_TDB Subprograms](#)

190.1 DBMS_TDB Overview

In many cases, Oracle supports transporting databases between platforms which have the same endian format. However, even when the endian formats are the same, a database must undergo a conversion process to move from one platform to another. There are also preconditions required for the process of transporting a database, such as having the database to be transported open read-only.

The `DBMS_TDB` package serves two purposes:

- Confirming that Oracle supports transporting a database from a given source platform to a given target platform
- Determining whether a database to be transported has been properly prepared for transport, and if not, identifying the condition that prevents database transport

The actual conversion is performed using the Recovery Manager `CONVERT DATABASE` command. For a complete discussion of the requirements for transporting a database, the process of converting a database for transport across platforms, and examples of the use of the `DBMS_TDB` subprograms in the conversion process, see *Oracle Database Backup and Recovery User's Guide*.

190.2 DBMS_TDB Security Model

Use of this package requires the `DBA` privilege.

190.3 DBMS_TDB Constants

The `DBMS_TDB` package defines several enumerated constants that should be used for specifying parameter values. Enumerated constants must be prefixed with the package name, for example, `DBMS_TDB.SKIP_NONE`.

The `DBMS_TDB` package uses the constants shown in [Table 190-1](#).

Table 190-1 DBMS_TDB Constants

Name	Type	Value	Description
<code>SKIP_NONE</code>	NUMBER	0	Check all files when checking whether a database is ready for transport.
<code>SKIP_OFFLINE</code>	NUMBER	2	Skip files in offline tablespaces when checking whether a database is ready for transport.
<code>SKIP_READONLY</code>	NUMBER	3	Skip files in read-only tablespaces when checking whether a database is ready for transport.

190.4 DBMS_TDB Views

The `DBMS_TDB` package uses the `V$DB_TRANSPORTABLE_PLATFORM` view.

This view is described in *Oracle Database Reference*.

- `V$DB_TRANSPORTABLE_PLATFORM`, which specifies which combinations of source and target platforms support database transport

190.5 DBMS_TDB Operational Notes

The following notes apply to `DBMS_TDB`.

- The subprograms in this package are useful both in determining whether the desired cross-platform database conversion is possible, and in checking whether the database is ready for conversion. See *Oracle Database Backup and Recovery User's Guide* for details on the different uses of these subprograms are used in the conversion process.
- The subprograms in this package return simple `TRUE` or `FALSE` results to indicate whether database transport is possible. Use the subprograms with `SERVEROUTPUT ON` for informative messages about why transport is not possible.

190.6 Summary of DBMS_TDB Subprograms

This table lists the `DBMS_TDB` subprograms and briefly describes them.

Table 190-2 DBMS_TDB Package Subprograms

Subprogram	Description
CHECK_DB Function	Checks whether a database can be transported to a target platform
CHECK_EXTERNAL Function	Checks whether a database has external tables, directory or BFILES

190.6.1 CHECK_DB Function

This function checks whether a database can be transported to a target platform. It tests whether transport is supported at all for a given source and destination platform, and whether the database is currently in the correct state for transport.

You can specify whether to skip checking parts of the database that are read-only or offline, if you do not plan to transport them.

The function is overloaded. The different functionality of each form of syntax is presented along with the definition.

Syntax

```
DBMS_TDB.CHECK_DB (
    target_platform_name  IN VARCHAR2,
    skip_option           IN  NUMBER)
RETURN BOOLEAN;
```

```
DBMS_TDB.CHECK_DB (
    target_platform_name  IN VARCHAR2)
RETURN BOOLEAN;
```

```
DBMS_TDB.CHECK_DB
RETURN BOOLEAN;
```

Parameters

Table 190-3 CHECK_DB Function Parameters

Parameter	Description
target_platform_name	The name of the destination platform, as it appears in V\$DB_TRANSPORTABLE_PLATFORM.
skip_option	Specifies which, if any, parts of the database to skip when checking whether the database can be transported. Supported values are listed in Table 190-1 .

Return Values

If the database cannot be transported to the target platform or is not ready to be transported, returns `FALSE`. If the database is ready for transport, returns `TRUE`.

Usage Notes

- If `SERVEROUTPUT` is `ON`, then the output will contain the reasons why the database cannot be transported and how to fix the problems. For details on possible reasons and fixes, see [Table 190-4](#).

Table 190-4 Reasons for CHECK_DB Function to Return FALSE

Cause	Action
Unrecognized target platform name.	Check <code>V\$DB_TRANSPORTABLE_PLATFORM</code> for recognized platform names.
Target platform has a different endian format.	Conversion is not supported.
Database is not open read-only.	Open database read-only and retry.
There are active or in-doubt transactions in the database.	Open the database read-write. After the active transactions are rolled back, open the database read-only and retry the operation. This situation can occur if users flash back the database and open it read only. The active transactions will be rolled back when the database is opened read-write.
Deferred transaction rollback needs to be done.	Open the database read-write and bring online the necessary tablespaces. Once the deferred transaction rollback is complete, open the database read-only and retry the operation.
Database compatibility version is below 10.0.0.	Change the <code>COMPATIBLE</code> initialization parameter to 10.0.0 or higher, open the database read-only, and retry the operation.
Some tablespaces have not been open read-write with compatibility version is 10.0.0 or higher.	Change the <code>COMPATIBLE</code> initialization parameter to 10.0.0 or higher, then open the affected tablespaces read-write. Shut down the database, open it read-only, and retry the operation.

Examples

This example illustrates the use of `CHECK_DB` with a database that is open read-write:

```
SQL> SET SERVEROUTPUT ON
SQL> DECLARE
    db_ready BOOLEAN;
BEGIN
    db_ready := DBMS_TDB.CHECK_DB('Microsoft Windows IA (32-bit)');
END;
/
```

Database is not open READ ONLY. Please open database READ ONLY and retry.

PL/SQL procedure successfully completed.

190.6.2 CHECK_EXTERNAL Function

This function determines whether a database has external tables, directories, or BFILEs.

Syntax

```
DBMS_TDB.CHECK_EXTERNAL  
    RETURN BOOLEAN;
```

Return Values

If the database has external tables, directories, or BFILEs, return `TRUE`. Otherwise, return `FALSE`.

Usage Notes

- If `SERVEROUTPUT` is ON, then the function will output the names of the external tables, directories, and BFILEs in the database.
- The database must be open read-write.

Examples

This example illustrates the use of `CHECK_EXTERNAL` with a database that has several external tables, directories, and BFILEs:

```
SQL> SET SERVEROUTPUT ON  
SQL> DECLARE  
    external BOOLEAN;  
BEGIN  
    external := DBMS_TDB.CHECK_EXTERNAL;  
END;  
/
```

The following external tables exist in the database:

SH.SALES_TRANSACTIONS_EXT

The following directories exist in the database:

SYS.MEDIA_DIR, SYS.DATA_FILE_DIR, SYS.LOG_FILE_DIR, SYS.DATA_PUMP_DIR

The following BFILEs exist in the database:

PM.PRINT_MEDIA

PL/SQL procedure successfully completed.

DBMS_TF

The DBMS_TF package contains utilities for Polymorphic Table Functions (PTF) implementation. You can use DBMS_TF subprograms to consume and produce data, and get information about its execution environment.

You must be familiar with the Polymorphic Table Function (PTF) concepts, syntax and semantics.

See Also:

- *Oracle Database PL/SQL Language Reference* for an overview of Polymorphic Table Function (PTF) concepts
- *Oracle Database PL/SQL Language Reference* for more information about `CREATE FUNCTION PIPELINED` clause syntax and semantics

This chapter contains the following topics:

- [DBMS_TF Overview](#)
- [DBMS_TF Security Model](#)
- [DBMS_TF Constants](#)
- [DBMS_TF Operational Notes](#)
- [DBMS_TF Execution Flow](#)
- [DBMS_TF Restrictions](#)
- [DBMS_TF Examples](#)
- [DBMS_TF Data Structures](#)
- [Summary of DBMS_TF Subprograms](#)

191.1 DBMS_TF Overview

The DBMS_TF package contains types, constants, and subprograms that can be used by Polymorphic Table Functions (PTFs).

Polymorphic Table Functions (PTFs) need various services from the database to implement their functionality. PTFs need a mechanism to get rows from the database and send back new rows, for instance. The DBMS_TF package provides these server and client interfaces utilities.

191.2 DBMS_TF Security Model

PUBLIC is granted the EXECUTE privilege on package DBMS_TF. Its subprograms execute with invoker's rights privileges.

191.3 DBMS_TF Constants

This topic describes useful constants defined in the DBMS_TF package.

The DBMS_TF package defines several enumerated constants that should be used for specifying parameter values or types. Enumerated constants must be prefixed with the package name, for example, DBMS_TF.TYPE_DATE.

Table 191-1 DBMS_TF Supported Types

Name	Description
TYPE_BINARY_DOUBLE	Type code for BINARY_DOUBLE
TYPE_BINARY_FLOAT	Type code for BINARY_FLOAT
TYPE_BLOB	Type code for BLOB
TYPE_BOOLEAN	Type code for BOOLEAN
TYPE_CHAR	Type code for CHAR
TYPE_CLOB	Type code for CLOB
TYPE_DATE	Type code for DATE
TYPE_INTERVAL_DS	Type code for INTERVAL_DS
TYPE_INTERVAL_YM	Type code for INTERVAL_YM
TYPE_NUMBER	Type code for NUMBER
TYPE_ROWID	Type code for ROWID
TYPE_RAW	Type code for RAW
TYPE_TIMESTAMP	Type code for TIMESTAMP
TYPE_TIMESTAMP_TZ	Type code for TIMESTAMP_TZ
TYPE_VARCHAR2	Type code for VARCHAR2

Additional constants are defined for use with specific subprograms.

See Also:

- [Table 191-3](#) for more information about CSTORE related constants
- [Table 191-4](#) for more information about predefined PTF method names
- [Table 191-6](#) for more information about XSTORE related constants
- [Supported Types Collections](#) for more information about predefined collections of supported types

191.4 DBMS_TF Operational Notes

These operational notes describe the client and the server-side interfaces, and detail the compilation and execution statement management of Polymorphic Table Functions (PTF).

191.4.1 PTF Client Interface

The Polymorphic Table Function (PTF) implementation client interface is a set of subprograms with fixed names that every PTF must provide.

The PTF client interface can have up to four subprograms as follow :

- `DESCRIBE` function (Required)
- `OPEN` procedure (Optional)
- `FETCH_ROWS` procedure (Optional)
- `CLOSE` procedure (Optional)

The function `DESCRIBE` is invoked during SQL cursor compilation.

The procedures `OPEN`, `FETCH_ROWS`, and `CLOSE` are invoked during query execution.

The arguments to the implementation functions must match the PTF function with the following modifications:

1. Arguments of the type `TABLE` and `COLUMNS` are skipped for the execution procedures `OPEN`, `FETCH_ROWS`, and `CLOSE`.
2. The `TABLE` and `COLUMNS` arguments have descriptor types for the `DESCRIBE` function.
3. Scalar arguments that are not available during compilation are passed as `NULL` values (when using bind variables for instance). During execution, the actual values are passed in.

DESCRIBE Function

The `DESCRIBE` function is invoked to determine the type of rows (row shape) produced by the Polymorphic Table Function (PTF). It returns a `DBMS_TF.DESCRIBE_T` table.

The function `DESCRIBE` is invoked during SQL cursor compilation when a SQL query references a PTF. The SQL compiler locates the `DESCRIBE` function defined in the PTF implementation package. All the argument values from the query calling the PTF are passed to the `DESCRIBE` function. Like any PLSQL function, the `DESCRIBE` function can be overloaded and can have arguments default values.

The arguments of the PTF function and `DESCRIBE` function must match, but with the type of any `TABLE` argument replaced with the `DBMS_TF.TABLE_T` descriptor type, and the type of any `COLUMNS` argument replaced with `DBMS_TF.COLUMN_T` descriptor.

The `DESCRIBE` function indicates which columns must be kept by the database and passed unchanged as the PTF output (Pass-Through columns). In addition, the `DESCRIBE` function indicates any input columns that the PTF will use for its computation (Read columns).

Finally, the `DESCRIBE` function returns the list of any new columns that the PTF will create (or `NULL` if no new columns are being produced) using the `DBMS_TF.DESCRIBE_T` descriptor.

OPEN Procedure

The `OPEN` procedure purpose is to initialize and allocate any execution specific state. The `OPEN` procedure is most useful when you implement a Table Semantics PTF. The function typically calls the `GET_XID` function to get a unique ID for managing the execution state.

`OPEN` procedure is generally invoked before calling the `FETCH_ROWS` procedure.

FETCH_ROWS Procedure

The `FETCH_ROWS` procedure produces an output rowset that it sends to the database. The number of invocations of this function and the size of each rowset are data dependent and determined during query execution.

CLOSE Procedure

The `CLOSE` procedure is called at the end of the PTF execution. The procedure releases resources associated with the PTF execution state.

Example 191-1 Noop Polymorphic Table Function Example

This example creates a PTF called `noop`. This PTF returns the input rows as the output rows without any modification or filtering. `Noop` is one of the smallest PTF you can write.

Live SQL:

You can view and run this example on Oracle Live SQL at [Noop Polymorphic Table Function](#)

To implement the `noop` PTF, you first create the implementation package `noop_package`.

```
CREATE PACKAGE noop_package AS
  FUNCTION describe(t IN OUT DBMS_TF.TABLE_T)
    RETURN DBMS_TF.DESCRIBE_T;

  PROCEDURE fetch_rows;
END noop_package;
```

The `DESCRIBE` function does not produce any new columns and hence, returns `NULL`. Executing `FETCH_ROWS` also results in `NULL`.

```
CREATE PACKAGE BODY noop_package AS
  FUNCTION describe(t IN OUT DBMS_TF.TABLE_T)
    RETURN DBMS_TF.DESCRIBE_T AS
  BEGIN
    RETURN NULL;
  END;

  PROCEDURE fetch_rows AS
```

```

BEGIN
    RETURN;
END;
END noop_package;

```

The noop PTF is defined to execute the noop_package when it is invoked.

```

CREATE FUNCTION noop (t TABLE)
    RETURN TABLE PIPELINED ROW POLYMORPHIC USING noop_package;

```

The PTF can be invoked in queries. For example:

```

SELECT *
FROM   NOOP(emp)
WHERE  deptno = 10;

```

7782	CLARK	MANAGER	7839	09-JUN-81	2450	10
7839	KING	PRESIDENT		17-NOV-81	5000	10
7934	MILLER	CLERK	7782	23-JAN-82	1300	10

```

WITH e
    AS (SELECT *
        FROM   emp
            NATURAL JOIN dept
            WHERE dname = 'SALES')
SELECT t.*
FROM   NOOP(e) t;

```

30	7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300
SALES		CHICAGO					
30	7521	WARD	SALESMAN	7698	22-FEB-81	1250	500
SALES		CHICAGO					
30	7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400
SALES		CHICAGO					
30	7698	BLAKE	MANAGER	7839	01-MAY-81	2850	
SALES		CHICAGO					
30	7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0
SALES		CHICAGO					
30	7900	JAMES	CLERK	7698	03-DEC-81	950	
SALES		CHICAGO					

191.4.1.1 DESCRIBE Only Polymorphic Table Function

A Polymorphic Table Function (PTF) can have a DESCRIBE function only.

A PTF which does not have any runtime methods (Open/Fetch_Rows/Close) is used only at cursor compilation time with no runtime row source allocated. The explain plan output of a Describe-Only PTF will not show any rows for the PTF.

191.4.2 PTF Server Side Interface

The DBMS_TF package provides the server side interface needed for Polymorphic Table Functions (PTFs) implementation to read and write information in the database.

This topic contains a partial list of types and subprograms used for the PTF server side implementation.

Table 191-2 Summary of Commonly Used Types and Subprograms in PTF Server Side Interface

NAME	DESCRIPTION
COLUMN_METADATA_T	Column metadata record
COLUMN_T	Column descriptor record
TABLE_T	Table descriptor record
COLUMNS_T	Collection containing column names
COLUMNS_NEW_T	Collection for new columns
TAB_<typ>_T	Collection for each supported types, where <typ> is described in " Supported Types Collections "
ROW_SET_T	Data for a rowset record
GET_COL Procedure	Fetches data for a specified (input) column
PUT_COL Procedure	Returns data for a specified (new) column
GET_ROW_SET Procedure	Fetches the input rowset of column values
PUT_ROW_SET Procedure	Returns data for ALL (new) columns
SUPPORTED_TYPE Function	Verifies if a type is supported by DBMS_TF subprograms
GET_XID Function	Returns a unique execution ID to index PTF state in a session

See Also:

- [DBMS_TF Data Structures](#) for the complete list of types
- [Summary of DBMS_TF Subprograms](#) for the complete list of subprograms

191.4.3 Read Columns

Read columns are a set of table columns that the Polymorphic Table Function (PTF) processes when executing the `FETCH_ROWS` procedure.

The PTF indicates the read columns inside `DESCRIBE` by annotating them in the input table descriptor, `TABLE_T`. Only the indicated read columns will be fetched and thus available for processing during `FETCH_ROWS`.

The PTF invocation in a query will typically use the `COLUMNS` operator to indicate which columns the query wants the PTF to read, and this information is passed to the `DESCRIBE` function which then in turn sets the `COLUMN_T.FOR_READ` boolean flag.

Only scalar SQL data types are allowed for the read columns.

The [Echo Polymorphic Table Function Example](#) takes a table and a list of columns and produces new columns with the same values.

191.4.4 Pass-Through Columns

Pass-through columns are passed from the input table of the Polymorphic Table Function (PTF) to the output, without any modifications.

The `DESCRIBE` function indicates the pass-through columns by setting the `COLUMN_T.PASS_THROUGH` boolean flag on the input table descriptor, `DBMS_TF.TABLE_T`.

All columns in the `Row Semantics` PTF are marked as pass-through by default. For `Table Semantics` PTF, the default value for pass-through is set to `false`. For the `Table Semantics` PTF, the partitioning columns are always pass-through and this cannot be changed by the `DESCRIBE` function.

Note, the notions of Pass-Through and Read are orthogonal, and indicating a column as one has no implication for the other.

191.4.5 State Management

The database manages the compilation and execution states of the polymorphic table functions (PTF).

The database fulfills the PTF conductor role. As such, it is responsible for the PTF compilation state and execution state.

1. **Compilation State** : This is the immutable state that is generated by `DESCRIBE` which is needed before execution.
2. **Execution State**: This is the state used by the execution time procedures (`OPEN`, `FETCH_ROWS`, and `CLOSE`) of a `Table semantics` PTF.

The most common use of compilation state is to keep track of the columns to be read and the new columns that are to be produced. The PTF Server interface provides functions that can be used to achieve this: `GET_ENV`, and `GET_ROW_SET`. The PTF author who defines, documents, and implements the PTF can rely on the database to manage the PTF states. The PTF author should not attempt to use the session state (such as PL/SQL package global variables) to store any compilation state. Problems can arise because in a given session all cursors using the PTF will share that state, and other sessions executing the PTF cursor will not see the original compilation state.

Since the execution state is session and cursor private, a `Table Semantics` PTF can use package globals for storing execution state, but with the provision that the PTF uses the database provided unique execution ID to identify that state. The `GET_XID` function guarantees to provide an execution unique ID for the PTF's execution procedures, where this ID remains constant for all the execution functions of a PTF.

191.4.5.1 CSTORE Compilation State Management

The CSTORE is the PTF compilation state management interface.

The CSTORE enables Polymorphic Table Functions (PTF) to store the compilation state in the SQL cursor.

The CSTORE interface is used to store key-value pairs during cursor compilation through the `DBMS_TF.DESCRIBE_T` record.

The compilation state information is retrieved during execution procedures such as OPEN, FETCH_ROWS and CLOSE.

CSTORE Subprograms

The CSTORE interface consists of the following subprograms.

Name	Description
CSTORE_GET procedure	Fetches item of specified type. If not found, the OUT value remains unchanged.
CSTORE_EXISTS function	If an item with the given key exists in the CSTORE, this function returns TRUE.

CSTORE Supported Types

The DBMS_TF.DESCRIBE_T supports specifying key-value pairs for these scalar types: VARCHAR2, NUMBER, DATE, BOOLEAN.

Table 191-3 DBMS_TF CSTORE Scalar Supported Types

Name	Description
CSTORE_TYPE_VARCHAR2	CSTORE VARCHAR2 type code
CSTORE_TYPE_NUMBER	CSTORE NUMBER type code
CSTORE_TYPE_DATE	CSTORE DATE type code
CSTORE_TYPE_BOOLEAN	CSTORE BOOLEAN type code

Collections For Compilation Storage

These predefined collection types are used for compilation state management.

```
TYPE CSTORE_CHR_T IS TABLE OF VARCHAR2(32767) INDEX BY VARCHAR2(32767);
TYPE CSTORE_NUM_T IS TABLE OF NUMBER INDEX BY VARCHAR2(32767);
TYPE CSTORE_BOL_T IS TABLE OF BOOLEAN INDEX BY VARCHAR2(32767);
TYPE CSTORE_DAT_T IS TABLE OF DATE INDEX BY VARCHAR2(32767);
```

DBMS_TF Method Names

The method names are also stored in the DBMS_TF.DESCRIBE_T record. These predefined values for the method names can be customized by the PTF author.

See [Method Name Overrides](#) for more information about changing the default method names

Table 191-4 DBMS_TF Method Names Constants

Name	Type	Value	Description
CLOSE	DBMS_QUOTED_ID	'CLOSE'	Predefined index value for the method named CLOSE

Table 191-4 (Cont.) DBMS_TF Method Names Constants

Name	Type	Value	Description
FETCH_ROWS	DBMS_QUOTED_ID	'FETCH_ROWS'	Predefined index value for the method named FETCH_ROWS
OPEN	DBMS_QUOTED_ID	'OPEN'	Predefined index value for the method named OPEN

191.4.5.2 XSTORE Execution State Management

XSTORE is the PTF execution state management interface.

The XSTORE key-value interface simplifies the implementation of Table Semantics PTFs by providing automatic state management capabilities when the keys are strings and values are of commonly used scalar types.

The database automatically manages the deletion of all execution states allocated using this interface.

XSTORE Subprograms

The execution state management interface consists of the following subprograms.

Table 191-5 DBMS_TF XSTORE Subprograms

Name	Description
XSTORE_CLEAR procedure	Removes all key-value pairs from the XSTORE execution state
XSTORE_EXISTS function	Returns TRUE if an item with a given key exists in the XSTORE
XSTORE_GET procedure	Gets the associated value for a given key stored in the XSTORE
XSTORE_REMOVE procedure	Removes an item associated with the given key and key_type
XSTORE_SET procedure	Sets the value for the given key for PTF Execution State Management

XSTORE Predefined Types

The XSTORE supports specifying key-value pairs for these scalar types: VARCHAR2, NUMBER, DATE, and BOOLEAN.

Table 191-6 DBMS_TF XSTORE Scalar Supported Types

Name	Description
XSTORE_TYPE_VARCHAR2	XSTORE VARCHAR2 type code
XSTORE_TYPE_NUMBER	XSTORE NUMBER type code

Table 191-6 (Cont.) DBMS_TF XSTORE Scalar Supported Types

Name	Description
XSTORE_TYPE_DATE	XSTORE DATE type code
XSTORE_TYPE_BOOLEAN	XSTORE BOOLEAN type code

191.4.6 Method Name Overrides

When multiple polymorphic table function (PTF) implementations are in the same package, you can override the default runtime method names (`OPEN`, `FETCH_ROWS`, and `CLOSE`) with your PTF specific names.

To override a method name, the application can specify the new method names using `DBMS_TF.METHOD_NAMES` collection (see [DESCRIBE_T Record Type](#)).

See Also:

[Table 191-4](#)

Example 191-2 DBMS_TF Method Name Overrides

This example shows how to change the default method name of the `noop_p` PTF `fetch_rows` method to `noop_fetch`.

Live SQL:

You can view and run this example on Oracle Live SQL at [DBMS_TF Method Name Overrides](#)

Create the PTF implementation package `noop_p`.

```
CREATE PACKAGE noop_p AS
  FUNCTION describe(tab IN OUT DBMS_TF.table_t)
    RETURN DBMS_TF.describe_t;
  PROCEDURE noop_fetch;
END noop_p;
```

To provide a method name override, you can specify the new method names using `DBMS_TF.Method_Names` collection. The `FETCH_ROWS` method name is changed to `'Noop_Fetch'`. The procedure `noop_fetch` to implement this method is defined in the package.

```
CREATE OR replace PACKAGE BODY noop_p
AS
  FUNCTION describe(tab IN OUT DBMS_TF.table_t)
    RETURN DBMS_TF.describe_t AS
```

```

        methods DBMS_TF.methods_t := DBMS_TF.methods_t(DBMS_TF.fetch_rows =>
'Noop_Fetch');
    BEGIN
        RETURN DBMS_TF.describe_t(method_names => methods);
    END;
    PROCEDURE noop_fetch AS
    BEGIN
        RETURN;
    END;
END noop_p;

```

The noop PTF is defined to execute the noop_p when it is invoked.

```

CREATE FUNCTION noop (t TABLE) RETURN TABLE PIPELINED ROW POLYMORPHIC USING
noop_p;

```

The PTF is invoked in the FROM clause of a query block.

```

SELECT *
FROM noop(scott.emp)
WHERE deptno =10;

```

191.4.7 Using the COLUMNS Pseudo-Operator

The COLUMNS pseudo-operator is an addition to the SQL expression language.

Use the COLUMNS pseudo-operator to specify the arguments when invoking a Polymorphic Table Function (PTF) in the FROM clause. The COLUMNS pseudo-operator arguments specify the list of column names, or the list of column names with associated types.



See Also:

Oracle Database PL/SQL Language Reference for more information about the COLUMNS pseudo-operator syntax and semantics

191.4.8 Query Transformations

About predicate, projection and partitioning.

The pass-through columns of a Row Semantics PTF, and the PARTITION BY key columns of a Table Semantics PTF can be used for projection and predicate pushdown.

Example 191-3 Query Transformations

This example illustrates the predicate and projection pushdown for a Row Semantics PTF.

This query calls the echo PTF created in [Echo Polymorphic Table Function Example](#).

```

SELECT empno, ename, sal, comm, echo_sal
FROM echo(emp, COLUMNS(sal,comm))

```



```
WHERE deptno = 30
      AND echo_sal > 1000;
```

EMPNO	ENAME	SAL	COMM	ECHO_SAL
7499	ALLEN	1600	300	1600
7521	WARD	1250	500	1250
7654	MARTIN	1250	1400	1250
7698	BLAKE	2850		2850
7844	TURNER	1500	0	1500

Conceptually, this query will get rewritten as:

```
WITH t AS (SELECT empno, ename, sal, comm
FROM emp
WHERE deptno=30)
SELECT empno, ename, sal, comm, echo_sal
FROM echo(t, COLUMNS(sal, comm))
WHERE echo_sal > 1000;
```

191.4.9 Parallel Execution

A key benefit of Polymorphic Table Functions (PTFs) is that their execution can be parallelized.

Row and table semantic PTFs execute in parallel differently.

Row Semantics PTF

Under `Row Semantics` PTF, the parallel query executes with the same degree of parallelism (DOP) as it would if the PTF were not present. The DOP is driven by the child row source.

Provided that the DOP on table `emp` has been set to 5, the following is an example that shows this parallelization:

```
EXPLAIN PLAN FOR
SELECT * FROM echo(emp, COLUMNS(ename, job))
WHERE deptno != 20;
```

Id	Operation	Name
0	SELECT STATEMENT	
1	PX COORDINATOR	
2	PX SEND QC (RANDOM)	:TQ10000
3	POLYMORPHIC TABLE FUNCTION	ECHO
6	PX BLOCK ITERATOR	
* 7	TABLE ACCESS FULL	EMP

```

Predicate Information (identified by operation id):
5 - filter("EMP"."DEPTNO"<>20)
```

Table Semantics PTF

Table Semantics PTF requires its input table rows to be redistributed using the `PARTITION BY` key. The parallel execution is determined by the `PARTITION BY` clause specified in the query.

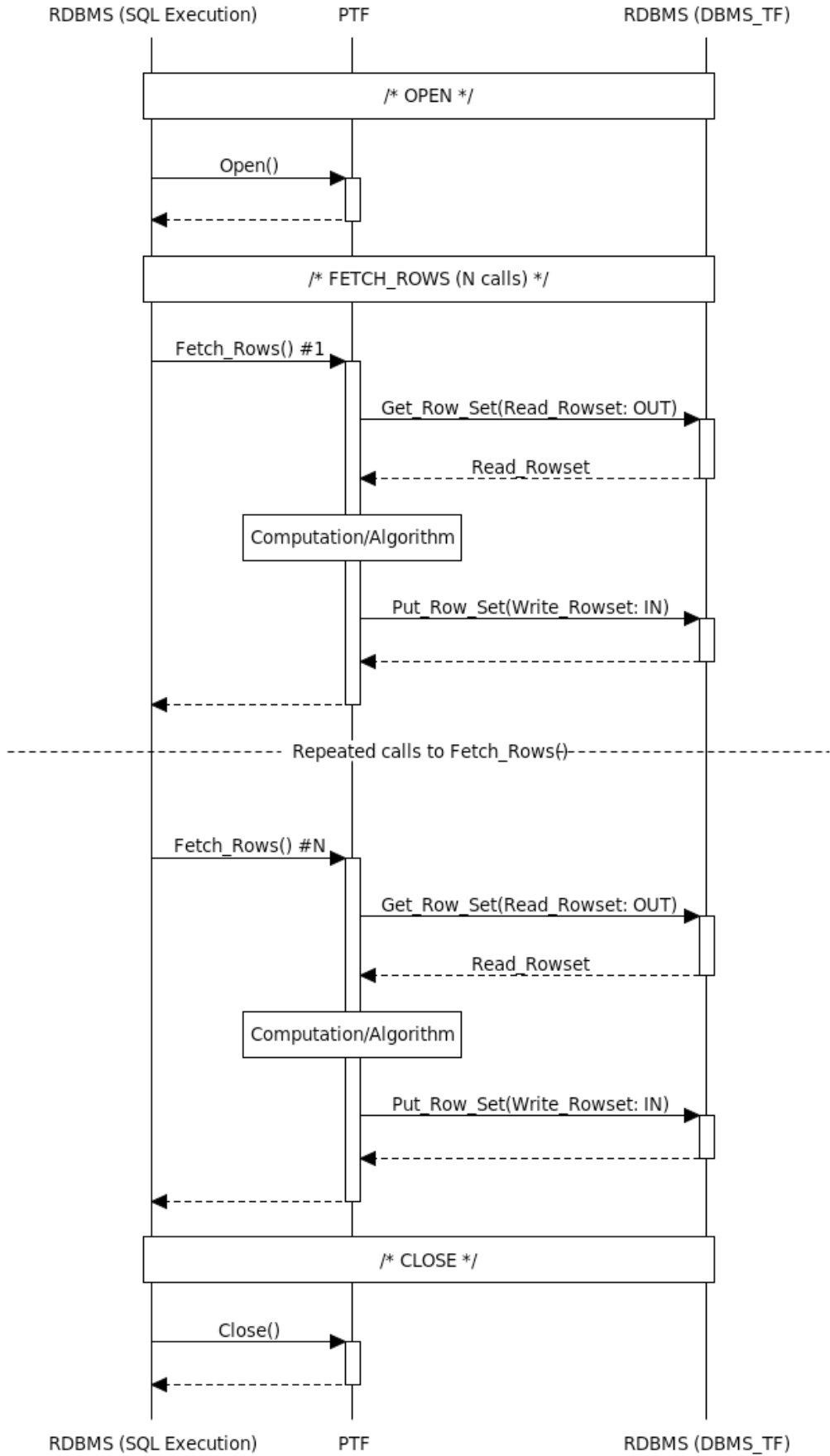
191.5 DBMS_TF Execution Flow

Query executions invoking Polymorphic Table Functions (PTF) follow this execution model and data transfers flow.

The PTF execution procedures (`OPEN`, `FETCH_ROWS` and `CLOSE`) are called by the database during query execution.

The PTF execution follows this flow :

1. `OPEN` (if present)
2. `FETCH_ROWS` (can be invoked multiple times)
3. `CLOSE` (if present)



The `FETCH_ROWS` procedure reads the data for a rowset (collection of rows), and produces an output rowset.

Each call to `FETCH_ROWS` is associated with a rowset which is a data collection of input rows that is expected to be processed by the PTF.

The `GET_ROW_SET` or `GET_COL` is used to read the input rowset.

The `PUT_ROW_SET` or `PUT_COL` is used to produce an output rowset, that is written back to the database.

`PUT_ROW_SET` is used to set all the new columns in a single call.

The `ROWSET_T` record holds data for multiple columns. When the PTF algorithm is more suited toward producing a single output column at a time, you can use `PUT_COL` to produce a single column. A given column can only be produced once within a call to `FETCH_ROWS`.

For a Row Semantics PTF, the `FETCH_ROWS` procedure will return the new rows using the PTF Server interface before returning back to the database.

191.6 DBMS_TF Restrictions

These restrictions apply to Polymorphic Table Functions (PTFs) and using the `DBMS_TF` package.

Type Restrictions

A Polymorphic Table Function (PTF) can operate on a table with columns of any SQL types. However, read and new columns are restricted to scalar types. The read and new columns are used in the `PUT_ROW_SET`, `PUT_COL`, `GET_ROW_SET` and `GET_COL` procedures. All SQL types can be used with pass-through columns. The `DESCRIBE` function can determine the supported types using the `DBMS_TF.SUPPORTED_TYPE` function.

PTF Invocation and Execution Restrictions

Polymorphic table functions cannot be nested in the `FROM` clause of a query. Nesting PTF is only allowed using `WITH` clause.

Nesting table function with polymorphic table function is only allowed using `CURSOR` expressions. A PTF cannot be specified as an argument of a table function.

You cannot select a rowid from a Polymorphic Table Function (PTF).

The `PARTITION BY` and the `ORDER BY` clause can only be specified on an argument of a Table Semantics PTF.

The PTF execution methods `OPEN`, `FETCH_ROWS`, and `CLOSE` must be invoked in the polymorphic table function execution context only.

You cannot invoke the `DESCRIBE` method directly.

This example shows ten PTF nested invocation.

```
WITH t0
  AS (SELECT /*+ parallel */ *
      FROM   noop(dept)),
```

```
t1
AS (SELECT *
    FROM noop(t0)),
t2
AS (SELECT *
    FROM noop(t1)),
t3
AS (SELECT *
    FROM noop(t2)),
t4
AS (SELECT *
    FROM noop(t3)),
t5
AS (SELECT *
    FROM noop(t4)),
t6
AS (SELECT *
    FROM noop(t5)),
t7
AS (SELECT *
    FROM noop(t6)),
t8
AS (SELECT *
    FROM noop(t7)),
t9
AS (SELECT *
    FROM noop(t8))
SELECT *
FROM noop(t9)
WHERE deptno = 10;
```

10 ACCOUNTING NEW YORK

191.7 DBMS_TF Examples

These examples use DBMS_TF subprograms.

Summary of DBMS_TF Examples

These examples are incomplete and for demonstration purpose only.

- [Example 191-1](#), "Noop Polymorphic Table Function"
- [Echo Polymorphic Table Function Example](#)
- [Example 191-2](#), "DBMS_TF Method Name Overrides"
- [Example 191-3](#), "Query Transformations"
- [Example 191-5](#), "DBMS_TF.COLUMN_TYPE_NAME Example"
- [Example 191-6](#), "DBMS_TF.COL_TO_CHAR Example"
- [Example 191-7](#), "DBMS_TF.CSTORE_EXISTS Example"
- [Example 191-8](#), "DBMS_TF.GET_COL Example"
- [Example 191-9](#), "DBMS_TF.GET_ENV Example"

- [Example 191-10](#), "DBMS_TF.GET_ROW_SET Example"
- [Example 191-12](#), "DBMS_TF.GET_XID Example"
- [Rand_col Polymorphic Table Function Example](#), (DBMS_TF.PUT_COL Example)
- [Stack Polymorphic Table Function Example](#)
- [Split Polymorphic Table Function Example](#), (DBMS_TF.GET_ROW_SET and PUT_ROW_SET Example)
- [Example 191-14](#), "DBMS_TF.PUT_ROW_SET Example"
- [Example 191-16](#), "Replicate : DBMS_TF.ROW_REPLICATION Example"
- [Example 191-17](#), "DBMS_TF.ROW_TO_CHAR Example"
- [Example 191-18](#), "DBMS_TF.TRACE Example"
- [Row_num Polymorphic Table Function Example](#), (DBMS_TF.XSTORE_GET and XSTORE_SET Example)

In other books :

- *Oracle PL/SQL Language Reference* , "Skip_col Polymorphic Table Function Example"
- *Oracle PL/SQL Language Reference*, "To_doc Polymorphic Table Function Example"

191.7.1 Echo Polymorphic Table Function Example

The echo PTF takes in a table and a list of columns and produces new columns with same values.

This PTF returns all the columns in the input table `tab`, and adds to it the columns listed in `cols` but with the column names prefixed with "ECHO_".



Live SQL:

You can view and run this example on Oracle Live SQL at [Echo Polymorphic Table Function](#)

The echo PTF can appear in the FROM clause of the query. The COLUMNS operator is used to specify columns, for example:

```
SELECT *
FROM echo(scott.dept, COLUMNS(dname, loc));
```

DEPTNO	DNAME	LOC	ECHO_DNAME	ECHO_LOC
10	ACCOUNTING	NEW YORK	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS	RESEARCH	DALLAS
30	SALES	CHICAGO	SALES	CHICAGO
40	OPERATIONS	BOSTON	OPERATIONS	BOSTON

A PTF consists of the following :

- PTF implementation package specification : The specification must have the DESCRIBE method. The OPEN, FETCH_ROWS and CLOSE methods are optional.

- PTF implementation package body: The DESCRIBE method may have a new-columns parameter (the additional columns created by this PTF), which is followed by the PTF functions parameters.
- PTF Function: The PTF function has a reference to the implementation package.

The echo_package package specification defines the DESCRIBE and FETCH_ROWS methods.

```
CREATE PACKAGE echo_package
AS
  prefix DBMS_ID := 'ECHO_';
  FUNCTION describe(
    tab IN OUT DBMS_TF.TABLE_T,
    cols IN DBMS_TF.COLUMNS_T)
  RETURN DBMS_TF.DESCRIBE_T;
  PROCEDURE fetch_rows;
END echo_package;
```

The echo_package package body contains the PTF implementation.

```
CREATE PACKAGE BODY echo_package
AS
  FUNCTION describe(tab IN OUT DBMS_TF.TABLE_T,
    cols IN DBMS_TF.COLUMNS_T)
  RETURN DBMS_TF.DESCRIBE_T
  AS
    new_cols DBMS_TF.COLUMNS_NEW_T;
    col_id PLS_INTEGER := 1;
  BEGIN
    FOR I IN 1 .. tab.COLUMN.COUNT LOOP
      FOR J IN 1 .. cols.COUNT LOOP
        IF ( tab.COLUMN(i).description.name = cols(j) ) THEN
          IF ( NOT
DBMS_TF.SUPPORTED_TYPE(tab.COLUMN(i).description.TYPE) )
          THEN
            RAISE_APPLICATION_ERROR(-20102, 'Unsupported column
type [' ||
          TAB.COLUMN(i).description.TYPE||']');
          END IF;

          TAB.COLUMN(i).for_read := TRUE;
          NEW_COLS(col_id) := TAB.COLUMN(i).description;
          NEW_COLS(col_id).name := prefix ||
TAB.COLUMN(i).description.name;
          col_id := col_id + 1;

          EXIT;
        END IF;
      END LOOP;
    END LOOP;

    /* Verify all columns were found */
    IF ( col_id - 1 != cols.COUNT ) THEN
      RAISE_APPLICATION_ERROR(-20101, 'Column mismatch ['||col_id -
```

```

1||'], ['||cols.COUNT||']');
    END IF;

    RETURN DBMS_TF.DESCRIBE_T(new_columns => new_cols);
END;
PROCEDURE FETCH_ROWS
AS
    ROWSET DBMS_TF.ROW_SET_T;
BEGIN
    DBMS_TF.GET_ROW_SET(rowset);
    DBMS_TF.PUT_ROW_SET(rowset);
END;
END echo_package;

```

The PTF echo references the implementation package echo_package.

```

CREATE FUNCTION echo(tab TABLE,
                    cols COLUMNS)
RETURN TABLE
PIPELINED ROW POLYMORPHIC USING echo_package;

```

Example 191-4 Using the Echo PTF in Queries

This example selects all employees in department 20. The resulting rows have three new columns ECHO_ENAME, ECHO_HIREDATE, and ECHO_SAL.

```

SELECT *
FROM   echo(scott.emp, COLUMNS(ename, sal, hiredate))
WHERE  deptno = 20;

```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	ECHO_ENAME	ECHO_HIRE	ECHO_SAL
7369	SMITH	CLERK	7902	17-DEC-80	800		20	SMITH	17-DEC-80	800
7566	JONES	MANAGER	7839	02-APR-81	2975		20	JONES	02-APR-81	2975
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20	SCOTT	19-APR-87	3000
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20	ADAMS	23-MAY-87	1100
7902	FORD	ANALYST	7566	03-DEC-81	3000		20	FORD	03-DEC-81	3000

Using subquery w, display ENAME, ECHO_LOC and DNAME columns for all employees in department 30 with a salary greater than 1000.

```

WITH w
AS (SELECT e.*,
         dname,
         loc
    FROM   scott.emp e,
         scott.dept d
   WHERE  e.deptno = d.deptno)
SELECT  ename,
        echo_loc,
        dname
FROM    echo(w, COLUMNS(sal, dname, loc, hiredate))

```



```
WHERE deptno = 30
       AND echo_sal > 1000;
```

ENAME	ECHO_LOC	DNAME
ALLEN	CHICAGO	SALES
WARD	CHICAGO	SALES
MARTIN	CHICAGO	SALES
BLAKE	CHICAGO	SALES
TURNER	CHICAGO	SALES

Using subquery w, display ENAME and DNAME columns for all employees with a salary greater than 1000.

```
WITH w
     AS (SELECT e.*,
              dname,
              loc
          FROM   scott.emp e,
              scott.dept d
          WHERE  e.deptno = d.deptno)
SELECT echo_ename,
       dname
FROM   echo(w, COLUMNS(loc, deptno, dname, ename)) e
WHERE  ename IN (SELECT echo_ename
                FROM   echo(scott.emp, COLUMNS(sal, deptno, ename,
                hiredate))
                WHERE  deptno = e.echo_deptno
                AND sal > 1000);
```

ECHO_ENAME	DNAME
ALLEN	SALES
MILLER	ACCOUNTING
CLARK	ACCOUNTING
WARD	SALES
ADAMS	RESEARCH
TURNER	SALES
SCOTT	RESEARCH
BLAKE	SALES
JONES	RESEARCH
KING	ACCOUNTING
FORD	RESEARCH
MARTIN	SALES

191.8 DBMS_TF Data Structures

The DBMS_TF package defines these RECORD types, TABLE types and subtype.

RECORD Types

- [COLUMN_DATA_T Record Type](#)
- [COLUMN_METADATA_T Record Type](#)
- [COLUMN_T Record Type](#)

- [DESCRIBE_T Record Type](#)
- [ENV_T Record Type](#)
- [PARALLEL_ENV_T Record Type](#)
- [TABLE_T Record Type](#)

TABLE Types

- [Supported Types Collections \(TAB_<typ>_T\)](#)
- [COLUMNS_NEW_T Table Type](#)
- [COLUMNS_T Table Type](#)
- [COLUMNS_WITH_TYPE_T Table Type](#)
- [TABLE_COLUMNS_T Table Type](#)
- [ROW_SET_T Table Type](#)

Types

- [XID_T Subtype](#)

CSTORE and XSTORE Data Structures

The compilation and execution state management interfaces use data structures internally.

See [Collections For Compilation Storage](#) for more information.

191.8.1 Supported Types Collections

Each supported type has a corresponding predefined collection defined.

Syntax

```

TYPE TAB_BOOLEAN_T          IS TABLE OF BOOLEAN          INDEX BY PLS_INTEGER;
TYPE TAB_BINARY_FLOAT_T     IS TABLE OF BINARY_FLOAT     INDEX BY PLS_INTEGER;
TYPE TAB_BINARY_DOUBLE_T    IS TABLE OF BINARY_DOUBLE    INDEX BY PLS_INTEGER;
TYPE TAB_BLOB_T             IS TABLE OF BLOB              INDEX BY PLS_INTEGER;
TYPE TAB_CHAR_T             IS TABLE OF CHAR(32767)       INDEX BY PLS_INTEGER;
TYPE TAB_CLOB_T             IS TABLE OF CLOB              INDEX BY PLS_INTEGER;
TYPE TAB_DATE_T             IS TABLE OF DATE              INDEX BY PLS_INTEGER;
TYPE TAB_INTERVAL_YM_T      IS TABLE OF YMINTERVAL_UNCONSTRAINED  INDEX BY PLS_INTEGER;
TYPE TAB_INTERVAL_DS_T      IS TABLE OF DSINTERVAL_UNCONSTRAINED  INDEX BY PLS_INTEGER;
TYPE TAB_NATURALN_T         IS TABLE OF NATURALN         INDEX BY PLS_INTEGER;
TYPE TAB_NUMBER_T           IS TABLE OF NUMBER           INDEX BY PLS_INTEGER;
TYPE TAB_RAW_T              IS TABLE OF RAW(32767)       INDEX BY PLS_INTEGER;
TYPE TAB_ROWID_T            IS TABLE OF ROWID            INDEX BY PLS_INTEGER;

```

```

TYPE TAB_VARCHAR2_T      IS TABLE OF VARCHAR2(32767) INDEX BY PLS_INTEGER;

TYPE TAB_TIMESTAMP_T    IS TABLE OF TIMESTAMP_UNCONSTRAINED INDEX BY
PLS_INTEGER;

TYPE TAB_TIMESTAMP_TZ_T IS TABLE OF TIMESTAMP_TZ_UNCONSTRAINED INDEX BY
PLS_INTEGER;

TYPE TAB_TIMESTAMP_LTZ_T IS TABLE OF TIMESTAMP_LTZ_UNCONSTRAINED INDEX BY
PLS_INTEGER;

```



See Also:

[Table 191-1](#) for more information about the DBMS_TF supported types

191.8.2 COLUMN_DATA_T Record Type

Data for a single column (variant record).

Exactly one variant field is active in the record. The description includes information about the column type that is active.

See [Table 191-1](#) for the list of supported types.

Syntax

```

TYPE COLUMN_DATA_T IS RECORD
( description          COLUMN_METADATA_T,
  tab_varchar2        TAB_VARCHAR2_T,
  tab_number          TAB_NUMBER_T,
  tab_date            TAB_DATE_T,
  tab_binary_float    TAB_BINARY_FLOAT_T,
  tab_binary_double   TAB_BINARY_DOUBLE_T,
  tab_raw             TAB_RAW_T,
  tab_char            TAB_CHAR_T,
  tab_clob            TAB_CLOB_T,
  tab_blob            TAB_BLOB_T,
  tab_timestamp       TAB_TIMESTAMP_T,
  tab_timestamp_tz    TAB_TIMESTAMP_TZ_T,
  tab_interval_ym     TAB_INTERVAL_YM_T,
  tab_interval_ds     TAB_INTERVAL_DS_T,
  tab_timestamp_ltz   TAB_TIMESTAMP_LTZ_T,
  tab_rowid           TAB_ROWID_T,
  tab_boolean         TAB_BOOLEAN_T);

```

Fields

Table 191-7 COLUMN_DATA_T Fields

Field	Description
description	The tag defines the metadata for the column indicating which variant field is active.

Table 191-7 (Cont.) COLUMN_DATA_T Fields

Field	Description
tab_varchar2	Variant field
tab_number	Variant field
tab_date	Variant field
tab_binary_float	Variant field
tab_binary_double	Variant field
tab_raw	Variant field
tab_char	Variant field
tab_clob	Variant field
tab_blob	Variant field
tab_timestamp	Variant field
tab_timestamp_tz	Variant field
tab_interval_ym	Variant field
tab_interval_ds	Variant field
tab_timestamp_ltz	Variant field
tab_rowid	Variant field
tab_boolean_t	Variant field

191.8.3 COLUMN_METADATA_T Record Type

This type contains metadata about an existing table column or a new column produced by PTF.

Syntax

```
TYPE COLUMN_METADATA_T IS RECORD
( type          PLS_INTEGER,
  max_len       PLS_integer DEFAULT -1,
  name          VARCHAR2(32767),
  name_len      PLS_INTEGER,
  precision     PLS_INTEGER,
  scale         PLS_INTEGER,
  charsetid     PLS_INTEGER,
  charsetform   PLS_INTEGER,
  collation     PLS_INTEGER );
```

Fields

Table 191-8 COLUMN_METADATA_T Fields

Field	Description
type	Internal Oracle typecode for the column's type

Table 191-8 (Cont.) COLUMN_METADATA_T Fields

Field	Description
max_len	Maximum length of a column. If it is less than the maximum allowed length then that value will be used, if it is NULL or zero, zero will be used. If it is less than zero, then maximum allowed length will be used. If types (like date,float), does not care about length, then this value will be ignored.
name	Name of the column
name_len	Length of the name
precision	The precision, or the maximum number of significant decimal digits (for numeric data types)
scale	Scale, or the number of digits from the decimal point to the least significant digit (for numeric data types)
charsetid	Character set id (internal Oracle code, applies to string types)
charsetform	Character set form (internal Oracle code, applies to string types)
collation	Collation id (internal Oracle code, applies to string types)

191.8.4 COLUMN_T Record Type

The column descriptor record for the type COLUMN_METADATA_T that contains PTF specific attributes.

Syntax

```
TYPE column_t IS RECORD (
    description          COLUMN_METADATA_T,
    pass_through        BOOLEAN,
    for_read            BOOLEAN);
```

Fields

Table 191-9 COLUMN_T Fields

Field	Description
description	Column metadata
pass_through	Is this a pass through column
for_read	Is this column read by the PTF

191.8.5 DESCRIBE_T Record Type

The return type from the DESCRIBE method of PTF.

Syntax

```
TYPE DESCRIBE_T          IS RECORD
( NEW_COLUMNS           COLUMNS_NEW_T DEFAULT COLUMNS_NEW_T(),
  CSTORE_CHR            CSTORE_CHR_T  DEFAULT CSTORE_CHR_T(),
  CSTORE_NUM           CSTORE_NUM_T   DEFAULT CSTORE_NUM_T(),
```

```

CSTORE_BOL          CSTORE_BOL_T  DEFAULT CSTORE_BOL_T(),
CSTORE_DAT          CSTORE_DAT_T  DEFAULT CSTORE_DAT_T(),
METHOD_NAMES       METHODS_T      DEFAULT METHODS_T();

```

Fields

Table 191-10 DESCRIBE_T Fields

Field	Description
NEW_COLUMNS	New columns description that will be produced by the PTF
CSTORE_CHR	CStore array key type : VARCHAR2 (optional)
CSTORE_NUM	CStore array key type : NUMBER (optional)
CSTORE_BOL	CStore array key type : BOOLEAN (optional)
CSTORE_DAT	CStore array key type : DATE (optional)
METHOD_NAMES	Method names, if user wants to override OPEN, FETCH_ROWS, CLOSE methods

191.8.6 ENV_T Record Type

This record contains metadata about the polymorphic table function execution state.

Syntax

```

TYPE ENV_T IS RECORD (
  get_columns      TABLE_METADATA_T,
  put_columns      TABLE_METADATA_T,
  ref_put_col      REFERENCED_COLS_T,
  parallel_env     PARALLEL_ENV_T,
  query_optim      BOOLEAN,
  row_count        PLS_INTEGER,
  row_replication  BOOLEAN,
  row_insertion    BOOLEAN);

```

Fields

Table 191-11 ENV_T Fields

Field	Description
get_columns	Metadata about the columns read by PTF GET_COL procedure
put_columns	Metadata about columns sent back to database by PUT_COL procedure
ref_put_col	TRUE if the put column was referenced in the query
parallel_env	Parallel execution information (when a query runs in parallel)
query_optim	Is this execution for query optimization? TRUE, if the query was running on behalf of optimizer
row_count	Number of rows in current row set
row_replication	Is Row Replication Enabled?
row_insertion	Is Row Insertion Enabled?

191.8.7 PARALLEL_ENV_T Record Type

The record contains metadata specific to polymorphic table functions parallel execution.

Syntax

```
TYPE PARALLEL_ENV_T          IS RECORD
( instance_id                PLS_INTEGER,
  session_id                 PLS_INTEGER,
  server_grp                 PLS_INTEGER,
  server_set_no              PLS_INTEGER,
  no_slocal_servers          PLS_INTEGER,
  global_server_no           PLS_INTEGER,
  no_local_servers           PLS_INTEGER,
  local_server_no            PLS_INTEGER );
```

Fields

Table 191-12 PARALLEL_ENV_T Fields

Field	Description
instance_id	QC instance ID
session_id	QC session ID
server_grp	Server group
server_set_no	Server set number
no_slocal_servers	Number of sibling servers (including self)
global_server_no	Global server number (base 0)
no_local_servers	Number of sibling servers running on instance
local_server_no	Local server number (base 0)

191.8.8 TABLE_T Record Type

The DESCRIBE function input table descriptor argument is of TABLE_T record type.

Syntax

```
TYPE TABLE_T IS RECORD(
  column                    TABLE_COLUMNS_T,
  schema_name                DBMS_id,
  package_name               DBMS_id,
  ptf_name                   DBMS_id);
```

Fields

Table 191-13 TABLE_T Fields

Field	Description
column	Column information

Table 191-13 (Cont.) TABLE_T Fields

Field	Description
schema_name	The PTF schema name
package_name	The PTF implementation package name
ptf_name	The PTF name invoked

191.8.9 COLUMNS_NEW_T Table Type

Collection for new columns

Syntax

```
TYPE COLUMNS_NEW_T IS TABLE OF COLUMN_METADATA_T INDEX BY PLS_INTEGER;
```

191.8.10 COLUMNS_T Table Type

Collection containing column names

Syntax

```
TYPE COLUMNS_T IS TABLE OF DBMS_QUOTED_ID;
```

191.8.11 COLUMNS_WITH_TYPE_T Table Type

Collection containing columns metadata

Syntax

```
TYPE COLUMNS_WITH_TYPE_T IS TABLE OF COLUMN_METADATA_T;
```

191.8.12 TABLE_COLUMNS_T Table Type

A collection of columns(COLUMN_T)

Syntax

```
TYPE TABLE_COLUMNS_T IS TABLE OF COLUMN_T;
```

191.8.13 ROW_SET_T Table Type

Data for a rowset

Syntax

```
TYPE ROW_SET_T IS TABLE OF COLUMN_DATA_T INDEX BY PLS_INTEGER;
```

191.8.14 XID_T Subtype

The XID_T subtype is defined to store the execution unique ID returned by function GET_XID.

Syntax

```
SUBTYPE XID_T IS VARCHAR2(1024);
```

191.9 Summary of DBMS_TF Subprograms

This summary briefly describes the DBMS_TF package subprograms.

Table 191-14 DBMS_TF Subprograms

Subprogram	Description
COLUMN_TYPE_NAME Function	Returns the type name of the specified column type
COL_TO_CHAR Function	Returns the string representation of the specified column
CSTORE_EXISTS Function	Returns TRUE if an item with a given key exists in the PTF Compilation State management Store
CSTORE_GET Procedure	Gets item(s) of specified type from the PTF Compilation State management Store
GET_COL Procedure	Gets read column values
GET_ENV Function	Returns information about the PTF runtime environment
GET_ROW_SET Procedure	Gets read set of column values in the collection
GET_XID Function	Returns a unique execution id that can be used by the PTF to index any cursor execution specific runtime state
PUT_COL Procedure	Puts column values in the database
PUT_ROW_SET Procedure	Puts the collection read set of column values in the database
ROW_REPLICATION Procedure	Sets the row replication factor
ROW_TO_CHAR Function	Returns the string representation of a row in a rowset
SUPPORTED_TYPE Function	Returns TRUE if a specified type is supported by PTF infrastructure
TRACE Procedure	Prints data structures to help development and problem diagnosis
XSTORE_CLEAR Procedure	Removes all key-value pairs from XStore
XSTORE_EXISTS Procedure	Returns TRUE if the key has an associated value
XSTORE_GET Procedure	Gets a key-value store for PTF Execution State Management
XSTORE_REMOVE Procedure	Removes any value associated with the given key
XSTORE_SET Procedure	Sets the value for the given key store for PTF Execution State Management

191.9.1 COLUMN_TYPE_NAME Function

Returns the type name for the specified column type.

Syntax

```
FUNCTION COLUMN_TYPE_NAME(
    col COLUMN_METADATA_T)
RETURN VARCHAR2;
```

Parameters

Table 191-15 DBMS_TF.COLUMN_TYPE_NAME Function Parameters

Parameter	Description
col	The column metadata. See COLUMN_METADATA_T Record Type

Return Values

Returns the column type converted as text.

Example 191-5 DBMS_TF.COLUMN_TYPE_NAME Example

This example shows an application type check that invokes `COLUMN_TYPE_NAME` to compare the column type and raise an application error if the column type is not `VARCHAR2`.

```
FUNCTION describe(
    tab IN OUT DBMS_TF.table_t,
    cols IN DBMS_TF.columns_t)
RETURN DBMS_TF.describe_t
AS
    new_cols DBMS_TF.columns_new_t;
    col_id PLS_INTEGER := 1;
BEGIN
    FOR i IN 1 .. tab.count LOOP
        FOR j IN 1 .. cols.count LOOP
            IF (tab(i).description.name = cols(j)) THEN
                IF (DBMS_TF.column_type_name(tab(i).description.type) != 'VARCHAR2')
THEN
                    raise_application_error(-20102,
                        'Unsupported column type ['||tab(i).description.type||']');
                END IF;
                tab(i).for_read := true;
                new_cols(col_id) := tab(i).description;
                new_cols(col_id).name := 'ECHO_'|| tab(i).description.name;
                col_id := col_id + 1;
                EXIT;
            END IF;
        END LOOP;
    END LOOP;

    -- Verify all columns were found
    IF (col_id - 1 != cols.count) THEN
        raise_application_error(-20101,
            'Column mismatch ['||col_id-1||'], ['||cols.count||']');
    END IF;
```

```

        RETURN DBMS_TF.describe_t(new_columns => new_cols);
    END;

```

191.9.2 COL_TO_CHAR Function

Returns the string representation of the specified column.

Syntax

```

FUNCTION COL_TO_CHAR(
    col    COLUMN_DATA_T,
    rid    PLS_INTEGER,
    quote  VARCHAR2 DEFAULT '')
RETURN VARCHAR2;

```

Parameters

Table 191-16 DBMS_TF.COL_TO_CHAR Function Parameters

Parameter	Description
col	The column whose value is to be converted
rid	Row number
quote	Quotation mark to use for non-numeric values

Return Values

The string representation of a column data value.

Example 191-6 DBMS_TF.COL_TO_CHAR Example

```

PROCEDURE Fetch_Rows AS
    rowset DBMS_TF.rROW_SET_T;
    str    VARCHAR2(32000);
BEGIN
    DBMS_TF.GET_ROW_SET(rowset);
    str := DBMS_TF.COL_TO_CHAR(rowset(1), 1)
END;

```

191.9.3 CSTORE_EXISTS Function

Returns TRUE if an item with a given key exists in the Store PTF Compilation State.

Syntax

```

FUNCTION CSTORE_EXISTS
(key    IN VARCHAR2,
 key_type IN PLS_INTEGER default NULL)
return BOOLEAN;

```

Parameters

Table 191-17 CSTORE_EXISTS Function Parameters

Parameter	Description
key	A unique character key
key_type	The type of key (optional) Default : NULL

Return Values

Returns TRUE if the key has an associated value. When the key_type is NULL (default), it returns TRUE if the key has an associated value of any of the supported type.

When a key_type parameter value is passed, it returns TRUE if the key and specified type of key has an associated value. Otherwise, it returns FALSE.

Example 191-7 DBMS_TF.CSTORE_EXISTS Example

This code excerpt checks if an item with the key exists before reading it from the compilation store.

```
IF (DBMS_TF.CSTORE_EXISTS('min'||j)) THEN
    DBMS_TF.CSTORE_GET('min'||j, min_col);
END IF;
```

191.9.4 CSTORE_GET Procedure

You can use the CSTORE_GET procedure to get the associated value for a given key stored for PTF Compilation State.

CSTORE is the PTF compilation state management interface. The CSTORE interface is used to set and store key-value pairs during cursor compilation through the DBMS_TF.DESCRIBE function.

You can get the PTF compilation state during runtime procedures such as OPEN, FETCH_ROWS and CLOSE.

This procedure is overloaded. The DESCRIBE_T supports specifying key-value pairs for these scalar types: VARCHAR2, NUMBER, DATE, BOOLEAN.

See [Table 191-3](#) for more information.

Syntax

Get the value associated with the key in the value out variable. The value type returned is one of the supported scalar types.

```
PROCEDURE CSTORE_GET(
    key    IN    VARCHAR2,
    value IN OUT VARCHAR2);
```

```
PROCEDURE CSTORE_GET(
```

```

key    IN    VARCHAR2,
value  IN OUT NUMBER);

PROCEDURE CSTORE_GET(
key    IN    VARCHAR2,
value  IN OUT DATE);

PROCEDURE CSTORE_GET(
key    IN    VARCHAR2,
value  IN OUT BOOLEAN);

```

When no specific key is passed as an input parameter, the entire collection of key values for that type that exist in the CSTORE is returned.

```

PROCEDURE CSTORE_GET(key_value OUT CSTORE_CHR_T);

PROCEDURE CSTORE_GET(key_value OUT CSTORE_NUM_T);

PROCEDURE CSTORE_GET(key_value OUT CSTORE_BOL_T);

PROCEDURE CSTORE_GET(key_value OUT CSTORE_DAT_T);

```

Parameters

Table 191-18 DBMS_TF.CSTORE_GET Procedure Parameters

Parameter	Description
key	A unique character key
value	Value corresponding to the key for supported types
key_value	Key value

191.9.5 GET_COL Procedure

Get Read Column Values

Syntax

```

PROCEDURE GET_COL(
columnId NUMBER,
collection IN OUT NOCOPY <datatype>);

```

Where <datatype> can be any one of the supported types.

See [Table 191-1](#) for the list of supported types.

Parameters

Table 191-19 GET_COL Procedure Parameters

Parameter	Description
columnid	The id for the column

Table 191-19 (Cont.) GET_COL Procedure Parameters

Parameter	Description
collection	The data for the column

Usage Notes

This procedure is used to get the read column values in the collection of scalar type.

The column numbers are in the get column order as created in DESCRIBE method of PTF.

For the same ColumnId, GET_COL and PUT_COL may correspond to different column.

Example 191-8 DBMS_TF.GET_COL Example

This example is an excerpt of a fetch_rows procedure defined in the PTF implementation package.

```
PROCEDURE fetch_rows
IS
  col1 DBMS_TF.TAB_CLOB_T;
  col2 DBMS_TF.TAB_CLOB_T;
  out1 DBMS_TF.TAB_CLOB_T;
  out2 DBMS_TF.TAB_CLOB_T;
BEGIN
  DBMS_TF.GET_COL(1, col1);
  DBMS_TF.GET_COL(2, col2);

  FOR I IN 1 .. col1.COUNT LOOP
    out1(i) := 'ECHO-' || col1(i);
  END LOOP;

  FOR I IN 1 .. col2.COUNT LOOP
    out2(i) := 'ECHO-' || col2(i);
  END LOOP;

  DBMS_TF.PUT_COL(1, out1);
  DBMS_TF.PUT_COL(2, out2);
END;
```

Note, invoking the DBMS_TF APIs directly is not allowed. An error is raised if an attempt is made to execute these procedures out of context.

```
exec fetch_rows
```

```
ERROR at line 1:
ORA-62562: The API Get_Col can be called only during execution time of a polymorphic
table function.
```

191.9.6 GET_ENV Function

Returns information about the PTF runtime environment

Syntax

```
FUNCTION GET_ENV
    RETURN ENV_T;
```

Return Values

Returns information about the PTF runtime environment.

Example 191-9 DBMS_TF.GET_ENV Example

This line shows how you could initialize a local variable `env` of type `ENV_T` with the PTF execution information in a `FETCH_ROWS` implementation procedure.

```
env          DBMS_TF.ENV_T := DBMS_TF.GET_ENV();
```

191.9.7 GET_ROW_SET Procedure

Get Read Column Values

The `FETCH_ROW` procedure can call the `GET_ROW_SET` procedure to read the input rowset set of column values in the collection of supported scalar type. This procedure is overloaded.

Syntax

```
PROCEDURE GET_ROW_SET(
    rowset      OUT NOCOPY ROW_SET_T);

PROCEDURE GET_ROW_SET(
    rowset      OUT NOCOPY ROW_SET_T,
    row_count   OUT          PLS_INTEGER);

PROCEDURE GET_ROW_SET(
    rowset      OUT NOCOPY ROW_SET_T,
    row_count   OUT          PLS_INTEGER,
    col_count   OUT          PLS_INTEGER);
```

Parameters

Table 191-20 GET_ROW_SET Procedure Parameters

Parameter	Description
<code>rowset</code>	The collection of data and metadata
<code>row_count</code>	The number of rows in the columns
<code>col_count</code>	The number of columns

Example 191-10 DBMS_TF.GET_ROW_SET Example

This example is an excerpt from a PTF implementation package for demonstration purpose.

```
PROCEDURE fetch_rows(new_name IN VARCHAR2 DEFAULT 'PTF_CONCATENATE')
AS
```

```

rowset      DBMS_TF.ROW_SET_T;
accumulator DBMS_TF.TAB_VARCHAR2_T;
row_count   PLS_INTEGER;

FUNCTION get_value(col  PLS_INTEGER,
                  ROW  PLS_INTEGER)
RETURN VARCHAR2
AS
  col_type PLS_INTEGER := rowset(col).description.TYPE;
BEGIN
  CASE col_type
    WHEN DBMS_TF.TYPE_VARCHAR2 THEN
      RETURN NVL(rowset(col).TAB_VARCHAR2 (ROW), 'empty');
    ELSE
      RAISE_APPLICATION_ERROR(-20201, 'Non-Varchar Type='||col_type);
  END CASE;
END;

BEGIN
  DBMS_TF.GET_ROW_SET(rowset, row_count);

  IF ( rowset.count = 0 ) THEN
    RETURN;
  END IF;

  FOR row_num IN 1 .. row_count LOOP
    accumulator(row_num) := 'empty';
  END LOOP;

  FOR col_num IN 1 .. rowset.count LOOP
    FOR row_num IN 1 .. row_count LOOP
      accumulator(row_num) := accumulator(row_num) ||
get_value(col_num, row_num);
    END LOOP;
  END LOOP;
  -- Pushout the accumulator
  DBMS_TF.PUT_COL(1, accumulator);
END;

```

191.9.7.1 Stack Polymorphic Table Function Example

The stack PTF example unpivots the non-null values of the specified numeric columns by converting each column value into a new row.

Example 191-11 Stack Polymorphic Table Function Example

Live SQL:

You can view and run this example on Oracle Live SQL at [Stack Polymorphic Table Function](#)

Create the PTF implementation package `stack_p`.

The parameters are :

- **tab** - Input table
- **col** - The names of numeric (input) table columns to stack

```
CREATE PACKAGE stack_p AS

    FUNCTION describe(tab IN OUT dbms_tf.table_t,
                     col      dbms_tf.columns_t)
        RETURN dbms_tf.describe_t;

    PROCEDURE fetch_rows;

END stack_p;
```

Create the PTF implementation package body `stack_p`.

This PTF produces two new columns, `COLUMN_NAME` and `COLUMN_VALUE`, where the former contains the name of the unpivoted column and the latter contains the numeric value of that column. Additionally, the unpivoted columns are removed from the PTF's output.

```
CREATE PACKAGE BODY stack_p AS

    FUNCTION describe(tab IN OUT dbms_tf.table_t,
                     col      dbms_tf.columns_t)
        RETURN dbms_tf.describe_t AS
    BEGIN
        FOR i IN 1 .. tab.column.count LOOP
            FOR j IN 1 .. col.count LOOP
                IF (tab.column(i).description.name = col(j) AND
                    tab.column(i).description.TYPE = dbms_tf.type_number) THEN
                    tab.column(i).pass_through := false;
                    tab.column(i).for_read    := true;
                END IF;
            END LOOP;
        END LOOP;

        RETURN dbms_tf.describe_t(
            new_columns => dbms_tf.columns_new_t(
                1 => dbms_tf.column_metadata_t(name => 'COLUMN_NAME',
                                              TYPE =>
dbms_tf.type_varchar2),
                2 => dbms_tf.column_metadata_t(name => 'COLUMN_VALUE',
                                              TYPE =>
dbms_tf.type_number)),
            row_replication => true);
    END;

    PROCEDURE fetch_rows AS
        env      dbms_tf.env_t := dbms_tf.get_env();
        rowset   dbms_tf.row_set_t;
        colcnt   PLS_INTEGER;
        rowcnt   PLS_INTEGER;
```

```

    repfac dbms_tf.tab_naturaln_t;
    namcol dbms_tf.tab_varchar2_t;
    valcol dbms_tf.tab_number_t;
BEGIN
    dbms_tf.get_row_set(rowset, rowcnt, colcnt);

    FOR i IN 1 .. rowcnt LOOP
        repfac(i) := 0;
    END LOOP;

    FOR r IN 1 .. rowcnt LOOP
        FOR c IN 1 .. colcnt LOOP
            IF rowset(c).tab_number(r) IS NOT NULL THEN
                repfac(r) := repfac(r) + 1;
                namcol(nvl(namcol.last+1,1)) :=
                    INITCAP(regex_replace(env.get_columns(c).name, '^"|"$'));
                valcol(NVL(valcol.last+1,1)) := rowset(c).tab_number(r);
            END IF;
        END LOOP;
    END LOOP;

    dbms_tf.row_replication(replication_factor => repfac);
    dbms_tf.put_col(1, namcol);
    dbms_tf.put_col(2, valcol);

END;

END stack_p;

```

Create the standalone PTF named `stack`. Specify exactly one formal argument of type `TABLE`, specify the return type of the PTF as `TABLE`, specify a Row Semantics PTF type, and indicate the PTF implementation package to use is `stack_p`.

```

CREATE FUNCTION stack(tab TABLE,
                    col columns)
    RETURN TABLE
PIPELINED ROW POLYMORPHIC USING stack_p;

```

For all employees in departments 10 and 30, report values of columns `MGR`, `SAL`, and `COMM` ordered by department number and employee name.

```

SELECT deptno, ename, column_name, column_value
FROM    stack(scott.emp, COLUMNS(mgr, sal, comm))
WHERE   deptno IN (10, 30)
ORDER BY deptno, ename;

```

DEPTNO	ENAME	COLUMN_NAME	COLUMN_VALUE
10	CLARK	Mgr	7839
10	CLARK	Sal	2450
10	KING	Sal	5000
10	MILLER	Sal	1300
10	MILLER	Mgr	7782
30	ALLEN	Comm	300

30 ALLEN	Mgr	7698
30 ALLEN	Sal	1600
30 BLAKE	Mgr	7839
30 BLAKE	Sal	2850
30 JAMES	Sal	950
30 JAMES	Mgr	7698
30 MARTIN	Comm	1400
30 MARTIN	Mgr	7698
30 MARTIN	Sal	1250
30 TURNER	Comm	0
30 TURNER	Sal	1500
30 TURNER	Mgr	7698
30 WARD	Comm	500
30 WARD	Mgr	7698
30 WARD	Sal	1250

191.9.8 GET_XID Function

Returns a unique execution id that can be used by the PTF to index any cursor-execution specific runtime state.

Syntax

```
FUNCTION GET_XID  
    RETURN XID_T;
```

Return Values

A unique execution id that can be used by the PTF to index any cursor-execution specific runtime state.

Example 191-12 DBMS_TF.GET_XID Example

This is an excerpt of code showing an invocation of GET_XID to initialize a local variable indexed using the execution id to a zero value.

```
PROCEDURE open IS  
BEGIN  
    xst(DBMS_TF.GET_XID()) := 0;  
END;
```

191.9.9 PUT_COL Procedure

Put Column Values

Syntax

```
PROCEDURE PUT_COL(  
    columnid NUMBER,  
    collection IN <datatype>);
```

Where <datatype> can be any one of the supported types.

See [Table 191-1](#) for the list of supported types.

Parameters

Table 191-21 PUT_COL Procedure Parameters

Parameter	Description
columnid	The id for the column
collection	The data for the column

Usage Notes

This procedure is used to put the read column values in the collection of scalar type.

The collection of scalar type should be of supported type only.

The column numbers are in the get column order as created in DESCRIBE method of PTF.

For the same columnid, GET_COL and PUT_COL may correspond to different column.

191.9.9.1 Rand_col Polymorphic Table Function Example

The rand_col PTF appends specified number of random-valued columns to the output.

Example 191-13 Rand_col Polymorphic Table Function Example



Live SQL:

You can view and run this example on Oracle Live SQL at [Rand_col Polymorphic Table Function](#)

This rand_col PTF example appends col_count number of random-valued columns to the output. Optionally, the caller can restrict the random values to a numeric range by specifying [low, high]. The new columns are named "RAND_<n>"

Create the PTF implementation package rand_col_p.

The parameters are :

- tab : Input table
- col_count (optional) : Number of random-valued columns to generate [Default = 1]
- low (optional) : Lower bound for the random numbers [Default = Null]
- high (optional) : Upper bound for the random numbers [Default = Null]

```
CREATE PACKAGE rand_col_p AS

    FUNCTION describe(tab          IN OUT DBMS_TF.table_t,
                     col_count    NATURALN DEFAULT 1,
                     low          NUMBER   DEFAULT NULL,
                     high         NUMBER   DEFAULT NULL)
    RETURN DBMS_TF.describe_t;
```

```

PROCEDURE fetch_rows(col_count NATURALN DEFAULT 1,
                    low         NUMBER   DEFAULT NULL,
                    high        NUMBER   DEFAULT NULL);

END rand_col_p;

```

Create the PTF implementation package body `rand_col_p`.

The parameter `col_count` is a 'shape-determining' parameter and thus must be a constant (no binds, correlations, or expressions). By defining the type of `col_count` to be `NATURALN`, which has an implicit `NOT NULL` constraint, we guarantee that a cursor with non-constant value for this parameter will get a compilation error.

```

CREATE PACKAGE BODY rand_col_p AS
  col_name_prefix CONSTANT dbms_id := 'RAND_';

  FUNCTION describe(tab          IN OUT DBMS_TF.table_t,
                   col_count    NATURALN DEFAULT 1,
                   low          NUMBER   DEFAULT NULL,
                   high         NUMBER   DEFAULT NULL)
    RETURN DBMS_TF.describe_t
  AS
    cols DBMS_TF.columns_new_t;
  BEGIN
    FOR i IN 1 .. col_count LOOP
      cols(i) := DBMS_TF.column_metadata_t(name=>col_name_prefix||i,
TYPE=>DBMS_TF.type_number);
    END LOOP;

    RETURN DBMS_TF.describe_t(new_columns => cols);
  END;

  PROCEDURE fetch_rows(col_count NATURALN DEFAULT 1,
                      low        NUMBER   DEFAULT NULL,
                      high       NUMBER   DEFAULT NULL)
  AS
    row_count CONSTANT PLS_INTEGER := DBMS_TF.get_env().row_count;
    col       DBMS_TF.tab_number_t;
  BEGIN
    FOR c IN 1 .. col_count LOOP
      FOR i IN 1 .. row_count LOOP
        col(i) := CASE WHEN (low IS NULL OR high IS NULL)
                      THEN dbms_random.VALUE
                      ELSE dbms_random.VALUE(low,
high)
        END;
      END LOOP;
      DBMS_TF.put_col(c, col);
    END LOOP;
  END;

END rand_col_p;

```

Create the standalone `rand_col` PTF. Specify exactly one formal argument of type `TABLE`, specify the return type of the PTF as `TABLE`, specify a Row Semantics PTF type, and indicate the PTF implementation package to use is `rand_col_p`.

```
CREATE FUNCTION rand_col(tab TABLE,
                        col_count NATURALN DEFAULT 1,
                        low        NUMBER   DEFAULT NULL,
                        high       NUMBER   DEFAULT NULL)
RETURN TABLE
PIPELINED ROW POLYMORPHIC USING rand_col_p;
```

Invoke the `rand_col` PTF to display all columns of table `SCOTT.DEPT` with one produced `RAND_1` column.

```
SELECT *
FROM rand_col(scott.dept);
```

DEPTNO	DNAME	LOC	RAND_1
10	ACCOUNTING	NEW YORK	.738666262
20	RESEARCH	DALLAS	.093256312
30	SALES	CHICAGO	.992944835
40	OPERATIONS	BOSTON	.397948124

Invoke the `rand_col` PTF to display all columns of table `SCOTT.DEPT` with two produced `RAND_1` and `RAND_2` columns.

```
SELECT *
FROM rand_col(scott.dept, col_count => 2);
```

DEPTNO	DNAME	LOC	RAND_1	RAND_2
10	ACCOUNTING	NEW YORK	.976521361	.209802028
20	RESEARCH	DALLAS	.899577891	.10050334
30	SALES	CHICAGO	.277238362	.110736583
40	OPERATIONS	BOSTON	.989839995	.164822363

For all employees for which their job is not being a `SALESMAN`, display the employee name, job, and produce three `RAND` columns generating random values between `-10` and `10`.

```
SELECT ename, job, rand_1, rand_2, rand_3
FROM   rand_col(scott.emp, col_count => 3, low => -10, high => +10)
WHERE  job != 'SALESMAN';
```

ENAME	JOB	RAND_1	RAND_2	RAND_3
SMITH	CLERK	8.91760464	6.67366638	-9.2789076
JONES	MANAGER	6.78612961	-1.8617958	6.5282227
BLAKE	MANAGER	7.59545803	5.22269017	-2.7966401
CLARK	MANAGER	-6.4747304	-7.3650276	3.28388872
SCOTT	ANALYST	6.80492435	-3.2271045	-.97099797
KING	PRESIDENT	-9.3161177	6.27762154	-1.8184785
ADAMS	CLERK	-1.6618848	3.13119089	8.06363075
JAMES	CLERK	2.86918245	-3.5187936	-.72913809

```
FORD      ANALYST      6.67038328 -7.4989893 1.99072598
MILLER    CLERK        -2.1574578 -8.5082989 -.56046716
```

191.9.10 PUT_ROW_SET Procedure

Writes a collection of new column values in the database.

You can use this procedure to write all new columns in a collection of rows in the database.

This procedure is overloaded. Rows are not replicated by default. You can use the `ROW_REPLICATION` procedure to set the replication factor.

Syntax

This syntax is used when rows are not replicated.

```
PROCEDURE PUT_ROW_SET(
    rowset IN ROW_SET_T);
```

This syntax is used when the replication factor is a constant.

```
PROCEDURE PUT_ROW_SET(
    rowset          IN  ROW_SET_T,
    replication_factor IN NATURALN);
```

This syntax is used when the replication factor is specified as an array with multiple values.

```
PROCEDURE PUT_ROW_SET(
    rowset          IN  ROW_SET_T,
    replication_factor IN TAB_NATURALN_T);
```

Parameters

Table 191-22 PUT_ROW_SET Procedure Parameters

Parameter	Description
rowset	The collection of data and metadata
replication_factor	The replication factor per row

Example 191-14

 DBMS_TF.PUT_ROW_SET Example

This code excerpt fetches a collection of rows and writes all new columns back to the database without any processing.

```
PROCEDURE fetch_rows
AS
    rowset DBMS_TF.ROW_SET_T;
BEGIN
    DBMS_TF.GET_ROW_SET(rowset);
    DBMS_TF.PUT_ROW_SET(rowset);
END;
```

191.9.10.1 Split Polymorphic Table Function Example

The split PTF example splits each row of the input table into specified pieces.

Example 191-15 Split Polymorphic Table Function Example

This PTF example splits each row of the input table into cnt pieces dividing the values of the split columns.



Live SQL:

You can view and run this example on Oracle Live SQL at [Split Polymorphic Table Function](#)

Create the PTF implementation package split_p.

The parameters are :

- tab - Input table
- col - The names of numeric (input) table columns to split
- cnt - The number of times each input row is to be split

```
CREATE PACKAGE split_p AS

    FUNCTION describe(tab IN OUT DBMS_TF.table_t,
                     col      DBMS_TF.columns_t,
                     cnt      NATURALN)
        RETURN DBMS_TF.describe_t;

    PROCEDURE fetch_rows(cnt NATURALN);

END split_p;
```

Create the PTF implementation package body split_p. Each row of the input table is split into cnt pieces dividing the values of the split columns.

```
CREATE PACKAGE BODY split_p AS

    FUNCTION describe(tab IN OUT DBMS_TF.Table_t,
                     col      DBMS_TF.Columns_t,
                     cnt      NATURALN)
        RETURN DBMS_TF.describe_t
    AS
        new_cols DBMS_TF.columns_new_t;
        col_id   PLS_INTEGER := 1;
    BEGIN
        FOR i IN 1 .. tab.column.count LOOP
            FOR j IN 1 .. col.count LOOP
                IF (tab.column(i).description.name = col(j) AND
                    tab.column(i).description.TYPE = DBMS_TF.type_number) THEN
                    tab.column(i).pass_through := FALSE;
                END IF;
            END LOOP;
        END LOOP;
    END describe;

    PROCEDURE fetch_rows(cnt NATURALN)
    AS
    BEGIN
    END fetch_rows;

END split_p;
```



```

        tab.column(i).for_read      := TRUE;
        new_cols(col_id) := tab.column(i).description;
        col_id := col_id + 1;
    END IF;
END LOOP;
END LOOP;

RETURN DBMS_TF.describe_t(new_columns=>new_cols,
row_replication=>true);
END;
PROCEDURE fetch_rows(cnt NATURALN)
AS
    inp_rs DBMS_TF.row_set_t;
    out_rs DBMS_TF.row_set_t;
    rows   PLS_INTEGER;
BEGIN
    DBMS_TF.get_row_set(inp_rs, rows);

    FOR c IN 1 .. inp_rs.count() LOOP
        FOR r IN 1 .. rows LOOP
            FOR i IN 1 .. cnt LOOP
                out_rs(c).tab_number((r-1)*cnt+i) := inp_rs(c).tab_number(r)/
cnt;
            END LOOP;
        END LOOP;
    END LOOP;

    DBMS_TF.put_row_set(out_rs, replication_factor => cnt);
END;

END split_p;

```

Create the standalone PTF named `split`. Specify exactly one formal argument of type `TABLE`, specify the return type of the PTF as `TABLE`, specify a Row Semantics PTF type, and indicate the PTF implementation package to use is `split_p`.

```

CREATE FUNCTION split(tab TABLE, col columns, cnt NATURALN)
RETURN TABLE
PIPELINED ROW POLYMORPHIC USING split_p;

```

For all employees in department 30, display the `ENAME`, `SAL`, and `COMM` columns. Invoke the `split` PTF with the `COLUMNS` pseudo-operator to divide the value of `SAL` and `COMM` by 2 for each replicated row returned by the query. Each row is replicated twice.

```

SELECT ename, sal, comm
FROM   split(scott.emp, COLUMNS(sal, comm), cnt => 2)
WHERE  deptno=30;

```

ENAME	SAL	COMM
ALLEN	800	150
ALLEN	800	150
WARD	625	250
WARD	625	250

MARTIN	625	700
MARTIN	625	700
BLAKE	1425	
BLAKE	1425	
TURNER	750	0
TURNER	750	0
JAMES	475	
JAMES	475	

191.9.11 ROW_REPLICATION Procedure

Sets the row replication factor either as a fixed value or as a value per row.

This procedure is overloaded. A `Row Semantics` polymorphic table function will either produce a single output row for a given input row (one-to-one), or it can produce more output rows for a given input rows (one-to-many), or it can produce no output rows (one-to-none).

Syntax

Sets the row replication factor as a fixed value.

```
PROCEDURE ROW_REPLICATION(
    replication_factor IN NATURALN);
```

Sets the row replication factor as a value per row.

```
PROCEDURE ROW_REPLICATION(
    replication_factor IN TAB_NATURALN_T);
```

Parameters

Table 191-23 ROW_REPLICATION Procedure Parameters

Parameter	Description
<code>replication_factor</code>	The replication factor per row

Example 191-16 Replicate Polymorphic Table Function Example

This example creates a PTF that replicates each input row by the `replication_factor` that is given as a parameter.



Live SQL:

You can view and run this example on Oracle Live SQL at [Replicate Polymorphic Table Function](#)

Create the PTF implementation package `replicate_p`.

```
CREATE PACKAGE replicate_p
AS

    FUNCTION Describe(tab IN OUT DBMS_TF.TABLE_T,
        replication_factor NATURAL)
        RETURN DBMS_TF.describe_t;
```

```

PROCEDURE Fetch_Rows(replication_factor NATURALN);

END replicate_p;

```

Create the PTF implementation package body replicate_p. The PTF replicates each input row by the replication_factor that is given as a parameter.

```

CREATE PACKAGE body replicate_p
AS

    FUNCTION Describe(tab IN OUT DBMS_TF.Table_t
                      , replication_factor NATURAL)
        RETURN DBMS_TF.describe_t AS
    BEGIN
        RETURN DBMS_TF.describe_t(row_replication => True);
    END;

    PROCEDURE Fetch_Rows(replication_factor NATURALN)
    AS
    BEGIN
        DBMS_TF.ROW_REPLICATION(replication_factor);
    END;
END replicate_p;

```

Create a standalone PTF named replicate. Specify exactly one formal argument of type TABLE, specify the return type of the PTF as TABLE, specify a Row Semantics PTF type, and indicate the PTF implementation package to use is replicate_p.

```

CREATE FUNCTION replicate(tab TABLE,
                          replication_factor NATURAL)
    RETURN TABLE PIPELINED ROW POLYMORPHIC USING replicate_p;

```

This example sets the replication_factor to 2 which results in doubling the number of rows.

```

SELECT *
FROM replicate(dept, replication_factor => 2);

```

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
20	RESEARCH	DALLAS
30	SALES	CHICAGO
30	SALES	CHICAGO
40	OPERATIONS	BOSTON
40	OPERATIONS	BOSTON

This example sets the `replication_factor` to zero.

```
SELECT *
FROM replicate(dept, replication_factor => 0);
```

no rows selected

Count the number of employees in each department. Invoke the replicate PTF to report from the `SCOTT.EMP` table to set the `replication_factor` to 1000000.

```
SELECT deptno, COUNT(*)
FROM replicate(scott.emp, 1e6)
GROUP BY deptno;
```

```
DEPTNO  COUNT(*)
-----  -
        30  6000000
        10  3000000
        20  5000000
```

This sets the `replication_factor` to 1000000000.

```
SELECT COUNT(*)
FROM replicate(dual, 1e9);
```

```
COUNT(*)
-----
1000000000
```

191.9.12 ROW_TO_CHAR Function

The `ROW_TO_CHAR` function converts a row data value to a string representation.

Syntax

```
FUNCTION ROW_TO_CHAR(
    rowset ROW_SET_T,
    rid    PLS_INTEGER,
    format PLS_INTEGER DEFAULT FORMAT_JSON)
RETURN VARCHAR2;
```

Parameters

Table 191-24 DBMS_TF.ROW_TO_CHAR Function Parameters

Parameter	Description
<code>rowset</code>	The rowset whose value is to be converted
<code>rid</code>	Row number
<code>format</code>	The string format (default is <code>FORMAT_JSON</code>)

Usage Notes

Only the JSON format is supported.

Return Values

The string representation in JSON format.

Example 191-17 DBMS_TF.ROW_TO_CHAR Example

```
PROCEDURE Fetch_Rows as
  rowset DBMS_TF.ROW_SET_T;
  str    VARCHAR2(32000);
BEGIN
  DBMS_TF.GET_ROW_SET(rowset);
  str := DBMS_TF.ROW_TO_CHAR(rowset, 1)
END;
```

191.9.13 SUPPORTED_TYPE Function

This function tests if a specified type is supported with polymorphic table functions.

Syntax

```
FUNCTION SUPPORTED_TYPE(
  type_id PLS_INTEGER)
RETURN BOOLEAN;
```

Parameters

Table 191-25 DBMS_TF.SUPPORTED_TYPE Function Parameters

Parameter	Description
type_id	The type

Return Values

Returns TRUE if the type_id is a scalar supported by PUT_COL and GET_COL.



See Also:

[Echo Polymorphic Table Function Example](#) for an example of DBMS_TF.SUPPORTED_TYPE use.

191.9.14 TRACE Procedure

Prints data structures to help development and problem diagnosis.

This procedure is overloaded.

Syntax

```
PROCEDURE TRACE(
  msg          VARCHAR2,
  with_id     BOOLEAN   DEFAULT FALSE,
  separator    VARCHAR2  DEFAULT NULL,
  prefix      VARCHAR2  DEFAULT NULL);
```

```

PROCEDURE TRACE(
    rowset      IN ROW_SET_T);

PROCEDURE TRACE(
    env         IN ENV_T);

PROCEDURE TRACE(
    columns_new IN COLUMNS_NEW_T);

PROCEDURE trace(
    cols        IN COLUMNS_T);

PROCEDURE trace(
    columns_with_type IN COLUMNS_WITH_TYPE_T);

PROCEDURE trace(
    tab         IN TABLE_T);

PROCEDURE trace(
    col         IN COLUMN_METADATA_T);

```

Parameters

Table 191-26 TRACE Procedure Parameters

Parameter	Description
msg	Custom user tracing message
with_id	Include the unique execution ID in the trace?
separator	Specify a string to use to separate values
prefix	Specify a string to prefix the actual values
rowset	Data for a rowset
env	Metadata about the polymorphic table function execution state
columns_new	Collection for new columns
cols	Collection containing column names
columns_with_type	Collection containing columns metadata
tab	Table descriptor
col	Metadata about an existing table column or a new column produced

Example 191-18 DBMS_TF.TRACE Example

This example adds tracing to a fetch_rows procedure.

```

PROCEDURE fetch_rows
AS
    rowset DBMS_TF.ROW_SET_T;
BEGIN
    DBMS_TF.TRACE('IDENTITY_PACKAGE.Fetch_Rows()', with_id => TRUE);
    DBMS_TF.TRACE(rowset);
    DBMS_TF.GET_ROW_SET(rowset);
    DBMS_TF.TRACE(rowset);
    DBMS_TF.PUT_ROW_SET(rowset);

```

```
DBMS_TF.TRACE(DBMS_TF.GET_ENV);
END;
```

191.9.15 XSTORE_CLEAR Procedure

Removes all key-value pairs from the XSTORE execution state.

Syntax

```
PROCEDURE XSTORE_CLEAR;
```

191.9.16 XSTORE_EXISTS Function

Returns TRUE if an item with a given key exists in the XSTORE.

Syntax

```
FUNCTION XSTORE_EXISTS(
    key      IN VARCHAR2,
    key_type IN PLS_INTEGER DEFAULT NULL)
RETURN BOOLEAN;
```

Parameters

Table 191-27 DBMS_TF.XSTORE_EXISTS Function Parameters

Parameter	Description
key	A unique character key
key_type	The type of key (optional). Default : NULL

Return Values

Returns TRUE if the key has an associated value. When the `key_type` is NULL (default), it returns TRUE if the key has an associated value of any of the supported type.

When a `key_type` parameter value is passed, it returns TRUE if the key and specified type of key has an associated value. Otherwise, it returns FALSE.



See Also:

[Table 191-6](#) for more information about supported key types.

191.9.17 XSTORE_GET Procedure

You can use the XSTORE_GET procedure to get the associated value for a given key stored for PTF Execution State Management.

XStore is the PTF execution state management interface. The XStore interface is used to set and store key-value pairs during PTF execution.

This procedure is overloaded. The XStore supports specifying key-value pairs for these scalar types: VARCHAR2, NUMBER, DATE, BOOLEAN.

See [Table 191-6](#) for more information about supported key types.

Syntax

```
PROCEDURE XSTORE_GET (
    key   IN VARCHAR2,
    value IN OUT VARCHAR2);
```

```
PROCEDURE XSTORE_GET (
    key   IN VARCHAR2,
    value IN OUT NUMBER);
```

```
PROCEDURE XSTORE_GET (
    key   IN VARCHAR2,
    value IN OUT DATE);
```

```
PROCEDURE XSTORE_GET (
    key   IN VARCHAR2,
    value IN OUT BOOLEAN);
```

Parameters

Table 191-28 DBMS_TF.XSTORE_GET Procedure Parameters

Parameter	Description
key	A unique character key
value	Value corresponding to the key for supported types

Usage Notes

If the key is not found, the value is unchanged.

191.9.17.1 Row_num Polymorphic Table Function Example

The row_num PTF example appends a sequence column to a table.

Example 191-19 Row_num Polymorphic Table Function Example

Live SQL:

You can view and run this example on Oracle Live SQL at [Row_num Polymorphic Table Function](#)

Create the PTF implementation package row_num_p.

The parameters are :

- tab - The input table
- ini - The initial value (Default = 1)

- `inc` - The amount to increment (Default = 1)

```
CREATE PACKAGE row_num_p IS
  FUNCTION describe(tab IN OUT dbms_tf.table_t,
                   ini NUMBER DEFAULT 1,
                   inc NUMBER DEFAULT 1)
    RETURN dbms_tf.describe_t;

  PROCEDURE fetch_rows(ini NUMBER DEFAULT 1, inc NUMBER DEFAULT 1);
END;
```

This PTF accepts any input table and appends the sequence column `ROW_ID` to the table. The sequence values start with the specified value (`ini`) and each time it is incremented by the specified value (`inc`).

```
CREATE PACKAGE BODY row_num_p IS
  FUNCTION describe(tab IN OUT dbms_tf.table_t,
                   ini NUMBER DEFAULT 1,
                   inc NUMBER DEFAULT 1)
    RETURN dbms_tf.describe_t AS
  BEGIN
    RETURN dbms_tf.describe_t(new_columns =>
                              dbms_tf.columns_new_t(1 =>
                                                    dbms_tf.column_metadata_t(name => 'ROW_ID',
                                                                                TYPE =>
dbms_tf.type_number)));
  END;

  PROCEDURE fetch_rows(ini NUMBER DEFAULT 1, inc NUMBER DEFAULT 1) IS
    row_cnt CONSTANT PLS_INTEGER := dbms_tf.get_env().row_count;
    rid      NUMBER              := ini;
    col      dbms_tf.tab_number_t;
  BEGIN
    dbms_tf.xstore_get('rid', rid);
    FOR i IN 1 .. row_cnt LOOP col(i) := rid + inc*(i-1); END LOOP;
    dbms_tf.put_col(1, col);
    dbms_tf.xstore_set('rid', rid + inc*row_cnt);
  END;
END;
```

Create a standalone polymorphic table function named `row_num`. Specify exactly one formal argument of type `TABLE`, specify the return type of the PTF as `TABLE`, specify a Table Semantics PTF type, and indicate the PTF implementation package to use is `row_num_p`.

```
CREATE FUNCTION row_num(tab TABLE,
                       ini NUMBER DEFAULT 1,
                       inc NUMBER DEFAULT 1)
  RETURN TABLE
PIPELINED TABLE POLYMORPHIC USING row_num_p;
```

The `row_num` PTF invocation reporting from the `SCOTT.DEPT` table produces a new column `ROW_ID` with value starting at 1 and incremented by 1 in the row set.

```
SELECT * FROM row_num(scott.dept);
```

DEPTNO	DNAME	LOC	ROW_ID
10	ACCOUNTING	NEW YORK	1
20	RESEARCH	DALLAS	2
30	SALES	CHICAGO	3
40	OPERATIONS	BOSTON	4

The `row_num` PTF invocation reporting from the `SCOTT.DEPT` table produces a new column `ROW_ID` with value starting at 100 and incremented by 1 in the row set.

```
SELECT * FROM row_num(scott.dept, 100);
```

DEPTNO	DNAME	LOC	ROW_ID
10	ACCOUNTING	NEW YORK	100
20	RESEARCH	DALLAS	101
30	SALES	CHICAGO	102
40	OPERATIONS	BOSTON	103

The `row_num` PTF invocation reporting from the `SCOTT.DEPT` table produces a new column `ROW_ID` with value starting at 0 and decremented by 1 in the row set.

```
SELECT * FROM row_num(scott.dept, ini => 0, inc => -1);
```

DEPTNO	DNAME	LOC	ROW_ID
10	ACCOUNTING	NEW YORK	0
20	RESEARCH	DALLAS	-1
30	SALES	CHICAGO	-2
40	OPERATIONS	BOSTON	-3

The `row_num` PTF invocation reporting from the `SCOTT.EMP` table produces a new column `ROW_ID` with value starting at 0 and incremented by 0.25 in the row set which is partitioned by department number and ordered by employee name.

```
SELECT deptno, ename, job, sal, row_id
   FROM row_num(scott.emp PARTITION BY deptno ORDER BY ename, ini => 0, inc
=> 0.25)
 WHERE deptno IN (10, 30);
```

DEPTNO	ENAME	JOB	SAL	ROW_ID
10	CLARK	MANAGER	2450	0
10	KING	PRESIDENT	5000	.25
10	MILLER	CLERK	1300	.5
30	ALLEN	SALESMAN	1600	0
30	BLAKE	MANAGER	2850	.25
30	JAMES	CLERK	950	.5
30	MARTIN	SALESMAN	1250	.75

```

30 TURNER      SALESMAN      1500      1
30 WARD       SALESMAN      1250     1.25

```

191.9.18 XSTORE_REMOVE Procedure

Removes an item associated with the given key and key_type.

Syntax

```

PROCEDURE XSTORE_REMOVE (
    key      IN VARCHAR2,
    key_type IN PLS_INTEGER DEFAULT NULL);

```

Parameters

Table 191-29 DBMS_TF.XSTORE_REMOVE Function Parameters

Parameter	Description
key	A unique character key
key_type	The type of key to remove (optional)

Usage Notes

When a key_type parameter value is passed, it removes the associated item for the key and specified type of key.

191.9.19 XSTORE_SET Procedure

Sets the value for the given key for PTF Execution State Management.

You can use this procedure to store an item key-value pair in the XStore. This procedure is overloaded. The XStore supports specifying key-value pairs for these scalar types: VARCHAR2, NUMBER, DATE, BOOLEAN.

Syntax

```

PROCEDURE XSTORE_SET (
    key   IN VARCHAR2,
    value IN VARCHAR2);

```

```

PROCEDURE XSTORE_SET (
    key   IN VARCHAR2,
    value IN NUMBER);

```

```

PROCEDURE XSTORE_SET (
    key   IN VARCHAR2,
    value IN DATE);

```

```

PROCEDURE XSTORE_SET (
    key   IN VARCHAR2,
    value IN BOOLEAN);

```

Parameters

Table 191-30 DBMS_TF.XSTORE_SET Procedure Parameters

Parameter	Description
key	A unique character key
value	Value corresponding to the key for supported types

Usage Notes

If an item for a given key already exists, the value is replaced.

DBMS_TNS

The `DBMS_TNS` package provides the `RESOLVE_TNSNAME` function to resolve a TNS name and return the corresponding Oracle Net8 connection string.

This chapter contains the following topics:

- [DBMS_TNS Overview](#)
- [DBMS_TNS Security Model](#)
- [Summary of DBMS_TNS Subprograms](#)

192.1 DBMS_TNS Overview

The `DBMS_TNS` package contains one function, `RESOLVE_TNSNAME`, which returns the resolved connect string from configured sources that have been defined in the `names.directory_path` parameter in the `sqlnet.ora` file.

The `RESOLVE_TNSNAME` function in this package helps you to identify interconnected databases and trace the system change number (SCN) flow across distributed databases.

See Also:

- *Oracle Database Administrator's Guide* for more information about finding database link information
- *Oracle Database Reference* for information about the `ALL_DB_LINKS` data dictionary view

192.2 DBMS_TNS Security Model

You must be granted the `EXECUTE` privilege on the `DBMS_TNS` package.

192.3 Summary of DBMS_TNS Subprograms

This table lists the `DBMS_TNS` subprograms and briefly describes them.

Table 192-1 DBMS_TNS Parameters

Subprogram	Description
RESOLVE_TNSNAME Function	Returns the resolved connect string from any configured source (tnsnames, LDAP, Easy Connect) as indicated in the <code>sqlnet.ora</code> <code>names.directory_path</code> parameter)

192.3.1 RESOLVE_TNSNAME Function

This function returns the resolved connect string from any configured source (for example, TNS names, Lightweight Directory Access Protocol (LDAP), or Oracle Easy Connect) as indicated in the `sqlnet.ora` `names.directory_path` parameter.

Syntax

```
DBMS_TNS.RESOLVE_TNSNAME (
    tns_name VARCHAR2)
RETURN VARCHAR2;
```

RESOLVE_TNSNAME Function Parameters

Parameter	Description
<code>tns_name</code>	Database address for establishing the connection

Usage Notes

- Database administrators and system management tools can explicitly call the `DBMS_TNS.RESOLVE_TNSNAME` function to resolve a `tns_name`:
- Because the resolved value can change over time, Oracle does not recommend storing or caching this value, because these kinds of values can become invalid over time.
- You can use the `DBMS_TNS.RESOLVE_TNSNAME` function to resolve TNS names that were referred to by other data dictionary views such as `ALL_DB_LINKS` and `USER_DB_LINKS`. In addition, you can use it to find any TNS name entry in the `tnsnames.ora` file.

Example

```
SELECT DB_LINK, DBMS_TNS.RESOLVE_TNSNAME(HOST) FROM DBA_DB_LINKS;

DB_LINK
-----
-----
DBMS_TNS.RESOLVE_TNSNAME(HOST)
-----
-----
US.EXAMPLE.COM
(DESCRIPTION=(ADDRESS=(PROTOCOL=ipc)(KEY=may))
(CONNECT_DATA=(SERVICE_NAME=us.example.com)(CID=(PROGRAM=oracle)
(HOST=juno)(USER=psmith)
))
```

DBMS_TRACE

The `DBMS_TRACE` package contains the interface to trace PL/SQL functions, procedures, and exceptions.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Restrictions](#)
- [Operational Notes](#)
- [Summary of DBMS_TRACE Subprograms](#)

193.1 DBMS_TRACE Overview

`DBMS_TRACE` provides subprograms to start and stop PL/SQL tracing in a session. Oracle collects the trace data as the program executes and writes it to database tables.

A typical session involves:

1. (Optional) Limit tracing to specific subprograms and choose a tracing level.
Tracing all subprograms and exceptions in a large program can produce huge amounts of data that are difficult to manage.
2. Starting PL/SQL tracing in session (`DBMS_TRACE.SET_PLSQL_TRACE`).
3. Running an application to be traced.
4. Stopping PL/SQL tracing in session (`DBMS_TRACE.CLEAR_PLSQL_TRACE`).

After you have collected data with Trace, you can query the database tables that contain the performance data and analyze it in the same way that you analyze the performance data from Profiler.

193.2 DBMS_TRACE Security Model

This package must be created under `SYS`.

193.3 DBMS_TRACE Constants

`DBMS_TRACE` defines constants to use when specifying parameter values.

These constants are shown in the following table.

Table 193-1 DBMS_TRACE Event Constants

Name	Type	Value	Description
TRACE_ALL_CALLS	INTEGER	1	Traces calls or returns
TRACE_ENABLED_CALLS	INTEGER	2	
TRACE_ALL_EXCEPTIONS	INTEGER	4	Traces exceptions
TRACE_ENABLED_EXCEPTIONS	INTEGER	8	Traces exceptions and handlers
TRACE_LIMIT	INTEGER	16	Save only the last few records. This allows tracing up to a problem area, without filling the database up with masses of irrelevant information. If event 10940 is set, the limit is 1023*(the value of event 10940). This can be overridden by the use of "TRACE_LIMIT" flag.
TRACE_ALL_SQL	INTEGER	32	Traces SQL statements
TRACE_ENABLED_SQL	INTEGER	64	Traces SQL statements at PL/SQL level. This does not invoke SQL Trace
TRACE_ALL_LINES	INTEGER	128	Traces each line
TRACE_ENABLED_LINES	INTEGER	256	
TRACE_PAUSE	INTEGER	4096	Pauses tracing
TRACE_RESUME	INTEGER	8192	Resume tracing
TRACE_STOP	INTEGER	16384	Stops tracing
NO_TRACE_ADMINISTRATIVE	INTEGER	32768	Prevents tracing of 'administrative events such as <ul style="list-style-type: none"> • PL/SQL Trace Tool started • Trace flags changed • PL/SQL Virtual Machine started • PL/SQL Virtual Machine stopped
NO_TRACE_HANDLED_EXCEPTIONS	INTEGER	65536	Prevents tracing of handled exceptions

Table 193-2 DBMS_TRACE Version Constants

Name	Type	Value	Description
TRACE_MINOR_VERSION	INTEGER	0	
TRACE_MAJOR_VERSION	INTEGER	1	

Oracle recommends using the symbolic form for all these constants.

193.4 DBMS_TRACE Restrictions

You cannot use PL/SQL tracing in a shared server environment.

193.5 DBMS_TRACE Operational Notes

Certain operational notes apply to `DBMS_TRACE`.

These are described in the following sections:

- [Controlling Data Volume](#)
- [Creating Database Tables to Collect DBMS_TRACE Output](#)
- [Collecting Trace Data](#)
- [Collected Data](#)
- [Trace Control](#)

Controlling Data Volume

Profiling large applications may produce a large volume of data. You can control the volume of data collected by *enabling* specific program units for trace data collection.

You can enable a program unit by compiling it debug. This can be done in one of two ways:

```
alter session set plsql_debug=true;
create or replace ... /* create the library units - debug information will be
generated */
```

or:

```
/* recompile specific library unit with debug option */
alter [PROCEDURE | FUNCTION | PACKAGE BODY] <libunit-name> compile debug;
```



Note:

You cannot use the second method for anonymous blocks.

You can limit the amount of storage used in the database by retaining only the most recent 8,192 records (approximately) by including `TRACE_LIMIT` in the `TRACE_LEVEL` parameter of the `SET_PLSQL_TRACE` procedure.

Creating Database Tables to Collect DBMS_TRACE Output

You must create database tables into which the `DBMS_TRACE` package writes output. Otherwise, the data is not collected. To create these tables, run the script `TRACETAB.SQL`. The tables this script creates are owned by `SYS`.

Collecting Trace Data

The PL/SQL features you can trace are described in the script `DBMS_PBT.SQL`. Some of the key tracing features are:

- Tracing Calls
- Tracing Exceptions
- Tracing SQL
- Tracing Lines

Additional features of DBMS_TRACE also allow pausing and resuming trace, and limiting the output.

Tracing Calls

Two levels of call tracing are available:

- Level 1: Trace all calls. This corresponds to the constant `TRACE_ALL_CALLS`.
- Level 2: Trace calls to enabled program units only. This corresponds to the constant `TRACE_ENABLED_CALLS`.

Enabling cannot be detected for remote procedure calls (RPCs); hence, RPCs are only traced with level 1.

Tracing Exceptions

Two levels of exception tracing are available:

- Level 1: Trace all exceptions. This corresponds to `TRACE_ALL_EXCEPTIONS`.
- Level 2: Trace exceptions raised in enabled program units only. This corresponds to `TRACE_ENABLED_EXCEPTIONS`.

Tracing SQL

Two levels of SQL tracing are available:

- Level 1: Trace all SQL. This corresponds to the constant `TRACE_ALL_SQL`.
- Level 2: Trace SQL in enabled program units only. This corresponds to the constant `TRACE_ENABLED_SQL`.

Tracing Lines

Two levels of line tracing are available:

- Level 1: Trace all lines. This corresponds to the constant `TRACE_ALL_LINES`.
- Level 2: Trace lines in enabled program units only. This corresponds to the constant `TRACE_ENABLED_LINES`.

When tracing lines, Oracle adds a record to the database each time the line number changes. This includes line number changes due to procedure calls and returns.

Note:

For all types of tracing, level 1 overrides level 2. For example, if both level 1 and level 2 are enabled, then level 1 takes precedence.

Collected Data

If tracing is requested only for enabled program units, and if the current program unit is not enabled, then no trace data is written.

When tracing calls, both the call and return are traced. The check for whether tracing is "enabled" passes if either the called routine or the calling routine is "enabled".

Call tracing will always output the program unit type, program unit name, and line number for both the caller and the callee. It will output the caller's stack depth. If the caller is enabled, the caller's name will also be output. If the callee is enabled, the callee's name will also be output.

Exception tracing writes out the line number. Raising the exception shows information on whether the exception is user-defined or pre-defined. It also shows the exception number in the case of pre-defined exceptions. Both the place where the exceptions are raised and their handler is traced. The check for tracing being "enabled" is done independently for the place where the exception is raised and the place where the exception is handled. Enabling `NO_TRACE_HANDLED_EXCEPTIONS` limits data collection to unhandled exceptions

All calls to `DBMS_TRACE.SET_PLSQL_TRACE` and `DBMS_TRACE.CLEAR_PLSQL_TRACE` place a special trace record in the database. Therefore, it is always possible to determine when trace settings were changed.

Trace Control

As well as determining which items are collected, you can pause and resume the trace process. No information is gathered between the time that tracing is paused and the time that it is resumed. The constants `TRACE_PAUSE` and `TRACE_RESUME` are used to accomplish this. Trace records are generated to indicate that the trace was paused/resumed.

It is also possible to retain only the last 8,192 trace events of a run by using the constant `TRACE_LIMIT`. This allows tracing to be turned on without filling up the database. When tracing stops, the last 8,192 records are saved. The limit is approximate, since it is not checked on every trace record. At least the requested number of trace records will be generated; up to 1,000 additional records may be generated. At least the requested number of trace records will be generated; up to 1,000 additional records may be generated. The 8,192 record limit can be changed. Setting event 10940 to level n changes the record limit to $1024 * n$.

Enabling `NO_TRACE_ADMINISTRATIVE` prevents the generation of such administrative event records as PL/SQL Trace Tool started, Trace flags changed, PL/SQL Virtual Machine started, and PL/SQL Virtual Machine stopped.

193.6 Summary of DBMS_TRACE Subprograms

This table lists the `DBMS_TRACE` subprograms and briefly describes them.

Table 193-3 DBMS_TRACE Package Subprograms

Subprogram	Description
<code>CLEAR_PLSQL_TRACE</code> Procedure	Stops trace data dumping in session
<code>GET_PLSQL_TRACE_LEVEL</code> Function	Gets the trace level

Table 193-3 (Cont.) DBMS_TRACE Package Subprograms

Subprogram	Description
PLSQL_TRACE_VERSION Procedure	Gets the version number of the trace package
SET_PLSQL_TRACE Procedure	Starts tracing in the current session

193.6.1 CLEAR_PLSQL_TRACE Procedure

This procedure disables trace data collection.

Syntax

```
DBMS_TRACE.CLEAR_PLSQL_TRACE;
```

193.6.2 GET_PLSQL_TRACE_LEVEL Function

This procedure returns the current trace level as the sum of one or more DBMS_TRACE constants.

See [Table 193-1](#) for a list of the constants.

Syntax

```
DBMS_TRACE.GET_PLSQL_TRACE_LEVEL  
RETURN BINARY_INTEGER;
```

193.6.3 PLSQL_TRACE_VERSION Procedure

This procedure gets the version number of the trace package. It returns the major and minor version number of the DBMS_TRACE package.

Syntax

```
DBMS_TRACE.PLSQL_TRACE_VERSION (  
  major OUT BINARY_INTEGER,  
  minor OUT BINARY_INTEGER);
```

Parameters

Table 193-4 PLSQL_TRACE_VERSION Procedure Parameters

Parameter	Description
major	Major version number of DBMS_TRACE.
minor	Minor version number of DBMS_TRACE.

193.6.4 SET_PLSQL_TRACE Procedure

This procedure enables PL/SQL trace data collection.

Syntax

```
DBMS_TRACE.SET_PLSQL_TRACE (  
    trace_level INTEGER);
```

Parameters

Table 193-5 *SET_PLSQL_TRACE Procedure Parameters*

Parameter	Description
trace_level	You must supply one or more of the constants as listed in Table 193-1 . By summing the constants, you can enable tracing of multiple PL/SQL language features simultaneously. The control constants "TRACE_PAUSE", "TRACE_RESUME" and "TRACE_STOP" should not be used in combination with other constants. Also see DBMS_TRACE Operational Notes: Collecting Trace Data for more information.

DBMS_TRANSACTION

The DBMS_TRANSACTION package provides access to SQL transaction statements from stored procedures.



See Also:

Oracle Database SQL Language Reference

This chapter contains the following topics:

- [DBMS_TRANSACTION Security Model](#)
- [Summary of DBMS_TRANSACTION Subprograms](#)

194.1 DBMS_TRANSACTION Security Model

This package runs with the privileges of calling user, rather than the package owner SYS.

194.2 Summary of DBMS_TRANSACTION Subprograms

This table lists the DBMS_TRANSACTION subprograms and briefly describes them.

Table 194-1 DBMS_TRANSACTION Package Subprograms

Subprogram	Description
ADVISE_COMMIT Procedure	Equivalent to the SQL statement: ALTER SESSION ADVISE COMMIT
ADVISE_NOTHING Procedure	Equivalent to the SQL statement: ALTER SESSION ADVISE NOTHING
ADVISE_ROLLBACK Procedure	Equivalent to the SQL statement: ALTER SESSION ADVISE ROLLBACK
COMMIT Procedure	Equivalent to the SQL statement: COMMIT
COMMIT_COMMENT Procedure	Equivalent to the SQL statement: COMMIT COMMENT <text>
COMMIT_FORCE Procedure	Equivalent to the SQL statement: COMMIT FORCE <text>, <number>"
LOCAL_TRANSACTION_ID Function	Returns the local (to instance) unique identifier for the current transaction

Table 194-1 (Cont.) DBMS_TRANSACTION Package Subprograms

Subprogram	Description
PURGE_LOST_DB_ENTRY Procedure	Enables removal of incomplete transactions from the local site when the remote database is destroyed or re-created before recovery completes
PURGE_MIXED Procedure	Deletes information about a given mixed outcome transaction
READ_ONLY Procedure	Equivalent to the SQL statement: SET TRANSACTION READ ONLY
READ_WRITE Procedure	equivalent to the SQL statement: SET TRANSACTION READ WRITE
ROLLBACK Procedure	Equivalent to the SQL statement: ROLLBACK
ROLLBACK_FORCE Procedure	Equivalent to the SQL statement: ROLLBACK FORCE <text>
ROLLBACK_SAVEPOINT Procedure	Equivalent to the SQL statement: ROLLBACK TO SAVEPOINT <savepoint_name>
SAVEPOINT Procedure	Equivalent to the SQL statement: SAVEPOINT <savepoint_name>
STEP_ID Function	Returns local (to local transaction) unique positive integer that orders the DML operations of a transaction
USE_ROLLBACK_SEGMENT Procedure	Equivalent to the SQL statement: SET TRANSACTION USE ROLLBACK SEGMENT <rb_seg_name>

194.2.1 ADVISE_COMMIT Procedure

This procedure is equivalent to the SQL statement: ALTER SESSION ADVISE COMMIT

Syntax

```
DBMS_TRANSACTION.ADVISE_COMMIT;
```

194.2.2 ADVISE_NOTHING Procedure

This procedure is equivalent to the SQL statement: ALTER SESSION ADVISE NOTHING

Syntax

```
DBMS_TRANSACTION.ADVISE_NOTHING;
```

194.2.3 ADVISE_ROLLBACK Procedure

This procedure is equivalent to the SQL statement: ALTER SESSION ADVISE ROLLBACK

Syntax

```
DBMS_TRANSACTION.ADVISE_ROLLBACK;
```

194.2.4 COMMIT Procedure

This procedure is equivalent to the SQL statement: COMMIT

This procedure is included for completeness, the functionality being already implemented as part of PL/SQL.

Syntax

```
DBMS_TRANSACTION.COMMIT;
```

194.2.5 COMMIT_COMMENT Procedure

This procedure is equivalent to the SQL statement: COMMIT COMMENT <text>

Syntax

```
DBMS_TRANSACTION.COMMIT_COMMENT (  
    cmnt VARCHAR2);
```

Parameters

Table 194-2 COMMIT_COMMENT Procedure Parameters

Parameter	Description
cmnt	Comment to associate with this commit.

194.2.6 COMMIT_FORCE Procedure

This procedure is equivalent to the SQL statement: COMMIT FORCE <text>, <number>

Syntax

```
DBMS_TRANSACTION.COMMIT_FORCE (  
    xid VARCHAR2,  
    scn VARCHAR2 DEFAULT NULL);
```

Parameters

Table 194-3 COMMIT_FORCE Procedure Parameters

Parameter	Description
xid	Local or global transaction ID.

Table 194-3 (Cont.) COMMIT_FORCE Procedure Parameters

Parameter	Description
scn	System change number.

194.2.7 LOCAL_TRANSACTION_ID Function

This function returns the local (to instance) unique identifier for the current transaction. It returns null if there is no current transaction.

Syntax

```
DBMS_TRANSACTION.LOCAL_TRANSACTION_ID (
    create_transaction BOOLEAN := FALSE)
RETURN VARCHAR2;
```

Parameters

Table 194-4 LOCAL_TRANSACTION_ID Function Parameters

Parameter	Description
create_transaction	If true, then start a transaction if one is not currently active.

194.2.8 PURGE_LOST_DB_ENTRY Procedure

Procedure `PURGE_LOST_DB_ENTRY` purges entries that control database recovery from a local site.

When a failure occurs during commit processing, automatic recovery consistently resolves the results at all sites involved in the transaction. However, if the remote database is destroyed or re-created before recovery completes, then the entries used to control recovery in `DBA_2PC_PENDING` and associated tables are never removed, and recovery will periodically retry. Procedure `PURGE_LOST_DB_ENTRY` enables removal of such transactions from the local site.

Syntax

```
DBMS_TRANSACTION.PURGE_LOST_DB_ENTRY (
    xid VARCHAR2);
```

Parameters

Table 194-5 PURGE_LOST_DB_ENTRY Procedure Parameters

Parameter	Description
xid	Must be set to the value of the <code>LOCAL_TRAN_ID</code> column in the <code>DBA_2PC_PENDING</code> table.

Usage Notes

⚠ WARNING:

PURGE_LOST_DB_ENTRY should *only* be used when the other database is lost or has been re-created. Any other use may leave the other database in an unrecoverable or inconsistent state.

Before automatic recovery runs, the transaction may show up in DBA_2PC_PENDING as state "collecting", "committed", or "prepared". If the DBA has forced an in-doubt transaction to have a particular result by using "commit force" or "rollback force", then states "forced commit" or "forced rollback" may also appear. Automatic recovery normally deletes entries in any of these states. The only exception is when recovery finds a forced transaction which is in a state inconsistent with other sites in the transaction; in this case, the entry is left in the table and the MIXED column has the value 'yes'.

However, under certain conditions, it may not be possible for automatic recovery to run. For example, a remote database may have been permanently lost. Even if it is re-created, it gets a new database ID, so that recovery cannot identify it (a possible symptom is ORA-02062). In this case, the DBA may use the procedure PURGE_LOST_DB_ENTRY to clean up the entries in any state other than "prepared". The DBA does not need to be in any particular hurry to resolve these entries, because they are not holding any database resources.

The following table indicates what the various states indicate about the transaction and what the DBA actions should be:

Table 194-6 PURGE_LOST_DB_ENTRY Procedure States

State of Column	State of Global Transaction	State of Local Transaction	Normal DBA Action	Alternative DBA Action
Collecting	Rolled back	Rolled back	None	PURGE_LOST_DB_ENTRY (See Note 1)
Committed	Committed	Committed	None	PURGE_LOST_DB_ENTRY (See Note 1)
Prepared	Unknown	Prepared	None	FORCE COMMIT or ROLLBACK
Forced commit	Unknown	Committed	None	PURGE_LOST_DB_ENTRY (See Note 1)
Forced rollback	Unknown	Rolled back	None	PURGE_LOST_DB_ENTRY (See Note 1)
Forced commit (mixed)	Mixed	Committed	(See Note 2)	
Forced rollback (mixed)	Mixed	Rolled back	(See Note 2)	

 **Note:**

Use only if significant reconfiguration has occurred so that automatic recovery cannot resolve the transaction. Examples are total loss of the remote database, reconfiguration in software resulting in loss of two-phase commit capability, or loss of information from an external transaction coordinator such as a TP monitor.

 **Note:**

Examine and take any manual action to remove inconsistencies; then use the procedure `PURGE_MIXED`.

194.2.9 PURGE_MIXED Procedure

This procedure deletes information about a given mixed outcome transaction

When in-doubt transactions are forced to commit or rollback (instead of letting automatic recovery resolve their outcomes), there is a possibility that a transaction can have a mixed outcome; some sites commit, and others rollback. Such inconsistency cannot be resolved automatically by Oracle. However, Oracle flags entries in `DBA_2PC_PENDING` by setting the `MIXED` column to a value of 'yes'.

Oracle never automatically deletes information about a mixed outcome transaction. When the application or DBA is certain that all inconsistencies that might have arisen as a result of the mixed transaction have been resolved, this procedure can be used to delete the information about a given mixed outcome transaction.

Syntax

```
DBMS_TRANSACTION.PURGE_MIXED (
    xid VARCHAR2);
```

Parameters

Table 194-7 PURGE_MIXED Procedure Parameters

Parameter	Description
<code>xid</code>	Must be set to the value of the <code>LOCAL_TRAN_ID</code> column in the <code>DBA_2PC_PENDING</code> table.

194.2.10 READ_ONLY Procedure

This procedure is equivalent to the SQL statement `SET TRANSACTION READ ONLY`.

Syntax

```
DBMS_TRANSACTION.READ_ONLY;
```

194.2.11 READ_WRITE Procedure

This procedure is equivalent to the SQL statement:

```
SET TRANSACTION READ WRITE
```

Syntax

```
DBMS_TRANSACTION.READ_WRITE;
```

194.2.12 ROLLBACK Procedure

This procedure is equivalent to the SQL statement `ROLLBACK`.

This procedure is included for completeness, the functionality being already implemented as part of PL/SQL.

Syntax

```
DBMS_TRANSACTION.ROLLBACK;
```

194.2.13 ROLLBACK_FORCE Procedure

This procedure is equivalent to the SQL statement `ROLLBACK FORCE <text>`.

Syntax

```
DBMS_TRANSACTION.ROLLBACK_FORCE (  
    xid VARCHAR2);
```

Parameters

Table 194-8 ROLLBACK_FORCE Procedure Parameters

Parameter	Description
<code>xid</code>	Local or global transaction ID.

194.2.14 ROLLBACK_SAVEPOINT Procedure

This procedure is equivalent to the SQL statement `ROLLBACK TO SAVEPOINT <savepoint_name>`.

This procedure is included for completeness, the functionality being already implemented as part of PL/SQL.

Syntax

```
DBMS_TRANSACTION.ROLLBACK_SAVEPOINT (  
    savept VARCHAR2);
```

Parameters

Table 194-9 ROLLBACK_SAVEPOINT Procedure Parameters

Parameter	Description
savept	Savepoint identifier.

194.2.15 SAVEPOINT Procedure

This procedure is equivalent to the SQL statement `SAVEPOINT <savepoint_name>`.

This procedure is included for completeness, the feature being already implemented as part of PL/SQL.

Syntax

```
DBMS_TRANSACTION.SAVEPOINT (
    savept VARCHAR2);
```

Parameters

Table 194-10 SAVEPOINT Procedure Parameters

Parameter	Description
savept	Savepoint identifier.

194.2.16 STEP_ID Function

This function returns local (to local transaction) unique positive integer that orders the DML operations of a transaction.

Syntax

```
DBMS_TRANSACTION.STEP_ID
RETURN NUMBER;
```

194.2.17 USE_ROLLBACK_SEGMENT Procedure

This procedure is equivalent to the SQL statement `SET TRANSACTION USE ROLLBACK SEGMENT <rb_seg_name>`.

Syntax

```
DBMS_TRANSACTION.USE_ROLLBACK_SEGMENT (
    rb_name VARCHAR2);
```

Parameters

Table 194-11 USE_ROLLBACK_SEGMENT Procedure Parameters

Parameter	Description
<code>rb_name</code>	Name of rollback segment to use.

DBMS_TRANSFORM

The `DBMS_TRANSFORM` package provides an interface to the message format transformation features of Oracle Advanced Queuing.

This chapter contains the following topic:

- [Summary of DBMS_TRANSFORM Subprograms](#)



See Also:

Oracle Database Advanced Queuing User's Guide for more on message format transformations.

195.1 Summary of DBMS_TRANSFORM Subprograms

This table lists the `DBMS_TRANSFORM` subprograms and briefly describes them.

Table 195-1 DBMS_TRANSFORM Package Subprograms

Subprograms	Description
CREATE_TRANSFORMATION Procedure	Creates a transformation that maps an object of the source type to an object of the destination type
DROP_TRANSFORMATION Procedure	Drops the given transformation
MODIFY_TRANSFORMATION Procedure	Modifies an existing transformation

195.1.1 CREATE_TRANSFORMATION Procedure

This procedure creates a transformation that maps an object of the source type to an object of the target type. The transformation expression can be a SQL expression or a PL/SQL function. It must return an object of the target type.

Syntax

```
DBMS_TRANSFORM.CREATE_TRANSFORMATION (
  schema          VARCHAR2 (30),
  name            VARCHAR2 (30),
  from_schema     VARCHAR2 (30),
  from_type       VARCHAR2 (30),
  to_schema       VARCHAR2 (30),
  to_type         VARCHAR2 (30),
  transformation   VARCHAR2 (4000));
```

Parameters

Table 195-2 CREATE_TRANSFORM Procedure Parameters

Parameter	Description
schema	Specifies the schema of the transformation.
name	Specifies the name of the transformation.
from_schema	Specifies the schema of the source type.
from_type	Specifies the source type.
to_schema	Specifies the target type schema.
to_type	Specifies the target type.
transformation	Specifies the transformation expression, returning an object of the target type. The expression must be a function returning an object of the target type or a constructor expression for the target type. You can choose not to specify a transformation expression and instead specify transformations for attributes of the target type using <code>MODIFY_TRANSFORM</code> .

Usage Notes

- The transformation expression must be a SQL expression or a PL/SQL function returning the type of the specified attribute of the target type.
- To create, modify or drop transformations, a user must be granted execute privileges on `DBMS_TRANSFORM`. The user must also have execute privileges on the user defined types that are the source and destination types of the transformation. In addition, the user must also have execute privileges on any PLSQL function being used in the transformation function.
- The transformation cannot write database state (perform DML) or commit or rollback the current transaction.
- The transformation must be a SQL function with source type as input type, returning an object of the target type. It could also be a SQL expression of target type, referring to a source type. All references to the source type must be of the form `source.user_data`.
- Both source and target types must be non-scalar database types. A null transformation expression maps to a null target object.

For using the transformation at enqueue and dequeue time, the login user invoking the operation must have execute privileges on the PLSQL functions used by the transformation. For propagation, the owning schema of the queue must have these privileges.

195.1.2 DROP_TRANSFORM Procedure

This procedure drops the given transformation.

Syntax

```
DBMS_TRANSFORM.DROP_TRANSFORM (
  schema VARCHAR2(30),
```



```
name          VARCHAR2(30);
```

Parameters

Table 195-3 DROP_TRANSFORMATION Procedure Parameters

Parameter	Description
schema	Specifies the schema of the transformation.
name	Specifies the name of the transformation.

195.1.3 MODIFY_TRANSFORMATION Procedure

This procedure modifies the transformation expression for the given transformation.

Syntax

```
DBMS_TRANSFORM.MODIFY_TRANSFORMATION (
  schema          VARCHAR2(30),
  name            VARCHAR2(30),
  attribute_number INTEGER,
  transformation  VARCHAR2(4000));
```

Parameters

Table 195-4 MODIFY_TRANSFORMATION Procedure Parameters

Parameter	Description
schema	Specifies the schema of the transformation.
name	Specifies the name of the transformation.
attribute_number	The attribute of the target type for which the new transformation expression is being specified. When specifying the new transformation as a single expression of the target type, specify a value of 0.
transformation	The transformation expression must be a SQL expression or a PL/SQL function returning the type of the specified attribute of the target type. If the attribute_number is 0, then the expression must be a PL/SQL function returning an object of the target type or a constructor expression for the target type.

Usage Notes

- If the new transformation is a single expression of the target type, it may be specified with an `attribute_number` of 0. The new transformation may also be specified for each attribute of the target type.
- You can use this procedure to define the transformation as a separate expression for each attribute of the target type. For large transformations, this representation may be more readable and allow the application of fine grain control over the transformation. If the transformation expression was left unspecified for some of the attributes of the target type, they are evaluated to null when the transformation is applied.

DBMS_TSDP_MANAGE

The `DBMS_TSDP_MANAGE` package provides an interface to import and manage sensitive columns and sensitive column types in the database, and is used in conjunction with the `DBMS_TSDP_PROTECT` package with regard to transparent sensitive data protection (TSDP) policies.

`DBMS_TSDP_MANAGE` is available with the Enterprise Edition only.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_TSDP_MANAGE Subprograms](#)

Related Topics

- [DBMS_TSDP_PROTECT](#)
The `DBMS_TSDP_PROTECT` package provides an interface to configure transparent sensitive data protection (TSDP) policies in conjunction with the `DBMS_TSDP_MANAGE` package.



See Also:

Oracle Database Security Guide

196.1 DBMS_TSDP_MANAGE Overview

The `DBMS_TSDP_MANAGE` package lets you manage sensitive columns and sensitive types in the Oracle database.

The identified sensitive columns are classified based on the sensitive types. By Using the [DBMS_TSDP_PROTECT](#) package to create a policy that protects data for a given class based on a column type rather than the data itself, you can then manage security for these types in a uniform fashion and modify the settings to accommodate changing compliance regulations.

You also can export the policies to other databases, when you perform a full export using Data Pump. You cannot export the policy itself, but an export of the database will include the TSDP policies.

196.2 DBMS_TSDP_MANAGE Security Model

All procedures are executed with invoker's rights. The `DBMS_TSDP_MANAGE` package is owned by `SYS`.

The `EXECUTE` privilege on this package should be granted as appropriate. Typically, an application database administrator should be granted the `EXECUTE` privilege for this package, while the `DBMS_TSDP_PROTECT` package would be governed by a security administrator.

196.3 Summary of DBMS_TSDP_MANAGE Subprograms

This table lists the `DBMS_TSDP_MANAGE` subprograms and briefly describes them.

Table 196-1 DBMS_TSDP_MANAGE Package Subprograms

Subprogram	Description
<code>ADD_SENSITIVE_COLUMN Procedure</code>	Adds a column to the sensitive column list
<code>ADD_SENSITIVE_TYPE Procedure</code>	Creates and adds a sensitive column type to the list of sensitive column types in the database
<code>ALTER_SENSITIVE_COLUMN Procedure</code>	Alters the sensitive type and/or the comment of a column in the sensitive column list.
<code>DROP_SENSITIVE_COLUMN Procedure</code>	Removes columns from the sensitive column list
<code>DROP_SENSITIVE_TYPE Procedure</code>	Drops a sensitive column type from the list sensitive column types in the database
<code>DROP_SENSITIVE_TYPE_SOURCE Procedure</code>	Drops sensitive column types corresponding to a source from the list sensitive column types in the database
<code>IMPORT_DISCOVERY_RESULT Procedure</code>	Imports sensitive columns from an external source. This can be an Application Data Model (ADM) from an Oracle Enterprise Manager Cloud Control instance
<code>IMPORT_SENSITIVE_TYPES Procedure</code>	Imports a list of sensitive column types from a source
<code>REMOVE_DISCOVERY_RESULT Procedure</code>	Removes sensitive columns corresponding to an Application Data Model (ADM) from an Oracle Enterprise Manager Cloud Control instance.

196.3.1 ADD_SENSITIVE_COLUMN Procedure

This procedure adds a column to the sensitive column list.

Syntax

```
DBMS_TSDP_MANAGE.ADD_SENSITIVE_COLUMN (
  schema_name      IN VARCHAR2,
  table_name       IN VARCHAR2,
  column_name      IN VARCHAR2,
  sensitive_type   IN VARCHAR2,
  user_comment     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 196-2 *ADD_SENSITIVE_COLUMN Procedure Parameters*

Parameter	Description
schema_name	Schema to which the column belongs
table_name	Table containing the column
column_name	Sensitive column name
sensitive_type	Identifier of the sensitive column type
user_comment	User comment regarding the sensitive column

Examples

Add a column SAL in SCOTT.EMP:

```
DBMS_TSDP_MANAGE.ADD_SENSITIVE_COLUMN (
  schema_name      => 'SCOTT',
  table_name       => 'EMP',
  column_name      => 'SAL',
  sensitive_type   => 'SALARY_TYPE',
  user_comment     => 'Salary column');
```

196.3.2 ALTER_SENSITIVE_COLUMN Procedure

This procedure alters the Sensitive Type and/or the Comment of a Column in the sensitive column list.

Syntax

```
DBMS_TSDP_MANAGE.ALTER_SENSITIVE_COLUMN (
  schema_name      IN VARCHAR2,
  table_name       IN VARCHAR2,
  column_name      IN VARCHAR2,
  sensitive_type   IN VARCHAR2,
  user_comment     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 196-3 *ALTER_SENSITIVE_COLUMN Procedure Parameters*

Parameter	Description
schema_name	Schema to which the column belongs
table_name	Table containing the column
column_name	Sensitive column name
sensitive_type	Identifier of the sensitive column type
user_comment	User comment regarding the sensitive column

Examples

Alter the column SAL in SCOTT.EMP that is listed in the sensitive column list:

```
DBMS_TSDP_MANAGE.ALTER_SENSITIVE_COLUMN (
  schema_name      => 'SCOTT',
  table_name       => 'EMP',
  column_name      => 'SAL',
  sensitive_type   => 'FINANCE_Type',
  user_comment     => 'Finance Type. Earlier categorized as Salary Type');
```

196.3.3 ADD_SENSITIVE_TYPE Procedure

This procedure creates and adds a sensitive column type to the list sensitive column types in the database.

Syntax

```
DBMS_TSDP_MANAGE.ADD_SENSITIVE_TYPE (
  sensitive_type   IN VARCHAR2,
  user_comment     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 196-4 *ADD_SENSITIVE_TYPE Procedure Parameters*

Parameter	Description
sensitive_type	Name of the sensitive column type
user_comment	User comment regarding the sensitive column

Examples

Add a sensitive column type called SALARY_TYPE that is intended to be associated with columns containing salary data:

```
DBMS_TSDP_MANAGE.ADD_SENSITIVE_TYPE (
  sensitive_type   => 'SALARY_TYPE',
  user_comment     => 'Salary data');
```

196.3.4 DROP_SENSITIVE_COLUMN Procedure

This procedure removes columns from the sensitive column list.

Syntax

```
DBMS_TSDP_MANAGE.DROP_SENSITIVE_COLUMN (
  schema_name      IN VARCHAR2 DEFAULT '%',
  table_name       IN VARCHAR2 DEFAULT '%',
  column_name      IN VARCHAR2 DEFAULT '%');
```

Parameters

Table 196-5 *DROP_SENSITIVE_COLUMN Procedure Parameters*

Parameter	Description
schema_name	Schema to which the column belongs
table_name	Table containing the column

Table 196-5 (Cont.) DROP_SENSITIVE_COLUMN Procedure Parameters

Parameter	Description
column_name	Sensitive column name

Examples

Remove column SAL in SCOTT.EMP from the sensitive column list:

```
DBMS_TSDP_MANAGE.DROP_SENSITIVE_COLUMN (
  schema_name   => 'SCOTT',
  table_name    => 'EMP',
  column_name   => 'SAL');
```

196.3.5 DROP_SENSITIVE_TYPE Procedure

This procedure drops a sensitive column type from the list sensitive column types in the database.

Syntax

```
DBMS_TSDP_MANAGE.DROP_SENSITIVE_TYPE (
  sensitive_type IN VARCHAR2);
```

Parameters**Table 196-6 DROP_SENSITIVE_TYPE Procedure Parameters**

Parameter	Description
sensitive_type	Name of the sensitive column type to be dropped

Examples

To drop SALARY_TYPE:

```
DBMS_TSDP_MANAGE.DROP_SENSITIVE_TYPE (
  sensitive_type => 'SALARY_TYPE');
```

196.3.6 DROP_SENSITIVE_TYPE_SOURCE Procedure

This procedure drops sensitive column types corresponding to a source from the list sensitive column types in the database.

Syntax

```
DBMS_TSDP_MANAGE.DROP_SENSITIVE_TYPE_SOURCE (
  source IN VARCHAR2);
```

Parameters

Table 196-7 *DROP_SENSITIVE_TYPE_SOURCE Procedure Parameters*

Parameter	Description
source	Name of the source

Examples

To drop all sensitive column types corresponding to an Application Data Model (ADM) from an Oracle Enterprise Manager Cloud Control instance, ADM_DEMO:

```
DBMS_TSDP_MANAGE.DROP_SENSITIVE_TYPE_SOURCE (
    source      => 'ADM_DEMO');
```

196.3.7 IMPORT_DISCOVERY_RESULT Procedure

This procedure can be used to import sensitive columns, along with the associated sensitive types, from an external source. The external source can be an Application Data Model (ADM) instance from Oracle Enterprise Manager Cloud Control.

Syntax

```
DBMS_TSDP_MANAGE.IMPORT_DISCOVERY_RESULT (
    discovery_result      IN CLOB,
    discovery_source      IN VARCHAR2,
    force                 IN FORCE DEFAULT FALSE);

DBMS_TSDP_MANAGE.IMPORT_DISCOVERY_RESULT (
    discovery_result      IN XMLTYPE,
    discovery_source      IN VARCHAR2,
    force                 IN FORCE DEFAULT FALSE);
```

Parameters

Table 196-8 *IMPORT_DISCOVERY_RESULT Procedure Parameters*

Parameter	Description
discovery_result	List of sensitive columns, along with the optional list of (the definitions of) the sensitive column types in XML format (possibly as a CLOB).
discovery_source	Source of the import. The discovery_sourcename identifies the list of imported sensitive columns. In case of ADM, this should be the ADM name.

Table 196-8 (Cont.) IMPORT_DISCOVERY_RESULT Procedure Parameters

Parameter	Description
force	<p>Specifies if the discovery result should be imported or not when the discovery result contains columns sensitive columns that are already identified as sensitive by another source.</p> <ul style="list-style-type: none"> FALSE (default) - the discovery result will not be imported in case of conflicting columns. None of the columns and the sensitive types are imported. TRUE - the discovery result is imported and the attributes of the conflicting columns is set based on the incoming discovery result

Examples

Import the list of sensitive columns of ADM instance, ADM_Demo:

```
DBMS_TSDP_MANAGE.IMPORT_DISCOVERY_RESULT (
    discovery_results => xml_adm_result,
    discovery_source => 'ADM_Demo');
```

196.3.8 IMPORT_SENSITIVE_TYPES Procedure

This procedure imports a list of sensitive column types from a source.

Syntax

```
DBMS_TSDP_MANAGE.IMPORT_SENSITIVE_TYPES (
    sensitive_types IN CLOB,
    source          IN VARCHAR2);
```

```
DBMS_TSDP_MANAGE.IMPORT_SENSITIVE_TYPES (
    sensitive_types IN XMLTYPE,
    source          IN VARCHAR2);
```

Parameters

Table 196-9 IMPORT_SENSITIVE_TYPES Procedure Parameters

Parameter	Description
sensitive_types	List of sensitive column types in XML Format (possibly as a CLOB)
source	Source of the import. The source identifies the list of imported sensitive column types. In case of Application Data Model (ADM) from an Oracle Enterprise Manager Cloud Control instance, this should be the ADM name.

Examples

Import the list of sensitive column types of ADM instance, ADM_Demo:

```
DBMS_TSDP_MANAGE.IMPORT_SENSITIVE_TYPES (
    sensitive_types => xml_adm_result,
    source          => 'ADM_Demo');
```


196.3.9 REMOVE_DISCOVERY_RESULT Procedure

This procedure removes sensitive columns corresponding to an Application Data Model (ADM) from an Oracle Enterprise Manager Cloud Control instance.

Syntax

```
DBMS_TSDP_MANAGE.REMOVE_DISCOVERY_RESULT (
  discovery_source IN VARCHAR2);
```

Parameters

Table 196-10 REMOVE_DISCOVERY_RESULT Procedure Parameters

Parameter	Description
discovery_source	Source of the import. In case of ADM, this should be the ADM name, the results of which is to be removed.

Examples

Remove the sensitive columns corresponding to ADM instance, ADM_Demo:

```
DBMS_TSDP_MANAGE.REMOVE_DISCOVERY_RESULT (
  discovery_source => 'ADM_Demo');
```

DBMS_TSDP_PROTECT

The `DBMS_TSDP_PROTECT` package provides an interface to configure transparent sensitive data protection (TSDP) policies in conjunction with the `DBMS_TSDP_MANAGE` package.

`DBMS_TSDP_PROTECT` is available with the Enterprise Edition only.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Data Structures](#)
- [Summary of DBMS_TSDP_PROTECT Subprograms](#)

Related Topics

- [DBMS_TSDP_MANAGE](#)
The `DBMS_TSDP_MANAGE` package provides an interface to import and manage sensitive columns and sensitive column types in the database, and is used in conjunction with the `DBMS_TSDP_PROTECT` package with regard to transparent sensitive data protection (TSDP) policies.



See Also:

Oracle Database Security Guide

197.1 DBMS_TSDP_PROTECT Overview

Use the `DBMS_TSDP_PROTECT` package to create transparent sensitive data protection policies, configure protection by associating the policies with sensitive types, and to enable and disable the configured protection.

Sensitive types can be added using the `DBMS_TSDP_MANAGE` package.

197.2 DBMS_TSDP_PROTECT Security Model

All procedures are executed with invoker's rights. Typically, a security administrator should have the `EXECUTE` privilege for this package.

197.3 DBMS_TSDP_PROTECT Constants

DBMS_TSDP_PROTECT defines the TSDP_PARAM_MAX constant for use when specifying parameter values.

This constant is described in the following table.

Table 197-1 DBMS_TSDP_PROTECT Constants - Compression Types

Constant	Type	Value	Description
TSDP_PARAM_MAX	INTEGER	4000	Maximum length of the parameter value that can be specified in FEATURE_OPTIONS

197.4 DBMS_TSDP_PROTECT Data Structures

The DBMS_TSDP_PROTECT package defines two TABLE types.

Table Types

- [FEATURE_OPTIONS Table Type](#)
- [POLICY_CONDITIONS Table Type](#)

197.4.1 FEATURE_OPTIONS Table Type

The following type is an associative array of VARCHAR2 (TSDP_PARAM_MAX) that is indexed by VARCHAR2 (M_IDEN).

Syntax

```
TYPE FEATURE_OPTIONS IS TABLE OF VARCHAR2 (TSDP_PARAM_MAX)
INDEX BY VARCHAR2 (M_IDEN);
```

197.4.2 POLICY_CONDITIONS Table Type

The following type is an associative array of VARCHAR2 (TSDP_PARAM_MAX) that is indexed by PLS_INTEGER.

Syntax

```
TYPE POLICY_CONDITIONS IS TABLE OF VARCHAR2 (TSDP_PARAM_MAX)
INDEX BY PLS_INTEGER;
```

197.5 Summary of DBMS_TSDP_PROTECT Subprograms

This table lists the DBMS_TSDP_PROTECT subprograms and briefly describes them.

Table 197-2 DBMS_TSDP_PROTECT Package Subprograms

Subprogram	Description
ADD_POLICY Procedure	Creates a TSDP policy
ALTER_POLICY Procedure	Alters a TSDP policy
ASSOCIATE_POLICY Procedure	Associates or disassociates a TSDP policy with a sensitive column type
DISABLE_PROTECTION_COLUMN Procedure	Disables protection for columns
DISABLE_PROTECTION_SOURCE Procedure	Disables protection based on the source of truth for the sensitive columns
DISABLE_PROTECTION_TYPE Procedure	Disables protection for a sensitive column type
DROP_POLICY Procedure	Removes a TSDP policy
ENABLE_PROTECTION_COLUMN Procedure	Enables protection for columns
ENABLE_PROTECTION_SOURCE Procedure	Enables protection based on the source of truth for the sensitive columns
ENABLE_PROTECTION_TYPE Procedure	Enables protection for a sensitive column type

197.5.1 ADD_POLICY Procedure

This procedure creates a TSDP policy.

Syntax

```
DBMS_TSDP_PROTECT.ADD_POLICY (
  policy_name          IN VARCHAR2,
  security_feature     IN PLS_INTEGER,
  policy_enable_options IN FEATURE_OPTIONS,
  policy_apply_condition IN POLICY_CONDITION DEFAULT TSDP$default_condition);
```

Parameters

Table 197-3 ADD_POLICY Procedure Parameters

Parameter	Description
<code>policy_name</code>	Name of the policy being created. The maximum length for this identifier is <code>M_IDEN</code> . This follows the Oracle naming convention.
<code>security_feature</code>	Oracle security feature with which the policy is associated. Allowed values: <ul style="list-style-type: none"> <code>DBMS_TSDP_PROTECT.REDACT</code> <code>DBMS_TSDP_PROTECT.VPD</code> <code>DBMS_TSDP_PROTECT.UNIFIED_AUDIT</code> <code>DBMS_TSDP_PROTECT.FINE_GRAINED_AUDIT</code> <code>DBMS_TSDP_PROTECT.COLUMN_ENCRYPTION</code>
<code>policy_enable_options</code>	Initialized with the parameter-value pairs corresponding to the <code>security_feature</code> setting

Table 197-3 (Cont.) ADD_POLICY Procedure Parameters

Parameter	Description
policy_apply_condition	<p>Initialized with the property-value pairs that must be satisfied in order to apply the corresponding policy_enable_options. This is an associative array with Property as the key (PLS_INTEGER).</p> <p>Example: example_policy_condition(Property)=property_value. Permissible values for Property:</p> <ul style="list-style-type: none"> • DBMS_TSDP_PROPERTY.DATATYPE • DBMS_TSDP_PROPERTY.LENGTH • DBMS_TSDP_PROPERTY.PARENT_SCHEMA • DBMS_TSDP_PROPERTY.PARENT_TABLE

Usage Notes

To create the TDSP policy, you must include the procedure in an anonymous block that defines the type of security feature that will use the policy and conditions to test when the policy is enabled. For more information, see *Oracle Database Security Guide*.

Examples

Create a policy PARTIAL_MASK_POLICY:

```

DECLARE
  redact_feature_options DBMS_TSDP_PROTECT.FEATURE_OPTIONS;
  policy_conditions DBMS_TSDP_PROTECT.POLICY_CONDITIONS;
BEGIN
  redact_feature_options ('expression') :=
    'SYS_CONTEXT(''USERENV'', ''SESSION_USER'')          =' 'APPUSER'';
  redact_feature_options ('function_type')              := 'DBMS_REDACT.PARTIAL';
  redact_feature_options ('function_parameters')        := 'STR, VVVVVVVVV, VVVVVVVVV,
*, 1, 6';
  policy_conditions(DBMS_TSDP_PROTECT.DATATYPE)        := 'VARCHAR2';
  DBMS_TSDP_PROTECT.ADD_POLICY
    ('PARTIAL_MASK_POLICY', DBMS_TSDP_PROTECT.REDACT, redact_feature_options,
policy_conditions);
END;

```

197.5.2 ALTER_POLICY Procedure

This procedure alters an existing TDSP policy

Syntax

```

DBMS_TSDP_PROTECT.ALTER_POLICY (
  policy_name           IN VARCHAR2,
  policy_enable_options IN FEATURE_OPTIONS,
  policy_apply_condition IN POLICY_CONDITION default TSDP$default_condition);

```

Parameters

Table 197-4 ALTER_POLICY Procedure Parameters

Parameter	Description
<code>policy_name</code>	Name of the policy to alter
<code>policy_enable_options</code>	Initialized with the parameter-value pairs corresponding to the security feature
<code>policy_apply_condition</code>	<p>Initialized with the property-value pairs that must be satisfied in order to apply the corresponding <code>policy_enable_options</code>. This is an associative array with <code>Property</code> as the key (<code>PLS_INTEGER</code>).</p> <p>Example: <code>example_policy_condition(Property)=property_value</code>. Permissible values for <code>Property</code>:</p> <ul style="list-style-type: none"> • <code>DBMS_TSDP_PROPERTY.DATATYPE</code> • <code>DBMS_TSDP_PROPERTY.LENGTH</code> • <code>DBMS_TSDP_PROPERTY.PARENT_SCHEMA</code> • <code>DBMS_TSDP_PROPERTY.PARENT_TABLE</code>

Usage Notes

- If the `policy_apply_condition` matches an existing condition for the policy, then the corresponding enable options are updated with `policy_enable_options`.
- If the `policy_apply_condition` does not match any existing condition for the policy, the combination of `policy_enable_options` and `policy_apply_condition` is added to the policy.

Examples

Add a new combination of `policy_apply_condition` and `policy_enable_options` to an existing policy `PARTIAL_MASK_POLICY`:

```
DECLARE
  redact_feature_options DBMS_TSDP_PROTECT.FEATURE_OPTIONS;
  policy_conditions DBMS_TSDP_PROTECT.POLICY_CONDITIONS;
BEGIN
  redact_feature_options ('expression') :=
    'SYS_CONTEXT(''USERENV'', 'SESSION_USER')='APPUSER'';
  redact_feature_options ('function_type') := 'DBMS_REDACT.PARTIAL';
  redact_feature_options ('function_parameters') := 'STR, VVVVVVVV, VVVVVVVV, *,
    1, 6';
  policy_conditions (DBMS_TSDP_PROTECT.DATATYPE) := 'VARCHAR2';
  DBMS_TSDP_PROTECT.ALTER_POLICY ('PARTIAL_MASK_POLICY', redact_feature_options,
  policy_conditions);
END;
```

197.5.3 ASSOCIATE_POLICY Procedure

This procedure associates or disassociates a TSDP policy with a sensitive column type.

Syntax

```
DBMS_TSDP_PROTECT.ASSOCIATE_POLICY (
  policy_name          IN VARCHAR2,
```

```
sensitive_type    IN VARCHAR2,
associate        IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 197-5 ASSOCIATE_POLICY Procedure Parameters

Parameter	Description
policy_name	Name of the TDSP policy
sensitive_type	Name of the sensitive column type:
associate	Associate or Disassociate. TRUE implies Associate

Usage Notes

Both the policy and the sensitive column type should exist in the database.

Examples

Associate PARTIAL_MASK_POLICY with SSN_TYPE:

```
DBMS_TSDP_PROTECT.ASSOCIATE_POLICY ('PARTIAL_MASK_POLICY', 'SSN_TYPE');
```

197.5.4 DISABLE_PROTECTION_COLUMN Procedure

This procedure disables protection for columns.

Syntax

```
DBMS_TSDP_PROTECT.DISABLE_PROTECTION_COLUMN (
  schema_name    IN VARCHAR2 DEFAULT '%',
  table_name     IN VARCHAR2 DEFAULT '%',
  column_name    IN VARCHAR2 DEFAULT '%',
  policy_name    IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 197-6 DISABLE_PROTECTION_COLUMN Procedure Parameters

Parameter	Description
schema_name	Name of the schema containing the column
table_name	Table containing the column
column_name	Column name
policy_name	Optional policy name. If given, only this policy is disabled.

Examples

Disable TSDP policies associated with the corresponding sensitive column types for columns that reside in schema with name like %PAYROLL%, table name like EMP%, and column name like SAL%:

```
EXEC DBMS_TSDP_PROTECT.DISABLE_PROTECTION_COLUMN ('%PAYROLL%', 'EMP%', 'SAL%');
```

197.5.5 DISABLE_PROTECTION_SOURCE Procedure

This procedure disables protection based on the source of truth for the sensitive columns.

Syntax

```
DBMS_TSDP_PROTECT.DISABLE_PROTECTION_SOURCE (
    discovery_sourcename    IN VARCHAR2);
```

Parameters

Table 197-7 *DISABLE_PROTECTION_SOURCE Procedure Parameters*

Parameter	Description
discovery_sourcename	Name of the discovery source. This could be the Application Data Model (ADM) name or the database user.

Examples

Disable protection for all columns corresponding to ADM_Demo:

```
DBMS_TSDP_PROTECT.DISABLE_PROTECTION_SOURCE ('ADM_Demo');
```

197.5.6 DISABLE_PROTECTION_TYPE Procedure

This procedure disables protection for a sensitive column type.

Syntax

```
DBMS_TSDP_PROTECT.DISABLE_PROTECTION_TYPE (
    sensitive_type    IN VARCHAR2);
```

Parameters

Table 197-8 *DISABLE_PROTECTION_TYPE Procedure Parameters*

Parameter	Description
sensitive_type	Name of the sensitive column type

Examples

Disable protection for all columns identified by SSN_TYPE:

```
DBMS_TSDP_PROTECT.DISABLE_PROTECTION_TYPE ('SSN_TYPE');
```

197.5.7 DROP_POLICY Procedure

This procedure removes a TDSP policy or one of its condition-enable_options combinations.

Syntax

```
DBMS_TSDP_PROTECT.DROP_POLICY (
    policy_name    IN VARCHAR2,
```



```

policy_apply_condition IN POLICY_CONDITIONS);

DBMS_TSDP_PROTECT.DROP_POLICY (
  policy_name          IN VARCHAR2);

```

Parameters

Table 197-9 DROP_POLICY Procedure Parameters

Parameter	Description
policy_name	Name of the policy to drop
policy_apply_condition	To be initialized with the relevant condition

Usage Notes

- The combination of `policy_conditions` and `policy_enable_options` can be dropped from a TSDP policy by giving the `policy_apply_condition` parameter. The default condition-default options combination can also be dropped (if it exists for the policy) by passing an empty associative array of type `DBMS_TSDP_PROTECT.POLICY_CONDITION`.
- If the condition-enable_options combination that is being dropped is the last condition-enable_options combination for the policy, the policy itself is dropped.
- A policy can be completely dropped by using the overloaded of the procedure that takes only `policy_name`.
- A policy or one of its conditions can be dropped only if the policy is not associated with any sensitive column type. This also means that a policy that is being dropped is not enabled on any column (object).

Examples

Dropping the condition-enable_options combination based on a specific condition:

```

DECLARE
  policy_conditions DBMS_TSDP_PROTECT.POLICY_CONDITIONS;
BEGIN
  policy_conditions (DBMS_TSDP_PROTECT.DATATYPE) := 'VARCHAR2';
  DBMS_TSDP_PROTECT.DROP_POLICY ('PARTIAL_MASK_POLICY', policy_conditions);
END;

```

The default condition-enable_options combination can be dropped by passing an empty associative array of type `DBMS_TSDP_PROTECT.POLICY_CONDITIONS` for the `policy_apply_condition` parameter:

```

DECLARE
  policy_conditions DBMS_TSDP_PROTECT.POLICY_CONDITIONS;
BEGIN
  DBMS_TSDP_PROTECT.DROP_POLICY ('redact_partial_cc', policy_conditions);
END;

```

Dropping a TSDP policy:

```

BEGIN
  DBMS_TSDP_PROTECT.DROP_POLICY (
    policy_name => 'PARTIAL_MASK_POLICY');
END;

```

197.5.8 ENABLE_PROTECTION_COLUMN Procedure

This procedure enables protection for columns.

Syntax

```
DBMS_TSDP_PROTECT.ENABLE_PROTECTION_COLUMN (
  schema_name      IN VARCHAR2 DEFAULT '%',
  table_name       IN VARCHAR2 DEFAULT '%',
  column_name      IN VARCHAR2 DEFAULT '%',
  policy_name      IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 197-10 *ENABLE_PROTECTION_COLUMN Procedure Parameters*

Parameter	Description
schema_name	Name of the schema containing the column
table_name	Table containing the column
column_name	Column name
policy_name	Optional policy name. If given, only this policy is enabled.

Usage Notes

- Only a TSDP Policy that is associated with the sensitive column type of the sensitive column can be enabled using this Procedure.
- LIKE condition is used for schema_name, table_name and column_name. AND semantics is followed.

Examples

Enable TSDP policies associated with the corresponding sensitive column types for columns that reside in schema with name like %PAYROLL%, table name like EMP%, and column name like SAL%:

```
DBMS_TSDP_PROTECT.ENABLE_PROTECTION_COLUMN ('%PAYROLL%', 'EMP%', 'SAL%');
```

197.5.9 ENABLE_PROTECTION_SOURCE Procedure

This procedure enables protection based on the source of truth for the sensitive columns.

Syntax

```
DBMS_TSDP_PROTECT.ENABLE_PROTECTION_SOURCE (
  discovery_sourcename IN VARCHAR2);
```

Parameters

Table 197-11 *ENABLE_PROTECTION_SOURCE Procedure Parameters*

Parameter	Description
discovery_sourcename	Name of the discovery source. This could be the Application Data Model (ADM) name or the database user.

Examples

Enable protection for all columns corresponding to ADM_Demo:

```
DBMS_TSDP_PROTECT.ENABLE_PROTECTION_SOURCE ('ADM_Demo');
```

197.5.10 ENABLE_PROTECTION_TYPE Procedure

This procedure enables protection for a sensitive column type.

Syntax

```
DBMS_TSDP_PROTECT.ENABLE_PROTECTION_TYPE (
    sensitive_type      IN VARCHAR2);
```

Parameters

Table 197-12 *ENABLE_PROTECTION_TYPE Procedure Parameters*

Parameter	Description
sensitive_type	Name of the sensitive column type

Examples

Enable protection for all columns identified by SSN_TYPE:

```
DBMS_TSDP_PROTECT.ENABLE_PROTECTION_TYPE ('SSN_TYPE');
```

DBMS_TTS

The DBMS_TTS package checks if the transportable set is self-contained. All violations are inserted into a temporary table that can be selected from the view TRANSPORT_SET_VIOLATIONS.

This chapter contains the following topics:

- [Security Model](#)
- [Exceptions](#)
- [Operational Notes](#)
- [Summary of DBMS_TTS Subprograms](#)

See Also:

- *Oracle Database Administrator's Guide*
- *Oracle Database Upgrade Guide*

198.1 DBMS_TTS Security Model

Only users having the `execute_catalog_role` can execute this procedure. This role is initially only assigned to user SYS.

198.2 DBMS_TTS Exceptions

The DBMS_TTS package creates exceptions for missing or invalid transportable tablespaces.

```
ts_not_found EXCEPTION;
PRAGMA exception_init(ts_not_found, -29304);
ts_not_found_num NUMBER := -29304;

invalid_ts_list EXCEPTION;
PRAGMA exception_init(invalid_ts_list, -29346);
invalid_ts_list_num NUMBER := -29346;

sys_or_tmp_ts EXCEPTION;
PRAGMA exception_init(sys_or_tmp_ts, -29351);
sys_or_tmp_ts_num NUMBER := -29351;
```

198.3 DBMS_TTS Operational Notes

With respect to transportable tablespaces, disabled and enabled referential integrity constraints are handled differently.

- A disabled referential integrity constraint does not violate the transportability rules and is dropped during the import phase.
- An enabled referential integrity constraint violates the transportability rules if it references a table in a tablespace outside the transportable set.

198.4 Summary of DBMS_TTS Subprograms

The two procedures listed in the table are designed to be called by database administrators.

Table 198-1 DBMS_TTS Package Subprograms

Subprogram	Description
DOWNGRADE Procedure	Downgrades transportable tablespace-related data
TRANSPORT_SET_CHECK Procedure	Checks if a set of tablespaces (to be transported) is self-contained

198.4.1 DOWNGRADE Procedure

This procedure downgrades transportable tablespace related data.

Syntax

```
DBMS_TTS.DOWNGRADE;
```

198.4.2 TRANSPORT_SET_CHECK Procedure

This procedure checks if a set of tablespaces (to be transported) is self-contained. After calling this procedure, the user may select from a view to see a list of violations, if there are any.

Syntax

```
DBMS_TTS.TRANSPORT_SET_CHECK (
    ts_list          IN CLOB,
    incl_constraints IN BOOLEAN DEFAULT FALSE,
    full_check       IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 198-2 TRANSPORT_SET_CHECK Procedure Parameters

Parameter	Description
<code>ts_list</code>	List of one or more tablespaces, separated by comma.

Table 198-2 (Cont.) TRANSPORT_SET_CHECK Procedure Parameters

Parameter	Description
<code>incl_constraints</code>	TRUE if you want to count in referential integrity constraints when examining if the set of tablespaces is self-contained. (The <code>incl_constraints</code> parameter is a default so that <code>TRANSPORT_SET_CHECK</code> will work if it is called with only the <code>ts_list</code> argument.)
<code>full_check</code>	Indicates whether a full or partial dependency check is required. If TRUE, treats all IN and OUT pointers (dependencies) and captures them as violations if they are not self-contained in the transportable set. The parameter should be set to TRUE for TSPITR or if a strict version of transportable is desired. By default the parameter is set to FALSE. It will only consider OUT pointers as violations.

Examples

If the view does not return any rows, then the set of tablespaces is self-contained. For example,

```
SQLPLUS> EXECUTE DBMS_TTS.TRANSPORT_SET_CHECK('foo,bar', TRUE);  
SQLPLUS> SELECT * FROM TRANSPORT_SET_VIOLATIONS;
```

DBMS_TYPES

The `DBMS_TYPES` package consists of constants, which represent the built-in and user-defined types.

This chapter contains the following topics:

- [Constants](#)
- [Exceptions](#)

199.1 DBMS_TYPES Constants

The `DBMS_TYPES` package defines several constants to use when specifying parameter values.

These constants are listed in following table .

Table 199-1 *DBMS_TYPES Constants*

Constant	Description
<code>NO_DATA</code>	Is only relevant if PieceWise is called, for a collection or any dataset. Denotes the end of collection/any dataset when all the elements have been accessed
<code>SUCCESS</code>	The operation succeeded
<code>TYPECODE_BDOUBLE</code>	A <code>NUMBER</code> type
<code>TYPECODE_BFILE</code>	A <code>BFILE</code> type
<code>TYPECODE_BFLOAT</code>	A <code>NUMBER</code> type
<code>TYPECODE_BLOB</code>	A <code>BLOB</code> type
<code>TYPECODE_CFILE</code>	A <code>CFILE</code> type
<code>TYPECODE_CHAR</code>	A <code>CHAR</code> type
<code>TYPECODE_CLOB</code>	A <code>CLOB</code> type
<code>TYPECODE_DATE</code>	A <code>DATE</code> type
<code>TYPECODE_INTERVAL_DS</code>	An <code>INTERVAL_DS</code> type
<code>TYPECODE_INTERVAL_YM</code>	A <code>INTERVAL_YM</code> type
<code>TYPECODE_MLSLABEL</code>	An <code>MLSLABEL</code> type
<code>TYPECODE_NAMEDCOLLECTION</code>	A named collection (<code>VARRAY</code> /nested table) type
<code>TYPECODE_NCHAR</code>	A <code>NCHAR</code> type
<code>TYPECODE_NCLOB</code>	A <code>NCLOB</code> type
<code>TYPECODE_NUMBER</code>	A <code>NUMBER</code> type
<code>TYPECODE_NVARCHAR2</code>	A <code>NVARCHAR2</code> type
<code>TYPECODE_OBJECT</code>	An <code>OBJECT</code> type

Table 199-1 (Cont.) DBMS_TYPES Constants

Constant	Description
TYPECODE_OPAQUE	An OPAQUE type
TYPECODE_RAW	A RAW type
TYPECODE_REF	A REF type
TYPECODE_TABLE	A nested table collection type
TYPECODE_TIMESTAMP	A TIMESTAMP type
TYPECODE_TIMESTAMP_LTZ	A TIMESTAMP_LTZ type
TYPECODE_TIMESTAMP_TZ	A TIMESTAMP_TZ type
TYPECODE_UROWID	A UROWID type
TYPECODE_VARCHAR2	A VARCHAR2 type
TYPECODE_VARCHAR	A VARCHAR type
TYPECODE_VARRAY	A VARRAY collection type

199.2 DBMS_TYPES Exceptions

DBMS_TYPES throws these exceptions.

- INVALID_PARAMETERS
- INCORRECT_USAGE
- TYPE_MISMATCH

DBMS_UMF

The `DBMS_UMF` package provides an interface for deploying the Remote Management Framework (RMF) for an Oracle Database. The RMF is used for collecting performance statistics for an Oracle Database.



See Also:

Oracle Database Performance Tuning Guide for more information about configuring the RMF for an Oracle Database.

This chapter contains the following topic:

- [Summary of DBMS_UMF Subprograms](#)

200.1 Summary of DBMS_UMF Subprograms

This topic lists the `DBMS_UMF` subprograms in alphabetical order and briefly describes them.

Table 200-1 DBMS_UMF Package Subprograms

Subprogram	Description
CONFIGURE_NODE Procedure	Configures a node in the RMF topology
CREATE_LINK Procedure	Creates a database link between two nodes in the RMF topology
CREATE_TOPOLOGY Procedure	Creates the RMF topology
DROP_LINK Procedure	Removes a database link between two nodes in the RMF topology
DROP_TOPOLOGY Procedure	Deletes the RMF topology
ENABLE_SERVICE Procedure	Enables a service on a node in the RMF topology
GET_NODE_ID_LOCAL Function	Returns the node ID of a node in the RMF topology
GET_NODE_NAME_LOCAL Function	Returns the node name of a node in the RMF topology
GET_TARGET_ID Function	Returns the destination ID in the RMF topology
GET_TOPOLOGY_NAME_LOCAL Function	Returns the RMF topology name of the local node
QUERY_LINK_INFO Procedure	Returns the information about a database link in the RMF topology
QUERY_NODE_INFO Procedures	Returns the information about a node in the RMF topology
REGISTER_NODE Function and Procedure	Registers a node in the RMF topology

Table 200-1 (Cont.) DBMS_UMF Package Subprograms

Subprogram	Description
SWITCH_DESTINATION Procedure	Designates a source node as a destination node in the RMF topology
UNCONFIGURE_NODE Procedure	Resets the configuration of a node in the RMF topology
UNREGISTER_NODE Procedure	Removes the registration of a node in the RMF topology

200.1.1 CONFIGURE_NODE Procedure

This procedure configures a node that needs to be registered with the RMF topology. This procedure must be executed on the node that needs to be configured.

Syntax

```
DBMS_UMF.CONFIGURE_NODE (
    node_name          IN VARCHAR2 DEFAULT NULL,
    dblink_to_target  IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 200-2 CONFIGURE_NODE Procedure Parameters

Parameter	Description
node_name	Name of the node. Each node in the RMF topology must be assigned a unique name. If a name is not provided for a node in this procedure, then the value of the initialization parameter <code>DB_UNIQUE_NAME</code> is assigned as the name for the node by default.
dblink_to_target	Database link from this node to the destination node.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.2 CREATE_LINK Procedure

This procedure creates database links between two nodes in the RMF topology. This procedure must be executed only on the destination node.

Syntax

```
DBMS_UMF.CREATE_LINK (
    topology_name     IN VARCHAR2,
    node_a_name       IN VARCHAR2,
```

```

node_b_name      IN VARCHAR2,
dblink_a_to_b    IN VARCHAR2,
dblink_b_to_a    IN VARCHAR2);

```

Parameters

Table 200-3 CREATE_LINK Procedure Parameters

Parameter	Description
topology_name	Name of the RMF topology.
node_a_name	Name of the first node.
node_b_name	Name of the second node.
dblink_a_to_b	Database link from the first node to the second node.
dblink_b_to_b	Database link from the second node to the first node.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.3 CREATE_TOPOLOGY Procedure

This procedure creates the RMF topology and designates the node on which it is executed as the destination node for that topology.

Syntax

```

DBMS_UMF.CREATE_TOPOLOGY(
  topology_name IN VARCHAR2);

```

Parameters

Table 200-4 CREATE_TOPOLOGY Procedure Parameters

Parameter	Description
topology_name	Name of the RMF topology.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.4 DROP_LINK Procedure

This procedure removes the database links between two nodes in the RMF topology. This procedure must be executed only on the destination node.

Syntax

```
DBMS_UMF.DROP_LINK(  
    topology_name IN VARCHAR2,  
    node_a_name   IN VARCHAR2,  
    node_b_name   IN VARCHAR2);
```

Parameters

Table 200-5 DROP_LINK Procedure Parameters

Parameter	Description
topology_name	Name of the RMF topology.
node_a_name	Name of the first node.
node_b_name	Name of the second node.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.5 DROP_TOPOLOGY Procedure

This procedure deletes the RMF topology. This procedure must be executed only on the destination node.

Syntax

```
DBMS_UMF.DROP_TOPOLOGY(  
    topology_name IN VARCHAR2);
```

Parameters

Table 200-6 DROP_TOPOLOGY Procedure Parameters

Parameter	Description
topology_name	Name of the topology to delete.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.6 ENABLE_SERVICE Procedure

This procedure enables a service, such as the AWR service, on a node in the RMF topology. This procedure must be executed only on the destination node.

Syntax

```
DBMS_UMF.ENABLE_SERVICE(  
    topology_name    IN VARCHAR2,  
    node_name        IN VARCHAR2,  
    service_type     IN NUMBER);
```

Parameters

Table 200-7 ENABLE_SERVICE Procedure Parameters

Parameter	Description
topology_name	Name of the RMF topology.
node_name	Name of the node on which a specific service needs to be enabled.
service_type	Numeric constant identifying the service. The only allowed value for this parameter is UMF_SERVICE_TYPE_AWR, which is Automatic Workload Repository (AWR) service.

Security Model

Only the database users SYS and SYS\$UMF can execute this procedure.

200.1.7 GET_NODE_ID_LOCAL Function

This function returns the node ID of the node in the RMF topology on which this function is executed.

Syntax

```
DBMS_UMF.GET_NODE_ID_LOCAL(  
    topology_name    IN VARCHAR2 DEFAULT NULL)  
    RETURN NUMBER;
```

Parameters

Table 200-8 GET_NODE_ID_LOCAL Function Parameters

Parameter	Description
topology_name	Name of the RMF topology with which the node is registered.

Return Value

Returns the node ID of the node in the RMF topology on which this function is executed.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this function.

200.1.8 GET_NODE_NAME_LOCAL Function

This function returns the name of the node in the RMF topology on which this function is executed.

Syntax

```
DBMS_UMF.GET_NODE_NAME_LOCAL RETURN VARCHAR2;
```

Return Value

Returns the name of the node in the RMF topology on which this function is executed.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.9 GET_TARGET_ID Function

This function returns the ID of the destination node in the RMF topology. This function can be executed on any node in the RMF topology.

Syntax

```
DBMS_UMF.GET_TARGET_ID(  
    topology_name IN VARCHAR2)  
RETURN NUMBER;
```

Parameters

Table 200-9 GET_TARGET_ID Function Parameters

Parameter	Description
<code>topology_name</code>	Name of the RMF topology.

Return Value

Returns the ID of the destination node in the RMF topology.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.10 GET_TOPOLOGY_NAME_LOCAL Function

This function returns the name of the active RMF topology of the node on which this function is executed.

Syntax

```
DBMS_UMF.GET_TOPOLOGY_NAME_LOCAL RETURN VARCHAR2;
```

Return Value

Returns the name of the active RMF topology of the node on which this function is executed.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.11 QUERY_LINK_INFO Procedure

This procedure returns the name of the database link between two nodes in the RMF topology. This procedure can be executed on any node in the RMF topology.

Syntax

```
DBMS_UMF.QUERY_LINK_INFO(  
    topology_name    IN    VARCHAR2,  
    from_node_id     IN    NUMBER,  
    to_node_id       IN    NUMBER,  
    link_name        OUT   VARCHAR2);
```

Parameters

Table 200-10 QUERY_LINK_INFO Procedure Parameters

Parameter	Description
<code>topology_name</code>	Name of the RMF topology.
<code>from_node_id</code>	Node ID of the first node.
<code>to_node_id</code>	Node ID of the second node.
<code>link_name</code>	Name of the database link from the first node to the second node returned by the procedure.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.12 QUERY_NODE_INFO Procedures

This procedure returns information about a node in the RMF topology. This procedure can be executed on any node in the RMF topology.

Syntax

```
DBMS_UMF.QUERY_NODE_INFO (
  topology_name      IN   VARCHAR2  DEFAULT NULL,
  node_name          IN   VARCHAR2,
  node_id            OUT  NUMBER);
```

```
DBMS_UMF.QUERY_NODE_INFO (
  node_id            IN   NUMBER,
  topology_name      OUT  VARCHAR2,
  node_name          OUT  VARCHAR2);
```

Parameters

Table 200-11 QUERY_NODE_INFO Procedure Parameters

Parameter	Description
topology_name	Name of the RMF topology with which the node is registered.
node_name	Name of the node.
node_id	Identifier of the node.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.13 REGISTER_NODE Function and Procedure

This function and procedure registers a node with the RMF topology. This procedure and function must be executed only on the destination node in the RMF topology.

Syntax

```
DBMS_UMF.REGISTER_NODE (
  topology_name      IN   VARCHAR2,
  node_name          IN   VARCHAR2,
  dblink_to_node     IN   VARCHAR2  DEFAULT NULL,
  dblink_from_node   IN   VARCHAR2  DEFAULT NULL,
  as_source           IN   VARCHAR2  DEFAULT 'TRUE',
  as_candidate_target IN   VARCHAR2  DEFAULT 'FALSE');
```

```
DBMS_UMF.REGISTER_NODE (
  topology_name      IN   VARCHAR2,
  node_name          IN   VARCHAR2,
  dblink_to_node     IN   VARCHAR2  DEFAULT NULL,
  dblink_from_node   IN   VARCHAR2  DEFAULT NULL,
```



```

as_source          IN VARCHAR2 DEFAULT 'TRUE',
as_candidate_target IN VARCHAR2 DEFAULT 'FALSE');
node_id           OUT VARCHAR2);

DBMS_UMF.REGISTER_NODE(
  topology_name    IN VARCHAR2,
  node_name        IN VARCHAR2,
  dblink_to_node   IN VARCHAR2 DEFAULT NULL,
  dblink_from_node IN VARCHAR2 DEFAULT NULL,
  as_source        IN VARCHAR2 DEFAULT 'TRUE',
  as_candidate_target IN VARCHAR2 DEFAULT 'FALSE')
RETURN NUMBER;
```

Parameters

Table 200-12 REGISTER_NODE Function and Procedure Parameters

Parameter	Description
topology_name	Name of the RMF topology.
node_name	Name of the node to register.
dblink_to_node	Name for the database link from the destination to the node.
dblink_from_node	Name for the database link from the node to the destination.
as_source	Set to TRUE, if the node is a source, else set to FALSE.
as_candidate_target	Set to TRUE, if the node is a candidate destination, else set to FALSE.
node_id	Node ID returned by the procedure.

Return Value

Returns the node ID of the registered node.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.14 SWITCH_DESTINATION Procedure

This procedure makes the candidate destination as the new destination in the RMF topology. This procedure must be executed only on the candidate destination node.

Syntax

```

DBMS_UMF.SWITCH_DESTINATION(
  topology_name    IN VARCHAR2,
  force_switch     IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 200-13 SWITCH_DESTINATION Procedure Parameters

Parameter	Description
topology_name	Name of the RMF topology.
force_switch	<p>If set to <code>FALSE</code>, the execution of this procedure fails in the following situations:</p> <ul style="list-style-type: none">• Candidate destination is a read-only database, and hence it cannot become the new destination.• Candidate destination does not have database links to one or more sources in the topology.• Candidate destination is unable to get the latest AWR data from the old destination. <p>If set to <code>TRUE</code>, the execution of this procedure fails in the following situation:</p> <ul style="list-style-type: none">• Candidate destination is a read-only database, and hence it cannot become the new destination.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.15 UNCONFIGURE_NODE Procedure

This procedure removes the configuration details of the node on which this procedure is executed.

Syntax

```
DBMS_UMF.UNCONFIGURE_NODE;
```

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

200.1.16 UNREGISTER_NODE Procedure

This procedure removes a node for the RMF topology. This procedure must be executed only on the destination node.

Syntax

```
DBMS_UMF.UNREGISTER_NODE(  
    topology_name    IN VARCHAR2,  
    node_name        IN VARCHAR2);
```

Parameters

Table 200-14 UNREGISTER_NODE Procedure Parameters

Parameter	Description
<code>topology_name</code>	Name of the RMF topology.
<code>node_name</code>	Name of the node which needs to be removed from the topology.

Security Model

Only the database users `SYS` and `SYS$UMF` can execute this procedure.

DBMS_UNDO_ADV

The Undo Advisor assists in correctly sizing the undo tablespace and sets the low threshold value of the Undo Retention Period for any Oracle Flashback requirements. The Undo Advisor can also be used to estimate the undo tablespace required for migration from manual to automatic undo management before actually creating the new undo tablespace.

The `DBMS_UNDO_ADVISOR` package provides subprograms to manage the execution of the Undo Advisor feature.

The Undo Advisor relies for its analysis on data collected in the Automatic Workload Repository (AWR). Thus, it is important that the AWR have adequate workload statistics available so that the Undo Advisor can make accurate recommendations. For newly created databases, adequate statistics may not be available immediately. In such cases, continue to use the default auto-extending undo tablespace until at least one workload cycle completes.

This chapter contains the following topic:

- [Summary of DBMS_UNDO_ADV Subprograms](#)

201.1 Summary of DBMS_UNDO_ADV Subprograms

This topic lists the `DBMS_UNDO_ADV` subprograms in alphabetical order and briefly describes them.

Table 201-1 DBMS_UNDO_ADV Package Subprograms

Subprogram	Description
BEST_POSSIBLE_RETENTION Function	Returns the best possible value for the <code>undo_retention</code> parameter that the current undo tablespace can satisfy in order to maximize the usage of the current undo tablespace based on the historical information of the given period.
LONGEST_QUERY Function	This function returns the duration of the longest query, in seconds, for a given period.
RBU_MIGRATION Function	Estimates the undo tablespace needed for migration from manual to automatic undo management.
REQUIRED_RETENTION Function	Returns the required value for the <code>undo_retention</code> parameter to satisfy the longest query based on undo statistics available for a given period.
REQUIRED_UNDO_SIZE Function	Returns the required undo tablespace size in MB to satisfy a certain undo retention value based on undo statistics available for a given period.
UNDO_ADVISOR Function	Uses the advisor framework to check if there is any problem with the current instance. It also provides recommendations.

Table 201-1 (Cont.) DBMS_UNDO_ADV Package Subprograms

Subprogram	Description
UNDO_AUTOTUNE Function	Determines whether auto-tuning of undo retention is enabled for the current undo tablespace.
UNDO_HEALTH Function	Checks whether there is any problem with the current setting of undo retention and undo tablespace size based on the historical information of a given period and provides recommendations to fix the problem.
UNDO_INFO Function	Retrieves information about the undo tablespace of the current instance.

201.1.1 BEST_POSSIBLE_RETENTION Function

This function returns the best possible value for the `undo_retention` parameter that the current undo tablespace can satisfy in order to maximize the usage for the current undo tablespace based on the historical information of a given period.

Syntax

Viewing the output using the historical information in memory:

```
DBMS_UNDO_ADV.BEST_POSSIBLE_RETENTION()
RETURN NUMBER;
```

Viewing the output using start time and end time:

```
DBMS_UNDO_ADV.BEST_POSSIBLE_RETENTION(
    start_time IN DATE,
    end_time   IN DATE)
RETURN NUMBER;
```

Viewing the output using begin and end AWR snapshot ID:

```
DBMS_UNDO_ADV.BEST_POSSIBLE_RETENTION(
    begin_snap IN NUMBER,
    end_snap   IN NUMBER)
RETURN NUMBER;
```

Parameters

Table 201-2 BEST_POSSIBLE_RETENTION Function Parameters

Parameter	Description
<code>start_time</code>	Start time of the given period.
<code>end_time</code>	End time of the given period.

Table 201-2 (Cont.) BEST_POSSIBLE_RETENTION Function Parameters

Parameter	Description
<code>begin_snap</code>	Begin snapshot identifier. It is based on historical information in AWR from the <code>begin_snap</code> identifier.
<code>end_snap</code>	End snapshot identifier. It is based on historical information in AWR until the <code>end_snap</code> identifier.

201.1.2 RBU_MIGRATION Function

This function estimates the undo tablespace needed for migration from manual to automatic undo management.

If you are currently using manual undo management (rollback segments) to manage undo space, then Oracle recommends migrating to automatic undo management. You must first create an undo tablespace, before opening a newly upgraded database. The required size of undo tablespace depends on the system workload and Flashback requirements.



Note:

The `RBU_MIGRATION` function should be called only when `undo_management = manual`.

Syntax

Viewing the output using the historical information in memory:

```
DBMS_UNDO_ADV.RBU_MIGRATION ()
RETURN NUMBER;
```

Viewing the output using the Start Time and End Time:

```
DBMS_UNDO_ADV.RBU_MIGRATION (
    START_TIME IN DATE,
    END_TIME   IN DATE)
RETURN NUMBER;
```

Parameters

Table 201-3 RBU_MIGRATION Function Parameters

Parameter	Description
<code>START_TIME</code>	Start time of the given period.
<code>END_TIME</code>	End time of the given period.

201.1.3 LONGEST_QUERY Function

This function returns the duration of the longest query, in seconds, for a given period.

Syntax

Viewing the output using the historical information in memory:

```
DBMS_UNDO_ADV.LONGEST_QUERY ()
RETURN NUMBER;
```

Viewing the output using start time and end time:

```
DBMS_UNDO_ADV.LONGEST_QUERY (
    start_time IN DATE,
    end_time   IN DATE)
RETURN NUMBER;
```

Viewing the output using begin and end AWR snapshot ID:

```
DBMS_UNDO_ADV.LONGEST_QUERY (
    begin_snap IN NUMBER,
    end_snap   IN NUMBER)
RETURN NUMBER;
```

Parameters

Table 201-4 LONGEST_QUERY Function Parameters

Parameter	Description
start_time	Start time for the specified period.
end_time	End time for the specified period.
begin_snap	Begin snapshot identifier. It is based on historical information in AWR from the begin_snap identifier.
end_snap	End snapshot identifier. It is based on historical information in AWR until the end_snap identifier.

201.1.4 REQUIRED_RETENTION Function

This function returns the required value for the `undo_retention` parameter to satisfy the longest query based on undo statistics available for a given period.

Syntax

Viewing the output using the historical information in memory:

```
DBMS_UNDO_ADV.REQUIRED_RETENTION()
RETURN NUMBER;
```

Viewing the output using start time and end time:

```
DBMS_UNDO_ADV.REQUIRED_RETENTION(
    start_time IN DATE,
    end_time   IN DATE)
RETURN NUMBER;
```

Viewing the output using begin and end AWR snapshot ID:

```
DBMS_UNDO_ADV.REQUIRED_RETENTION(
    begin_snap IN NUMBER,
    end_snap   IN NUMBER)
RETURN NUMBER;
```

Parameters

Table 201-5 REQUIRED_RETENTION Function Parameters

Parameter	Description
<code>start_time</code>	Start time of the given period.
<code>end_time</code>	End time of the given period.
<code>begin_snap</code>	Begin snapshot identifier. It is based on historical information in AWR from the <code>begin_snap</code> identifier.
<code>end_snap</code>	End snapshot identifier. It is based on historical information in AWR until the <code>end_snap</code> identifier.

201.1.5 REQUIRED_UNDO_SIZE Function

This function returns the required undo tablespace size (in MB) to satisfy certain undo retention value based on undo statistics available for a given period.



Note:

Zero will be returned if the information about the given period is not available.

Syntax

Viewing the output using the historical information in memory:

```
DBMS_UNDO_ADV.REQUIRED_UNDO_SIZE(
    retention IN NUMBER)
RETURN NUMBER;
```

Viewing the output using start time and end time:

```
DBMS_UNDO_ADV.REQUIRED_UNDO_SIZE(
    retention IN NUMBER,
    start_time IN DATE,
    end_time IN DATE)
RETURN NUMBER;
```

Viewing the output using begin and end AWR snapshot ID:

```
DBMS_UNDO_ADV.REQUIRED_UNDO_SIZE(
    retention IN NUMBER,
    begin_snap IN NUMBER,
    end_snap IN NUMBER)
RETURN NUMBER;
```

Parameters

Table 201-6 REQUIRED_UNDO_SIZE Function Parameters

Parameter	Description
retention	Retention value you want to set for the <code>undo_retention init.ora</code> parameter.
start_time	Start time of the given period.
end_time	End time of the given period.
begin_snap	Begin snapshot identifier. It is based on historical information in AWR from the <code>begin_snap</code> identifier.
end_snap	End snapshot identifier. It is based on historical information in AWR until the <code>end_snap</code> identifier.

201.1.6 UNDO_ADVISOR Function

This function uses the advisor framework to check if there is any problem with the current instance and provide recommendations.



Note:

This function should be used when `undo_management` is set to `auto`.

Syntax

Viewing the output using the historical information in memory:

```
DBMS_UNDO_ADV.UNDO_ADVISOR(  
    instance_id IN NUMBER)  
RETURN VARCHAR2;
```

Viewing the output using start time and end time:

```
DBMS_UNDO_ADV.UNDO_ADVISOR(  
    start_time IN DATE,  
    end_time   IN DATE,  
    instance_id IN NUMBER)  
RETURN VARCHAR2;
```

Viewing the output using begin and end AWR snapshot ID:

```
DBMS_UNDO_ADV.UNDO_ADVISOR(  
    begin_snap IN NUMBER,  
    end_snap   IN NUMBER,  
    instance_id IN NUMBER)  
RETURN VARCHAR2;
```

Parameters

Table 201-7 UNDO_ADVISOR Function Parameters

Parameter	Description
<code>start_time</code>	Start time of the given period.
<code>end_time</code>	End time of the given period.
<code>begin_snap</code>	Begin snapshot identifier. It is based on historical information in AWR from the <code>begin_snap</code> identifier.
<code>end_snap</code>	End snapshot identifier. It is based on historical information in AWR until the <code>end_snap</code> identifier.
<code>instance_id</code>	Instance ID of the current instance.

201.1.7 UNDO_AUTOTUNE Function

This function finds out whether the auto-tuning of undo retention is enabled for the current undo tablespace.

Syntax

```
DBMS_UNDO_ADV.UNDO_AUTOTUNE (
    chk OUT BOOLEAN)
RETURN BOOLEAN;
```

Parameters

Table 201-8 UNDO_AUTOTUNE Function Parameters

Parameter	Description
chk	TRUE if auto-tuning of undo retention is enabled, FALSE otherwise.

201.1.8 UNDO_HEALTH Function

Checks whether there is any problem with the current setting of undo retention and undo tablespace size based on the historical information of a given period and provides recommendations to fix the problem.

If the return value is 0, no problem is found. Otherwise, parameter `prob` and `reco` are the problem and recommendation on fixing the problem.

Syntax

Viewing the output using the historical information in memory:

```
DBMS_UNDO_ADV.UNDO_HEALTH (
    prob OUT VARCHAR2,
    reco OUT VARCHAR2,
    rtn1 OUT VARCHAR2,
    retn OUT NUMBER,
    utbs OUT NUMBER);
```

Viewing the output using start time and end time:

```
DBMS_UNDO_ADV.UNDO_HEALTH (
    prob OUT VARCHAR2,
    reco OUT VARCHAR2,
    rtn1 OUT VARCHAR2,
    retn OUT NUMBER,
    utbs OUT NUMBER)
RETURN NUMBER;
```

Viewing the output using begin and end AWR snapshot ID:

```
DBMS_UNDO_ADV.UNDO_HEALTH (
  begin_snap IN NUMBER,
  end_snap   IN NUMBER,
  prob       OUT VARCHAR2,
  reco       OUT VARCHAR2,
  rtn1       OUT VARCHAR2,
  retn       OUT NUMBER,
  utbs       OUT NUMBER)
RETURN NUMBER;
```

Parameters

Table 201-9 UNDO_HEALTH Function Parameters

Parameter	Description
start_time	Start time of the given period.
end_time	End time of the given period.
begin_snap	Begin snapshot identifier. It is based on historical information in AWR from the <code>begin_snap</code> identifier.
end_snap	End snapshot identifier. It is based on historical information in AWR until the <code>end_snap</code> identifier.
prob	Problem that is being diagnosed. For example, long running query may fail or undo tablespace cannot satisfy <code>undo_retention</code> .
reco	Recommendation for fixing the problem.
rtn1	Rationale for the recommendation.
retn	The numerical value of retention if the recommendation is to change retention.
utbs	The numerical value of undo tablespace size (in MB) if the recommendation is to change undo tablespace size.

201.1.9 UNDO_INFO Function

This function retrieves information about the undo tablespace of the current instance.

This function returns the undo tablespace name, maximum possible size for the undo tablespace, current undo retention value, and boolean values to verify if it is auto-extensible or if the undo tablespace has guaranteed undo retention.

Syntax

```
DBMS_UNDO_ADV.UNDO_INFO (
  tbs_name       OUT VARCHAR2,
  tbs_size       OUT NUMBER,
  tbs_autoextend OUT BOOLEAN,
  tbs_retention  OUT NUMBER,
```

```

    tbs_guarantee OUT BOOLEAN)
RETURN BOOLEAN;

```

Parameters

Table 201-10 UNDO_INFO Function Parameters

Parameter	Description
tbs_name	Name of the current undo tablespace the instance is using.
tbs_size	The size of the undo tablespace in MB, if the undo tablespace is <i>fixed-sized</i> . If the tablespace is <i>auto_extensible</i> , it is the maximum possible size of the undo tablespace in MB.
tbs_autoextend	TRUE if the undo tablespace is extensible, FALSE otherwise.
tbs_retention	The value of the <code>undo_retentioninit.ora</code> parameter.
tbs_guarantee	TRUE if the undo tablespace has guaranteed retention, FALSE otherwise.

DBMS_USER_CERTS

The `DBMS_USER_CERTS` package allows you add and delete certificates.

This chapter contains the following topics:

- [DBMS_USER_CERTS Overview](#)
- [DBMS_USER_CERTS Security Model](#)
- [Summary of DBMS_USER_CERTS Subprograms](#)



See Also:

- *Oracle Database Administrator's Guide*
- *Oracle Database Concepts*
- *Oracle Database SQL Language Reference*
- *Oracle Database Reference*
- For information on hidden columns in blockchain tables, see *Hidden Columns in Blockchain Tables*

202.1 DBMS_USER_CERTS Overview

The `DBMS_USER_CERTS` package allows you add and delete certificates.

The `DBMS_USER_CERTS` package allows you to:

- add certificates
- delete certificates

One use case is to attach a digital signature to a row in a blockchain table and be able to verify the digital signature later. A certificate used to sign one or more rows in blockchain tables and which has since expired should remain in the database until all those rows have been deleted from the blockchain tables.

202.2 DBMS_USER_CERTS Security Model

The `DBMS_USER_CERTS` package is owned by `SYS` and is installed as part of database installation.

- Both `ADD_CERTIFICATE()` and `DROP_CERTIFICATE()` sub-programs can be executed by any database user. The `EXECUTE` privilege on `DBMS_USER_CERTS` package is granted to `PUBLIC` role.

- Using `ADD_CERTIFICATE()`, a database user can add multiple certificates, each one would be identified uniquely using a GUID.
- Only SYSDBA or the user who owns the certificate, can drop it using `DROP_CERTIFICATE()`.

202.3 Summary of DBMS_USER_CERTS Subprograms

The `DBMS_USER_CERTS` package uses `ADD_CERTIFICATE`, `ADD_COPY`, and `DROP_CERTIFICATE` subprograms to add, copy, and delete X.509 certificates which are used for signature verification for blockchain tables by the current user.

Table 202-1 DBMS_USER_CERTS Package Subprograms

Subprogram	Description
ADD_CERTIFICATE Procedure	Adds X.509 certificates which are used for signature verification of blockchain tables.
ADD_COPY Procedure	Adds a certificate to the database and assign the certificate a specific global unique identifier (GUID).
DROP_CERTIFICATE Procedure	Drops a certificate that is used for signature verification of blockchain tables.

202.3.1 ADD_CERTIFICATE Procedure

This procedure can be used by the current user to add an X.509 certificate that is used for signature verification of blockchain tables.

Syntax

```
DBMS_USER_CERTS.ADD_CERTIFICATE(
    x509_cert      IN BLOB,
    cert_id        OUT RAW);
```

Parameters

Table 202-2 ADD_CERTIFICATE Procedure Parameters

Parameter	Description
<code>x509_cert</code>	The X.509 certificate used for signature verification of blockchain tables.
<code>cert_id</code>	The Global Unique Identifier (GUID) for the certificate.

202.3.2 ADD_COPY Procedure

This procedure enables you add a certificate to the database and assign the certificate a specific global unique identifier (GUID).

This procedure is used when a user needs to make a copy of the certificate that was previously created in one database and add the copy to another database while preserving its GUID. When recording blockchain table signatures in one database and verifying the signatures in another, the certificate GUID must be preserved. One scenario is when you use Oracle Data Pump to copy a blockchain table between

databases. Another scenario is when you use Oracle GoldenGate to replicate rows in a blockchain table between databases.

Syntax

```
DBMS_USER_CERTS.ADD_COPY(  
    x509_cert IN BLOB,  
    cert_id IN RAW,  
    username IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 202-3 ADD_COPY Procedure Parameters

Parameter	Description
x509_cert	The X.509 certificate used for signature verification of blockchain tables.
cert_id	The Global Unique Identifier (GUID) for the certificate.
username	The name of the user who will own the certificate. A NULL value defaults to the current user.

Usage Note

If `username` is not NULL, either `username` must refer to the current user, or the current user must be SYSDBA.

202.3.3 DROP_CERTIFICATE Procedure

This procedure can be used by the current user to drop a certificate that is used for signature verification of blockchain tables.

Syntax

```
DBMS_USER_CERTS.DROP_CERTIFICATE(  
    cert_id IN RAW);
```

Parameters

Table 202-4 DROP_CERTIFICATE Procedure Parameters

Parameter	Description
cert_id	The Global Unique Identifier (GUID) of the certificate.

DBMS_USERDIAG

The `DBMS_USERDIAG` package allows you to perform a limited set of diagnosis operations on the PDB.

This chapter contains the following topics:

- [DBMS_USERDIAG Overview](#)
- [Summary of DBMS_USERDIAG Subprograms](#)

Enabling traces on cloud requires additional configuration as documented here: [Perform SQL Tracing on Autonomous Database](#).

203.1 DBMS_USERDIAG Overview

The `DBMS_USERDIAG` package is for diagnosis and allows you to set up a trace within a PDB.

The `DBMS_USERDIAG` package utilizes underneath `DBMS_SYSTEM` functionality but with a narrow set of definitions which restrict arbitrary event settings.

For a given PDB, the `DBMS_USERDIAG` package allows you:

- to enable the SQL trace at a given level.
- to disable the SQL trace.
- to check the SQL trace.

Most of the regular diagnostic mechanisms have been restricted outside of a given PDB using lockdown profiles, so that arbitrary events cannot be enabled from user sessions in a shared tenancy in CBD deployments in cloud instances. In particular, "alter session set events" statement is blocked in cloud deployments, because it can be misused to set events/actions which may change code-path execution or simulate errors.

203.2 Summary of DBMS_USERDIAG Subprograms

The `DBMS_USERDIAG` package uses `ENABLE_SQL_TRACE_EVENT` and `CHECK_SQL_TRACE_EVENT` subprograms to enable, disable, and monitor `sql_trace` events.

Table 203-1 DBMS_USERDIAG Package Subprograms

Subprogram	Description
CHECK_SQL_TRACE_EVENT Procedure	Checks the current <code>sql_trace</code> event and retrieves the level.
ENABLE_SQL_TRACE_EVENT Procedure	Enables <code>sql_trace</code> event at a given level in user session, and generates SQL traces into respective process trace files.
GET_CALL_ERROR_MSG Function	Obtains the error message if the last call to <code>DBMS_USERDIAG</code> API returned an error.
GET_CALL_STATUS Function	Obtains the status of the last call to the <code>DBMS_USERDIAG</code> API.

Table 203-1 (Cont.) DBMS_USERDIAG Package Subprograms

Subprogram	Description
SET_EXCEPTION_MODE Procedure	Raises an exception on any error or silently ignores the same (default).
SET_TRACEFILE_IDENTIFIER Procedure	Sets a custom trace file identifier for the active trace file in the current ADR home.
TRACE Procedure	Traces message to the trace file or alert log.

203.2.1 CHECK_SQL_TRACE_EVENT Procedure

This procedure can be used by the current user to check the current `sql_trace` event and retrieves the level.

Syntax

```
DBMS_USERDIAG.CHECK_SQL_TRACE_EVENT (
  sql_id          IN VARCHAR2          DEFAULT NULL
  sys             IN BINARY_INTEGER  DEFAULT NULL
  level          OUT BINARY_INTEGER);
```

Parameters

Table 203-2 CHECK_SQL_TRACE_EVENT Procedure Parameters

Parameter	Description
<code>level</code>	Required. Output of the current level at which <code>sql_trace</code> event is enabled.
<code>sql_id</code>	<code>sql_trace</code> in scope of a given <code>sql_id</code> alone. This is currently ignored.
<code>sys</code>	Optional. Set event instance-wide or PDB-wide. Default 0. This is currently ignored.

203.2.2 ENABLE_SQL_TRACE_EVENT Procedure

This procedure enables `sql_trace` event (`sql_trace/10046`) at a given `level` in user session, and generates SQL traces into respective process trace files.

Optionally a `sql_id` can also be specified in which case tracing is enabled for that `sql_id` alone. Default is to enable events without `sql` scope. Default is to set event in current session alone. Event can be disabled by setting `disable` to non-zero value (default zero).

Syntax

```
DBMS_USERDIAG.ENABLE_SQL_TRACE_EVENT (
  level          IN BINARY_INTEGER  DEFAULT 1,
  sid            IN BINARY_INTEGER  DEFAULT 0,
  ser           IN BINARY_INTEGER  DEFAULT 0,
  binds         IN BINARY_INTEGER  DEFAULT 0,
```

```

waits          IN  BINARY_INTEGER DEFAULT 0,
plan_stat     IN  VARCHAR2         DEFAULT NULL,
sql_id        IN  VARCHAR2         DEFAULT NULL,
disable       IN  BINARY_INTEGER DEFAULT 0,
sys           IN  BINARY_INTEGER DEFAULT 0);

```

Parameters

Table 203-3 ENABLE_SQL_TRACE_EVENT Procedure Parameters

Parameter	Description
level	Optional. Specifies the level associated with <code>sql_trace</code> event. Other settings augment the level value. For example, <code>binds=>true</code> adds to whatever level value has been provided by the user. This is kept for ease of usage.
sid	Optional. Target session identifier. <code>sid, ser</code> pair must be validated to be within current PDB id.
ser	Optional. Target serial number.
binds	Optional. A non-zero value traces bind values. Maps to level 4.
waits	Optional. A non-zero value traces waits. Maps to level 8.
plan_stat	Optional. Allowed values: <code>FIRST_EXECUTION</code> (default), <code>NEVER</code> , <code>ALL_EXECUTIONS</code> , and <code>ADAPTIVE</code>
sql_id	Enable <code>sql_trace</code> in scope of a given <code>sql_id</code> alone
disable	Optional. Non-zero value disables the already set <code>sql_trace</code> event.
sys	Optional. Set event instance-wide or PDB-wide. Default 0.

203.2.3 GET_CALL_ERROR_MSG Function

This function is used to obtain the error message if the last call to `DBMS_USERDIAG` API returned an error.

Syntax

```
DBMS_USERDIAG.GET_CALL_ERROR_MSG RETURN VARCHAR2;
```

Return Value

If the previous call to `DBMS_USERDIAG` was unsuccessful, the `VARCHAR2` contains the error message associated with it.

If the previous call to `DBMS_USERDIAG` was successful, the value returned is `NULL`.

203.2.4 GET_CALL_STATUS Function

This function is used to obtain the status of the last call to the `DBMS_USERDIAG` API.

Syntax

```
DBMS_USERDIAG.GET_CALL_STATUS RETURN NUMBER;
```

Return Value

Returns a number for the status of the last call to the DBMS_USERDIAG API.

If the previous call was successful, the value of this call is NOERROR(0).

If the previous call was unsuccessful, the value of this call is the error code number.

203.2.5 SET_EXCEPTION_MODE Procedure

This procedure raises an exception on any error or silently ignores the same (default).

Syntax

```
DBMS_USERDIAG.SET_EXCEPTION_MODE(  
    exc_mode IN BOOLEAN DEFAULT FALSE);
```

Parameters**Table 203-4 SET_EXCEPTION_MODE Procedure Parameters**

Parameter	Description
exc_mode	When TRUE, an exception is raised on any error. When FALSE (default), errors are ignored.

203.2.6 SET_TRACEFILE_IDENTIFIER Procedure

This procedure is used to set a custom trace file identifier for the active trace file in the current ADR home.

Syntax

```
DBMS_USERDIAG.SET_TRACEFILE_IDENTIFIER(  
    trc_identifier IN VARCHAR2);
```

Parameters**Table 203-5 SET_TRACEFILE_IDENTIFIER Procedure Parameters**

Parameter	Description
trc_identifier	Specifies the trace identifier for the active trace file in the current ADR home.

203.2.7 TRACE Procedure

This procedure is used to trace message to the trace file or alert log.

Syntax

```
DBMS_USERDIAG.TRACE (  
    message IN VARCHAR2,  
    alert    IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 203-6 TRACE Procedure Parameters

Parameter	Description
message	Specifies the text or message to be traced.
alert	When TRUE , the alert logs are included with the trace file for the trace operation. When FALSE (default), the alert logs are ignored and only the trace file is used for the trace operation.

DBMS_UTILITY

The `DBMS_UTILITY` package provides various utility subprograms.

This chapter contains the following topics:

- [DBMS_UTILITY Deprecated Subprograms](#)
- [Security Model](#)
- [Constants](#)
- [Exceptions](#)
- [Data Structures](#)
- [Summary of DBMS_UTILITY Subprograms](#)

204.1 DBMS_UTILITY Deprecated Subprograms

These `DBMS_UTILITY` subprograms are deprecated in Oracle Database 12c release 12.2.



Note:

Oracle recommends that you do not use deprecated procedures in new applications. Support for deprecated features is for backward compatibility only.

- [GET_PARAMETER_VALUE Function](#)
Query `v$_parameter` directly to find the value of an `init.ora` parameter.
- [ANALYZE_PART_OBJECT Procedure](#)
Use `DBMS_STATS` to gather statistics.
- [GET_DEPENDENCY Procedure](#)
There is no replacement for this subprogram. However, you can directly query the dictionary views.

There are no replacements for these subprograms.

204.2 DBMS_UTILITY Security Model

`DBMS_UTILITY` runs with the privileges of the calling user for the `NAME_RESOLVE` procedure and the `COMPILE_SCHEMA` procedure. This is necessary so that the SQL works correctly.

The package does not run as `SYS`. The privileges are checked using `DBMS_DDL`.

Related Topics

- [NAME_RESOLVE Procedure](#)
This procedure resolves the given name, including synonym translation and authorization checking as necessary.
- [COMPILE_SCHEMA Procedure](#)
This procedure compiles all procedures, functions, packages, views and triggers in the specified schema.

204.3 DBMS_UTILITY Constants

The `DBMS_UTILITY` package defines one constant to use when specifying parameter values.

This constant is shown in the following table.

Table 204-1 DBMS_UTILITY Constants

Name	Type	Value	Description
<code>INV_ERROR_ON_RESTRICTIONS</code>	<code>PLS_INTEGER</code>	1	This constant is the only legal value for the <code>p_option_flags</code> parameter of the <code>INVALIDATE</code> subprogram

204.4 DBMS_UTILITY Exceptions

This table lists the exceptions raised by `DBMS_UTILITY`.

Table 204-2 Exceptions Raised by DBMS_UTILITY

Exception	Error Code	Description
<code>INV_NOT_EXIST_OR_NO_PRIV</code>	-24237	Raised by the <code>INVALIDATE</code> subprogram when the <code>object_id</code> argument is <code>NULL</code> or invalid, or when the caller does not have <code>CREATE</code> privileges on the object being invalidated
<code>INV_MALFORMED_SETTINGS</code>	-24238	Raised by the <code>INVALIDATE</code> subprogram if a compiler setting is specified more than once in the <code>p_plsql_object_settings</code> parameter
<code>INV_RESTRICTED_OBJECT</code>	-24239	Raised by the <code>INVALIDATE</code> subprogram when different combinations of conditions pertaining to the <code>p_object_id</code> parameter are contravened

204.5 DBMS_UTILITY Data Structures

The `DBMS_UTILITY` package defines a single `RECORD` type and `TABLE` types.

Record Types

- [INSTANCE_RECORD Record Type](#)

Table Types

- [DBLINK_ARRAY TABLE Type](#)
- [INDEX_TABLE_TYPE Table Type](#)
- [INSTANCE_TABLE Table Type](#)
- [LNAME_ARRAY Table Type](#)
- [NAME_ARRAY Table Type](#)
- [NUMBER_ARRAY Table Type](#)
- [UNCL_ARRAY Table Type](#)

204.5.1 DBMS_UTILITY INSTANCE_RECORD Record Type

This type describes a list of active instance number-name pairs.

Syntax

```
TYPE INSTANCE_RECORD IS RECORD (  
    inst_number    NUMBER,  
    inst_name      VARCHAR2(60));
```

Fields

Table 204-3 INSTANCE_RECORD Record Type Fields

Field	Description
inst_number	Active instance number
inst_name	Instance name

204.5.2 DBMS_UTILITY DBLINK_ARRAY TABLE Type

This type stores a list of database links.

Syntax

```
TYPE DBLINK_ARRAY IS TABLE OF VARCHAR2(128) INDEX BY BINARY_INTEGER;
```

204.5.3 DBMS_UTILITY INDEX_TABLE_TYPE Table Type

This type describes the order in which generated objects are returned to a user.

Syntax

```
TYPE INDEX_TABLE_TYPE IS TABLE OF BINARY_INTEGER INDEX BY BINARY_INTEGER;
```


204.5.4 DBMS_UTILITY INSTANCE_TABLE Table Type

This type describes a table of `INSTANCE_RECORD` Record Type.

Syntax

```
TYPE INSTANCE_TABLE IS TABLE OF INSTANCE_RECORD INDEX BY BINARY_INTEGER;
```

Usage Notes

The starting index of `INSTANCE_TABLE` is 1; `INSTANCE_TABLE` is Dense.

Related Topics

- [DBMS_UTILITY INSTANCE_RECORD Record Type](#)
This type describes a list of active instance number-name pairs.

204.5.5 DBMS_UTILITY LNAME_ARRAY Table Type

This type stores lists of `LONG NAME` including fully qualified attribute names.

Syntax

```
TYPE LNAME_ARRAY IS TABLE OF VARCHAR2(4000) INDEX BY BINARY_INTEGER;
```

204.5.6 DBMS_UTILITY NAME_ARRAY Table Type

This type stores lists of `NAME`.

Syntax

```
TYPE NAME_ARRAY IS TABLE OF VARCHAR2(30) INDEX BY BINARY_INTEGER;
```

204.5.7 DBMS_UTILITY NUMBER_ARRAY Table Type

This type describes the order in which generated objects are returned to users.

Syntax

```
TYPE NUMBER_ARRAY IS TABLE OF NUMBER INDEX BY BINARY_INTEGER;
```

204.5.8 DBMS_UTILITY UNCL_ARRAY Table Type

This type stores lists of `"user"."name"."column"@link`

Syntax

```
TYPE UNCL_ARRAY IS TABLE OF VARCHAR2(227) INDEX BY BINARY_INTEGER;
```

204.6 Summary of DBMS_UTILITY Subprograms

This table lists the `DBMS_UTILITY` subprograms and briefly describes them.

Table 204-4 DBMS_UTILITY Package Subprograms

Subprogram	Description
ACTIVE_INSTANCES Procedure	Returns the active instance
ANALYZE_DATABASE Procedure	Analyzes all the tables, clusters and indexes in a database
ANALYZE_PART_OBJECT Procedure	Analyzes the given tables and indexes This procedure is deprecated from the <code>DBMS_UTILITY</code> package with Oracle Database 12c release 12.2 and later. Use <code>DBMS_STATS</code> to gather statistics.
ANALYZE_SCHEMA Procedure	Analyzes all the tables, clusters and indexes in a schema
CANONICALIZE Procedure	Canonicalizes a given string
COMMA_TO_TABLE Procedures	Converts a comma-delimited list of names into a PL/SQL table of names
COMPILE_SCHEMA Procedure	Compiles all procedures, functions, packages, views and triggers in the specified schema
CREATE_ALTER_TYPE_ERROR_TABLE Procedure	Creates an error table to be used in the <code>EXCEPTION</code> clause of the <code>ALTER TYPE</code> statement
CURRENT_INSTANCE Function	Returns the current connected instance number
DATA_BLOCK_ADDRESS_BLOCK Function	Gets the block number part of a data block address
DATA_BLOCK_ADDRESS_FILE Function	Gets the file number part of a data block address
DB_VERSION Procedure	Returns version information for the database
EXEC_DDL_STATEMENT Procedure	Executes the DDL statement in <code>parse_string</code>
EXPAND_SQL_TEXT Procedure	Recursively replaces any view references in the input SQL query with the corresponding view subquery
FORMAT_CALL_STACK Function	Formats the current call stack
FORMAT_ERROR_BACKTRACE Function	Formats the backtrace from the point of the current error to the exception handler where the error has been caught
FORMAT_ERROR_STACK Function	Formats the current error stack
GET_CPU_TIME Function	Returns the current CPU time in 100th's of a second
GET_DEPENDENCY Procedure	Shows the dependencies on the object passed in. This procedure is deprecated from the <code>DBMS_UTILITY</code> package with Oracle Database 12c release 12.2 and later. There is no replacement for this subprogram.
GET_ENDIANNESNESS Function	Gets the endianness of the database platform
GET_HASH_VALUE Function	Computes a hash value for the given string
GET_PARAMETER_VALUE Function	Gets the value of specified <code>init.ora</code> parameter. This function is deprecated from the <code>DBMS_UTILITY</code> package with Oracle Database 12c release 12.2 and later. You can query <code>v\$_parameter</code> directly.
GET_SQL_HASH Function	Computes a hash value for the given string using MD5 algorithm
GET_TIME Function	Returns the current time in 100th's of a second
GET_TZ_TRANSITIONS Procedure	Returns time zone transitions by <code>regionid</code> from the <code>timezone.dat</code> file

Table 204-4 (Cont.) DBMS_UTILITY Package Subprograms

Subprogram	Description
INVALIDATE Procedure	Invalidates a database object and (optionally) modifies its PL/SQL compiler parameter settings
IS_BIT_SET Function	Checks the bit setting for the given bit in the given RAW value
IS_CLUSTER_DATABASE Function	Determines if the database is running in cluster database mode
MAKE_DATA_BLOCK_ADDRESS Function	Creates a data block address given a file number and a block number
NAME_RESOLVE Procedure	Resolves the given name
NAME_TOKENIZE Procedure	Calls the parser to parse the given name
OLD_CURRENT_SCHEMA Function	Returns the session value from SYS_CONTEXT ('USERENV', 'CURRENT_SCHEMA')
OLD_CURRENT_USER Function	Returns the session value from SYS_CONTEXT ('USERENV', 'CURRENT_USER')
PORT_STRING Function	Returns a string that uniquely identifies the version of Oracle and the operating system
SQLID_TO_SQLHASH Function	Converts a SQL ID into a hash value
TABLE_TO_COMMA Procedures	Converts a PL/SQL table of names into a comma-delimited list of names
VALIDATE Procedure	Makes invalid database objects valid
WAIT_ON_PENDING_DML Function	Waits until all transactions (other than the caller's own) that have locks on the listed tables and began prior to the specified SCN have either committed or been rolled back

204.6.1 ACTIVE_INSTANCES Procedure

This procedure returns the active instance.

Syntax

```
DBMS_UTILITY.ACTIVE_INSTANCES (
    instance_table OUT INSTANCE_TABLE,
    instance_count OUT NUMBER);
```

Parameters

Table 204-5 ACTIVE_INSTANCES Procedure Parameters

Procedure	Description
instance_table	Contains a list of the active instance numbers and names. When no instance is up, the list is empty.
instance_count	Number of active instances

204.6.2 ANALYZE_DATABASE Procedure

This procedure analyzes all the tables, clusters and indexes in a database.

Syntax

```
DBMS_UTILITY.ANALYZE_DATABASE (
  method          IN VARCHAR2,
  estimate_rows   IN NUMBER DEFAULT NULL,
  estimate_percent IN NUMBER DEFAULT NULL,
  method_opt      IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 204-6 ANALYZE_DATABASE Procedure Parameters

Parameter	Description
method	One of ESTIMATE, COMPUTE or DELETE. If ESTIMATE then either estimate_rows or estimate_percent must be nonzero.
estimate_rows	Number of rows to estimate
estimate_percent	Percentage of rows to estimate. If estimate_rows is specified ignore this parameter.
method_opt	Method options of the following format: [FOR TABLE] [FOR ALL [INDEXED] COLUMNS] [SIZE n] [FOR ALL INDEXES]

Exceptions

ORA-20000: Insufficient privileges for some object in this database

204.6.3 ANALYZE_PART_OBJECT Procedure

This procedure is equivalent to SQL: "ANALYZE TABLE|INDEX [<schema>.]<object_name> PARTITION <pname> [<command_type>] [<command_opt>] [<sample_clause>]"

Note:

This subprogram has been deprecated and replaced by improved technology. It is maintained only for purposes of backward compatibility. As an alternative, you can use [DBMS_STATS](#) to gather statistics.

Syntax

```
DBMS_UTILITY.ANALYZE_PART_OBJECT (
  schema          IN VARCHAR2 DEFAULT NULL,
  object_name     IN VARCHAR2 DEFAULT NULL,
  object_type     IN CHAR      DEFAULT 'T',
  command_type    IN CHAR      DEFAULT 'E',
```

```
command_opt IN VARCHAR2 DEFAULT NULL,
sample_clause IN VARCHAR2 DEFAULT 'sample 5 percent ');
```

Parameters

Table 204-7 ANALYZE_PART_OBJECT Procedure Parameters

Parameter	Description
schema	Schema of the object_name
object_name	Name of object to be analyzed, must be partitioned
object_type	Type of object, must be T (table) or I (index)
command_type	Must be V (validate structure)
command_opt	Other options for the command type. For C, E it can be FOR table, FOR all LOCAL indexes, FOR all columns or combination of some of the 'for' options of analyze statistics (table). For V, it can be CASCADE when object_type is T.
sample_clause	Sample clause to use when command_type is 'E'

Usage Notes

For each partition of the object, run in parallel using job queues.

204.6.4 ANALYZE_SCHEMA Procedure

This procedure analyzes all the tables, clusters and indexes in a schema.

Syntax

```
DBMS_UTILITY.ANALYZE_SCHEMA (
  schema          IN VARCHAR2,
  method          IN VARCHAR2,
  estimate_rows   IN NUMBER DEFAULT NULL,
  estimate_percent IN NUMBER DEFAULT NULL,
  method_opt     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 204-8 ANALYZE_SCHEMA Procedure Parameters

Parameter	Description
schema	Name of the schema
method	One of ESTIMATE, COMPUTE or DELETE. If ESTIMATE then either estimate_rows or estimate_percent must be nonzero.
estimate_rows	Number of rows to estimate
estimate_percent	Percentage of rows to estimate. If estimate_rows is specified ignore this parameter.

Table 204-8 (Cont.) ANALYZE_SCHEMA Procedure Parameters

Parameter	Description
method_opt	Method options of the following format: [FOR TABLE] [FOR ALL [INDEXED] COLUMNS] [SIZE n] [FOR ALL INDEXES]

Exceptions

ORA-20000: Insufficient privileges for some object in this schema

204.6.5 CANONICALIZE Procedure

This procedure canonicalizes the given string. The procedure handles a single reserved or key word (such as 'table'), and strips off white spaces for a single identifier so that ' table ' becomes TABLE.

Syntax

```
DBMS_UTILITY.CANONICALIZE (
    name          IN   VARCHAR2,
    canon_name    OUT  VARCHAR2,
    canon_len     IN   BINARY_INTEGER);
```

Parameters**Table 204-9 CANONICALIZE Procedure Parameters**

Parameter	Description
name	String to be canonicalized
canon_name	Canonicalized string
canon_len	Length of the string (in bytes) to canonicalize

Return Values

Returns the first canon_len bytes in canon_name.

Usage Notes

- If name is NULL, canon_name becomes NULL.
- If name is not a dotted name, and if name begins and ends with a double quote, remove both quotes. Alternatively, convert to upper case with NLS_UPPER. Note that this case does not include a name with special characters, such as a space, but is not doubly quoted.
- If name is a dotted name (such as a."b".c), for each component in the dotted name in the case in which the component begins and ends with a double quote, no transformation will be performed on this component. Alternatively, convert to upper case with NLS_UPPER and apply begin and end double quotes to the capitalized form of this component. In such

a case, each canonicalized component will be concatenated together in the input position, separated by ".".

- Any other character after a[b]* will be ignored.
- The procedure does not handle cases like 'A B.'

Examples

- a becomes A
- "a" becomes a
- "a".b becomes "a"."B"
- "a".b,c.f becomes "a"."B" with ",c.f" ignored.

204.6.6 COMMA_TO_TABLE Procedures

These procedures convert a comma-delimited list of names into a PL/SQL table of names. The second version supports fully-qualified attribute names.

Syntax

```
DBMS_UTILITY.COMMA_TO_TABLE (
  list  IN  VARCHAR2,
  tablen OUT BINARY_INTEGER,
  tab   OUT uncl_array);
```

```
DBMS_UTILITY.COMMA_TO_TABLE (
  list  IN  VARCHAR2,
  tablen OUT BINARY_INTEGER,
  tab   OUT lname_array);
```

Parameters

Table 204-10 COMMA_TO_TABLE Procedure Parameters

Parameter	Description
list	Comma separated list of list of 'names', where a name should have the following format for the first overloading: a [. b [. c]][@ d] and the following format for the second overloading: a [. b]* where a, b, c, d are simple identifiers (quoted or unquoted).
tablen	Number of tables in the PL/SQL table
tab	PL/SQL table which contains list of names

Return Values

A PL/SQL table is returned, with values 1..n and n+1 is null.

Usage Notes

- The list must be a non-empty comma-delimited list: Anything other than a comma-delimited list is rejected. Commas inside double quotes do not count.
- Entries in the comma-delimited list cannot include multibyte characters.

- The values in `tab` are copied from the original list, with no transformations.
- The procedure fails if the string between separators is longer than 30 bytes.

204.6.7 COMPILE_SCHEMA Procedure

This procedure compiles all procedures, functions, packages, views and triggers in the specified schema.

Syntax

```
DBMS_UTILITY.COMPILE_SCHEMA (
    schema          IN VARCHAR2,
    compile_all     IN BOOLEAN DEFAULT TRUE,
    reuse_settings  IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 204-11 COMPILE_SCHEMA Procedure Parameters

Parameter	Description
<code>schema</code>	Name of the schema
<code>compile_all</code>	If <code>TRUE</code> , will compile everything within the schema regardless of whether it is <code>VALID</code> If <code>FALSE</code> , will compile only <code>INVALID</code> objects
<code>reuse_settings</code>	Indicates whether the session settings in the objects should be reused, or whether the current session settings should be adopted instead

Exceptions

Table 204-12 COMPILE_SCHEMA Procedure Exceptions

Exception	Description
ORA-20000	Insufficient privileges for some object in this schema
ORA-20001	Cannot recompile <code>SYS</code> objects
ORA-20002	Maximum iterations exceeded. Some objects may not have been recompiled.

Usage Notes

- Note that this subprogram is a wrapper for the [RECOMP_SERIAL Procedure](#) included with the [UTL_RECOMP](#) package.
- After calling this procedure, you should select from view `ALL_OBJECTS` for items with status of `INVALID` to see if all objects were successfully compiled.
- To see the errors associated with `INVALID` objects, you may use the Enterprise Manager command:

```
SHOW ERRORS <type> <schema>.<name>
```


204.6.8 CREATE_ALTER_TYPE_ERROR_TABLE Procedure

This procedure creates an error table to be used in the `EXCEPTION` clause of the `ALTER TYPE` statement.

Syntax

```
DBMS_UTILITY.CREATE_ALTER_TYPE_ERROR_TABLE(  
    schema_name    IN    VARCHAR2,  
    table_name     IN    VARCHAR2);
```

Parameters

Table 204-13 CREATE_ALTER_TYPE_ERROR_TABLE Procedure Parameters

Parameter	Description
schema_name	Name of the schema
table_name	Name of the table created

Exceptions

An error is returned if the table already exists.

204.6.9 CURRENT_INSTANCE Function

This function returns the current connected instance number. It returns `NULL` when connected instance is down.

Syntax

```
DBMS_UTILITY.CURRENT_INSTANCE  
    RETURN NUMBER;
```

204.6.10 DATA_BLOCK_ADDRESS_BLOCK Function

This function gets the block number part of a data block address.

Syntax

```
DBMS_UTILITY.DATA_BLOCK_ADDRESS_BLOCK (  
    dba NUMBER)  
    RETURN NUMBER;
```

Parameters

Table 204-14 DATA_BLOCK_ADDRESS_BLOCK Function Parameters

Parameter	Description
dba	Data block address

Pragmas

```
pragma restrict_references(data_block_address_block, WNDS, RNDS, WNPS, RNPS);
```

Return Values

Block offset of the block.

Usage Notes

This function should not be used with datablocks which belong to bigfile tablespaces.

204.6.11 DATA_BLOCK_ADDRESS_FILE Function

This function gets the file number part of a data block address.

Syntax

```
DBMS_UTILITY.DATA_BLOCK_ADDRESS_FILE (  
    dba NUMBER)  
    RETURN NUMBER;
```

Parameters**Table 204-15 DATA_BLOCK_ADDRESS_FILE Function Parameters**

Parameter	Description
dba	Data block address

Pragmas

```
pragma restrict_references (data_block_address_file, WNDS, RNDS, WNPS, RNPS);
```

Return Values

File that contains the block.

Usage Notes

This function should not be used with datablocks which belong to bigfile tablespaces.

204.6.12 DB_VERSION Procedure

This procedure returns version information for the database.

Syntax

```
DBMS_UTILITY.DB_VERSION (  
    version      OUT VARCHAR2,  
    compatibility OUT VARCHAR2);
```

Parameters

Table 204-16 DB_VERSION Procedure Parameters

Parameter	Description
<code>version</code>	A string which represents the internal software version of the database (for example, 7.1.0.0.0). The length of this string is variable and is determined by the database version.
<code>compatibility</code>	The compatibility setting of the database determined by the "compatible" <code>init.ora</code> parameter. If the parameter is not specified in the <code>init.ora</code> file, then NULL is returned.

204.6.13 EXEC_DDL_STATEMENT Procedure

This procedure executes the DDL statement in `parse_string`.

Syntax

```
DBMS_UTILITY.EXEC_DDL_STATEMENT (
    parse_string IN VARCHAR2);
```

Parameters

Table 204-17 EXEC_DDL_STATEMENT Procedure Parameters

Parameter	Description
<code>parse_string</code>	DDL statement to be executed

204.6.14 EXPAND_SQL_TEXT Procedure

This procedure recursively replaces any view references in the input SQL query with the corresponding view subquery.

Syntax

```
DBMS_UTILITY.EXPAND_SQL_TEXT (
    input_sql_text    IN          CLOB,
    output_sql_text   OUT NOCOPY CLOB);
```

Parameters

Table 204-18 EXPAND_SQL_TEXT Procedure Parameters

Parameter	Description
<code>input_sql_text</code>	Input SQL query text
<code>output_sql_text</code>	View-expanded query text

Exceptions

Table 204-19 EXPAND_SQL_TEXT Procedure Exceptions

Exception	Description
ORA-00942	Current user does not have select privileges on all the views and tables recursively referenced in the <code>input_sql_text</code>
ORA-24251	<code>input_sql_text</code> is not a <code>SELECT</code> statement
ORA-00900	Input is not valid
ORA-29477	Input LOB size exceeds maximum size of 4GB -1

Usage Notes

The expanded and merged SQL statement text is copied to `output_sql_text` on successful completion. The resulting query text only contains references to underlying tables and is semantically equivalent with some caveats:

- If there are invoker rights functions called from any of the views, they may be called as a different user in the resulting query text if the view owner is different from the user who will eventually compile/run the expanded SQL text.
- The VPD policy expands differently if there is a function supplied to generate the dynamic `WHERE` clause. This function would return differently, for example, if the `userid` caused the expansion to be different.
- If there are references to remote objects, results are undetermined.

204.6.15 FORMAT_CALL_STACK Function

This function formats the current call stack. This can be used on any stored procedure or trigger to access the call stack. This can be useful for debugging.

Syntax

```
DBMS_UTILITY.FORMAT_CALL_STACK
RETURN VARCHAR2;
```

Pragmas

```
pragma restrict_references(format_call_stack,WNDS);
```

Return Values

This returns the call stack, up to 2000 bytes.

204.6.16 FORMAT_ERROR_BACKTRACE Function

This function displays the call stack at the point where an exception was raised, even if the subprogram is called from an exception handler in an outer scope.

The output is similar to the output of the `SQLERRM` function, but not subject to the same size limitation.

Syntax

```
DBMS_UTILITY.FORMAT_ERROR_BACKTRACE  
    RETURN VARCHAR2;
```

Return Values

The backtrace string. A NULL string is returned if no error is currently being handled.

Examples

```
CREATE OR REPLACE PROCEDURE Log_Errors ( i_buff in varchar2 ) IS  
    g_start_pos integer := 1;  
    g_end_pos integer;  
  
    FUNCTION Output_One_Line RETURN BOOLEAN IS  
    BEGIN  
        g_end_pos := Instr ( i_buff, Chr(10), g_start_pos );  
  
        CASE g_end_pos > 0  
            WHEN true THEN  
                DBMS_OUTPUT.PUT_LINE ( Substr ( i_buff, g_start_pos,  
g_end_pos-g_start_pos ) );  
                g_start_pos := g_end_pos+1;  
                RETURN TRUE;  
  
            WHEN FALSE THEN  
                DBMS_OUTPUT.PUT_LINE ( Substr ( i_buff, g_start_pos,  
(Length(i_buff)-g_start_pos)+1 ) );  
                RETURN FALSE;  
            END CASE;  
        END Output_One_Line;  
  
    BEGIN  
        WHILE Output_One_Line() LOOP NULL;  
        END LOOP;  
    END Log_Errors;  
/  
  
Set Doc Off  
Set Feedback off  
Set Echo Off  
  
CREATE OR REPLACE PROCEDURE P0 IS  
    e_01476 EXCEPTION; pragma exception_init ( e_01476, -1476 );  
    BEGIN  
        RAISE e_01476;  
    END P0;  
/  
Show Errors  
  
CREATE OR REPLACE PROCEDURE P1 IS  
    BEGIN  
        P0();  
    END P1;  
/  
SHOW ERRORS  
  
CREATE OR REPLACE PROCEDURE P2 IS  
    BEGIN
```

```

    P1();
END P2;
/
SHOW ERRORS

CREATE OR REPLACE PROCEDURE P3 IS
BEGIN
    P2();
END P3;
/
SHOW ERRORS

CREATE OR REPLACE PROCEDURE P4 IS
    BEGIN P3(); END P4;
/
CREATE OR REPLACE PROCEDURE P5 IS
    BEGIN P4(); END P5;
/
SHOW ERRORS

CREATE OR REPLACE PROCEDURE Top_Naive IS
BEGIN
    P5();
END Top_Naive;
/
SHOW ERRORS

CREATE OR REPLACE PROCEDURE Top_With_Logging IS
    -- NOTE: SqlErrm in principle gives the same info as Format_Error_Stack.
    -- But SqlErrm is subject to some length limits,
    -- while Format_Error_Stack is not.
BEGIN
    P5();
EXCEPTION
    WHEN OTHERS THEN
        Log_Errors ( 'Error_Stack...' || Chr(10) ||
            DBMS_UTILITY.FORMAT_ERROR_STACK() );
        Log_Errors ( 'Error_Backtrace...' || Chr(10) ||
            DBMS_UTILITY.FORMAT_ERROR_BACKTRACE() );
        DBMS_OUTPUT.PUT_LINE ( '-----' );
END Top_With_Logging;
/
SHOW ERRORS

```

```

Set ServerOutput On
call Top_Naive()
/*
ERROR at line 1:
ORA-01476: divisor is equal to zero
ORA-06512: at "U.P0", line 4
ORA-06512: at "U.P1", line 3
ORA-06512: at "U.P2", line 3
ORA-06512: at "U.P3", line 3
ORA-06512: at "U.P4", line 2
ORA-06512: at "U.P5", line 2
ORA-06512: at "U.TOP_NAIVE", line 3
*/
;

```

```
Set ServerOutput On
call Top_With_Logging()
/*
Error_Stack...
ORA-01476: divisor is equal to zero
Error_Backtrace...
ORA-06512: at "U.P0", line 4
ORA-06512: at "U.P1", line 3
ORA-06512: at "U.P2", line 3
ORA-06512: at "U.P3", line 3
ORA-06512: at "U.P4", line 2
ORA-06512: at "U.P5", line 2
ORA-06512: at "U.TOP_WITH_LOGGING", line 6
-----
*/
;

/*
ORA-06512:
Cause:
  Backtrace message as the stack is
  unwound by unhandled exceptions.
Action:
  Fix the problem causing the exception
  or write an exception handler for this condition.
  Or you may need to contact your application administrator
  or database administrator.
*/
```

204.6.17 FORMAT_ERROR_STACK Function

This function formats the current error stack. This can be used in exception handlers to look at the full error stack.

Syntax

```
DBMS_UTILITY.FORMAT_ERROR_STACK
RETURN VARCHAR2;
```

Return Values

This returns the error stack, up to 2000 bytes.

204.6.18 GET_CPU_TIME Function

This function returns a measure of current CPU processing time in hundredths of a second. The difference between the times returned from two calls measures the CPU processing time (not the total elapsed time) between those two points.

Syntax

```
DBMS_UTILITY.GET_CPU_TIME
RETURN NUMBER;
```

Return Values

Time is the number of 100th's of a second from some arbitrary epoch.

Usage Notes

The amount of work performed is calculated by measuring the difference between a start point and end point for a particular operation.

204.6.19 GET_DEPENDENCY Procedure

This **deprecated procedure** shows the dependencies on the object passed in.



Note:

This subprogram has been deprecated and replaced in Oracle Database 12c release 12.2 and later. Oracle recommends that you do not use deprecated subprograms. It is maintained only for purposes of backward compatibility.

Syntax

```
DBMS_UTILITY.GET_DEPENDENCY
type          IN      VARCHAR2,
schema       IN      VARCHAR2,
name         IN      VARCHAR2);
```

Parameters

Table 204-20 GET_DEPENDENCY Procedure Parameters

Parameter	Description
type	Type of the object, for example if the object is a table give the type as 'TABLE'
schema	Schema name of the object
name	Name of the object

Usage Notes

This procedure uses the [DBMS_OUTPUT](#) package to display results, and so you must declare `SET SERVEROUTPUT ON` if you wish to view dependencies. Alternatively, any application that checks the `DBMS_OUTPUT` output buffers can invoke this subprogram and then retrieve the output by means of `DBMS_OUTPUT` subprograms such as `GET_LINES`.

204.6.20 GET_ENDIANNESS Function

This function gets the endianness of the database platform.

Syntax

```
DBMS_UTILITY.GET_ENDIANNESS
RETURN NUMBER;
```


Return Values

A `NUMBER` value indicating the endianness of the database platform: 1 for big-endian or 2 for little-endian.

204.6.21 GET_HASH_VALUE Function

This function computes a hash value for the given string.

Syntax

```
DBMS_UTILITY.GET_HASH_VALUE (
    name      VARCHAR2,
    base      NUMBER,
    hash_size NUMBER)
RETURN NUMBER;
```

Parameters**Table 204-21** GET_HASH_VALUE Function Parameters

Parameter	Description
name	String to be hashed.
base	Base value for the returned hash value at which to start
hash_size	Desired size of the hash table

Pragmas

```
pragma restrict_references(get_hash_value, WNDS, RNDS, WNPS, RNPS);
```

Return Values

A hash value based on the input string. For example, to get a hash value on a string where the hash value should be between 1000 and 3047, use 1000 as the base value and 2048 as the `hash_size` value. Using a power of 2 for the `hash_size` parameter works best.

204.6.22 GET_PARAMETER_VALUE Function

This deprecated function gets the value of specified `init.ora` parameter.

 **Note:**

This subprogram has been deprecated and replaced by improved technology. It is maintained only for purposes of backward compatibility. As an alternative, you can query `v$_parameter` directly.

Syntax

```
DBMS_UTILITY.GET_PARAMETER_VALUE (
    parnam    IN      VARCHAR2,
```

```

    intval    IN OUT    BINARY_INTEGER,
    strval    IN OUT    VARCHAR2,
    listno    IN        BINARY_INTEGER DEFAULT 1)
RETURN BINARY_INTEGER;

```

Parameters

Table 204-22 GET_PARAMETER_VALUE Function Parameters

Parameter	Description
parnam	Parameter name
intval	Value of an integer parameter or the value length of a string parameter
strval	Value of a string parameter
listno	List item number. If retrieving parameter values for a parameter that can be specified multiple times to accumulate values, use this parameter to get each individual parameter.

Return Values

Parameter type:

- 0 if parameter is an INTEGER/BOOLEAN parameter
- 1 if parameter is a string/file parameter

Usage Notes

- To execute the this function, you must have the SELECT privilege on the V\$PARAMETER dynamic view.

Examples

```

DECLARE
    parnam VARCHAR2(256);
    intval BINARY_INTEGER;
    strval VARCHAR2(256);
    partyp BINARY_INTEGER;
BEGIN
    partyp := dbms_utility.get_parameter_value('max_dump_file_size',
                                              intval, strval);

    dbms_output.put('parameter value is: ');
    IF partyp = 1 THEN
        dbms_output.put_line(strval);
    ELSE
        dbms_output.put_line(intval);
    END IF;
    IF partyp = 1 THEN
        dbms_output.put('parameter value length is: ');
        dbms_output.put_line(intval);
    END IF;
    dbms_output.put('parameter type is: ');
    IF partyp = 1 THEN
        dbms_output.put_line('string');
    ELSE
        dbms_output.put_line('integer');
    END IF;
END;

```

204.6.23 GET_SQL_HASH Function

This function computes a hash value for the given string using MD5 algorithm.

Syntax

```
Dbms_utility.get_sql_hash (
    name          IN   VARCHAR2,
    hash          OUT  RAW,
    pre10ihash    OUT  NUMBER)
RETURN NUMBER;
```

Pragmas

Pragma Restrict_references(Get_sql_hash, Wnds, Rnds, Wnps, Rnps);

Parameters

Table 204-23 GET_SQL_HASH Procedure Parameters

Parameter	Description
name	String to be hashed
hash	Stores all 16 bytes of returned hash value
pre10ihash	Stores the pre 10i database version hash value

Return Values

A hash value (last 4 bytes) based on the input string. the MD5 hash algorithm computes a 16 byte hash value, but we only return the last 4 bytes so that we can return an actual number. Use the `hash` parameter to get all 16 bytes and `pre10i` hash parameter to store the pre 10i hash value of 4 bytes.

204.6.24 GET_TIME Function

This function determines the current time in hundredths of a second. This subprogram is primarily used for determining elapsed time. The subprogram is called twice – at the beginning and end of some process – and then the first (earlier) number is subtracted from the second (later) number to determine the time elapsed.

Syntax

```
DBMS_UTILITY.GET_TIME
RETURN NUMBER;
```

Return Values

Time is the number of hundredths of a second from the point in time at which the subprogram is invoked.

Usage Notes

Numbers are returned in the range -2147483648 to 2147483647 depending on platform and machine, and your application must take the sign of the number into account in determining the interval. For instance, in the case of two negative numbers,

application logic must allow that the first (earlier) number will be larger than the second (later) number which is closer to zero. By the same token, your application should also allow that the first (earlier) number be negative and the second (later) number be positive.

204.6.25 GET_TZ_TRANSITIONS Procedure

This procedure returns time zone transitions by `regionid` from the `timezone.dat` file.

Syntax

```
DBMS_UTILITY.GET_TZ_TRANSITIONS  
  regionid      IN      NUMBER,  
  transitions   OUT    MAXRAW);
```

Parameters

Table 204-24 GET_TZ_TRANSITIONS Procedure Parameters

Parameter	Description
<code>regionid</code>	Number corresponding to the region
<code>transitions</code>	Raw bytes from the <code>timezone.dat</code> file

Exceptions

Table 204-25 GET_TZ_TRANSITIONS Procedure Exceptions

Exception	Description
ORA-6502: PL/SQL: NUMERIC OR VALUE ERROR	For an invalid <code>regionid</code>

204.6.26 INVALIDATE Procedure

This procedure invalidates a database object and (optionally) modifies its PL/SQL compiler parameter settings. It also invalidates any objects that (directly or indirectly) depend on the object being invalidated.

Syntax

```
DBMS_UTILITY.INVALIDATE (  
  p_object_id      NUMBER,  
  p_plsql_object_settings VARCHAR2 DEFAULT NULL,  
  p_option_flags   PLS_INTEGER DEFAULT 0);
```

Parameters

Table 204-26 INVALIDATE Procedure Parameters

Parameter	Description
<code>p_object_id</code>	ID number of object to be invalidated. This is the same as the value of the <code>OBJECT_ID</code> column from <code>ALL_OBJECTS</code> . If the <code>object_id</code> argument is <code>NULL</code> or invalid then the exception <code>inv_not_exist_or_no_priv</code> is raised. The caller of this procedure must have create privileges on the object being invalidated else the <code>inv_not_exist_or_no_priv</code> exception is raised.
<code>p_plsql_object_settings</code>	Optional parameter that ignored if the object specified by <code>p_object_id</code> is not a PL/SQL object. If no value is specified for this parameter then the PL/SQL compiler settings are left unchanged, that is, equivalent to <code>REUSE SETTINGS</code> . If a value is provided, it must specify the values of the PL/SQL compiler settings separated by one or more spaces. Each setting can be specified only once else <code>inv_malformed_settings</code> exception will be raised. The setting values are changed only for the object specified by <code>p_object_id</code> and do not affect dependent objects that may be invalidated. The setting names and values are case insensitive. If a setting is omitted and <code>REUSE SETTINGS</code> is specified, then if a value was specified for the compiler setting in an earlier compilation of this library unit, Oracle Database uses that earlier value. If a setting is omitted and <code>REUSE SETTINGS</code> was not specified or no value has been specified for the parameter in an earlier compilation, then the database will obtain the value for that setting from the session environment.
<code>p_option_flags</code>	Optional parameter defaults to zero (no flags). Option flags supported by <code>invalidate</code> . <ul style="list-style-type: none"> <code>inv_error_on_restrictions</code> (see Constants): The subprogram imposes various restrictions on the objects that can be invalidated. For example, the object specified by <code>p_object_id</code> cannot be a table. By default, <code>invalidate</code> quietly returns on these conditions (and does not raise an exception). If the caller sets this flag, the exception <code>inv_restricted_object</code> is raised.

Exceptions

Table 204-27 INVALIDATE Exceptions

Exception	Description
<code>INV_NOT_EXIST_OR_NO_PRIV</code>	Raised when the <code>object_id</code> argument is <code>NULL</code> or invalid, or when the caller does not have <code>CREATE</code> privileges on the object being invalidated
<code>INV_MALFORMED_SETTINGS</code>	Raised if a compiler setting is specified more than once in the <code>p_plsql_object_settings</code> parameter
<code>INV_RESTRICTED_OBJECT</code>	Raised when different combinations of conditions pertaining to the <code>p_object_id</code> parameter are contravened

Usage Notes

The object type (`object_type` column from `ALL_OBJECTS`) of the object specified by `p_object_id` must be a `PROCEDURE`, `FUNCTION`, `PACKAGE`, `PACKAGE BODY`, `TRIGGER`, `TYPE`, `TYPE BODY`, `LIBRARY`, `VIEW`, `OPERATOR`, `SYNONYM`, or `JAVA CLASS`. If the object is not one of these types and the flag `inv_error_on_restrictions` is specified in `p_option_flags` then the exception `inv_restricted_object` is raised, else no action is taken.

If the object specified by `p_object_id` is the package specification of `STANDARD`, `DBMS_STANDARD`, or specification or body of `DBMS_UTILITY` and the flag `inv_error_on_restrictions` is specified in `p_option_flags` then the exception `inv_restricted_object` is raised, else no action is taken.

If the object specified by `p_object_id` is an object type specification and there exist tables which depend on the type and the flag `inv_error_on_restrictions` is specified in `p_option_flags` then the exception `inv_restricted_object` is raised, else no action is taken.

Examples

Example 1

```
DBMS_UTILITY.INVALIDATE (1232, 'PLSQL_OPTIMIZE_LEVEL = 2 REUSE SETTINGS');
```

Assume that the `object_id` 1232 refers to the procedure `remove_emp` in the `HR` schema. Then the above call will mark the `remove_emp` procedure invalid and change its `PLSQL_OPTIMIZE_LEVEL` compiler setting to 2. The values of other compiler settings will remain unchanged since `REUSE SETTINGS` is specified.

Objects that depend on `hr.remove_emp` will also get marked invalid. Their compiler parameters will not be changed.

Example 2

```
DBMS_UTILITY.INVALIDATE (40775, 'plsql_code_type = native');
```

Assume that the `object_id` 40775 refers to the type body `leaf_category_typ` in the `OE` schema. Then the above call will mark the type body invalid and change its `PLSQL_CODE_TYPE` compiler setting to `NATIVE`. The values of other compiler settings will be picked up from the current session environment since `REUSE SETTINGS` has not been specified.

Since no objects can depend on bodies, there are no cascaded invalidations.

Example 3

```
DBMS_UTILITY.INVALIDATE (40796);
```

Assume that the `object_id` 40796 refers to the view `oc_orders` in the `OE` schema. Then the above call will mark the `oc_orders` view invalid.

Objects that depend on `oe.oc_orders` will also get marked invalid.

204.6.27 IS_BIT_SET Function

This function checks the bit setting for the given bit in the given RAW value.

Syntax

```
DBMS_UTILITY.IS_BIT_SET (
    r      IN RAW,    n      IN NUMBER)
RETURN NUMBER;
```

Parameters

Table 204-28 IS_BIT_SET Function Parameters

Parameter	Description
r	RAW source
n	Bit in r to check

Return Values

This function returns 1 if bit n in raw r is set, zero otherwise. Bits are numbered high to low with the lowest bit being bit number 1.

204.6.28 IS_CLUSTER_DATABASE Function

This function finds out if this database is running in cluster database mode.

Syntax

```
DBMS_UTILITY.IS_CLUSTER_DATABASE
RETURN BOOLEAN;
```

Return Values

This function returns TRUE if this instance was started in cluster database mode; FALSE otherwise.

204.6.29 MAKE_DATA_BLOCK_ADDRESS Function

This function creates a data block address given a file number and a block number.

A data block address is the internal structure used to identify a block in the database. This function is useful when accessing certain fixed tables that contain data block addresses.

Syntax

```
DBMS_UTILITY.MAKE_DATA_BLOCK_ADDRESS (
    file NUMBER,
    block NUMBER)
RETURN NUMBER;
```

Parameters

Table 204-29 MAKE_DATA_BLOCK_ADDRESS Function Parameters

Parameter	Description
file	File that contains the block
block	Offset of the block within the file in terms of block increments

Pragmas

```
pragma restrict_references (make_data_block_address, WNDS, RNDS, WNPS, RNPS);
```

Return Values

Data block address.

204.6.30 NAME_RESOLVE Procedure

This procedure resolves the given name, including synonym translation and authorization checking as necessary.

Syntax

```
DBMS_UTILITY.NAME_RESOLVE (
  name          IN VARCHAR2,
  context       IN NUMBER,
  schema        OUT VARCHAR2,
  part1         OUT VARCHAR2,
  part2         OUT VARCHAR2,
  dblink        OUT VARCHAR2,
  part1_type    OUT NUMBER,
  object_number OUT NUMBER);
```

Parameters

Table 204-30 NAME_RESOLVE Procedure Parameters

Parameter	Description
name	<p>Name of the object.</p> <p>This can be of the form [[a.]b.]c[@d], where a, b, c are SQL identifier and d is a dblink. No syntax checking is performed on the dblink. If a dblink is specified, or if the name resolves to something with a dblink, then object is not resolved, but the schema, part1, part2 and dblink OUT parameters are filled in.</p> <p>a, b and c may be delimited identifiers, and may contain Globalization Support (NLS) characters (single and multibyte).</p>

Table 204-30 (Cont.) NAME_RESOLVE Procedure Parameters

Parameter	Description
context	Must be an integer between 0 and 9. <ul style="list-style-type: none"> • 0 - table • 1 - PL/SQL (for 2 part names) • 2 - sequences • 3 - trigger • 4 - Java Source • 5 - Java resource • 6 - Java class • 7 - type • 8 - Java shared data • 9 - index
schema	Schema of the object: c. If no schema is specified in name, then the schema is determined by resolving the name.
part1	First part of the name. The type of this name is specified part1_type (synonym or package).
part2	If this is non-NULL, then this is a subprogram name. If part1 is non-NULL, then the subprogram is within the package indicated by part1. If part1 is NULL, then the subprogram is a top-level subprogram.
dblink	If this is non-NULL, then a database link was either specified as part of name or name was a synonym which resolved to something with a database link. In this case, if further name translation is desired, then you must call the DBMS_UTILITY.NAME_RESOLVE procedure on this remote node.
part1_type	Type of part1 is: <ul style="list-style-type: none"> • 5 - synonym • 7 - procedure (top level) • 8 - function (top level) • 9 - package
object_number	Object identifier

Exceptions

All errors are handled by raising exceptions. A wide variety of exceptions are possible, based on the various syntax error that are possible when specifying object names.

204.6.31 NAME_TOKENIZE Procedure

This procedure calls the parser to parse the given name as a [. b [. c]][@ dblink].

It strips double quotes, or converts to uppercase if there are no quotes. It ignores comments of all sorts, and does no semantic analysis. Missing values are left as NULL.

Syntax

```
DBMS_UTILITY.NAME_TOKENIZE (
    name      IN  VARCHAR2,
    a         OUT VARCHAR2,
    b         OUT VARCHAR2,
```

```

c      OUT VARCHAR2,
dblink OUT VARCHAR2,
nextpos OUT BINARY_INTEGER);

```

Parameters

Table 204-31 NAME_RESOLVE Procedure Parameters

Parameter	Description
name	Input name, consisting of SQL identifiers (for example, scott.foo@dblink)
a	Output for the first token of the name
b	Output for the second token of the name (if applicable)
c	Output for the third token of the name (if applicable)
dblink	Output for the dblink of the name
nextpos	Next position after parsing the input name

204.6.32 OLD_CURRENT_SCHEMA Function

This function returns the session value from `sys_context('userenv', 'current_schema')`.

Syntax

```

DBMS_UTILITY.OLD_CURRENT_SCHEMA
RETURN VARCHAR2;

```

204.6.33 OLD_CURRENT_USER Function

This function returns the session value from `sys_context('userenv', 'current_user')`.

Syntax

```

DBMS_UTILITY.OLD_CURRENT_USER
RETURN VARCHAR2;

```

204.6.34 PORT_STRING Function

This function returns a string that identifies the operating system and the TWO TASK PROTOCOL version of the database. For example, "VAX/VMX-7.1.0.0"

The maximum length is port-specific.

Syntax

```

DBMS_UTILITY.PORT_STRING
RETURN VARCHAR2;

```

Pragmas

```

pragma restrict_references(port_string, WNDS, RNDS, WNPS, RNPS);

```

204.6.35 SQLID_TO_SQLHASH Function

This function converts a SQL ID into a hash value.

Syntax

```
DBMS_UTILITY.SQLID_TO_SQLHASH (
    sql_id    IN    VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 204-32 SQLID_TO_SQLHASH Function Parameters

Parameter	Description
sql_id	SQL ID of a SQL statement. Must be VARCHAR2 (13).

204.6.36 TABLE_TO_COMMA Procedures

This procedure converts a PL/SQL table of names into a comma-delimited list of names.

This takes a PL/SQL table, 1..n, terminated with n+1 null. The second version supports fully-qualified attribute names.

Syntax

```
DBMS_UTILITY.TABLE_TO_COMMA (
    tab    IN    UNCL_ARRAY,
    tablen OUT BINARY_INTEGER,
    list   OUT VARCHAR2);
```

```
DBMS_UTILITY.TABLE_TO_COMMA (
    tab    IN    lname_array,
    tablen OUT BINARY_INTEGER,
    list   OUT VARCHAR2);
```

Parameters

Table 204-33 TABLE_TO_COMMA Procedure Parameters

Parameter	Description
tab	PL/SQL table which contains list of table names
tablen	Number of tables in the PL/SQL table
list	Comma separated list of tables

Return Values

A comma-delimited list and the number of elements found in the table.

204.6.37 VALIDATE Procedure

This procedure makes invalid database objects valid.

Syntax

```
DBMS_UTILITY.VALIDATE (
    object_id      NUMBER);

DBMS_UTILITY.VALIDATE (
    owner          VARCHAR2,
    objname        VARCHAR2,
    namespace      NUMBER,  edition_name  := SYS_CONTEXT ('USERENV',
    'CURRENT_EDITION'));
```

Parameters

Table 204-34 VALIDATE Procedure Parameters

Parameter	Description
owner	Name of the user who owns the object. Same as the OWNER field in ALL_OBJECTS.
objname	Name of the object to be validated. Same as the OBJECT_NAME field in ALL_OBJECTS.
namespace	Namespace of the object. Same as the namespace field in obj\$. Equivalent numeric values are as follows: <ul style="list-style-type: none"> • 1 — TABLE/PROCEDURE/TYPE • 2 — BODY • 3 — TRIGGER • 4 — INDEX • 5 — CLUSTER • 8 — LOB • 9 — DIRECTORY • 10 — QUEUE • 11 — REPLICATION OBJECT GROUP • 12 — REPLICATION PROPAGATOR • 13 — JAVA SOURCE • 14 — JAVA RESOURCE • 58 — (Data Mining) MODEL
edition_name	[Note: Currently not operable. Reserved for future use]

Usage Notes

- No errors are raised if the object does not exist or is already valid or is an object that cannot be validated.
- If the object being validated is not actual in the specified edition, the subprogram automatically switches into the edition in which the object is actual prior to validation. That is, a call to VALIDATE will not actualize the object in the specified edition.
- The [INVALIDATE Procedure](#) invalidates a database object and optionally changes its PL/SQL compiler parameter settings. The object to be invalidated is specified by its

`object_id`. The subprogram automatically switches to the edition in which the object is actual prior to invalidation. That is, a call to `INVALIDATE` will not actualize the object in the current edition.

204.6.38 WAIT_ON_PENDING_DML Function

This function waits until all transactions (other than the caller's own) that have locks on the listed tables and began prior to the specified `scn` have either committed or been rolled back.

Syntax

```
DBMS_UTILITY.WAIT_ON_PENDING_DML (
    tables      IN      VARCHAR2,
    timeout     IN      BINARY_INTEGER,
    scn         IN OUT  NUMBER)
RETURN BOOLEAN;
```

Parameters

Table 204-35 WAIT_ON_PENDING_DML Function Parameters

Parameter	Description
<code>tables</code>	Comma-separated list of one or more table names. The list must be valid for COMMA_TO_TABLE Procedure , and each item valid to the NAME_RESOLVE Procedure . Neither column specifiers nor DBLINK (database link) specifiers are allowed in the names, and each name must resolve to an existing table in the local database.
<code>timeout</code>	Maximum number of seconds to wait, totalled across all tables/transactions. A <code>NULL</code> or negative value will cause a very long wait.
<code>scn</code>	SCN prior to which transactions must have begun to be considered relevant to this request. If the value is <code>NULL</code> or not recognized as a meaningful <code>scn</code> on input, the most current SCN across all instances will be used and will be set into the passed argument as an output. If a meaningful value is passed in, its value will be preserved in the output.

Return Values

`TRUE` if all relevant transactions have committed or been rolled back, `FALSE` if the timeout occurred prior to all relevant transactions committing or being rolled back

DBMS_VECTOR

The `DBMS_VECTOR` package simplifies common operations with Oracle AI Vector Search, such as chunking and embedding data, generating text for prompts, or creating vector indexes.

These functions accept their respective input parameters in JSON format.

Related Topics

- *Oracle Database AI Vector Search User's Guide*

205.1 Summary of DBMS_VECTOR Subprograms

This table lists the `DBMS_VECTOR` subprograms and briefly describes them.

Table 205-1 DBMS_VECTOR Package Subprograms

Subprogram	Description
ONNX Model Related Procedures:	
These procedure enables you to load an ONNX model into Oracle Database and drop the ONNX model.	
LOAD_ONNX_MODEL	Loads an ONNX model into the database
DROP_ONNX_MODEL Procedure	Drops the ONNX model
Chainable Utility (UTL) Functions:	
These functions are a set of modular and flexible functions within vector utility PL/SQL packages. You can chain these together to automate end-to-end data transformation and similarity search operations.	
UTL_TO_CHUNKS	Splits data into smaller pieces or chunks
UTL_TO_EMBEDDING and UTL_TO_EMBEDDINGS	Converts data to one or more vector embeddings
UTL_TO_GENERATE_TEXT	Generates text for a prompt or input string
Credential Helper Procedures:	
These procedures enable you to securely manage authentication credentials in the database. You require these credentials to enable access to third-party service providers for making REST calls.	
CREATE_CREDENTIAL	Creates a credential name
DROP_CREDENTIAL	Drops an existing credential name
Data Access Functions:	
These functions enable you to retrieve data, create index, and perform simple similarity search operations.	
CREATE_INDEX	Creates a vector index
REBUILD_INDEX	Rebuilds a vector index
QUERY	Perform a similarity search query
Accuracy Reporting Function:	
This function enables you to determine the accuracy of existing search indexes and advise recalibration.	

Table 205-1 (Cont.) DBMS_VECTOR Package Subprograms

Subprogram	Description
INDEX_ACCURACY_QUERY	Verifies the accuracy of a vector index

205.1.1 CREATE_CREDENTIAL

Use the `DBMS_VECTOR.CREATE_CREDENTIAL` credential helper procedure to create a credential name for storing user authentication details in Oracle Database.

Purpose

To securely manage authentication credentials in the database. You require these credentials to enable access during REST API calls to your chosen third-party service provider, such as Cohere, Google AI, Hugging Face, Oracle Cloud Infrastructure (OCI) Generative AI, OpenAI, or Vertex AI.

A credential name holds authentication parameters, such as user name, password, access token, private key, or fingerprint.



Note:

If you are using Oracle Database as the service provider, then you do not need to create a credential.

Syntax

```
DBMS_VECTOR.CREATE_CREDENTIAL (
    CREDENTIAL_NAME    IN VARCHAR2,
    PARAMS              IN JSON DEFAULT NULL
);
```

CREDENTIAL_NAME

Specify a name of the credential that you want to create for holding authentication parameters.

PARAMS

Specify authentication parameters in JSON format, based on your chosen service provider.

Generative AI requires the following authentication parameters:

```
{
  "user_ocid": "<user ocid>",
  "tenancy_ocid": "<tenancy ocid>",
  "compartment_ocid": "<compartment ocid>",
  "private_key": "<private key>",
  "fingerprint": "<fingerprint>"
}
```

Cohere, Google AI, Hugging Face, OpenAI, and Vertex AI require the following authentication parameter:

```
{ "access_token": "<access token>" }
```

Table 205-2 Parameter Details

Parameter	Description
user_ocid	Oracle Cloud Identifier (OCID) of the user, as listed on the User Details page in the OCI console.
tenancy_ocid	OCID of your tenancy, as listed on the Tenancy Details page in the OCI console.
compartment_ocid	OCID of your compartment, as listed on the Compartments information page in the OCI console.
private_key	OCI private key. Note: The generated private key may appear as: <pre>-----BEGIN RSA PRIVATE KEY----- <private key string> -----END RSA PRIVATE KEY-----</pre> <p>You pass the <i><private key string></i> value (excluding the BEGIN and END lines), either as a single line or as multiple lines.</p>
fingerprint	Fingerprint of the OCI profile key, as listed on the User Details page under API Keys in the OCI console.
access_token	Access token obtained from your third-party service provider.

Required Privilege

You need the `CREATE CREDENTIAL` privilege to call this API.

Examples

- For Generative AI:

```
declare
  jo json_object_t;
begin
  jo := json_object_t();

  jo.put('user_ocid','ocid1.user.oc1..aabbalbbaa1112233aabbaabb1111222aa1111bb');

  jo.put('tenancy_ocid','ocid1.tenancy.oc1..aaaaalbbbbb1112233aaaabbaa1111222aa1111a');

  jo.put('compartment_ocid','ocid1.compartment.oc1..ababalabab1112233abababab1111222ab1111ab');
  jo.put('private_key','AAAAaaBBB11112222333...AAA111AAABBB222aaa1a/+');
  jo.put('fingerprint','01:1a:a1:aa:12:a1:12:1a:ab:12:01:ab:a1:12:ab:1a');
  dbms_output.put_line(jo.to_string);
  dbms_vector.create_credential(
```



```

        credential_name => 'OCI_CRED',
        params          => json(jo.to_string);
end;
/

```

- For Cohere:

```

declare
    jo json_object_t;
begin
    jo := json_object_t();
    jo.put('access_token', 'A1Aa0abA1AB1a1Abc123ab1A123ab123AbcA12a');
    dbms_vector.create_credential(
        credential_name => 'COHERE_CRED',
        params          => json(jo.to_string));
end;
/

```

To run an end-to-end example scenario using this function, see [Directly Convert Text String to Embedding in Oracle Database AI Vector Search User's Guide](#).

205.1.2 CREATE_INDEX

Use the `DBMS_VECTOR.CREATE_INDEX` procedure to create an index.

Syntax

```

DBMS_VECTOR.CREATE_INDEX (
    IDX_NAME           IN VARCHAR2,
    TABLE_NAME       IN VARCHAR2,
    IDX_VECTOR_COL     IN VARCHAR2,
    IDX_INCLUDE_COLS   IN VARCHAR2,
    IDX_PARTITIONING_SCHEME IN VARCHAR2,
    IDX_ORGANIZATION   IN VARCHAR2,
    IDX_DISTANCE_METRIC IN VARCHAR2,
    IDX_ACCURACY       IN NUMBER,
    IDX_PARAMETERS     IN CLOB,
    IDX_PARALLEL_CREATION IN NUMBER,
    IDX_DDL            IN CLOB
);

```

Parameters

Specify the input parameters in JSON format.

Table 205-3 CREATE_INDEX (IN) Parameters of DBMS_VECTOR

Parameter	Description
<code>table_name</code>	Table on which to create the index.
<code>idx_name</code>	Name of the index.
<code>idx_vector_col</code>	Vector column on which to create the index.

Table 205-3 (Cont.) CREATE_INDEX (IN) Parameters of DBMS_VECTOR

Parameter	Description
idx_partitioning_scheme	Partitioning scheme. LOCAL or GLOBAL.
idx_organization	Index organization. Either NEIGHBOR PARTITIONS or INMEMORY NEIGHBOR GRAPH.
idx_distance_metric	Distance computation metric. Defaults to COSINE. Can also be MANHATTAN, HAMMING, DOT, EUCLIDEAN, L2_SQUARED, EUCLIDEAN_SQUARED.
idx_accuracy	Target accuracy.
idx_parameters	Takes in CLOB with type of index and associated parameters. Type, neighbor partitions for IVF, neighbors/efConstruction for HNSW)
idx_parallel_creation	Number of parallel threads used for index construction.
idx_dd	Defaults to NULL. Only passed by rebuild_index() to rebuild the index.

205.1.3 DROP_CREDENTIAL

Use the DBMS_VECTOR.DROP_CREDENTIAL credential helper procedure to drop an existing credential name from the data dictionary.

Syntax

```
DBMS_VECTOR.DROP_CREDENTIAL (
    CREDENTIAL_NAME      IN VARCHAR2
);
```

CREDENTIAL_NAME

Specify the credential name that you want to drop.

Examples

- For Generative AI:

```
exec dbms_vector.drop_credential('OCI_CRED');
```

- For Cohere:

```
exec dbms_vector.drop_credential('COHERE_CRED');
```

205.1.4 DROP_ONNX_MODEL Procedure

This procedure deletes the specified ONNX model.

Syntax

```
DBMS_VECTOR.DROP_ONNX_MODEL (model_name IN VARCHAR2,
                             force       IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 205-4 DROP_ONNX_MODEL Procedure Parameters

Parameter	Description
model_name	Name of the machine learning ONNX model in the form <code>[schema_name.]model_name</code> . If you do not specify a schema, then your own schema is used.
force	Forces the machine learning ONNX model to be dropped even if it is invalid. An ONNX model may be invalid if a serious system error interrupted the model build process.

Usage Note

To drop a machine learning model, you must be the owner or you must have the `DROP ANY MINING MODEL` privilege. See *Oracle Data Mining User's Guide* for information about privileges for Oracle Machine Learning for SQL.

Example

You can use the following command to delete a valid ONNX model named `doc_model` that exists in your schema.

```
BEGIN
  DBMS_VECTOR.DROP_ONNX_MODEL(model_name => 'doc_model');
END;
/
```

205.1.5 INDEX_ACCURACY_QUERY

Use the `DBMS_VECTOR.INDEX_ACCURACY_QUERY` function to verify the accuracy of a vector index for a given query vector, top-K, and target accuracy.

Syntax

```
DBMS_VECTOR.INDEX_ACCURACY_QUERY (
  OWNER_NAME      IN VARCHAR2,
  INDEX_NAME      IN VARCHAR2,
  QV              IN VECTOR,
  TOP_K          IN NUMBER,
  TARGET_ACCURACY IN NUMBER
) return VARCHAR2;
```

```
DBMS_VECTOR.INDEX_ACCURACY_QUERY (
  OWNER_NAME      IN VARCHAR2,
```

```

INDEX_NAME      IN VARCHAR2,
QV              IN VECTOR,
TOP_K          IN NUMBER,
QUERY_PARAM    IN JSON
) return VARCHAR2;
```

DATA

This function accepts the input data type as `VARCHAR2`, `VECTOR`, or `NUMBER`.

It returns a brief report on the achieved accuracy for a given target accuracy.

```
{
}
```

For example:

Where,

- `owner_name` specifies the name of the vector index owner.
- `index_name` specifies the name of the vector index.
- `qv` specifies the query vector.
- `top_k` the `top_k` value for accuracy computation.
- `target_accuracy` the target accuracy value for the vector index.

For information about determining the accuracy of your vector indexes, see *Index Accuracy Report* in *Oracle Database AI Vector Search User's Guide*.

PARAMS

Specify the input parameters in JSON format:

Example

205.1.6 INDEX_ACCURACY_REPORT

Use the `DBMS_VECTOR.INDEX_ACCURACY_REPORT` function to...

Syntax

```

DBMS_VECTOR.INDEX_ACCURACY_REPORT (
  OWNER_NAME      IN VARCHAR2,
  INDEX_NAME      IN VARCHAR2,
  START_TIME      IN TIMESTAMP WITH TIME ZONE,
  END_TIME        IN TIMESTAMP WITH TIME ZONE
) return NUMBER;
```

DATA

This function accepts the input data type as VARCHAR2, VECTOR, or NUMBER.

It returns a brief report on the achieved accuracy for a given target accuracy.

```
{  
  
}
```

For example:

Where,

- `owner_name` specifies the name of the vector index owner.
- `index_name` specifies the name of the vector index.

For information about determining the accuracy of your vector indexes, see Index Accuracy Report in *Oracle Database AI Vector Search User's Guide*.

PARAMS

Specify the input parameters in JSON format:

Example

205.1.7 LOAD_ONNX_MODEL

This procedure enables you to load an ONNX model into the Database.

Syntax

```
DBMS_VECTOR.LOAD_ONNX_MODEL (  
    directory VARCHAR2,  
    file_name  VARCHAR2,  
    model_name VARCHAR2,  
    metadata   JSON);
```

```
DBMS_VECTOR.LOAD_ONNX_MODEL (  
model_name IN VARCHAR2,  
model_data IN BLOB,  
metadata   IN JSON);
```

Parameters

Table 205-5 LOAD_ONNX_MODEL Procedure Parameters

Parameter	Description
directory	The directory name of the data dump. For example, DM_DUMP.
file_name	A VARCHAR2 type parameter that specifies the name of the ONNX model.
model_name	Name of the model in the form [schema_name.]model_name. If you do not specify a schema, then your own schema is used.
model_data	It is a BLOB holding the ONNX representation of the model. The BLOB contains the identical byte sequence as the one stored in an ONNX file.
metadata	A JSON description of the metadata describing the model. The metadata at minimum must describe the machine learning function supported by the model. The model's metadata parameters are described in JSON Metadata Parameters for ONNX Models .

Examples

The following examples illustrates a code snippet of using the DBMS_VECTOR.LOAD_ONNX_MODEL procedure. The complete step-by-step example is illustrated in [Import ONNX Models and Generate Embeddings](#).

```
EXECUTE DBMS_VECTOR.LOAD_ONNX_MODEL (
    'DM_DUMP',
    'my_embedding_model.onnx',
    'doc_model',
    JSON('{"function" : "embedding", "embeddingOutput" : "embedding", "input": {"input":
["DATA"]}}'));
```

```
DBMS_VECTOR.LOAD_ONNX_MODEL('my_embedding_model.onnx',
                             'doc_model',
                             JSON('{"function" :
"embedding",
                                     "embeddingOutput" :
"embedding" ,
                                     "input":{"input":
["DATA"]}}'));
```

Usage Notes

The name of the model follows the same restrictions as those used for other machine learning models, namely:

- The schema name, if provided, is limited to 128 characters.
- The model name is limited to 123 characters and must follow the rules of unquoted identifiers: they contain only alphanumeric characters, the underscore (_), dollar sign (\$), and pound sign (#). The initial character must be alphabetic.
- The model size is limited to 1 gigabyte.
- The model must not depend on external initializers. To know more about initializers and other ONNX concepts, see <https://onnx.ai/onnx/intro/concepts.html>.

- There are default input and output names for input and output attributes for models that are prepared by the Python utility. You can load those models without the JSON parameters. For example:

```
EXECUTE DBMS_VECTOR.LOAD_ONNX_MODEL('DM_DUMP',
'my_embedding_model.onnx', 'doc_model');
```

See Also:

Oracle Machine Learning for SQL User's Guide for examples of using ONNX models for machine learning tasks

205.1.7.1 JSON Metadata Parameters for ONNX Models

When importing models using the `DBMS_DATA_MINING.IMPORT_ONNX_MODEL` procedure, you supply metadata as JSON parameters.

Parameters

Field	Value Type	Description
function	String	Specify regression, classification, clustering, or embedding. This is a mandatory setting. NOTE: The only JSON parameter required when importing the model is the machine learning function.
input	NA	Describes the model input mapping. See "Input" in Usage Notes.
regressionOutput	String	The name of the regression model output that stores the regression results. The output is expected to be a tensor of supported shape of any supported regression output type. See "Output" in Usage Notes.
classificationProbOutput	String	The name of the classification model output storing probabilities. The output is expected to be a tensor value of type float (width 32/64) of supported shape. See "Automatic normalization of output probabilities" in Usage Notes.
clusteringDistanceOutput	String	The name of the clustering model output storing distances. The output is of type float (width 16/32/64) of supported shape.
clusteringProbOutput	String	The name of the clustering model output storing probabilities. The output is of type float (width 16/32/64) of supported shape.

Field	Value Type	Description
classificationLabelOutput	String	<p>The name of the model output holding label information.</p> <p>You have the following metadata parameters to specify the labels for classification:</p> <ul style="list-style-type: none"> labels: specify the labels directly in the JSON metadata classificationLabelOutput: specify the model output that provides labels <p>If you do not specify any value for this parameter or the function of the model is not classification, you will receive an error.</p> <p>The user can specify to use labels from the model directly by setting classificationLabelOutput to the model output holding the label information. The tensor output holding the label information must be the same size as the number of classes and must be of integer or string type. If the tensor that holds the labels is of string type, the returned type of the PREDICTION operator is VARCHAR2. If the tensor that holds the labels is of integer type, the returned type of the PREDICTION operator is NUMBER.</p>
normalizeProb	String	<p>Describes automatic normalization of output probabilities. See "Automatic normalization of output probabilities" in Usage Notes.</p>
labels	NA	<p>The labels used for classification.</p> <p>If you want to use custom labels, specify the labels using the labels field in the JSON metadata. The field can be set to an array of length equal to the number of classes. The labels for the class i must be stored at index i of the label array. If an array of strings is used, the returned type of the PREDICTION operator is VARCHAR2. The size of the string labels specified by the user cannot exceed 4000 bytes. If an array of numbers is used, the returned type of the PREDICTION operator is NUMBER.</p> <p>If you do not specify labels or classificationLabelOutput, classes are identified by integers in the range 1 to N where N is the number of classes. In this case, the returned type of the PREDICTION operator is NUMBER.</p>
embeddingOutput	String	<p>The model output that holds the generated embeddings.</p>
suitableDistanceMetrics	String	<p>An array of names of suitable distance metrics for the model. The names must be the names of the distance metrics used for the Oracle VECTOR_DISTANCE operator. To know the supported distance metrics, see Vector Distance Metrics.</p>

Field	Value Type	Description
normalization	Boolean	A boolean value indicates if normalization is applied to the output vector. The value 1 means normalization is applied. Normalization is process of converting an embedding vector so that it's norm or length equals 1. A normalized vector maintains its direction but its length becomes 1. The resulting vector is often called a unit vector.
maxSequenceLength	Number	The maximum length of the token (input) sequence that is meaningful for the model. This parameter sets a limit on the number of tokens, words, or elements in each input sequence that the model will process. This ensures uniform input size for the model. For example, the value could be 128, or 512 to 4096 depending on the task for which the parameter is used. A machine translation model might have a <code>maxSequenceLength</code> of 512, accommodating sentences or paragraphs up to 512 tokens for translation tasks.
pooling	String	Indicates the pooling function performed on the output vector.
modelDescription	Object	A JSON object that allows users to add additional descriptions to the models complementing the existing ONNX metadata for model description.
languages	String	A comma-separated list of language name or abbreviation, as described in " A.1 Languages " of <i>Oracle Database Globalization Support Guide</i> . If you import multi-lingual embedding model, specify the language or the language abbreviation as the metadata.
tokenizer	String	Tokenizers help in transforming text into words. There are several tokenizers available, including: bert, gpt2, bpe, wordpiece, sentencepiece, and clip.
embeddingLayer	String	An identifier for the embedding layer. An embedding layer, serving as a hidden layer in neural networks, transforms input data from high to lower dimensions, enhancing the network's understanding of input relationships and data processing efficiency. Embedding layer helps in processing and analyzing categorical or discrete data. It achieves this by transforming categories into continuous embeddings, capturing the essential semantic relationships and similarities between them. For example the last hidden state in some transformer, or a layer in a resnet network.

Field	Value Type	Description
defaultOnNull	NA	Specify the replacement of missing values in the JSON using the <code>defaultOnNull</code> field. If <code>defaultOnNull</code> is not specified, the replacement of missing values is not performed. The <code>defaultOnNull</code> sets the missing values to NULL by default. You can override the default value of NULL by providing meaningful default values to substitute for NULL. The field must be a JSON object literal, whose fields are the input attribute names and whose values are the default values for the input. Note that the default value is of type string and must be a valid Oracle PL/SQL NVL value for the given datatype.

Note: The parameters are case-sensitive. A number of default conventions for output parameter names and default values allows to minimize the information that you may have to provide. The parameters such as `suitableDistanceMetrics` are informational only and you are not expected to provide this information while importing the model. The JSON descriptor may specify only one input attribute. If more are specified, you will receive an error. You will receive an error if the `normalizeProb` field is specified as the JSON metadata parameter.

Usage Notes

The name of the model follows the same restrictions as those used for other machine learning models, namely:

- **Input**

When importing a model from an ONNX representation, you must specify the name of the attribute used for scoring and how it maps to actual ONNX inputs. A scoring operator uses these attribute names to identify the columns to be used. (For example, `PREDICTION`). Follow these conventions to specify the attribute names using the input field:

not specified: When the field input is not specified, attribute names are mapped directly to model inputs by name. That is, if the attribute name is not specified in the JSON metadata, then the name of the input tensor is used as an attribute name. Each model input must have dimension `[batch_size, value]`. If you do not specify `input` in the JSON metadata, the value must be 1. You don't have to specify extra metadata if the input of the model already conforms to the format. For an embedding model, a single input is provided that may be used in batches. Here, if the `input` parameter is not specified in the JSON metadata, the valid model will have `[batch_size, 1]`.

You must ensure that all attribute names, whether implied by the model or explicitly set by you through the input field, are valid Oracle Database identifiers for column names. Each attribute name within a model must be unique, ensuring no duplicates exist.

You can explicitly specify attribute name for model that use input tensors that have a dimension larger than 1 (for example, `(batch_size, 2)`). In this case, you must specify a name for each of these values for them to be interpreted as independent attribute name. This can be done for regression, classification, clustering which are models whose scoring operation can take multiple input attributes.

- **Output**

As models might have multiple outputs, you can specify which output is of interest for a specific machine learning technique. You have the following ways to specify model outputs:

- Specify the output name of interest in the JSON during model import. If the specified name is not a valid model output (see the table with valid outputs for a given machine learning function), you will receive an error.
- If the model produces an output that matches the expected output name for the given machine learning technique (for example, `classificationProbOutput`) and you didn't explicitly specify it, the output is automatically assumed.
- If you do not specify any output name and the model has a single output, the system assumes that the single output corresponds to a default specific to the machine learning technique. For an embedding machine learning function, the default value is `embeddingOutput`.

The system reports an error if you do not specify model outputs or if you supply outputs that the specified machine learning function does not support. The following table displays supported outputs for a specific machine learning function:

Mach ine learni ng functi on	Output
regres sion	<code>regressionOutput</code>
classif ication	<code>classificationProbOutput</code>
cluste ring	<code>clusteringDistanceOutput</code>
embe dding	<code>embeddingOutput</code>

If none of the mentioned model outputs are specified, or if you supply outputs that are not supported by the specified machine learning function, you will receive an error.

- **Automatic Normalization of Output Probabilities**

Many users widely employ the softmax function to normalize the output of multi-class classification models, as it enables to easily interpret the results of these models. The **softmax function** is a mathematical function that converts a vector of real numbers into a probability distribution. It is also known as the softargmax, or normalized exponential function. This function is available to you to specify at the model import-time that a softmax normalization must be applied to the tensor holding output probabilities such as `classificationProbOutput` and `clusteringProbOutput`. Specify `normalizeProb` to define the normalization that must be applied for softmax normalization. The default setting is `none`, indicating that no normalization is applied. You can choose `softmax` to apply a softmax function to the probability output. Specifying any other value for this field will result

in an error during import. Additionally, specifying this field for models other than classification and clustering will also lead to an error.

Example: Specifying JSON Metadata Parameters for Embedding Models

The following example illustrates a simple case of how you can specify JSON metadata parameters while importing an ONNX embedding model into the Database using the `DBMS_DATA_MINING.IMPORT_ONNX_MODEL` procedure.

```
DBMS_DATA_MINING.IMPORT_ONNX_MODEL('my_embedding_model.onnx', 'doc_model',
    JSON('{"function" : "embedding",
        "embeddingOutput" : "embedding" ,
        "input":{"input": ["DATA"]}}'));
```

Example: Specifying Complete JSON Metadata Parameters for Embedding Models

The following example illustrates how to provide a complete JSON metadata parameters, with an exception of `embeddingLayer`, for importing embedding models.

```
DECLARE
    metadata JSON;
    mdtxt varchar2(4000);
BEGIN
    metadata := JSON(q'#
        {
            "function"                : "embedding",
            "embeddingOutput"         : "embedding",
            "input"                   : { "input" : ["txt"]},
            "maxSequenceLength"       : 512,
            "tokenizer"                : "bert",
            "suitableDistanceMetrics" : [ "DOT", "COSINE", "EUCLIDEAN"],
            "pooling"                  : "Mean Pooling",
            "normalization"            : true,
            "languages"                : ["US"],
            "modelDescription"         : {
                "description" : "This model was tuned for semantic search:
                Given a query/question, if can find relevant passages. It was trained on a
                large and diverse set of (question, a
                nswer) pairs.",
                "url" : "https://example.co/sentence-transformers/
my_embedding_model"
            }
        }
    #');
    -- load the onnx model
    DBMS_DATA_MINING.IMPORT_ONNX_MODEL('my_embedding_model.onnx',
'doc_model', metadata);
END;
/
```

 **See Also:**

Oracle Machine Learning for SQL User's Guide for examples of using ONNX models for machine learning tasks

205.1.8 QUERY

Use the `DBMS_VECTOR.QUERY` function to perform a similarity search operation which returns the top-k results as a JSON array.

Syntax

Query is overloaded and supports a version with `query_vector` passed in as a `VECTOR` type in addition to `CLOB`.

```
DBMS_VECTOR.QUERY (
    TAB_NAME           IN VARCHAR2,
    VEC_COL_NAME       IN VARCHAR2,
    QUERY_VECTOR       IN CLOB,
    TOP_K              IN NUMBER,
    VEC_PROJ_COLS      IN JSON_ARRAY_T DEFAULT NULL,
    IDX_NAME           IN VARCHAR2 DEFAULT NULL,
    DISTANCE_METRIC    IN VARCHAR2 DEFAULT 'EUCLIDEAN',
    USE_INDEX          IN BOOLEAN DEFAULT 'TRUE',
    ACCURACY           IN NUMBER DEFAULT '95',
    IDX_PARAMETERS     IN CLOB DEFAULT NULL,
) return JSON_ARRAY_T;
```

Parameters

Specify the input parameters in JSON format.

Table 205-6 DBMS_VECTOR.QUERY Parameters

Parameter	Description
<code>tab_name</code>	Table name to query
<code>vec_col_name</code>	Vector column name
<code>query_vector</code>	Query vector passed in as <code>CLOB</code> or <code>VECTOR</code> .
<code>top_k</code>	Number of results to be returned.
<code>vec_proj_cols</code>	Columns to be projected as part of the result.
<code>idx_name</code>	Name of the index queried.
<code>distance_metric</code>	Distance computation metric. Defaults to <code>COSINE</code> . Can also be <code>MANHATTAN</code> , <code>HAMMING</code> , <code>DOT</code> , <code>EUCLIDEAN</code> , <code>L2_SQUARED</code> , <code>EUCLIDEAN_SQUARED</code> .
<code>use_index</code>	Specifies whether the search is an approximate search or exact search. Defaults to <code>TRUE</code> (that is, approximate).
<code>accuracy</code>	Specifies the minimum desired query accuracy.

Table 205-6 (Cont.) DBMS_VECTOR.QUERY Parameters

Parameter	Description
idx_parameters	Specifies values of efsearch and neighbor partition probes passed in, formatted as JSON

DATA

This function accepts the input data type as VARCHAR2, NUMBER, JSON, BOOLEAN or CLOB.

205.1.9 REBUILD_INDEX

Use the DBMS_VECTOR.REBUILD_INDEX function to rebuild an index.

Syntax

This API rebuilds an index. In case only the idx_name is provided, it rebuilds the index using get_ddl. When all params are provided, it performs a drop index followed by a call to dbms_vector.create_index().

```
DBMS_VECTOR.REBUILD_INDEX (
    IDX_NAME                IN VARCHAR2,
    TABLE_NAME             IN VARCHAR2 DEFAULT NULL,
    IDX_VECTOR_COL          IN VARCHAR2 DEFAULT NULL,
    IDX_INCLUDE_COLS       IN VARCHAR2 DEFAULT NULL,
    IDX_PARTITIONING_SCHEME IN VARCHAR2 DEFAULT NULL,
    IDX_ORGANIZATION        IN VARCHAR2 DEFAULT NULL,
    IDX_DISTANCE_METRICS   IN VARCHAR2 DEFAULT 'EUCLIDEAN',
    IDX_ACCURACY            IN NUMBER DEFAULT 95,
    IDX_PARAMETERS         IN CLOB DEFAULT NULL,
    IDX_PARALLEL_CREATION  IN NUMBER DEFAULT 4,
);
```

Parameters

Specify the input parameters in JSON format.

Table 205-7 REBUILD_INDEX (IN) Parameters of DBMS_VECTOR

Parameter	Description
table_name	Table on which to create the index.
idx_name	Name of the index.
idx_vector_col	Vector column on which to rebuild the index.
idx_partitioning_scheme	Partitioning scheme. LOCAL or GLOBAL.
idx_organization	Index organization. Either NEIGHBOR PARTITIONS or INMEMORY NEIGHBOR GRAPH.
idx_distance_metric	Distance computation metric. Defaults to COSINE. Can also be MANHATTAN, HAMMING, DOT, EUCLIDEAN, L2_SQUARED, EUCLIDEAN_SQUARED.

Table 205-7 (Cont.) REBUILD_INDEX (IN) Parameters of DBMS_VECTOR

Parameter	Description
<code>idx_accuracy</code>	Target accuracy.
<code>idx_parameters</code>	Takes in CLOB with type of index and associated parameters. Type, neighbor partitions for IVF, neighbors/efConstruction for HNSW)
<code>idx_parallel_creation</code>	Number of parallel threads used for index construction.

DATA

This function accepts the input data type as `VARCHAR2`, `NUMBER`, or `CLOB`.

If you specify only the `idx_name` value, then the function rebuilds the index using `get_ddl`. If you specify all the parameter values, then the function first performs a drop index operation and then calls the `DBMS_VECTOR.CREATE_INDEX()` function.

205.1.10 UTL_TO_CHUNKS

Use the `DBMS_VECTOR.UTL_TO_CHUNKS` chainable utility function to split a larger plain text document into smaller chunks (pieces of words, sentences, or paragraphs).

Purpose

To perform a text to chunks transformation, by internally calling the `VECTOR_CHUNKS` SQL function for the operation.

Syntax

```
DBMS_VECTOR.UTL_TO_CHUNKS (
    DATA          IN CLOB | VARCHAR2
    PARAMS        IN JSON default NULL
) return VECTOR_ARRAY_T;
```

DATA

This function accepts the input data type as `CLOB` or `VARCHAR2`.

It returns an array of `CLOB`s, where each `CLOB` contains a chunk along with its metadata in JSON format, as follows:

```
{
  "chunk_id":NUMBER,
  "chunk_offset":NUMBER,
  "chunk_length":NUMBER,
  "chunk_data": "VARCHAR2(4000)"
}
```

For example:

```
{"chunk_id":1,"chunk_offset":1,"chunk_length":6,"chunk_data":"sample"}
```

Where,

- `chunk_id` specifies the chunk ID for each chunk.
- `chunk_offset` specifies the original position of each chunk in the source document, relative to the start of document which has a position of 1.
- `chunk_length` specifies the character length of each chunk.
- `chunk_data` displays text pieces from each chunk.

PARAMS

Specify the input parameters in JSON format:

```
{
  "by"           : mode,
  "max"         : max,
  "overlap"     : overlap,
  "split"       : split_condition,
  "custom_list" : [ split_chars1, ... ],
  "vocabulary"  : vocabulary_name,
  "language"    : nls_language,
  "normalize"   : normalize_mode,
  "norm_options": [ normalize_option1, ... ],
  "extended"    : boolean
}
```

For example:

```
JSON('{"by":"vocabulary",
      "vocabulary":"myvocab",
      "max":"100",
      "overlap":"0",
      "split":"custom",
      "custom_list": [ "<p>" , "<s>" ],
      "language":"american",
      "normalize":"options",
      "norm_options": [ "WHITESPACE" ] }')
```

All these parameters are aligned with the `VECTOR_CHUNKS` SQL function, as follows:

- `by`, `max`, `overlap`, `split`, `language`, and `extended` specify the same values as that of `VECTOR_CHUNKS`.
- `vocabulary` is the name of the custom vocabulary; same as the vocabulary name that you specify when using the `by vocabulary` mode.
- `custom_list` is an array of the custom split characters; same as the `split by custom condition`.
- `norm_options` is an array of normalization options; same as the `normalize` parameter.

For a complete description of these parameters, see VECTOR_CHUNKS in *Oracle Database SQL Language Reference*.

Example

```
SELECT D.id doc,
       JSON_VALUE(C.column_value, '$.chunk_id' RETURNING NUMBER) AS id,
       JSON_VALUE(C.column_value, '$.chunk_offset' RETURNING NUMBER) AS
pos,
       JSON_VALUE(C.column_value, '$.chunk_length' RETURNING NUMBER) AS
siz,
       JSON_VALUE(C.column_value, '$.chunk_data') AS txt
FROM docs D,
     dbms_vector.utl_to_chunks(D.text,
     JSON('{ "by": "words",
             "max": "100",
             "overlap": "0",
             "split": "recursively",
             "language": "american",
             "normalize": "all" }')) C;
```

To run an end-to-end example scenario using this function, see Convert Text to Chunks With Custom Chunking Specifications in *Oracle Database AI Vector Search User's Guide*.

205.1.11 UTL_TO_EMBEDDING and UTL_TO_EMBEDDINGS

Use the DBMS_VECTOR.UTL_TO_EMBEDDING and DBMS_VECTOR.UTL_TO_EMBEDDINGS chainable utility functions to convert plain text to one or more vector embeddings.

Purpose

To perform a text to embedding transformation by accessing:

- Oracle Database as the service provider: Calls the pretrained ONNX format embedding model that you have loaded into the database (default setting)
- Third-party embedding model: Makes a REST call to your chosen third-party service provider, such as Cohere, Google AI, Hugging Face, Oracle Cloud Infrastructure (OCI) Generative AI, OpenAI, or Vertex AI

Syntax

```
DBMS_VECTOR.UTL_TO_EMBEDDING (
    DATA           IN CLOB,
    PARAMS          IN JSON default NULL
) return VECTOR;
```

```
DBMS_VECTOR.UTL_TO_EMBEDDINGS (
    DATA           IN VECTOR_ARRAY_T,
    PARAMS          IN JSON default NULL
) return VECTOR_ARRAY_T;
```

DATA

UTL_TO_EMBEDDING converts text (CLOB) to a single embedding (VECTOR).

UTL_TO_EMBEDDINGS convert an array of chunks (VECTOR_ARRAY_T) to an array of embeddings (VECTOR_ARRAY_T).

The embedding output includes:

```
{
  "embed_id":NUMBER,
  "embed_data":"VARCHAR2(4000)",
  "embed_vector":"CLOB"
}
```

Where,

- embed_id displays the ID number of each embedding.
- embed_data displays the input text that is transformed into embeddings.
- embed_vector displays the generated vector representations.

PARAMS

Specify input parameters in JSON format, depending on the service provider that you want to use.

If using Oracle Database as the provider:

```
{
  "provider": "database",
  "model": "<pretrained ONNX embedding model file name>"
}
```

Table 205-8 Database Provider Parameter Details

Parameter	Description
provider	Specify DATABASE (default setting) to use Oracle Database as the provider. With this setting, you must load pretrained ONNX embedding model into the database.
model	User-specified name under which the imported pretrained ONNX embedding model is stored in Oracle Database. If you do not have pretrained embedding model in ONNX format, then perform the steps listed in <i>Oracle Database AI Vector Search User's Guide</i> .

If using a third-party provider:

Set the following parameters along with additional embedding parameters specific to your provider:

- For UTL_TO_EMBEDDING:

```
{
  "provider": "<AI service provider>",
```

```
"credential_name": "<credential name>",
"url": "<REST endpoint URL for embedding service>",
"model": "<REST provider embedding model name>",
"transfer_timeout": <maximum wait time for the request to
complete>,
"<REST provider parameter>": "<additional REST provider
parameters>"
}
```

- For UTL_TO_EMBEDDINGS:

```
{
  "provider": "<AI service provider>",
  "credential_name": "<credential name>",
  "url": "<REST endpoint URL for embedding service>",
  "model": "<REST provider embedding model name>",
  "transfer_timeout": <maximum wait time for the request to
complete>,
  "batch size": "<number of vectors to request at a time>",
  "<REST provider parameter>": "<additional REST provider
parameters>"
}
```

Table 205-9 Third-Party Provider Parameter Details

Parameter	Description
provider	<p>Third-party service provider that you want to access for this operation. A REST call is made to the specified provider to access its embedding model.</p> <p>Specify one of the following values:</p> <ul style="list-style-type: none"> • Cohere • GoogleAI • HuggingFace • OCI GenAI • OpenAI • VertexAI
credential_name	<p>Name of the credential in the form: <i>schema.credential_name</i></p> <p>A credential name holds authentication credentials to enable access to your provider for making REST API calls.</p> <p>You need to first set up your credential by calling the <code>DBMS_VECTOR.CREATE_CREDENTIAL</code> helper function to create and store a credential, and then refer to the credential name here. See CREATE_CREDENTIAL.</p>
url	URL of the API endpoint for each REST call.
model	<p>Name of the third-party embedding model in the form: <i>schema.model_name</i></p> <p>If you do not specify a schema, then the schema of the procedure invoker is used.</p> <p>Note: For accurate results, ensure that the chosen model matches the vocabulary file used for chunking. If you are not using a vocabulary file, then ensure that the input length is defined within the token limits of your model.</p>

Table 205-9 (Cont.) Third-Party Provider Parameter Details

Parameter	Description
<code>transfer_timeout</code>	Maximum time to wait for the request to complete. The default value is 60 seconds. You can increase this value for busy web servers.
<code>batch_size</code>	Maximum number of vectors to request at a time. For example, for a batch size of 50, if 100 chunks are passed, then this API sends two requests with an array of 50 strings each. If 30 chunks are passed (which is lesser than the defined batch size), then the API sends those in a single request. For REST calls, it is more efficient to send a batch of inputs at a time rather than requesting a single input per call. Increasing the batch size can provide better performance, whereas reducing the batch size may reduce memory and data usage, especially if your provider has a rate limit. The default or maximum allowed value depends on the third-party provider settings.

Additional REST provider parameters:

Cohere example:

```
{
  "provider": "cohere",
  "credential_name": "COHERE_CRED",
  "url": "https://api.cohere.example.com/embed",
  "model": "embed-model",
  "input_type": "search_query"
}
```

Google AI example:

```
{
  "provider": "googleai",
  "credential_name": "GOOGLEAI_CRED",
  "url": "https://googleapis.example.com/models/",
  "model": "embed-model"
}
```

Hugging Face example:

```
{
  "provider": "huggingface",
  "credential_name": "HF_CRED",
  "url": "https://api.huggingface.example.com/",
  "model": "embed-model",
  "wait_for_model": "true"
}
```

Generative AI example:

```
{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/embedText",
  "model": "embed-model",
  "batch_size": 10
}
```

OpenAI example:

```
{
  "provider": "openai",
  "credential_name": "OPENAI_CRED",
  "url": "https://api.openai.example.com/embeddings",
  "model": "embed-model"
}
```

Vertex AI example:

```
{
  "provider": "vertexai",
  "credential_name": "VERTEXAI_CRED",
  "url": "https://googleapis.example.com/models/",
  "model": "embed-model"
}
```

Table 205-10 Additional REST Provider Parameter Details

Parameter	Description
input_type	Type of input to vectorize.
wait_for_model	Whether to wait for the model when it is not ready, as TRUE or FALSE.

For more information on additional parameters, refer to your third-party provider's documentation.

 **Note:**

The generated embedding results may be different between requests for the same input and configuration, depending on your embedding model or floating point precision. However, this does not affect your queries (and provides semantically correct results) because the vector distance will be similar.

Examples

You can use `UTL_TO_EMBEDDING` in a `SELECT` clause and `UTL_TO_EMBEDDINGS` in a `FROM` clause, as follows:

- The following examples use `UTL_TO_EMBEDDING` to generate a vector embedding with Hello world as the input, by accessing the Generative AI embedding model:

```
-- select example

var params clob;
exec :params := '
{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/embedText",
  "model": "embed.modelname",
  "batch_size": 10
}';

select dbms_vector.utl_to_embedding('Hello world', json(:params)) from
dual;

-- PL/SQL example

declare
  input clob;
  params clob;
  v vector;
begin
  input := 'Hello world';

  params := '
{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/embedText",
  "model": "embed.modelname"
}';

  v := dbms_vector.utl_to_embedding(input, json(params));
  dbms_output.put_line(vector_serialize(v));
exception
  when OTHERS THEN
    DBMS_OUTPUT.PUT_LINE (SQLERRM);
    DBMS_OUTPUT.PUT_LINE (SQLCODE);
end;
/
```

To run an end-to-end example scenario using `UTL_TO_EMBEDDING`, see [Directly Convert Text String to Embedding in Oracle Database AI Vector Search User's Guide](#).

- The following example uses `UTL_TO_EMBEDDINGS` to generate vector embeddings with a PDF document (stored in the `documentation_tab` table) as the input, by calling pretrained ONNX model:

```
SELECT et.* from documentation_tab
dt,dbms_vector.utl_to_embeddings(dbms_vector.utl_to_chunks(dbms_vector.utl
```

```
_to_text(dt.data),
json(:embed_params)) et;
```

To run an end-to-end example scenario using `UTL_TO_EMBEDDINGS`, see *Step By Step Convert File to Text to Chunks to Embeddings* in *Oracle Database AI Vector Search User's Guide*.

205.1.12 UTL_TO_GENERATE_TEXT

Use the `DBMS_VECTOR.UTL_TO_GENERATE_TEXT` chainable utility function to generate text for a given prompt.

Purpose

To generate text using a prompt, by accessing third-party text generation models.

This API makes a REST call to your specified third-party service provider, such as Cohere, Google AI, Hugging Face, Oracle Cloud Infrastructure (OCI) Generative AI, OpenAI, or Vertex AI.

A prompt can be an input string, such as a question that you ask a Large Language Model (LLM). For example, "What is Oracle Text?". A prompt can also be a command, such as "Summarize the following ...", "Draft an email asking for ...", or "Rewrite the following ...", and can include results from a search.

Syntax

```
DBMS_VECTOR.UTL_TO_GENERATE_TEXT (
    DATA          IN CLOB,
    PARAMS        IN JSON default NULL
) return CLOB;
```

DATA

This function accepts the input data type as `CLOB`, and returns the output as `CLOB`.

PARAMS

Specify the following input parameters in JSON format, depending on the service provider that you want to access for text generation:

```
{
  "provider": "<AI service provider>",
  "credential_name": "<credential name>",
  "url": "<REST endpoint URL for text generation service>",
  "model": "<text generation model name>",
  "transfer_timeout": <maximum wait time for the request to complete>,
  "<REST provider parameter>": "<additional REST provider parameters>"
}
```

Table 205-11 UTL_TO_GENERATE_TEXT Parameter Details

Parameter	Description
<code>provider</code>	Service provider that you want to access to generate the text: <ul style="list-style-type: none"> • Cohere • GoogleAI • HuggingFace • OCI GenAI • OpenAI • VertexAI
<code>credential_name</code>	Name of the credential in the form: <i>schema.credential_name</i> A credential name holds authentication credentials to enable access to your provider for making REST API calls. You need to first set up your credential by calling the <code>DBMS_VECTOR.CREATE_CREDENTIAL</code> helper function to create and store a credential, and then refer to the credential name here. See CREATE_CREDENTIAL .
<code>url</code>	URL of the API endpoint for each REST call.
<code>model</code>	Name of the third-party text generation model in the form: <i>schema.model_name</i> If the model name is not schema-qualified, then the schema of the procedure invoker is used.
<code>transfer_timeout</code>	Maximum time to wait for the request to complete. The default value is 60 seconds. You can increase this value for busy web servers.

Additional REST provider parameters:

Cohere example:

```
{
  "provider": "Cohere",
  "credential_name": "COHERE_CRED",
  "url": "https://api.cohere.example.com/generateText",
  "model": "generate-text-model"
}
```

Google AI example:

```
{
  "provider": "googleai",
  "credential_name": "GOOGLEAI_CRED",
  "url": "https://googleapis.example.com/models/",
  "model": "generate-text-model"
}
```


Hugging Face example:

```
{
  "provider": "huggingface",
  "credential_name": "HF_CRED",
  "url": "https://api.huggingface.example.com/models/",
  "model": "generate-text-model",
  "wait_for_model": "true"
}
```

Generative AI example:

```
{
  "provider": "OCIGenAI",
  "credential_name": "GENAI_CRED",
  "url": "https://generativeai.oci.example.com/generateText",
  "model": "generate-text-model",
  "inferenceRequest": {
    "maxTokens": 300,
    "temperature": 1
  }
}
```

OpenAI example:

```
{
  "provider": "openai",
  "credential_name": "OPENAI_CRED",
  "url": "https://api.openai.example.com",
  "model": "generate-text-model",
  "max_tokens": 60,
  "temperature": 1.0
}
```

Vertex AI example:

```
{
  "provider": "vertexai",
  "credential_name": "VERTEXAI_CRED",
  "url": "https://googleapis.example.com/models/",
  "model": "generate-text-model",
  "generation_config": {
    "temperature": 0.9,
    "topP": 1,
    "candidateCount": 1,
    "maxOutputTokens": 256
  }
}
```

Table 205-12 Additional REST Provider Parameter Details

Parameter	Description
wait_for_model	Whether to wait for the model when it is not ready, as TRUE or FALSE.
max_tokens	Maximum number of tokens in the output text.
temperature	Degree of randomness used when generating the output text, in the range of 0.0–5.0. To generate the same output for a prompt, use 0. To generate a random new text for that prompt, increase the temperature. Note: Start with the temperature set to 0. If you do not require random results, a recommended temperature value is between 0 and 1. A higher value is not recommended because a high temperature may produce creative text, which might also include hallucinations.
topP	Probability of tokens in the output, in the range of 0.0–1.0. A lower value provides less random responses and a higher value provides more random responses.
candidateCount	Number of response variations to return, in the range of 1–4.
maxOutputTokens	Maximum number of tokens to generate for each response.

For more information on additional parameters, refer to your third-party provider's documentation.

Examples

These statements generate text using "What is Oracle Text?" as the prompt, by making a REST call to Generative AI.

```
-- select example

var params clob;
exec :params := '
{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/generateText",
  "model": "generate.modelname"
}';

select dbms_vector.utl_to_generate_text(
  'What is Oracle Text?',
  json(:params)) from dual;

-- PL/SQL example

declare
  input clob;
  params clob;
  output clob;
begin
  input := 'What is Oracle Text?';
```

```
params := '  
{  
  "provider": "ocigenai",  
  "credential_name": "OCI_CRED",  
  "url": "https://generativeai.oci.example.com/generateText",  
  "model": "generate.modelname"  
}';  
  
output := dbms_vector.utl_to_generate_text(input, json(params));  
dbms_output.put_line(output);  
if output is not null then  
  dbms_lob.freetemporary(output);  
end if;  
exception  
  when OTHERS THEN  
    DBMS_OUTPUT.PUT_LINE (SQLERRM);  
    DBMS_OUTPUT.PUT_LINE (SQLCODE);  
end;  
/
```

To run an end-to-end example scenario using this function, see [Generate Text for a Prompt: PL/SQL Example](#) in *Oracle Database AI Vector Search User's Guide*.

DBMS_VECTOR_CHAIN

The `DBMS_VECTOR_CHAIN` package enables advanced operations with Oracle AI Vector Search, such as chunking and embedding data along with text generation and summarization capabilities. It is more suitable for text processing with similarity search, using functionality that can be pipelined together for an end-to-end search.

These functions accept their respective input parameters in JSON format.

Related Topics

- [Oracle Database AI Vector Search User's Guide](#)

206.1 Summary of DBMS_VECTOR_CHAIN Subprograms

This table lists the `DBMS_VECTOR_CHAIN` subprograms and briefly describes them.

Table 206-1 DBMS_VECTOR_CHAIN Package Subprograms

Subprogram	Description
Chainable Utility (UTL) Functions:	
These functions are a set of modular and flexible functions within vector utility PL/SQL packages. You can chain these together to automate end-to-end data transformation and similarity search operations.	
UTL_TO_TEXT	Extracts plain text data from documents
UTL_TO_CHUNKS	Splits data into smaller pieces or chunks
UTL_TO_EMBEDDING and UTL_TO_EMBEDDINGS	Converts data to one or more vector embeddings
UTL_TO_SUMMARY	Extracts a summary from documents
UTL_TO_GENERATE_TEXT	Generates text for a prompt or input string
Credential Helper Procedures:	
These procedures enable you to securely manage authentication credentials in the database. You require these credentials to enable access to third-party service providers for making REST calls.	
CREATE_CREDENTIAL	Creates a credential name
DROP_CREDENTIAL	Drops an existing credential name
Chunker Helper Procedures:	
These procedures enable you to configure vocabulary and language data (abbreviations), to be used with the <code>VECTOR_CHUNKS</code> SQL function or <code>UTL_TO_CHUNKS</code> PL/SQL function.	
CREATE_VOCABULARY	Loads your token vocabulary file into the database
DROP_VOCABULARY	Removes existing vocabulary data
CREATE_LANG_DATA	Loads your language data file into the database
DROP_LANG_DATA	Removes existing abbreviation data

206.1.1 CREATE_CREDENTIAL

Use the `DBMS_VECTOR_CHAIN.CREATE_CREDENTIAL` credential helper procedure to create a credential name for storing user authentication details in Oracle Database.

Purpose

To securely manage authentication credentials in the database. You require these credentials to enable access during REST API calls to your chosen third-party service provider, such as Cohere, Google AI, Hugging Face, Oracle Cloud Infrastructure (OCI) Generative AI, OpenAI, or Vertex AI.

A credential name holds authentication parameters, such as user name, password, access token, private key, or fingerprint.

 **Note:**

If you are using Oracle Database as the service provider, then you do not need to create a credential.

Syntax

```
DBMS_VECTOR_CHAIN.CREATE_CREDENTIAL (  
    CREDENTIAL_NAME      IN VARCHAR2,  
    PARAMS                IN JSON DEFAULT NULL  
);
```

CREDENTIAL_NAME

Specify a name of the credential that you want to create for holding authentication parameters.

PARAMS

Specify authentication parameters in JSON format, based on your chosen service provider.

Generative AI requires the following authentication parameters:

```
{  
  "user_oci": "<user oci>",  
  "tenancy_oci": "<tenancy oci>",  
  "compartment_oci": "<compartment oci>",  
  "private_key": "<private key>",  
  "fingerprint": "<fingerprint>"  
}
```

Cohere, Google AI, Hugging Face, OpenAI, and Vertex AI require the following authentication parameter:

```
{ "access_token": "<access token>" }
```

Table 206-2 Parameter Details

Parameter	Description
user_ocid	Oracle Cloud Identifier (OCID) of the user, as listed on the User Details page in the OCI console.
tenancy_ocid	OCID of your tenancy, as listed on the Tenancy Details page in the OCI console.
compartment_ocid	OCID of your compartment, as listed on the Compartments information page in the OCI console.
private_key	OCI private key. Note: The generated private key may appear as: -----BEGIN RSA PRIVATE KEY----- <private key string> -----END RSA PRIVATE KEY----- You pass the <private key string> value (excluding the BEGIN and END lines), either as a single line or as multiple lines.
fingerprint	Fingerprint of the OCI profile key, as listed on the User Details page under API Keys in the OCI console.
access_token	Access token obtained from your third-party service provider.

Required Privilege

You need the `CREATE CREDENTIAL` privilege to call this API.

Examples

- For Generative AI:

```

declare
  jo json_object_t;
begin
  jo := json_object_t();

  jo.put('user_ocid','ocid1.user.oc1..aabbalbbaa1112233aabbaabb1111222aa1111
bb');

  jo.put('tenancy_ocid','ocid1.tenancy.oc1..aaaaalbbbbb1112233aaaabbaa1111222
aa111a');

  jo.put('compartment_ocid','ocid1.compartment.oc1..ababalabab1112233abababa
b111222ab111ab');
  jo.put('private_key','AAAaaaBBB11112222333...AAA111AAABBB222aaa1a/+');
  jo.put('fingerprint','01:1a:a1:aa:12:a1:12:1a:ab:12:01:ab:a1:12:ab:1a');
  dbms_output.put_line(jo.to_string);
  dbms_vector_chain.create_credential(
    credential_name => 'OCI_CRED',
    params          => json(jo.to_string));
end;
/

```

- For Cohere:

```
declare
  jo json_object_t;
begin
  jo := json_object_t();
  jo.put('access_token', 'A1Aa0abA1AB1a1Abc123ab1A123ab123AbcA12a');
  dbms_vector_chain.create_credential(
    credential_name => 'COHERE_CRED',
    params          => json(jo.to_string));
end;
/
```

To run an end-to-end example scenario using this procedure, see Convert Text String to Summary in *Oracle Database AI Vector Search User's Guide*.

206.1.2 CREATE_LANG_DATA

Use the `DBMS_VECTOR_CHAIN.CREATE_LANG_DATA` chunker helper procedure to load your own language data file into the database.

Purpose

To create custom language data for your chosen language (specified using the `LANGUAGE` chunking parameter).

A language data file contains language-specific abbreviation tokens. You can supply this data to the chunker to help in accurately determining sentence boundaries of chunks, by using knowledge of the input language's end-of-sentence (EOS) punctuations, abbreviations, and contextual rules.

Usage Notes

- All supported languages are distributed with the default language-specific abbreviation dictionaries. You can create a language data based on the abbreviation tokens loaded in the `schema.table.column`, using a user-specified language data name (`PREFERENCE_NAME`).
- After loading your language data, you can use language-specific chunking by specifying the `LANGUAGE` chunking parameter with `VECTOR_CHUNKS` or `UTL_TO_CHUNKS`.
- You can query these data dictionary views to access existing language data:
 - `ALL_VECTOR_LANG` displays all available languages data.
 - `USER_VECTOR_LANG` displays languages data from the schema of the current user.
 - `ALL_VECTOR_ABBREV_TOKENS` displays abbreviation tokens from all available language data.
 - `USER_VECTOR_ABBREV_TOKENS` displays abbreviation tokens from the language data owned by the current user.

Syntax

```
DBMS_VECTOR_CHAIN.CREATE_LANG_DATA (
    PARAMS          IN JSON default NULL
);
```

PARAMS

Specify the input parameters in JSON format:

```
{
    TABLE_NAME,
    COLUMN_NAME,
    LANGUAGE,
    PREFERENCE_NAME
}
```

Table 206-3 Parameter Details

Parameter	Description	Required	Default Value
TABLE_NAME	Name of the table (along with the optional table owner) in which you want to load the language data	Yes	No value
COLUMN_NAME	Column name in the language data table in which you want to load the language data	Yes	No value
LANGUAGE	Any supported language name, as listed in Supported Languages and Data File Locations	Yes	No value
PREFERENCE_NAME	User-specified preference name for this language data	Yes	No value

Example

```
declare
    params CLOB := '{"TABLE_NAME"      : "eos_data_1",
                  "COLUMN_NAME"     : "TOKEN",
                  "LANGUAGE"        : "INDONESIAN",
                  "PREFERENCE_NAME" : "my_lang_1"}';
begin
    DBMS_VECTOR_CHAIN.CREATE_LANG_DATA(
        JSON (params));
end;
/
```

To run an end-to-end example scenario using this procedure, see *Create and Use Custom Language Data in Oracle Database AI Vector Search User's Guide*.

Related Topics

- VECTOR_CHUNKS

- **UTL_TO_CHUNKS**
Use the `DBMS_VECTOR_CHAIN.UTL_TO_CHUNKS` chainable utility function to split a larger plain text document into smaller chunks (pieces of words, sentences, or paragraphs).
- Vector Utilities-Related Views

206.1.3 CREATE_VOCABULARY

Use the `DBMS_VECTOR_CHAIN.CREATE_VOCABULARY` chunker helper procedure to load your own token vocabulary file into the database.

Purpose

To create custom token vocabulary that is recognized by the tokenizer used by your vector embedding model.

A vocabulary contains a set of tokens (words and word pieces) that are collected during a model's statistical training process. You can supply this data to the chunker to help in accurately selecting the text size that approximates the maximum input limit imposed by the tokenizer of your embedding model.

Usage Notes

- Usually, the supported vocabulary files (containing recognized tokens) are included as part of a model's distribution. Oracle recommends to use the vocabulary files associated with your model.

If a vocabulary file is not available, then you may download one of the following files depending on the tokenizer type:

- **WordPiece:**

Vocabulary file (`vocab.txt`) for the "bert-base-uncased" (English) or "bert-base-multilingual-cased" model

- **Byte-Pair Encoding (BPE):**

Vocabulary file (`vocab.json`) for the "GPT2" model

Use the following python script to extract the file:

```
import json
import sys

with open(sys.argv[1], encoding="utf-8") as f:
    d = json.load(f)
    for term in d:
        print(term)
```

- **SentencePiece:**

Vocabulary file (`tokenizer.json`) for the "xlm-roberta-base" model

Use the following python script to extract the file:

```
import json
import sys
```

```
with open(sys.argv[1], encoding="utf-8") as f:
    d = json.load(f)
    for entry in d["model"]["vocab"]:
        print(entry[0])
```

Ensure to save your vocabulary files in UTF-8 encoding.

- You can create a vocabulary based on the tokens loaded in the `schema.table.column`, using a user-specified vocabulary name (`VOCABULARY_NAME`).

After loading your vocabulary data, you can use the `BY VOCABULARY` chunking mode (with `VECTOR_CHUNKS` or `UTL_TO_CHUNKS`) to split input data by counting the number of tokens.

- You can query these data dictionary views to access existing vocabulary data:
 - `ALL_VECTOR_VOCAB` displays all available vocabularies.
 - `USER_VECTOR_VOCAB` displays vocabularies from the schema of the current user.
 - `ALL_VECTOR_VOCAB_TOKENS` displays a list of tokens from all available vocabularies.
 - `USER_VECTOR_VOCAB_TOKENS` displays a list of tokens from the vocabularies owned by the current user.

Syntax

```
DBMS_VECTOR_CHAIN.CREATE_VOCABULARY (
    PARAMS          IN JSON default NULL
);
```

PARAMS

Specify the input parameters in JSON format:

```
{
    TABLE_NAME,
    COLUMN_NAME,
    VOCABULARY_NAME,
    FORMAT,
    CASED
}
```

Table 206-4 Parameter Details

Parameter	Description	Required	Default Value
TABLE_NAME	Name of the table (along with the optional table owner) in which you want to load the vocabulary file	Yes	No value
COLUMN_NAME	Column name in the vocabulary table in which you want to load the vocabulary file	Yes	No value
VOCABULARY_NAME	User-specified name of the vocabulary, along with the optional owner name (if other than the current owner)	Yes	No value

Table 206-4 (Cont.) Parameter Details

Parameter	Description	Required	Default Value
FORMAT	<ul style="list-style-type: none"> • XLM for SentencePiece tokenization • BERT for WordPiece tokenization • GPT2 for BPE tokenization 	Yes	No value
CASED	Character-casing of the vocabulary, that is, vocabulary to be treated as cased or uncased	No	FALSE

Example

```

DECLARE
  params clob := '{"table_name"      : "doc_vocabtab",
                 "column_name"     : "token",
                 "vocabulary_name" : "doc_vocab",
                 "format"          : "bert",
                 "cased"           : false}';

BEGIN
  dbms_vector_chain.create_vocabulary(json(params));
END;
/

```

To run an end-to-end example scenario using this procedure, see *Create and Use Custom Vocabulary in Oracle Database AI Vector Search User's Guide*.

Related Topics

- VECTOR_CHUNKS
- [UTL_TO_CHUNKS](#)
Use the DBMS_VECTOR_CHAIN.UTL_TO_CHUNKS chainable utility function to split a larger plain text document into smaller chunks (pieces of words, sentences, or paragraphs).
- Vector Utilities-Related Views

206.1.4 DROP_CREDENTIAL

Use the DBMS_VECTOR_CHAIN.DROP_CREDENTIAL credential helper procedure to drop an existing credential name from the data dictionary.

Syntax

```

DBMS_VECTOR_CHAIN.DROP_CREDENTIAL (
  CREDENTIAL_NAME      IN VARCHAR2
);

```

CREDENTIAL_NAME

Specify the credential name that you want to drop.

Examples

- For Generative AI:

```
exec dbms_vector_chain.drop_credential('OCI_CRED');
```

- For Cohere:

```
exec dbms_vector_chain.drop_credential('COHERE_CRED');
```

206.1.5 DROP_LANG_DATA

Use the `DBMS_VECTOR_CHAIN.DROP_LANG_DATA` chunker helper procedure to remove abbreviation data from the data dictionary.

Syntax

```
DBMS_VECTOR_CHAIN.DROP_LANG_DATA(  
    PREF_NAME      IN VARCHAR2  
);
```

LANG

Specify the name of the language data that you want to drop for a given language.

Example

```
DBMS_VECTOR_CHAIN.DROP_LANG_DATA(  
    'INDONESIAN'  
);
```

206.1.6 DROP_VOCABULARY

Use the `DBMS_VECTOR_CHAIN.DROP_VOCABULARY` chunker helper procedure to remove vocabulary data from the data dictionary.

Syntax

```
DBMS_VECTOR_CHAIN.DROP_VOCABULARY(  
    VOCABULARY_NAME  IN VARCHAR2  
);
```

VOCAB_NAME

Specify the name of the vocabulary that you want to drop, in the form:

vocabulary_name

or

owner.vocabulary_name

Example

```
DBMS_VECTOR_CHAIN.DROP_VOCABULARY (  
    'MY_VOCAB_1'  
);
```

206.1.7 UTL_TO_CHUNKS

Use the `DBMS_VECTOR_CHAIN.UTL_TO_CHUNKS` chainable utility function to split a larger plain text document into smaller chunks (pieces of words, sentences, or paragraphs).

Purpose

To perform a text to chunks transformation, by internally calling the `VECTOR_CHUNKS` SQL function for the operation.

Syntax

```
DBMS_VECTOR_CHAIN.UTL_TO_CHUNKS (  
    DATA          IN CLOB | VARCHAR2  
    PARAMS        IN JSON default NULL  
) return VECTOR_ARRAY_T;
```

DATA

This function accepts the input data type as `CLOB` or `VARCHAR2`.

It returns an array of `CLOBs`, where each `CLOB` contains a chunk along with its metadata in JSON format, as follows:

```
{  
    "chunk_id":NUMBER,  
    "chunk_offset":NUMBER,  
    "chunk_length":NUMBER,  
    "chunk_data":"VARCHAR2(4000)"  
}
```

For example:

```
{"chunk_id":1,"chunk_offset":1,"chunk_length":6,"chunk_data":"sample"}
```

Where,

- `chunk_id` specifies the chunk ID for each chunk.
- `chunk_offset` specifies the original position of each chunk in the source document, relative to the start of document which has a position of 1.
- `chunk_length` specifies the character length of each chunk.
- `chunk_data` displays text pieces from each chunk.

PARAMS

Specify the input parameters in JSON format.

```

{
  "by"           : mode,
  "max"          : max,
  "overlap"      : overlap,
  "split"        : split_condition,
  "custom_list"  : [ split_chars1, ... ],
  "vocabulary"   : vocabulary_name,
  "language"     : nls_language,
  "normalize"    : normalize_mode,
  "norm_options" : [ normalize_option1, ... ],
  "extended"     : boolean
}

```

For example:

```

JSON(' { "by": "vocabulary",
         "vocabulary": "myvocab",
         "max": "100",
         "overlap": "0",
         "split": "custom",
         "custom_list": [ "<p>" , "<s>" ],
         "language": "american",
         "normalize": "options",
         "norm_options": [ "WHITESPACE" ] } ')

```

All these parameters are aligned with the `VECTOR_CHUNKS` SQL function, as follows:

- `by`, `max`, `overlap`, `split`, `language`, and `extended` specify the same values as that of `VECTOR_CHUNKS`.
- `vocabulary` is the name of the custom vocabulary; same as the vocabulary name that you specify when using the `by vocabulary` mode.
- `custom_list` is an array of the custom split characters; same as the `split by custom condition`.
- `norm_options` is an array of normalization options; same as the `normalize` parameter.

For a complete description of these parameters, see `VECTOR_CHUNKS` in *Oracle Database SQL Language Reference*.

Example

```

SELECT D.id doc,
       JSON_VALUE(C.column_value, '$.chunk_id' RETURNING NUMBER) AS id,
       JSON_VALUE(C.column_value, '$.chunk_offset' RETURNING NUMBER) AS pos,
       JSON_VALUE(C.column_value, '$.chunk_length' RETURNING NUMBER) AS siz,
       JSON_VALUE(C.column_value, '$.chunk_data') AS txt
FROM docs D,
     dbms_vector_chain.utl_to_chunks(D.text,
     JSON(' { "by": "words",

```

```
"max": "100",  
"overlap": "0",  
"split": "recursively",  
"language": "american",  
"normalize": "all" }')) C;
```

To run end-to-end example scenarios using this function, see *Convert Text to Chunks With Custom Chunking Specifications* and *Step By Step Convert File to Text to Chunks to Embeddings* in *Oracle Database AI Vector Search User's Guide*.

206.1.8 UTL_TO_EMBEDDING and UTL_TO_EMBEDDINGS

Use the `DBMS_VECTOR_CHAIN.UTL_TO_EMBEDDING` and `DBMS_VECTOR_CHAIN.UTL_TO_EMBEDDINGS` chainable utility functions to convert plain text to one or more vector embeddings.

Purpose

To perform a text to embedding transformation by accessing:

- Oracle Database as the service provider: Calls the pretrained ONNX format embedding model that you have loaded into the database (default setting)
- Third-party embedding model: Makes a REST call to your chosen third-party service provider, such as Cohere, Google AI, Hugging Face, Oracle Cloud Infrastructure (OCI) Generative AI, OpenAI, or Vertex AI

Syntax

```
DBMS_VECTOR_CHAIN.UTL_TO_EMBEDDING (  
    DATA          IN CLOB,  
    PARAMS         IN JSON default NULL  
) return VECTOR;
```

```
DBMS_VECTOR_CHAIN.UTL_TO_EMBEDDINGS (  
    DATA          IN VECTOR_ARRAY_T,  
    PARAMS         IN JSON default NULL  
) return VECTOR_ARRAY_T;
```

DATA

`UTL_TO_EMBEDDING` converts text (CLOB) to a single embedding (VECTOR).

`UTL_TO_EMBEDDINGS` convert an array of chunks (VECTOR_ARRAY_T) to an array of embeddings (VECTOR_ARRAY_T).

The embedding output includes:

```
{  
    "embed_id": NUMBER,  
    "embed_data": "VARCHAR2(4000)",  
    "embed_vector": "CLOB"  
}
```

Where,

- `embed_id` displays the ID number of each embedding.
- `embed_data` displays the input text that is transformed into embeddings.
- `embed_vector` displays the generated vector representations.

PARAMS

Specify input parameters in JSON format, depending on the service provider that you want to use.

If using Oracle Database as the provider:

```
{
  "provider": "database",
  "model": "<pretrained ONNX embedding model file name>"
}
```

Table 206-5 Database Provider Parameter Details

Parameter	Description
<code>provider</code>	Specify DATABASE (default setting) to use Oracle Database as the provider. With this setting, you must load pretrained ONNX embedding model into the database.
<code>model</code>	User-specified name under which the imported pretrained ONNX embedding model is stored in Oracle Database. If you do not have pretrained embedding model in ONNX format, then perform the steps listed in <i>Oracle Database AI Vector Search User's Guide</i> .

If using a third-party provider:

Set the following parameters along with additional embedding parameters specific to your provider:

- For `UTL_TO_EMBEDDING`:

```
{
  "provider": "<AI service provider>",
  "credential_name": "<credential name>",
  "url": "<REST endpoint URL for embedding service>",
  "model": "<REST provider embedding model name>",
  "transfer_timeout": <maximum wait time for the request to complete>,
  "<REST provider parameter>": "<additional REST provider parameters>"
}
```

- For `UTL_TO_EMBEDDINGS`:

```
{
  "provider": "<AI service provider>",
  "credential_name": "<credential name>",
  "url": "<REST endpoint URL for embedding service>",
  "model": "<REST provider embedding model name>",
  "transfer_timeout": <maximum wait time for the request to complete>,

```



```
"batch size": "<number of vectors to request at a time>",
"<REST provider parameter>": "<additional REST provider
parameters>"
}
```

Table 206-6 Third-Party Provider Parameter Details

Parameter	Description
provider	<p>Third-party service provider that you want to access for this operation. A REST call is made to the specified provider to access its embedding model.</p> <p>Specify one of the following values:</p> <ul style="list-style-type: none"> • Cohere • GoogleAI • HuggingFace • OCIGenAI • OpenAI • VertexAI
credential_name	<p>Name of the credential in the form: <i>schema.credential_name</i></p> <p>A credential name holds authentication credentials to enable access to your provider for making REST API calls.</p> <p>You need to first set up your credential by calling the <code>DBMS_VECTOR_CHAIN.CREATE_CREDENTIAL</code> helper function to create and store a credential, and then refer to the credential name here. See CREATE_CREDENTIAL.</p>
url	URL of the API endpoint for each REST call.
model	<p>Name of the third-party embedding model in the form: <i>schema.model_name</i></p> <p>If you do not specify a schema, then the schema of the procedure invoker is used.</p> <p>Note: For accurate results, ensure that the chosen model matches the vocabulary file used for chunking. If you are not using a vocabulary file, then ensure that the input length is defined within the token limits of your model.</p>
transfer_timeout	<p>Maximum time to wait for the request to complete.</p> <p>The default value is 60 seconds. You can increase this value for busy web servers.</p>
batch_size	<p>Maximum number of vectors to request at a time.</p> <p>For example, for a batch size of 50, if 100 chunks are passed, then this API sends two requests with an array of 50 strings each. If 30 chunks are passed (which is lesser than the defined batch size), then the API sends those in a single request.</p> <p>For REST calls, it is more efficient to send a batch of inputs at a time rather than requesting a single input per call. Increasing the batch size can provide better performance, whereas reducing the batch size may reduce memory and data usage, especially if your provider has a rate limit.</p> <p>The default or maximum allowed value depends on the third-party provider settings.</p>

Additional REST provider parameters:

Cohere example:

```
{
  "provider": "cohere",
  "credential_name": "COHERE_CRED",
  "url": "https://api.cohere.example.com/embed",
  "model": "embed-model",
  "input_type": "search_query"
}
```

Google AI example:

```
{
  "provider": "googleai",
  "credential_name": "GOOGLEAI_CRED",
  "url": "https://googleapis.example.com/models/",
  "model": "embed-model"
}
```

Hugging Face example:

```
{
  "provider": "huggingface",
  "credential_name": "HF_CRED",
  "url": "https://api.huggingface.example.com/",
  "model": "embed-model",
  "wait_for_model": "true"
}
```

Generative AI example:

```
{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/embedText",
  "model": "embed-model",
  "batch_size": 10
}
```

OpenAI example:

```
{
  "provider": "openai",
  "credential_name": "OPENAI_CRED",
  "url": "https://api.openai.example.com/embeddings",
  "model": "embed-model"
}
```

Vertex AI example:

```
{
  "provider": "vertexai",
```

```

    "credential_name": "VERTEXAI_CRED",
    "url": "https://googleapis.example.com/models/",
    "model": "embed-model"
  }

```

Table 206-7 Additional REST Provider Parameter Details

Parameter	Description
input_type	Type of input to vectorize.
wait_for_model	Whether to wait for the model when it is not ready, as TRUE or FALSE.

For more information on additional parameters, refer to your third-party provider's documentation.

 **Note:**

The generated embedding results may be different between requests for the same input and configuration, depending on your embedding model or floating point precision. However, this does not affect your queries (and provides semantically correct results) because the vector distance will be similar.

Examples

You can use `UTL_TO_EMBEDDING` in a `SELECT` clause and `UTL_TO_EMBEDDINGS` in a `FROM` clause, as follows:

- The following examples use `UTL_TO_EMBEDDING` to generate a vector embedding with `Hello world` as the input, by accessing the Generative AI embedding model:

```

-- select example

var params clob;
exec :params := '
{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/embedText",
  "model": "embed.modelname",
  "batch_size": 10
}';

select dbms_vector_chain.utl_to_embedding('Hello world',
json(:params)) from dual;

-- PL/SQL example

declare
  input clob;
  params clob;
  v vector;

```

```

begin
  input := 'Hello world';

  params := '
{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/embedText",
  "model": "embed.modelname"
}';

  v := dbms_vector_chain.utl_to_embedding(input, json(params));
  dbms_output.put_line(vector_serialize(v));
exception
  when OTHERS THEN
    DBMS_OUTPUT.PUT_LINE (SQLERRM);
    DBMS_OUTPUT.PUT_LINE (SQLCODE);
end;
/

```

To run an end-to-end example scenario using `UTL_TO_EMBEDDING`, see *Directly Convert Text String to Embedding in Oracle Database AI Vector Search User's Guide*.

- The following example uses `UTL_TO_EMBEDDINGS` to generate vector embeddings with a PDF document (stored in the `documentation_tab` table) as the input, by calling the pretrained ONNX model `my_embedding_model.onnx`:

```

SELECT et.* from documentation_tab
dt,dbms_vector_chain.utl_to_embeddings(dbms_vector_chain.utl_to_chunks(dbm
s_vector_chain.utl_to_text(dt.data)),
json(:embed_params)) et;

```

To run an end-to-end example scenario using `UTL_TO_EMBEDDINGS`, see *Step By Step Convert File to Text to Chunks to Embeddings in Oracle Database AI Vector Search User's Guide*.

206.1.9 UTL_TO_GENERATE_TEXT

Use the `DBMS_VECTOR_CHAIN.UTL_TO_GENERATE_TEXT` chainable utility function to generate text for a given prompt.

Purpose

To generate text using a prompt, by accessing third-party text generation models.

This API makes a REST call to your specified third-party service provider, such as Cohere, Google AI, Hugging Face, Oracle Cloud Infrastructure (OCI) Generative AI, OpenAI, or Vertex AI.

A prompt can be an input string, such as a question that you ask a Large Language Model (LLM). For example, "What is Oracle Text?". A prompt can also be a command, such as "Summarize the following ...", "Draft an email asking for ...", or "Rewrite the following ...", and can include results from a search.

Syntax

```
DBMS_VECTOR_CHAIN.UTL_TO_GENERATE_TEXT (
    DATA          IN CLOB,
    PARAMS        IN JSON default NULL
) return CLOB;
```

DATA

This function accepts the input data type as CLOB, and returns the output as CLOB.

PARAMS

Specify the following input parameters in JSON format, depending on the service provider that you want to access for text generation:

```
{
  "provider": "<AI service provider>",
  "credential_name": "<credential name>",
  "url": "<REST endpoint URL for text generation service>",
  "model": "<text generation model name>",
  "transfer_timeout": <maximum wait time for the request to complete>,
  "<REST provider parameter>": "<additional REST provider parameters>"
}
```

Table 206-8 UTL_TO_GENERATE_TEXT Parameter Details

Parameter	Description
provider	Service provider that you want to access to generate the text: <ul style="list-style-type: none"> • Cohere • GoogleAI • HuggingFace • OCIGenAI • OpenAI • VertexAI
credential_name	Name of the credential in the form: <i>schema.credential_name</i> A credential name holds authentication credentials to enable access to your provider for making REST API calls. You need to first set up your credential by calling the <code>DBMS_VECTOR_CHAIN.CREATE_CREDENTIAL</code> helper function to create and store a credential, and then refer to the credential name here. See CREATE_CREDENTIAL .
url	URL of the API endpoint for each REST call.

Table 206-8 (Cont.) UTL_TO_GENERATE_TEXT Parameter Details

Parameter	Description
model	Name of the third-party text generation model in the form: <i>schema.model_name</i> If the model name is not schema-qualified, then the schema of the procedure invoker is used.
transfer_timeout	Maximum time to wait for the request to complete. The default value is 60 seconds. You can increase this value for busy web servers.

Additional REST provider parameters:

Cohere example:

```
{
  "provider": "Cohere",
  "credential_name": "COHERE_CRED",
  "url": "https://api.cohere.example.com/generateText",
  "model": "generate-text-model"
}
```

Google AI example:

```
{
  "provider": "googleai",
  "credential_name": "GOOGLEAI_CRED",
  "url": "https://googleapis.example.com/models/",
  "model": "generate-text-model"
}
```

Hugging Face example:

```
{
  "provider": "huggingface",
  "credential_name": "HF_CRED",
  "url": "https://api.huggingface.example.com/models/",
  "model": "generate-text-model",
  "wait_for_model": "true"
}
```

Generative AI example:

```
{
  "provider": "OCI GenAI",
  "credential_name": "GENAI_CRED",
  "url": "https://generativeai.oci.example.com/generateText",
  "model": "generate-text-model",
  "inferenceRequest": {
```

```

    "maxTokens": 300,
    "temperature": 1
  }
}

```

OpenAI example:

```

{
  "provider": "openai",
  "credential_name": "OPENAI_CRED",
  "url": "https://api.openai.example.com",
  "model": "generate-text-model",
  "max_tokens": 60,
  "temperature": 1.0
}

```

Vertex AI example:

```

{
  "provider": "vertexai",
  "credential_name": "VERTEXAI_CRED",
  "url": "https://googleapis.example.com/models/",
  "model": "generate-text-model",
  "generation_config": {
    "temperature": 0.9,
    "topP": 1,
    "candidateCount": 1,
    "maxOutputTokens": 256
  }
}

```

Table 206-9 Additional REST Provider Parameter Details

Parameter	Description
wait_for_model	Whether to wait for the model when it is not ready, as TRUE or FALSE.
max_tokens	Maximum number of tokens in the output text.
temperature	Degree of randomness used when generating the output text, in the range of 0.0-5.0. To generate the same output for a prompt, use 0. To generate a random new text for that prompt, increase the temperature. Note: Start with the temperature set to 0. If you do not require random results, a recommended temperature value is between 0 and 1. A higher value is not recommended because a high temperature may produce creative text, which might also include hallucinations.
topP	Probability of tokens in the output, in the range of 0.0-1.0. A lower value provides less random responses and a higher value provides more random responses.
candidateCount	Number of response variations to return, in the range of 1-4.
maxOutputTokens	Maximum number of tokens to generate for each response.

For more information on additional parameters, refer to your third-party provider's documentation.

Examples

These statements generate text using "What is Oracle Text?" as the prompt, by making a REST call to Generative AI.

```
-- select example

var params clob;
exec :params := '
{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/generateText",
  "model": "generate.modelname"
}';

select dbms_vector_chain.utl_to_generate_text(
  'What is Oracle Text?',
  json(:params)) from dual;

-- PL/SQL example

declare
  input clob;
  params clob;
  output clob;
begin
  input := 'What is Oracle Text?';

  params := '
{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/generateText",
  "model": "generate.modelname"
}';

  output := dbms_vector_chain.utl_to_generate_text(input, json(params));
  dbms_output.put_line(output);
  if output is not null then
    dbms_lob.freetemporary(output);
  end if;
exception
  when OTHERS THEN
    DBMS_OUTPUT.PUT_LINE (SQLERRM);
    DBMS_OUTPUT.PUT_LINE (SQLCODE);
end;
/
```

To run an end-to-end example scenario using this function, see [Generate Text for a Prompt: PL/SQL Example](#) in *Oracle Database AI Vector Search User's Guide*.

206.1.10 UTL_TO_TEXT

Use the `DBMS_VECTOR_CHAIN.UTL_TO_TEXT` chainable utility function to convert an input document (for example, PDF, DOC, JSON, XML, or HTML) to plain text.

Purpose

To perform a file to text transformation by using the Oracle Text component (`CONTEXT`) of Oracle Database.

Syntax

```
DBMS_VECTOR_CHAIN.UTL_TO_TEXT (
    DATA          IN CLOB | BLOB,
    PARAMS        IN JSON default NULL
) return CLOB;
```

DATA

This function accepts the input data type as `CLOB` or `BLOB`.

It returns a plain text version of the document as `CLOB`.

You can either pass the input document directly to the API or specify a file stored in Oracle Database.

For a complete list of all the supported document formats, see *Oracle Text Reference*.

PARAMS

Specify the following input parameter in JSON format:

```
{
  "plaintext": "true or false",
  "charset": "UTF8"
}
```

Table 206-10 Parameter Details

Parameter	Description
<code>plaintext</code>	Plain text output. The default value for this parameter is <code>TRUE</code> , that is, by default the output format is plain text. If you do not want to return the document as plain text, then set this parameter to <code>FALSE</code> .
<code>charset</code>	Character set encoding. Currently, only <code>UTF8</code> is supported.

Example

```
select DBMS_VECTOR_CHAIN.UTL_TO_TEXT (
    t.blobdata,
```

```

        json('{
            "plaintext": "true",
            "charset": "UTF8"
        }')
    ) from tab t;

```

To run an end-to-end example scenario using this function, see Step By Step Convert File to Text to Chunks to Embeddings in *Oracle Database AI Vector Search User's Guide*.

206.1.11 UTL_TO_SUMMARY

Use the `DBMS_VECTOR_CHAIN.UTL_TO_SUMMARY` chainable utility function to convert plain text to a summary.

Purpose

To perform a text to summary transformation by accessing:

- Oracle Database as the AI service provider: Uses a document gist (or summary) generated by Oracle Text (default setting)
- Third-party summarization model: Makes a REST API call to your chosen third-party AI service provider, such as Cohere, Google AI, Hugging Face, Oracle Cloud Infrastructure (OCI) Generative AI, OpenAI, or Vertex AI

A summary is a short and concise extract with key features of a document that best represents what the document is about as a whole. A summary can be free-form paragraphs or bullet points based on the format that you specify.

Syntax

```

DBMS_VECTOR_CHAIN.UTL_TO_SUMMARY (
    DATA          IN CLOB,
    PARAMS        IN JSON default NULL
) return CLOB;

```

DATA

This function accepts the input data type as `CLOB`.

It returns a summary of the input document in plain text as `CLOB`.

PARAMS

Specify input parameters in JSON format, depending on the service provider that you want to use for text summarization.

If using Oracle Database as the provider:

```

{
    "provider": "database",
    "glevel": "<summary format>",
    "numParagraphs": <number in the range 1-16>,
    "maxPercent": <number in the range 1-100>,
    "num_themes": <number in the range 1-50>,
}

```

```

    "language": "<name of the language>"
  }

```

Table 206-11 Database Provider Parameter Details

Parameter	Description
provider	Specify DATABASE (default setting) to access Oracle Database as the provider. Oracle Text is internally used to extract a document gist or summary from user data.
glevel	Format to display the summary: <ul style="list-style-type: none"> SENTENCE S: As a list of sentences PARAGRAPH P: In a free-form paragraph
numParagraphs	Maximum number of document paragraphs (or sentences) selected for the summary. The default value is 16. The numParagraphs parameter is used only when this parameter yields a smaller summary size than the summary size yielded by the maxPercent parameter, because the function always returns the smallest size summary.
maxPercent	Maximum number of document paragraphs (or sentences) selected for the summary, as a percentage of the total paragraphs (or sentences) in the document. The default value is 10. The maxPercent parameter is used only when this parameter yields a smaller summary size than the summary size yielded by the numParagraphs parameter, because the function always returns the smallest size summary.
num_themes	Number of theme summaries to produce. For example, if you specify 10, then this function returns the top 10 theme summaries. If you specify 0 or NULL, then this function returns all themes in a document. The default value is 50. If the document contains more than 50 themes, only the top 50 themes show conceptual hierarchy.
language	Language name of your summary text, as listed in Supported Languages and Data File Locations .

If using a third-party provider:

Set the following parameters along with additional summarization parameters specific to your provider:

```

{
  "provider": "<AI service provider>",
  "credential_name": "<credential name>",
  "url": "<REST endpoint URL for summarization service>",
  "model": "<REST provider summarization model name>",
  "transfer_timeout": <maximum wait time for the request to complete>,
  "<REST provider parameter>": "<additional REST provider parameters>"
}

```

Table 206-12 Third-Party Provider Parameter Details

Parameter	Description
<code>provider</code>	<p>Third-party service provider that you want to access to get the summary. A REST call is made to the specified provider to access its text summarization model.</p> <p>Specify one of the following values:</p> <ul style="list-style-type: none"> • Cohere • GoogleAI • HuggingFace • OCIGenAI • OpenAI • VertexAI
<code>credential_name</code>	<p>Name of the credential in the form: <i>schema.credential_name</i></p> <p>A credential name holds authentication credentials to enable access to your provider for making REST API calls.</p> <p>You need to first set up your credential by calling the <code>DBMS_VECTOR_CHAIN.CREATE_CREDENTIAL</code> helper function to create and store a credential, and then refer to the credential name here. See CREATE_CREDENTIAL.</p>
<code>url</code>	URL of the API endpoint for each REST call.
<code>model</code>	<p>Name of the third-party text summarization model in the form: <i>schema.model_name</i></p> <p>If the model name is not schema-qualified, then the schema of the procedure invoker is used.</p> <p>Note: For Generative AI, you must specify <i>schema.model_name</i>.</p>
<code>transfer_timeout</code>	<p>Maximum time to wait for the request to complete.</p> <p>The default value is 60 seconds. You can increase this value for busy web servers.</p>

Additional REST provider parameters:

Cohere example:

```
{
  "provider": "cohere",
  "credential_name": "COHERE_CRED",
  "url": "https://api.cohere.example.com/summarize",
  "model": "summarize-model",
  "length": "medium",
  "format": "paragraph",
  "temperature": 1.0
}
```

Google AI example:

```
{
  "provider": "googleai",
  "credential_name": "GOOGLEAI_CRED",
}
```

```

    "url": "https://googleapis.example.com/models/",
    "model": "summarize-model",
    "generation_config": {
      "temperature": 0.9,
      "topP": 1,
      "candidateCount": 1,
      "maxOutputTokens": 256
    }
  }
}

```

Hugging Face example:

```

{
  "provider": "huggingface",
  "credential_name": "HF_CRED",
  "url": "https://api.huggingface.example.co/models/",
  "model": "summarize-model",
  "wait_for_model": "true"
}

```

Generative AI example:

```

{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/summarizeText",
  "model": "summarize-model",
  "length": "medium",
  "format": "paragraph"
}

```

OpenAI example:

```

{
  "provider": "openai",
  "credential_name": "OPENAI_CRED",
  "url": "https://api.openai.example.com",
  "model": "summarize-model",
  "max_tokens": 256,
  "temperature": 1.0
}

```

Vertex AI example:

```

{
  "provider": "vertexai",
  "credential_name": "VERTEXAI_CRED",
  "url": "https://googleapis.example.com/models/",
  "model": "summarize-model",
  "generation_config": {
    "temperature": 0.9,
    "topP": 1,

```

```

        "candidateCount": 1,
        "maxOutputTokens": 256
    }
}

```

Table 206-13 Additional REST Provider Parameter Details

Parameter	Description
length	<p>Approximate length of the summary text:</p> <ul style="list-style-type: none"> SHORT: Roughly up to 2 sentences MEDIUM: Between 3 and 5 sentences LONG: 6 or more sentences AUTO: The model chooses a length based on the input size <p>Note: For Generative AI, you must enter this value in uppercase.</p>
format	<p>Format to display the summary:</p> <ul style="list-style-type: none"> PARAGRAPH: In a free-form paragraph BULLETS: In bullet points <p>Note: For Generative AI, you must enter this value in uppercase.</p>
temperature	<p>Degree of randomness used when generating output text, in the range of 0.0–5.0.</p> <p>To generate the same output for a prompt, use 0. To generate a random new text for that prompt, increase the temperature.</p> <p>Default temperature is 1 and the maximum temperature is 5.</p> <p>Note: To summarize a text, start with the temperature set to 0. If you do not require random results, a recommended temperature value is 0.2 for Generative AI and between 0 and 1 for Cohere. Use a higher value if for example you plan to perform a selection of the various summaries afterward. Do not use a high temperature for summarization because a high temperature encourages the model to produce creative text, which might also include hallucinations.</p>
extractiveness	<p>How much to reuse the input in the summary:</p> <ul style="list-style-type: none"> LOW: Summaries with low extractiveness tend to paraphrase. HIGH: Summaries with high extractiveness lean toward reusing sentences verbatim. <p>Note: For Generative AI, you must enter this value in uppercase.</p>
max_tokens	Maximum number of tokens in the output text.
topP	<p>Probability of tokens in the output, in the range of 0.0–1.0.</p> <p>A lower value provides less random responses and a higher value provides more random responses.</p>
candidateCount	Number of response variations to return, in the range of 1–4.
maxOutputTokens	Maximum number of tokens to generate for each response.
wait_for_model	Whether to wait for the model when it is not ready, as TRUE or FALSE.



Note:

When you enter the length, format, and extractiveness values for Generative AI, ensure to enter them in uppercase letters.

For more information on additional parameters, refer to your third-party provider's documentation.

Examples

These statements generate a summary from an extract on "Transactions", by accessing the Generative AI summarization model.

```
-- select example

var params clob;
exec :params := '
{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/summarizeText",
  "model": "summarize.modelname",
  "temperature": "0.0",
  "extractiveness": "LOW"
}';

select dbms_vector_chain.utl_to_summary(
  'A transaction is a logical, atomic unit of work that contains one or
  more SQL statements. An RDBMS must be able to group SQL statements so
  that they are either all committed, which means they are applied to
  the database, or all rolled back, which means they are undone. An
  illustration of the need for transactions is a funds transfer from a
  savings account to a checking account. The transfer consists of the
  following separate operations:
    1. Decrease the savings account.
    2. Increase the checking account.
    3. Record the transaction in the transaction journal.
  Oracle Database guarantees that all three operations succeed or
  fail as a unit. For example, if a hardware failure prevents a
  statement in the transaction from executing, then the other statements
  must be rolled back.
  Transactions set Oracle Database apart from a file system. If you
  perform an atomic operation that updates several files, and if the
  system fails halfway through, then the files will not be consistent.
  In contrast, a transaction moves an Oracle database from one
  consistent state to another. The basic principle of a transaction is
  "all or nothing": an atomic operation succeeds or fails as a whole.',
  json(:params)) from dual;

-- PL/SQL example

declare
  input clob;
  params clob;
  output clob;
begin
  input := 'A transaction is a logical, atomic unit of work that
  contains one or more SQL statements. An RDBMS must be able to group
  SQL statements so that they are either all committed, which means they
  are applied to the database, or all rolled back, which means they are
```

undone. An illustration of the need for transactions is a funds transfer from a savings account to a checking account. The transfer consists of the following separate operations:

1. Decrease the savings account.
2. Increase the checking account.
3. Record the transaction in the transaction journal.

Oracle Database guarantees that all three operations succeed or fail as a unit. For example, if a hardware failure prevents a statement in the transaction from executing, then the other statements must be rolled back.

Transactions set Oracle Database apart from a file system. If you perform an atomic operation that updates several files, and if the system fails halfway through, then the files will not be consistent. In contrast, a transaction moves an Oracle database from one consistent state to another. The basic principle of a transaction is "all or nothing": an atomic operation succeeds or fails as a whole.';

```

params := '
{
  "provider": "ocigenai",
  "credential_name": "OCI_CRED",
  "url": "https://generativeai.oci.example.com/summarizeText",
  "model": "summarize.modelname",
  "length": "MEDIUM",
  "format": "PARAGRAPH",
  "temperature": 1.0
}';

output := dbms_vector_chain.utl_to_summary(input, json(params));
dbms_output.put_line(output);
if output is not null then
  dbms_lob.freetemporary(output);
end if;
exception
when OTHERS THEN
  DBMS_OUTPUT.PUT_LINE (SQLERRM);
  DBMS_OUTPUT.PUT_LINE (SQLCODE);
end;
/

```

To run an end-to-end example scenario using this function, see [Convert Text String to Summary](#) in *Oracle Database AI Vector Search User's Guide*.

206.2 Supported Languages and Data File Locations

These are the supported languages for which language data files are distributed by default in the specified directories.

Language Name	Abbreviation	Data File
AFRIKAANS	af	ctx/data/eos/dreosaf.txt
AMERICAN	us	ctx/data/eos/dreosus.txt
ARABIC	ar	ctx/data/eos/dreosar.txt

Language Name	Abbreviation	Data File
BASQUE	eu	ctx/data/eos/dreoseu.txt
BELARUSIAN	be	ctx/data/eos/dreosbe.txt
BRAZILIAN PORTUGUESE	ptb	ctx/data/eos/dreosptb.txt
BULGARIAN	bg	ctx/data/eos/dreosbg.txt
CANADIAN FRENCH	frc	ctx/data/eos/dreosfrc.txt
CATALAN	ca	ctx/data/eos/dreosca.txt
CROATIAN	hr	ctx/data/eos/dreoshr.txt
CYRILLIC SERBIAN	csr	ctx/data/eos/dreoscsr.txt
CZECH	cs	ctx/data/eos/dreoscs.txt
DANISH	dk	ctx/data/eos/dreosdk.txt
DARI	prs	ctx/data/eos/dreosprs.txt
DUTCH	nl	ctx/data/eos/dreosnl.txt
EGYPTIAN	eg	ctx/data/eos/dreoseg.txt
ENGLISH	gb	ctx/data/eos/dreosgb.txt
ESTONIAN	et	ctx/data/eos/dreoset.txt
FINNISH	sf	ctx/data/eos/dreossf.txt
FRENCH	f	ctx/data/eos/dreosf.txt
GALICIAN	ga	ctx/data/eos/dreosga.txt
GERMAN	d	ctx/data/eos/dreosd.txt
GERMAN DIN	din	ctx/data/eos/dreosdin.txt
GREEK	el	ctx/data/eos/dreosel.txt
HEBREW	iw	ctx/data/eos/dreosiw.txt
HINDI	hi	ctx/data/eos/dreoshi.txt
HUNGARIAN	hu	ctx/data/eos/dreoshu.txt
ICELANDIC	is	ctx/data/eos/dreosis.txt
INDONESIAN	in	ctx/data/eos/dreosin.txt
ITALIAN	i	ctx/data/eos/dreosi.txt
JAPANESE	ja	ctx/data/eos/dreosja.txt
KOREAN	ko	ctx/data/eos/dreosko.txt
LATIN AMERICAN SPANISH	esa	ctx/data/eos/dreosesa.txt
LATIN BOSNIAN	lbs	ctx/data/eos/dreoslbs.txt
LATIN SERBIAN	lsr	ctx/data/eos/dreoslsr.txt
LATVIAN	lv	ctx/data/eos/dreoslv.txt
LITHUANIAN	lt	ctx/data/eos/dreoslt.txt
MACEDONIAN	mk	ctx/data/eos/dreosmk.txt
MALAY	ms	ctx/data/eos/dreosms.txt

Language Name	Abbreviation	Data File
MEXICAN SPANISH	esm	ctx/data/eos/dreosesm.txt
NORWEGIAN	n	ctx/data/eos/dreosn.txt
NYNORSK	nn	ctx/data/eos/dreosnn.txt
PERSIAN	fa	ctx/data/eos/dreosfa.txt
POLISH	pl	ctx/data/eos/dreospl.txt
PORTUGUESE	pt	ctx/data/eos/dreospt.txt
ROMANIAN	ro	ctx/data/eos/dreosro.txt
RUSSIAN	ru	ctx/data/eos/dreosru.txt
SIMPLIFIED CHINESE	zhs	ctx/data/eos/dreoszhs.txt
SLOVAK	sk	ctx/data/eos/dreossk.txt
SLOVENIAN	sl	ctx/data/eos/dreossil.txt
SPANISH	e	ctx/data/eos/dreose.txt
SWEDISH	s	ctx/data/eos/dreoss.txt
THAI	th	ctx/data/eos/dreosth.txt
TRADITIONAL CHINESE	zht	ctx/data/eos/dreoszht.txt
TURKISH	tr	ctx/data/eos/dreostr.txt
UKRAINIAN	uk	ctx/data/eos/dreosuk.txt
URDU	ur	ctx/data/eos/dreosur.txt

Related Topics

- [CREATE_LANG_DATA](#)
Use the `DBMS_VECTOR_CHAIN.CREATE_LANG_DATA` chunker helper procedure to load your own language data file into the database.

DBMS_WARNING

The `DBMS_WARNING` package provides a way to manipulate the behavior of PL/SQL warning messages, in particular by reading and changing the setting of the `PLSQL_WARNINGS` initialization parameter to control what kinds of warnings are suppressed, displayed, or treated as errors. This package provides the interface to query, modify and delete current system or session settings.

This chapter contains the following topics:

- [Security Model](#)
- [Summary of DBMS_WARNING Subprograms](#)

207.1 DBMS_WARNING Security Model

Note that for all the following interfaces, if value of the scope parameter is `SYSTEM`, then the user must have `ALTER SYSTEM` privilege.

207.2 Summary of DBMS_WARNING Subprograms

This table lists the `DBMS_WARNING` subprograms and briefly describes them.

Table 207-1 *DBMS_WARNING Package Subprograms*

Subprogram	Description
ADD_WARNING_SETTING_CAT Procedure	Modifies the current <code>session</code> or <code>system</code> warning settings of the <code>warning_category</code> previously supplied
ADD_WARNING_SETTING_NUM Procedure	Modifies the current <code>session</code> or <code>system</code> warning settings of the or <code>warning_number</code> previously supplied
GET_CATEGORY Function	Returns the category name, given the message number
GET_WARNING_SETTING_CAT Function	Returns the specific warning category in the session
GET_WARNING_SETTING_NUM Function	Returns the specific warning number in the session
GET_WARNING_SETTING_STRING Function	Returns the entire warning string for the current session
SET_WARNING_SETTING_STRING Procedure	Replaces previous settings with the new value

207.2.1 ADD_WARNING_SETTING_CAT Procedure

You can modify the current session's or system's warning settings with the value supplied in this procedure. The value will be added to the existing parameter setting if the value for the `warning_category` or `warning_value` has not been set, or override the existing value.

The effect of calling this function is same as adding the qualifier (`ENABLE/DISABLE/ERROR`) on the category specified to the end of the current session or system setting.

Syntax

```
DBMS_WARNING.ADD_WARNING_SETTING_CAT (
    warning_category  IN   VARCHAR2,
    warning_value     IN   VARCHAR2,
    scope             IN   VARCHAR2);
```

Parameters

Table 207-2 ADD_WARNING_SETTING_CAT Procedure Parameters

Parameter	Description
<code>warning_category</code>	Name of the category. Allowed values are ALL, INFORMATIONAL, SEVERE and PERFORMANCE.
<code>warning_value</code>	Value for the category. Allowed values are ENABLE, DISABLE, and ERROR.
<code>scope</code>	Specifies if the changes are being performed in the session context or the system context. Allowed values are SESSION or SYSTEM.

207.2.2 ADD_WARNING_SETTING_NUM Procedure

You can modify the current `session` or `system` warning settings with the value supplied in this procedure. If the value was already set, you will override the existing value.

The effect of calling this function is same as adding the qualifier (`ENABLE / DISABLE/ERROR`) on the category specified to the end of the current session or system setting.

Syntax

```
DBMS_WARNING.ADD_WARNING_SETTING_NUM (
    warning_number    IN   NUMBER,
    warning_value     IN   VARCHAR2,
    scope             IN   VARCHAR2);
```

Parameters

Table 207-3 ADD_WARNING_SETTING_NUM Procedure Parameters

Parameter	Description
<code>warning_number</code>	The warning number. Allowed values are all valid warning numbers.

Table 207-3 (Cont.) ADD_WARNING_SETTING_NUM Procedure Parameters

Parameter	Description
warning_value	Value for the category. Allowed values are ENABLE, DISABLE, and ERROR.
scope	Specifies if the changes are being performed in the session context or the system context. Allowed values are SESSION or SYSTEM.

Example 207-1 Enabling the Deprecation Warnings

This example shows how to enable the DEPRECATE pragma warnings using the DBMS_WARNING package for the session.

```
BEGIN
  DBMS_WARNING.ADD_WARNING_SETTING_NUM (6019,
                                         'ENABLE',
                                         'SESSION');

  DBMS_WARNING.ADD_WARNING_SETTING_NUM (6020,
                                         'ENABLE',
                                         'SESSION');

  DBMS_WARNING.ADD_WARNING_SETTING_NUM (6021,
                                         'ENABLE',
                                         'SESSION');

  DBMS_WARNING.ADD_WARNING_SETTING_NUM (6022,
                                         'ENABLE',
                                         'SESSION');
END;
```

207.2.3 GET_CATEGORY Function

This function returns the category name, given the message number.

Syntax

```
DBMS_WARNING.GET_CATEGORY (
  warning_number IN pls_integer)
RETURN VARCHAR2;
```

Parameters**Table 207-4 GET_CATEGORY Function Parameters**

Parameter	Description
warning_number	The warning message number.

207.2.4 GET_WARNING_SETTING_CAT Function

This function returns the specific warning category setting for the current session.

Syntax

```
DBMS_WARNING.GET_WARNING_SETTING_CAT (  
    warning_category IN VARCHAR2)  
RETURN warning_value;
```

Parameters

Table 207-5 GET_WARNING_SETTING_CAT Function Parameters

Parameter	Description
warning_category	Name of the category. Allowed values are all valid category names (ALL, INFORMATIONAL, SEVERE and PERFORMANCE).

207.2.5 GET_WARNING_SETTING_NUM Function

This function returns the specific warning number setting for the current session.

Syntax

```
DBMS_WARNING.GET_WARNING_SETTING_NUM (  
    warning_number IN NUMBER)  
RETURN warning_value;
```

Parameters

Table 207-6 GET_WARNING_SETTING_NUM Function Parameters

Parameter	Description
warning_number	Warning number. Allowed values are all valid warning numbers.

207.2.6 GET_WARNING_SETTING_STRING Function

This function returns the entire warning string for the current session.

Syntax

```
DBMS_WARNING.GET_WARNING_SETTING_STRING  
RETURN VARCHAR2;
```

Usage Notes

Use this function when you do not have `SELECT` or `READ` privilege on `v$parameter` or `v$parameter2` fixed tables, or if you want to parse the warning string yourself and then modify and set the new value using `SET_WARNING_SETTING_STRING`.

207.2.7 SET_WARNING_SETTING_STRING Procedure

This procedure replaces previous settings with the new value.

The warning string may contain mix of category and warning numbers using the same syntax as used on the right hand side of '=' when issuing an ALTER SESSION or SYSTEM SET PLSQL_WARNINGS command. This will have same effect as ALTER SESSION or ALTER SYSTEM command.

Syntax

```
DBMS_WARNING.SET_WARNING_SETTING_STRING (  
    warning_value  IN  VARCHAR2,  
    scope         IN  VARCHAR2);
```

Parameters

Table 207-7 SET_WARNING_SETTING_STRING Procedure Parameters

Parameter	Description
warning_value	The new string that will constitute the new value.
scope	This will specify if the changes are being done in the session context, or system context. Allowed values are SESSION or SYSTEM.

DBMS_WM

The `DBMS_WM` package provides an interface to Oracle Database Workspace Manager (often referred to as Workspace Manager).

For a complete description of this package, see `DBMS_WM` in the *Oracle Database Workspace Manager Developer's Guide*.

DBMS_WORKLOAD_CAPTURE

The `DBMS_WORKLOAD_CAPTURE` package configures the Workload Capture system and produce the workload capture data.

Replay of this capture is implemented by way of the `DBMS_WORKLOAD_REPLAY` package.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_WORKLOAD_CAPTURE Subprograms](#)



See Also:

Oracle Database Testing Guide for more information about database replay

209.1 DBMS_WORKLOAD_CAPTURE Overview

Since the capture infrastructure is instance wide (and also within an Oracle Real Application Clusters (Oracle RAC)), only one workload capture is being produced at any point in time. Thus capture interfaces do not need a state object passed in as a parameter since there is one single state at any point in time. This means that all subprograms cannot be methods of an object but are package wide PL/SQL subprograms.

209.2 DBMS_WORKLOAD_CAPTURE Security Model

The security model describes the privileges needed for using `DBMS_WORKLOAD_CAPTURE`.

The following code describes the minimal set of privileges required to:

- Create directory objects
- Operate the interface provided by the `DBMS_WORKLOAD_CAPTURE` and `DBMS_WORKLOAD_REPLAY` packages
- Act as a replay client user (`wrc someuser/somepassword` or `wrc USER=someuser PASSWORD=somepassword`)

```
DROP USER rom1 CASCADE;
CREATE USER rom1 IDENTIFIED BY rom1;
```

```
GRANT EXECUTE ON DBMS_WORKLOAD_CAPTURE TO rom1;
GRANT EXECUTE ON DBMS_WORKLOAD_REPLAY TO rom1;
```

```
GRANT CREATE SESSION TO rom1;
GRANT CREATE ANY DIRECTORY TO rom1;
```

```
GRANT SELECT_CATALOG_ROLE TO rom1;
GRANT BECOME USER TO rom1;
```

Appropriate OS permissions are required to access and manipulate files and directories on both the capture and replay system. This means that the Oracle process(es) and the OS user performing the capture or replay must be able to access and manipulate at least one common directory accessible from the host where the instance is running. Additionally, the OS user performing the replay should be able to execute wrcc on hosts that are used for the replay clients and be able to access the file system appropriately to copy the capture to the replay clients' hosts if required.

209.3 Summary of DBMS_WORKLOAD_CAPTURE Subprograms

This table lists the DBMS_WORKLOAD_CAPTURE package subprograms in alphabetical order.

Table 209-1 DBMS_WORKLOAD_CAPTURE Package Subprograms

Subprogram	Description
ADD_FILTER Procedure	Adds a specified filter
DECRYPT_CAPTURE Procedure	This procedure decrypts sensitive data in workload capture that was encrypted using various advanced encryption standards such as AES128, AES192, or AES256.
DELETE_CAPTURE_INFO Procedure	Deletes the rows in the DBA_WORKLOAD_CAPTURES and DBA_WORKLOAD_FILTERS views that corresponds to the given workload capture ID
DELETE_FILTER Procedure	Deletes a specified filter
ENCRYPT_CAPTURE Procedure	This procedure encrypts sensitive data in workload capture using various advanced encryption standards such as AES128, AES192, or AES256.
EXPORT_AWR Procedure	Exports the AWR snapshots associated with a given capture ID
FINISH_CAPTURE Procedure	Finalizes the workload capture by signaling all connected sessions to stop capture, and stops future requests to the database from being captured
GET_CAPTURE_INFO Function	Retrieves all the information regarding a workload capture present in the stipulated directory, imports the information into the DBA_WORKLOAD_CAPTURES and DBA_WORKLOAD_FILTERS views, and returns the appropriate DBA_WORKLOAD_CAPTURES.ID
IMPORT_AWR Function	Imports the AWR snapshots associated with a given capture ID
REPORT Function	Returns a report on the workload capture under consideration using one or more different sources
START_CAPTURE Procedure	Initiates workload capture on all instances

209.3.1 ADD_FILTER Procedures

This procedure adds a filter to capture a subset of the workload.

Syntax

```
DBMS_WORKLOAD_CAPTURE.ADD_FILTER (
    fname          IN   VARCHAR2 NOT NULL,
    fattribute     IN   VARCHAR2 NOT NULL,
    fvalue        IN   VARCHAR2 NOT NULL);
```

```
DBMS_WORKLOAD_CAPTURE.ADD_FILTER (
    fname          IN   VARCHAR2 NOT NULL,
    fattribute     IN   VARCHAR2 NOT NULL,
    fvalue        IN   NUMBER NOT NULL);
```

Parameters

Table 209-2 ADD_FILTER Procedure Parameters

Parameter	Description
fname	Name for the filter to be added. Can be used to delete the filter later if it is not required. (Mandatory)
fattribute	Specifies the attribute on which the filter needs to be applied (Mandatory). The possible values are: <ul style="list-style-type: none"> INSTANCE_NUMBER - type NUMBER USER - type STRING MODULE - type STRING ACTION - type STRING PROGRAM - type STRING SERVICE - type STRING PDB_NAME - type STRING
fvalue	Specifies the value to which the given attribute should be equal to for the filter to be considered active. Wildcards like '%' are acceptable for all attributes that are of type STRING. This means that the filter for a NUMBER attribute is parsed as "attribute = value", with the filter for a STRING attribute parsed as "attribute like value" (Mandatory).

Usage Notes

- The workload capture filters work in either the `DEFAULT INCLUSION` or the `DEFAULT EXCLUSION` mode as determined by the `default_action` input to the [START_CAPTURE Procedure](#).
- `ADD_FILTER` adds a new filter that affects the next workload capture, and whether the filters are considered as `INCLUSION` filters or `EXCLUSION` filters depends on the value of the `default_action` input to [START_CAPTURE Procedure](#).
- Filters once specified are valid only for the next workload capture. If the same set of filters need to be used for subsequent capture, they need to be specified each time before the [START_CAPTURE Procedure](#) is executed.
- All the filters are listed in the `DBA_WORKLOAD_FILTERS` view.

- You can capture the workload for a particular PDB by specifying a filter of PDB type.

Examples

- By default, a capture works in an `INCLUSION` mode, which records everything except for those requests that satisfy conditions of specified filters. For example, if you want to exclude all requests from `SCOTT`, you can add the following filter before starting a capture.

```
EXEC DBMS_WORKLOAD_CAPTURE.ADD_FILTER ('filter user1', 'USER', 'SCOTT');
```

- Multiple filters are evaluated according to the logical disjunction operator `OR`. Therefore, if you want to record workload for both `SCOTT` and `JOHN`, you add an additional filter:

```
EXEC DBMS_WORKLOAD_CAPTURE.ADD_FILTER ('filter user2', 'USER', 'JOHN');
```

- In a CDB, you exclude the workload of a particular PDB by the filter:

```
EXEC DBMS_WORKLOAD_CAPTURE.ADD_FILTER ('filter pdb workload', 'PDB_NAME',  
'CDB1_PDB1');
```

- To use [DBMS_APPLICATION_INFO](#) to identify workload that is issued to the database:

```
DBMS_APPLICATION_INFO.SET_MODULE('ORDER_ENTRY', NULL);  
-- run some SQL here  
DBMS_APPLICATION_INFO.SET_ACTION('ORDER_ENTRY_LOG');  
-- run logging SQL
```

- If having captured workload, you want to exclude the logging SQL from the captured, specify a filter for capture:

```
DBMS_WORKLOAD_CAPTURE.ADD_FILTER('filter logging operations', 'ACTION',  
'ORDER_ENTRY_LOG');
```

- To filter out the full order entry transaction, define a filter:

```
DBMS_WORKLOAD_CAPTURE.ADD_FILTER('filter order entry', 'MODULE',  
'ORDER_ENTRY');
```

209.3.2 DECRYPT_CAPTURE Procedure

This procedure decrypts sensitive data in workload capture that was encrypted using various advanced encryption standards such as AES128, AES192, or AES256.

Syntax

```
DBMS_WORKLOAD_CAPTURE.DECRYPT_CAPTURE (  
  src_dir          IN  VARCHAR2,  
  dst_dir          IN  VARCHAR2);
```

Parameters

Table 209-3 DECRYPT_CAPTURE Procedure Parameters

Parameter	Description
src_dir	A directory object pointing to the workload capture to be decrypted. This parameter is case sensitive.
dst_dir	A directory object pointing to an OS path that has write permissions. The decrypted capture files will be written to this directory This parameter is case sensitive.

Usage Notes

This procedure relies on a software keystore. The identifier is `oracle.rat.database_replay.encryption` (case-sensitive).

209.3.3 DELETE_CAPTURE_INFO Procedure

This procedure deletes the rows in the `DBA_WORKLOAD_CAPTURES` and `DBA_WORKLOAD_FILTERS` views that corresponds to the given workload capture ID.

Syntax

```
DBMS_WORKLOAD_CAPTURE.DELETE_CAPTURE_INFO
  (capture_id IN NUMBER);
```

Parameters

Table 209-4 DELETE_CAPTURE_INFO Procedure Parameters

Parameter	Description
capture_id	ID of the workload capture that needs to be deleted. Corresponds to <code>DBA_WORKLOAD_CAPTURES.ID</code> . (Mandatory)

Usage Notes

Passing the ID of a capture that is in progress will first automatically stop that capture.

209.3.4 DELETE_FILTER Procedure

This procedure deletes a specified filter.

Syntax

```
DBMS_WORKLOAD_CAPTURE.DELETE_FILTER (
  filter_name IN VARCHAR2(40) NOT NULL);
```

Parameters

Table 209-5 DELETE_FILTER Procedure Parameters

Parameter	Description
filter_name	Filter to be deleted

Usage Notes

The `DELETE_FILTER` Procedure only affects filters that have not been used by any previous capture. Consequently, filters can be deleted only if they have been added using the [ADD_FILTER Procedures](#) after any capture has been completed. Filters that have been added using `ADD_FILTER` before a `START_CAPTURE` and `FINISH_CAPTURE` cannot be deleted anymore using this subprogram.

209.3.5 ENCRYPT_CAPTURE Procedure

This procedure encrypts sensitive data in workload capture using various advanced encryption standards such as AES128, AES192, or AES256. To encrypt capture on the fly, use encryption parameter in `START_CAPTURE` procedure.

Syntax

```
DBMS_WORKLOAD_CAPTURE.ENCRYPT_CAPTURE
  src_dir      IN VARCHAR2,
  dst_dir      IN VARCHAR2,
  encryption   IN VARCHAR2 DEFAULT 'AES256');
```

Parameters

Table 209-6 ENCRYPT_CAPTURE Procedure Parameters

Parameter	Description
src_dir	A directory object pointing to the workload capture to be encrypted. The parameter value is case sensitive.
dst_dir	A directory object pointing to an OS path that has write permissions. The encrypted capture files will be written to this directory. The parameter value is case sensitive.
encryption	Specifies if sensitive data in workload capture is encrypted or not. The possible values are: AES128, AES192, and AES256. The default value is AES256.

Usage Notes

For encrypted capture, the `ENCRYPT_CAPTURE` Procedure relies on a software keystore. The identifier is `oracle.rat.database_replay.encryption` (case-sensitive).

209.3.6 EXPORT_AWR Procedure

This procedure exports the AWR snapshots associated with a given capture ID.

Syntax

```
DBMS_WORKLOAD_CAPTURE.EXPORT_AWR (
    capture_id    IN NUMBER);
```

Parameters

Table 209-7 EXPORT_AWR Procedure Parameters

Parameter	Description
capture_id	ID of the capture whose AWR snapshots are to be exported. (Mandatory)

Usage Notes

This procedure works only if the corresponding workload capture was performed in the current database (meaning that the corresponding row in `DBA_WORKLOAD_CAPTURES` was not created by calling the [GET_CAPTURE_INFO Function](#)) and the AWR snapshots that correspond to the original capture time period are still available.

209.3.7 FINISH_CAPTURE Procedure

This procedure signals all connected sessions to stop the workload capture and stops future requests to the database from being captured.

Syntax

```
DBMS_WORKLOAD_CAPTURE.FINISH_CAPTURE
    timeout    IN    NUMBER    DEFAULT 30
    reason     IN    VARCHAR2  DEFAULT NULL);
```

Parameters

Table 209-8 FINISH_CAPTURE Procedure Parameters

Parameter	Description
timeout	Specifies in seconds for how long the procedure should wait before it times out. Pass 0 if you want to cancel the current workload capture and not wait for any sessions to flush its capture buffers. Default value: 30 seconds
reason	Specifies a reason for calling the procedure. The reason appears in the column <code>ERROR_MESSAGE</code> of the view <code>DBA_WORKLOAD_CAPTURES</code> .

Usage Notes

- By default, `FINISH_CAPTURE` waits for 30 seconds to receive a successful acknowledgement from all sessions in the database cluster before timing out.

- All sessions that either were in the middle of executing a user request or received a new user request, while `FINISH_CAPTURE` was waiting for acknowledgements, flush their buffers and send back their acknowledgement to `FINISH_CAPTURE`.
- If a database session remains idle (waiting for the next user request) throughout the duration of `FINISH_CAPTURE`, the session might have unflushed capture buffers and does not send its acknowledgement to `FINISH_CAPTURE`.

To avoid this, do not have sessions that remain idle (waiting for the next user request) while invoking `FINISH_CAPTURE`. Either close the database session(s) before running `FINISH_CAPTURE` or send new database requests to those sessions during `FINISH_CAPTURE`.

209.3.8 GET_CAPTURE_INFO Function

This procedure retrieves all information regarding a workload capture present in the stipulated directory, imports the information into the `DBA_WORKLOAD_CAPTURES` and `DBA_WORKLOAD_FILTERS` views, and returns the appropriate `DBA_WORKLOAD_CAPTURES.ID`

Syntax

```
DBMS_WORKLOAD_CAPTURE.GET_CAPTURE_INFO
  dir      IN  VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 209-9 GET_CAPTURE_INFO Function Parameters

Parameter	Description
dir	Name of the <code>DIRECTORY</code> object (case sensitive) where all the workload capture files are located (Mandatory)

Usage Notes

If an appropriate row describing the capture in the stipulated directory already exists in `DBA_WORKLOAD_CAPTURES`, the [GET_CAPTURE_INFO Function](#) simply returns that row's `DBA_WORKLOAD_CAPTURES.ID`. If no existing row matches the capture present in the stipulated directory a new row is inserted to `DBA_WORKLOAD_CAPTURES` and that row's `ID` is returned.

209.3.9 IMPORT_AWR Function

This procedure imports the AWR snapshots associated with a given capture ID provided those AWR snapshots were exported earlier from the original capture system using the `EXPORT_AWR` procedure.

Syntax

```
DBMS_WORKLOAD_CAPTURE.IMPORT_AWR (
  capture_id      IN  NUMBER,
  staging_schema  IN  VARCHAR2,
  force_cleanup   IN  BOOLEAN DEFAULT FALSE)
RETURN NUMBER;
```


Parameters

Table 209-10 IMPORT_AWR Function Parameters

Parameter	Description
capture_id	ID of the capture whose AWR snapshots should be imported. (Mandatory)
staging_schema	Name of a valid schema in the current database which can be used as a staging area while importing the AWR snapshots from the capture directory to the SYS AWR schema. The SYS schema is not a valid input. (Mandatory, Case sensitive).
force_cleanup	<p>Values:</p> <ul style="list-style-type: none"> TRUE - any AWR data present in the given staging_schema are removed before the actual import operation. All tables with names that match any of the tables in AWR are dropped before the actual import. This typically is equivalent to dropping all tables returned by the following SQL: <pre>SELECT table_name FROM dba_tables WHERE owner = staging_schema AND table_name like 'WR_\$%';</pre> <p>Use this option only if you are sure that there are no important data in any such tables in the staging_schema.</p> FALSE - (default) no tables dropped from the staging_schema prior to the import operation

Return Values

Returns the new randomly generated database ID that was used to import the AWR snapshots. The same value can be found in the AWR_DBID column in the DBA_WORKLOAD_CAPTURES view.

Usage Notes

IMPORT_AWR fails if the staging_schema provided as input contains any tables with the same name as any of the AWR tables, such as WRM\$_SNAPSHOT or WRH\$_PARAMETER. Please drop any such tables in the staging_schema before invoking IMPORT_AWR.

Related Topics

- [EXPORT_AWR Procedure](#)
This procedure exports the AWR snapshots associated with a given capture ID.

209.3.10 REPORT Function

This function generates a report on the stipulated workload capture.

Syntax

```
DBMS_WORKLOAD_CAPTURE.REPORT (
  capture_id      IN   NUMBER,
  format          IN   VARCHAR2)
RETURN CLOB;
```

Parameters

Table 209-11 REPORT Function Parameters

Parameter	Description
capture_id	ID of the workload capture whose capture report is required. (Mandatory) This relates to the directory that contains the workload capture on which the Report needs to be generated. Should be a valid DIRECTORY object that points to a valid directory in the host system that contains a workload capture.
format	Specifies the report format. Valid values are DBMS_WORKLOAD_CAPTURE.TYPE_TEXT and DBMS_WORKLOAD_CAPTURE.TYPE_HTML.(Mandatory)

Return Values

The report body in the desired format returned as a CLOB.

Table 209-12 Constants Used by Report Function

Constant	Type	Value	Description
TYPE_HTML	VARCHAR2 (4)	'HTML'	Generates the HTML version of the report
TYPE_TEXT	VARCHAR2 (4)	'TEXT'	Used as input to the format argument to generate the text version of the report

209.3.11 START_CAPTURE Procedure

This procedure initiates workload capture on all instances.

Syntax

```
DBMS_WORKLOAD_CAPTURE.START_CAPTURE (
  name           IN  VARCHAR2,
  dir            IN  VARCHAR2,
  duration       IN  NUMBER   DEFAULT NULL,
  default_action IN  VARCHAR2 DEFAULT 'INCLUDE',
  auto_unrestrict IN BOOLEAN DEFAULT TRUE,
  capture_sts    IN  BOOLEAN DEFAULT FALSE,
  sts_cap_interval IN NUMBER  DEFAULT 300,
  plsqli_mode    IN  VARCHAR2 DEFAULT 'TOP_LEVEL',
  encryption     IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 209-13 START_CAPTURE Procedure Parameters

Parameter	Description
name	Name of the workload capture. Allows the workload capture to be given a label, such as "Thanksgiving weekend" or "Christmas peak workload" for future reference. The workload capture's name is preserved along with the captured workload actions. (Mandatory)
dir	Name of the DIRECTORY object (case sensitive) where all the workload capture files are stored. Should contain enough space to hold all the workload capture files. (Mandatory)
duration	Optional input to specify the duration (in seconds) for which the workload needs to be captured. DEFAULT is NULL which means that workload capture continues until the user executes DBMS_WORKLOAD_CAPTURE.FINISH_CAPTURE.
default_action	Can be either INCLUDE or EXCLUDE. Determines whether, by default, every user request should be captured or not. Also determines whether the workload filters specified should be considered as INCLUSION filters or EXCLUSION filters. <ul style="list-style-type: none"> If INCLUDE, by default all user requests to the database are captured, except for the part of the workload defined by the filters. In this case, all the filters specified using the ADD_FILTER Procedures are treated as EXCLUSION filters, determining the workload that is not captured. (DEFAULT, and so all the filters specified are assumed to be EXCLUSION filters.) If EXCLUDE, by default no user request to the database is captured, except for the part of the workload defined by the filters. In this case, all the filters specified using the ADD_FILTER Procedures are treated as INCLUSION filters, determining the workload that is captured.
auto_unrestrict	Can be either TRUE or FALSE. <ul style="list-style-type: none"> If TRUE, all instances started up in RESTRICTED mode using STARTUP RESTRICT are automatically unrestricted upon a successful START_CAPTURE. (DEFAULT) If FALSE, no database instance is automatically unrestricted.
capture_sts	If this parameter is TRUE, a SQL tuning set capture is also started in parallel with workload capture. The resulting SQL tuning set can be exported using the EXPORT_AWR Procedure along with the AWR data. Currently, parallel STS capture is not supported in an Oracle RAC environment, so this parameter has no effect if used in that context. Capture filters defined using the DBMS_WORKLOAD_REPLAY interface do not apply to the SQL tuning set capture. The calling user must have the appropriate privileges ('ADMINISTER SQL TUNING SET'). If starting SQL set capture fails, workload capture is stopped. The reason is stored in DBA_WORKLOAD_CAPTURES.ERROR_MESSAGE. The default value is FALSE.
sts_cap_interval	Specifies the capture interval of the SQL set capture from the cursor cache in seconds. The default value is 300.

Table 209-13 (Cont.) START_CAPTURE Procedure Parameters

Parameter	Description
plsql_mode	<p>Specifies the PL/SQL capture mode:</p> <ul style="list-style-type: none"> • TOP_LEVEL — only top-level PL/SQL calls are captured • EXTENDED — both top-level PL/SQL calls and SQL called from PL/SQL are captured
encryption	<p>Specify if sensitive data in workload capture is encrypted or not. The possible values are:</p> <ul style="list-style-type: none"> • NULL — capture files are not encrypted • AES128 — capture files are encrypted using AES128 • AES192 — capture files are encrypted using AES192 • AES256 — capture files is encrypted using AES256 <p>The default value is NULL.</p>

Usage Notes

- All user requests sent to database after a successful invocation of `START_CAPTURE` are recorded in the given `dir` directory for the given duration provided that one was specified. If no duration was specified, the capture lasts indefinitely until the [FINISH_CAPTURE Procedure](#) is executed.
- A workload capture once started continues to record user requests across database instance shutdowns and startups for the specified duration, or until `FINISH_CAPTURE` is executed, whichever occurs first.
- One can use workload filters (as described with regard to the [ADD_FILTER Procedures](#)) to capture only a subset of the user requests sent to the database. By default, when no workload filters are defined, all user requests are captured.
- Workload that is initiated from Oracle Database background processes (such as `SMON`, `PMON`, `MMON`) and Oracle Database Scheduler Jobs (as detailed in the [DBMS_SCHEDULER](#) package) is not captured, no matter how the workload filters are defined. These activities should happen automatically on an appropriately configured replay system.
- By default, all database instances that were started up in `RESTRICTED` mode using `STARTUP RESTRICT` are `UNRESTRICTED` upon a successful invocation of `START_CAPTURE`. Use `FALSE` for the `auto_unrestrict` input parameter, if you do not want this behavior.
- It is important to have a well-defined starting point for the workload so that the replay system can be restored to that point before initiating a replay of the captured workload. To have a well-defined starting point for the workload capture, it is preferable not to have any active user sessions when `START_CAPTURE` is executed. If ongoing sessions have ongoing transactions, those transactions are not replayed properly in subsequent database replays, since only that part of the transaction whose calls were executed after `START_CAPTURE` are replayed.
- For encrypted capture, the `START_CAPTURE` Procedure relies on a software keystore. The identifier is `oracle.rat.database_replay.encryption` (case-sensitive).
- You must configure a software keystore in `auto-login` mode. Otherwise, if the database is bounced during capture, the capture is automatically terminated.

210

DBMS_WORKLOAD_REPLAY

The `DBMS_WORKLOAD_REPLAY` package provides an interface to replay a workload capture.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_WORKLOAD_REPLAY Subprograms](#)



See Also:

Oracle Database Testing Guide for more information about database replay

210.1 DBMS_WORKLOAD_REPLAY Overview

The `DBMS_WORKLOAD_REPLAY` package provides an interface to replay a workload capture that was originally created by way of the `DBMS_WORKLOAD_CAPTURE` package.

Typically, the `DBMS_WORKLOAD_CAPTURE` package is used in the production system to capture a production workload, and the `DBMS_WORKLOAD_REPLAY` package is subsequently used in a test system to replay the captured production workload for testing purposes.

Related Topics

- [DBMS_WORKLOAD_CAPTURE](#)
The `DBMS_WORKLOAD_CAPTURE` package configures the Workload Capture system and produce the workload capture data.

210.2 DBMS_WORKLOAD_REPLAY Security Model

The security model describes the privileges needed for using `DBMS_WORKLOAD_REPLAY`.

The following code sample shows the minimum set of privileges required to:

- Create directory objects
- Operate the interface provided by the `DBMS_WORKLOAD_CAPTURE` and `DBMS_WORKLOAD_REPLAY` packages
- Act as a replay client user (`wrc someuser/somepassword` or `wrc USER=someuser PASSWORD=somepassword`)

```
DROP USER rom1 CASCADE;  
CREATE USER rom1 IDENTIFIED BY rom1;
```

```
GRANT EXECUTE ON DBMS_WORKLOAD_CAPTURE TO rom1;  
GRANT EXECUTE ON DBMS_WORKLOAD_REPLAY TO rom1;
```

```
GRANT CREATE SESSION TO rom1;
GRANT CREATE ANY DIRECTORY TO rom1;
GRANT SELECT_CATALOG_ROLE TO rom1;
GRANT BECOME USER TO rom1;
```

Appropriate OS permissions are required to access and manipulate files and directories on both the capture and replay system. The Oracle process(es) and the OS user performing the capture or replay must be able to access and manipulate at least one common directory accessible from the host where the instance is running.

The replay client is a multithreaded program (an executable named `wrc` located in the `$ORACLE_HOME/bin` directory) where each thread submits a workload from a captured session. The OS user performing the replay must be able to execute `wrc` on hosts that are used for the replay clients and be able to access the file system appropriately to be able to copy the capture to the replay clients' hosts if required.

210.3 Summary of DBMS_WORKLOAD_REPLAY Subprograms

This table lists the `DBMS_WORKLOAD_REPLAY` package subprograms in alphabetical order.

Table 210-1 DBMS_WORKLOAD_REPLAY Package Subprograms

Subprogram	Description
ADD_CAPTURE Function	Adds the given capture to the current schedule
ADD_FILTER Procedure	Adds a filter to replay only a subset of the captured workload
ADD_SCHEDULE_ORDERING Function	Adds a schedule order between two captures
ASSIGN_GROUP_TO_INSTANCE Procedure	Modifies the view <code>DBA_WORKLOAD_GROUP_ASSIGNMENTS</code>
BEGIN_REPLAY_SCHEDULE Procedure	Initiates the creation of a reusable replay schedule
CALIBRATE Function	Operates on a processed workload capture directory to estimate the number of hosts and workload replay clients needed to faithfully replay the given workload
CANCEL_REPLAY Procedure	Cancels the workload replay in progress
COMPARE_PERIOD_REPORT Procedure	Generates a report comparing a replay to its capture or to another replay of the same capture
COMPARE_SQLSET_REPORT Function	Generates a report comparing a sqlset captured during replay to one captured during workload capture or to one captured during another replay of the same capture
CREATE_FILTER_SET Procedure	Uses the replay filters added to create a set of filters to use against the replay in <code>replay_dir</code>
DELETE_FILTER Procedure	Deletes the named filter
DELETE_REPLAY_INFO Procedure	Deletes the rows in <code>DBA_WORKLOAD_REPLAYS</code> that corresponds to the given workload replay ID
END_REPLAY_SCHEDULE Procedure	Wraps up the creation of the current schedule

Table 210-1 (Cont.) DBMS_WORKLOAD_REPLAY Package Subprograms

Subprogram	Description
EXPORT_AWR Procedure	Exports the Automatic Workload Repository (AWR) snapshots associated with a given replay ID
GENERATE_CAPTURE_SUBSET Procedure	Creates a new capture from an existing workload capture
GET_DIVERGING_STATEMENT Function	Exports the Automatic Workload Repository (AWR) snapshots associated with a given replay ID
GET_REPLAY_DIRECTORY Function	Returns the current replay directory set by the SET_REPLAY_DIRECTORY Procedure .
GET_REPLAY_INFO Function	Retrieves information about the workload capture and the history of all the workload replay attempts from the related directory
GET_REPLAY_TIMEOUT Procedure	Retrieves the replay timeout setting
IMPORT_AWR Function	Imports the Automatic Workload Repository (AWR) snapshots associated with a given replay ID
INITIALIZE_CONSOLIDATED_REPLAY Procedure	Puts the database state in <code>INIT</code> for a multiple-capture replay
INITIALIZE_REPLAY Procedure	Initializes replay, and loads specific data produced during processing into the database
IS_REPLAY_PAUSED Function	Reports whether the replay is currently paused
LOAD_LONG_SQLTEXT Procedure	Loads the captured SQL statements that are longer than 1000 characters to the <code>DBA_WORKLOAD_LONG_SQLTEXT</code> view
PAUSE_REPLAY Procedure	Pauses the in-progress workload replay
POPULATE_DIVERGENCE Procedure	Precomputes the divergence information for the given call, stream, or the whole replay so that the GET_DIVERGING_STATEMENT Function returns as quickly as possible for the precomputed calls
PREPARE_CONSOLIDATED_REPLAY Procedure	Puts the database in a special "Prepare" mode for a multiple-capture replay
PREPARE_REPLAY Procedure	Puts the database in a special "Prepare" mode
PROCESS_CAPTURE Procedure	Processes the workload capture found in <code>capture_dir</code> in place
REMAP_CONNECTION Procedure	Remaps the captured connection to a new one so that the user sessions can connect to the database in a desired way during workload replay
REMOVE_CAPTURE Procedure	Removes the given capture from the current schedule
REMOVE_SCHEDULE_ORDERING Procedure	Removes an existing schedule order from the current replay schedule
REPORT Function	Generates a report on the given workload replay
RESUME_REPLAY Procedure	Resumes a paused workload replay
REUSE_REPLAY_FILTER_SET Procedure	Reuses filters in the specified filter set as if each were added using the ADD_SCHEDULE_ORDERING Function

Table 210-1 (Cont.) DBMS_WORKLOAD_REPLAY Package Subprograms

Subprogram	Description
SET_ADVANCED_PARAMETER Procedure	Sets an advanced parameter for replay besides the ones used with the PREPARE_REPLAY Procedure
SET_REPLAY_DIRECTORY Procedure	Sets a directory that contains multiple workload captures as the current replay directory
SET_REPLAY_TIMEOUT Procedure	Sets the replay timeout setting
SET_SQL_MAPPING Procedure	Specifies SQL statements to be skipped or replaced during a database replay operation
SET_USER_MAPPING Procedure	Sets a new schema or user name to be used during replay instead of the captured user
START_CONSOLIDATED_REPLAY Procedure	Starts the replay of a multiple-capture capture
START_REPLAY Procedure	Starts the workload replay
USE_FILTER_SET Procedure	Uses the given filter set that has been created by calling the CREATE_FILTER_SET Procedure to filter the current replay

210.3.1 ADD_CAPTURE Function

This function adds the given capture to the current schedule. The directory has to be a valid capture processed in the current database's version. It returns a unique ID that identifies this capture within this schedule.

Syntax

```
DBMS_WORKLOAD_REPLAY.ADD_CAPTURE (
    capture_dir_name      IN    VARCHAR2,
    start_delay_seconds   IN    NUMBER DEFAULT 0,
    stop_replay          IN    BOOLEAN FALSE,
    take_begin_snapshot  IN    BOOLEAN TRUE,
    take_end_snapshot    IN    BOOLEAN TRUE,
    query_only           IN    BOOLEAN DEFAULT FALSE)
RETURN NUMBER;
```

```
DBMS_WORKLOAD_REPLAY.ADD_CAPTURE (
    capture_dir_name      IN    VARCHAR2,
    start_delay_seconds   IN    NUMBER DEFAULT 0,
    stop_replay          IN    BOOLEAN FALSE,
    take_begin_snapshot  IN    BOOLEAN TRUE,
    take_end_snapshot    IN    BOOLEAN TRUE,
    query_only           IN    VARCHAR2 DEFAULT 'N')
RETURN NUMBER;
```


Parameters

Table 210-2 ADD_CAPTURE Function Parameters

Parameter	Description
capture_dir_name	Name of the OS directory containing the capture under the replay top-level directory
start_delay_seconds	Delay time in seconds before the replay of this capture starts
stop_replay	Stop the replay after it finishes
take_begin_snapshot	Take an AWR snapshot when the replay of this capture starts
take_end_snapshot	Take an AWR snapshot when the replay of this capture finishes
query_only	Replay only the read-only queries of this workload capture

Usage Notes

The [SET_REPLAY_DIRECTORY Procedure](#) must have already been called.

210.3.2 ADD_FILTER Procedure

This procedure adds a filter to replay only a subset of the captured workload.

The procedure adds a new filter that is used in the next replay filter set created using the [CREATE_FILTER_SET Procedure](#). This filter will be considered an "INCLUSION" or "EXCLUSION" filter depending on the argument passed to `CREATE_FILTER_SET` when creating the filter set.

Syntax

```
DBMS_WORKLOAD_REPLAY.ADD_FILTER (
    fname          IN VARCHAR2,
    fattribute     IN VARCHAR2,
    fvalue         IN VARCHAR2);
```

```
DBMS_WORKLOAD_REPLAY.ADD_FILTER (
    fname          IN VARCHAR2,
    fattribute     IN VARCHAR2,
    fvalue         IN NUMBER);
```

Parameters

Table 210-3 ADD_FILTER Procedure Parameters

Parameter	Description
fname	(Mandatory) Name of the filter. Can be used to delete the filter later if it is not required.

Table 210-3 (Cont.) ADD_FILTER Procedure Parameters

Parameter	Description
fattribute	(Mandatory) Specifies the attribute on which the filter is defined as one of the following values of type <code>STRING</code> : <ul style="list-style-type: none"> • <code>USER</code> • <code>MODULE</code> • <code>ACTION</code> • <code>PROGRAM</code> • <code>SERVICE</code> • <code>CONNECTION_STRING</code>
fvalue	(Mandatory) Specifies the value to which the given 'attribute' must be equal to for the filter to be considered active. Wildcards such as '%' are acceptable for all attributes that are of type <code>STRING</code> . Currently all the listed values of <code>fattribute</code> are of type <code>STRING</code> . <code>INSTANCE_NUMBER</code> is a <code>NUMBER</code> attribute. It is currently only supported for capture.

210.3.3 ADD_SCHEDULE_ORDERING Function

This function adds a schedule order between two captures.

Together, `schedule_capture_id` and `waitfor_capture_id` form a schedule ordering that previously added by the [ADD_SCHEDULE_ORDERING Function](#). The order is that replay of capture indicated by `schedule_capture_id` will not start unless the replay of capture indicated by `waiting_for_capture_id` finishes.

Syntax

```
DBMS_WORKLOAD_REPLAY.ADD_SCHEDULE_ORDERING (
    schedule_capture_id    IN VARCHAR2,
    waitfor_capture_id     IN VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 210-4 ADD_SCHEDULE_ORDERING Function Parameters

Parameter	Description
<code>schedule_capture_id</code>	Points to a capture that has been added to the current replay schedule. According to the new schedule ordering added by this subprogram, its replay will not start until the replay of another capture specified by <code>waitfor_capture_id</code> runs to completion.
<code>waitfor_capture_id</code>	Points to a capture that has been added to the current replay schedule. According to the new schedule ordering added by this subprogram, the replay of capture specified by <code>schedule_capture_id</code> will not start until the replay of this capture runs to completion.

Return Values

Returns a non-zero error code if the constraint cannot be added

Usage Notes

The two captures must have already been added to the replay schedule.

210.3.4 ASSIGN_GROUP_TO_INSTANCE Procedure

This procedure modifies the view `DBA_WORKLOAD_GROUP_ASSIGNMENTS`.

Syntax

```
DBMS_WORKLOAD_REPLAY.ASSIGN_GROUP_TO_INSTANCE (
    group_id          IN INTEGER,
    instance_number  IN INTEGER);
```

Parameters

Table 210-5 ASSIGN_GROUP_TO_INSTANCE Procedure Parameters

Parameter	Description
<code>group_id</code>	The identifier of the specified group of capture files
<code>instance_number</code>	The number used for instance registration. It is equivalent to the <code>INSTANCE_NUMBER</code> column in <code>V\$INSTANCE</code> .



See Also:

- `DBA_WORKLOAD_GROUP_ASSIGNMENTS` in *Oracle Database Reference*
- `V$INSTANCE` in *Oracle Database Reference*

210.3.5 BEGIN_REPLAY_SCHEDULE Procedure

This procedure initiates the creation of a reusable replay schedule.

Syntax

```
DBMS_WORKLOAD_REPLAY.BEGIN_REPLAY_SCHEDULE (
    replay_dir_obj  IN  VARCHAR2,
    schedule_name  IN  VARCHAR2);
```

Parameters

Table 210-6 BEGIN_REPLAY_SCHEDULE Procedure Parameters

Parameter	Description
replay_dir_obj	Directory object that points to the replay directory that contains all the capture directories involved in the schedule
schedule_name	Name of the schedule to be replayed

Usage Notes

- Only one schedule can be in creation mode at a time. Calling the subprogram again before `end_replay_schedule` will raise an error.
- Prerequisites:
 - The workload capture was already processed using the [PROCESS_CAPTURE Procedure](#) in the same database version.
 - The user must have copied the capture directory appropriately.
 - The database is not in replay mode.
 - The [SET_REPLAY_DIRECTORY Procedure](#) has already been called.

210.3.6 CALIBRATE Function

This function operates on a processed workload capture directory to estimate the number of hosts and workload replay clients needed to faithfully replay the given workload. This function returns the results as an XML CLOB.

Syntax

```
DBMS_WORKLOAD_REPLAY.CALIBRATE (
    capture_dir          IN VARCHAR2,
    process_per_cpu     IN BINARY_INTEGER DEFAULT 4,
    threads_per_process IN BINARY_INTEGER DEFAULT 50)
RETURN CLOB;
```

Parameters

Table 210-7 CALIBRATE Function Parameters

Parameter	Description
capture_dir	Name of the directory object that points to the (case sensitive) OS directory that contains processed capture data
process_per_cpu	Maximum number of processes allowed for each CPU (default is 4)
threads_per_process	Maximum number of threads allowed for each process (default is 50)

Return Values

Returns a CLOB formatted as XML that contains:

- Information about the capture
- Current database version
- Input parameters to this function
- Number of CPUs and replay clients needed to replay the given workload
- Information about the sessions captured (total number and maximum concurrency)

Usage Notes

- Prerequisite: The input workload capture was already processed using the [PROCESS_CAPTURE Procedure](#) in the same database version.
- This procedure will return the same results as the workload replay client in calibrate mode, which can be run as follows.

```
$ wrc mode=calibrate replaydir=
```

210.3.7 CANCEL_REPLAY Procedure

This procedure cancels workload replay in progress. All the external replay clients (WRC) will automatically be notified to stop issuing the captured workload and exit.

Syntax

```
DBMS_WORKLOAD_REPLAY.CANCEL_REPLAY (
    error_msg    IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 210-8 CANCEL_REPLAY Procedure Parameters

Parameter	Description
error_msg	An optional reason for cancelling the replay can be passed which is recorded into DBA_WORKLOAD_REPLAYS.ERROR_MESSAGE.

Usage Notes

Prerequisite: A call to the [INITIALIZE_REPLAY Procedure](#), or [PREPARE_REPLAY Procedure](#), or [START_REPLAY Procedure](#) was already issued.

210.3.8 COMPARE_PERIOD_REPORT Procedure

This procedure generates a report comparing a replay to its capture or to another replay of the same capture.

Syntax

```
DBMS_WORKLOAD_REPLAY.COMPARE_PERIOD_REPORT (
    replay_id1   IN   NUMBER,
    replay_id2   IN   NUMBER,
    format       IN   VARCHAR2,
    result       OUT  CLOB );
```

Parameters

Table 210-9 COMPARE_PERIOD_REPORT Procedure Parameters

Parameter	Description
replay_id1	First ID of the workload replay whose report is requested
replay_id2	Second ID of the workload replay whose report is requested. If this is NULL, then the comparison is done with the capture.
format	Specifies the report format. Valid values are DBMS_WORKLOAD_CAPTURE.TYPE_HTML and DBMS_WORKLOAD_CAPTURE.TYPE_XML.
result	Output of the report (CLOB)

210.3.9 COMPARE_SQLSET_REPORT Function

This procedure generates a report comparing a sqlset captured during replay to one captured during workload capture or to one captured during another replay of the same capture.

Syntax

```
DBMS_WORKLOAD_REPLAY.COMPARE_SQLSET_REPORT (
    replay_id1    IN NUMBER,
    replay_id2    IN NUMBER,
    format        IN VARCHAR2,
    r_level       IN VARCHAR2 DEFAULT 'ALL',
    r_sections    IN VARCHAR2 DEFAULT 'ALL',
    result        OUT CLOB )
RETURN VARCHAR2;
```

Parameters

Table 210-10 COMPARE_SQLSET_REPORT Function Parameters

Parameter	Description
replay_id1	First ID of the workload replay after a change
replay_id2	Second ID of the workload replay before a change. If this is NULL, then the comparison is done with the capture.
format	Specifies the report format. Valid values are DBMS_WORKLOAD_CAPTURE.TYPE_HTML, DBMS_WORKLOAD_CAPTURE.TYPE_XML and DBMS_WORKLOAD_CAPTURE.TYPE_TEXT.
r_level	See level parameter in the REPORT_ANALYSIS_TASK Function in the DBMS_SQLPA package
r_sections	See section parameter in the REPORT_ANALYSIS_TASK Function in the DBMS_SQLPA package
result	Output of the report (CLOB)

210.3.10 CREATE_FILTER_SET Procedure

This procedure creates a new filter set for the replays at `replay_dir`.

It includes all the replay filters that have already been added by the [ADD_FILTER Procedure](#). After the procedure has completed and replay initiated, the newly-created filter set can be used to filter the replay in `replay_dir` by calling the [USE_FILTER_SET Procedure](#).

Syntax

```
DBMS_WORKLOAD_REPLAY.CREATE_FILTER_SET (
    replay_dir      IN  VARCHAR2,
    filter_set      IN  VARCHAR2,
    default_action  IN  VARCHAR2 DEFAULT 'INCLUDE');
```

Parameters

Table 210-11 CREATE_FILTER_SET Procedure Parameters

Parameter	Description
<code>replay_dir</code>	Object directory of the replay to be filtered
<code>filter_set</code>	Name of the filter set to create (to use in USE_FILTER_SET Procedure)
<code>default_action</code>	<p>Can be either <code>INCLUDE</code> or <code>EXCLUDE</code>. Determines whether, by default, every captured call must be replayed or not. Also determines whether the workload filters specified must be considered as <code>INCLUSION</code> filters or <code>EXCLUSION</code> filters.)</p> <p>If it is <code>INCLUDE</code>, then by default all captured calls are replayed, except for the part of the workload defined by the filters. In this case, all the filters that were specified using the ADD_SCHEDULE_ORDERING Function are treated as <code>EXCLUSION</code> filters, and will determine the workload that will not be replayed.</p> <p>If it is <code>EXCLUDE</code>, then by default no captured call to the database is replayed, except for the part of the workload defined by the filters. In this case, all the filters that were specified using the ADD_SCHEDULE_ORDERING Function are treated as <code>INCLUSION</code> filters, and will determine the workload that is replayed.</p> <p>Default: <code>INCLUDE</code> and all the filters specified are assumed to be <code>EXCLUSION</code> filters</p>

Usage Notes

This operation must be invoked when no replay is initialized, prepared, or in progress.

210.3.11 DELETE_FILTER Procedure

This procedure deletes the named filter.

Syntax

```
DBMS_WORKLOAD_REPLAY.DELETE_FILTER (
    fname  IN  VARCHAR2);
```

Parameters

Table 210-12 DELETE_FILTER Procedure Parameters

Parameter	Description
fname	(Mandatory) Name of the filter that must be deleted

Usage Notes

The `DELETE_FILTER` Procedure only affects filters that have not been used by any previous capture. Consequently, filters can be deleted only if they have been added using the [ADD_FILTER Procedures](#) after any capture has been completed. Filters that have been added using `ADD_FILTER` before a `START_CAPTURE` and `FINISH_CAPTURE` cannot be deleted anymore using this subprogram.

210.3.12 DELETE_REPLAY_INFO Procedure

This procedure deletes the rows in `DBA_WORKLOAD_REPLAYS` that correspond to the given workload replay ID.

Syntax

```
DBMS_WORKLOAD_REPLAY.DELETE_REPLAY_INFO (
    replay_id    IN NUMBER);
```

Parameters

Table 210-13 DELETE_REPLAY_INFO Procedure Parameters

Parameter	Description
replay_id	(Mandatory) ID of the workload replay that must be deleted. Corresponds to <code>DBA_WORKLOAD_REPLAYS.ID</code>

210.3.13 END_REPLAY_SCHEDULE Procedure

This procedure wraps up the creation of the current schedule. The schedule is now saved and associated with the replay directory and can be used for a replay.

Syntax

```
DBMS_WORKLOAD_REPLAY.END_REPLAY_SCHEDULE;
```

Usage Notes

The [BEGIN_REPLAY_SCHEDULE Procedure](#) must have already been called.

210.3.14 EXPORT_AWR Procedure

This procedure exports the AWR snapshots associated with a stipulated replay ID.

Syntax

```
DBMS_WORKLOAD_REPLAY.EXPORT_AWR (
    replay_id    IN NUMBER);
```

Parameters

Table 210-14 EXPORT_AWR Function Parameters

Parameter	Description
replay_id	(Mandatory) ID of the replay whose AWR snapshots are to be exported

Usage Notes

- At the end of each replay, the corresponding AWR snapshots are automatically exported. Consequently, there is no need to do this manually after a workload replay is complete, unless the automatic `EXPORT_AWR` invocation failed.
- This procedure will work only if the corresponding workload replay was performed in the current database (meaning that the corresponding row in `DBA_WORKLOAD_REPLAYS` was not created by calling the [GET_REPLAY_INFO Function](#)) and the AWR snapshots that correspond to that replay time period are still available.

210.3.15 GENERATE_CAPTURE_SUBSET Procedure

This procedure creates a new capture from an existing workload capture.

Syntax

```
DBMS_WORKLOAD_REPLAY.GENERATE_CAPTURE_SUBSET (
    input_capture_dir    IN VARCHAR2,
    output_capture_dir   IN VARCHAR2,
    new_capture_name     IN VARCHAR2,
    begin_time           IN NUMBER,
    begin_include_incomplete IN BOOLEAN DEFAULT TRUE,
    end_time             IN NUMBER,
    end_include_incomplete IN BOOLEAN DEFAULT FALSE,
    parallel_level       IN NUMBER DEFAULT NULL);
```

Parameters

Table 210-15 GENERATE_CAPTURE_SUBSET Procedure Parameters

Parameter	Description
input_capture_dir	(Mandatory) Name of the directory object that points to an existing workload capture
output_capture_dir	(Mandatory) Name of the directory object that points to the new capture

Table 210-15 (Cont.) GENERATE_CAPTURE_SUBSET Procedure Parameters

Parameter	Description
<code>new_capture_name</code>	(Mandatory) Name of new capture
<code>begin_time</code>	Start of the time range - time offset in seconds from the start of a workload capture
<code>begin_include_incomplete</code>	Column to include incomplete calls caused by <code>begin_time</code>
<code>end_time</code>	End of the time range - time offset in seconds from the start of a workload capture. If <code>end_time</code> is zero or <code>end_time</code> is less or equal than <code>begin_time</code> , the time range is invalid. The new capture will use the whole duration of the input capture.
<code>end_include_incomplete</code>	Column to include incomplete calls caused by <code>end_time</code>
<code>parallel_level</code>	Number of Oracle processes used to process the input captures in a parallel fashion. The <code>NULL</code> default value will auto-compute the parallelism level based on number of CPUs, whereas a value of 1 will enforce serial execution.

210.3.16 GET_DIVERGING_STATEMENT Function

This function retrieves information about a diverging call, including the statement text, the SQL ID, and the binds. If the replay of a recorded user call has data or error divergence, it is a diverging call.

Syntax

```
DBMS_WORKLOAD_REPLAY.GET_DIVERGING_STATEMENT (
    replay_id    IN NUMBER,
    stream_id    IN NUMBER,
    call_counter IN NUMBER)
RETURN CLOB;
```

Parameters

Table 210-16 GET_DIVERGING_STATEMENT Function Parameters

Parameter	Description
<code>replay_id</code>	ID of the replay in which that call diverged
<code>stream_id</code>	Stream ID of the diverging call
<code>call_counter</code>	Call counter of the diverging call

Usage Notes

- Returns a `CLOB` formatted as XML that contains:
 - SQL ID
 - SQL Text
 - Bind information: position, name and value
- This function will silently invoke the [POPULATE_DIVERGENCE Procedure](#) to read the information from the capture files. Therefore, if divergence has not been

populated, then the first call to this function for a particular diverging call might take longer, especially in very large captures.

210.3.17 GET_REPLAY_DIRECTORY Function

This function returns the current replay directory set by the SET_REPLAY_DIRECTORY Procedure. It returns NULL if no replay directory has been set.

Syntax

```
DBMS_WORKLOAD_REPLAY.GET_REPLAY_DIRECTORY
RETURN VARCHAR2;
```

Related Topics

- [SET_REPLAY_DIRECTORY Procedure](#)
This procedure sets a directory that contains multiple workload captures as the current replay directory.

210.3.18 GET_REPLAY_INFO Function

This function retrieves information about the workload capture and the history of all the workload replay attempts from the stipulated directory.

Syntax

```
DBMS_WORKLOAD_REPLAY.GET_REPLAY_INFO (
    replay_dir    IN VARCHAR2,
    load_details  IN BOOLEAN DEFAULT FALSE)
RETURN NUMBER;
```

Parameters

Table 210-17 GET_REPLAY_INFO Function Parameters

Parameter	Description
replay_dir	(Mandatory) Name of the workload replay directory object (case sensitive).
load_details	Load the divergence and tracked commits data. The default value is FALSE.

Return Values

The procedure returns the CAPTURE_ID, which can be associated with both DBA_WORKLOAD_CAPTURES.ID and DBA_WORKLOAD_REPLAYS.CAPTURE_ID to access the imported information.

Usage Notes

- The procedure first imports a row into DBA_WORKLOAD_CAPTURES which will contain information about the capture. It then imports a row for every replay attempt retrieved from the given replay directory into DBA_WORKLOAD_REPLAYS.

- The procedure will not insert new rows to DBA_WORKLOAD_CAPTURES and DBA_WORKLOAD_REPLAYS if these views already contain rows describing the capture and replay history present in the given directory.

210.3.19 GET_REPLAY_TIMEOUT Procedure

This procedure gets the replay timeout setting.

Syntax

```
DBMS_WORKLOAD_REPLAY.GET_REPLAY_TIMEOUT (
    enabled      OUT  BOOLEAN,
    min_delay    OUT  NUMBER,
    max_delay    OUT  NUMBER,
    delay_factor OUT  NUMBER);
```

Parameters

Table 210-18 GET_REPLAY_TIMEOUT Procedure Parameters

Parameter	Description
enabled	TRUE if the timeout action is enabled, FALSE otherwise.
min_delay	Lower bound of call delay in minutes. The replay action is activated only when the delay is equal to or more than min_delay.
max_delay	Upper bound of call delay in minutes. The timeout action throws ORA-15569 when the delay is more than max_delay.
delay_factor	Factor for the call delay that is between min_delay and max_delay. The timeout action throws ORA-15569 when the current replay elapsed time is more than the product of capture elapsed time and delay_factor.

Usage Notes

This procedure can be called anytime during replay.

210.3.20 IMPORT_AWR Function

This procedure imports the AWR snapshots from a given replay.

Syntax

```
DBMS_WORKLOAD_REPLAY.IMPORT_AWR (
    replay_id      IN  NUMBER,
    staging_schema IN  VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 210-19 IMPORT_AWR Function Parameters

Parameter	Description
replay_id	(Mandatory) ID of the replay whose AWR snapshots must be imported
staging_schema	(Mandatory) Name of a valid schema in the current database which can be used as a staging area while importing the AWR snapshots from the replay directory to the SYS AWR schema. The SYS schema is not a valid input.

Return Values

Returns the new randomly generated database ID that was used to import the AWR snapshots. The same value can be found in the AWR_DBID column in the DBA_WORKLOAD_REPLAYS view.

Usage Notes

- This procedure will work provided those AWR snapshots were exported earlier from the original replay system using the [EXPORT_AWR Procedure](#).
- IMPORT_AWR will fail if the staging_schema provided as input contains any tables with the same name as any of the AWR tables, such as WRM\$_SNAPSHOT or WRH\$_PARAMETER. Drop any such tables in the staging_schema before invoking IMPORT_AWR.

210.3.21 INITIALIZE_CONSOLIDATED_REPLAY Procedure

This procedure puts the database state in INIT for a multiple-capture replay.

It uses the replay_dir which has already been defined by the [SET_REPLAY_DIRECTORY Procedure](#), pointing to a directory that contains all the capture directories involved in the schedule. It reads data about schedule schedule_name from the directory, and loads required connection data into the replay system.

Syntax

```
DBMS_WORKLOAD_REPLAY.INITIALIZE_CONSOLIDATED_REPLAY (
    replay_name      IN    VARCHAR2,
    schedule_name    IN    VARCHAR2,
    plsqli_mode      IN    VARCHAR2 DEFAULT 'TOP_LEVEL');
```

Parameters

Table 210-20 INITIALIZE_CONSOLIDATED_REPLAY Procedure Parameters

Parameter	Description
replay_name	(Mandatory) Name of the workload replay. Every replay of a processed workload capture can be given a name.
schedule_name	Name of the schedule to be replayed. It must have been created through the BEGIN_REPLAY_SCHEDULE Procedure for the replay directory replay_dir.

Table 210-20 (Cont.) INITIALIZE_CONSOLIDATED_REPLAY Procedure Parameters

Parameter	Description
plsql_mode	Specifies the replay options for PL/SQL calls: <ul style="list-style-type: none"> • TOP_LEVEL — only top-level PL/SQL calls are replayed • EXTENDED — SQL executed from PL/SQL or top-level SQL PL/SQL if there is no SQL recorded inside the PL/SQL are replayed. All captures must have been done in 'EXTENDED' PL/SQL mode.

Usage Notes

Prerequisites:

- Workload capture was already processed using the [PROCESS_CAPTURE Procedure](#) in the same database version.
- Database state has been logically restored to what it was at the beginning of the original workload capture.
- The [SET_REPLAY_DIRECTORY Procedure](#) has been called.

210.3.22 INITIALIZE_REPLAY Procedure

This procedure puts the database state in INIT for REPLAY mode, and loads data into the replay system that is required before preparing for the replay (by executing the PAUSE_REPLAY Procedure).

Syntax

```
DBMS_WORKLOAD_REPLAY.INITIALIZE_REPLAY (
    replay_name      IN  VARCHAR2,
    replay_dir       IN  VARCHAR2,
    plsqli_mode      IN  VARCHAR2 DEFAULT 'TOP_LEVEL',
    rac_inst_list    IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 210-21 INITIALIZE_REPLAY Procedure Parameters

Parameter	Description
replay_name	(Mandatory) Name of the workload replay. Every replay of a processed workload capture can be given a name.
replay_dir	Name of the directory object that points to the OS directory (case sensitive) that contains processed capture data
plsqli_mode	Specifies the replay options for PL/SQL calls: <ul style="list-style-type: none"> • TOP_LEVEL — only top-level PL/SQL calls are replayed • EXTENDED — SQL executed from PL/SQL or top-level SQL PL/SQL if there is no SQL recorded inside the PL/SQL are replayed. All captures must have been done in 'EXTENDED' PL/SQL mode.

Table 210-21 (Cont.) INITIALIZE_REPLAY Procedure Parameters

Parameter	Description
<code>rac_inst_list</code>	Specifies a list of Oracle Real Application Clusters (Oracle RAC) instances that will be used for replay. The parameter is a string of instance numbers that are separated by commas. For example: <code>rac_inst_list='1,3,5'</code>

Usage Notes

- Prerequisites:
 - Workload capture was already processed using the [PROCESS_CAPTURE Procedure](#) in the same database version.
 - Database state has been logically restored to what it was at the beginning of the original workload capture.
- The subprogram loads data into the replay system that is required before preparing for the replay by calling the `PAUSE_REPLAY` Procedure.

For instance, during capture the user may record the connection string each session used to connect to the server. The `INITIALIZE_REPLAY` Procedure loads this data and allows the user to re-map the recorded connection string to new connection strings or service points.

Elaborating on the example described in the `PROCESS_CAPTURE` Procedure, the user could invoke the following:

```
DBMS_WORKLOAD_REPLAY.INITIALIZE_REPLAY('replay foo #1', 'rec_dir');
```

This command will load up the connection map and by default will set all replay time connection strings to be equal to `NULL`. A `NULL` replay time connection string means that the workload replay clients (WRCs) will connect to the default host as determined by the replay client's runtime environment settings. The user can change a particular connection string to a new one (or a new service point) for replay by using the `REMAP_CONNECTION` Procedure.

- For encrypted capture, the `INITIALIZE_REPLAY` Procedure relies on Oracle wallet. The identifier is `oracle.rat.database_replay.encryption` (case-sensitive).

Related Topics

- [PAUSE_REPLAY Procedure](#)
This procedure pauses the in-progress workload replay.
- [INITIALIZE_REPLAY Procedure](#)
This procedure puts the database state in `INIT` for `REPLAY` mode, and loads data into the replay system that is required before preparing for the replay (by executing the `PAUSE_REPLAY` Procedure).
- [PROCESS_CAPTURE Procedure](#)
This procedure processes the workload capture found in `capture_dir` in place.
- [REMAP_CONNECTION Procedure](#)
This procedure remaps the captured connection to a new one so that the user sessions can connect to the database in a desired way during workload replay.

210.3.23 IS_REPLAY_PAUSED Function

This function reports whether the replay is currently paused.

Syntax

```
DBMS_WORKLOAD_REPLAY.IS_REPLAY_PAUSED  
    RETURN BOOLEAN;
```

Return Values

Returns `TRUE` if the [PAUSE_REPLAY Procedure](#) has been called successfully and the [RESUME_REPLAY Procedure](#) has not been called yet.

Usage Notes

A call to the [START_REPLAY Procedure](#) must have already been issued as a prerequisite.

210.3.24 LOAD_LONG_SQLTEXT Procedure

This procedure loads the captured SQL statements that are longer than 1000 characters to the `DBA_WORKLOAD_LONG_SQLTEXT` view.

Syntax

```
DBMS_WORKLOAD_REPLAY.LOAD_LONG_SQLTEXT (  
    capture_id    IN NUMBER);
```

Parameters

Table 210-22 LOAD_LONG_SQLTEXT Procedure Parameters

Parameter	Description
capture_id	Internal key for the workload capture

Note:

This procedure is available starting with Oracle Database Release 18c.

See Also:

`DBA_WORKLOAD_LONG_SQLTEXT` in *Oracle Database Reference*

210.3.25 PAUSE_REPLAY Procedure

This procedure pauses the in-progress workload replay.

All subsequent user calls from the replay clients will be stalled until either a call to the [RESUME_REPLAY Procedure](#) is issued or the replay is cancelled.

Syntax

```
DBMS_WORKLOAD_REPLAY.PAUSE_REPLAY;
```

Usage Notes

- Prerequisite: A call to the [START_REPLAY Procedure](#) must have already been issued.
- User calls that were already in-progress when this procedure was invoked are allowed to run to completion. Only subsequent user calls, when issued, are paused.

210.3.26 POPULATE_DIVERGENCE Procedure

This procedure precomputes the divergence information for the given call, stream, or the whole replay so that the [GET_DIVERGING_STATEMENT](#) Function returns as quickly as possible for the precomputed calls.

Syntax

```
DBMS_WORKLOAD_REPLAY.POPULATE_DIVERGENCE (  
    replay_id    IN    NUMBER,  
    stream_id    IN    NUMBER DEFAULT NULL,  
    call_counter IN    NUMBER DEFAULT NULL);
```

Parameters

Table 210-23 POPULATE_DIVERGENCE Procedure Parameters

Parameter	Description
replay_id	ID of the replay
stream_id	Stream ID of the diverging call. If NULL is provided, then divergence information is precomputed for all diverging calls in the given replay.
call_counter	Call counter of the diverging call. If NULL is provided, then divergence information is precomputed for all diverging calls in the given stream.

Related Topics

- [GET_DIVERGING_STATEMENT Function](#)
This function retrieves information about a diverging call, including the statement text, the SQL ID, and the binds. If the replay of a recorded user call has data or error divergence, it is a diverging call.

210.3.27 PREPARE_CONSOLIDATED_REPLAY Procedure

Similar to the `PREPARE_REPLAY` Procedure, this procedure puts the database in a special "Prepare" mode for a multiple-capture replay. The difference is that this subprogram should be used only for consolidated replays.

Syntax

```
DBMS_WORKLOAD_REPLAY.PREPARE_CONSOLIDATED_REPLAY (
    synchronization          IN BOOLEAN,
    connect_time_scale      IN NUMBER    DEFAULT 100,
    think_time_scale        IN NUMBER    DEFAULT 100,
    think_time_auto_correct IN BOOLEAN   DEFAULT TRUE,
    capture_sts             IN BOOLEAN   DEFAULT FALSE,
    sts_cap_interval        IN NUMBER    DEFAULT 300);
```

```
DBMS_WORKLOAD_REPLAY.PREPARE_CONSOLIDATED_REPLAY (
    synchronization          IN VARCHAR2  DEFAULT 'SCN',
    connect_time_scale      IN NUMBER    DEFAULT 100,
    think_time_scale        IN NUMBER    DEFAULT 100,
    think_time_auto_correct IN BOOLEAN   DEFAULT TRUE,
    capture_sts             IN BOOLEAN   DEFAULT FALSE,
    sts_cap_interval        IN NUMBER    DEFAULT 300);
```

Parameters

Table 210-24 PREPARE_CONSOLIDATED_REPLAY Procedure Parameters

Parameter	Description
<code>synchronization</code>	<p>Sets the synchronization mode for replay:</p> <ul style="list-style-type: none"> <code>'TIME'</code> — The synchronization will be based on the time the action took place during capture (clock-based time). <code>'SCN'</code> — The synchronization will be based on the capture-time commits; the commit order will be preserved during replay. This is the default mode. <code>'OBJECT_ID'</code> — Every replayed action will be executed only <i>after</i> the relevant commits have finished execution. The relevant commits are those that were issued before the given action in the captured workload and that modified at least one of the database objects the given action is referencing (either implicitly or explicitly). This synchronization mode makes sure that any replay action will see the same data that the action saw during capture, but allows greater concurrency for the actions that do not touch the same objects/tables. <p>This value is deprecated.</p> <p>For compatibility, an overloaded version of this procedure uses <code>BOOLEAN</code> for this parameter:</p> <ul style="list-style-type: none"> <code>TRUE</code> means <code>'SCN'</code> <code>FALSE</code> means <code>'TIME'</code>

Table 210-24 (Cont.) PREPARE_CONSOLIDATED_REPLAY Procedure Parameters

Parameter	Description
<code>connect_time_scale</code>	Scales the time elapsed between the instant the workload capture was started and the session connects with the given value. The input is interpreted as a % value. Can potentially be used to increase or decrease the number of concurrent users during the workload replay. DEFAULT VALUE is 100. See " Example 210-1 ".
<code>think_time_scale</code>	Scales the time elapsed between two successive user calls " Example 210-1 " from the same session. The input is interpreted as a % value. Can potentially be used to increase or decrease the number of concurrent users during the workload replay. DEFAULT VALUE is 100. See " Example 210-2 ".
<code>think_time_auto_correct</code>	Auto corrects the think time between calls appropriately when user calls takes longer to complete during replay than during the original capture. DEFAULT is TRUE which is to reduce think time if replay goes slower than capture. See " Example 210-3 ".
<code>capture_sts</code>	If this parameter is TRUE, then a SQL tuning set capture is also started in parallel with workload replay. The resulting SQL tuning set can be exported using the EXPORT_AWR Procedure along with the Automatic Workload Repository (AWR) data. Currently, parallel SQL tuning set (STS) capture is not supported in an Oracle RAC environment. So, this parameter has no effect in that context. The calling user must have the appropriate privileges ('ADMINISTER SQL TUNING SET'). The default value is FALSE.
<code>sts_cap_interval</code>	Specifies the capture interval of the SQL set capture from the cursor cache in seconds. The default value is 300.

Usage Notes

A consolidated replay replays multiple captures in one replay. Each capture records different system change number (SCN) values. For this reason SCN-based sync is not supported for consolidated replays. Consolidated replays only support non-sync mode and the Object-ID based synchronization, and SCN-based synchronization is currently not supported.

Related Topics

- [PREPARE_REPLAY Procedure](#)
This procedure puts the database state in `PREPARE FOR REPLAY` mode.

210.3.28 PREPARE_REPLAY Procedure

This procedure puts the database state in `PREPARE FOR REPLAY` mode.

Syntax

```
DBMS_WORKLOAD_REPLAY.PREPARE_REPLAY (
  synchronization          IN BOOLEAN,
  connect_time_scale       IN NUMBER    DEFAULT 100,
  think_time_scale        IN NUMBER    DEFAULT 100,
  think_time_auto_correct  IN BOOLEAN   DEFAULT TRUE,
  scale_up_multiplier      IN NUMBER    DEFAULT 1,
```

```

capture_sts           IN BOOLEAN  DEFAULT FALSE,
sts_cap_interval      IN NUMBER   DEFAULT 300,
rac_mode              IN NUMBER   DEFAULT GLOBAL_SYNC,
query_only            IN BOOLEAN  DEFAULT FALSE);

DBMS_WORKLOAD_REPLAY.PREPARE_REPLAY (
synchronization      IN VARCHAR2  DEFAULT 'SCN',
connect_time_scale    IN NUMBER   DEFAULT 100,
think_time_scale     IN NUMBER   DEFAULT 100,
think_time_auto_correct IN BOOLEAN  DEFAULT TRUE,
scale_up_multiplier   IN NUMBER   DEFAULT 1,
capture_sts           IN BOOLEAN  DEFAULT FALSE,
sts_cap_interval      IN NUMBER   DEFAULT 300),
rac_mode              IN NUMBER   DEFAULT GLOBAL_SYNC,
query_only            IN BOOLEAN  DEFAULT FALSE);

```

Parameters

Table 210-25 PREPARE_REPLAY Procedure Parameters

Parameter	Description
synchronization	<p>Sets the synchronization mode for replay:</p> <ul style="list-style-type: none"> 'TIME' — The synchronization will be based on the time the action took place during capture (clock-based time). 'SCN' — The synchronization will be based on the capture-time commits; the commit order will be preserved during replay. This is the default mode. 'OBJECT_ID' — Every replayed action will be executed only <i>after</i> the relevant commits have finished execution. The relevant commits are those that were issued before the given action in the captured workload and that modified at least one of the database objects the given action is referencing (either implicitly or explicitly). This synchronization mode makes sure that any replay action will see the same data that the action saw during capture, but allows greater concurrency for the actions that do not touch the same objects/tables. <p>This value is deprecated.</p> <p>For compatibility, an overloaded version of this procedure uses BOOLEAN for this parameter:</p> <ul style="list-style-type: none"> TRUE means 'SCN' FALSE means 'TIME'
connect_time_scale	<p>Scales the time elapsed between the instant the workload capture was started and the session connects with the given value. The input is interpreted as a % value. Can potentially be used to increase or decrease the number of concurrent users during the workload replay. DEFAULT VALUE is 100. See "Example 210-1".</p>
think_time_scale	<p>Scales the time elapsed between two successive user calls from the same session. The input is interpreted as a % value. Can potentially be used to increase or decrease the number of concurrent users during the workload replay. DEFAULT VALUE is 100. See "Example 210-2".</p>

Table 210-25 (Cont.) PREPARE_REPLAY Procedure Parameters

Parameter	Description
<code>think_time_auto_correct</code>	Auto corrects the think time between calls appropriately when a user call takes longer to complete during replay than during the original capture. <code>DEFAULT</code> is <code>TRUE</code> which is to reduce think time if replay goes slower than capture. See "Example 210-3".
<code>scale_up_multiplier</code>	Defines the number of times the query workload is scaled up during replay. Each captured session is replayed concurrently as many times as the value of the <code>scale_up_multiplier</code> . However, only one of the sessions in each set of identical replay sessions executes both queries and updates. The remaining sessions only execute queries.
<code>capture_sts</code>	If this parameter is <code>TRUE</code> , then a SQL tuning set capture is also started in parallel with workload replay. The resulting SQL tuning set can be exported using the EXPORT_AWR Procedure along with the AWR data. Currently, parallel SQL tuning set (STS) capture is not supported in an Oracle RAC environment. So, this parameter has no effect in that context. The calling user must have the appropriate privileges (<code>ADMINISTER SQL TUNING SET</code>). The default value is <code>FALSE</code> .
<code>sts_cap_interval</code>	Specifies the capture interval of the SQL set capture from the cursor cache in seconds. The default value is 300.
<code>rac_mode</code>	Specifies replay options in an Oracle Real Application Cluster (Oracle RAC) environment. This parameter accepts the following values: <ul style="list-style-type: none"> <code>GLOBAL_SYNC</code> — Synchronization across all Oracle RAC instances. This is the default value. <code>PER_INSTANCE_CLIENT</code> — Synchronization is global and each WRC client handles part of the workload that is sent to only one instance. <code>PER_INSTANCE_SYNC</code> — Synchronization is local (within each instance only) and each WRC client handles part of the workload that is sent to only one instance
<code>query_only</code>	Replays only the read-only queries of the workload capture. The default value is <code>FALSE</code> .

Usage Notes

- Prerequisites:
 - The database has been initialized for replay using the [INITIALIZE_REPLAY Procedure](#).
 - Any capture time connection strings that require remapping have been already done using the [REMAP_CONNECTION Procedure](#).
- One or more external replay clients (WRC) can be started once the `PREPARE_REPLAY` procedure has been executed.
- With regard to `scale_up_multiplier`:
 - One replay session (base session) of each set of identical sessions will replay every call from the capture as usual.

- The remaining sessions (scale-up sessions) will only replay calls that are read-only. Thus, DDL, DML, and PL/SQL calls that modified the database is skipped. `SELECT FOR UPDATE` statements are also skipped.
- Read-only calls from the scale-up are synchronized appropriately and obey the timings defined by `think_time_scale`, `connect_time_scale`, and `think_time_auto_correct`. Also, the queries are made to wait for the appropriate commits.
- No replay data or error divergence records are generated for the scale-up sessions.
- All base or scale-up sessions that replay the same capture file will connect from the same workload replay client.

Example 210-1 Application of the `connect_time_scale` Parameter

If the following was observed during the original workload capture:

```
12:00 : Capture was started
12:10 : First session connect (10m after)
12:30 : Second session connect (30m after)
12:42 : Third session connect (42m after)
```

If the `connect_time_scale` is 50, then the session connects will happen as follows:

```
12:00 : Replay was started with 50% connect time scale
12:05 : First session connect ( 5m after)
12:15 : Second session connect (15m after)
12:21 : Third session connect (21m after)
```

If the `connect_time_scale` is 200, then the session connects will happen as follows:

```
12:00 : Replay was started with 200% connect time scale
12:20 : First session connect (20m after)
13:00 : Second session connect (60m after)
13:24 : Third session connect (84m after)
```

Example 210-2 Application of the `think_time_scale` Parameter

If the following was observed during the original workload capture:

```
12:00 : User SCOTT connects
12:10 : First user call issued (10m after completion of prevcall)
12:14 : First user call completes in 4mins
12:30 : Second user call issued (16m after completion of prevcall)
12:40 : Second user call completes in 10m
12:42 : Third user call issued ( 2m after completion of prevcall)
12:50 : Third user call completes in 8m
```

If the `think_time_scale` is 50 during the workload replay, then the user calls will look something like below:

```
12:00 : User SCOTT connects
12:05 : First user call issued 5 mins (50% of 10m) after the completion of
        previous call
12:10 : First user call completes in 5m (takes a minute longer)
12:18 : Second user call issued 8 mins (50% of 16m) after the completion of prev
        call
12:25 : Second user call completes in 7m (takes 3 minutes less)
12:26 : Third user call issued 1 min (50% of 2m) after the completion of prev
```

```

call
12:35 : Third user call completes in 9m (takes a minute longer)

```

Example 210-3 Application of the think_time_auto_correct Parameter

If the following was observed during the original workload capture:

```

12:00 : User SCOTT connects
12:10 : First user call issued (10m after completion of prevcall)
12:14 : First user call completes in 4m
12:30 : Second user call issued (16m after completion of prevcall)
12:40 : Second user call completes in 10m
12:42 : Third user call issued ( 2m after completion of prevcall)
12:50 : Third user call completes in 8m

```

If the think_time_scale is 100 and the think_time_auto_correct is TRUE during the workload replay, then the user calls will look something like below:

```

12:00 : User SCOTT connects
12:10 : First user call issued 10 mins after the completion of prev call
12:15 : First user call completes in 5m (takes 1 minute longer)
12:30 : Second user call issued 15 mins (16m minus the extra time of 1m the prev
call took) after the completion of prev call
12:44 : Second user call completes in 14m (takes 4 minutes longer)
12:44 : Third user call issued immediately (2m minus the extra time of 4m the prev
call took) after the completion of prev call
12:52 : Third user call completes in 8m

```

210.3.29 PROCESS_CAPTURE Procedure

This procedure processes the workload capture found in capture_dir in place.

Syntax

```

DBMS_WORKLOAD_REPLAY.PROCESS_CAPTURE (
capture_dir          IN   VARCHAR2,
parallel_level      IN   NUMBER DEFAULT NULL,
synchronization    IN   VARCHAR2 DEFAULT 'SCN',
plsqli_mode        IN   VARCHAR2 DEFAULT 'TOP_LEVEL');

```

Parameters

Table 210-26 PROCESS_CAPTURE Procedure Parameters

Parameter	Description
capture_dir	(Mandatory) Name of the workload capture directory object (case sensitive). The directory object must point to a valid OS directory that has the appropriate permissions. New files are added to this directory.
parallel_level	Number of Oracle processes used to process the capture in parallel. The NULL default value will auto-compute the parallelism level, whereas a value of 1 will enforce serial execution.

Table 210-26 (Cont.) PROCESS_CAPTURE Procedure Parameters

Parameter	Description
synchronization	<p>Determines the synchronization mode that the user will be able to use for replay:</p> <ul style="list-style-type: none"> 'TIME' — When 'TIME' is selected, the replay can use 'TIME' synchronization mode only. When 'TIME' synchronization mode is used for replay, the synchronization will be based on the time the action took place during capture (clock-based time). 'SCN' — When 'SCN' is selected, the replay can use the 'TIME' or 'SCN' synchronization mode. This is the default. When 'SCN' synchronization mode is used for replay, the synchronization will be based on the capture-time commits; the commit order will be preserved during replay. This is the default mode. 'OBJECT_ID' — When 'OBJECT_ID' is selected, replay can use the 'TIME', 'SCN', or 'OBJECT_ID' synchronization mode. When 'OBJECT_ID' synchronization mode is used for replay, every replayed action will be executed only <i>after</i> the relevant commits have finished execution. The relevant commits are those that were issued before the given action in the captured workload and that modified at least one of the database objects the given action is referencing (either implicitly or explicitly). This synchronization mode makes sure that any replay action will see the same data that the action saw during capture, but allows greater concurrency for the actions that do not touch the same objects/tables. This synchronization mode is deprecated.
plsql_mode	<p>Specifies the processing mode for PL/SQL:</p> <ul style="list-style-type: none"> 'TOP_LEVEL' — metadata is generated for top-level PL/SQL calls only; 'TOP_LEVEL' will be the only option for replay. 'EXTENDED' — metadata is generated for both top-level PL/SQL calls and the SQL called from PL/SQL. A new directory ppe_X.X.X.X (where the Xs represent the current Oracle version) is created under the capture root directory. Capture must have been done with this same value for the plsql_mode parameter. Replay can use either 'TOP_LEVEL' or 'EXTENDED'.

Usage Notes

- This subprogram analyzes the workload capture found in the `capture_dir` and creates new workload replay specific metadata files that are required to replay the given workload capture. It only creates new files and does not modify any files that were originally created during the workload capture. Therefore, this procedure can be run multiple times on the same capture directory, such as when the procedure encounters unexpected errors or is cancelled by the user.
- Once this procedure runs successfully, the `capture_dir` can be used as input to the [INITIALIZE_REPLAY Procedure](#) in order to replay the captured workload present in `capture_dir`.

- Before a workload capture can be replayed in a particular database version, the capture must be processed using `PROCESS_CAPTURE` in the same database version. Once created, a processed workload capture can be used to replay the captured workload multiple times in the same database version.

For example, suppose workload "foo" was captured in `rec_dir` in Oracle database version 10.2.0.5. In order to replay the workload "foo" in version 11.1.0.1 the workload must be processed in version 11.1.0.1. The following procedure must be executed in an 11.1.0.1 database in order to process the capture directory `rec_dir`:

```
DBMS_WORKLOAD_REPLAY.PROCESS_CAPTURE('rec_dir');
```

Now, `rec_dir` contains a valid 11.1.0.1 processed workload capture that can be used to replay the workload "foo" in 11.1.0.1 databases as many times as required.

- For encrypted capture, the `PROCESS_CAPTURE` procedure relies on Oracle wallet. The identifier is `oracle.rat.database_replay.encryption` (case-sensitive).

210.3.30 REMAP_CONNECTION Procedure

This procedure remaps the captured connection to a new one so that the user sessions can connect to the database in a desired way during workload replay.

Syntax

```
DBMS_WORKLOAD_REPLAY.REMAP_CONNECTION (
    connection_id      IN NUMBER,
    replay_connection  IN VARCHAR2);
```

```
DBMS_WORKLOAD_REPLAY.REMAP_CONNECTION (
    capture_number     IN VARCHAR2,
    connection_id      IN NUMBER,
    replay_connection  IN VARCHAR2);
```

Parameters

Table 210-27 REMAP_CONNECTION Procedure Parameters

Parameter	Description
<code>capture_number</code>	Pointing to a capture of the current replay schedule
<code>connection_id</code>	ID of the connection to be remapped. Corresponds to <code>DBA_WORKLOAD_CONNECTION_MAP.CONN_ID</code> .
<code>replay_connection</code>	New connection string to be used during replay

Usage Notes

- Prior to calling `REMAP_CONNECTION` all replay connection strings are set to `NULL` by default. If a `replay_connection` is `NULL`, then the replay sessions will connect as determined by the replay client's runtime environment. For example, if the environment variable `TNS_ADMIN` is defined and the user does not call the [REMAP_CONNECTION Procedure](#), then the `wrc` executable will connect to the server specified in the `tnsnames.ora` file pointed to by `TNS_ADMIN`.
- A valid `replay_connection` must specify a connect identifier or a service point. See the *Oracle Database Net Services Reference* for ways to specify connect identifiers (such as

net service names, database service names, and net service aliases) and naming methods that can be used to resolve a connect identifier to a connect descriptor.

- An error is returned if no row matches the given `connection_id`.
- Use the `DBA_WORKLOAD_CONNECTION_MAP` view to review all the connection strings that are used by the subsequent workload replay, and also to examine connection string remappings used for previous workload replays.

210.3.31 REMOVE_CAPTURE Procedure

This procedure removes the given capture from the current schedule.

Syntax

```
DBMS_WORKLOAD_REPLAY.REMOVE_CAPTURE (
    schedule_capture_number    IN    NUMBER);
```

Parameters

Table 210-28 REMOVE_CAPTURE Procedure Parameters

Parameter	Description
<code>schedule_capture_number</code>	Unique ID that identifies this capture within this schedule

210.3.32 REMOVE_SCHEDULE_ORDERING Procedure

This procedure removes an existing schedule order from the current replay schedule.

Together, `schedule_capture_id` and `waitfor_capture_id` form a schedule ordering that previously added by the [ADD_SCHEDULE_ORDERING Function](#) (`schedule_capture_id, waitfor_capture_id`). The order is that replay of capture indicated by `schedule_capture_id` will not start unless the replay of capture indicated by `waitfor_capture_id` finishes.

Syntax

```
DBMS_WORKLOAD_REPLAY.REMOVE_SCHEDULE_ORDERING (
    schedule_capture_id    IN    NUMBER,
    waitfor_capture_id    IN    NUMBER);
```

Parameters

Table 210-29 REMOVE_SCHEDULE_ORDERING Procedure Parameters

Parameter	Description
<code>schedule_capture_id</code>	Points to a capture that has been added to the current replay schedule (see procedure description).
<code>waitfor_capture_id</code>	Points to a capture that has been added to the current replay schedule.

Usage Notes

Prerequisites:

- The [BEGIN_REPLAY_SCHEDULE Procedure](#) must have been called.
- The replay schedule order should have already been added using the [ADD_SCHEDULE_ORDERING Function](#).

210.3.33 REPORT Function

This function generates a report on the stipulated workload replay.

Syntax

```
DBMS_WORKLOAD_REPLAY.REPORT (
    replay_id          IN NUMBER,
    format             IN VARCHAR2)
RETURN CLOB;
```

Parameters

Table 210-30 REPORT Function Parameters

Parameter	Description
replay_id	(Mandatory) Specifies the ID of the workload replay whose report is requested.
format	(Mandatory) Specifies the report format. Valid values: <ul style="list-style-type: none"> • HTML - Generates the HTML version of the report • XML - Generates the XML version of the report • TEXT - Generates the text version of the report

Return Values

The report body in the desired format returned as a CLOB

210.3.34 RESUME_REPLAY Procedure

This procedure resumes a paused workload replay.

Syntax

```
DBMS_WORKLOAD_REPLAY.RESUME_REPLAY;
```

Usage Notes

Prerequisite: A call to the [PAUSE_REPLAY Procedure](#) must have already been issued.

210.3.35 REUSE_REPLAY_FILTER_SET Procedure

This procedure reuses filters in the specified filter set as if each were added using the [ADD_SCHEDULE_ORDERING Function](#).

Each call adds one filter set, which is a collection of individual filters on various attributes. Also, a new filter rule can be added, and an existing filter can be deleted before invoking the [CREATE_FILTER_SET Procedure](#) to create a new filter set.

Syntax

```
DBMS_WORKLOAD_REPLAY.REUSE_REPLAY_FILTER_SET (
    replay_dir IN VARCHAR2,
    filter_set IN VARCHAR2);
```

Parameters

Table 210-31 REUSE_REPLAY_FILTER_SET Procedure Parameters

Parameter	Description
replay_dir	Capture ID of the existing filter set with which it is associated
filter_set	Name of the filter set to be reused

Related Topics

- [ADD_SCHEDULE_ORDERING Function](#)
This function adds a schedule order between two captures.

210.3.36 SET_ADVANCED_PARAMETER Procedure

This procedure sets an advanced parameter for replay besides the ones used with the PREPARE_REPLAY Procedure.

The advanced parameters control aspects of the replay that are more specialized. The advanced parameters are reset to their default values after the replay has finished.

Syntax

```
DBMS_WORKLOAD_REPLAY.SET_ADVANCED_PARAMETER (
    pname IN VARCHAR2,
    pvalue IN VARCHAR2);
```

```
DBMS_WORKLOAD_REPLAY.SET_ADVANCED_PARAMETER (
    pname IN VARCHAR2,
    pvalue IN NUMBER);
```

```
DBMS_WORKLOAD_REPLAY.SET_ADVANCED_PARAMETER (
    pname IN VARCHAR2,
    pvalue IN BOOLEAN);
```

Parameters

Table 210-32 SET_ADVANCED_PARAMETER Procedure Parameters

Parameter	Description
pname	Name of the parameter (case insensitive)
pvalue	Value of the parameter

Usage Notes

The current parameters and values that can be used are:

'DO_NO_WAIT_COMMITS': (default: FALSE)

This parameter controls whether the `COMMIT` issued by replay sessions is `NOWAIT`. The default value for this parameter is `FALSE`. In this case all the `COMMITs` are issued with the mode they were captured (`wait`, `no-wait`, `batch`, `no-batch`). If the parameter is set to `TRUE`, then all `COMMITs` are issued in `no-wait` mode. This is useful in cases where the replay is becoming noticeably slow because of a high volume of concurrent `COMMITs`. Setting the parameter to `TRUE` will significantly decrease the waits on the 'log file sync' event during the replay with respect to capture.

Related Topics

- [PREPARE_REPLAY Procedure](#)
This procedure puts the database state in `PREPARE FOR REPLAY` mode.

210.3.37 SET_REPLAY_DIRECTORY Procedure

This procedure sets a directory that contains multiple workload captures as the current replay directory.

Syntax

```
DBMS_WORKLOAD_REPLAY.SET_REPLAY_DIRECTORY (
    replay_dir IN VARCHAR2);
```

Parameters

Table 210-33 SET_REPLAY_DIRECTORY Procedure Parameters

Parameter	Description
<code>replay_dir</code>	Name of the OS directory containing the captures for a workload consolidation

210.3.38 SET_REPLAY_TIMEOUT Procedure

This procedure sets the replay timeout setting. The purpose is to abort user calls that might make the replay much slower or even cause a replay hang.

Syntax

```
DBMS_WORKLOAD_REPLAY.SET_REPLAY_TIMEOUT (
    enabled OUT BOOLEAN DEFAULT TRUE,
    min_delay OUT NUMBER DEFAULT 10,
    max_delay OUT NUMBER DEFAULT 120,
    delay_factor OUT NUMBER DEFAULT 8);
```

Parameters

Table 210-34 SET_REPLAY_TIMEOUT Procedure Parameters

Parameter	Description
<code>enabled</code>	<code>TRUE</code> to enable the timeout action, and <code>FALSE</code> to disable.
<code>min_delay</code>	Lower bound of call delay in minutes. The replay action is activated only when the delay is equal to or more than <code>min_delay</code> . Default = 10.

Table 210-34 (Cont.) SET_REPLAY_TIMEOUT Procedure Parameters

Parameter	Description
max_delay	Upper bound of call delay in minutes. The timeout action throws ORA-15569 when the delay is more than max_delay. Default = 120.
delay_factor	Factor for the call delay that is between min_delay and max_delay. The timeout action throws ORA-15569 when the current replay elapsed time is more than the product of capture elapsed time and delay_factor. Default = 8.

Usage Notes

- This procedure can be called anytime during replay.
- Call delay is defined as the difference between replay and capture if replay elapsed time is longer than call elapsed time.
- Once a replay timeout action is enabled, a user call will exit with ORA-15569 if it has been delayed more than the condition specified by the replay action. The call and its error are reported as error divergence.
- Replay timeout operates as follows:
 - The timeout action has no effect if it is not enabled.
 - If the call delay in minutes is less than a lower bound specified by parameter min_delay, then the timeout action is non-operational.
 - If the delay in minutes is more than an upper bound specified by parameter max_delay, the timeout action will abort the user call and throw ORA-15569.
 - For delay that is between the lower bound and upper bound, the user call will abort with ORA-15569 only when the current replay elapsed time is more than the product of capture elapsed time and parameter delay_factor.

210.3.39 SET_SQL_MAPPING Procedure

This procedure specifies SQL statements to be skipped or replaced during a database replay operation.

Syntax

```
PROCEDURE SET_SQL_MAPPING (
  schedule_cap_id    IN NUMBER,
  sql_id             IN VARCHAR2,
  operation          IN VARCHAR2,
  replacement_sql_text IN VARCHAR2 DEFAULT NULL);
```

```
PROCEDURE SET_SQL_MAPPING (
  sql_id             IN VARCHAR2,
  operation          IN VARCHAR2,
  replacement_sql_text IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 210-35 SET_SQL_MAPPING Procedure Parameters

Parameter	Description
<code>schedule_cap_id</code>	ID of a capture in the schedule
<code>sql_id</code>	SQL identifier of the SQL statement at the time of capture
<code>operation</code>	Directs that one of the following actions be performed for the specified statement during database replay: <ul style="list-style-type: none"> 'SKIP' — Skip the SQL statement identified by <code>sql_id</code> 'REPLACE' — Replace this SQL statement identified by <code>sql_id</code> with the SQL statement in the <code>replacement_sql_text</code> parameter

Usage Notes

- `replacement_sql_text`: When 'SKIP' is specified for the `operation` parameter, this parameter is NULL. When 'REPLACE' is specified for the `operation` parameter, this parameter's value is the SQL statement to be used.
- `schedule_cap_id` is used for consolidated replay.

210.3.40 SET_USER_MAPPING Procedure

This procedure sets a new schema or user name to be used during replay instead of the captured user.

Syntax

```
DBMS_WORKLOAD_REPLAY.SET_USER_MAPPING (
  schedule_cap_id  IN NUMBER,
  capture_user     IN VARCHAR2,
  replay_user      IN VARCHAR2);
```

```
DBMS_WORKLOAD_REPLAY.SET_USER_MAPPING (
  capture_user     IN VARCHAR2,
  replay_user      IN VARCHAR2);
```

Parameters

Table 210-36 SET_USER_MAPPING Procedure Parameters

Parameter	Description
<code>schedule_cap_id</code>	ID of the a capture in the schedule
<code>capture_user</code>	User name during the time of the workload capture
<code>replay_user</code>	User name to which captured user is remapped during replay.

Usage Notes

- A `schedule_cap_id` of NULL is used for regular non-consolidate replay.
- The replay must be initialized but not prepared in order to use this subprogram.

- If `replay_user` is set to `NULL`, then the mapping is disabled.
- After multiple calls with the same `capture_user`, the last call always takes effect.
- To list all the mappings that will be in effect during the subsequent replay execute the following:

```
SELECT * FROM DBA_WORKLOAD_ACTIVE_USER_MAP
```

- The overloaded version without the `schedule_cap_id` calls the one with the `schedule_cap_id` argument by passing in `NULL`.
- Mappings are stored in a table made public through the view `DBA_WORKLOAD_USER_MAP`. To remove old mappings execute

```
DELETE * FROM DBA_WORKLOAD_USER_MAP
```

210.3.41 START_CONSOLIDATED_REPLAY Procedure

This procedure starts the replay of a multiple-capture capture. It should be used only for consolidated replays.

Syntax

```
DBMS_WORKLOAD_REPLAY.START_CONSOLIDATED_REPLAY;
```

Usage Notes

Prerequisites:

- The call to the [PREPARE_REPLAY Procedure](#) was already issued.
- A sufficient number of external replay clients (WRC) that can faithfully replay the captured workload already started. The status of such external replay clients can be monitored using `V$WORKLOAD_REPLAY_CLIENTS`.

210.3.42 START_REPLAY Procedure

This procedure starts the workload replay.

All the external replay clients (WRC) that are currently connected to the replay database will automatically be notified, and those replay clients (WRC) will begin issuing the captured workload. It should only be used for consolidated replays.

Syntax

```
DBMS_WORKLOAD_REPLAY.START_REPLAY;
```

Usage Notes

- Prerequisites:
 - The call to the [PREPARE_REPLAY Procedure](#) was already issued.
 - A sufficient number of external replay clients (WRC) that can faithfully replay the captured workload already started. The status of such external replay clients can be monitored using `V$WORKLOAD_REPLAY_CLIENTS`.
- Use the WRC's `CALIBRATE` mode to determine the number of replay clients that might be required to faithfully replay the captured workload. For example:


```
$ wrc mode=calibrate replaydir=.
```

210.3.43 USE_FILTER_SET Procedure

This procedure applies a filter set to a capture in the current replay schedule.

The filter set must have been created by calling the [CREATE_FILTER_SET Procedure](#).

Syntax

```
DBMS_WORKLOAD_REPLAY.USE_FILTER_SET(  
    capture_number IN VARCHAR2,  
    filter_set     IN  VARCHAR2);
```

```
DBMS_WORKLOAD_REPLAY.USE_FILTER_SET(  
    filter_set     IN  VARCHAR2);
```

Parameters

Table 210-37 USE_FILTER_SET Procedure Parameters

Parameter	Description
capture_number	Pointing to a capture of the current replay schedule
filter_set	Name of the filter set

Usage Notes

The filter set must have been created by calling the [CREATE_FILTER_SET Procedure](#).

DBMS_WORKLOAD_REPOSITORY

The `DBMS_WORKLOAD_REPOSITORY` package lets you manage the Automatic Workload Repository (AWR) by performing operations, such as, managing snapshots and baselines.

The chapter contains the following topics:

- [Examples](#)
- [Data Structures](#)
- [Summary of DBMS_WORKLOAD_REPOSITORY Subprograms](#)



See Also:

Oracle Database Performance Tuning Guide for more information about the Automatic Workload Repository

211.1 DBMS_WORKLOAD_REPOSITORY Examples

This example shows how to generate an AWR text report with the `DBMS_WORKLOAD_REPOSITORY` package for database ID 1557521192, instance ID 1, snapshot IDs 5390 and 5391, and with default options.

```
-- make sure to set line size appropriately
-- set linesize 152
SELECT output FROM TABLE(
  DBMS_WORKLOAD_REPOSITORY.AWR_REPORT_TEXT(
    1557521192, 1, 5390, 5392) );
```

You can call the `DBMS_WORKLOAD_REPOSITORY` packaged functions directly as in the example, but Oracle recommends you use the corresponding supplied SQL script (`awrrpt.sql` in this case) for the packaged function, which prompts the user for required information.

211.2 DBMS_WORKLOAD_REPOSITORY Data Structures

The `DBMS_WORKLOAD_REPOSITORY` package defines an object and associated table types.

OBJECT Types

- [AWR_BASELINE_METRIC_TYPE](#) Object Type

TABLE Types

- [AWR_BASELINE_METRIC_TYPE_TABLE](#) Table Type
- [AWRRPT_INSTANCE_LIST_TYPE](#) Table Type

211.2.1 DBMS_WORKLOAD_REPOSITORY AWR_BASELINE_METRIC_TYPE Object Type

This type shows the values of the metrics corresponding to a baseline.

Syntax

```
TYPE awr_baseline_metric_type AS OBJECT (
  baseline_name      VARCHAR2(64),
  dbid               NUMBER NOT NULL,
  instance_number    NUMBER NOT NULL,
  beg_time           DATE NOT NULL,
  end_time           DATE NOT NULL,
  metric_id          NUMBER NOT NULL,
  metric_name        VARCHAR2(64) NOT NULL,
  metric_unit        VARCHAR2(64) NOT NULL,
  num_interval       NUMBER NOT NULL,
  interval_size      NUMBER NOT NULL,
  average            NUMBER NOT NULL,
  minimum            NUMBER NOT NULL,
  maximum            NUMBER NOT NULL);
```

Fields

Table 211-1 AWR_BASELINE_METRIC_TYPE Fields

Field	Description
baseline_name	Name of the Baseline
dbid	Database ID for the snapshot
instance_number	Instance number for the snapshot
beg_time	Begin time of the interval
end_time	End time of the interval
metric_id	Metric ID
metric_name	Metric name
metric_unit	Unit of measurement
num_interval	Number of intervals observed
interval_size	Interval size (in hundredths of a second)
average	Average over the period
minimum	Minimum value observed
maximum	Maximum value observed

211.2.2 DBMS_WORKLOAD_REPOSITORY AWR_BASELINE_METRIC_TYPE_TABLE Table Type

This type is used by the SELECT_BASELINE_METRIC Function.

Syntax

```
CREATE TYPE awr_baseline_metric_type_table AS TABLE OF awr_baseline_metric_type;
```

Related Topics

- [SELECT_BASELINE_METRIC Function](#)
This table function shows the values of the metrics corresponding to a baseline for all the snapshots.

211.2.3 DBMS_WORKLOAD_REPOSITORY AWRRPT_INSTANCE_LIST_TYPE Table Type

This type provides an alternative to a comma-separated list.

Syntax

```
CREATE TYPE awrrpt_instance_list_type AS TABLE OF NUMBER;
```

211.3 Summary of DBMS_WORKLOAD_REPOSITORY Subprograms

This table lists the DBMS_WORKLOAD_REPOSITORY subprograms and briefly describes them.

Table 211-2 DBMS_WORKLOAD_REPOSITORY Package Subprograms

Subprogram	Description
ADD_COLORED_SQL Procedure	Adds a colored SQL ID
ASH_GLOBAL_REPORT_HTML Function	Displays a global or Oracle Real Application Clusters (Oracle RAC) ASH Spot report in HTML format.
ASH_GLOBAL_REPORT_TEXT Function	Displays a global or Oracle Real Application Clusters (Oracle RAC) ASH Spot report in Text format.
ASH_REPORT_ANALYTICS Function	Displays the ASH Analytics active report
ASH_REPORT_HTML Function	Displays the ASH report in HTML
ASH_REPORT_TEXT Function	Displays the ASH report in text
AWR_DIFF_REPORT_HTML Function	Displays the AWR Diff-Diff report in HTML
AWR_DIFF_REPORT_TEXT Function	Displays the AWR Diff-Diff report in text
AWR_GLOBAL_DIFF_REPORT_HTML Functions	Displays the Global AWR Compare Periods Report in HTML

Table 211-2 (Cont.) DBMS_WORKLOAD_REPOSITORY Package Subprograms

Subprogram	Description
AWR_GLOBAL_DIFF_REPORT_TEXT Functions	Displays the Global AWR Compare Periods Report in text
AWR_EXP Procedure	Extracts AWR data from the AWR schema into a dump file.
AWR_GLOBAL_REPORT_HTML Functions	Displays the Global AWR report in HTML
AWR_GLOBAL_REPORT_TEXT Functions	Displays the Global AWR report in text
AWR_IMP Procedure	Loads the AWR data from a dump file into the SYS schema.
AWR_REPORT_HTML Function	Displays the AWR report in HTML
AWR_REPORT_TEXT Function	Displays the AWR report in text
AWR_SET_REPORT_THRESHOLD S Procedure	Configures specified report thresholds, including the number of rows in the report
AWR_SQL_REPORT_HTML Function	Displays the AWR SQL Report in HTML format
AWR_SQL_REPORT_TEXT Function	Displays the AWR SQL Report in text format
CONTROL_RESTRICTED_SNAPSHOT Procedure	Controls the AWR snapshot creation for a database in the <i>restricted session</i> mode.
CREATE_BASELINE Functions & Procedures	Creates a single baseline
CREATE_BASELINE_TEMPLATE Procedures	Creates a baseline template
CREATE_REMOTE_SNAPSHOT Function and Procedure	Creates a manual <i>remote</i> snapshot immediately using the Remote Management Framework (RMF)
CREATE_SNAPSHOT Function and Procedure	Creates a manual <i>local</i> snapshot immediately
DROP_BASELINE Procedure	Drops a previously-defined baseline
DROP_BASELINE_TEMPLATE Procedure	Removes a baseline template that is no longer needed
DROP_SNAPSHOT_RANGE Procedure	Drops a range of snapshots
LOCAL_AWR_DBID Function	Returns the database identifier for the local AWR database
MODIFY_BASELINE_WINDOW_SIZE Procedure	Modifies the window size for the Default Moving Window Baseline
MODIFY_SNAPSHOT_SETTINGS Procedures	Modifies the snapshot settings
PURGE_SQL_DETAILS Procedure	Purges SQL details, specifically rows from <code>WRH\$_SQLTEXT</code> and <code>WRH\$_SQL_PLAN</code> that do not have corresponding rows (DBID, SQL_ID) in <code>WRH\$_SQLSTAT</code> .
REGISTER_REMOTE_DATABASE Procedures	Registers a remote database in the AWR using the Remote Management Framework (RMF)
REMOVE_COLORED_SQL Procedure	Removes a colored SQL ID
RENAME_BASELINE Procedure	Renames a baseline

Table 211-2 (Cont.) DBMS_WORKLOAD_REPOSITORY Package Subprograms

Subprogram	Description
SELECT_BASELINE_DETAILS Function	Shows the values of the metrics corresponding to a baseline for a range of snapshots
SELECT_BASELINE_METRIC Function	Shows the values of the metrics corresponding to a baseline for all the snapshots
UNREGISTER_REMOTE_DATABASE Procedures	Removes all the statistics, metadata, and partitions of a remote database from the AWR using the Remote Management Framework (RMF)
UPDATE_DATAFILE_INFO Procedure	Updates the data file and tablespace information stored in the AWR with the current information in the database
UPDATE_OBJECT_INFO Procedure	Updates rows of WRH\$_SEG_STAT_OBJ table that represent objects in the local database

211.3.1 ADD_COLORED_SQL Procedure

This procedure adds a colored SQL ID.

If an SQL ID is colored, it will be captured in every snapshot, independent of its level of activities (so that it does not have to be a *TOP SQL*). Capture occurs if the SQL is found in the cursor cache at snapshot time. To uncolor the SQL, invoke the [REMOVE_COLORED_SQL Procedure](#).

Syntax

```
DBMS_WORKLOAD_REPOSITORY.ADD_COLORED_SQL (
    sql_id          IN VARCHAR2,
    dbid            IN NUMBER DEFAULT NULL);
```

Parameters

Table 211-3 ADD_COLORED_SQL Procedure Parameters

Parameter	Description
sql_id	13-character external SQL ID
dbid	Optional DBID, defaults to Local DBID

211.3.2 ASH_GLOBAL_REPORT_HTML Function

This table function displays a global or Oracle Real Application Clusters (Oracle RAC) ASH Spot report in HTML format.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.ASH_GLOBAL_REPORT_HTML (
    l_dbid          IN NUMBER,
    l_inst_num      IN VARCHAR2 ((1023)),
    l_btime         IN DATE,
    l_etime         IN DATE,
    l_options       IN NUMBER    DEFAULT 0,
```

```

l_slot_width    IN NUMBER    DEFAULT 0,
l_sid           IN NUMBER    DEFAULT NULL,
l_sql_id        IN VARCHAR2  DEFAULT NULL,
l_wait_class    IN VARCHAR2  DEFAULT NULL,
l_service_hash  IN NUMBER    DEFAULT NULL,
l_module        IN VARCHAR2  DEFAULT NULL,
l_action        IN VARCHAR2  DEFAULT NULL,
l_client_id     IN VARCHAR2  DEFAULT NULL,
l_plsql_entry   IN VARCHAR2  DEFAULT NULL,
l_data_src      IN NUMBER    DEFAULT 0,
l_container     IN VARCHAR2  DEFAULT NULL)
RETURN awrrpt_html_type_table PIPELINED;
```

Parameters

Table 211-4 *ASH_GLOBAL_REPORT_HTML Parameters*

Parameter	Description
<code>l_dbid</code>	Database identifier
<code>l_inst_num</code>	List of instances (such as '1, 2, 3'), or NULL to report on all instances in the database
<code>l_btime</code>	The 'begin time'
<code>l_etime</code>	The 'end time'
<code>l_options</code>	Report level (currently not used)
<code>l_slot_width</code>	Specifies (in seconds) how wide the slots used in the "Top Activity" section of the report should be. This argument is optional, and if it is not specified the time interval between <code>l_btime</code> and <code>l_etime</code> is appropriately split into not more than 10 slots.
<code>l_sid</code>	Session ID (see Usage Notes)
<code>l_sql_id</code>	SQL ID (see Usage Notes)
<code>l_wait_class</code>	Wait class name (see Usage Notes)
<code>l_service_hash</code>	Service name hash (see Usage Notes)
<code>l_module</code>	Module name (see Usage Notes)
<code>l_action</code>	Action name (see Usage Notes)
<code>l_client_id</code>	Client ID for end-to-end backtracing (see Usage Notes)
<code>l_plsql_entry</code>	PL/SQL entry point (see Usage Notes)
<code>l_data_src</code>	Ignored since the report works off of data on disk only
<code>l_container</code>	Name of the container for which report activity is limited. Valid values other than NULL (default) should be taken from container names in <code>V\$CONTAINERS</code> . Behavior is as follows: <ul style="list-style-type: none"> • If NULL: When connected to a root container the report is on all containers. When connected to a PDB the report is on only that PDB. • If not NULL: When connected to a root container the report is on activity from the specified container. When connected to a PDB the report is the same as NULL value for <code>l_container</code> regarding the connected PDB. <p>Note: If while connected to a PDB you request information from another PDB this produces an empty report.</p>

Return Values

The output will be one column of VARCHAR2 (1500).

Usage Notes

- You can call the function directly but Oracle recommends you use the `ashrpti.sql` script which prompts users for the required information.
- The unspecified optional arguments are used to generate an ASH Reports that specify 'report targets' such as a SQL statement, or a session, or a particular Service/Module combination. These arguments are specified to restrict the ASH rows that would be used to generate the report. For example, to generate an ASH report on a particular SQL statement, such as `SQL_ID 'abcdefghijkl123'` pass that `sql_id` value to the `l_sql_id` argument:

```
l_sql_id => 'abcdefghijkl123'
```

Any combination of those optional arguments can be passed in, and only rows in ASH that satisfy all of those 'report targets' will be used. If multiple 'report targets' are specified, AND conditional logic is used to connect them. For example, to generate an ASH report on `MODULE "PAYROLL"` and `ACTION "PROCESS"`, use the following predicate:

```
l_module => 'PAYROLL', l_action => 'PROCESS'
```

Valid SQL wildcards can be used in all the arguments that are of type VARCHAR2.

Table 211-5 ASH_REPORT_HTML: Wildcards Allowed (or Not) in Arguments

Argument Name	Comment	Wildcard Allowed
<code>l_sid</code>	Session ID (for example, <code>V\$SESSION.SID</code>)	No
<code>l_sql_id</code>	SQL ID (for example, <code>V\$SQL.SQL_ID</code>)	Yes
<code>l_wait_class</code>	Wait class name (for example, <code>V\$EVENT_NAME.WAIT_CLASS</code>)	Yes
<code>l_service_hash</code>	Service name hash (for example, <code>V\$ACTIVE_SERVICES.NAME_HASH</code>)	No
<code>l_module</code>	Module name (for example, <code>V\$SESSION.MODULE</code>)	Yes
<code>l_action</code>	Action name (for example, <code>V\$SESSION.ACTION</code>)	Yes
<code>l_client_id</code>	Client ID for end-to-end backtracing (for example, <code>V\$SESSION.CLIENT_IDENTIFIER</code>)	Yes
<code>l_data_src</code>	Wildcards are not allowed for <code>l_data_src</code> as it is of numeric datatype	No

211.3.3 ASH_GLOBAL_REPORT_TEXT Function

This table function displays a global or Oracle Real Application Clusters (Oracle RAC) ASH Spot report in text format.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.ASH_GLOBAL_REPORT_TEXT(
  l_dbid          IN VARCHAR2(1023),
  l_inst_num     IN NUMBER,
```



```

l_btime      IN DATE,
l_etime      IN DATE,
l_options    IN NUMBER    DEFAULT 0,
l_slot_width IN NUMBER    DEFAULT 0,
l_sid        IN NUMBER    DEFAULT NULL,
l_sql_id     IN VARCHAR2  DEFAULT NULL,
l_wait_class IN VARCHAR2  DEFAULT NULL,
l_service_hash IN NUMBER   DEFAULT NULL,
l_module     IN VARCHAR2  DEFAULT NULL,
l_action     IN VARCHAR2  DEFAULT NULL,
l_client_id  IN VARCHAR2  DEFAULT NULL,
l_plsql_entry IN VARCHAR2  DEFAULT NULL,
l_data_src   IN NUMBER    DEFAULT 0,
l_container  IN VARCHAR2  DEFAULT NULL)
RETURN awrrpt_text_type_table PIPELINED;

```

Parameters

Table 211-6 ASH_GLOBAL_REPORT_TEXT Parameters

Parameter	Description
<code>l_dbid</code>	Database identifier
<code>l_inst_num</code>	List of instances (such as '1,2,3'), or NULL to report on all instances in the database
<code>l_btime</code>	The 'begin time'
<code>l_etime</code>	The 'end time'
<code>l_options</code>	Report level (currently not used)
<code>l_slot_width</code>	Specifies (in seconds) how wide the slots used in the "Top Activity" section of the report should be. This argument is optional, and if it is not specified the time interval between <code>l_btime</code> and <code>l_etime</code> is appropriately split into not more than 10 slots.
<code>l_sid</code>	Session ID (see Usage Notes)
<code>l_sql_id</code>	SQL ID (see Usage Notes)
<code>l_wait_class</code>	Wait class name (see Usage Notes)
<code>l_service_hash</code>	Service name hash (see Usage Notes)
<code>l_module</code>	Module name (see Usage Notes)
<code>l_action</code>	Action name (see Usage Notes)
<code>l_client_id</code>	Client ID for end-to-end backtracing (see Usage Notes)
<code>l_plsql_entry</code>	PL/SQL entry point (see Usage Notes)
<code>l_data_src</code>	Ignored since the report works off of data on disk only

Table 211-6 (Cont.) ASH_GLOBAL_REPORT_TEXT Parameters

Parameter	Description
<code>l_container</code>	<p>Name of the container for which report activity is limited. Valid values other than <code>NULL</code> (default) should be taken from container names in <code>V\$CONTAINERS</code>. Behavior is as follows:</p> <ul style="list-style-type: none"> • If <code>NULL</code>: When connected to a root container the report is on all containers. When connected to a PDB the report is on only that PDB. • If not <code>NULL</code>: When connected to a root container the report is on activity from the specified container. When connected to a PDB the report is the same as <code>NULL</code> value for <code>l_container</code> regarding the connected PDB. <p>Note: If while connected to a PDB you request information from another PDB this produces an empty report.</p>

Return Values

The output will be one column of `VARCHAR2 (320)`.

Usage Notes

- You can call the function directly but Oracle recommends you use the `ashrpti.sql` script which prompts users for the required information.
- The unspecified optional arguments are used to generate an ASH Reports that specify 'report targets' such as a SQL statement, or a session, or a particular Service/Module combination. These arguments are specified to restrict the ASH rows that would be used to generate the report. For example, to generate an ASH report on a particular SQL statement, such as `SQL_ID 'abcdefghij123'` pass that `SQL_ID` value to the `l_sql_id` argument:

```
l_sql_id => 'abcdefghij123'
```

Table 211-7 ASH_GLOBAL_REPORT_TEXT: Wildcards Allowed (or Not) in Arguments

Argument Name	Comment	Wildcard Allowed
<code>l_sid</code>	Session ID (for example, <code>V\$SESSION.SID</code>)	No
<code>l_sql_id</code>	SQL ID (for example, <code>V\$SQL.SQL_ID</code>)	Yes
<code>l_wait_class</code>	Wait class name (for example, <code>V\$EVENT_NAME.WAIT_CLASS</code>)	Yes
<code>l_service_hash</code>	Service name hash (for example, <code>V\$ACTIVE_SERVICES.NAME_HASH</code>)	No
<code>l_module</code>	Module name (for example, <code>V\$SESSION.MODULE</code>)	Yes
<code>l_action</code>	Action name (for example, <code>V\$SESSION.ACTION</code>)	Yes
<code>l_client_id</code>	Client ID for end-to-end backtracing (for example, <code>V\$SESSION.CLIENT_IDENTIFIER</code>)	Yes

Table 211-7 (Cont.) ASH_GLOBAL_REPORT_TEXT: Wildcards Allowed (or Not) in Arguments

Argument Name	Comment	Wildcard Allowed
<code>l_plsql_entry</code>	PL/SQL entry point (for example, "SYS.DBMS_LOB.*")	Yes
<code>l_data_src</code>	Wildcards are not allowed for <code>l_data_src</code> as it is of numeric datatype	No

- Any combination of those optional arguments can be passed in, and only rows in ASH that satisfy all of those 'report targets' will be used. If multiple 'report targets' are specified, AND conditional logic is used to connect them. For example, to generate an ASH report on MODULE "PAYROLL" and ACTION "PROCESS", use the following predicate:

```
l_module => 'PAYROLL', l_action => 'PROCESS'
```

Valid SQL wildcards can be used in all the arguments that are of type VARCHAR2.

211.3.4 ASH_REPORT_ANALYTICS Function

This function returns the ASH Analytics active report.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.ASH_REPORT_ANALYTICS(
  dbid          IN NUMBER DEFAULT NULL,
  inst_id       IN NUMBER DEFAULT NULL,
  begin_time    IN DATE,
  end_time      IN DATE,
  report_level  IN VARCHAR2 DEFAULT NULL,
  filter_list   IN VARCHAR2 DEFAULT NULL)
RETURN CLOB;
```

Parameters

Table 211-8 ASH_REPORT_ANALYTICS Parameters

Parameter	Description
<code>dbid</code>	Database identifier. If its value is set to NULL, then the database identifier for the local database is used. Its default value is NULL.
<code>inst_id</code>	Instance number of the database for which the statistics are required. If its value is set to NULL, then the statistics for the local database are returned. Its default value is NULL.
<code>begin_time</code>	The start time of the interval for which the ASH report is required.
<code>end_time</code>	The end time of the interval for which the ASH report is required.
<code>report_level</code>	Describes the list of components to build.
<code>filter_list</code>	Describes the list of filters to apply. Its default value is NULL (no filters to apply).

Return Values

Returns the ASH Analytics active report.

211.3.5 ASH_REPORT_HTML Function

This table function displays the ASH Spot report in HTML.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.ASH_REPORT_HTML(
    l_dbid          IN NUMBER,
    l_inst_num      IN NUMBER,
    l_btime         IN DATE,
    l_etime         IN DATE,
    l_options       IN NUMBER    DEFAULT 0,
    l_slot_width    IN NUMBER    DEFAULT 0,
    l_sid           IN NUMBER    DEFAULT NULL,
    l_sql_id        IN VARCHAR2  DEFAULT NULL,
    l_wait_class    IN VARCHAR2  DEFAULT NULL,
    l_service_hash  IN NUMBER    DEFAULT NULL,
    l_module        IN VARCHAR2  DEFAULT NULL,
    l_action        IN VARCHAR2  DEFAULT NULL,
    l_client_id     IN VARCHAR2  DEFAULT NULL,
    l_plsql_entry   IN VARCHAR2  DEFAULT NULL,
    l_data_src      IN NUMBER    DEFAULT 0,
    l_container     IN VARCHAR2  DEFAULT NULL)
RETURN awrrpt_html_type_table PIPELINED;
```

Parameters

Table 211-9 *ASH_REPORT_HTML Parameters*

Parameter	Description
<code>l_dbid</code>	Database identifier
<code>l_inst_num</code>	Instance number
<code>l_btime</code>	The 'begin time'
<code>l_etime</code>	The 'end time'
<code>l_options</code>	Report level (currently not used)
<code>l_slot_width</code>	Specifies (in seconds) how wide the slots used in the "Top Activity" section of the report should be. This argument is optional, and if it is not specified the time interval between <code>l_btime</code> and <code>l_etime</code> is appropriately split into not more than 10 slots.
<code>l_sid</code>	Session ID (see Usage Notes)
<code>l_sql_id</code>	SQL ID (see Usage Notes)
<code>l_wait_class</code>	Wait class name (see Usage Notes)
<code>l_service_hash</code>	Service name hash (see Usage Notes)
<code>l_module</code>	Module name (see Usage Notes)
<code>l_action</code>	Action name (see Usage Notes)
<code>l_client_id</code>	Client ID for end-to-end backtracing (see Usage Notes)
<code>l_plsql_entry</code>	PL/SQL entry point (see Usage Notes)

Table 211-9 (Cont.) ASH_REPORT_HTML Parameters

Parameter	Description
<code>l_data_src</code>	<p>Can be used to specify a data source (see Usage Notes)</p> <ul style="list-style-type: none"> • 1 => memory (V\$ACTIVE_SESSION_HISTORY) • 2 => disk (DBA_HIST_ACTIVE_SESS_HISTORY) • 0 => both. This is the default value. Here, the begin and end time parameters are used to get the samples from the appropriate data source, which can be memory, disk, or both.
<code>l_container</code>	<p>Name of the container for which report activity is limited. Valid values other than NULL (default) should be taken from container names in V\$CONTAINERS. Behavior is as follows:</p> <ul style="list-style-type: none"> • If NULL: When connected to a root container the report is on all containers. When connected to a PDB the report is on only that PDB. • If not NULL: When connected to a root container the report is on activity from the specified container. When connected to a PDB the report is the same as NULL value for <code>l_container</code> regarding the connected PDB. <p>Note: If while connected to a PDB you request information from another PDB this produces an empty report.</p>

Return Values

The output will be one column of VARCHAR2 (500).

Usage Notes

- You can call the function directly but Oracle recommends you use the `ashrpti.sql` script which prompts users for the required information.
- By default, the report uses the begin and end time parameters (`l_btime` and `l_etime`, respectively) to find all rows in that time range either from memory, or disk, or both. However, using `l_data_src`, one can explicitly specify one of those data sources. For example, to generate an ASH report on all rows between `l_btime` and `l_time` found in memory, use

```
l_data_src => 1
```

Similarly, to generate a report on samples found only on disk, use

```
l_data_src => 2
```

- The unspecified optional arguments are used to generate an ASH Reports that specify 'report targets' such as a SQL statement, or a session, or a particular Service/Module combination. These arguments are specified to restrict the ASH rows that would be used to generate the report. For example, to generate an ASH report on a particular SQL statement, such as `SQL_ID 'abcdefghijkl123'` pass that `sql_id` value to the `l_sql_id` argument:

```
l_sql_id => 'abcdefghijkl123'
```

Any combination of those optional arguments can be passed in, and only rows in ASH that satisfy all of those 'report targets' will be used. If multiple 'report targets' are specified, AND conditional logic is used to connect them. For example, to

generate an ASH report on MODULE "PAYROLL" and ACTION "PROCESS", use the following predicate:

```
l_module => 'PAYROLL', l_action => 'PROCESS'
```

Valid SQL wildcards can be used in all the arguments that are of type VARCHAR2.

Table 211-10 ASH_REPORT_HTML: Wildcards Allowed (or Not) in Arguments

Argument Name	Comment	Wildcard Allowed
l_sid	Session ID (for example, V\$SESSION.SID)	No
l_sql_id	SQL ID (for example, V\$SQL.SQL_ID)	Yes
l_wait_class	Wait class name (for example, V\$EVENT_NAME.WAIT_CLASS)	Yes
l_service_hash	Service name hash (for example, V\$ACTIVE_SERVICES.NAME_HASH)	No
l_module	Module name (for example, V\$SESSION.MODULE)	Yes
l_action	Action name (for example, V\$SESSION.ACTION)	Yes
l_client_id	Client ID for end-to-end backtracing (for example, V\$SESSION.CLIENT_IDENTIFIER)	Yes

211.3.6 ASH_REPORT_TEXT Function

This table function displays the ASH Spot report in text.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.ASH_REPORT_TEXT (
  l_dbid          IN NUMBER,
  l_inst_num      IN NUMBER,
  l_btime         IN DATE,
  l_etime        IN DATE,
  l_options       IN NUMBER      DEFAULT 0,
  l_slot_width   IN NUMBER      DEFAULT 0,
  l_sid          IN NUMBER      DEFAULT NULL,
  l_sql_id       IN VARCHAR2    DEFAULT NULL,
  l_wait_class   IN VARCHAR2    DEFAULT NULL,
  l_service_hash IN NUMBER      DEFAULT NULL,
  l_module       IN VARCHAR2    DEFAULT NULL,
  l_action       IN VARCHAR2    DEFAULT NULL,
  l_client_id    IN VARCHAR2    DEFAULT NULL,
  l_plsql_entry  IN VARCHAR2    DEFAULT NULL,
  l_data_src     IN NUMBER      DEFAULT 0,
  l_container    IN VARCHAR2    DEFAULT NULL)
RETURN awrrpt_text_type_table PIPELINED;
```

Parameters

Table 211-11 ASH_REPORT_TEXT Parameters

Parameter	Description
l_dbid	Database identifier

Table 211-11 (Cont.) ASH_REPORT_TEXT Parameters

Parameter	Description
<code>l_inst_num</code>	Instance number
<code>l_btime</code>	The 'begin time'
<code>l_etime</code>	The 'end time'
<code>l_options</code>	Report level (currently not used)
<code>l_slot_width</code>	Specifies (in seconds) how wide the slots used in the "Top Activity" section of the report should be. This argument is optional, and if it is not specified the time interval between <code>l_btime</code> and <code>l_etime</code> is appropriately split into not more than 10 slots.
<code>l_sid</code>	Session ID (see Usage Notes)
<code>l_sql_id</code>	SQL ID (see Usage Notes)
<code>l_wait_class</code>	Wait class name (see Usage Notes)
<code>l_service_hash</code>	Service name hash (see Usage Notes)
<code>l_module</code>	Module name (see Usage Notes)
<code>l_action</code>	Action name (see Usage Notes)
<code>l_client_id</code>	Client ID for end-to-end backtracing (see Usage Notes)
<code>l_plsql_entry</code>	PL/SQL entry point (see Usage Notes)
<code>l_data_src</code>	Can be used to specify a data source (see Usage Notes) <ul style="list-style-type: none"> • 1 => memory (<code>V\$ACTIVE_SESSION_HISTORY</code>) • 2 => disk (<code>DBA_HIST_ACTIVE_SESS_HISTORY</code>) • 0 => both. This is the default value. Here, the begin and end time parameters are used to get the samples from the appropriate data source, which can be memory, disk, or both.
<code>l_container</code>	Name of the container for which report activity is limited. Valid values other than <code>NULL</code> (default) should be taken from container names in <code>V\$CONTAINERS</code> . Behavior is as follows: <ul style="list-style-type: none"> • If <code>NULL</code>: When connected to a root container the report is on all containers. When connected to a PDB the report is on only that PDB. • If not <code>NULL</code>: When connected to a root container the report is on activity from the specified container. When connected to a PDB the report is the same as <code>NULL</code> value for <code>l_container</code> regarding the connected PDB. <p>Note: If while connected to a PDB you request information from another PDB this produces an empty report.</p>

Return Values

The output will be one column of `VARCHAR2 (80)`.

Usage Notes

- You can call the function directly but Oracle recommends you use the `ashrpti.sql` script which prompts users for the required information.
- By default, the report uses the begin and end time parameters (`l_btime` and `l_etime`, respectively) to find all rows in that time range either from memory, or

disk, or both. However, using `l_data_src`, one can explicitly specify one of those data sources. For example, to generate an ASH report on all rows between `l_btime` and `l_time` found in memory, use

```
l_data_src => 1
```

Similarly, to generate a report on samples found only on disk, use

```
l_data_src => 2
```

- The unspecified optional arguments are used to generate an ASH Reports that specify 'report targets' such as a SQL statement, or a session, or a particular Service/Module combination. These arguments are specified to restrict the ASH rows that would be used to generate the report. For example, to generate an ASH report on a particular SQL statement, such as `SQL_ID 'abcdefghijkl123'` pass that `SQL_ID` value to the `l_sql_id` argument:

```
l_sql_id => 'abcdefghijkl123'
```

Table 211-12 ASH_REPORT_TEXT: Wildcards Allowed (or Not) in Arguments

Argument Name	Comment	Wildcard Allowed
<code>l_sid</code>	Session ID (for example, <code>V\$SESSION.SID</code>)	No
<code>l_sql_id</code>	SQL ID (for example, <code>V\$SQL.SQL_ID</code>)	Yes
<code>l_wait_class</code>	Wait class name (for example, <code>V\$EVENT_NAME.WAIT_CLASS</code>)	Yes
<code>l_service_hash</code>	Service name hash (for example, <code>V\$ACTIVE_SERVICES.NAME_HASH</code>)	No
<code>l_module</code>	Module name (for example, <code>V\$SESSION.MODULE</code>)	Yes
<code>l_action</code>	Action name (for example, <code>V\$SESSION.ACTION</code>)	Yes
<code>l_client_id</code>	Client ID for end-to-end backtracing (for example, <code>V\$SESSION.CLIENT_IDENTIFIER</code>)	Yes
<code>l_plsql_entry</code>	PL/SQL entry point (for example, <code>"SYS.DBMS_LOB.*"</code>)	Yes
<code>l_data_src</code>	Wildcards are not allowed for <code>l_data_src</code> as it is of numeric datatype	No

- Any combination of those optional arguments can be passed in, and only rows in ASH that satisfy all of those 'report targets' will be used. If multiple 'report targets' are specified, `AND` conditional logic is used to connect them. For example, to generate an ASH report on `MODULE "PAYROLL"` and `ACTION "PROCESS"`, use the following predicate:

```
l_module => 'PAYROLL', l_action => 'PROCESS'
```

Valid SQL wildcards can be used in all the arguments that are of type `VARCHAR2`.

211.3.7 AWR_DIFF_REPORT_HTML Function

This table function displays the AWR Compare Periods report in HTML.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.AWR_DIFF_REPORT_HTML(
  dbid1      IN NUMBER,
  inst_num1  IN NUMBER,
  bid1       IN NUMBER,
  eid1       IN NUMBER,
  dbid2      IN NUMBER,
  inst_num2  IN NUMBER,
  bid2       IN NUMBER,
  eid2       IN NUMBER)
RETURN awrdrpt_text_type_table PIPELINED;
```

Parameters

Table 211-13 AWR_DIFF_REPORT_HTML Parameters

Parameter	Description
dbid1	1st database identifier
inst_num1	1st instance number
bid1	1st beginning snapshot ID
eid1	1st ending snapshot ID
dbid2	2nd database identifier
inst_num2	2nd instance number
bid2	2nd beginning snapshot ID
eid2	2nd ending snapshot ID

Return Values

The output will be one column of VARCHAR2 (500).

Usage Notes

You can call the function directly but Oracle recommends you use the awrddrpt.sql script which prompts users for the required information.

211.3.8 AWR_DIFF_REPORT_TEXT Function

This table function displays the AWR Compare Periods report in text.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.AWR_DIFF_REPORT_TEXT(
  dbid1      IN NUMBER,
  inst_num1  IN NUMBER,
  bid1       IN NUMBER,
  eid1       IN NUMBER,
  dbid2      IN NUMBER,
```

```

inst_num2 IN NUMBER,
bid2      IN NUMBER,
eid2      IN NUMBER)
RETURN awrrpt_text_type_table PIPELINED;

```

Parameters

Table 211-14 *AWR_DIFF_REPORT_TEXT* Parameters

Parameter	Description
dbid1	1st database identifier
inst_num1	1st instance number
bid1	1st beginning snapshot ID
eid1	1st ending snapshot ID
dbid2	2nd database identifier
inst_num2	2nd instance number
bid2	2nd beginning snapshot ID
eid2	2nd ending snapshot ID

Return Values

The output will be one column of VARCHAR2 (500).

Usage Notes

You can call the function directly but Oracle recommends you use the `awrrdrpt.sql` script which prompts users for the required information.

211.3.9 AWR_EXP Procedure

This procedure extracts AWR data from the AWR schema and dump the information into a file. You can specify the snapshot range for the data that you want to extract.

Syntax

```

DBMS_WORKLOAD_REPOSITORY.AWR_EXP (
  dmpfile      IN   VARCHAR2  DEFAULT 'awrdat',
  dmpdir       IN   VARCHAR2  DEFAULT 'DATA_PUMP_DIR',
  dbid         IN   NUMBER     DEFAULT NULL,
  bid         IN   NUMBER     DEFAULT 1,
  eid         IN   NUMBER     DEFAULT 1000000);

```

Parameters

Table 211-15 *AWR_EXP* Procedure Parameters

Parameter	Description
dmpfile	The prefix for the name of the extract dump file and log file. The name of the dump file where all the data from the AWR table will be written is <code>dmpfile.dmp</code> . The <code>dmpfile.log</code> log file shows the status of the export job. The default value for the prefix is <code>awrdat</code> .

Table 211-15 (Cont.) AWR_EXP Procedure Parameters

Parameter	Description
dmpdir	Name of the Directory Object for the file system directory where the extract dump file will be written. The list of Directory Objects can be queried using the DBA_DIRECTORIES view, and a new directory object can be created using the following command: create directory dmpdir as '/directory/path'. The default value is DATA_PUMP_DIR.
dbid	The database ID for the snapshots that you want to export. The default value is NULL, for the local database ID.
bid	The begin snapshot ID for snapshots to be exported. The default value is 1.
eid	The end Snapshot Id for snapshots to be exported. The default value is 10000000.

211.3.10 AWR_GLOBAL_DIFF_REPORT_HTML Functions

This table function displays Global AWR Compare Periods Report in HTML format.

The first overload accepts comma-separated lists of instance numbers for `inst_num1` and `inst_num2`. No leading zeroes are allowed and there is a limit of 1023 characters.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.AWR_GLOBAL_DIFF_REPORT_HTML (
    dbid1      IN      NUMBER,
    inst_num1  IN      AWRRPT_INSTANCE_LIST_TYPE,
    bid1       IN      NUMBER,
    eid1       IN      NUMBER,
    dbid2      IN      NUMBER,
    inst_num2  IN      AWRRPT_INSTANCE_LIST_TYPE,
    bid2       IN      NUMBER,
    eid2       IN      NUMBER)
RETURN awrrpt_html_type_table PIPELINED;
```

```
DBMS_WORKLOAD_REPOSITORY.AWR_GLOBAL_DIFF_REPORT_HTML (
    dbid1      IN      NUMBER,
    inst_num1  IN      VARCHAR2,
    bid1       IN      NUMBER,
    eid1       IN      NUMBER,
    dbid2      IN      NUMBER,
    inst_num2  IN      VARCHAR2,
    bid2       IN      NUMBER,
    eid2       IN      NUMBER)
RETURN awrrpt_html_type_table PIPELINED;
```

Parameters

Table 211-16 *AWR_GLOBAL_DIFF_REPORT_HTML Function Parameters*

Parameter	Description
dbid1	1st database identifier
inst_num1	1st list of instance numbers. If set to NULL, all instances for which begin and end snapshots are available, and which have not been restarted between snapshots, will be included in the report.
bid1	1st beginning snapshot ID
eid1	1st ending snapshot ID
dbid2	2nd database identifier
inst_num2	2nd list of instance numbers to be included in report. If set to NULL, all instances for which begin and end snapshots are available, and which have not been restarted between snapshots, will be included in the report.
bid2	2nd beginning snapshot ID
eid2	2nd ending snapshot ID

Return Values

The output will be one column of VARCHAR2 (1500).

211.3.11 AWR_GLOBAL_DIFF_REPORT_TEXT Functions

This table function displays Global AWR Compare Periods Report in text format.

The first overload accepts comma-separated lists of instance numbers for inst_num1 and inst_num2. No leading zeroes are allowed and there is a limit of 1023 characters.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.AWR_GLOBAL_DIFF_REPORT_TEXT (
    dbid1      IN      NUMBER,
    inst_num1  IN      AWRRPT_INSTANCE_LIST_TYPE,
    bid1       IN      NUMBER,
    eid1       IN      NUMBER,
    dbid2      IN      NUMBER,
    inst_num2  IN      AWRRPT_INSTANCE_LIST_TYPE,
    bid2       IN      NUMBER,
    eid2       IN      NUMBER)
RETURN awdrpt_text_type_table PIPELINED;
```

```
DBMS_WORKLOAD_REPOSITORY.AWR_GLOBAL_DIFF_REPORT_TEXT (
    dbid1      IN      NUMBER,
    inst_num1  IN      VARCHAR2,
    bid1       IN      NUMBER,
    eid1       IN      NUMBER,
    dbid2      IN      NUMBER,
    inst_num2  IN      VARCHAR2,
    bid2       IN      NUMBER,
    eid2       IN      NUMBER)
RETURN awdrpt_text_type_table PIPELINED;
```

Parameters

Table 211-17 AWR_GLOBAL_DIFF_REPORT_TEXT Functions Parameters

Parameter	Description
dbid1	1st database identifier
inst_num1	1st list of instance numbers. If set to NULL, all instances for which begin and end snapshots are available, and which have not been restarted between snapshots, will be included in the report.
bid1	1st beginning snapshot ID
eid1	1st ending snapshot ID
dbid2	2nd database identifier
inst_num2	2nd list of instance numbers to be included in report. If set to NULL, all instances for which begin and end snapshots are available, and which have not been restarted between snapshots, will be included in the report.
bid2	2nd beginning snapshot ID
eid2	2nd ending snapshot ID

Return Values

The output will be one column of VARCHAR2 (320).

211.3.12 AWR_GLOBAL_REPORT_HTML Functions

This table function displays the Global AWR report in HTML.

The first overload accepts a comma-separated list of instance numbers. No leading zeroes are allowed and there is a limit of 1023 characters.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.AWR_GLOBAL_REPORT_HTML (
    l_dbid          IN    NUMBER,
    l_inst_num      IN    AWRRPT_INSTANCE_LIST_TYPE,
    l_bid           IN    NUMBER,
    l_eid           IN    NUMBER,
    l_options       IN    NUMBER DEFAULT 0)
RETURN awrrpt_html_type_table PIPELINED;
```

```
DBMS_WORKLOAD_REPOSITORY.AWR_GLOBAL_REPORT_HTML (
    l_dbid          IN    NUMBER,
    l_inst_num      IN    VARCHAR2,
    l_bid           IN    NUMBER,
    l_eid           IN    NUMBER,
    l_options       IN    NUMBER DEFAULT 0)
RETURN awrrpt_html_type_table PIPELINED;
```

Parameters

Table 211-18 *AWR_GLOBAL_REPORT_HTML Function Parameters*

Parameter	Description
<code>l_dbid</code>	Database identifier
<code>l_inst_num</code>	List of instance numbers to be included in report. If set to <code>NULL</code> , all instances for which begin and end snapshots are available, and which have not been restarted between snapshots, will be included in the report.
<code>l_bid</code>	Beginning snapshot ID
<code>l_eid</code>	Ending snapshot ID
<code>l_options</code>	Report level (currently not used)

Return Values

The output will be one column of `VARCHAR2(1500)`.

211.3.13 AWR_GLOBAL_REPORT_TEXT Functions

This table function displays the Global AWR report in text.

The first overload accepts a comma-separated list of instance numbers. No leading zeroes are allowed and there is a limit of 1023 characters

Syntax

```
DBMS_WORKLOAD_REPOSITORY.AWR_GLOBAL_REPORT_TEXT(
    l_dbid          IN    NUMBER,
    l_inst_num      IN    AWRRPT_INSTANCE_LIST_TYPE,
    l_bid           IN    NUMBER,
    l_eid           IN    NUMBER,
    l_options       IN    NUMBER DEFAULT 0)
RETURN awdrpt_text_type_table PIPELINED;
```

```
DBMS_WORKLOAD_REPOSITORY.AWR_GLOBAL_REPORT_TEXT(
    l_dbid          IN    NUMBER,
    l_inst_num      IN    VARCHAR2,
    l_bid           IN    NUMBER,
    l_eid           IN    NUMBER,
    l_options       IN    NUMBER DEFAULT 0)
RETURN awdrpt_text_type_table PIPELINED;
```

Parameters

Table 211-19 *AWR_GLOBAL_REPORT_TEXT Function Parameters*

Parameter	Description
<code>l_dbid</code>	Database identifier

Table 211-19 (Cont.) AWR_GLOBAL_REPORT_TEXT Function Parameters

Parameter	Description
<code>l_inst_num</code>	List of instance numbers to be included in report. If set to <code>NULL</code> , all instances for which begin and end snapshots are available, and which have not been restarted between snapshots, will be included in the report.
<code>l_bid</code>	Beginning snapshot ID
<code>l_eid</code>	Ending snapshot ID
<code>l_options</code>	A flag to specify to control the output of the report. Currently, not used.

Return Values

The output will be one column of `VARCHAR2 (320)`.

211.3.14 AWR_IMP Procedure

This procedure loads the AWR data from a dump file into the `SYS` schema.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.AWR_IMP (
    dmpfile      IN  VARCHAR2  DEFAULT 'awrdat',
    dmpdir       IN  VARCHAR2  DEFAULT 'DATA_PUMP_DIR',
    new_dbid     IN  NUMBER     DEFAULT NULL);
```

Parameters

Table 211-20 AWR_IMP Procedure Parameters

Parameter	Description
<code>dmpfile</code>	The prefix for the name of the dump file and log file. This file will be the source of the imported AWR data. The default value is <code>awrdat</code> .
<code>dmpdir</code>	The name of the Directory Object for the file system directory where the load dump file is located. The default value is <code>DATA_PUMP_DIR</code> .
<code>new_dbid</code>	The database ID to be used instead of existing database ID.

211.3.15 AWR_REPORT_HTML Function

This table function displays the AWR report in HTML.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.AWR_REPORT_HTML (
    l_dbid      IN  NUMBER,
    l_inst_num  IN  NUMBER,
    l_bid       IN  NUMBER,
    l_eid       IN  NUMBER,
```

```

l_options    IN    NUMBER DEFAULT 0)
RETURN awrrpt_text_type_table PIPELINED;

```

Parameters

Table 211-21 *AWR_REPORT_HTML Parameters*

Parameter	Description
l_dbid	Database identifier
l_inst_num	Instance number
l_bid	Beginning snapshot ID
l_eid	Ending snapshot ID
l_options	A flag to specify to control the output of the report. Currently, Oracle supports one value: <ul style="list-style-type: none"> l_options - 8. Displays the ADDM specific portions of the report. These sections include the Buffer Pool Advice, Shared Pool Advice, and PGA Target Advice.

Return Values

The output will be one column of VARCHAR2 (1500).

Usage Notes

You can call the function directly but Oracle recommends you use the `awrrpt.sql` script which prompts users for the required information.

211.3.16 AWR_REPORT_TEXT Function

This table function displays the AWR report in text.

Syntax

```

DBMS_WORKLOAD_REPOSITORY.AWR_REPORT_TEXT (
  l_dbid      IN    NUMBER,
  l_inst_num  IN    NUMBER,
  l_bid       IN    NUMBER,
  l_eid       IN    NUMBER,
  l_options   IN    NUMBER DEFAULT 0)
RETURN awrrpt_text_type_table PIPELINED;

```

Parameters

Table 211-22 *AWR_REPORT_TEXT Parameters*

Parameter	Description
l_dbid	Database identifier
l_inst_num	Instance number
l_bid	Beginning snapshot ID
l_eid	Ending snapshot ID

Table 211-22 (Cont.) AWR_REPORT_TEXT Parameters

Parameter	Description
<code>l_options</code>	A flag to specify to control the output of the report. Currently, Oracle supports one value: <ul style="list-style-type: none"> <code>l_options - 8</code>. Displays the ADDM specific portions of the report. These sections include the Buffer Pool Advice, Shared Pool Advice, and PGA Target Advice.

Return Values

The output will be one column of `VARCHAR2 (80)`.

Usage Notes

You can call the function directly but Oracle recommends you use the `awrrpt.sql` script which prompts users for the required information.

211.3.17 AWR_SET_REPORT_THRESHOLDS Procedure

This procedure configure specified report thresholds, including the number of rows in the report.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.AWR_SET_REPORT_THRESHOLDS (
  top_n_events      IN  NUMBER DEFAULT NULL,
  top_n_files       IN  NUMBER DEFAULT NULL,
  top_n_segments    IN  NUMBER DEFAULT NULL,
  top_n_services    IN  NUMBER DEFAULT NULL,
  top_n_sql          IN  NUMBER DEFAULT NULL,
  top_n_sql_max     IN  NUMBER DEFAULT NULL,
  top_sql_pct       IN  NUMBER DEFAULT NULL,
  shmem_threshold   IN  NUMBER DEFAULT NULL,
  versions_threshold IN  NUMBER DEFAULT NULL,
  top_n_disks       IN  NUMBER DEFAULT NULL,
  outlier_pct       IN  NUMBER DEFAULT NULL,
  outlier_cpu_pct   IN  NUMBER DEFAULT NULL);
```

Parameters

Table 211-23 AWR_SET_REPORT_THRESHOLDS Procedure Parameters

Parameter	Description
<code>top_n_events</code>	Number of most significant wait events to be included
<code>top_n_files</code>	Number of most active files to be included
<code>top_n_segments</code>	Number of most active segments to be included
<code>top_n_services</code>	Number of most active services to be included
<code>top_n_sql</code>	Number of most significant SQL statements to be included
<code>top_n_sql_max</code>	Number of SQL statements to be included if their activity is greater than that specified by <code>top_sql_pct</code>

Table 211-23 (Cont.) AWR_SET_REPORT_THRESHOLDS Procedure Parameters

Parameter	Description
top_sql_pct	Significance threshold for SQL statements between top_n_sql and top_n_sql_max
shmem_threshold	Shared memory low threshold
versions_threshold	Plan version count low threshold
top_n_disks	Number of cell disks with most I/O
outlier_pct	Percentage of maximum capacity before displaying outliers for Exadata sections
outlier_cpu_pct	Threshold for mean percentage CPU to display outliers

User Notes

- The effect of each setting depends on the type of report being generated as well as on the underlying AWR data. Not all settings are meaningful for each report type. Invalid settings (such as negative numbers) are ignored.
- Settings are effective only in the context of the session that executes the AWR_SET_REPORT_THRESHOLDS procedure. For example, to get a report that lists top 12 segments as compared to the default, one can invoke as follows:

```
DBMS_WORKLOAD_REPOSITORY.AWR_SET_REPORT_THRESHOLDS (top_n_segments=>12);
```

211.3.18 AWR_SQL_REPORT_HTML Function

This table function displays the AWR SQL Report in HTML format.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.AWR_SQL_REPORT_HTML (
    l_dbid      IN    NUMBER,
    l_inst_num  IN    NUMBER,
    l_bid       IN    NUMBER,
    l_eid       IN    NUMBER,
    l_sqlid     IN    VARCHAR2,
    l_options   IN    NUMBER DEFAULT 0)
RETURN awrrpt_html_type_table PIPELINED;
```

Parameters

Table 211-24 AWR_SQL_REPORT_HTML Parameters

Parameter	Description
l_dbid	Database identifier
l_inst_num	Instance number
l_bid	Beginning snapshot ID
l_eid	Ending snapshot ID
l_sqlid	SQL ID of statement to be analyzed

Table 211-24 (Cont.) AWR_SQL_REPORT_HTML Parameters

Parameter	Description
<code>l_options</code>	A flag to specify to control the output of the report. Currently, not used.

Return Values

The output will be one column of `VARCHAR2 (500)`.

Usage Notes

You can call the function directly but Oracle recommends you use the `awrsqrpt.sql` script which prompts users for the required information.

211.3.19 AWR_SQL_REPORT_TEXT Function

This table function displays the AWR SQL Report in text format.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.AWR_SQL_REPORT_TEXT (
    l_dbid      IN    NUMBER,
    l_inst_num  IN    NUMBER,
    l_bid       IN    NUMBER,
    l_eid       IN    NUMBER,
    l_sqlid     IN    VARCHAR2,
    l_options   IN    NUMBER DEFAULT 0)
RETURN awrrpt_text_type_table PIPELINED;
```

Parameters

Table 211-25 AWR_SQL_REPORT_TEXT Parameters

Parameter	Description
<code>l_dbid</code>	Database identifier
<code>l_inst_num</code>	Instance number
<code>l_bid</code>	Beginning snapshot ID
<code>l_eid</code>	Ending snapshot ID
<code>l_sqlid</code>	SQL ID of statement to be analyzed
<code>l_options</code>	Flag to specify to control the output of the report. Currently, not used.

Return Values

The output will be one column of `VARCHAR2 (120)`.

Usage Notes

You can call the function directly but Oracle recommends you use the `awrsqrpt.sql` script which prompts users for the required information.

211.3.20 CONTROL_RESTRICTED_SNAPSHOT Procedure

This procedure controls the AWR snapshot creation for a database in the *restricted session* mode. If this procedure is not used, then by default, the AWR snapshots cannot be created for a database in the *restricted session* mode. This procedure affects the local database on which it is executed.



Note:

To enable AWR snapshot creation for an Oracle RAC in the *restricted session* mode, this procedure must be executed on every database instance in the Oracle RAC.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.CONTROL_RESTRICTED_SNAPSHOT (
    allow IN BOOLEAN);
```

Parameters

Table 211-26 CONTROL_RESTRICTED_SNAPSHOT Parameters

Parameter	Description
allow	This parameter can have one of the following values: <ul style="list-style-type: none"> TRUE: AWR snapshots can be created for the database in the <i>restricted session</i> mode. FALSE: AWR snapshots cannot be created for the database in the <i>restricted session</i> mode.

211.3.21 CREATE_BASELINE Functions and Procedures

This function and procedure creates a baseline.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.CREATE_BASELINE (
    start_snap_id    IN    NUMBER,
    end_snap_id      IN    NUMBER,
    baseline_name    IN    VARCHAR2,
    dbid             IN    NUMBER DEFAULT NULL,
    expiration       IN    NUMBER DEFAULT NULL);
```

```
DBMS_WORKLOAD_REPOSITORY.CREATE_BASELINE (
    start_snap_id    IN    NUMBER,
    end_snap_id      IN    NUMBER,
    baseline_name    IN    VARCHAR2,
    dbid             IN    NUMBER DEFAULT NULL,
    expiration       IN    NUMBER DEFAULT NULL)
RETURN NUMBER;
```

```
DBMS_WORKLOAD_REPOSITORY.CREATE_BASELINE (
    start_time       IN    DATE,
```

```

end_time          IN DATE,
baseline_name    IN VARCHAR2,
dbid              IN NUMBER DEFAULT NULL,
expiration       IN NUMBER DEFAULT NULL);

DBMS_WORKLOAD_REPOSITORY.CREATE_BASELINE(
start_time       IN DATE,
end_time         IN DATE,
baseline_name    IN VARCHAR2,
dbid             IN NUMBER DEFAULT NULL,
expiration       IN NUMBER DEFAULT NULL);
RETURN NUMBER;

```

Parameters

Table 211-27 CREATE_BASELINE Function & Procedure Parameters

Parameter	Description
start_snap_id	Start snapshot sequence number for the baseline.
end_snap_id	End snapshot sequence number for the baseline.
start_time	Start time for the baseline.
end_time	End time for the baseline.
baseline_name	Name of baseline.
dbid	Database Identifier for baseline. If NULL, this takes the database identifier for the local database. Defaults to NULL.
expiration	Expiration in number of days for the baseline. If NULL, then expiration is infinite, meaning do not drop baseline ever. Defaults to NULL.

Exceptions

- An error will be returned if this baseline name already exists in the system.
- The snapshot range that is specified for this interface must be an existing pair of snapshots in the database. An error will be returned if the inputted snapshots do not exist in the system.

Examples

This example creates a baseline (named 'oltp_peakload_bl') between snapshots 105 and 107 for the local database:

```

EXECUTE DBMS_WORKLOAD_REPOSITORY.CREATE_BASELINE (start_snap_id => 105,
                                                    end_snap_id   => 107,
                                                    baseline_name =>
'oltp_peakload_bl');

```

If you query the DBA_HIST_BASELINE view after the CREATE BASELINE action, you will see the newly created baseline in the Workload Repository.

211.3.22 CREATE_BASELINE_TEMPLATE Procedures

This procedure specifies a template for how they would like baselines to be created for future time periods.

Syntax

Specifies a template for generating a baseline for a single time period in the future.

```
DBMS_WORKLOAD_REPOSITORY.CREATE_BASELINE_TEMPLATE (
    start_time          IN DATE,
    end_time            IN DATE,
    baseline_name       IN VARCHAR2,
    template_name       IN VARCHAR2,
    expiration          IN NUMBER,
    dbid                IN NUMBER   DEFAULT NULL);
```

Specifies a template for creating and dropping baseline based on repeating time periods:

```
DBMS_WORKLOAD_REPOSITORY.CREATE_BASELINE_TEMPLATE (
    day_of_week         IN VARCHAR2,
    hour_in_day         IN NUMBER,
    duration            IN NUMBER,
    start_time          IN DATE,
    end_time            IN DATE,
    baseline_name_prefix IN VARCHAR2,
    template_name       IN VARCHAR2,
    expiration          IN NUMBER,
    dbid                IN NUMBER   DEFAULT NULL);
```

Parameters

Table 211-28 CREATE_BASELINE_TEMPLATE Procedure Parameters

Parameter	Description
start_time	Start Time for the baseline to be created'
end_time	End Time for the baseline to be created
baseline_name	Name of baseline to be created
template_name	Name for the template
expiration	Expiration in number of days for the baseline. If NULL, then expiration is infinite, meaning do not drop baseline ever. Defaults to NULL
dbid	Database ID for which the baseline template needs to be used. If NULL, this takes the database identifier of the local database. Defaults to NULL.
day_of_week	Day of week that the baseline should repeat on. Specify one of the following values: SUNDAY, MONDAY, TUESDAY, WEDNESDAY, THURSDAY, FRIDAY, SATURDAY.
hour_in_day	Value of 0-23 to specify the Hour in the Day the baseline should start
duration	Duration (in number of hours) after hour in the day that the baseline should last
baseline_name_prefix	Name for baseline prefix. When creating the baseline, the name of the baseline will be the prefix appended with the date information.

211.3.23 CREATE_REMOTE_SNAPSHOT Function and Procedure

This function and procedure create a remote snapshot using the Remote Management Framework (RMF). The function returns the snapshot ID.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.CREATE_REMOTE_SNAPSHOT(
    node_id      IN NUMBER,
    flush_level  IN VARCHAR2 DEFAULT 'BESTFIT');
```

```
DBMS_WORKLOAD_REPOSITORY.CREATE_REMOTE_SNAPSHOT(
    node_id      IN NUMBER,
    flush_level  IN VARCHAR2 DEFAULT 'BESTFIT')
RETURN NUMBER;
```

```
DBMS_WORKLOAD_REPOSITORY.CREATE_REMOTE_SNAPSHOT(
    node_name     IN VARCHAR2,
    topology_name IN VARCHAR2 DEFAULT NULL,
    flush_level   IN VARCHAR2 DEFAULT 'BESTFIT');
```

```
DBMS_WORKLOAD_REPOSITORY.CREATE_REMOTE_SNAPSHOT(
    node_name     IN VARCHAR2,
    topology_name IN VARCHAR2 DEFAULT NULL,
    flush_level   IN VARCHAR2 DEFAULT 'BESTFIT')
RETURN NUMBER;
```

Parameters

Table 211-29 CREATE_REMOTE_SNAPSHOT Parameters

Parameter	Description
node_id	RMF node identifier of the database for which the snapshot needs to be created.
node_name	RMF node name of the database for which the snapshot needs to be created.
topology_name	RMF topology name of the database for which the snapshot needs to be created.

Table 211-29 (Cont.) CREATE_REMOTE_SNAPSHOT Parameters

Parameter	Description
flush_level	<p>The flush level can be one of the following:</p> <ul style="list-style-type: none"> • BESTFIT: Uses the default value depending on the type of snapshot being taken. • LITE: Lightweight snapshot. Only the most important statistics are collected. This is default for a pluggable database (PDB) and application container. • TYPICAL: Regular snapshot. Most of the statistics are collected. This is default for a container database root (CDB root) and non-CDB database. • ALL: Heavyweight snapshot. All the possible statistics are collected. This consumes a considerable amount of disk space and takes a long time to create.

Examples

This example creates a remote snapshot of the database having the RMF node identifier of 10:

```
EXECUTE DBMS_WORKLOAD_REPOSITORY.CREATE_REMOTE_SNAPSHOT(10);
```

If you query the `DBA_HIST_SNAPSHOT` view after executing the above procedure, you will see a new snapshot record added to the Automatic Workload Repository (AWR).

211.3.24 CREATE_SNAPSHOT Function and Procedure

This function and procedure create a snapshot. The function returns the snapshot ID. If both, the database ID and the database name are not specified in this subprogram, then the snapshot is created for the local database on which the subprogram is executed.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.CREATE_SNAPSHOT(
  flush_level IN VARCHAR2 DEFAULT 'BESTFIT',
  dbid        IN NUMBER   DEFAULT NULL,
  source_name IN VARCHAR2 DEFAULT NULL);
```



```

DBMS_WORKLOAD_REPOSITORY.CREATE_SNAPSHOT(
    flush_level IN VARCHAR2 DEFAULT 'BESTFIT',
    dbid        IN NUMBER   DEFAULT NULL,
    source_name IN VARCHAR2 DEFAULT NULL)
RETURN NUMBER;

```

Parameters

Table 211-30 CREATE_SNAPSHOT Parameters

Parameter	Description
flush_level	<p>The flush level can be one of the following:</p> <ul style="list-style-type: none"> • BESTFIT: Uses the default value depending on the type of snapshot being taken. • LITE: Lightweight snapshot. Only the most important statistics are collected. This is default for a pluggable database (PDB) and application container. • TYPICAL: Regular snapshot. Most of the statistics are collected. This is default for a container database root (CDB root) and non-CDB database. • ALL: Heavyweight snapshot. All the possible statistics are collected. This consumes a considerable amount of disk space and takes a long time to create.
dbid	Database ID of the database for which the snapshot needs to be created.
source_name	Name of the database for which the snapshot needs to be created.

Examples

This example creates a snapshot of the local database with the flush level of `ALL`:

```
EXECUTE DBMS_WORKLOAD_REPOSITORY.CREATE_SNAPSHOT('ALL');
```

If you query the `DBA_HIST_SNAPSHOT` view after executing the above procedure, you will see a new snapshot record added to the Automatic Workload Repository (AWR).

211.3.25 DROP_BASELINE Procedure

This procedure drops a previously-defined baseline.

Syntax

```

DBMS_WORKLOAD_REPOSITORY.DROP_BASELINE(
    baseline_name IN VARCHAR2,
    cascade       IN BOOLEAN  DEFAULT FALSE,
    dbid          IN NUMBER   DEFAULT NULL);

```

Parameters

Table 211-31 DROP_BASELINE Parameters

Parameter	Description
baseline_name	Name of baseline to drop from the system
cascade	If TRUE, the pair of snapshots associated with the baseline will also be dropped. Otherwise, only the baseline is removed.
dbid	Database ID for which the baseline needs to be dropped (defaults to local DBID).

Examples

This example drops the baseline 'oltp_peakload_bl' without dropping the underlying snapshots:

```
EXECUTE DBMS_WORKLOAD_REPOSITORY.DROP_BASELINE (
    baseline_name => 'oltp_peakload_bl');
```

If you query the DBA_HIST_BASELINE view after the DROP_BASELINE action, you will see the specified baseline definition is removed. You can query the DBA_HIST_SNAPSHOT view to find that the underlying snapshots are left intact.

211.3.26 DROP_BASELINE_TEMPLATE Procedure

This procedure removes a template that is no longer needed.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.DROP_BASELINE_TEMPLATE (
    template_name    IN VARCHAR2,
    dbid             IN NUMBER    DEFAULT NULL);
```

Parameters

Table 211-32 DROP_BASELINE_TEMPLATE Procedure Parameters

Parameter	Description
template_name	Name of the template to remove
dbid	Database ID for which the baseline template needs to be dropped. If NULL, this takes the database identifier of the local database. Defaults to NULL.

211.3.27 DROP_SNAPSHOT_RANGE Procedure

This procedure drops a range of snapshots.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.DROP_SNAPSHOT_RANGE (
    low_snap_id     IN NUMBER,
```

```
high_snap_id IN NUMBER,
dbid         IN NUMBER  DEFAULT NULL);
```

Parameters

Table 211-33 DROP_SNAPSHOT_RANGE Procedure Parameters

Parameter	Description
low_snap_id	Low snapshot id of snapshots to drop.
high_snap_id	High snapshot id of snapshots to drop.
dbid	Database id (defaults to local DBID).

Examples

This example drops the range of snapshots between snapshot id 102 to 105 for the local database:

```
EXECUTE DBMS_WORKLOAD_REPOSITORY.DROP_SNAPSHOT_RANGE(102, 105);
```

If you query the `dba_hist_snapshot` view after the Drop Snapshot action, you will see that snapshots 102 to 105 are removed from the Workload Repository.

211.3.28 LOCAL_AWR_DBID Function

This function returns the database identifier for the local AWR database.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.LOCAL_AWR_DBID()
RETURN NUMBER;
```

211.3.29 MODIFY_BASELINE_WINDOW_SIZE Procedure

This procedure modifies the window size for the Default Moving Window Baseline.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.MODIFY_BASELINE_WINDOW_SIZE(
    window_size IN NUMBER,
    dbid        IN NUMBER  DEFAULT NULL);
```

Parameters

Table 211-34 MODIFY_BASELINE_WINDOW_SIZE Procedure Parameters

Parameter	Description
window_size	New Window size for the default Moving Window Baseline, in number of days.
dbid	Database ID (defaults to local DBID).

Usage Notes

The window size must be less than or equal to the AWR retention setting. If the window size needs to be greater than the retention setting, the [MODIFY_SNAPSHOT_SETTINGS Procedures](#) can be used to adjust the retention setting. A moving window can be set to a maximum of 13 weeks.

211.3.30 MODIFY_SNAPSHOT_SETTINGS Procedures

This procedure controls three aspects of snapshot generation.

- The `INTERVAL` setting affects how often snapshots are automatically captured.
- The `RETENTION` setting affects how long snapshots are retained in the Workload Repository.
- The number of SQL captured for each Top criteria. If the user manually specifies a value for Top N SQL, the AWR SQL collection will use the user-specified number for both automatic and manual snapshots.

There are two overloads. The first takes a `NUMBER` and the second takes a `VARCHAR2` for the `topnsql` argument. The differences are described under the Parameters description.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.MODIFY_SNAPSHOT_SETTINGS (
    retention      IN NUMBER      DEFAULT NULL,
    interval       IN NUMBER      DEFAULT NULL,
    topnsql        IN NUMBER      DEFAULT NULL,
    dbid           IN NUMBER      DEFAULT NULL,
    tablespace_name IN VARCHAR2   DEFAULT NULL);
```

```
DBMS_WORKLOAD_REPOSITORY.MODIFY_SNAPSHOT_SETTINGS (
    retention      IN NUMBER      DEFAULT NULL,
    interval       IN NUMBER      DEFAULT NULL,
    topnsql        IN VARCHAR2,
    dbid           IN NUMBER      DEFAULT NULL,
    tablespace_name IN VARCHAR2   DEFAULT NULL);
```

Parameters

Table 211-35 MODIFY_SNAPSHOT_SETTINGS Procedure Parameters

Parameter	Description
retention	<p>New retention time (in minutes). The specified value must be in the range of <code>MIN_RETENTION</code> (1 day) to <code>MAX_RETENTION</code> (100 years).</p> <p>If <code>ZERO</code> is specified, snapshots will be retained forever. A large system-defined value will be used as the interval setting.</p> <p>If <code>NULL</code> is specified, the old value for retention is preserved.</p> <p>NOTE: The retention setting must be greater than or equal to the window size of the 'SYSTEM_MOVING_WINDOW' baseline. If the retention needs to be less than the window size, the MODIFY_BASELINE_WINDOW_SIZE Procedure can be used to adjust the window size.</p>

Table 211-35 (Cont.) MODIFY_SNAPSHOT_SETTINGS Procedure Parameters

Parameter	Description
interval	New interval setting between each snapshot, in units of minutes. The specified value must be in the range MIN_INTERVAL (10 minutes) to MAX_INTERVAL (1 year). If ZERO is specified, automatic and manual snapshots will be disabled. A large system-defined value will be used as the retention setting. If NULL is specified, the current value is preserved.
topnsql	<ul style="list-style-type: none"> If NUMBER: Top N SQL size. The number of Top SQL to flush for each SQL criteria (Elapsed Time, CPU Time, Parse Calls, Shareable Memory, Version Count). The value for this setting will not be affected by the statistics/flush level and will override the system default behavior for the AWR SQL collection. The setting will have a minimum value of 30 and a maximum value of 50,000. Specifying NULL will keep the current setting. If VARCHAR2: Users are allowed to specify the following values: (DEFAULT, MAXIMUM, N), where N is the number of Top SQL to flush for each SQL criteria. Specifying DEFAULT will revert the system back to the default behavior of Top 30 for statistics level TYPICAL and Top 100 for statistics level ALL. Specifying MAXIMUM will cause the system to capture the complete set of SQL in the cursor cache. Specifying the number N is equivalent to setting the Top N SQL with the NUMBER type. Specifying NULL for this argument will keep the current setting.
dbid	Database identifier in AWR for which to modify the snapshot settings. If NULL is specified, the local dbid will be used. Defaults to NULL.
tablespace_name	Specify a user-defined tablespace for storing AWR data (snapshot data). If this parameter is not used, then AWR data is stored in the SYSAUX tablespace by default.

Examples

This example changes the `interval` setting to one hour and the `retention` setting to two weeks for the local database:

```
EXECUTE DBMS_WORKLOAD_REPOSITORY.MODIFY_SNAPSHOT_SETTINGS (
  interval => 60,
  retention => 20160);
```

If you query the `DBA_HIST_WR_CONTROL` table after this procedure is executed, you will see the changes to these settings.

211.3.31 PURGE_SQL_DETAILS Procedure

This procedure purges SQL details, specifically rows from `WRH$_SQLTEXT`, `WRH$_SQL_PLAN`, and `WRH$_SQL_BIND_METADATA` that do not have corresponding rows (`DBID`, `SQL_ID`) in `WRH$_SQLSTAT`.

The subprogram calls for the `DBID` for which to run the purge. If the `DBID` is not specified, the database `DBID` is used. You can constrain runtime by specifying the maximum number of rows to purge per table. If no maximum is specified, the subprograms tries to purge all applicable rows.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.PURGE_SQL_DETAILS (
    numrows IN NUMBER DEFAULT NULL,
    dbid    IN NUMBER DEFAULT NULL);
```

Parameters

Table 211-36 PURGE_SQL_DETAILS Procedure Parameters

Parameter	Description
numrows	Number of rows
dbid	Database ID (default to local DBID)

211.3.32 REGISTER_REMOTE_DATABASE Procedures

This procedure registers a remote database in the Automatic Workload Repository (AWR) using the Remote Management Framework (RMF).

Syntax

```
DBMS_WORKLOAD_REPOSITORY.REGISTER_REMOTE_DATABASE (
    node_id IN NUMBER);
```

```
DBMS_WORKLOAD_REPOSITORY.REGISTER_REMOTE_DATABASE (
    node_name      IN VARCHAR2,
    topology_name  IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 211-37 REGISTER_REMOTE_DATABASE Parameters

Parameter	Description
node_id	RMF node identifier of the database that needs to be registered in the AWR.
node_name	RMF node name of the database that needs to be registered in the AWR.
topology_name	RMF topology name of the database that needs to be registered in the AWR.

Examples

This example registers the remote database having the RMF node identifier of 10 in the AWR:

```
EXECUTE DBMS_WORKLOAD_REPOSITORY.REGISTER_REMOTE_DATABASE(10);
```

211.3.33 REMOVE_COLORED_SQL Procedure

This procedure removes a colored SQL ID. After a SQL is uncolored, it will no longer be captured in a snapshot automatically, unless it makes the TOP list.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.REMOVE_COLORED_SQL(
    sql_id      IN VARCHAR2,
    dbid        IN NUMBER DEFAULT NULL);
```

Parameters

Table 211-38 REMOVE_COLORED_SQL Procedure Parameters

Parameter	Description
sql_id	13-character external SQL ID
dbid	Optional dbid, defaults to Local DBID

211.3.34 RENAME_BASELINE Procedure

This procedure renames a baseline.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.RENAME_BASELINE(
    old_baseline_name  IN VARCHAR2,
    new_baseline_name  IN VARCHAR2,
    dbid                IN NUMBER  DEFAULT NULL);
```

Parameters

Table 211-39 RENAME_BASELINE Procedure Parameters

Parameter	Description
old_baseline_name	Old baseline name.
new_baseline_name	New baseline name.
dbid	Database ID for which the baseline needs to be renamed (defaults to local DBID).

211.3.35 SELECT_BASELINE_DETAILS Function

This table function shows the values of the metrics corresponding to a baseline for a range of snapshots.

This table function returns an object of [AWR_BASELINE_METRIC_TYPE Object Type](#).

Syntax

```
DBMS_WORKLOAD_REPOSITORY.SELECT_BASELINE_DETAILS(
    l_baseline_id    IN NUMBER,
    l_begin_snap     IN NUMBER DEFAULT NULL,
    l_end_snap       IN NUMBER DEFAULT NULL,
    l_dbid           IN NUMBER DEFAULT NULL)
RETURN awrbl_details_type_table PIPELINED;
```

Parameters

Table 211-40 SELECT_BASELINE_DETAILS Function Parameters

Parameter	Description
l_baseline_id	ID of the baseline for which the statistics need to be retrieved. Specifying the value 0 returns the statistics for the moving window baseline.
l_begin_snap	Start snapshot sequence number for the baseline.
l_end_snap	End snapshot sequence number for the baseline.
l_dbid	Database identifier for the baseline. If its value is set to NULL, then the database identifier for the local database is used. Its default value is NULL.

211.3.36 SELECT_BASELINE_METRIC Function

This table function shows the values of the metrics corresponding to a baseline for all the snapshots.

This table function returns an object of [AWR_BASELINE_METRIC_TYPE Object Type](#).

Syntax

```
DBMS_WORKLOAD_REPOSITORY.SELECT_BASELINE_METRIC(
    l_baseline_name  IN VARCHAR2,
    l_dbid           IN NUMBER DEFAULT NULL,
    l_instance_num   IN NUMBER DEFAULT NULL)
RETURN awr_metric_type_table PIPELINED;
```

Parameters

Table 211-41 SELECT_BASELINE_METRIC Function Parameters

Parameter	Description
l_baseline_name	Name of the baseline for which the metrics need to be viewed.
l_dbid	Database identifier for the baseline. If set to NULL, the database identifier for the local database is used. Default is NULL.
l_instance_num	The instance number for which the metrics need to be viewed. If set to NULL, metrics for the local database instance are shown. Default is NULL.

211.3.37 UNREGISTER_REMOTE_DATABASE Procedures

This procedure removes all the statistics, metadata, partitions, and so on of a remote database from the Automatic Workload Repository (AWR). After executing this procedure, the remote database cannot be used for any AWR operations, such as creating remote snapshots.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.UNREGISTER_REMOTE_DATABASE (
    node_id          IN NUMBER,
    remote_check     IN BOOLEAN  DEFAULT TRUE);
```

```
DBMS_WORKLOAD_REPOSITORY.UNREGISTER_REMOTE_DATABASE (
    node_name        IN VARCHAR2,
    topology_name    IN VARCHAR2 DEFAULT NULL,
    remote_check     IN BOOLEAN  DEFAULT TRUE);
```

Parameters

Table 211-42 UNREGISTER_REMOTE_DATABASE Parameters

Parameter	Description
node_id	Identifier of the remote database whose data needs to be removed from the AWR.
node_name	Name of the remote database whose data needs to be removed from the AWR.
topology_name	RMF topology name of the remote database.
remote_check	If set to TRUE, the remote database's metadata is validated before removing its data from the AWR. This option requires the remote database to be available. If set to FALSE, the remote database's data is removed from the AWR without validating its metadata. This option must be selected to unregister a remote database that is not available (it is offline or there is a network outage).

Examples

This example removes the AWR data related to the remote database having the database identifier of 10:

```
EXECUTE DBMS_WORKLOAD_REPOSITORY.UNREGISTER_REMOTE_DATABASE(10);
```

211.3.38 UPDATE_DATAFILE_INFO Procedure

This procedure updates the data file and tablespace information stored in the Automatic Workload Repository (AWR) with the current information in the database. This procedure is useful when a data file or a tablespace has been moved or renamed. As this change is not always captured in the next snapshot, AWR report may not show the most current information.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.UPDATE_DATAFILE_INFO();
```

211.3.39 UPDATE_OBJECT_INFO Procedure

This procedure updates rows of WRH\$_SEG_STAT_OBJ table that represent objects in the local database. It attempts to determine the current names for all object belonging to the local database, except those with 'MISSING' and/or 'TRANSIENT' values in the name columns.

The amount of work performed at each invocation of this routine may be controlled by setting the input parameter.

Syntax

```
DBMS_WORKLOAD_REPOSITORY.UPDATE_OBJECT_INFO(  
    maxrows IN NUMBER DEFAULT 0);
```

Parameters

Table 211-43 UPDATE_OBJECT_INFO Procedure Parameters

Parameter	Description
maxrows	Maximum number of rows to be updated. Default= 0, meaning there is no limit.

DBMS_XDB

The `DBMS_XDB` package supports the following features:

**Note:**

The Oracle XML DB Repository is deprecated with Oracle Database 23ai.

Oracle recommends that you replace any functionality used in XML DB Repository with alternative technologies.

The `DBMS_XDB` package supports the following features:

- Resource Management subprograms which complement Resource Views
- The Access Control List (ACL)-based Security Mechanism
- Configuration Session Management
- Creation of the XDB username

This chapter contains the following topics:

- [DBMS_XDB Overview](#)
- [DBMS_XDB Security Model](#)
- [DBMS_XDB Constants](#)
- [Summary of DBMS_XDB Subprograms](#)

**See Also:**

- *Oracle XML DB Developer's Guide*

212.1 DBMS_XDB Overview

`DBMS_XDB` provides a range of management functions.

The `DBMS_XDB` package supports the following features:

- The Resource Management functionality provides [LINK Procedures](#), [EXISTSRESOURCE Function](#), [LOCKRESOURCE Function](#), [GETLOCKTOKEN Procedure](#), [UNLOCKRESOURCE Function](#), [CREATERESOURCE Functions](#), [RENAMERESOURCE Procedure](#), [DELETERESOURCE Procedure](#), [GETRESOID Function](#), [CREATEOIDPATH Function](#), and [CREATEFOLDER Function](#) subprograms which complement Resource Views.

- The Access Control List (ACL)-based Security Mechanism can be used with in-hierarchy ACLs stored by the database or in-memory ACLs that may be stored outside the database. Some of these methods can be used for both Oracle resources and arbitrary database objects. Use [CHECKPRIVILEGES Function](#), [GETACLDOCUMENT Function](#), and [CHANGEPRIVILEGES Function](#) for Oracle Resources. [ACLCHECKPRIVILEGES Function](#) provides access to Oracle's ACL-based Security mechanism without storing objects in the Hierarchy.
- The XDB username is created during XDB installation. This user owns a set of default tables and packages. [GETXDB_TABLESPACE Function](#) and the `DBMS_XDB_ADMIN.MOVEXDB_TABLESPACE` Procedure enable movement of schemas to a specified tablespace, and support the default `SYSAUX` tablespace introduction

212.2 DBMS_XDB Security Model

Owned by XDB, the `DBMS_XDB` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `PUBLIC`. Subprograms in this package are executed using the privileges of the current user. Subprograms that operate on the XDB Configuration will succeed only if the current user is `SYS` or `XDB`, or the current user has the `XDBADMIN` or `DBA` role.

212.3 DBMS_XDB Constants

All constants described in the following table are deprecated in Oracle Release 12c.

They are relocated to either the [DBMS_XDB_CONFIG](#) package or the [DBMS_XDB_REPOS](#) package. The specifics of transference in each case are detailed in the **Relocated** column.

Oracle recommends that you do not use constants in their `DBMS_XDB` context in new applications. Support for deprecated features is for backward compatibility only and may be terminated in future releases.

Table 212-1 DBMS_XDB Constants

Constant	Type	Value	Description	Relocated
<code>DELETE_RESOURCE</code>	NUMBER	1	Deletes a resource; fails if the resource has children.	<code>DBMS_XDB_REPOS</code>
<code>DELETE_RECURSIVE</code>	NUMBER	2	Deletes a resource and its children, if any.	<code>DBMS_XDB_REPOS</code>
<code>DELETE_FORCE</code>	NUMBER	3	Deletes the resource, even if the object it contains is invalid.	<code>DBMS_XDB_REPOS</code>
<code>DELETE_RECURSIVE_FORCE</code>	NUMBER	4	Deletes a resource and its children, if any, even if the object it contains is invalid.	<code>DBMS_XDB_REPOS</code>
<code>DELETE_RES_METADATA_CASCADE</code>	NUMBER	1	Deletes the corresponding row in the metadata table	<code>DBMS_XDB_REPOS</code>
<code>DELETE_RES_METADATA_NOCASCADE</code>	NUMBER	2	Does not delete the row in the metadata table	<code>DBMS_XDB_REPOS</code>

Table 212-1 (Cont.) DBMS_XDB Constants

Constant	Type	Value	Description	Relocated
DEFAULT_LOCK_TIMEOUT CONSTANT	PLS_INTEGER	(60*60)	Default time (in seconds) after which lock will expire	DBMS_XDB_REPOS
LINK_TYPE_HARD	NUMBER	1	Type of link to be created (default)	DBMS_XDB_REPOS
LINK_TYPE_WEAK	NUMBER	2	Type of link to be created	DBMS_XDB_REPOS
LINK_TYPE_SYMBOLIC	NUMBER	3	Type of link to be created	DBMS_XDB_REPOS
ON_DENY_NEXT_CUSTOM	NUMBER	1	If access denied, the next custom authorization is tried	DBMS_XDB_CONFIG
ON_DENY_BASIC	NUMBER	2	If access denied, basic authentication is used	DBMS_XDB_CONFIG

212.4 Summary of DBMS_XDB Subprograms

This table lists the DBMS_XDB subprograms and briefly describes them.

Table 212-2 DBMS_XDB Package Subprograms

Subprogram	Description
ACLCHECKPRIVILEGES Function	Checks access privileges granted to the current user by specified ACL document on a resource whose owner is specified by the 'owner' parameter.
APPENDRESOURCEMETADATA Procedure	Takes in user-defined metadata either as a REF to XMLTYPE or an XMLTYPE and adds it to the desired resource
CHANGEOWNER Procedure	Changes the owner of the resource/s to the specified owner.
CHANGEPRIVILEGES Function	Adds a specified ACE to a specified resource's ACL
CHECKPRIVILEGES Function	Checks access privileges granted to the current user on the specified resource
CREATEFOLDER Function	Creates a new folder resource in the hierarchy
CREATEOIDPATH Function	Creates a virtual path to the resource based on object ID
CREATERESOURCE Functions	Creates a new resource
DELETERESOURCE Procedure	Deletes a resource from the hierarchy
DELETERESOURCEMETADATA Procedures	Deletes metadata from a resource (can be used for schema-based or nonschema-based metadata)
ENABLEDIGESTAUTHENTICATION Procedure	Enables digest authentication
EXISTSRESOURCE Function	Determines if a resource is in the hierarchy, based on its absolute path
GETACLDOCUMENT Function	Retrieves ACL document that protects resource given its path name

Table 212-2 (Cont.) DBMS_XDB Package Subprograms

Subprogram	Description
GETCONTENTBLOB Function	Retrieves the contents of a resource returned as a BLOB
GETCONTENTCLOB Function	Retrieves the contents of a resource returned as a CLOB
GETCONTENTVARCHAR2 Function	Retrieves the contents of a resource returned as a string
GETCONTENTXMLREF Function	Retrieves the contents of a resource returned as a REF to an XMLTYPE
GETCONTENTXMLTYPE Function	Retrieves the contents of a resource returned as an XMLTYPE
GETHTTPREQUESTHEADER Function	Gets the values of the passed header
GETLOCKTOKEN Procedure	Returns that resource's lock token for the current user given a path to a resource
GETPRIVILEGES Function	Gets all privileges granted to the current user on a specified resource
GETRESOID Function	Returns the object ID of the resource from its absolute path
GETXDB_TABLESPACE Function	Returns the current tablespace of the XDB (user)
HASBLOBCONTENT Function	Returns TRUE if the resource has BLOB content
HASCHARCONTENT Function	Returns TRUE if the resource has character content
HASXMLCONTENT Function	Returns TRUE if the resource has XML content
HASXMLREFERENCE Function	Returns TRUE if the resource has REF to XML content
ISFOLDER Function	Returns TRUE if the resource is a folder or container
LINK Procedures	Creates a link to an existing resource
LOCKRESOURCE Function	Gets a WebDAV-style lock on that resource given a path to that resource
PROCESSLINKS Procedure	Processes document links in the specified resource
PURGERESOURCEMETADATA Procedure	Deletes all user metadata from a resource
RENAMERESOURCE Procedure	Renames the XDB resource
SETACL Procedure	Sets the ACL on a specified resource
SPLITPATH Procedure	Splits the path into a parentpath and childpath
TOUCHRESOURCE Procedure	Changes the modification time of the resource to the current time
UNLOCKRESOURCE Function	Unlocks the resource given a lock token and resource path
UPDATERESOURCEMETADATA Procedures	Updates metadata for a resource

212.4.1 ACLCHECKPRIVILEGES Function

This function checks access privileges granted to the current user by specified ACL document by the `OWNER` of the resource. Returns positive integer if all privileges are granted.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the `DBMS_XDB_REPOS` package - the [ACLCHECKPRIVILEGES Function](#).

Syntax

```
DBMS_XDB.ACLCHECKPRIVILEGES (
  acl_path IN VARCHAR2,
  owner    IN VARCHAR2,
  privs    IN xmltype)
RETURN PLS_INTEGER;
```

Parameters

Table 212-3 *ACLCHECKPRIVILEGES Function Parameters*

Parameter	Description
<code>acl_path</code>	Absolute path in the Hierarchy for ACL document
<code>owner</code>	Resource owner name; the pseudo user "DAV:owner" is replaced by this user during ACL privilege resolution
<code>privs</code>	An <code>XMLType</code> instance of the privilege element specifying the requested set of access privileges. See description for CHECKPRIVILEGES Function .

212.4.2 APPENDRESOURCEMETADATA Procedure

This procedure takes in user-defined metadata either as a `REF` to `XMLTYPE` or an `XMLTYPE` and adds it to the desired resource.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the `DBMS_XDB_REPOS` package - the [APPENDRESOURCEMETADATA Procedure](#).

Syntax

```
DBMS_XDB.APPENDRESOURCEMETADATA (
  abspath IN VARCHAR2,
  metadata IN XMLTYPE);

DBMS_XDB.APPENDRESOURCEMETADATA (
```

```

abspath  IN  VARCHAR2,
metadata IN  REF SYS.XMLTYPE);

```

Parameters

Table 212-4 APPENDRESOURCEMETADATA Procedure

Parameter	Description
abspath	Absolute path of the resource
metadata	Metadata can be schema based or nonschema-based. Schema-based metadata is stored in its own table.

Usage Notes

- In the case in which a `REF` is passed in, the procedure stores the `REF` in the resource, and the metadata is stored in a separate table. In this case you are responsible for populating the `RESID` column for the metadata table. Note that the `REF` passed in must be unique. In other words, there must not be a `REF` with the same value in the resource metadata, as this would violate uniqueness of properties. An error is thrown if users attempt to add a `REF` that already exists.
- In the case where the `XMLTYPE` is passed in, the data is parsed to determine if it is schema-based or not and stored accordingly.

212.4.3 CHANGEOWNER Procedure

This procedure changes the owner of the resource/s to the specified owner. This procedure is deprecated in Release 12c.

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the `DBMS_XDB_REPOS` package - the [CHANGEOWNER Procedure](#).

Syntax

```

DBMS_XDB.CHANGEOWNER (
  abspath  IN  VARCHAR2,
  owner    IN  VARCHAR2,
  recurse  IN  BOOLEAN := FALSE);

```

Parameters

Table 212-5 CHANGEOWNER Procedure Parameters

Parameter	Description
abspath	Absolute path of the resource
owner	New owner for the resource
recurse	If <code>TRUE</code> , recursively change owner of all resources in the folder tree

212.4.4 CHANGEPRIVILEGES Function

This function adds a specified ACE to a specified resource's ACL. This procedure is deprecated in Release 12c.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [CHANGEPRIVILEGES Function](#).

Syntax

```
DBMS_XDB.CHANGEPRIVILEGES (  
    res_path  IN    VARCHAR2,  
    ace       IN    xmltype)  
RETURN PLS_INTEGER;
```

Parameters

Table 212-6 CHANGEPRIVILEGES Function Parameters

Parameter	Description
res_path	Path name of the resource for which privileges need to be changed
ace	An XMLType instance of the <ace> element which specifies the <principal>, the operation <grant> and the list of privileges

Return Values

A positive integer if the ACL was successfully modified.

Usage Notes

If no ACE with the same principal and the same operation (*grant/deny*) already exists in the ACL, the new ACE is added at the end of the ACL.

212.4.5 CHECKPRIVILEGES Function

This function checks access privileges granted to the current user on the specified resource.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [CHECKPRIVILEGES Function](#).

Syntax

```
DBMS_XDB.CHECKPRIVILEGES (
    res_path  IN VARCHAR2,
    privs     IN xmltype)
RETURN PLS_INTEGER;
```

Parameters

Table 212-7 CHECKPRIVILEGES Function Parameters

Parameter	Description
res_path	Absolute path in the Hierarchy for resource
privs	An XMLType instance of the privilege element specifying the requested set of access privileges

Return Values

A positive integer if all requested privileges granted.

212.4.6 CREATEFOLDER Function

This deprecated function creates a new folder resource in the hierarchy.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [CREATEFOLDER Function](#).

Syntax

```
DBMS_XDB.CREATEFOLDER (
    path  IN VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 212-8 CREATEFOLDER Function Parameters

Parameter	Description
path	Path name for the new folder

Return Values

TRUE if operation successful; FALSE, otherwise.

Usage Notes

The given path name's parent folder must already exist in the hierarchy: if '/folder1/folder2' is passed as the path parameter, then '/folder1' must already exist.

212.4.7 CREATEOIDPATH Function

This deprecated function creates a virtual path to the resource based on object ID.

Note:

This function is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [CREATEOIDPATH Function](#).

Syntax

```
DBMS_XDB.CREATEOIDPATH(  
    oid IN RAW)  
RETURN VARCHAR2;
```

Parameters

Table 212-9 CREATEOIDPATH Function Parameters

Parameter	Description
oid	Object ID of the resource

212.4.8 CREATERESOURCE Functions

The deprecated function creates a new resource. The description of the overload options precede each version of the syntax

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [CREATERESOURCE Functions](#).

Syntax

Given a REF to an existing XMLType row, creates a resource whose contents point to that row. That row should not already exist inside another resource:

```
DBMS_XDB.CREATERESOURCE(  
    abspath IN VARCHAR2,  
    datarow IN REF SYS.XMLTYPE,
```

```

    createfolders IN BOOLEAN := FALSE)
RETURN BOOLEAN;

```

Creates a resource with a specified BLOB as its contents, and specifies character set of the source BLOB:

```

DBMS_XDB.CREATERESOURCE (
    abspath      IN VARCHAR2,
    data         IN BLOB,
    csid         IN NUMBER :=0,
    createfolders IN BOOLEAN := FALSE)
RETURN BOOLEAN;

```

Creates a resource with a specified BFILE as its contents, and specifies character set of the source BFILE:

```

DBMS_XDB.CREATERESOURCE (
    abspath      IN VARCHAR2,
    data         IN BFILE,
    csid         IN NUMBER :=0,
    createfolders IN BOOLEAN := FALSE)
RETURN BOOLEAN;

```

Creates a resource with a specified CLOB as its contents:

```

DBMS_XDB.CREATERESOURCE (
    abspath      IN VARCHAR2,
    data         IN CLOB,
    createfolders IN BOOLEAN := FALSE)
RETURN BOOLEAN;

```

Given a string, inserts a new resource into the hierarchy with the string as the contents:

```

DBMS_XDB.CREATERESOURCE (
    abspath      IN VARCHAR2,
    data         IN VARCHAR2,
    schemaurl    IN VARCHAR2 := NULL,
    elem        IN VARCHAR2 := NULL)
RETURN BOOLEAN;

```

Given an XMLTYPE and a schema URL, inserts a new resource into the hierarchy with the XMLTYPE as the contents:

```

DBMS_XDB.CREATERESOURCE (
    abspath      IN VARCHAR2,
    data         IN SYS.XMLTYPE,
    schemaurl    IN VARCHAR2 := NULL,
    elem        IN VARCHAR2 := NULL)
RETURN BOOLEAN;

```

Parameters

Table 212-10 CREATERESOURCE Function Parameters

Parameter	Description
abspath	Absolute path of the resource to create. The path name's parent folder must already exist in the hierarchy. In other words, if /foo/bar.txt is passed in, then folder /foo must already exist.

Table 212-10 (Cont.) CREATERESOURCE Function Parameters

Parameter	Description
data	String buffer containing new resource's contents. The data is parsed to check if it contains a schema-based XML document, and the contents are stored as schema-based in the schema's default table. Otherwise, it is saved as binary data.
datarow	REF to an XMLType row to be used as the contents
csid	Character set id of the document. Must be a valid Oracle ID; otherwise returns an error. If CSID is not specified, or if a zero CSID is specified, then the character set id of the document is determined as follows: <ul style="list-style-type: none"> From the abspath extension, determine the resource's MIME type. If the MIME type is */xml, then the encoding is detected based on Appendix F of the W3C XML 1.0 Reference at http://www.w3.org/TR/2000/REC-xml-20001006; Otherwise, it is defaulted to the database character set.
createfolders	If TRUE, create the parent folders if they do not exist
schemaur1	For XML data, schema URL data conforms to (default NULL)
elem	Element name (default NULL)

Return Values

TRUE if operation successful; FALSE, otherwise.

212.4.9 DELETERESOURCE Procedure

This **deprecated procedure** deletes a resource from the hierarchy.

**Note:**

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [DELETERESOURCE Procedure](#).

Syntax

```
DBMS_XDB.DELETERESOURCE (
    path          IN          VARCHAR2,
    delete_option IN          PLS_INTEGER);
```

Parameters**Table 212-11 DELETERESOURCE Procedure Parameters**

Parameter	Description
path	Path name of the resource to delete

Table 212-11 (Cont.) DELETERESOURCE Procedure Parameters

Parameter	Description
delete_option	The option that controls how a resource is deleted; defined in Table 212-1 : <ul style="list-style-type: none"> DELETE_RESOURCE DELETE_RECURSIVE DELETE_FORCE DELETE_RECURSIVE_FORCE

212.4.10 DELETERESOURCEMETADATA Procedures

This **deprecated procedure** takes in a resource by absolute path and removes either the schema-based metadata identified by the REF, or the metadata identified by the namespace and name combination, which can be either schema-based or non-schema based. It also takes an additional (optional) parameter that specifies how to delete it. This parameter is only relevant for schema-based resource metadata that needs to be deleted. For non-schema based metadata, this parameter is ignored.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [DELETERESOURCEMETADATA Procedures](#).

Syntax

Can be used only for schema-based metadata:

```
DBMS_XDB.DELETERESOURCEMETADATA (
    abspath      IN  VARCHAR2,
    metadata     IN  REF SYS.XMLTYPE,
    delete_option IN pls_integer := dbms_xdb.DELETE_RESOURCE_METADATA_CASCADE);
```

Can be used for schema-based or nonschema-based metadata:

```
DBMS_XDB.DELETERESOURCEMETADATA (
    abspath      IN  VARCHAR2,
    metadatans   IN  VARCHAR2,
    metadataname IN  VARCHAR2,
    delete_option IN pls_integer := dbms_xdb.DELETE_RESOURCE_METADATA_CASCADE);
```

Parameters

Table 212-12 DELETERESOURCEMETADATA Procedure Parameters

Parameter	Description
abspath	Absolute path of the resource
metadata	REF to the piece of metadata (schema based) to be deleted

Table 212-12 (Cont.) DELETERESOURCEMETADATA Procedure Parameters

Parameter	Description
mettadatans	Namespace of the metadata fragment to be removed
mettadataname	Local name of the metadata fragment to be removed
delete_option	Only applicable for schema-based metadata, this can be one of the following: <ul style="list-style-type: none"> DELETE_RES_METADATA_CASCADE - deletes the corresponding row in the metadata table DELETE_RES_METADATA_NOCASCADE - does not delete the row in the metadata table

212.4.11 ENABLEDIGESTAUTHENTICATION Procedure

This deprecated procedure enabling digest authentication. It will list digest as the first authentication mechanism to be used by the XML DB HTTP server.

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_CONFIG](#) package - the [ENABLEDIGESTAUTHENTICATION Procedure](#).

Syntax

```
DBMS_XDB.ENABLEDIGESTAUTHENTICATION;
```

212.4.12 EXISTSRESOURCE Function

This deprecated function indicates if a resource is in the hierarchy. Matches resource by a string that represents its absolute path.

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [EXISTSRESOURCE Function](#).

Syntax

```
DBMS_XDB.EXISTSRESOURCE (
    abspath    IN    VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 212-13 EXISTSRESOURCE Function Parameters

Parameter	Description
abspath	Path name of the resource whose ACL document is required

Return Values

TRUE if the resource is found.

212.4.13 GETACLDOCUMENT Function

This deprecated function retrieves ACL document that protects resource given its path name.

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [GETACLDOCUMENT Function](#).

Syntax

```
DBMS_XDB.GETACLDOCUMENT(
    abspath IN VARCHAR2)
RETURN sys.xmltype;
```

Parameters

Table 212-14 GETACLDOCUMENT Function Parameters

Parameter	Description
abspath	Path name of the resource whose ACL document is required

Return Values

The XMLType for ACL document.

212.4.14 GETCONTENTBLOB Function

This deprecated function retrieves the contents of a resource returned as a BLOB.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [GETCONTENTBLOB Function](#).

Syntax

```
DBMS_XDB.GETCONTENTBLOB(  
    abspath    IN    VARCHAR2,  
    csid       OUT   PLS_INTEGER,  
    locksrc    IN    BOOLEAN := FALSE)  
RETURN BLOB;
```

Parameters

Table 212-15 GETCONTENTBLOB Function Parameters

Parameter	Description
abspath	Absolute path of the resource
csid	If TRUE, lock and return the source LOB. If FALSE, return a temp LOB copy.
locksrc	Contents of the resource as a BLOB

Return Values

The contents of the resource as a BLOB.

212.4.15 GETCONTENTCLOB Function

This deprecated function gets the contents of a resource returned as a CLOB.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [GETCONTENTCLOB Function](#).

Syntax

```
DBMS_XDB.GETCONTENTCLOB(  
    abspath    IN    VARCHAR2,  
    RETURN CLOB;
```

Parameters

Table 212-16 GETCONTENTCLOB Function Parameters

Parameter	Description
abspath	Absolute path of the resource

Return Values

The contents of the resource as a CLOB.

212.4.16 GETCONTENTVARCHAR2 Function

This deprecated function gets the contents of a resource returned as a string.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [GETCONTENTVARCHAR2 Function](#).

Syntax

```
DBMS_XDB.GETCONTENTVARCHAR2 (
    abspath    IN    VARCHAR2,
    RETURN BLOB;
```

Parameters

Table 212-17 GETCONTENTVARCHAR2 Function Parameters

Parameter	Description
abspath	Absolute path of the resource

Return Values

The contents of the resource as a string.

212.4.17 GETCONTENTXMLREF Function

This deprecated function retrieves the contents of a resource returned as a `REF` to an `XMLTYPE`.

 **Note:**

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the `DBMS_XDB_REPOS` package - the [GETCONTENTXMLREF Function](#).

Syntax

```
DBMS_XDB.GETCONTENTXMLREF (  
    abspath    IN    VARCHAR2,  
    RETURN SYS.XMLTYPE;
```

Parameters

Table 212-18 GETCONTENTXMLREF Function Parameters

Parameter	Description
abspath	Absolute path of the resource

Return Values

The contents of the resource as a `REF` to an `XMLTYPE`.

212.4.18 GETCONTENTXMLTYPE Function

This deprecated function retrieves the contents of a resource returned as an `XMLTYPE`.

 **Note:**

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the `DBMS_XDB_REPOS` package - the [GETCONTENTXMLTYPE Function](#).

Syntax

```
DBMS_XDB.GETCONTENTXMLTYPE (  
    abspath    IN    VARCHAR2,  
    RETURN SYS.XMLTYPE;
```

Parameters

Table 212-19 GETCONTENTXMLTYPE Function Parameters

Parameter	Description
abspath	Absolute path of the resource

Return Values

The contents of the resource as an XMLTYPE.

212.4.19 GETHTTPREQUESTHEADER Function

This deprecated function, if called during an HTTP request serviced by XDB, returns the values of the passed header. It is used by routines that implement custom authentication.



Note:

This procedure is deprecated in Release 12c.

Syntax

```
DBMS_XDB.GETHTTPREQUESTHEADER(
    header_name IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 212-20 GETHTTPREQUESTHEADER Function Parameters

Parameter	Description
header_name	Passed header

Return Values

Returns NULL in case the header is not present in the request, or for AUTHENTICATION, for security reasons.

212.4.20 GETLOCKTOKEN Procedure

Given a path to a resource, this deprecated procedure returns that resource's lock token for the current user.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [GETLOCKTOKEN Procedure](#).

Syntax

```
DBMS_XDB.GETLOCKTOKEN (  
    path          IN    VARCHAR2,  
    locktoken     OUT   VARCHAR2);
```

Parameters

Table 212-21 GETLOCKTOKEN Procedure Parameters

Parameter	Description
path	Path name to the resource
locktoken	Logged-in user's lock token for the resource

Usage Notes

The user must have `READPROPERTIES` privilege on the resource.

212.4.21 GETPRIVILEGES Function

This deprecated function gets all privileges granted to the current user on a specified resource.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [GETPRIVILEGES Function](#).

Syntax

```
DBMS_XDB.GETPRIVILEGES (  
    res_path      IN    VARCHAR2)  
RETURN sys.xmltype;
```

Parameters

Table 212-22 GETPRIVILEGES Function Parameters

Parameter	Description
res_path	Absolute path in the hierarchy of the resource

Return Values

An XMLType instance of <privilege> element, which contains the list of all leaf privileges granted on this resource to the current user.

212.4.22 GETRESOID Function

This deprecated procedure returns the object ID of the resource from its absolute path.

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [GETRESOID Function](#).

Syntax

```
DBMS_XDB.GETRESOID(
    abspath IN VARCHAR2)
RETURN RAW;
```

Parameters

Table 212-23 GETRESOID Function Parameters

Parameter	Description
abspath_path	Absolute path of the resource

Return Values

NULL if the resource is not present.

212.4.23 GETXDB_TABLESPACE Function

This deprecated function returns the current tablespace of the XDB (user).



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [GETXDB_TABLESPACE](#) Function.

Syntax

```
DBMS_XDB.GETXDB_TABLESPACE  
RETURN VARCHAR2;
```

212.4.24 HASBLOBCONTENT Function

This deprecated function returns `TRUE` if the resource has BLOB content.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [HASBLOBCONTENT](#) Function.

Syntax

```
DBMS_XDB.HASBLOBCONTENT  
  (abspath IN VARCHAR2)  
RETURN BOOLEAN;
```

Parameters

Table 212-24 HASBLOBCONTENT Function Parameters

Parameter	Description
<code>abspath_path</code>	Absolute path of the resource

Return Values

`TRUE` if the resource has BOB content.

212.4.25 HASCHARCONTENT Function

This deprecated function returns `TRUE` if the resource has character content.

 **Note:**

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [HASCHARCONTENT Function](#).

Syntax

```
DBMS_XDB.HASCHARCONTENT  
  (abspath IN VARCHAR2)  
  RETURN BOOLEAN;
```

Parameters

Table 212-25 HASCHARCONTENT Function Parameters

Parameter	Description
<code>abspath_path</code>	Absolute path of the resource

Return Values

`TRUE` if the resource has character content.

212.4.26 HASXMLCONTENT Function

This deprecated function returns `TRUE` if the resource has XML content.

 **Note:**

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [HASXMLCONTENT Function](#).

Syntax

```
DBMS_XDB.HASXMLCONTENT  
  (abspath IN VARCHAR2)  
  RETURN BOOLEAN;
```


Parameters

Table 212-26 HASXMLCONTENT Function Parameters

Parameter	Description
abspath_path	Absolute path of the resource

Return Values

TRUE if the resource has XML content.

212.4.27 HASXMLREFERENCE Function

This deprecated function returns TRUE if the resource has a REF to XML content.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [HASXMLREFERENCE Function](#).

Syntax

```
DBMS_XDB.HASXMLREFERENCE
  (abspath IN VARCHAR2)
  RETURN BOOLEAN;
```

Parameters

Table 212-27 HASXMLREFERENCE Function Parameters

Parameter	Description
abspath_path	Absolute path of the resource

Return Values

TRUE resource has a REF to XML content.

212.4.28 ISFOLDER Function

This deprecated function returns `TRUE` if the resource is a folder or container.

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [ISFOLDER Function](#).

Syntax

```
DBMS_XDB.ISFOLDER
  abspath IN VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 212-28 DBMS_XDB.ISFOLDER Function Parameters

Parameter	Description
<code>abspath_path</code>	Absolute path of the resource

Return Values

`TRUE` if the resource is a folder or container.

212.4.29 LINK Procedures

This deprecated procedure creates a link from a specified folder to a specified resource.

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [LINK Procedures](#).

Syntax

```
DBMS_XDB.LINK(
  srcpath IN VARCHAR2,
  linkfolder IN VARCHAR2,
  linkname IN VARCHAR2);

DBMS_XDB.LINK(
  srcpath IN VARCHAR2,
  linkfolder IN VARCHAR2,
```

```

linkname    IN    VARCHAR2,
linktype    IN    PLS_INTEGER := DBMS_XDB.LINK_TYPE_HARD);

```

Parameters

Table 212-29 LINK Procedure Parameters

Parameter	Description
srcpath	Path name of the resource to which a link is created
linkfolder	Folder in which the new link is placed
linkname	Name of the new link
linktype	Type of link to be created: <ul style="list-style-type: none"> • DBMS_XDB.LINK_TYPE_HARD (default) • DBMS_XDB.LINK_TYPE_WEAK • DBMS_XDB.LINK_TYPE_SYMBOLIC

212.4.30 LOCKRESOURCE Function

Given a path to a resource, this deprecated function gets a WebDAV-style lock on that resource.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [LOCKRESOURCE Function](#).

Syntax

```

DBMS_XDB.LOCKRESOURCE (
  path      IN  VARCHAR2,
  depthzero IN  BOOLEAN,
  shared    IN  boolean)
RETURN BOOLEAN;

```

Parameters

Table 212-30 LOCKRESOURCE Function Parameters

Parameter	Description
path	Path name of the resource to lock.
depthzero	Currently not supported
shared	Passing TRUE obtains a shared write lock

Return Values

TRUE if successful.

Usage Notes

The user must have `UPDATE` privileges on the resource.

212.4.31 PROCESSLINKS Procedure

This deprecated procedure processes document links in the specified resource.

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [PROCESSLINKS Procedure](#).

Syntax

```
DBMS_XDB.PURGERESOURCEMETADATA (
  abspath IN VARCHAR2,
  recurse IN BOOLEAN := FALSE);
```

Parameters

Table 212-31 PROCESSLINKS Procedure Parameters

Parameter	Description
<code>abspath</code>	Absolute path of the resource. If the path is a folder, use the <code>recurse</code> flag.
<code>recurse</code>	Used only if <code>abspath</code> specifies a folder. If <code>TRUE</code> , process links of all resources in the folder hierarchy rooted at the specified resource. If <code>FALSE</code> , process links of all documents in this folder only.

212.4.32 PURGERESOURCEMETADATA Procedure

This deprecated procedure deletes all user metadata from a resource. Schema-based metadata is removed in cascade mode, rows being deleted from the corresponding metadata tables.

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [PURGERESOURCEMETADATA Procedure](#).

Syntax

```
DBMS_XDB.PURGERESOURCEMETADATA (
  abspath IN VARCHAR2);
```

Parameters

Table 212-32 PURGERESOURCEMETADATA Procedure Parameters

Parameter	Description
abspath	Absolute path of the resource

212.4.33 RENAMERESOURCE Procedure

This deprecated procedure renames the XDB resource.

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [RENAMERESOURCE Procedure](#).

Syntax

```
DBMS_XDB.RENAMERESOURCE (
  srcpath   IN VARCHAR2,
  destfolder IN CARCHAR2,
  newname   IN VARCHAR2);
```

Parameters

Table 212-33 RENAMERESOURCE Procedure Parameters

Parameter	Description
srcpath	Absolute path in the Hierarchy for the source resource destination folder
destfolder	Absolute path in the Hierarchy for the destination folder
newname	Name of the child in the destination folder

212.4.34 SETACL Procedure

This deprecated procedure set the ACL on a specified resource to be the ACL specified by path.

Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [SETACL Procedure](#).

Syntax

```
DBMS_XDB.SETACL(
  res_path  IN  VARCHAR2,
  acl_path  IN  VARCHAR2);
```

Parameters**Table 212-34 SETACL Procedure Parameters**

Parameter	Description
res_path	Absolute path in the Hierarchy for resource
acl_path	Absolute path in the Hierarchy for ACL

Usage Notes

The user must have `<write-acl>` privileges on the resource.

212.4.35 SPLITPATH Procedure

This deprecated procedure splits the path into a parentpath and childpath.

 **Note:**

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [SPLITPATH Procedure](#).

Syntax

```
DBMS_XDB.SPLITPATH(
  abspath      IN  VARCHAR2,
  parentpath   OUT VARCHAR2,
  childpath    OUT VARCHAR2);
```

Parameters**Table 212-35 SPLITPATH Procedure Parameters**

Parameter	Description
abspath	Absolute path to be split
parentpath	Parentpath
childpath	Childpath

212.4.36 TOUCHRESOURCE Procedure

This **deprecated procedure** changes the modification time of the resource to the current time.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [TOUCHRESOURCE Procedure](#).

Syntax

```
DBMS_XDB.TOUCHRESOURCE
  (abspath IN VARCHAR2);
```

Parameters

Table 212-36 DBMS_XDB.TOUCHRESOURCE Procedure Parameters

Parameter	Description
abspath_path	Absolute path of the resource

212.4.37 UNLOCKRESOURCE Function

This deprecated function unlocks the resource given a lock token and a path to the resource.



Note:

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [UNLOCKRESOURCE Function](#).

Syntax

```
DBMS_XDB.UNLOCKRESOURCE (
  path IN VARCHAR2,
  deltoken IN VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 212-37 UNLOCKRESOURCE Function Parameters

Parameter	Description
path	Path name to the resource

Table 212-37 (Cont.) UNLOCKRESOURCE Function Parameters

Parameter	Description
deltoken	Lock token to be removed

Return Values

TRUE if operation successful.

Usage Notes

The user must have UPDATE privileges on the resource.

212.4.38 UPDATERESOURCEMETADATA Procedures

This deprecated procedure updates metadata for a resource.

 **Note:**

This procedure is deprecated in Release 12c. This functionality is replaced by a subprogram of the same name in the [DBMS_XDB_REPOS](#) package - the [UPDATERESOURCEMETADATA Procedures](#).

The procedure takes in a resource identified by absolute path and the metadata in it to replace identified by its REF. It replaces that piece of metadata with user-defined metadata which is either in the form of a REF to XMLTYPE or an XMLTYPE.

Syntax

Can be used to update schema-based metadata only. The new metadata must be schema-based:

```
DBMS_XDB.UPDATERESOURCEMETADATA (
  abspath IN VARCHAR2,
  oldmetadata IN REF SYS.XMLTYPE,
  newmetadata IN REF SYS.XMLTYPE)
```

Can be used to update schema-based metadata only. The new metadata must be schema-based or nonschema-based:

```
DBMS_XDB.UPDATERESOURCEMETADATA (
  abspath IN VARCHAR2,
  oldmetadata IN REF SYS.XMLTYPE,
  newmetadata IN XMLTYPE);
```

Can be used for both schema-based and nonschema-based metadata:

```
DBMS_XDB.UPDATERESOURCEMETADATA (
  abspath IN VARCHAR2,
  oldns IN VARCHAR2,
  oldname IN VARCHAR,
```



```
newmetadata IN XMLTYPE);
```

Can be used for both schema-based or nonschema-based metadata. New metadata must be schema-based:

```
DBMS_XDB.UPDATERESOURCEMETADATA (  
  abspath      IN   VARCHAR2,  
  oldns        IN   VARCHAR2,  
  oldname      IN   VARCHAR,  
  newmetadata  IN   REF SYS.XMLTYPE);
```

Parameters

Table 212-38 UPDATERESOURCEMETADATA Procedure Parameters

Parameter	Description
abspath	Absolute path of the resource
oldmetadata	REF to the old of metadata
newmetadata	REF to the new, replacement metadata (can be either schema-based or nonschema-based depending on the overload)
oldns	Namespace identifying old metadata
oldname	Local name identifying old metadata

Usage Notes

In the case of REF, it stores the REF in the resource and the metadata is stored in a separate table. Uniqueness of REFs is enforced. In the case where the XMLTYPE is passed in, data is parsed to determine if it is schema-based or not and is stored accordingly.

DBMS_XA

The `DBMS_XA` package contains the XA/Open interface for applications to call XA interface in PL/SQL. Using this package, application developers can switch or share transactions across SQL*Plus sessions or processes using PL/SQL.

The chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Operational Notes](#)
- [Data Structures](#)
- [Summary of DBMS_XA Subprograms](#)



See Also:

Oracle Database Advanced Application Developer's Guide for more information about "Developing Applications with Oracle XA"

213.1 DBMS_XA Overview

These subprograms allow a PL/SQL application to define a global transaction branch ID (`XID`) and associate or disassociate the current session with the transaction branch.

Subsequently, these transaction branches may be prepared and committed by following the two-phase commit protocol. A single-phase commit protocol is also supported if only one resource manager is involved.

Interfaces are also provided for a PL/SQL application to set the timeout values for any new global transaction branches that may start with the current session.

213.2 DBMS_XA Security Model

This package is created under `SYS`. Operations provided by this package are performed under the current calling user, not under the package owner `SYS`. Any `DBMS_XA` subprogram called from an anonymous PL/SQL block is executed using the privileges of the current user. Any `DBMS_XA` subprogram called from a stored procedure is executed using the privileges of the owner of the stored procedure.

`SELECT` or `READ` privilege on `SYS.DBA_PENDING_TRANSACTIONS` is required for users who need to execute `XA_RECOVER` subprogram.

FORCE ANY TRANSACTION privilege is required for users who need to manipulate XA transactions created by other users.

213.3 DBMS_XA Constants

The DBMS_XA package defines several constants that can be used for specifying parameter values.

The package uses the constants shown in [Table 213-1](#) for use in the flag field of the [XA_START Function](#) and the [XA_END Function](#).

Table 213-1 DBMS_XA Constants for Flag Field of XA_START & XA_END Functions

Name	Type	Value	Description
TMNOFLAGS	PLS_INTEGER	00000000	Indicates no flag value is selected.
TMSUCCESS	PLS_INTEGER	UTL_RAW.CAST_TO_BINARY_INTEGER('04000000')	Dissociates caller from transaction branch
TMJOIN	PLS_INTEGER	UTL_RAW.CAST_TO_BINARY_INTEGER('00200000')	Caller is joining existing transaction branch.
TMSUSPEND	PLS_INTEGER	UTL_RAW.CAST_TO_BINARY_INTEGER('02000000')	Caller is suspending, not ending, association
TMRESUME	PLS_INTEGER	UTL_RAW.CAST_TO_BINARY_INTEGER('08000000')	Caller is resuming association with suspended transaction branch.

The DBMS_XA package uses the constants shown in [Table 213-2](#) for Possible Return Values

Table 213-2 DBMS_XA Constants for Possible Return Values

Name	Type	Value	Description
XA_RBBASE	PLS_INTEGER	100	Inclusive lower bound of the rollback codes
XA_RBROLLBACK	PLS_INTEGER	XA_RBBASE	Rollback was caused by an unspecified reason
XA_RBCOMMFAIL	PLS_INTEGER	XA_RBBASE+1	Rollback was caused by a communication failure
XA_RBDEADLOCK	PLS_INTEGER	XA_RBBASE+2	Deadlock was detected
XA_RBINTEGRITY	PLS_INTEGER	XA_RBBASE+3	Condition that violates the integrity of the resources was detected
XA_RBOTHER	PLS_INTEGER	XA_RBBASE+4	Resource manager rolled back the transaction for an unlisted reason

Table 213-2 (Cont.) DBMS_XA Constants for Possible Return Values

Name	Type	Value	Description
XA_RBPROTO	PLS_INTEGER	XA_RBBASE+5	Protocol error occurred in the resource manager
XA_RBTIMEOUT	PLS_INTEGER	XA_RBBASE+6	transaction branch took long
XA_RBTRANSIENT	PLS_INTEGER	XA_RBBASE+7	May retry the transaction branch
XA_RBEND	PLS_INTEGER	XA_RBTRANSIENT	Inclusive upper bound of the rollback codes
XA_NOMIGRATE	PLS_INTEGER	9	Transaction branch may have been heuristically completed
XA_HEURHAZ	PLS_INTEGER	8	Transaction branch may have been heuristically completed
XA_HEURCOM	PLS_INTEGER	7	Transaction branch has been heuristically committed
XA_HEURRB	PLS_INTEGER	6	Transaction branch has been heuristically rolled back
XA_HEURMIX	PLS_INTEGER	5	Some of the transaction branches have been heuristically committed, others rolled back
XA_RETRY	PLS_INTEGER	4	Routine returned with no effect and may be re-issued
XA_RDONLY	PLS_INTEGER	3	Transaction was read-only and has been committed
XA_OK	PLS_INTEGER	0	Normal execution
XAER_ASYNC	PLS_INTEGER	-2	Asynchronous operation already outstanding
XAER_RMERR	PLS_INTEGER	-3	Resource manager error occurred in the transaction branch
XAER_NOTA	PLS_INTEGER	-4	XID is not valid
XAER_INVALID	PLS_INTEGER	-5	Invalid arguments were given
XAER_PROTO	PLS_INTEGER	-6	Routine invoked in an improper context
XAER_RMFAIL	PLS_INTEGER	-7	Resource manager unavailable
XAER_DUPID	PLS_INTEGER	-8	XID already exists
XAER_OUTSIDE	PLS_INTEGER	-9	Resource manager doing work outside global transaction

213.4 DBMS_XA Operational Notes

In compliance with the XA specification of the X/Open CAE Standard for Distributed Transaction Processing, `XA_PREPARE/COMMIT/ROLLBACK/FORGET` may not be called when the transaction is still associated with the current session. Only after `XA_END` has been called so

that there is not any transaction associated with the current session, the application may call `XA_PREPARE/COMMIT/ROLLBACK/FORGET`.

`XAER_PROTO` error is returned from `XA_PREPARE/COMMIT/ROLLBACK/FORGET` if a transaction is being associated with the current session.

Prior to calling any of the package subprograms, a connection/session must have already been established to the Oracle database server backend, or a resource manager. Resource manager identifiers are not supported. If multiple resource managers are involved, multiple connections/sessions must be pre-established to each resource manager before calling any the package subprograms. If multiple connections/sessions are established during the course of global transaction processing, the caller must ensure that all of those connections/sessions associated with a specific global transaction branch identifier (XID) are established to the same resource manager.

213.5 DBMS_XA Data Structures

The `DBMS_XA` package uses this `OBJECT` type and associated `TABLE` type.

OBJECT Types

- [DBMS_XA_XID Object Type](#)

TABLE Types

- [DBMS_XA_XID_ARRAY Table Type](#)

213.5.1 DBMS_XA DBMS_XA_XID Object Type

The PL/SQL XA interface allows the PL/SQL application to define a global transaction branch id (XID) and associate/disassociate the current session with the transaction branch. XID is defined as a PL/SQL object type.



Note:

For more information, see "Distributed Transaction Processing: The XA Specification" in the public XA Standard.

Syntax

```
TYPE DBMS_XA_XID IS OBJECT (
  formatid      NUMBER,
  gtrid         RAW(64),
  bqual        RAW(64),
  constructor function DBMS_XA_XID(
    gtrid      IN  NUMBER)
    RETURN SELF AS RESULT,
  constructor function DBMS_XA_XID (
    gtrid      IN  RAW,
    bqual      IN  RAW)
    RETURN SELF AS RESULT,
  constructor function DBMS_XA_XID(
    formatid  IN  NUMBER,
```

```

gtrid      IN  RAW,
bqual     IN  RAW DEFAULT HEXTORAW('00000000000000000000000000000001'))
RETURN SELF AS RESULT)

```

Attributes

Table 213-3 DBMS_XA_XID Object Type

Attribute	Description
formatid	Format identifier, a number identifying different transaction managers (TM)
gtrid	Global transaction identifier uniquely identifying a global transaction, of which the maximum size is 64 bytes
bqual	Branch qualifier, of which the maximum size is 64 bytes

213.5.2 DBMS_XA DBMS_XA_XID_ARRAY Table Type

This type is used to define an array of `xid` that represent a list of global transaction branches.

Syntax

```
TYPE DBMS_XA_XID_ARRAY as TABLE of DBMS_XA_XID
```

213.6 Summary of DBMS_XA Subprograms

This table lists the DBMS_XA subprograms and briefly describes them.

Table 213-4 DBMS_XA Package Subprograms

Subprogram	Description
DIST_TXN_SYNC Procedure	Used in recovery of synchronization when utilizing Oracle Real Application Clusters (Oracle RAC)
XA_COMMIT Function	Commits the global transaction specified by <code>xid</code>
XA_END Function	Disassociates the current session from the transaction branch specified by <code>xid</code>
XA_FORGET Function	Informs the resource manager to forget about a heuristically committed or rolled back transaction branch.
XA_GETLASTOER Function	Obtains the last Oracle error code, in case of failure of previous XA calls.
XA_PREPARE Function	Prepares the transaction branch specified in <code>xid</code> for committing the transaction subsequently if possible
XA_RECOVER Function	Obtains a list of prepared or heuristically completed transaction branches from a resource manager
XA_ROLLBACK Function	Informs the resource manager to roll back work done on behalf of a transaction branch
XA_SETTIMEOUT Function	Sets the transaction timeout in seconds for the current session
XA_START Function	Associates the current session with the transaction branch specified by <code>xid</code>

213.6.1 DIST_TXN_SYNC Procedure

This procedure can be used to synchronize in-doubt transactions when one of the Oracle Real Application Clusters (Oracle RAC) instances fails.

Syntax

```
DBMS_XA.DIST_TXN_SYNC;
```

213.6.2 XA_COMMIT Function

This function commits the global transaction specified by `xid`.

Syntax

```
DBMS_XA.XA_COMMIT (
    xid          IN DBMS_XA_XID,
    onePhase     IN BOOLEAN)
RETURN PLS_INTEGER;
```

Parameters

Table 213-5 XA_COMMIT Function Parameters

Parameter	Description
<code>xid</code>	See DBMS_XA_XID Object Type
<code>onePhase</code>	If <code>TRUE</code> , apply single phase commit

Return Values

See [Table 213-2](#). Possible return values indicating error are: `XAER_RMERR`, `XAER_RMFAIL`, `XAER_NOTA`, `XAER_INVAL`, or `XAER_PROTO`. Other possible return values include: `XA_OK`, `XA_RB*`, `XA_HEURHAZ`, `XA_HEURCOM`, `XA_HEURRB`, and `XA_HEURMIX`.

Usage Notes

- An application must not call `COMMIT`, but instead must call `XA_COMMIT` to commit the global transaction specified by `xid`. If a user needs to commit a transaction branch that is created by other users, `FORCE ANY TRANSACTION` must be granted to the user.
- If `onePhase` is `TRUE`, the resource manager should use a one-phase commit protocol to commit the work done on behalf of `xid`. Otherwise, only if all branches of the global transaction have been prepared successfully and the preceding `XA_PREPARE` call has returned `XA_OK`, should `XA_COMMIT` be called.
- The application must make a separate `XA_COMMIT` call for each of the transaction branches of the global transaction for which `XA_PREPARE` has returned `XA_OK`.
- If the resource manager did not commit the transaction and the parameter `onePhase` is set to `TRUE`, the resource manager may return one of the `XA_RB*` code. Upon return, the resource manager has rolled back the branch's work and has released all held resources.

213.6.3 XA_END Function

This function disassociates the current session from the transaction branch specified by `xid`.

A transaction manager calls `XA_END` when a thread of control finishes, or needs to suspend work on, a transaction branch. This occurs when the application completes a portion of its work, either partially or in its entirety (for example, before blocking on some event in order to let other threads of control work on the branch). When `XA_END` successfully returns, the calling thread of control is no longer actively associated with the branch but the branch still exists

Syntax

```
DBMS_XA.XA_END (  
    xid    IN  DBMS_XA_XID,  
    flag   IN  PLS_INTEGER)  
RETURN PLS_INTEGER;
```

Parameters

Table 213-6 XA_END Function Parameters

Parameter	Description
<code>xid</code>	See DBMS_XA_XID Object Type
<code>flag</code>	See Table 213-1 .

Return Values

See [Table 213-2](#). Possible return values in error are `XAER_RMERR`, `XAER_RMFAILED`, `XAER_NOTA`, `XAER_INVAL`, `XAER_PROTO`, or `XA_RB*`.

Usage Notes

- `TMSUCCESS` or `TMSUSPEND` may be specified in `flag`, and the transaction branch is disassociated with the current session in detached state if the return value is `XA_OK`. `TMFAIL` is not supported. `XA_END` may be called with either `TMSUCCESS` or `TMSUSPEND` to disassociate the transaction branch identified by `xid` from the current session.
- `XA_OK` is returned if `XA_END` succeeds. An application must check the return value and handle error cases. Only when `XA_OK` is returned, the application should proceed for other normal operations.
- Executing a `ROLLBACK` statement without calling `XA_END` first will rollback the changes made by the current transaction. However, the transaction context is still associated with the current session until `XA_END` is called.
- Executing a `COMMIT` statement without calling `XA_END` first will result in `ORA-02089: COMMIT is not allowed in a subordinate session`.
- Executing a `COMMIT` or a `ROLLBACK` statement after `XA_END` has no effect on the transaction identified by `xid`, since this transaction is no longer associated with the current session.

213.6.4 XA_FORGET Function

This function informs the resource manager to forget about a heuristically committed or rolled back transaction branch.

Syntax

```
DBMS_XA.XA_FORGET (  
    xid      IN DBMS_XA_XID)  
RETURN PLS_INTEGER;
```

Parameters

Table 213-7 XA_FORGET Function Parameters

Parameter	Description
xid	See DBMS_XA_XID Object Type

Return Values

See [Table 213-2](#). Possible return values are XA_OK, XAER_RMERR, XAER_RMFAIL, XAER_NOTA, XAER_INVAL, or XAER_PROTO.

213.6.5 XA_GETLASTOER Function

This function obtains the last Oracle error code, in case of failure of previous XA calls.

Syntax

```
DBMS_XA.XA_GETLASTOER  
RETURN PLS_INTEGER;
```

Return Values

The return value carries the last Oracle error code.

213.6.6 XA_PREPARE Function

This function prepares the transaction branch specified in xid for committing the transaction subsequently if possible.

Syntax

```
DBMS_XA.XA_PREPARE (  
    xid      IN DBMS_XA_XID)  
RETURN PLS_INTEGER;
```

Parameters

Table 213-8 XA_PREPARE Function Parameters

Parameter	Description
xid	See DBMS_XA_XID Object Type

Return Values

See [Table 213-2](#). Possible return codes include: XA_OK, XA_RDONLY, XA_RB*, XAER_RMERR, XAER_RMFAIL, XAER_NOTA, XAER_INVAL, or XAER_PROTO.

Usage Notes

- If a user needs to prepare a transaction branch that is created by other users, `FORCE ANY TRANSACTION` must be granted to the user.
- An application must keep track of all the branches of one global transaction, and prepare each transaction branch. Only if all branches of the global transaction have been prepared successfully and `XA_PREPARE` has returned `XA_OK`, the application may proceed to call `XA_COMMIT`.

213.6.7 XA_RECOVER Function

This function obtains a list of prepared or heuristically completed transaction branches from a resource manager.

Syntax

```
DBMS_XA.XA_RECOVER
RETURN DBMS_XA_XID_ARRAY;
```

Return Values

See [DBMS_XA_XID_ARRAY Table Type](#)

Usage Notes

- The flags `TMSTARTSCAN`, `TMENDSCAN`, `TMNOFLAGS` are not supported.
- The privilege `SELECT ON DBA_PENDING_TRANSACTIONS` must be granted to the user who needs to call `XA_RECOVER`.

213.6.8 XA_ROLLBACK Function

This function informs the resource manager to roll back work done on behalf of a transaction branch.

Syntax

```
DBMS_XA.XA_ROLLBACK (
xid          IN DBMS_XA_XID)
RETURN PLS_INTEGER;
```

Parameters

Table 213-9 XA_ROLLBACK Function Parameters

Parameter	Description
xid	See DBMS_XA_XID Object Type

Return Values

See [Table 213-2](#). Possible return values are: XA_OK, XA_RB*, XA_HEURHAZ, XA_HEURCOM, XA_HEURRB, or XA_HEURMIX.

Usage Notes

If a user needs to rollback a transaction branch that created by other users, the privilege `FORCE ANY TRANSACTION` must be granted to the user.

213.6.9 XA_SETTIMEOUT Function

This function sets the transaction timeout in seconds for the current session.

Syntax

```
DBMS_XA.XA_SETTIMEOUT (
    seconds IN PLS_INTEGER)
RETURN PLS_INTEGER;
```

Parameters

Table 213-10 XA_SETTIMEOUT Function Parameters

Parameter	Description
seconds	The timeout value indicates the maximum time in seconds that a transaction branch may be disassociated from the session before the system automatically aborts the transaction. The default value is 60 seconds.

Return Values

See [Table 213-2](#). Possible return values are XA_OK, XAER_RMERR, XAER_RMFAIL, or XAER_INVAL.

Usage Notes

Only if return value is XA_OK, is the timeout value successfully set.

213.6.10 XA_START Function

This function associates the current session with a transaction branch specified by the `xid`.

Syntax

```
DBMS_XA.XA_START (  
    xid IN DBMS_XA_XID,    flag IN PLS_INTEGER) RETURN PLS_INTEGER;
```

Parameters

Table 213-11 XA_START Function Parameters

Parameter	Description
<code>xid</code>	See DBMS_XA_XID Object Type
<code>flag</code>	See Table 213-1 .

Return Values

See [Table 213-2](#)

Usage Notes

- If `TMJOIN` or `TMRESUME` is specified in `flag`, the start is for joining an existing transaction branch identified by the `xid`. `TMJOIN` flag should be used when the transaction is detached with `TMSUCCESS` flag. `TMRESUME` should be used when the transaction branch is detached with `TMSUSPEND` flag. `XA_START` may be called with either flag to join an existing transaction branch.
- If `TMNOFLAGS` is specified in `flag`, and neither `TMJOIN` nor `TMRESUME` is specified, a new transaction branch is to be started. If the transaction branch specified in `xid` already exists, `XA_START` returns an `XAER_DUPID` error code.
- Possible return values in error include: `XAER_RMERR`, `XAER_RMFAIL`, `XAER_DUPID`, `XAER_OUTSIDE`, `XAER_NOTA`, `XAER_INVAL`, and `XAER_PROTO`.
- `XA_OK` is returned if `XA_START` succeeds. An application must check the return value and handle error cases. Only when `XA_OK` is returned, the PL/SQL application should proceed for other normal operations. Transaction stacking is not supported. If there is an active transaction associated with the current session, may not be called to start or join another transaction. `XAER_PROTO` will be returned if `XA_START` is called with an active global transaction branch associated with the session. `XAER_OUTSIDE` will be returned if `XA_START` is called with a local transaction associated with the current session.

DBMS_XDB_ADMIN

The `DBMS_XDB_ADMIN` package provides an interface to manage the Oracle XML DB repository.

This chapter contains the following topics:

- [DBMS_XDB_ADMIN Security Model](#)
- [Summary of DBMS_XDB_ADMIN Subprograms](#)



See Also:

Oracle XML DB Developer's Guide for information about Oracle XML DB Repository

214.1 DBMS_XDB_ADMIN Security Model

Owned by `XDB`, the `DBMS_XDB_ADMIN` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `SYS` or `XDB` or `DBA`. Subprograms in this package are executed using the privileges of the current user.

214.2 Summary of DBMS_XDB_ADMIN Subprograms

This table lists the package subprograms in alphabetical order.

Table 214-1 DBMS_XDB_ADM Package Subprograms

Subprogram	Description
CREATENONCEKEY Procedure	Generates a nonce value for use in digest authentication
INSTALLDEFAULTWALLET Procedure	Installs the default XDB wallet in the default XDB wallet directory
MOVEXDB_TABLESPACE Procedure	Moves the XDB (user) to the specified tablespace
REBUILDHIERARCHICALINDEX Procedure	Rebuilds the hierarchical index after import or export operations

214.2.1 CREATENONCEKEY Procedure

This procedure generates a nonce value for use in digest authentication.

Syntax

```
DBMS_XDB_ADMIN.CREATENONCEKEY;
```

214.2.2 INSTALLDEFAULTWALLET Procedure

This procedure installs the default XDB wallet in the default XDB wallet directory.

The directory name where the XDB wallet is stored is prefixed either by `ORACLE_BASE` when it is defined, or `ORACLE_HOME`. It is then followed by `/admin/db_name/xdb_wallet` where `db_name` is the unique database name.

Syntax

```
DBMS_XDB_ADMIN.INSTALLDEFAULTWALLET;
```

Usage Notes

Only `SYS` can install or replace the default wallet.

214.2.3 MOVEXDB_TABLESPACE Procedure

This procedure moves the XDB (user) to the specified tablespace.

Syntax

```
DBMS_XDB_ADMIN.MOVEXDB_TABLESPACE(  
    new_tablespace IN VARCHAR2);
```

Parameters

Table 214-2 MOVEXDB_TABLESPACE Procedure Parameters

Parameter	Description
<code>new_tablespace</code>	Name of the tablespace to where the XDB is moved

Usage Notes

- This operation waits for all concurrent XDB sessions to exit.
- If `MOVEXDB_TABLESPACE` fails, the user should restart the database before issuing any further command. Failure to do so will result into unexpected behavior from the database.
- The XDB repository by default resides in the `SYSAUX` tablespace. Using this procedure it can be moved to another tablespace. As a best practice we recommend to create a dedicated tablespace for the XDB repository only and not share it with other objects (such as tables). The tablespace containing the XDB repository should never be set to `READ ONLY` because this might affect various XML operations being executed.

214.2.4 REBUILDHIERARCHICALINDEX Procedure

This procedure rebuilds the hierarchical index after import or export operations. This is necessary because data cannot be exported from index tables.

Syntax

```
DBMS_XDB_ADMIN.REBUILDHIERARCHICALINDEX;
```

DBMS_XDB_CONFIG

The `DBMS_XDB_CONFIG` package provides an interface for configuring Oracle XML DB and its repository.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Summary of DBMS_XDB_CONFIG Subprograms](#)



See Also:

Oracle XML DB Developer's Guide

215.1 DBMS_XDB_CONFIG Overview

PL/SQL package `DBMS_XDB_CONFIG` is the Oracle XML DB resource application program interface (API) for PL/SQL for DBAs to configure their system.

This API provides functions and procedures to access and manage Oracle XML DB Repository resources using PL/SQL. It includes methods for managing resource security and Oracle XML DB configuration.



Note:

The Oracle XML DB Repository is deprecated with Oracle Database 23ai.

Oracle recommends that you replace any functionality used in XML DB Repository with alternative technologies.

Oracle XML DB Repository is modeled on XML, and provides a database file system for any data. The repository maps path names (or URLs) onto database objects of XMLType and provides management facilities for these objects.

PL/SQL package `DBMS_XDB_CONFIG` is an API that you can use to manage all of the following:

- Oracle XML DB resources
- Oracle XML DB security based on access control lists (ACLs). An ACL is a list of access control entries (ACEs) that determines which principals (users and roles) have access to which resources.

- Oracle XML DB configuration

215.2 DBMS_XDB_CONFIG Security Model

Owned by XDB, the DBMS_XDB_CONFIG package must be created by SYS or XDB. The EXECUTE privilege is granted to PUBLIC. Subprograms in this package are executed using the privileges of the current user.

215.3 DBMS_XDB_CONFIG Constants

The DBMS_XDB_CONFIG package defines several enumerated constants that should be used for specifying parameter values.

These constants are shown in the following table.

Table 215-1 DBMS_XDB_CONFIG Constants

Constant	Type	Value	Description
XDB_ENDPOINT_HTTP	NUMBER	1	Defining listener for first HTTP port
XDB_ENDPOINT_HTTP2	NUMBER	2	Defining listener for second HTTP port
XDB_ENDPOINT_RHTTP	NUMBER	3	Defining listener for a remote HTTP port
XDB_ENDPOINT_RHTTPS	NUMBER	4	Defining listener for a remote HTTPS port
XDB_PROTOCOL_TCP	NUMBER	1	Defining listener for HTTP protocol
XDB_PROTOCOL_TCPS	NUMBER	2	Defining listener for HTTPS protocol

215.4 Summary of DBMS_XDB_CONFIG Subprograms

The DBMS_XDB_CONFIG package uses subprograms for configuring Oracle XML DB and its repository.

These subprograms are listed in the following table.

Table 215-2 DBMS_XDB_CONFIG Package Subprograms

Subprogram	Description
ADDHTTPEXPIREMAPPING Procedure	Adds to XDB\$CONFIG a mapping of the URL pattern to an expiration date. This will control the Expire headers for URLs matching the pattern.
ADDMIMEMAPPING Procedure	Adds a mime mapping to XDB configuration
ADDSCHEMALOCMAPPING Procedure	Adds a schema location mapping to the XDB configuration
ADDSERVLET Procedure	Adds a servlet to XDB configuration
ADDSERVLETMAPPING Procedure	Adds a servlet mapping to XDB configuration

Table 215-2 (Cont.) DBMS_XDB_CONFIG Package Subprograms

Subprogram	Description
ADDSERVLETSECROLE Procedure	Adds a security role REF to a specified servlet in XDB configuration
ADDXMLEXTENSION Procedure	Adds adds the following XML extension to the XDB configuration under <code><xml-extensions></code> : <code><extension>extension</extension></code>
CFG_GET Function	Retrieves the session's configuration information as an <code>XMLType</code> instance
CFG_REFRESH Procedure	Refreshes the session's configuration information to the latest configuration
CFG_UPDATE Procedure	Updates the configuration information and commits the change.
DELETEHTTPEXPIREMAPPING Procedure	Deletes from <code>XDB\$CONFIG</code> all mappings of the URL pattern to an expiration date
DELETEMIMEMAPPING Procedure	Deletes the mime mapping for a specified extension from the XDB configuration
DELETESCHEMALOCMAPPING Procedure	Deletes the schema location mapping for a specified schema URL from the XDB configuration
DELETESERVLET Procedure	Deletes a servlet from the XDB configuration
DELETESERVLETMAPPING Procedure	Deletes the servlet mapping for a specified servlet name from the XDB configuration
DELETESERVLETSECROLE Procedure	Deletes the specified role from a servlet in the XDB configuration
DELETEXMLEXTENSION Procedure	Deletes the specified XML extension from the XDB configuration
ENABLEDIGESTAUTHENTICATION Procedure	Enables enables digest authentication
GETFTPSPORT Function	Gets the value of the current FTP port
GETHTTPSPORT Function	Gets the value of the current HTTP port
GETHTTPCONFIGREALM Function	Gets the realm name
GETHTTPSSPORT Function	Gets the value of the current HTTPS port
GETLISTENERENDPOINT Procedure	Gets the parameters of a listener end point corresponding to the XML DB HTTP server
GETREMOTEHTTPSPORT Function	Gets the value of a remote HTTP port
GETREMOTEHTTPSSPORT Function	Gets the value of a remote HTTPS port
ISGLOBALPORTENABLED Function	Returns the value of the <code>DBMS_XDB_CONFIG.SETGLOBALPORTENABLED</code> procedure setting
SETFTPSPORT Procedure	Sets the FTP port to a new value
SETHTTPSPORT Procedure	Sets the HTTP port to a new value
SETHTTPCONFIGREALM Procedure	Sets the realm to a new value

Table 215-2 (Cont.) DBMS_XDB_CONFIG Package Subprograms

Subprogram	Description
SETHTTSPORT Procedure	Sets the HTTPS port to a new value
SETLISTENERENDPOINT Procedure	Sets the parameters of a listener end point corresponding to the XML DB HTTP server
SETLISTENERLOCALACCESS Procedure	Restricts all listener end points of the XML DB HTTP server to listen either only on the localhost interface (when <code>l_access</code> is set to <code>TRUE</code>) or to listen on both localhost and non-localhost interfaces (when <code>l_access</code> is set to <code>FALSE</code>)
SETREMOTEHTTPPORT Procedure	Sets the remote HTTP port to a new value
SETREMOTEHTTSPORT Procedure	Sets the remote HTTPS port to a new value
USEDPORT Procedure	Obtains the port numbers used by other pluggable databases in the same consolidation database

215.4.1 ADDHTTPEXPIREMAPPING Procedure

This procedure adds to `XDB$CONFIG` a mapping of the URL pattern to an expiration date. This will control the Expire headers for URLs matching the pattern.

Syntax

```
DBMS_XDB_REPOS.ADDHTTPEXPIREMAPPING (
    pattern    IN    VARCHAR2,
    expire     IN    VARCHAR2);
```

Parameters

Table 215-3 ADDHTTPEXPIREMAPPING Procedure Parameters

Parameter	Description
<code>pattern</code>	URL pattern (only * accepted as wildcards)
<code>expire</code>	Expiration directive, follows the <code>ExpireDefault</code> in Apache's <code>mod_expires</code> : <code>base [plus] (num type)*</code> <code>-- base: now modification</code> <code>-- type: year years month months week weeks day days </code> <code>minute minutess second seconds</code>

Examples

```
DBMS_XDB_REPOS.ADDHTTPEXPIREMAPPING ('/public/test1/*', 'now plus 4 weeks');
DBMS_XDB_REPOS.ADDHTTPEXPIREMAPPING (
    '/public/test2/*', 'modification plus 1 day 30 seconds');
```

215.4.2 ADDMIMEMAPPING Procedure

This procedure adds the following mime mapping to XDB configuration:

```
<mime-mapping>
  <extension>extension</extension>
  <mime-type>mimetype</mime-type>
</mime-mapping>
```

Syntax

```
DBMS_XDB_CONFIG.ADDMIMEMAPPING (
  extension IN VARCHAR2,
  mimetype  IN VARCHAR2);
```

Parameters

Table 215-4 *ADDMIMEMAPPING Procedure Parameters*

Parameter	Description
extension	Extension for which a mime type is being added
mimetype	Mime type

215.4.3 ADDSCHEMALOCMAPPING Procedure

This procedure adds the following schema location mapping to the XDB configuration:

```
<schemaLocation-mapping>
  <namespace>namespace</namespace>
  <element>element</element>
  <schemaURL>schemaURL</schemaURL>
</schemaLocation-mapping>
```

Syntax

```
DBMS_XDB_CONFIG.ADDSCHEMALOCMAPPING (
  namespace IN VARCHAR2,
  element   IN VARCHAR2,
  schemaURL IN VARCHAR2);
```

Parameters

Table 215-5 *ADDSCHEMALOCMAPPING Procedure Parameters*

Parameter	Description
namespace	Namespace
element	Element
schemaURL	Schema URL

215.4.4 ADDSERVLET Procedure

This procedure adds a servlet to XDB configuration.

IT adds the following servlet:

```
<servlet>
  <servlet-name>name</servlet-name>      <servlet-language>language</servlet-
language>
  <display-name>dispname</display-name>
  <description>descript</description>
  <servlet-class>class</servlet-class>
  <servlet-schema>schema</servlet-schema>
</servlet>
```

Syntax

```
DBMS_XDB_CONFIG.ADDSERVLET (
  name          IN  VARCHAR2,
  language      IN  VARCHAR2,
  dispname     IN  VARCHAR2,
  icon         IN  VARCHAR2 := NULL,
  descript     IN  VARCHAR2 := NULL,
  class        IN  VARCHAR2 := NULL,
  jspfile      IN  VARCHAR2 := NULL,
  plsql        IN  VARCHAR2 := NULL,
  schema       IN  VARCHAR2 := NULL);
```

Parameters

Table 215-6 ADDSERVLET Procedure Parameters

Parameter	Description
name	Servlet name
language	Must be one of "C", "Java", "PL/SQL"
dispname	Display name
icon	Icon
descript	Description
class	The class / jspfile / plsql function corresponding to this servlet. The first non-NULL argument amongst these three is chosen, and the others are treated as NULL.
jspfile	This parameter is not supported. Always provide NULL value for this parameter. System throws an error if the value is not NULL.
plsql	The class / jspfile / plsql function corresponding to this servlet. The first non-NULL argument amongst these three is chosen, and the others are treated as NULL.
schema	Schema is used to specify <code>servlet-schema</code> xml element name in <code>xdbconfig.xml</code> . It indicates the Oracle schema in which the Java class is loaded. If you do not specify any value, then the schema is searched using the default resolver specification.

215.4.5 ADDSERVLETMAPPING Procedure

This procedure adds a servlet mapping to XDB configuration.

It adds the following servlet mapping:

```
<servlet-mapping>
  <servlet-pattern>pattern</servlet-pattern>
  <servlet-name>name</servlet-name>
</servlet-mapping>
```

Syntax

```
DBMS_XDB_CONFIG.ADDSERVLETMAPPING(
  pattern IN VARCHAR2, name IN VARCHAR2);
```

Parameters

Table 215-7 *ADDSERVLETMAPPING Procedure Parameters*

Parameter	Description
pattern	Sservlet pattern
name	Servlet name

215.4.6 ADDSERVLETSECROLE Procedure

This procedure adds the security role `REF` to a specified servlet in XDB configuration.

It adds the following security role as shown in the following:

```
<security-role-ref>
  <role-name>rolename</role-name>
  <role-link>rolelink</role-link>
  <description>descript</description>
</security-role-ref>
```

Syntax

```
DBMS_XDB_CONFIG.ADDSERVLETSECROLE(
  servname IN VARCHAR2, rolename IN VARCHAR2, rolelink IN
  VARCHAR2, descript IN VARCHAR2 := NULL);
```

Parameters

Table 215-8 *ADDSERVLETSECROLE Procedure Parameters*

Parameter	Description
servname	Sservlet name
rolename	Role name
rolelink	Role link
descript	Description

215.4.7 ADDXMLEXTENSION Procedure

This procedure adds an XML extension to the XDB configuration under `<xml-extensions>`.

It adds the following XML extension to the XDB configuration, under `<xml-extensions>`:

```
<extension>extension</extension>
```

Syntax

```
DBMS_XDB_CONFIG.ADDXMLEXTENSION(  
    extension IN VARCHAR2);
```

Parameters

Table 215-9 *ADDXMLEXTENSION Procedure Parameters*

Parameter	Description
extension	XML extension to be added

215.4.8 CFG_GET Function

This function retrieves the session's configuration information as an `XMLType` instance.

Syntax

```
DBMS_XDB_CONFIG.CFG_GET  
RETURN SYS.XMLType;
```

215.4.9 CFG_REFRESH Procedure

This procedure refreshes the session's configuration information to the latest configuration.

Syntax

```
DBMS_XDB_CONFIG.CFG_REFRESH;
```

215.4.10 CFG_UPDATE Procedure

This procedure updates the configuration information and commits the change.

Syntax

```
DBMS_XDB_CONFIG.CFG_UPDATE(  
    xdbconfig IN SYS.XMLTYPE);
```

Parameters

Table 215-10 CFG_UPDATE Procedure Parameters

Parameter	Description
xdbconfig	The new configuration data

215.4.11 DELETEHTTPEXPIREMAPPING Procedure

This procedure deletes from XDB\$CONFIG all mappings of the URL pattern to an expiration date.

Syntax

```
DBMS_XDB_REPOS.DELETEHTTPEXPIREMAPPING(
    pattern IN VARCHAR2);
```

Parameters

Table 215-11 DELETEHTTPEXPIREMAPPING Procedure Parameters

Parameter	Description
pattern	URL pattern (only * accepted as wildcards)

215.4.12 DELETEMIMEMAPPING Procedure

This procedure deletes the mime mapping for a specified extension from the XDB configuration.

Syntax

```
DBMS_XDB_CONFIG.DELETEMIMEMAPPING(
    extension IN VARCHAR2);
```

Parameters

Table 215-12 DELETEMIMEMAPPING Procedure Parameters

Parameter	Description
extension	Extension for which a mime type is to be deleted

215.4.13 DELETESCHEMALOCMAPPING Procedure

This procedure deletes the schema location mapping for a specified schema URL from the XDB configuration.

Syntax

```
DBMS_XDB_CONFIG.DELETESCHEMALOCMAPPING(
    schemaURL IN VARCHAR2);
```


Parameters**Table 215-13** *DELETESCHEMALOCMAPPING Procedure Parameters*

Parameter	Description
schemaURL	Schema URL

215.4.14 DELETESERVLET Procedure

This procedure deletes a servlet from the XDB configuration.

Syntax

```
DBMS_XDB_CONFIG.DELETESERVLET(
    name          IN  VARCHAR2);
```

Parameters**Table 215-14** *DELETESERVLET Procedure Parameters*

Parameter	Description
name	Servlet name

215.4.15 DELETESERVLETMAPPING Procedure

This procedure deletes the servlet mapping for a specified servlet name from the XDB configuration.

Syntax

```
DBMS_XDB_CONFIG.DELETESERVLETMAPPING(
    name          IN  VARCHAR2);
```

Parameters**Table 215-15** *DELETESERVLETMAPPING Procedure Parameters*

Parameter	Description
name	Servlet name

215.4.16 DELETESERVLETSECROLE Procedure

This procedure deletes the specified role from a servlet in the XDB configuration.

Syntax

```
DBMS_XDB_CONFIG.DELETESERVLETSECROLE(
    servname      IN  VARCHAR2,    rolename        IN  VARCHAR2);
```

Parameters

Table 215-16 *DELETESERVLETSECCROLE Procedure Parameters*

Parameter	Description
servname	Servlet name
rolename	Name of the role to be deleted

215.4.17 DELETEXMLEXTENSION Procedure

This procedure deletes the specified XML extension from the XDB configuration.

Syntax

```
DBMS_XDB_CONFIG.DELETEXMLEXTENSION(  
    extension IN VARCHAR2);
```

Parameters

Table 215-17 *DELETEXMLEXTENSION Procedure Parameters*

Parameter	Description
extension	XML extension to be deleted

215.4.18 ENABLEDIGESTAUTHENTICATION Procedure

This procedure enables digest authentication. It will list digest as the first authentication mechanism to be used by the XML DB HTTP server.

Syntax

```
DBMS_XDB_CONFIG.ENABLEDIGESTAUTHENTICATION;
```

215.4.19 GETFTPPORT Function

This procedure gets the value of the current FTP port.

Syntax

```
DBMS_XDB_CONFIG.GETFTPPORT  
RETURN NUMBER;
```

215.4.20 GETHTTPCONFIGREALM Function

This function gets the realm name. Definition of a realm is referenced in IETF's RFC2617.

Syntax

```
DBMS_XDB_CONFIG.GETHTTPCONFIGREALM  
RETURN VARCHAR2;
```

215.4.21 GETHTTPPORT Function

This function gets the value of the current HTTP port.

Syntax

```
DBMS_XDB_CONFIG.GETHTTPPORT  
RETURN NUMBER;
```

215.4.22 GETHTTPSPORT Function

This procedure gets the value of the current HTTPS port.

Syntax

```
DBMS_XDB_CONFIG.GETHTTPSPORT  
RETURN NUMBER;
```

Usage Notes

Returns `NULL` if no port has been configured

215.4.23 GETLISTENERENDPOINT Procedure

This procedure retrieves the parameters of a listener end point corresponding to the XML DB HTTP server. The parameters of both HTTP and HTTP2 end points can be retrieved by invoking this procedure.

Syntax

```
DBMS_XDB_CONFIG.GETLISTENERENDPOINT (  
    endpoint IN NUMBER,  
    host     OUT VARCHAR2,    port     OUT NUMBER,  
    protocol OUT NUMBER);
```

Parameters

Table 215-18 GETLISTENERENDPOINT Procedure Parameters

Parameter	Description
endpoint	End point to be retrieved. Its value can be <code>XDB_ENDPOINT_HTTP</code> or <code>XDB_ENDPOINT_HTTP2</code> .
host	Interface on which the listener end point listens
port	Port on which the listener end point listens
protocol	Transport protocol accepted by the listener end point

215.4.24 GETREMOTEHTTPPORT Function

This function gets the value of a remote HTTP port.

Syntax

```
DBMS_XDB_CONFIG.GETREMOTEHTTPPORT
RETURN NUMBER;
```

215.4.25 GETREMOTEHTTPSPORT Function

This function gets the value of a remote HTTPS port.

Syntax

```
DBMS_XDB_CONFIG.GETREMOTEHTTPSPORT
RETURN NUMBER;
```

215.4.26 ISGLOBALPORTENABLED Function

This procedure returns the value of the GlobalPortEnabled setting.

Syntax

```
DBMS_XDB_CONFIG.ISGLOBALPORTENABLED RETURN BOOLEAN;
```

Usage Notes

- This procedure returns `TRUE` if `GlobalPortEnabled` has been set to `TRUE`; otherwise it returns `FALSE`.
- In a multitenant environment, you can execute this function in both the CDB root and PDBs.

215.4.27 SETFTPSPORT Procedure

This procedure sets the FTP port to a new value.

Syntax

```
DBMS_XDB_CONFIG.SETFTPSPORT (
    new_port IN NUMBER);
```

Parameters

Table 215-19 SETFTPSPORT Procedure Parameters

Parameter	Description
<code>new_port</code>	Value to which the FTP port is set

215.4.28 SETHTTPPORT Procedure

This procedure sets the HTTP port to a new value.

Syntax

```
DBMS_XDB_CONFIG.SETHTTPPORT(  
    new_port IN NUMBER);
```

Parameters

Table 215-20 SETHTTPPORT Procedure Parameters

Parameter	Description
new_port	Value to which the HTTP port is set

215.4.29 SETHTTPCONFIGREALM Procedure

This procedure modifies the realm value.

Syntax

```
DBMS_XDB_CONFIG.SETHTTPCONFIGREALM(  
    realm IN VARCHAR2);
```

Parameters

Table 215-21 SETHTTPPORT Procedure Parameters

Parameter	Description
realm	Realm as defined in IETF's RFC2617

215.4.30 SETHTTPSPORT Procedure

This procedure sets the HTTPS port to a new value.

Syntax

```
DBMS_XDB_CONFIG.SETHTTPSPORT(  
    new_port IN NUMBER);
```

Parameters

Table 215-22 SETHTTPSPORT Procedure Parameters

Parameter	Description
new_port	Value to which the HTTPS port is set

215.4.31 SETLISTENERENDPOINT Procedure

This procedure sets the parameters of a listener end point corresponding to the XML DB HTTP server.

Both HTTP and HTTP2 end points can be set by invoking this procedure.

Syntax

```
DBMS_XDB_CONFIG.SETLISTENERENDPOINT (
    endpoint IN NUMBER,
    host      IN VARCHAR2,    port      IN NUMBER,
    protocol  IN NUMBER);
```

Parameters

Table 215-23 SETLISTENERENDPOINT Procedure Parameters

Parameter	Description
endpoint	End point to be set. Its value can be XDB_ENDPOINT_HTTP or XDB_ENDPOINT_HTTP2.
host	Interface on which the listener end point is to listen. Its value can be 'LOCALHOST,' NULL, or a hostname. If its value is 'LOCALHOST' the listener end point is permitted to only listen on the localhost interface. If its value is NULL or hostname, the listener end point is permitted to listen on both localhost and non-localhost interfaces.
port	Port on which the listener end point is to listen
protocol	Transport protocol that the listener end point is to accept. Its value can be XDB_PROTOCOL_TCP or XDB_PROTOCOL_TCPS

215.4.32 SETLISTENERLOCALACCESS Procedure

This procedure restricts all listener end points of the XML DB HTTP server to listen either only on the localhost interface (when `l_access` is set to `TRUE`) or to listen on both localhost and non-localhost interfaces (when `l_access` is set to `FALSE`).

Syntax

```
DBMS_XDB_CONFIG.SETLISTENERLOCALACCESS (
    l_access  BOOLEAN);
```

Parameters

Table 215-24 SETLISTENERLOCALACCESS Procedure Parameters

Parameter	Description
<code>l_access.</code>	<code>TRUE</code> or <code>FALSE</code> .

215.4.33 SETREMOTEHTTPPORT Procedure

This procedure sets a remote HTTP port to a new value.

Syntax

```
DBMS_XDB_CONFIG.SETREMOTEHTTPPORT (
    new_port IN NUMBER);
```

Parameters

Table 215-25 SETREMOTEHTTPPORT Procedure Parameters

Parameter	Description
new_port	Value to which the remote HTTP port is set

215.4.34 SETREMOTEHTTPSPORT Procedure

This procedure sets a remote HTTPS port to a new value.

Syntax

```
DBMS_XDB_CONFIG.SETREMOTEHTTPSPORT (
    new_port IN NUMBER);
```

Parameters

Table 215-26 SETREMOTEHTTPSPORT Procedure Parameters

Parameter	Description
new_port	Value to which the remote HTTPS port is set

215.4.35 USEDPORT Function

This function obtains the port numbers used by other pluggable databases in the same consolidation database.

Syntax

```
DBMS_XDB_CONFIG.USEDPORT RETURN XMLTYPE;
```

DBMS_XDB_CONSTANTS

The `DBMS_XDB_CONSTANTS` package provides an interface to commonly used constants. Users should use constants instead of dynamic strings to avoid typographical errors.

This chapter contains the following topics:

- [Security Model](#)
- [Summary of DBMS_XDB_CONSTANTS Subprograms](#)

216.1 DBMS_XDB_CONSTANTS Security Model

Owned by `XDB`, the `DBMS_XDB_CONSTANTS` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `PUBLIC`. Subprograms in this package are executed using the privileges of the current user.

216.2 Summary of DBMS_XDB_CONSTANTS Subprograms

This table lists the `DBMS_XDB_CONSTANTS` subprograms and briefly describes them.

Table 216-1 DBMS_XDB_CONSTANTS Package Subprograms

Subprograms	Description
ENCODING_DEFAULT Function	Returns 'AL32UTF8'
ENCODING_ISOLATIN1 Function	Returns 'WE8ISO8859P1'
ENCODING_UTF8 Function	Returns 'AL32UTF8'
ENCODING_WIN1252 Function	Returns 'WE8MSWIN1252'
NAMESPACE_ACL Function	Returns 'http://xmlns.oracle.com/xdb/acl.xsd'
NAMESPACE_METADATA Function	Returns 'http://xmlns.oracle.com/xdbuserMetaData'
NAMESPACE_ORACLE Function	Returns 'http://xmlns.oracle.com'
NAMESPACE_ORACLE_XDB Function	Returns 'http://xmlns.oracle.com/xdb'
NAMESPACE_RESOURCE Function	Returns 'http://xmlns.oracle.com/xdb/XDBResource.xsd'
NAMESPACE_RESOURCE_EVENT Function	Returns 'http://xmlns.oracle.com/resourceEvent'
NAMESPACE_RESOURCE_CONFIG Function	Returns 'http://xmlns.oracle.com/XDBResConfig.xsd'
NAMESPACE_XDBSCHEMA Function	Returns 'http://xmlns.oracle.com/xdb/XDBSchema.xsd'
NAMESPACE_XMLDIFF Function	Returns 'http://xmlns.oracle.com/xdb/xdiff.xsd'

Table 216-1 (Cont.) DBMS_XDB_CONSTANTS Package Subprograms

Subprograms	Description
NAMESPACE_XMLINSTANCE Function	Returns 'http://www.w3.org/2001/XMLSchema-instance'
NAMESPACE_XMLSCHEMA Function	Returns 'http://www.w3.org/2001/XMLSchema'
NSPREFIX_ACL_ACL Function	Returns 'xmlns:acl= 'http://xmlns.oracle.com/acs.xsd'
NSPREFIX_RESCONFIG_RC Function	Returns 'xmlns:rc="http://xmlns.oracle.com/xdb/XDBResConfig.xsd"'
NSPREFIX_RESOURCE_R Function	Returns 'xmlns:r="http://xmlns.oracle.com/XDBResource.xsd'
NSPREFIX_XDB_XDB Function	Returns 'http://xmlns.oracle.com/xdb'
NSPREFIX_XMLINSTANCE_XSI Function	Returns 'xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"'
NSPREFIX_XMLDIFF_XD Function	Returns 'xmlns:xd="http://xmlns.oracle.com/xdb/xdiff.xsd"'
NSPREFIX_XMLSCHEMA_XSD Function	Returns 'xmlns:xsd="http://www.w3.org/2001/XMLSchema"'
SCHEMAURL_ACL Function	Returns 'http://xmlns.oracle.com/xdb/acl.xsd'
SCHEMAELEM_RES_ACL Function	Returns 'http://xmlns.oracle.com/xdb/acl.xsd#acl'
SCHEMAELEM_RESCONTENT_BINARY Function	Returns 'http://xmlns.oracle.com/xdb/XDBSchema.xsd#binary'
SCHEMAELEM_RESCONTENT_TEXT Function	Returns 'http://xmlns.oracle.com/xdb/XDBSchema.xsd#text'
SCHEMAURL_RESOURCE Function	Returns 'http://xmlns.oracle.com/xdb/XDBResource.xsd'
SCHEMAURL_XDBSCHEMA Function	Returns 'http://xmlns.oracle.com/xdb/XDBSchema.xsd'
XDBSCHEMA_PREFIXES Function	Returns 'xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xdb="http://xmlns.oracle.com/xdb'
XSD_ATTRIBUTE Function	Returns 'attribute'
XSD_COMPLEX_TYPE Function	Returns 'complexType'
XSD_ELEMENT Function	Returns 'element'
XSD_GROUP Function	Returns 'group'

216.2.1 ENCODING_DEFAULT Function

This function returns 'AL32UTF8'.

Syntax

```
DBMS_XDB_CONSTANTS.ENCODING_DEFAULT
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'AL32UTF8'

216.2.2 ENCODING_ISOLATIN1 Function

This function returns 'WE8ISO8859P1'.

Syntax

```
DBMS_XDB_CONSTANTS.ENCODING_ISOLATIN1  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'WE8ISO8859P1'

216.2.3 ENCODING_UTF8 Function

This function returns 'AL32UTF8'.

Syntax

```
DBMS_XDB_CONSTANTS.ENCODING_UTF8  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'AL32UTF8'

216.2.4 ENCODING_WIN1252 Function

This function returns 'WE8MSWIN1252'.

Syntax

```
DBMS_XDB_CONSTANTS.ENCODING_WIN1252  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'WE8MSWIN1252'

216.2.5 NAMESPACE_ACL Function

This function returns 'http://xmlns.oracle.com/xdb/acl.xsd'.

Syntax

```
DBMS_XDB_CONSTANTS.NAMESPACE_ACL  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb/acl.xsd'

216.2.6 NAMESPACE_METADATA Function

This function returns 'http://xmlns.oracle.com/xduserMetaData'.

Syntax

```
DBMS_XDB_CONSTANTS.NAMESPACE_METADATA  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xduserMetaData'

216.2.7 NAMESPACE_ORACLE Function

This function returns 'http://xmlns.oracle.com'.

Syntax

```
DBMS_XDB_CONSTANTS.NAMESPACE_ORACLE  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com'

216.2.8 NAMESPACE_ORACLE_XDB Function

This function returns 'http://xmlns.oracle.com/xdb'.

Syntax

```
DBMS_XDB_CONSTANTS.NAMESPACE_ORACLE_XDB  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb'

216.2.9 NAMESPACE_RESOURCE Function

This function returns '/XDBResource.xsd'

Syntax

```
DBMS_XDB_CONSTANTS.NAMESPACE_RESOURCE  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb/XDBResource.xsd'

216.2.10 NAMESPACE_RESOURCE_EVENT Function

This function returns 'http://xmlns.oracle.com/resourceEvent'.

Syntax

```
DBMS_XDB_CONSTANTS.NAMESPACE_RESOURCE_EVENT  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/resourceEvent'

216.2.11 NAMESPACE_RESOURCE_CONFIG Function

This function returns 'http://xmlns.oracle.com/XDBResConfig.xsd'.

Syntax

```
DBMS_XDB_CONSTANTS.NAMESPACE_RESOURCE_CONFIG  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/XDBResConfig.xsd'

216.2.12 NAMESPACE_XDBSCHEMA Function

This function returns 'http://xmlns.oracle.com/xdb/XDBSchema.xsd'.

Syntax

```
DBMS_XDB_CONSTANTS.NAMESPACE_XDBSCHEMA  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb/XDBSchema.xsd'

216.2.13 NAMESPACE_XMLDIFF Function

This function returns 'http://xmlns.oracle.com/xdb/xdiff.xsd'.

Syntax

```
DBMS_XDB_CONSTANTS.NAMESPACE_XMLDIFF  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb/xdiff.xsd'

216.2.14 NAMESPACE_XMLINSTANCE Function

This function returns 'http://www.w3.org/2001/XMLSchema-instance'.

Syntax

```
DBMS_XDB_CONSTANTS.NAMESPACE_XMLINSTANCE  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://www.w3.org/2001/XMLSchema-instance'

216.2.15 NAMESPACE_XMLSCHEMA Function

This function returns 'http://www.w3.org/2001/XMLSchema'.

Syntax

```
DBMS_XDB_CONSTANTS.NAMESPACE_XMLSCHEMA  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://www.w3.org/2001/XMLSchema'

216.2.16 NSPREFIX_ACL_ACL Function

This function returns 'xmlns:acl= 'http://xmlns.oracle.com/acs.xsd'.

Syntax

```
DBMS_XDB_CONSTANTS.NSPREFIX_ACL_ACL  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'xmlns:acl= 'http://xmlns.oracle.com/acs.xsd'

216.2.17 NSPREFIX_RESCONFIG_RC Function

This function returns ''xmlns:rc="http://xmlns.oracle.com/xdb/XDBResConfig.xsd"'.
'

Syntax

```
DBMS_XDB_CONSTANTS.NSPREFIX_RESCONFIG_RC  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

Returns ''xmlns:rc="http://xmlns.oracle.com/xdb/XDBResConfig.xsd"'

216.2.18 NSPREFIX_RESOURCE_R Function

This function returns 'xmlns:r="http://xmlns.oracle.com/XDBResource.xsd"'.

Syntax

```
DBMS_XDB_CONSTANTS.NSPREFIX_RESOURCE_R  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'xmlns:r="http://xmlns.oracle.com/XDBResource.xsd"'

216.2.19 NSPREFIX_XDB_XDB Function

This function returns 'http://xmlns.oracle.com/xdb'.

Syntax

```
DBMS_XDB_CONSTANTS.NSPREFIX_XDB_XDB  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb'

216.2.20 NSPREFIX_XMLINSTANCE_XSI Function

This function returns 'xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"'.

Syntax

```
DBMS_XDB_CONSTANTS.NSPREFIX_XMLINSTANCE_XSI  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"'

216.2.21 NSPREFIX_XMLDIFF_XD Function

This function returns 'xmlns:xd="http://xmlns.oracle.com/xdb/xdiff.xsd"'.

Syntax

```
DBMS_XDB_CONSTANTS.NSPREFIX_XMLDIFF_XD  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'xmlns:xd="http://xmlns.oracle.com/xdb/xdiff.xsd"'

216.2.22 NSPREFIX_XMLSCHEMA_XSD Function

This function returns 'xmlns:xsd="http://www.w3.org/2001/XMLSchema" '.

Syntax

```
DBMS_XDB_CONSTANTS.NSPREFIX_XMLSCHEMA_XSD  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'xmlns:xsd="http://www.w3.org/2001/XMLSchema" '

216.2.23 SCHEMAURL_ACL Function

This function returns 'http://xmlns.oracle.com/xdb/acl.xsd'.

Syntax

```
DBMS_XDB_CONSTANTS.SCHEMAURL_ACL  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb/acl.xsd'

216.2.24 SCHEMAELEM_RES_ACL Function

This function returns 'http://xmlns.oracle.com/xdb/acl.xsd#acl'.

Syntax

```
DBMS_XDB_CONSTANTS.SCHEMAELEM_RES_ACL  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb/acl.xsd#acl'

216.2.25 SCHEMAELEM_RESCONTENT_BINARY Function

This function returns 'http://xmlns.oracle.com/xdb/XDBSchema.xsd#binary'.

Syntax

```
DBMS_XDB_CONSTANTS.SCHEMAELEM_RESCONTENT_BINARY  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb/XDBSchema.xsd#binary'

216.2.26 SCHEMAELEM_RESCONTENT_TEXT Function

This function returns 'http://xmlns.oracle.com/xdb/XDBSchema.xsd#text'.

Syntax

```
DBMS_XDB_CONSTANTS.SCHEMAELEM_RESCONTENT_TEXT  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb/XDBSchema.xsd#text'

216.2.27 SCHEMAURL_RESOURCE Function

This function returns 'http://xmlns.oracle.com/xdb/XDBResource.xsd'.

Syntax

```
DBMS_XDB_CONSTANTS.SCHEMAURL_RESOURCE  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb/XDBResource.xsd'

216.2.28 SCHEMAURL_XDBSCHEMA Function

This function returns 'http://xmlns.oracle.com/xdb/XDBSchema.xsd'.

Syntax

```
DBMS_XDB_CONSTANTS.SCHEMAURL_XDBSCHEMA  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'http://xmlns.oracle.com/xdb/XDBSchema.xsd'

216.2.29 XDBSCHEMA_PREFIXES Function

This function returns 'xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xdb="http://xmlns.oracle.com/xdb".'

Syntax

```
DBMS_XDB_CONSTANTS.XDBSCHEMA_PREFIXES  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xdb="http://
xmlns.oracle.com/xdb"'

216.2.30 XSD_ATTRIBUTE Function

This function returns 'attribute'.

Syntax

```
DBMS_XDB_CONSTANTS.XSD_ATTRIBUTE  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'attribute'

216.2.31 XSD_COMPLEX_TYPE Function

This function returns 'complexType'.

Syntax

```
DBMS_XDB_CONSTANTS.XSD_COMPLEX_TYPE  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'complexType'

216.2.32 XSD_ELEMENT Function

This function returns 'element'.

Syntax

```
DBMS_XDB_CONSTANTS.XSD_ELEMENT  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'element'

216.2.33 XSD_GROUP Function

This function returns 'group'.

Syntax

```
DBMS_XDB_CONSTANTS.XSD_GROUP  
RETURN VARCHAR2 DETERMINISTIC;
```

Return Value

'group'

DBMS_XDB_REPOS

The `DBMS_XDB_REPOS` package provides an interface to operate on the Oracle XML database Repository.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Summary of DBMS_XDB_REPOS Subprograms](#)

See Also:

Oracle XML DB Developer's Guide for more information regarding:

- Using and managing repository resources
- ACL-based security management (controlling access to repository resources)
- Managing XLink and XInclude links
- Loading documents into the repository
- Creating, deleting, and managing resource metadata

217.1 DBMS_XDB_REPOS Overview

The `DBMS_XDB_REPOS` package lets you operate on the Oracle XML DB Repository to create, modify and delete resources, including managing security based on access control lists (ACLs). The interface provides both query and DML functions.

Using a combination of PL/SQL packages - `DBMS_XDB_REPOS`, [DBMS_XDBZ](#), and [DBMS_XDB_VERSION](#) - you can create, delete, and rename documents and folders, move a file or folder within the folder hierarchy, set and change the access permissions on a file or folder, and initiate and manage versioning.

217.2 DBMS_XDB_REPOS Security Model

Owned by XDB, the `DBMS_XDB_REPOS` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `PUBLIC`. Subprograms in this package are executed using the privileges of the current user. Subprograms that operate on the XDB Configuration will succeed only if the current user is `SYS` or `XDB`, or the current user has the `XDBADMIN` or `DBA` role.

217.3 DBMS_XDB_REPOS Constants

The `DBMS_XDB_REPOS` package defines several constants that can be used for specifying parameter values.

These constants are shown in the following table.

Table 217-1 DBMS_XDB_REPOS Constants

Constant	Type	Value	Description
<code>DELETE_RESOURCE</code>	NUMBER	1	Deletes a resource; fails if the resource has children.
<code>DELETE_RECURSIVE</code>	NUMBER	2	Deletes a resource and its children, if any.
<code>DELETE_FORCE</code>	NUMBER	3	Deletes the resource, even if the object it contains is invalid
<code>DELETE_RECURSIVE_FORCE</code>	NUMBER	4	Deletes a resource and its children, if any, even if the object it contains is invalid
<code>DELETE_RES_METADATA_CASCADE</code>	NUMBER	1	Deletes the row in the metadata
<code>DELETE_RES_METADATA_NOCASCADE</code>	NUMBER	2	Does not delete the row
<code>DEFAULT_LOCK_TIMEOUT</code>	PLS_INTEGER	(60*60)	Timeout value (in seconds) of the webdav lock
<code>LINK_TYPE_HARD</code>	NUMBER	1	Hard link of a folder to a resource
<code>LINK_TYPE_WEAK</code>	NUMBER	2	Weak link of a folder to a resource
<code>LINK_TYPE_SYMBOLIC</code>	NUMBER	3	Symbolic link of a folder to a resource

217.4 Summary of DBMS_XDB_REPOS Subprograms

This table lists the `DBMS_XDB_REPOS` subprograms and briefly describes them.

Table 217-2 DBMS_XDB_REPOS Package Subprograms

Subprogram	Description
ACLCHECKPRIVILEGES Function	Checks access privileges granted to the current user by specified ACL document on a resource whose owner is specified by the 'owner' parameter.
APPENDRESOURCEMETADATA Procedure	Takes in user-defined metadata either as a <code>REF</code> to <code>XMLTYPE</code> or an <code>XMLTYPE</code> and adds it to the desired resource
CHANGEOWNER Procedure	Changes the owner of the resource/s to the specified owner.
CHANGEPRIVILEGES Function	Adds a specified ACE to a specified resource's ACL
CHECKPRIVILEGES Function	Checks access privileges granted to the current user on the specified resource
CREATEFOLDER Function	Creates a new folder resource in the hierarchy

Table 217-2 (Cont.) DBMS_XDB_REPOS Package Subprograms

Subprogram	Description
CREATEOIDPATH Function	Creates a virtual path to the resource based on object ID
CREATERESOURCE Functions	Creates a new resource
DELETERESOURCE Procedure	Deletes a resource from the hierarchy
DELETERESOURCEMETADATA Procedures	Deletes metadata from a resource (can be used for schema-based or nonschema-based metadata)
EXISTSRESOURCE Function	Determines if a resource is in the hierarchy, based on its absolute path
GETACLDOCUMENT Function	Retrieves ACL document that protects resource given its path name
GETCONTENTBLOB Function	Retrieves the contents of a resource returned as a BLOB
GETCONTENTCLOB Function	Retrieves the contents of a resource returned as a CLOB
GETCONTENTVARCHAR2 Function	Retrieves the contents of a resource returned as a string
GETCONTENTXMLREF Function	Retrieves the contents of a resource returned as a REF to an XMLTYPE
GETCONTENTXMLTYPE Function	Retrieves the contents of a resource returned as an XMLTYPE
GETLOCKTOKEN Procedure	Returns that resource's lock token for the current user given a path to a resource
GETPRIVILEGES Function	Gets all privileges granted to the current user on a specified resource
GETRESOID Function	Returns the object ID of the resource from its absolute path
GETXDB_TABLESPACE Function	Returns the current tablespace of the XDB (user)
HASBLOBCONTENT Function	Returns TRUE if the resource has BLOB content
HASCHARCONTENT Function	Returns TRUE if the resource has character content
HASXMLCONTENT Function	Returns TRUE if the resource has XML content
HASXMLREFERENCE Function	Returns TRUE if the resource has REF to XML content
ISFOLDER Function	Returns TRUE if the resource is a folder or container
LINK Procedures	Creates a link to an existing resource
LOCKRESOURCE Function	Gets a WebDAV-style lock on that resource given a path to that resource
PROCESSLINKS Procedure	Processes document links in the specified resource
PURGERESOURCEMETADATA Procedure	Deletes all user metadata from a resource
RENAMERESOURCE Procedure	Renames the XDB resource
SETACL Procedure	Sets the ACL on a specified resource
SPLITPATH Procedure	Splits the path into a parentpath and childpath

Table 217-2 (Cont.) DBMS_XDB_REPOS Package Subprograms

Subprogram	Description
TOUCHRESOURCE Procedure	Changes the modification time of the resource to the current time
UNLOCKRESOURCE Function	Unlocks the resource given a lock token and resource path
UPDATERESOURCEMETADATA Procedures	Updates metadata for a resource

217.4.1 ACLCHECKPRIVILEGES Function

This function checks access privileges granted to the current user by specified ACL document by the `OWNER` of the resource. Returns positive integer if all privileges are granted.

Syntax

```
DBMS_XDB_REPOS.ACLCHECKPRIVILEGES (
    acl_path IN VARCHAR2,
    owner    IN VARCHAR2,
    privs    IN xmltype)
RETURN PLS_INTEGER;
```

Parameters

Table 217-3 ACLCHECKPRIVILEGES Function Parameters

Parameter	Description
<code>acl_path</code>	Absolute path in the Hierarchy for ACL document
<code>owner</code>	Resource owner name; the pseudo user "DAV:owner" is replaced by this user during ACL privilege resolution
<code>privs</code>	An <code>XMLType</code> instance of the privilege element specifying the requested set of access privileges. See description for CHECKPRIVILEGES Function .

217.4.2 APPENDRESOURCEMETADATA Procedure

This procedure takes in user-defined metadata either as a `REF` to `XMLTYPE` or an `XMLTYPE` and adds it to the desired resource.

Syntax

```
DBMS_XDB_REPOS.APPENDRESOURCEMETADATA (
    abspath IN VARCHAR2,
    metadata IN XMLTYPE);

DBMS_XDB_REPOS.APPENDRESOURCEMETADATA (
    abspath IN VARCHAR2,
    metadata IN REF SYS.XMLTYPE);
```

Parameters

Table 217-4 APPENDRESOURCEMETADATA Procedure

Parameter	Description
abspath	Absolute path of the resource
metadata	Metadata can be schema based or nonschema-based. Schema-based metadata is stored in its own table.

Usage Notes

- In the case in which a REF is passed in, the procedure stores the REF in the resource, and the metadata is stored in a separate table. In this case you are responsible for populating the RESID column for the metadata table. Note that the REF passed in must be unique. In other words, there must not be a REF with the same value in the resource metadata, as this would violate uniqueness of properties. An error is thrown if users attempt to add a REF that already exists.
- In the case where the XMLTYPE is passed in, the data is parsed to determine if it is schema-based or not and stored accordingly.

217.4.3 CHANGEOWNER Procedure

This procedure changes the owner of the resource/s to the specified owner.

Syntax

```
DBMS_XDB_REPOS.CHANGEOWNER (
  abspath  IN  VARCHAR2,
  owner    IN  VARCHAR2,
  recurse  IN  BOOLEAN := FALSE);
```

Parameters

Table 217-5 CHANGEOWNER Procedure Parameters

Parameter	Description
abspath	Absolute path of the resource
owner	New owner for the resource
recurse	If TRUE, recursively change owner of all resources in the folder tree

217.4.4 CHANGEPRIVILEGES Function

This function adds a specified ACE to a specified resource's ACL.

Syntax

```
DBMS_XDB_REPOS.CHANGEPRIVILEGES (
  res_path  IN  VARCHAR2,
  ace       IN  xmltype)
RETURN PLS_INTEGER;
```

Parameters

Table 217-6 CHANGEPRIVILEGES Function Parameters

Parameter	Description
res_path	Path name of the resource for which privileges need to be changed
ace	An XMLType instance of the <ace> element which specifies the <principal>, the operation <grant> and the list of privileges

Return Values

A positive integer if the ACL was successfully modified.

Usage Notes

If no ACE with the same principal and the same operation (*grant/deny*) already exists in the ACL, the new ACE is added at the end of the ACL.

217.4.5 CHECKPRIVILEGES Function

This function checks access privileges granted to the current user on the specified resource.

Syntax

```
DBMS_XDB_REPOS.CHECKPRIVILEGES (
    res_path IN VARCHAR2,
    privs    IN xmltype)
RETURN PLS_INTEGER;
```

Parameters

Table 217-7 CHECKPRIVILEGES Function Parameters

Parameter	Description
res_path	Absolute path in the Hierarchy for resource
privs	An XMLType instance of the privilege element specifying the requested set of access privileges

Return Values

A positive integer if all requested privileges granted.

217.4.6 CREATEFOLDER Function

This function creates a new folder resource in the hierarchy.

Syntax

```
DBMS_XDB_REPOS.CREATEFOLDER (
    path IN VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 217-8 CREATEFOLDER Function Parameters

Parameter	Description
path	Path name for the new folder

Return Values

TRUE if operation successful; FALSE, otherwise.

Usage Notes

The given path name's parent folder must already exist in the hierarchy: if '/folder1/folder2' is passed as the path parameter, then '/folder1' must already exist.

217.4.7 CREATEOIDPATH Function

This function creates a virtual path to the resource based on object ID.

Syntax

```
DBMS_XDB_REPOS.CREATEOIDPATH(
    oid IN RAW)
RETURN VARCHAR2;
```

Parameters

Table 217-9 CREATEOIDPATH Function Parameters

Parameter	Description
oid	Object ID of the resource

217.4.8 CREATERESOURCE Functions

The functions create a new resource. The description of the overload options precede each version of the syntax

Syntax

Creates a new resource with a specified string as its contents:

```
DBMS_XDB_REPOS.CREATERESOURCE(
    abspath IN VARCHAR2,
    data IN VARCHAR2)
RETURN BOOLEAN;
```

Creates a new resource with a specified XMLType data as its contents:

```
DBMS_XDB_REPOS.CREATERESOURCE(
    abspath IN VARCHAR2,
    data IN SYS.XMLTYPE)
RETURN BOOLEAN;
```


Given a REF to an existing XMLType row, creates a resource whose contents point to that row. That row should not already exist inside another resource:

```
DBMS_XDB_REPOS.CREATERESOURCE (
    abspath      IN  VARCHAR2,
    datarow     IN  REF SYS.XMLTYPE)
RETURN BOOLEAN;
```

Creates a resource with a specified BLOB as its contents, and specifies character set of the source BLOB:

```
DBMS_XDB_REPOS.CREATERESOURCE (
    abspath      IN  VARCHAR2,
    data         IN  BLOB,
    csid         IN  NUMBER :=0)
RETURN BOOLEAN;
```

Creates a resource with a specified BFILE as its contents, and specifies character set of the source BFILE:

```
DBMS_XDB_REPOS.CREATERESOURCE (
    abspath      IN  VARCHAR2,
    data         IN  BFILE,
    csid         IN  NUMBER :=0)
RETURN BOOLEAN;
```

Creates a resource with a specified CLOB as its contents:

```
DBMS_XDB_REPOS.CREATERESOURCE (
    abspath      IN  VARCHAR2,
    data         IN  CLOB)
RETURN BOOLEAN;
```

Given a string, inserts a new resource into the hierarchy with the string as the contents:

```
DBMS_XDB_REPOS.CREATERESOURCE (
    abspath      IN  VARCHAR2,
    data         IN  VARCHAR2,
    schemaurl    IN  VARCHAR2 := NULL,
    elem         IN  VARCHAR2 := NULL)
RETURN BOOLEAN;
```

Given an XMLTYPE and a schema URL, inserts a new resource into the hierarchy with the XMLTYPE as the contents:

```
DBMS_XDB_REPOS.CREATERESOURCE (
    abspath      IN  VARCHAR2,
    data         IN  SYS.XMLTYPE,
    schemaurl    IN  VARCHAR2 := NULL,
    elem         IN  VARCHAR2 := NULL)
RETURN BOOLEAN;
```

Parameters

Table 217-10 CREATERESOURCE Function Parameters

Parameter	Description
abspath	Absolute path of the resource to create. The path name's parent folder must already exist in the hierarchy. In other words, if <code>/foo/bar.txt</code> is passed in, then folder <code>/foo</code> must already exist.
data	String buffer containing new resource's contents. The data is parsed to check if it contains a schema-based XML document, and the contents are stored as schema-based in the schema's default table. Otherwise, it is saved as binary data.
datarow	REF to an <code>XMLType</code> row to be used as the contents
csid	Character set id of the document. Must be a valid Oracle ID; otherwise returns an error. If CSID is not specified, or if a zero CSID is specified, then the character set id of the document is determined as follows: <ul style="list-style-type: none"> From the abspath extension, determine the resource's MIME type. If the MIME type is <code>*/*xml</code>, then the encoding is detected based on Appendix F of the W3C XML 1.0 Reference at http://www.w3.org/TR/2000/REC-xml-20001006; Otherwise, it is defaulted to the database character set.
schemaur1	For XML data, schema URL data conforms to (default NULL)
elem	Element name (default NULL)

Return Values

TRUE if operation successful; FALSE, otherwise.

217.4.9 DELETERESOURCE Procedure

This procedure deletes a resource from the hierarchy.

Syntax

```
DBMS_XDB_REPOS.DELETERESOURCE (
    path          IN      VARCHAR2,
    delete_option IN      PLS_INTEGER);
```

Parameters

Table 217-11 DELETERESOURCE Procedure Parameters

Parameter	Description
path	Path name of the resource to delete
delete_option	The option that controls how a resource is deleted: <ul style="list-style-type: none"> DELETE_RESOURCE DELETE_RECURSIVE DELETE_FORCE DELETE_RECURSIVE_FORCE

217.4.10 DELETERESOURCEMETADATA Procedures

This procedure takes in a resource by absolute path and removes either the schema-based metadata identified by the REF, or the metadata identified by the namespace and name combination, which can be either schema-based or non-schema based. It also takes an additional (optional) parameter that specifies how to delete it. This parameter is only relevant for schema-based resource metadata that needs to be deleted. For non-schema based metadata, this parameter is ignored.

Syntax

Can be used only for schema-based metadata:

```
DBMS_XDB_REPOS.DELETERESOURCEMETADATA (
    abspath          IN VARCHAR2,
    metadata         IN REF SYS.XMLTYPE,
    delete_option   IN pls_integer :=
DBMS_XDB_REPOS.DELETE_RESOURCE_METADATA_CASCADE);
```

Can be used for schema-based or nonschema-based metadata:

```
DBMS_XDB_REPOS.DELETERESOURCEMETADATA (
    abspath          IN VARCHAR2,
    metadatans       IN VARCHAR2,
    metadataname     IN VARCHAR2,
    delete_option   IN pls_integer :=
DBMS_XDB_REPOS.DELETE_RESOURCE_METADATA_CASCADE);
```

Parameters

Table 217-12 DELETERESOURCEMETADATA Procedure Parameters

Parameter	Description
abspath	Absolute path of the resource
metadata	REF to the piece of metadata (schema based) to be deleted
mettadatans	Namespace of the metadata fragment to be removed
mettadataname	Local name of the metadata fragment to be removed
delete_option	Only applicable for schema-based metadata, this can be one of the following: <ul style="list-style-type: none"> DELETE_RES_METADATA_CASCADE - deletes the corresponding row in the metadata table DELETE_RES_METADATA_NOCASCADE - does not delete the row in the metadata table

217.4.11 EXISTSRESOURCE Function

This function indicates if a resource is in the hierarchy. It matches the resource by a string that represents its absolute path.

Syntax

```
DBMS_XDB_REPOS.EXISTSRESOURCE(  
    abspath IN VARCHAR2)  
RETURN BOOLEAN;
```

Parameters

Table 217-13 EXISTSRESOURCE Function Parameters

Parameter	Description
abspath	Path name of the resource whose ACL document is required

Return Values

TRUE if the resource is found.

217.4.12 GETACLDOCUMENT Function

This function retrieves ACL document that protects resource given its path name.

Syntax

```
DBMS_XDB_REPOS.GETACLDOCUMENT(  
    abspath IN VARCHAR2)  
RETURN sys.xmltype;
```

Parameters

Table 217-14 GETACLDOCUMENT Function Parameters

Parameter	Description
abspath	Path name of the resource whose ACL document is required

Return Values

The XMLType for ACL document.

217.4.13 GETCONTENTBLOB Function

This function retrieves the contents of a resource returned as a BLOB.

Syntax

```
DBMS_XDB_REPOS.GETCONTENTBLOB(  
    abspath IN VARCHAR2,  
    csid OUT PLS_INTEGER,
```

```
locksrc IN BOOLEAN := FALSE)
RETURN BLOB;
```

Parameters

Table 217-15 GETCONTENTBLOB Function Parameters

Parameter	Description
abspath	Absolute path of the resource
csid	If TRUE, lock and return the source LOB. If FALSE, return a temp LOB copy.
locksrc	Contents of the resource as a BLOB

Return Values

The contents of the resource as a BLOB.

217.4.14 GETCONTENTCLOB Function

This function gets the contents of a resource returned as a CLOB.

Syntax

```
DBMS_XDB_REPOS.GETCONTENTCLOB(
    abspath IN VARCHAR2,
    RETURN CLOB;
```

Parameters

Table 217-16 GETCONTENTCLOB Function Parameters

Parameter	Description
abspath	Absolute path of the resource

Return Values

The contents of the resource as a CLOB.

217.4.15 GETCONTENTVARCHAR2 Function

This function gets the contents of a resource returned as a string.

Syntax

```
DBMS_XDB_REPOS.GETCONTENTVARCHAR2(
    abspath IN VARCHAR2,
    RETURN BLOB;
```

Parameters**Table 217-17** GETCONTENTVARCHAR2 Function Parameters

Parameter	Description
abspath	Absolute path of the resource

Return Values

The contents of the resource as a string.

217.4.16 GETCONTENTXMLREF Function

This function retrieves the contents of a resource returned as a REF to an XMLTYPE.

Syntax

```
DBMS_XDB_REPOS.GETCONTENTXMLREF (
    abspath IN VARCHAR2,
    RETURN SYS.XMLTYPE;
```

Parameters**Table 217-18** GETCONTENTXMLREF Function Parameters

Parameter	Description
abspath	Absolute path of the resource

Return Values

The contents of the resource as a REF to an XMLTYPE.

217.4.17 GETCONTENTXMLTYPE Function

This function retrieves the contents of a resource returned as an XMLTYPE.

Syntax

```
DBMS_XDB_REPOS.GETCONTENTXMLTYPE (
    abspath IN VARCHAR2,
    RETURN SYS.XMLTYPE;
```

Parameters**Table 217-19** GETCONTENTXMLTYPE Function Parameters

Parameter	Description
abspath	Absolute path of the resource

Return Values

The contents of the resource as an XMLTYPE.

217.4.18 GETLOCKTOKEN Procedure

Given a path to a resource, this procedure returns that resource's lock token for the current user.

Syntax

```
DBMS_XDB_REPOS.GETLOCKTOKEN (
    path          IN      VARCHAR2,
    locktoken     OUT     VARCHAR2);
```

Parameters

Table 217-20 GETLOCKTOKEN Procedure Parameters

Parameter	Description
path	Path name to the resource
locktoken	Logged-in user's lock token for the resource

Usage Notes

The user must have READPROPERTIES privilege on the resource.

217.4.19 GETPRIVILEGES Function

This function gets all privileges granted to the current user on a specified resource.

Syntax

```
DBMS_XDB_REPOS.GETPRIVILEGES (
    res_path      IN      VARCHAR2)
RETURN sys.xmltype;
```

Parameters

Table 217-21 GETPRIVILEGES Function Parameters

Parameter	Description
res_path	Absolute path in the hierarchy of the resource

Return Values

An XMLType instance of <privilege> element, which contains the list of all leaf privileges granted on this resource to the current user.

217.4.20 GETRESOID Function

The `GETRESOID` function returns the object ID of the resource from its absolute path.

Syntax

```
DBMS_XDB_REPOS.GETRESOID(  
    abspath IN VARCHAR2)  
RETURN RAW;
```

Parameters

Table 217-22 GETRESOID Function Parameters

Parameter	Description
<code>abspath_path</code>	Absolute path of the resource

Return Values

`NULL` if the resource is not present.

217.4.21 GETXDB_TABLESPACE Function

This function returns the current tablespace of the XDB (user).

Syntax

```
DBMS_XDB_REPOS.GETXDB_TABLESPACE  
RETURN VARCHAR2;
```

217.4.22 HASBLOBCONTENT Function

This function returns `TRUE` if the resource has BLOB content.

Syntax

```
DBMS_XDB_REPOS.HASBLOBCONTENT  
    abspath IN VARCHAR2)  
RETURN BOOLEAN;
```

Parameters

Table 217-23 HASBLOBCONTENT Function Parameters

Parameter	Description
<code>abspath_path</code>	Absolute path of the resource

Return Values

`TRUE` if the resource has BOB content.

217.4.23 HASCHARCONTENT Function

This function returns `TRUE` if the resource has character content.

Syntax

```
DBMS_XDB_REPOS.HASCHARCONTENT  
  abspath IN VARCHAR2)  
RETURN BOOLEAN;
```

Parameters

Table 217-24 HASCHARCONTENT Function Parameters

Parameter	Description
abspath_path	Absolute path of the resource

Return Values

`TRUE` if the resource has character content.

217.4.24 HASXMLCONTENT Function

This function returns `TRUE` if the resource has XML content.

Syntax

```
DBMS_XDB_REPOS.HASXMLCONTENT  
  abspath IN VARCHAR2)  
RETURN BOOLEAN;
```

Parameters

Table 217-25 HASXMLCONTENT Function Parameters

Parameter	Description
abspath_path	Absolute path of the resource

Return Values

`TRUE` if the resource has XML content.

217.4.25 HASXMLREFERENCE Function

This function returns `TRUE` if the resource has a `REF` to XML content.

Syntax

```
DBMS_XDB_REPOS.HASXMLREFERENCE  
  abspath IN VARCHAR2)  
RETURN BOOLEAN;
```

Parameters

Table 217-26 HASXMLREFERENCE Function Parameters

Parameter	Description
abspath_path	Absolute path of the resource

Return Values

TRUE resource has a REF to XML content.

217.4.26 ISFOLDER Function

This function returns TRUE if the resource is a folder or container.

Syntax

```
DBMS_XDB_REPOS.ISFOLDER
    abspath IN VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 217-27 ISFOLDER Function Parameters

Parameter	Description
abspath_path	Absolute path of the resource

Return Values

TRUE if the resource is a folder or container.

217.4.27 LINK Procedures

This procedure creates from a specified folder to a specified resource.

Syntax

```
DBMS_XDB_REPOS.LINK(
    srcpath IN VARCHAR2,
    linkfolder IN VARCHAR2,
    linkname IN VARCHAR2);

DBMS_XDB_REPOS.LINK(
    srcpath IN VARCHAR2,
    linkfolder IN VARCHAR2,
    linkname IN VARCHAR2,
    linktype IN PLS_INTEGER := DBMS_XDB_REPOS.LINK_TYPE_HARD);
```

Parameters

Table 217-28 LINK Procedure Parameters

Parameter	Description
srcpath	Path name of the resource to which a link is created
linkfolder	Folder in which the new link is placed
linkname	Name of the new link
linktype	Type of link to be created: <ul style="list-style-type: none"> • DBMS_XDB.LINK_TYPE_HARD (default) • DBMS_XDB.LINK_TYPE_WEAK • DBMS_XDB.LINK_TYPE_SYMBOLIC

217.4.28 LOCKRESOURCE Function

Given a path to a resource, this function gets a WebDAV-style lock on that resource.

Syntax

```
DBMS_XDB_REPOS.LOCKRESOURCE (
    path      IN  VARCHAR2,
    depthzero IN  BOOLEAN,
    shared    IN  boolean)
RETURN BOOLEAN;
```

Parameters

Table 217-29 LOCKRESOURCE Function Parameters

Parameter	Description
path	Path name of the resource to lock.
depthzero	Currently not supported
shared	Passing TRUE obtains a shared write lock

Return Values

TRUE if successful.

Usage Notes

The user must have UPDATE privileges on the resource.

217.4.29 PROCESSLINKS Procedure

This procedure processes document links in the specified resource.

Syntax

```
DBMS_XDB_REPOS.PURGERESOURCEMETADATA (
  abspath IN VARCHAR2,
  recurse IN BOOLEAN := FALSE);
```

Parameters

Table 217-30 PROCESSLINKS Procedure Parameters

Parameter	Description
abspath	Absolute path of the resource. If the path is a folder, use the <code>recurse</code> flag.
recurse	Used only if <code>abspath</code> specifies a folder. If <code>TRUE</code> , process links of all resources in the folder hierarchy rooted at the specified resource. If <code>FALSE</code> , process links of all documents in this folder only.

217.4.30 PURGERESOURCEMETADATA Procedure

This procedure deletes all user metadata from a resource. Schema-based metadata is removed in cascade mode, rows being deleted from the corresponding metadata tables.

Syntax

```
DBMS_XDB_REPOS.PURGERESOURCEMETADATA (
  abspath IN VARCHAR2);
```

Parameters

Table 217-31 PURGERESOURCEMETADATA Procedure Parameters

Parameter	Description
abspath	Absolute path of the resource

217.4.31 RENAMERESOURCE Procedure

This procedure renames the XDB resource.

Syntax

```
DBMS_XDB_REPOS.RENAMERESOURCE (
  srcpath IN VARCHAR2,
  destfolder IN CARCHAR2,
  newname IN VARCHAR2);
```

Parameters

Table 217-32 RENAMERESOURCE Procedure Parameters

Parameter	Description
srcpath	Absolute path in the Hierarchy for the source resource destination folder
destfolder	Absolute path in the Hierarchy for the destination folder
newname	Name of the child in the destination folder

217.4.32 SETACL Procedure

This procedure sets the ACL on a specified resource to be the ACL specified by path.

Syntax

```
DBMS_XDB_REPOS.SETACL(
    res_path IN VARCHAR2,
    acl_path IN VARCHAR2);
```

Parameters

Table 217-33 SETACL Procedure Parameters

Parameter	Description
res_path	Absolute path in the Hierarchy for resource
acl_path	Absolute path in the Hierarchy for ACL

Usage Notes

The user must have <write-acl> privileges on the resource.

217.4.33 SPLITPATH Procedure

This procedure splits the path into a parentpath and childpath.

Syntax

```
DBMS_XDB_REPOS.SPLITPATH(
    abspath IN VARCHAR2,
    parentpath OUT VARCHAR2,
    childpath OUT VARCHAR2);
```

Parameters

Table 217-34 SPLITPATH Procedure Parameters

Parameter	Description
abspath	Absolute path to be split
parentpath	Parentpath

Table 217-34 (Cont.) SPLITPATH Procedure Parameters

Parameter	Description
childpath	Childpath

217.4.34 TOUCHRESOURCE Procedure

This procedure changes the modification time of the resource to the current time.

Syntax

```
DBMS_XDB_REPOS.TOUCHRESOURCE
    (abspath IN VARCHAR2);
```

Parameters

Table 217-35 TOUCHRESOURCE Procedure Parameters

Parameter	Description
abspath_path	Absolute path of the resource

217.4.35 UNLOCKRESOURCE Function

This function unlocks the resource given a lock token and a path to the resource.

Syntax

```
DBMS_XDB_REPOS.UNLOCKRESOURCE (
    path IN VARCHAR2,
    deltoken IN VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 217-36 UNLOCKRESOURCE Function Parameters

Parameter	Description
path	Path name to the resource
deltoken	Lock token to be removed

Return Values

TRUE if operation successful.

Usage Notes

The user must have UPDATE privileges on the resource.

217.4.36 UPDATERESOURCEMETADATA Procedures

This procedure updates metadata for a resource.

The procedure takes in a resource identified by absolute path and the metadata in it to replace identified by its REF. It replaces that piece of metadata with user-defined metadata which is either in the form of a REF to XMLTYPE or an XMLTYPE.

Syntax

Can be used to update schema-based metadata only. The new metadata must be schema-based:

```
DBMS_XDB_REPOS.UPDATERESOURCEMETADATA (
    abspath IN VARCHAR2,
    oldmetadata IN REF SYS.XMLTYPE,
    newmetadata IN REF SYS.XMLTYPE)
```

Can be used to update schema-based metadata only. The new metadata must be schema-based or nonschema-based:

```
DBMS_XDB_REPOS.UPDATERESOURCEMETADATA (
    abspath IN VARCHAR2,
    oldmetadata IN REF SYS.XMLTYPE,
    newmetadata IN XMLTYPE);
```

Can be used for both schema-based and nonschema-based metadata:

```
DBMS_XDB_REPOS.UPDATERESOURCEMETADATA (
    abspath IN VARCHAR2,
    oldns IN VARCHAR2,
    oldname IN VARCHAR,
    newmetadata IN XMLTYPE);
```

Can be used for both schema-based or nonschema-based metadata. New metadata must be schema-based:

```
DBMS_XDB_REPOS.UPDATERESOURCEMETADATA (
    abspath IN VARCHAR2,
    oldns IN VARCHAR2,
    oldname IN VARCHAR,
    newmetadata IN REF SYS.XMLTYPE);
```

Parameters

Table 217-37 UPDATERESOURCEMETADATA Procedure Parameters

Parameter	Description
abspath	Absolute path of the resource
oldmetadata	REF to the old of metadata
newmetadata	REF to the new, replacement metadata (can be either schema-based or nonschema-based depending on the overload)

Table 217-37 (Cont.) UPDATERESOURCEMETADATA Procedure Parameters

Parameter	Description
oldns	Namespace identifying old metadata
oldname	Local name identifying old metadata

Usage Notes

In the case of `REF`, it stores the `REF` in the resource and the metadata is stored in a separate table. Uniqueness of `REFs` is enforced. In the case where the `XMLTYPE` is passed in, data is parsed to determine if it is schema-based or not and is stored accordingly.

DBMS_XDB_VERSION

Oracle XML DB versioning interfaces are found in the `DBMS_XDB_VERSION` package. Functions and procedures of `DBMS_XDB_VERSION` help to create a VCR and manage the versions in the version history.

Note:

The Oracle XML DB Repository is deprecated with Oracle Database 23ai.

Oracle recommends that you replace any functionality used in XML DB Repository with alternative technologies.

This chapter contains the following topics:

- [Security Model](#)
- [Summary of DBMS_XDB_VERSION Subprograms](#)

See Also:

Oracle XML DB Developer's Guide

218.1 DBMS_XDB_VERSION Security Model

Owned by `XDB`, the `DBMS_XDB_VERSION` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `PUBLIC`. Subprograms in this package are executed using the privileges of the current user.

218.2 Summary of DBMS_XDB_VERSION Subprograms

This table lists the `DBMS_XDB_VERSION` subprograms and briefly describes them.

Table 218-1 *DBMS_XDB_VERSION Package Subprograms*

Method	Description
CHECKIN Function	Checks in a checked-out VCR and returns the resource id of the newly-created version
CHECKOUT Procedure	Checks out a VCR before updating or deleting it
GETCONTENTS BLOB BY RESID Function	Obtain contents as a BLOB

Table 218-1 (Cont.) DBMS_XDB_VERSION Package Subprograms

Method	Description
GETCONTENTSLOBBYRESID Function	Obtain contents as a CLOB
GETCONTENTSXMLBYRESID Function	Obtain contents as an XMLType
GETPREDECESSORS Function	Retrieves the list of predecessors by path name
GETPREDSBYRESID Function	Retrieves the list of predecessors by resource id
GETRESOURCEBYRESID Function	Obtains the resource as an XMLType, given the resource object ID
GETSUCCESSORS Function	Retrieves the list of successors by path name
GETSUCCSBYRESID Function	Retrieves the list of successors by resource id
MAKEVERSIONED Function	Turns a regular resource whose path name is given into a version-controlled resource
UNCHECKOUT Function	Checks in a checked-out resource, returns the resource id of the version before the resource is checked out

218.2.1 CHECKIN Function

This function checks in a checked-out VCR and returns the resource id of the newly-created version.

Syntax

```
DBMS_XDB_VERSION.CHECKIN(
    pathname VARCHAR2)
RETURN DBMS_XDB.resid_type;
```

Parameters

Table 218-2 CHECKIN Function Parameters

Parameter	Description
pathname	The path name of the checked-out resource.

Usage Notes

This is not an auto-commit SQL operation. [CHECKIN Function](#) doesn't have to take the same path name that was passed to [CHECKOUT Procedure](#) operation. However, the [CHECKIN Function](#) path name and the [CHECKOUT Procedure](#) path name must be of the same resource for the operations to function correctly. If the resource has been renamed, the new name must be used to [CHECKIN Function](#) because the old name is either invalid or is currently bound with a different resource. Exception is raised if the path name does not exist. If the path name has been changed, the new path name must be used to [CHECKIN Function](#) the resource.

218.2.2 CHECKOUT Procedure

This procedure checks out a VCR before updating or deleting it.

Syntax

```
DBMS_XDB_VERSION.Checkout (
    pathname    VARCHAR2);
```

Parameters

Table 218-3 CHECKOUT Procedure Parameters

Parameter	Description
pathname	The path name of the VCR to be checked out.

Usage Notes

This is not an auto-commit SQL operation. Two users of the same workspace cannot [CHECKOUT Procedure](#) the same VCR at the same time. If this happens, one user must rollback. As a result, it is good practice to commit the [CHECKOUT Procedure](#) operation before updating a resource and avoid loss of the update if the transaction is rolled back. An exception is raised if the given resource is not a VCR, if the VCR is already checked out, if the resource doesn't exist.

218.2.3 GETCONTENTSbloobyresid Function

This function obtain contents as a BLOB.

Syntax

```
DBMS_XDB_VERSION.GETCONTENTSbloobyresid (
    resid    DBMS_XDB.resid_type)
RETURN BLOB;
```

Parameters

Table 218-4 GETCONTENTSbloobyresid Function Parameters

Parameter	Description
resid	The resource id.

218.2.4 GETCONTENTScloobyresid Function

This function obtains contents as a CLOB.

Syntax

```
DBMS_XDB_VERSION.GETCONTENTScloobyresid (
    resid    DBMS_XDB.resid_type)
RETURN CLOB;
```

Parameters

Table 218-5 GETCONTENTSCLOBYRESID Function Parameters

Parameter	Description
resid	The resource id.

218.2.5 GETCONTENTSXMLBYRESID Function

This function obtains contents as an XMLType.

Syntax

```
DBMS_XDB_VERSION.GETCONTENTSXMLBYRESID(
    resid      DBMS_XDB.resid_type)
RETURN XMLType;
```

Parameters

Table 218-6 GETCONTENTSXMLBYRESID Function Parameters

Parameter	Description
resid	The resource id.

Return Values

If the contents are not valid XML, returns NULL.

218.2.6 GETPREDECESSORS Function

This function retrieves the list of predecessors by the path name.

Syntax

```
DBMS_XDB_VERSION.GETPREDECESSORS(
    pathname  VARCHAR2)
RETURN resid_list_type;
```

Parameters

Table 218-7 GETPREDECESSORS Function Parameters

Parameter	Description
pathname	The path name of the resource.

Return Values

An exception is raised if `pathname` is illegal.

218.2.7 GETPREDSBYRESID Function

This function retrieves the list of predecessors by resource id.

Syntax

```
DBMS_XDB_VERSION.GETPREDSBYRESID(  
    resid      resid_type)  
RETURN resid_list_type;
```

Parameters

Table 218-8 GETPREDSBYRESID Function Parameters

Parameter	Description
resid	The resource id.

Usage Notes

Getting predecessors by RESID is more efficient than by pathname.

Exceptions

An exception is raised if the RESID is illegal.

218.2.8 GETRESOURCEBYRESID Function

This function obtains the resource as an XMLType, given the resource object ID. Because the system does not create a path name for versions, this function is useful for retrieving the resource using its resource id.

Syntax

```
DBMS_XDB_VERSION.GETRESOURCEBYRESID(  
    resid      resid_type)  
RETURN XMLType;
```

Parameters

Table 218-9 GETRESOURCEBYRESID Function Parameters

Parameter	Description
resid	The resource id.

218.2.9 GETSUCCESSORS Function

Given a version resource or a VCR, this function retrieves the list of the successors of the resource by the path name.

Syntax

```
DBMS_XDB_VERSION.GETSUCCESSORS (  
    pathname VARCHAR2)  
RETURN resid_list_type;
```

Parameters

Table 218-10 GETSUCCESSORS Function Parameters

Parameter	Description
pathname	The path name of the resource.

Usage Notes

Getting successors by RESID is more efficient than by pathname.

Exceptions

An exception is raised if the pathname is illegal.

218.2.10 GETSUCCSBYRESID Function

This function retrieves the list of the successors of the resource by resource id using version resource or VCR.

Syntax

```
DBMS_XDB_VERSION.GETSUCCSBYRESID(  
    resid    resid_type)  
RETURN resid_list_type;
```

Parameters

Table 218-11 GETSUCCSBYRESID Function Parameters

Parameter	Description
resid	The resource id.

Usage Notes

Getting successors by RESID is more efficient than by pathname.

Exceptions

An exception is raised if the pathname is illegal.

218.2.11 MAKEVERSIONED Function

This function turns a regular resource whose path name is given into a version-controlled resource. This new resource is then put under version control. All other path names continue to refer to the original resource.

Syntax

```
DBMS_XDB_VERSION.MAKEVERSIONED(
    pathname  VARCHAR2)
RETURN DBMS_XDB.resid_type;
```

Parameters

Table 218-12 MAKEVERSIONED Function Parameters

Parameter	Description
pathname	The path name of the resource to be put under version control.

Return Values

This function returns the resource ID of the first version, or root, of the VCR.

Usage Notes

If two or more path names are bound with the same resource, a copy of the resource is created, and the given path name is bound with the newly-created copy.

This is not an auto-commit SQL operation. An exception is raised if the resource doesn't exist.

- This call is legal for VCR, and neither exception nor warning is raised.
- This call is illegal for folder, version history, version resource, and ACL.
- No support for Schema-based resources is provided.

218.2.12 UNCHECKOUT Function

This function checks-in a checked-out resource and returns the resource id of the version before the resource is checked out.

Syntax

```
DBMS_XDB_VERSION.UNCHECKOUT(
    pathname  VARCHAR2)
RETURN DBMS_XDB.resid_type;
```

Parameters

Table 218-13 UNCHECKOUT Function Parameters

Parameter	Description
pathname	The path name of the checked-out resource.

Usage Notes

This is not an auto-commit SQL operation. The [UNCHECKOUT Function](#) does not have to take the same path name that was passed to the operation by the [CHECKOUT Procedure](#). However, the [UNCHECKOUT Function](#) path name and the [CHECKOUT Procedure](#) path name must be of the same resource for the operations to function correctly. If the resource has been renamed, the new name must be used to [UNCHECKOUT Function](#), because the old name is either invalid or is currently bound with a different resource. If the path name has been changed, the new path name must be used to [UNCHECKOUT Function](#) the resource.

Exceptions

An exception is raised if the path name doesn't exist.

DBMS_XDBRESOURCE

The `DBMS_XDBRESOURCE` package provides the interface to operate on the resource's metadata and contents.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_XDBRESOURCE Subprograms](#)



See Also:

Oracle XML DB Developer's Guide for examples of "Using `DBMS_XDBRESOURCE`"

219.1 DBMS_XDBRESOURCE Overview

The `DBMS_XDBRESOURCE` package provides routines to get and set the resource's metadata and contents. To take advantage of the DOM traversal facility, provided in `DBMS_XMLDOM` package, an `XDBResource` instance could be converted to a `DOMDocument` type by using `DBMS_XDBRESOURCE.MAKEDOCUMENT` routine.

219.2 DBMS_XDBRESOURCE Security Model

Owned by `XDB`, the `DBMS_XDBRESOURCE` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `PUBLIC`. Subprograms in this package are executed using the privileges of the current user.

219.3 Summary of DBMS_XDBRESOURCE Subprograms

This table lists the `DBMS_XDBRESOURCE` subprograms and briefly describes them.

Table 219-1 *DBMS_XDBRESOURCE Package Subprograms*

Subprogram	Description
FREERESOURCE Procedure	Frees any memory associated with an <code>XDBResource</code>
GETACL Function	Given an <code>XDBResource</code> , returns its ACL as string
GETACLDOCFROMRES Function	Returns the ACL Document for the given resource as <code>XMLType</code>
GETAUTHOR Function	Given an <code>XDBResource</code> , returns its author

Table 219-1 (Cont.) DBMS_XDBRESOURCE Package Subprograms

Subprogram	Description
GETCHARACTERSET Function	Given an XDBResource, returns its character set
GETCOMMENT Function	Given an XDBResource, returns its comment
GETCONTENTBLOB Function	Returns the contents of the resource as a BLOB
GETCONTENTCLOB Function	Returns the contents of the resource as a CLOB
GETCONTENTREF Function	Returns the contents of the resource as an XMLTypeRef
GETCONTENTTYPE Function	Given an XDBResource, returns its content-type
GETCONTENTXML Function	Returns the contents of the resource as XML
GETCONTENTVARCHAR2 Function	Returns the contents of the resource as a string
GETCREATIONDATE Function	Given an XDBResource, returns its creation date
GETCREATOR Function	Given an XDBResource, returns its creator
GETCUSTOMMETADATA Function	Returns the requested custom metadata given the xpath and namespace to the metadata
GETDISPLAYNAME Function	Given an XDBResource, returns its display name
GETLANGUAGE Function	Given an XDBResource, returns its language
GETLASTMODIFIER Function	Given an XDBResource, returns its last modifier
GETMODIFICATIONDATE Function	Given an XDBResource, returns its modification date
GETOWNER Function	Given an XDBResource, returns its owner.
GETREFCOUNT Function	Given an XDBResource, returns its reference count
GETVERSIONID Function	Given an XDBResource, returns its version ID.
HASACLCHANGED Function	Returns TRUE if the ACL of the given resource has changed, FALSE otherwise
HASAUTHORCHANGED Function	Returns TRUE if the ACL of the given resource has changed FALSE otherwise
HASCHANGED Function	Returns TRUE if the element or attribute represented by the given XPath has changed, FALSE otherwise
HASCHARACTERSETCHANGED Function	Returns TRUE if the character set of the given resource has changed, FALSE otherwise
HASCOMMENTCHANGED Function	Returns TRUE if the comment of the given resource has changed, FALSE otherwise
HASCONTENTCHANGED Function	Returns TRUE if the contents of the given resource has changed, FALSE otherwise
HASCONTENTTYPECHANGED Function	Returns TRUE if the content-type of the given resource has changed, FALSE otherwise
HASCREATIONDATECHANGED Function	Returns TRUE if the creation date of the given resource has changed, FALSE otherwise
HASCREATORCHANGED Function	Returns TRUE if the creator of the given resource has changed, FALSE otherwise
HASCUSTOMMETADATACHANGED Function	Returns TRUE if custom-metadata for this XPath has changed, FALSE otherwise

Table 219-1 (Cont.) *DBMS_XDBRESOURCE Package Subprograms*

Subprogram	Description
HASDISPLAYNAMECHANGED Function	Returns <code>TRUE</code> if the display name of the given resource has changed, <code>FALSE</code> otherwise
HASLANGUAGECHANGED Function	Returns <code>TRUE</code> if the language of the given resource has changed, <code>FALSE</code> otherwise
HASLASTMODIFIERCHANGED Function	Returns <code>TRUE</code> if the last modifier of the given resource has changed, <code>FALSE</code> otherwise
HASMODIFICATIONDATECHANGED Function	Returns <code>TRUE</code> if the modification date of the given resource has changed, <code>FALSE</code> otherwise
HASOWNERCHANGED Function	Returns <code>TRUE</code> if the owner of the given resource has changed, <code>FALSE</code> otherwise
HASREFCOUNTCHANGED Function	Returns <code>TRUE</code> if the reference count of the given resource has changed, <code>FALSE</code> otherwise
HASVERSIONIDCHANGED Function	Returns <code>TRUE</code> if the version ID of the given resource has changed, <code>FALSE</code> otherwise
ISFOLDER Function	Returns <code>TRUE</code> if the given resource is a folder, <code>FALSE</code> otherwise
ISNULL Function	Returns <code>TRUE</code> if input resource is <code>NULL</code> , <code>FALSE</code> otherwise
MAKEDOCUMENT Function	Converts the <code>XDBResource</code> to a <code>DOMDocument</code> which can be operated on using the <code>XMLDOM</code> interface
SAVE Procedure	Updates the resource with any modifications
SETACL Procedure	Sets the ACL of the given <code>XDBResource</code> to the path specified
SETAUTHOR Procedure	Sets the author of the given <code>XDBResource</code> to the specified string
SETCHARACTERSET Procedure	Sets the character set of the given <code>XDBResource</code> to a specified character set
SETCOMMENT Procedure	Sets a comment associated with the given <code>XDBResource</code>
SETCONTENT Procedures	Replaces the contents of the given resource with the given <code>CLOB</code>
SETCONTENTTYPE Procedure	Sets the content-type of the given <code>XDBResource</code>
SETCUSTOMMETADATA Procedure	Sets the custom metadata specified by the XPath and namespace to new data
SETDISPLAYNAME Procedure	Sets the display name of the given <code>XDBResource</code>
SETLANGUAGE Procedure	Sets the language of the given <code>XDBResource</code>
SETOWNER Procedure	Sets the owner of the given <code>XDBResource</code>

219.3.1 FREERESOURCE Procedure

This procedure frees any memory associated with an XDBResource.

Syntax

```
DBMS_XDBRESOURCE.FREERESOURCE (
    res IN XDBResource)
RETURN VARCHAR2;
```

Parameters

Table 219-2 FREERESOURCE Procedure Parameters

Parameter	Description
res	XDBResource to free

219.3.2 GETACL Function

Given an XDBResource, this function returns its ACL as string.

Syntax

```
DBMS_XDBRESOURCE.GETACL (
    res IN XDBResource)
RETURN VARCHAR2;
```

Parameters

Table 219-3 GETACL Function Parameters

Parameter	Description
res	XDBResource

219.3.3 GETACLDOCFROMRES Function

This function returns the ACL Document for the given resource as XMLType.

Syntax

```
DBMS_XDBRESOURCE.GETACLDOCFROMRES (
    res IN XDBResource)
RETURN SYS.XMLTYPE;
```

Parameters

Table 219-4 GETACLDOCFROMRES Function Parameters

Parameter	Description
res	XDBResource

219.3.4 GETAUTHOR Function

Given an XDBResource, this function returns its author.

Syntax

```
DBMS_XDBRESOURCE.GETAUTHOR (  
    res IN XDBResource)  
RETURN VARCHAR2;
```

Parameters

Table 219-5 GETAUTHOR Function Parameters

Parameter	Description
res	XDBResource

219.3.5 GETCHARACTERSET Function

Given an XDBResource, this function returns its character set.

Syntax

```
DBMS_XDBRESOURCE.GETCHARACTERSET (  
    res IN XDBResource)  
RETURN VARCHAR2;
```

Parameters

Table 219-6 GETCHARACTERSET Function Parameters

Parameter	Description
res	XDBResource

219.3.6 GETCOMMENT Function

Given an XDBResource, this function returns its comment.

Syntax

```
DBMS_XDBRESOURCE.GETCOMMENT (  
    res IN XDBResource)  
RETURN VARCHAR2;
```

Parameters

Table 219-7 GETCOMMENT Function Parameters

Parameter	Description
res	XDBResource

219.3.7 GETCONTENTBLOB Function

This function returns the contents of the resource as a BLOB.

Syntax

```
DBMS_XDBRESOURCE.GETCONTENTBLOB (
    res    IN    XDBResource,
    csid   OUT   PLS_INTEGER)
RETURN BLOB;
```

Parameters

Table 219-8 GETCONTENTBLOB Function Parameters

Parameter	Description
res	XDBResource
csid	Character set ID of the BLOB returned

219.3.8 GETCONTENTCLOB Function

This function returns the contents of the resource as a CLOB.

Syntax

```
DBMS_XDBRESOURCE.GETCONTENTCLOB (
    res    IN    XDBResource)
RETURN CLOB;
```

Parameters

Table 219-9 GETCONTENTCLOB Function Parameters

Parameter	Description
res	XDBResource

219.3.9 GETCONTENTREF Function

This function returns the contents of the resource as an XMLTypeRef.

Syntax

```
DBMS_XDBRESOURCE.GETCONTENTREF (
    res    IN    XDBResource)
RETURN VARCHAR2;
```

Parameters

Table 219-10 GETCONTENTREF Function Parameters

Parameter	Description
res	XDBResource

219.3.10 GETCONTENTTYPE Function

Given an XDBResource, this function returns its content-type.

Syntax

```
DBMS_XDBRESOURCE.GETCONTENTTYPE (  
    res IN XDBResource)  
RETURN VARCHAR2;
```

Parameters

Table 219-11 GETCONTENTTYPE Function Parameters

Parameter	Description
res	XDBResource

219.3.11 GETCONTENTXML Function

This function returns the contents of the resource as an XMLTypeRef.

Syntax

```
DBMS_XDBRESOURCE.GETCONTENTXML (  
    res IN XDBResource)  
RETURN XMLType;
```

Parameters

Table 219-12 GETCONTENTXML Function Parameters

Parameter	Description
res	XDBResource

219.3.12 GETCONTENTVARCHAR2 Function

This function returns the contents of the resource as a string.

Syntax

```
DBMS_XDBRESOURCE.GETCONTENTVARCHAR2 (  
    res IN XDBResource)  
RETURN VARCHAR2;
```

Parameters

Table 219-13 GETCONTENTVARCHAR2 Function Parameters

Parameter	Description
res	XDBResource

219.3.13 GETCREATIONDATE Function

Given an XDBResource, this function returns its creation date.

Syntax

```
DBMS_XDBRESOURCE.GETCREATIONDATE (
    res IN XDBResource)
RETURN TIMESTAMP;
```

Parameters

Table 219-14 GETCREATIONDATE Function Parameters

Parameter	Description
res	XDBResource

219.3.14 GETCREATOR Function

Given an XDBResource, this function returns its creator.

Syntax

```
DBMS_XDBRESOURCE.GETCREATOR (
    res IN XDBResource)
RETURN VARCHAR2;
```

Parameters

Table 219-15 GETCREATOR Function Parameters

Parameter	Description
res	XDBResource

219.3.15 GETCUSTOMMETADATA Function

This function returns the requested custom metadata given the xpath and namespace to the metadata.

Syntax

```
DBMS_XDBRESOURCE.GETCUSTOMMETADATA (
    res IN XDBResource,
```



```

    xpath    IN    VARCHAR2,    namespace IN    VARCHAR2)
RETURN XMLType;

```

Parameters

Table 219-16 GETCUSTOMMETADATA Function Parameters

Parameter	Description
res	XDBResource
xpath	XPath for custom metadata
namespace	Namespace

Usage Notes

The first component of the XPath expression must be "Resource".

219.3.16 GETDISPLAYNAME Function

Given an XDBResource, this function returns its display name.

Syntax

```

DBMS_XDBRESOURCE.GETDISPLAYNAME (
    res    IN    XDBResource)
RETURN VARCHAR2;

```

Parameters

Table 219-17 GETDISPLAYNAME Function Parameters

Parameter	Description
res	XDBResource

219.3.17 GETLANGUAGE Function

Given an XDBResource, this function returns its language.

Syntax

```

DBMS_XDBRESOURCE.GETLANGUAGE (
    res    IN    XDBResource)
RETURN VARCHAR2;

```

Parameters

Table 219-18 GETLANGUAGE Function Parameters

Parameter	Description
res	XDBResource

219.3.18 GETLASTMODIFIER Function

Given an XDBResource, this function returns its last modifier.

Syntax

```
DBMS_XDBRESOURCE.GETLASTMODIFIER (  
    res IN XDBResource)  
RETURN VARCHAR2;
```

Parameters

Table 219-19 GETLASTMODIFIER Function Parameters

Parameter	Description
res	XDBResource

219.3.19 GETMODIFICATIONDATE Function

Given an XDBResource, this function returns its modification date.

Syntax

```
DBMS_XDBRESOURCE.GETMODIFICATIONDATE (  
    res IN XDBResource)  
RETURN TIMESTAMP;
```

Parameters

Table 219-20 GETMODIFICATIONDATE Function Parameters

Parameter	Description
res	XDBResource

219.3.20 GETOWNER Function

Given an XDBResource, this function returns its owner.

Syntax

```
DBMS_XDBRESOURCE.GETOWNER (  
    res IN XDBResource)  
RETURN VARCHAR2;
```

Parameters

Table 219-21 GETOWNER Function Parameters

Parameter	Description
res	XDBResource

219.3.21 GETREFCOUNT Function

Given an XDBResource, this function returns its reference count.

Syntax

```
DBMS_XDBRESOURCE.GETREFCOUNT (  
    res IN XDBResource)  
RETURN PLS_INTEGER;
```

Parameters

Table 219-22 GETREFCOUNT Function Parameters

Parameter	Description
res	XDBResource

219.3.22 GETVERSIONID Function

Given an XDBResource, this function returns its version ID.

Syntax

```
DBMS_XDBRESOURCE.GETVERSIONID (  
    res IN XDBResource)  
RETURN PLS_INTEGER;
```

Parameters

Table 219-23 GETVERSIONID Function Parameters

Parameter	Description
res	XDBResource

219.3.23 HASACLCHANGED Function

This function returns `TRUE` if the ACL of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASACLCHANGED (  
    res IN XDBResource)  
RETURN BOOLEAN;
```

Parameters

Table 219-24 HASACLCHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.24 HASAUTHORCHANGED Function

This function returns `TRUE` if the author of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASAUTHORCHANGED (
    res IN XDBResource)
RETURN BOOLEAN;
```

Parameters

Table 219-25 HASAUTHORCHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.25 HASCHANGED Function

Given an XPath, this function determines whether the element or attribute represented by the XPath has changed.

Syntax

```
DBMS_XDBRESOURCE.HASCHANGED (
    res IN XDBResource,
    xpath IN VARCHAR2,
    namespace IN VARCHAR2)
RETURN BOOLEAN;
```

Parameters

Table 219-26 HASCHANGED Function Parameters

Parameter	Description
res	XDBResource
xpath	XPath to check
bnamespace	Namespace to use

219.3.26 HASCHARACTERSETCHANGED Function

This function returns `TRUE` if the character set of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASCHARACTERSETCHANGED (
    res IN XDBResource)
RETURN BOOLEAN;
```

Parameters**Table 219-27 HASCHARACTERSETCHANGED Function Parameters**

Parameter	Description
res	XDBResource

219.3.27 HASCOMMENTCHANGED Function

This function returns `TRUE` if the comment of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASCOMMENTCHANGED (
  res IN XDBResource)
RETURN BOOLEAN;
```

Parameters**Table 219-28 HASCOMMENTCHANGED Function Parameters**

Parameter	Description
res	XDBResource

219.3.28 HASCONTENTCHANGED Function

This function returns `TRUE` if the contents of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASCONTENTCHANGED (
  res IN XDBResource)
RETURN BOOLEAN;
```

Parameters**Table 219-29 HASCONTENTCHANGED Function Parameters**

Parameter	Description
res	XDBResource

219.3.29 HASCONTENTTYPECHANGED Function

This function returns `TRUE` if the content-type of the given resource has changed, `FALSE` otherwise

Syntax

```
DBMS_XDBRESOURCE.HASCONTENTTYPECHANGED (
    res IN XDBResource)
RETURN BOOLEAN;
```

Parameters

Table 219-30 HASCONTENTTYPECHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.30 HASCREATIONDATECHANGED Function

This function returns `TRUE` if the creation date of the given resource has changed, `FALSE` otherwise

Syntax

```
DBMS_XDBRESOURCE.HASCREATIONDATECHANGED (
    res IN XDBResource)
RETURN BOOLEAN;
```

Parameters

Table 219-31 HASCREATIONDATECHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.31 HASCREATORCHANGED Function

This function returns `TRUE` if the creator of the given resource has changed, `FALSE` otherwise

Syntax

```
DBMS_XDBRESOURCE.HASCREATORCHANGED (
    res IN XDBResource)
RETURN BOOLEAN;
```

Parameters

Table 219-32 HASCREATORCHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.32 HASCUSTOMMETADATACHANGED Function

This function checks whether the custom-metadata for a given resource has changed.

Syntax

```
DBMS_XDBRESOURCE.HASCUSTOMMETADATACHANGED (  
    res IN XDBResource)  
RETURN BOOLEAN;
```

Parameters

Table 219-33 HASCUSTOMMETADATACHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.33 HASDISPLAYNAMECHANGED Function

This function returns `TRUE` if the display name of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASDISPLAYNAMECHANGED (  
    res IN XDBResource)  
RETURN BOOLEAN;
```

Parameters

Table 219-34 HASDISPLAYNAMECHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.34 HASLANGUAGECHANGED Function

This function returns `TRUE` if the language of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASLANGUAGECHANGED (
    res IN XDBResource)
RETURN BOOLEAN;
```

Parameters

Table 219-35 HASLANGUAGECHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.35 HASLASTMODIFIERCHANGED Function

This function returns `TRUE` if the last modifier of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASLASTMODIFIERCHANGED (
    res IN XDBResource)
RETURN BOOLEAN;
```

Parameters

Table 219-36 HASLASTMODIFIERCHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.36 HASMODIFICATIONDATECHANGED Function

This function returns `TRUE` if the modification date of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASMODIFICATIONDATECHANGED (
    res IN XDBResource)
RETURN BOOLEAN;
```


Parameters

Table 219-37 HASMODIFICATIONDATECHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.37 HASOWNERCHANGED Function

This function returns `TRUE` if the owner of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASOWNERCHANGED (
    res IN XDBResource)
RETURN BOOLEAN;
```

Parameters

Table 219-38 HASOWNERCHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.38 HASREFCOUNTCHANGED Function

This function returns `TRUE` if the reference count of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASREFCOUNTCHANGED (
    res IN XDBResource)
RETURN BOOLEAN;
```

Parameters

Table 219-39 HASREFCOUNTCHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.39 HASVERSIONIDCHANGED Function

This function returns `TRUE` if the version ID of the given resource has changed, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.HASVERSIONIDCHANGED (  
    res IN XDBResource)  
RETURN BOOLEAN;
```

Parameters

Table 219-40 HASVERSIONIDCHANGED Function Parameters

Parameter	Description
res	XDBResource

219.3.40 ISFOLDER Function

This function returns `TRUE` if the given resource is a folder, `FALSE` otherwise.

Syntax

```
DBMS_XDBRESOURCE.ISFOLDER (  
    res IN XDBResource)  
RETURN BOOLEAN;
```

Parameters

Table 219-41 ISFOLDER Function Parameters

Parameter	Description
res	XDBResource

219.3.41 ISNULL Function

This function returns `TRUE` if input resource is `NULL`.

Syntax

```
DBMS_XDBRESOURCE.ISNULL (  
    res IN XDBResource)  
RETURN BOOLEAN;
```

Parameters

Table 219-42 ISNULL Function Parameters

Parameter	Description
res	Input resource

219.3.42 MAKEDOCUMENT Function

This function converts the XDBResource to a DOMDocument which can be operated on using the XMLDOM interface.



See Also:

The [DBMS_XMLDOM](#) package

Syntax

```
DBMS_XDBRESOURCE.MAKEDOCUMENT (
    res IN XDBResource)
RETURN DBMS_XMLDOM.DOMDocument;
```

Parameters

Table 219-43 MAKEDOCUMENT Function Parameters

Parameter	Description
res	XDBResource

219.3.43 SAVE Procedure

This procedure updates the resource with any modifications.

Syntax

```
DBMS_XDBRESOURCE.SAVE (
    res IN XDBResource);
```

Parameters

Table 219-44 SAVE Procedure Parameters

Parameter	Description
res	XDBResource

219.3.44 SETACL Procedure

This procedure sets the ACL of the given XDBResource to the path specified.

Syntax

```
DBMS_XDBRESOURCE.SETACL (
    res      IN OUT  XDBResource,
    ACLPath  IN      VARCHAR2);
```

Parameters

Table 219-45 SETACL Procedure Parameters

Parameter	Description
res	XDBResource
ACLPath	Absolute path of the new ACL

219.3.45 SETAUTHOR Procedure

This procedure sets the author of the given XDBResource to the specified string.

Syntax

```
DBMS_XDBRESOURCE.SETAUTHOR (
    res      IN OUT  XDBResource,
    author  IN      VARCHAR2);
```

Parameters

Table 219-46 SETAUTHOR Procedure Parameters

Parameter	Description
res	XDBResource
author	Author

219.3.46 SETCHARACTERSET Procedure

This procedure sets the character set of the given XDBResource to a specified character set.

Syntax

```
DBMS_XDBRESOURCE.SETCHARACTERSET (
    res      IN OUT  XDBResource,
    charSet  IN      VARCHAR2);
```

Parameters

Table 219-47 SETCHARACTERSET Procedure Parameters

Parameter	Description
res	XDBResource
charset	New character set

219.3.47 SETCOMMENT Procedure

This procedure sets a comment associated with the given XDBResource.

Syntax

```
DBMS_XDBRESOURCE.SETCOMMENT (
    res      IN OUT XDBResource,
    comment  IN      VARCHAR2);
```

Parameters

Table 219-48 SETCOMMENT Procedure Parameters

Parameter	Description
res	XDBResource
comment	New comment

219.3.48 SETCONTENT Procedures

This procedure replaces the contents of the given resource with the given datatype.

Syntax

```
DBMS_XDBRESOURCE.SETCONTENT (
    res      IN OUT XDBResource,
    data     IN      BFILE,
    csid     IN      NUMBER);
```

```
DBMS_XDBRESOURCE.SETCONTENT (
    res      IN OUT XDBResource,
    data     IN      BLOB,
    csid     IN      PLS_INTEGER);
```

```
DBMS_XDBRESOURCE.SETCONTENT (
    res      IN OUT XDBResource,
    data     IN      CLOB);
```

```
DBMS_XDBRESOURCE.SETCONTENT (
    res      IN OUT XDBResource,
    data     IN      REF SYS.XMLType,
    sticky   IN      BOOLEAN := TRUE);
```

```
DBMS_XDBRESOURCE.SETCONTENT (
    res      IN OUT XDBResource,
```

```

data      IN      VARCHAR2);

DBMS_XDBRESOURCE.SETCONTENT (
  res      IN OUT  XDBResource,
  data     IN      SYS.XMLType);

```

Parameters

Table 219-49 SETCONTENT Procedure Parameters

Parameter	Description
res	XDBResource
data	Data input as BFILE, BLOB, CLOB, string, XMLType
csid	Character set ID of the BFILE, BLOB
sticky	If TRUE creates a sticky REF, otherwise non-sticky

219.3.49 SETCONTENTTYPE Procedure

This procedure sets the content-type of the given XDBResource.

Syntax

```

DBMS_XDBRESOURCE.SETCONTENTTYPE (
  res      IN OUT  XDBResource,
  conttype IN      VARCHAR2);

```

Parameters

Table 219-50 SETCONTENTTYPE Procedure Parameters

Parameter	Description
res	XDBResource
conttype	New content-type

219.3.50 SETCUSTOMMETADATA Procedure

This procedure sets the custom metadata specified by the xpath and namespace to new data.

Syntax

```

DBMS_XDBRESOURCE.SETCUSTOMMETADATA (
  res      IN OUT  XDBResource,
  xpath    IN      VARCHAR2,
  namespace IN      VARCHAR2,
  newMetadata IN    XMLType);

```

Parameters

Table 219-51 SETCUSTOMMETADATA Procedure Parameters

Parameter	Description
res	XDBResource
xpath	XPath to change
namespace	Namespace to use
newMetadata	New data that should replace the metadata at the given XPath

Usage Notes

The first component of the XPath expression must be "Resource".

219.3.51 SETDISPLAYNAME Procedure

This procedure sets the display name of the given XDBResource.

Syntax

```
DBMS_XDBRESOURCE.SETDISPLAYNAME (
    res      IN OUT XDBResource,
    name     IN     VARCHAR2);
```

Parameters

Table 219-52 SETDISPLAYNAME Procedure Parameters

Parameter	Description
res	XDBResource
name	New display name

219.3.52 SETLANGUAGE Procedure

This procedure sets the language of the given XDBResource.

Syntax

```
DBMS_XDBRESOURCE.SETLANGUAGE (
    res      IN OUT XDBResource,
    ACLPath IN     VARCHAR2);
```

Parameters

Table 219-53 SETLANGUAGE Procedure Parameters

Parameter	Description
res	XDBResource
ACLPath	New path

219.3.53 SETOWNER Procedure

This procedure sets the owner of the given XDBResource.

Syntax

```
DBMS_XDBRESOURCE.SETOWNER (  
    res      IN OUT XDBResource,  
    owner    IN     VARCHAR2);
```

Parameters

Table 219-54 SETOWNER Procedure Parameters

Parameter	Description
res	XDBResource
owner	New owner

Usage Notes

The user must have the `XDBADMIN` privilege to call this subprogram.

DBMS_XDBZ

The DBMS_XDBZ package controls the Oracle XML DB repository security, which is based on Access Control Lists (ACLs).

This chapter contains the following topics:

- [Security Model](#)
- [Constants](#)
- [Summary of DBMS_XDBZ Subprograms](#)



See Also:

Oracle XML DB Developer's Guide

220.1 DBMS_XDBZ Security Model

Owned by XDB, the DBMS_XDBZ package must be created by SYS or XDB. The EXECUTE privilege is granted to PUBLIC. Subprograms in this package are executed using the privileges of the current user.

220.2 DBMS_XDBZ Constants

The DBMS_XDBZ package defines several constants that can be used for specifying parameter values.

The package uses the constants shown in following tables.

Table 220-1 DBMS_XDBZ Constants - Name Format

Constant	Type	Value	Description
NAME_FORMAT_SHORT	PLS_INTEGER	1	DB user name or LDAP nickname
NAME_FORMAT_DISTINGUISHED	PLS_INTEGER	2	LDAP distinguished name

Table 220-2 DBMS_XDBZ Constants - Enable Option

Constant	Type	Value	Description
ENABLE_CONTENTS	PLS_INTEGER	1	Enables hierarchy for contents and is used by users when calling the ENABLE_HIERARCHY Procedure

Table 220-2 (Cont.) DBMS_XDBZ Constants - Enable Option

Constant	Type	Value	Description
ENABLE_RESMETADATA	PLS_INTEGER	2	Enables hierarchy for resource metadata, that is, this table will store schema based custom metadata for resources

Table 220-3 DBMS_XDBZ Constants - Enable Option Exercised

Constant	Type	Value	Description
IS_ENABLED_CONTENTS	PLS_INTEGER	1	If hierarchy was enabled for contents, that is, the ENABLE_HIERARCHY Procedure was called with <code>hierarchy_type</code> as <code>ENABLE_CONTENTS</code>
IS_ENABLED_RESMETADATA	PLS_INTEGER	2	If hierarchy was enabled for resource metadata, that is, the ENABLE_HIERARCHY Procedure was called with <code>hierarchy_type</code> as <code>ENABLE_RESMETADATA</code>

220.3 Summary of DBMS_XDBZ Subprograms

This table lists the DBMS_XDBZ subprograms and briefly describes them.

Table 220-4 DBMS_XDBZ Package Subprograms

Method	Description
DISABLE_HIERARCHY Procedure	Disables repository support for the specified XMLTYPE table or view
ENABLE_HIERARCHY Procedure	Enables repository support for the specified XMLType table or view
GET_ACLOID Function	Retrieves the ACL Object ID for the specified resource
GET_USERID Function	Retrieves the user ID for the specified user
IS_HIERARCHY_ENABLED Function	Determines if repository support for the specified XMLType table or view is enabled
PURGELDAPCACHE Function	Purges the LDAP nickname cache

220.3.1 CREATENONCEKEY Procedure

This procedure generates a nonce value for use in digest authentication.

Syntax

```
DBMS_XDBZ.CREATENONCEKEY;
```

220.3.2 DISABLE_HIERARCHY Procedure

This procedure disables repository support for a particular XMLType table or view.

Syntax

```
DBMS_XDBZ.DISABLE_HIERARCHY(  
    object_schema IN VARCHAR2,  
    object_name   IN VARCHAR2);
```

Parameters

Table 220-5 DISABLE_HIERARCHY Procedure Parameters

Parameter	Description
object_schema	Schema name of the XMLType table or view
object_name	Name of the XMLType table or view

220.3.3 ENABLE_HIERARCHY Procedure

This procedure enables repository support for a particular XMLType table or view. This allows the use of a uniform ACL-based security model across all documents in the repository.



See Also:

Oracle XML DB Developer's Guide for more information about

Syntax

```
DBMS_XDBZ.ENABLE_HIERARCHY(  
    object_schema IN VARCHAR2,  
    object_name   IN VARCHAR2,  
    hierarchy_type IN PLS_INTEGER := DBMS_XDBZ.ENABLE_CONTENTS);
```

Parameters

Table 220-6 ENABLE_HIERARCHY Procedure Parameters

Parameter	Description
object_schema	Schema name of the XMLType table or view
object_name	Name of the XMLType table or view

Table 220-6 (Cont.) ENABLE_HIERARCHY Procedure Parameters

Parameter	Description
hierarchy_type	<p>How to enable the hierarchy.</p> <ul style="list-style-type: none"> ENABLE_CONTENTS - enable hierarchy for contents, that is, this table will store contents of resources in the repository ENABLE_RESMETADATA - enable hierarchy for resource metadata, that is, this table will store schema based custom metadata for resources <p>If this subprogram is called on a table, another call will have no effect. Note that you cannot enable hierarchy for both contents and resource metadata.</p>

220.3.4 GET_ACLOID Function

This function retrieves the ACL Object ID for the specified resource, if the repository path is known.

Syntax

```
DBMS_XDBZ.GET_ACLOID(
  aclpath IN VARCHAR2,
  acloid  OUT RAW)
RETURN BOOLEAN;
```

Parameters

Table 220-7 GET_ACLOID Function Parameters

Parameter	Description
aclpath	ACL resource path for the repository
acloid	Returned Object ID

Return Values

Returns `TRUE` if successful.

220.3.5 GET_USERID Function

This function retrieves the user ID for the specified user name. The local database is searched first, and if found, the `USERID` is returned in 4-byte database format. Otherwise, the LDAP directory is searched, if available, and if found, the `USERID` is returned in 4-byte database format.

Syntax

```
DBMS_XDBZ.GET_USERID(
  username IN VARCHAR2,
  userid  OUT RAW,
  format  IN BINARY_INTEGER := NAME_FORMAT_SHORT)
RETURN BOOLEAN;
```

Parameters

Table 220-8 GET_USERID Function Parameters

Parameter	Description
username	Name of the database or LDAP user.
userid	Return parameter for the matching user id.
format	Format of the specified user name; valid options are: <ul style="list-style-type: none"> DBMS_XDBZ.NAME_FORMAT_SHORT (default) -- DB user name or LDAP nickname DBMS_XDBZ.NAME_FORMAT_DISTINGUISHED -- LDAP distinguished name.

Return Values

Returns `TRUE` if successful.

220.3.6 IS_HIERARCHY_ENABLED Function

This function determines if repository support for the specified `XMLType` table or view is enabled.

Syntax

```
DBMS_XDBZ.IS_HIERARCHY_ENABLED(
  object_schema IN VARCHAR2,
  object_name   IN VARCHAR2,
  hierarchy_type IN PLS_INTEGER := IS_ENABLED_CONTENTS)
RETURN BOOLEAN;
```

Parameters

Table 220-9 IS_HIERARCHY_ENABLED Function Parameters

Parameter	Description
object_schema	Schema name of the <code>XMLType</code> table or view
object_name	Name of the <code>XMLType</code> table or view
hierarchy_type	Type of hierarchy to check for: <ul style="list-style-type: none"> <code>IS_ENABLED_CONTENTS</code> - if hierarchy was enabled for contents, that is, the ENABLE_HIERARCHY Procedure was called with <code>hierarchy_type</code> as <code>ENABLE_CONTENTS</code> <code>IS_ENABLED_RESMETADATA</code> - if hierarchy was enabled for resource metadata, that is, the ENABLE_HIERARCHY Procedure was called with <code>hierarchy_type</code> as <code>ENABLE_RESMETADATA</code>

Return Values

Returns `TRUE` if the given `XMLTYPE` table or view has the XDB Hierarchy enabled with the specified type.

220.3.7 PURGELDAPCACHE Function

This function purges the LDAP nickname cache.

It returns `TRUE` if successful.

Syntax

```
DBMS_XDBZ.PURGELDAPCACHE  
RETURN BOOLEAN;
```

DBMS_XEVENT

The `DBMS_XEVENT` package provides event-related types and supporting subprograms.

This chapter contains the following topics:

- [Security Model](#)
- [Constants](#)
- [Subprogram Groups](#)
- [Summary of DBMS_XEVENT Subprograms](#)



See Also:

Oracle XML DB Developer's Guide for more information about "Oracle XML DB Repository Events"

221.1 DBMS_XEVENT Security Model

Owned by `XDB`, the `DBMS_XEVENT` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `PUBLIC`. Subprograms in this package are executed using the privileges of the current user.

221.2 DBMS_XEVENT Constants

The `DBMS_XEVENT` package defines several constants that can be used for specifying parameter values.

The constants are defined in the following table.

Table 221-1 DBMS_XEVENT Constants

Name	Type	Value	Description
<code>RENDER_EVENT</code>	<code>PLS_INTEGER</code>	1	
<code>PRE_CREATE_EVENT</code>	<code>PLS_INTEGER</code>	2	
<code>POST_CREATE_EVENT</code>	<code>PLS_INTEGER</code>	3	
<code>PRE_DELETE_EVENT</code>	<code>PLS_INTEGER</code>	4	
<code>POST_DELETE_EVENT</code>	<code>PLS_INTEGER</code>	5	
<code>PRE_UPDATE_EVENT</code>	<code>PLS_INTEGER</code>	6	
<code>POST_UPDATE_EVENT</code>	<code>PLS_INTEGER</code>	7	
<code>PRE_LOCK_EVENT</code>	<code>PLS_INTEGER</code>	8	

Table 221-1 (Cont.) DBMS_XEVENT Constants

Name	Type	Value	Description
POST_LOCK_EVENT	PLS_INTEGER	9	
PRE_UNLOCK_EVENT	PLS_INTEGER	10	
POST_UNLOCK_EVENT	PLS_INTEGER	11	
PRE_LINKIN_EVENT	PLS_INTEGER	12	
POST_LINKIN_EVENT	PLS_INTEGER	13	
PRE_LINKTO_EVENT	PLS_INTEGER	14	
POST_LINKTO_EVENT	PLS_INTEGER	15	
PRE_UNLINKIN_EVENT	PLS_INTEGER	16	
POST_UNLINKIN_EVENT	PLS_INTEGER	17	
PRE_UNLINKFROM_EVENT	PLS_INTEGER	18	
POST_UNLINKFROM_EVENT	PLS_INTEGER	19	
PRE_CHECKIN_EVENT	PLS_INTEGER	20	
POST_CHECKIN_EVENT	PLS_INTEGER	21	
PRE_CHECKOUT_EVENT	PLS_INTEGER	22	
POST_CHECKOUT_EVENT	PLS_INTEGER	23	
PRE_UNCHECKOUT_EVENT	PLS_INTEGER	24	
POST_UNCHECKOUT_EVENT	PLS_INTEGER	25	
PRE_VERSIONCONTROL_EVENT	PLS_INTEGER	26	
POST_VERSIONCONTROL_EVENT	PLS_INTEGER	27	
PRE_OPEN_EVENT	PLS_INTEGER	28	
POST_OPEN_EVENT	PLS_INTEGER	29	
PRE_INCONSISTENT_UPDATE_EVENT	PLS_INTEGER	30	
POST_INCONSISTENT_UPDATE_EVENT	PLS_INTEGER	21	
POST_CHECKIN_EVENT	PLS_INTEGER	21	

221.3 Subprogram Groups

The subprograms in the `DBMS_XEVENT` package can be divided in groups.

- [XDBEvent Type Subprograms](#)
- [XDBRepositoryEvent Type Subprograms](#)
- [XDBHandlerList Type Subprograms](#)
- [XDBHandler Type Subprograms](#)
- [XDBPath Type Subprograms](#)
- [XDBLink Type Subprograms](#)

221.3.1 DBMS_XEVENT XDBEvent Type Subprograms

This subprogram group provides an interface for use with the XDBEvent type.

Table 221-2 XDBEvent Subprograms

Subprogram	Description
GETCURRENTUSER Function	Returns the name of the user executing the operation that triggers the event
GETEVENT Function	Returns a value identifying the triggering event
ISNULL Functions	Returns <code>TRUE</code> if input argument is <code>NULL</code>

The [Summary of DBMS_XEVENT Subprograms](#) contains a complete listing of all subprograms in the package.

221.3.2 DBMS_XEVENT XDBRepositoryEvent Type Subprograms

This subprogram group provides an interface for use in conjunction with the XDBRepositoryEvent type.

Table 221-3 XDBRepositoryEvent Subprograms

Subprogram	Description
GETAPPLICATIONDATA Function	Returns the <code><applicationData></code> element extracted from the resource configuration that defines the invoking handler
GETHANDLERLIST Function	Returns an <code>XDBHandlerList</code> object containing the list of handlers that will be executed after the currently executing handler
GETINTERFACE Function	Returns the top-level interface used to initiate the operation that triggered the event
GETLINK Function	Returns an <code>XDBLink</code> object for the target resource
GETLOCK Function	Returns the lock object corresponding to the current operation
GETOLDRESOURCE Function	Returns the original <code>XDBResource</code> object before the operation was executed
GETOPENACCESSMODE Function	Returns the access mode for the open operation
GETOPENDENYMODE Function	Returns the deny mode for the open operation
GETOUTPUTSTREAM Function	Returns the output BLOB in which the handler can write the rendered data
GETPARAMETER Function	Returns the value of a request or session-specific parameter
GETPARENT Function	Returns the resource object corresponding to a parent folder of the target resource
GETPATH Function	Returns the <code>XDBPath</code> object representing the path of the resource for which the event was fired

Table 221-3 (Cont.) XDBRepositoryEvent Subprograms

Subprogram	Description
GETRESOURCE Function	Returns an <code>XDBResource</code> object that provides methods to access and modify the contents and metadata of the target resource
GETUPDATEBYTECOUNT Function	If the current operation is a byte-range write, returns the byte count
GETUPDATEBYTEOFFSET Function	If the current operation is a byte-range write, function returns the byte offset at which the range begins
GETXDBeVENT Function	Converts an <code>XDBRepositoryEvent</code> object to an <code>XDBEvent</code> type
ISNULL Functions	Returns <code>TRUE</code> if input argument is <code>NULL</code>
SETRENDERPATH Procedure	Specifies the path of the resource that contains the rendered contents
SETRENDERSTREAM Procedure	sets the <code>BLOB</code> from which the rendered contents can be read

The [Summary of DBMS_XEVENT Subprograms](#) contains a complete listing of all subprograms in the package.

221.3.3 DBMS_XEVENT XDBHandlerList Type Subprograms

This subprogram group provides an interface for use in conjunction with the `XDBHandlerList` type.

Table 221-4 XDBHandlerList Subprograms

Subprogram	Description
CLEAR Procedure	Clears the handler list
GETFIRST Function	Returns the first handler in the list
GETNAME Function	Returns the next handler in the list
ISNULL Functions	Returns <code>TRUE</code> if input argument is <code>NULL</code>
REMOVE Procedure	Removes the specified handler from the handler list

The [Summary of DBMS_XEVENT Subprograms](#) contains a complete listing of all subprograms in the package.

221.3.4 DBMS_XEVENT XDBHandler Type Subprograms

This subprogram group provides an interface for use in conjunction with the `XDBHandler` type.

Table 221-5 XDBHandler Type Subprograms

Subprogram	Description
GETLANGUAGE Function	Returns the implementation language of the handler

Table 221-5 (Cont.) XDBHandler Type Subprograms

Subprogram	Description
GETSCHEMA Function	Returns the schema of the handler's source
GETSOURCE Function	Returns the name of the Java class, PL/SQL package or object type implementing the handler
ISNULL Functions	Returns <code>TRUE</code> if input argument is <code>NULL</code>

The [Summary of DBMS_XEVENT Subprograms](#) contains a complete listing of all subprograms in the package.

221.3.5 DBMS_XEVENT XDBPath Type Subprograms

This subprogram group provides an interface for use in conjunction with the XDBPath type.

Table 221-6 XDBPath Type Subprograms

Subprogram	Description
GETNAME Function	Returns the string representation of the path
GETPARENTPATH Function	Returns the parent's path
ISNULL Functions	Returns <code>TRUE</code> if input argument is <code>NULL</code>

The [Summary of DBMS_XEVENT Subprograms](#) contains a complete listing of all subprograms in the package.

221.3.6 DBMS_XEVENT XDblink Type Subprograms

This subprogram group provides an interface for use in conjunction with the XDblink type.

Table 221-7 XDblink Type Subprograms

Subprogram	Description
GETCHILDROID Function	Returns the OID of the resource to which the link is pointing
GETPARENTNAME Function	Returns the link's parent folder's name
GETPARENTOID Function	Returns the link's parent folder's OID
ISNULL Functions	Returns <code>TRUE</code> if input argument is <code>NULL</code>

The [Summary of DBMS_XEVENT Subprograms](#) contains a complete listing of all subprograms in the package.

221.4 Summary of DBMS_XEVENT Subprograms

This table lists the DBMS_XEVENT subprograms and briefly describes them.

Table 221-8 DBMS_XEVENT Package Subprograms

Subprogram	Description	Group
CLEAR Procedure	Clears the handler list	XDBHandlerList Type Subprograms
GETAPPLICATIONDATA Function	Returns the <applicationData> element extracted from the resource configuration that defines the invoking handler	XDBRepositoryEvent Type Subprograms
GETCHILDROID Function	Returns the OID of the resource to which the link is pointing	XDBLink Type Subprograms
GETCURRENTUSER Function	Returns the name of the user executing the operation that triggers the event	XDBEvent Type Subprograms
GETEVENT Function	Returns a value identifying the triggering event	XDBEvent Type Subprograms
GETFIRST Function	Returns the first handler in the list	XDBHandlerList Type Subprograms
GETHANDLERLIST Function	Returns an <code>XDBHandlerList</code> object containing the list of handlers that will be executed after the currently executing handler	XDBRepositoryEvent Type Subprograms
GETINTERFACE Function	Returns the top-level interface used to initiate the operation that triggered the event	XDBRepositoryEvent Type Subprograms
GETLANGUAGE Function	Returns the implementation language of the handler	XDBHandler Type Subprograms
GETLINK Function	Returns an <code>XDBLink</code> object for the target resource	XDBRepositoryEvent Type Subprograms
GETLOCK Function	Returns the lock object corresponding to the current operation	XDBRepositoryEvent Type Subprograms
GETNAME Function	Returns the string representation of the path	XDBPath Type Subprograms
GETNAME Function	Returns the next handler in the list	XDBHandlerList Type Subprograms
GETOLDRESOURCE Function	Returns the original <code>XDBResource</code> object before the operation was executed	XDBRepositoryEvent Type Subprograms
GETOPENACCESSMODE Function	Returns the access mode for the open operation	XDBRepositoryEvent Type Subprograms
GETOPENDENYMODE Function	Returns the deny mode for the open operation	XDBRepositoryEvent Type Subprograms
GETOUTPUTSTREAM Function	Returns the output BLOB in which the handler can write the rendered data	XDBRepositoryEvent Type Subprograms
GETPARAMETER Function	Returns the value of a request or session-specific parameter	XDBRepositoryEvent Type Subprograms
GETPARENT Function	Returns the resource object corresponding to a parent folder of the target resource	XDBRepositoryEvent Type Subprograms

Table 221-8 (Cont.) DBMS_XEVENT Package Subprograms

Subprogram	Description	Group
GETPARENTNAME Function	Returns the link's parent folder's name	XDBLink Type Subprograms
GETPARENTOID Function	Returns the link's parent folder's OID	XDBLink Type Subprograms
GETPARENTNAME Function	Returns the parent's path	XDBPath Type Subprograms
GETPATH Function	Returns the <code>XDBPath</code> object representing the path of the resource for which the event was fired	XDBRepositoryEvent Type Subprograms
GETRESOURCE Function	Returns an <code>XDBResource</code> object that provides methods to access and modify the contents and metadata of the target resource	XDBRepositoryEvent Type Subprograms
GETSCHEMA Function	Returns the schema of the handler's source	XDBHandler Type Subprograms
GETSOURCE Function	Returns the name of the Java class, PL/SQL package or object type implementing the handler	XDBHandler Type Subprograms
GETUPDATEBYTECOUNT Function	If the current operation is a byte-range write, returns the byte count	XDBRepositoryEvent Type Subprograms
GETUPDATEBYTEOFFSET Function	If the current operation is a byte-range write, function returns the byte offset at which the range begins	XDBRepositoryEvent Type Subprograms
GETXDBEVENT Function	Converts an <code>XDBRepositoryEvent</code> object to an <code>XDBEvent</code> type	XDBRepositoryEvent Type Subprograms
ISNULL Functions	Returns <code>TRUE</code> if input argument is <code>NULL</code>	XDBEvent Type Subprograms XDBRepositoryEvent Type Subprograms XDBHandlerList Type Subprograms XDBHandler Type Subprograms XDBPath Type Subprograms
REMOVE Procedure	Removes the specified handler from the handler list	XDBHandlerList Type Subprograms
SETRENDERPATH Procedure	Specifies the path of the resource that contains the rendered contents	XDBRepositoryEvent Type Subprograms
SETRENDERSTREAM Procedure	sets the <code>BLOB</code> from which the rendered contents can be read	XDBRepositoryEvent Type Subprograms

221.4.1 CLEAR Procedure

This procedure clears the handler list.



See Also:

[XDBHandlerList Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.CLEAR (
    hl          IN OUT  XDBHandlerList);
```

Parameters

Table 221-9 CLEAR Procedure Parameters

Parameter	Description
hl	Handler list

221.4.2 GETAPPLICATIONDATA Function

This function returns the <applicationData> element extracted from the resource configuration that defines the invoking handler.



See Also:

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETAPPLICATIONDATA (
    ev  IN  XDBRepositoryEvent)
RETURN XMLType;
```

Parameters

Table 221-10 GETAPPLICATIONDATA Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.3 GETCHILDROID Function

This function returns the OID of the resource to which the link is pointing.



See Also:

[XDBLink Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETCHILDROID (  
    link IN XDBLink)  
    RETURN RAW;
```

Parameters

Table 221-11 GETCHILDROID Function Parameters

Parameter	Description
link	Link

221.4.4 GETCURRENTUSER Function

This function returns the name of the user executing the operation that triggers the event.



See Also:

[XDBEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETCURRENTUSER (  
    ev IN XDBEvent)  
    RETURN VARCHAR2;
```

Parameters

Table 221-12 GETCURRENTUSER Function Parameters

Parameter	Description
ev	Event of XDBEvent type

221.4.5 GETEVENT Function

This function returns the name of the user executing the operation that triggers the event.



See Also:

[XDBEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETEVENT (
    ev    IN    XDBEvent)
RETURN XDBEventID;
```

Parameters

Table 221-13 GETEVENT Function Parameters

Parameter	Description
ev	Event of XDBEvent type

221.4.6 GETFIRST Function

This function returns the first handler in the list.



See Also:

[XDBHandlerList Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETFIRST (
    hl    IN    XDBHandlerList)
RETURN XDBHandler;
```

Parameters

Table 221-14 GETFIRST Function Parameters

Parameter	Description
hl	Handler list

221.4.7 GETHANDLERLIST Function

This function returns an `XDBHandlerList` object containing the list of handlers that will be executed after the currently executing handler.

The current handler can then filter out some of the subsequent handlers if necessary, subject to security checks. An insufficient privilege exception is raised if the executing user does not have the required access privilege to any of the resource configuration associating with a handler in the list.



See Also:

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETHANDLERLIST (  
    ev IN XDBRepositoryEvent)  
    RETURN XDBHandlerList;
```

Parameters

Table 221-15 GETHANDLERLIST Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.8 GETINTERFACE Function

This function returns the top-level interface used to initiate the operation that triggered the event. This could be HTTP, FTP or SQL.



See Also:

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETINTERFACE (  
    ev IN XDBRepositoryEvent)  
    RETURN VARCHAR2;
```

Parameters

Table 221-16 GETINTERFACE Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.9 GETLANGUAGE Function

This function returns the implementation language of the handler.

**See Also:**

[XDBHandler Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETLANGUAGE (
    handler IN XDBHandler)
RETURN VARCHAR2;
```

Parameters

Table 221-17 GETLANGUAGE Function Parameters

Parameter	Description
handler	Handler

221.4.10 GETLINK Function

This function returns an `XDBLink` object for the target resource.

For a `link*` or `unlink*` event, this will be the link involved in the operation. For other events, an error is returned. Using this object the handler can access link properties, such as, `ParentName`, `ParentOID`, `ChildOID` and `LinkName`.

**See Also:**

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETLINK (
    ev IN XDBRepositoryEvent)
RETURN XDBLink;
```

Parameters

Table 221-18 GETLINK Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.11 GETLINKNAME Function

This function returns the name of the link.

**See Also:**

[XDBLink Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETLINKNAME (
    link IN XDBLink)
RETURN VARCHAR2;
```

Parameters

Table 221-19 GETLINKNAME Function Parameters

Parameter	Description
link	Link

221.4.12 GETLOCK Function

This function returns the lock object corresponding to the current operation. It is only valid for lock and unlock events.

**See Also:**

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETLOCK (
    ev IN XDBRepositoryEvent)
RETURN XDBLock;
```

Parameters

Table 221-20 GETLOCK Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.13 GETLANGUAGE Function

This function returns the implementation language of the handler.



See Also:

[XDBHandler Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETLANGUAGE (
    handler IN XDBHandler)
RETURN VARCHAR2;
```

Parameters

Table 221-21 GETLANGUAGE Function Parameters

Parameter	Description
handler	Handler

221.4.14 GETNAME Function

This function returns the string representation of the path.



See Also:

[XDBPath Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETNAME (
    path IN XDBPath)
RETURN VARCHAR2;
```

Parameters

Table 221-22 GETNAME Function Parameters

Parameter	Description
path	Path

221.4.15 GETNEXT Function

This function returns the next handler in the list.

**See Also:**

[XDBHandlerList Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETNEXT (
    hl IN XDBHandlerList)
RETURN XDBHandler;
```

Parameters

Table 221-23 GETNEXT Function Parameters

Parameter	Description
hl	Handler list

221.4.16 GETOLDRESOURCE Function

This function returns the original `XDBResource` object before the operation was executed.

This method applies only to update event. For other events, an error is returned. This is a read-only object, and consequently none of the modifier methods will work on this object.

**See Also:**

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETOLDRESOURCE (
    ev IN XDBRepositoryEvent)
RETURN XDBResource;
```

Parameters

Table 221-24 GETOLDRESOURCE Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.17 GETOPENACCESSMODE Function

This function returns the access mode for the open operation.

**See Also:**

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETOPENACCESSMODE (
    ev IN XDBRepositoryEvent)
RETURN PLS_INTEGER;
```

Parameters

Table 221-25 GETOPENACCESSMODE Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

Return Values

- XDBRepositoryEvent.OPEN_ACCESS_READ (value 1)
- XDBRepositoryEvent.OPEN_ACCESS_WRITE (value 2)
- XDBRepositoryEvent.OPEN_ACCESS_READ_WRITE (value 3)

221.4.18 GETOPENDENYMODE Function

This function returns the deny mode for the open operation. It is only valid for the open event.

**See Also:**

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETOPENENYMODE (
    ev IN XDBRepositoryEvent)
RETURN PLS_INTEGER;
```

Parameters**Table 221-26** GETOPENENYMODE Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

Return Values

- XDBRepositoryEvent.OPEN_DENY_NONE (value 0)
- XDBRepositoryEvent.OPEN_DENY_READ (value 1)
- XDBRepositoryEvent.OPEN_DENY_READ_WRITE (value 2)

221.4.19 GETOUTPUTSTREAM Function

This function returns the output BLOB in which the handler can write the rendered data. It is only valid for the render event.

**See Also:**

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETOUTPUTSTREAM (
    ev IN XDBRepositoryEvent)
RETURN BLOB;
```

Parameters**Table 221-27** GETOUTPUTSTREAM Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.20 GETPARAMETER Function

This function returns the value of a request or session-specific parameter. The definition of the `key` parameter can be found in RFC 2616 (HTTP/1.1). They will be mapped to equivalent SQL session parameters (if any).



See Also:

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETPARAMETER (  
    ev    IN    XDBRepositoryEvent,  
    key   IN    VARCHAR2)  
RETURN VARCHAR2;
```

Parameters

Table 221-28 GETPARAMETER Function Parameters

Parameter	Description
<code>ev</code>	Event of XDBRepositoryEvent type
<code>key</code>	Supported parameters: <ul style="list-style-type: none">• ACCEPT• ACCEPT-LANGUAGE• ACCEPT-CHARSET• ACCEPT_ENCODING

221.4.21 GETPARENT Function

This function returns the resource object corresponding to a parent folder of the target resource. Note that this could be any folder that contains a link to the target resource. This is a read-only object, and consequently none of the modifier methods will work on this object. For a `link*` or `unlink*` event, this method returns the link's parent folder.



See Also:

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETPARENT (  
    ev    IN    XDBRepositoryEvent)  
RETURN XDBResource;
```


Parameters

Table 221-29 GETPARENT Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.22 GETPARENTNAME Function

This function returns the link's parent folder's name.



See Also:

[XDBLink Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETPARENTNAME (  
    link IN XDBLink)  
    RETURN VARCHAR2;
```

Parameters

Table 221-30 GETPARENTNAME Function Parameters

Parameter	Description
link	Link

221.4.23 GETPARENTOID Function

This function returns the link's parent folder's OID.



See Also:

[XDBLink Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETPARENTOID (  
    link IN XDBLink)  
    RETURN RAW;
```

Parameters

Table 221-31 GETPARENTOID Function Parameters

Parameter	Description
link	Link

221.4.24 GETPARENTPATH Function

This function returns the parent's path. The level indicates the number of levels up the hierarchy. This value must be greater than zero. Level 1 means the immediate parent. If level exceeds the height of the tree then a `NULL` is returned.

**See Also:**

[XDBPath Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETPARENTPATH (
    path IN XDBPath,
    level IN INTEGER)
RETURN XDBPath;
```

Parameters

Table 221-32 GETPARENTPATH Function Parameters

Parameter	Description
path	Path
level	Number of levels up the hierarchy

221.4.25 GETPATH Function

This function returns the `XDBPath` object representing the path of the resource for which the event was fired. From this object, functions are provided to get the different path segments.

**See Also:**

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETPATH (
    ev IN XDBRepositoryEvent)
RETURN XDBPath;
```

Parameters**Table 221-33** GETPATH Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.26 GETRESOURCE Function

This function returns an `XDBResource` object that provides methods to access and modify the contents and metadata of the target resource. This object reflects any changes made by previous handlers to the resource.

The modifier methods will work only in the pre-create and pre-update event handlers. For a `link*` or `unlink*` event, this method returns the resource that the link is pointing to. For a `create` event, this method returns the resource that is being created.

**See Also:**

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETRESOURCE (
    ev IN XDBRepositoryEvent)
RETURN XDBResource;
```

Parameters**Table 221-34** GETRESOURCE Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.27 GETSCHEMA Function

This function returns the schema of the handler's source.

**See Also:**

[XDBHandler Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETSCHEMA (  
    handler IN XDBHandler)  
    RETURN VARCHAR2;
```

Parameters**Table 221-35 GETSCHEMA Function Parameters**

Parameter	Description
handler	Handler

221.4.28 GETSOURCE Function

This function returns the name of the Java class, PL/SQL package or object type implementing the handler.

**See Also:**

[XDBHandler Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETSOURCE (  
    handler IN XDBHandler)  
    RETURN VARCHAR2;
```

Parameters**Table 221-36 GETSOURCE Function Parameters**

Parameter	Description
handler	Handler

221.4.29 GETUPDATEBYTECOUNT Function

If the current operation is a byte-range write, the `GETUPDATEBYTECOUNT` function returns the byte count. It is only valid for the inconsistent-update event.

**See Also:**

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETUPDATEBYTECOUNT (
  ev IN XDBRepositoryEvent)
RETURN NUMBER;
```

Parameters**Table 221-37** GETUPDATEBYTECOUNT Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.30 GETUPDATEBYTEOFFSET Function

If the current operation is a byte-range write, the `GETUPDATEBYTEOFFSET` function returns the byte offset at which the range begins. It is only valid for the inconsistent-update event.

**See Also:**

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETUPDATEBYTEOFFSET (
  ev IN XDBRepositoryEvent)
RETURN NUMBER;
```

Parameters**Table 221-38** GETUPDATEBYTEOFFSET Function Parameters

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.31 GETXDBEVENT Function

This function converts an `XDBRepositoryEvent` object to an `XDBEvent` type.

**See Also:**

[XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.GETXDBEVENT (
  ev IN XDBRepositoryEvent)
  RETURN XDBEvent;
```

Parameters**Table 221-39 GETXDBEVENT Function Parameters**

Parameter	Description
ev	Event of XDBRepositoryEvent type

221.4.32 ISNULL Functions

This function returns `TRUE` if input argument is `NULL`.

 **See Also:**

- [XDBEvent Type Subprograms](#) for other subprograms in this group
- [XDBRepositoryEvent Type Subprograms](#) for other subprograms in this group
- [XDBHandlerList Type Subprograms](#) for other subprograms in this group
- [XDBHandler Type Subprograms](#) for other subprograms in this group
- [XDBPath Type Subprograms](#) for other subprograms in this group
- [XDBLink Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.ISNULL (
  ev IN XDBEvent)
  RETURN BOOLEAN;
```

```
DBMS_XEVENT.ISNULL (
  ev IN XDBRepositoryEvent)
  RETURN BOOLEAN;
```

```
DBMS_XEVENT.ISNULL (
  hl IN XDBHandlerList)
  RETURN BOOLEAN;
```

```
DBMS_XEVENT.ISNULL (
  handler IN XDBHandler)
  RETURN BOOLEAN;
RETURN BOOLEAN;
```

```
DBMS_XEVENT.ISNULL (
  path IN XDBPath)
  RETURN BOOLEAN;
```

```
DBMS_XEVENT.ISNULL (
    link      IN  XDBLink)
RETURN BOOLEAN;
```

Parameters

Table 221-40 ISNULL Function Parameters

Parameter	Description
ev	Event of specified type
hl	Handler list
handler	Handler
path	Path

221.4.33 REMOVE Procedure

This procedure removes the specified handler from the handler list.



See Also:

[XDBHandlerList Type Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XEVENT.REMOVE (
    hl      IN OUT  XDBHandlerList,
    handler IN      XDBHandler);
```

Parameters

Table 221-41 REMOVE Procedure Parameters

Parameter	Description
hl	Handler list
handler	Handler

221.4.34 SETRENDERPATH Procedure

This procedure specifies the path of the resource that contains the rendered contents.

This should not be called after the stream returned by [GETOUTPUTSTREAM Function](#) is written to or after the [SETRENDERSTREAM Procedure](#) is called; doing so will result in an error. This is only valid for the render event.

Syntax

```
DBMS_XEVENT.SETRENDERPATH (
    ev      IN  XDBRepositoryEvent,
    path    IN  VARCHAR2);
```

Parameters

Table 221-42 SETRENDERPATH Procedure Parameters

Parameter	Description
ev	XDB Repository Event object
path	Path of the resource containing the rendered contents

221.4.35 SETRENDERSTREAM Procedure

This procedure sets the BLOB from which the rendered contents can be read.

This should not be called after the stream returned by GETOUTPUTSTREAM is written to or after SETRENDERPATH is called; doing so will result in an error. This is only valid for the render event.

Syntax

```
DBMS_XEVENT.SETRENDERSTREAM (
    ev    IN    XDBRepositoryEvent,
    istr  IN    BLOB);
```

Parameters

Table 221-43 SETRENDERSTREAM Procedure Parameters

Parameter	Description
ev	XDBRepositoryEvent object
istr	Input stream from which to get the rendered contents

DBMS_XMLDOM

The `DBMS_XMLDOM` package is used to access `XMLType` objects, and implements the Document Object Model (DOM), an application programming interface for HTML and XML documents.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Types](#)
- [Exceptions](#)
- [Subprogram Groups](#)
- [Subprogram Groups](#)
- [Summary of DBMS_XMLDOM Subprograms](#)



See Also:

Oracle XML Developer's Kit Programmer's Guide

222.1 DBMS_XMLDOM Overview

The Document Object Model (DOM) is an application programming interface (API) for HTML and XML documents. It defines the logical structure of documents, and the manner in which they are accessed and manipulated.

In the DOM specification, the term "document" is used in the broad sense. XML is being increasingly used to represent many different kinds of information that may be stored in diverse systems. This information has been traditionally be seen as "data"; nevertheless, XML presents this data as documents, and the `DBMS_XMLDOM` package allows you access to both schema-based and non schema-based documents.



Note:

Read-from and write-to files must be on the server file system.

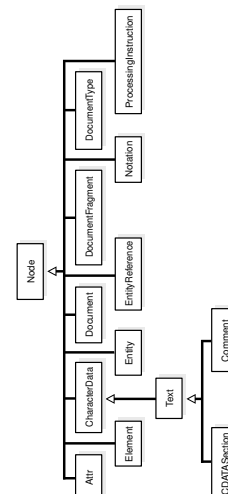
With DOM, anything found in an HTML or XML document can be accessed, changed, deleted, or added using the Document Object Model, with a few exceptions. In particular, the DOM interfaces for the XML internal and external subsets have not yet been specified.

One important objective of the W3C DOM specification is to provide a standard programming interface that can be used in a wide variety of environments, programming languages, and applications. Because the DOM standard is object-oriented while PL/SQL is essentially a procedural language, some changes had to be made:

- Various DOM interfaces such as `Node`, `Element`, and others have equivalent PL/SQL types `DOMNode`, `DOMElement`, respectively.
- Various `DOMException` codes such as `WRONG_DOCUMENT_ERR`, `HIERARCHY_REQUEST_ERR`, and others, have similarly named PL/SQL exceptions.
- Various DOM Node type codes such as `ELEMENT_NODE`, `ATTRIBUTE_NODE`, and others, have similarly named PL/SQL constants.
- Subprograms defined on a DOM type become functions or procedures that accept it as a parameter. For example, to perform [APPENDCHILD Function](#) on a `DOMNode` `n`, the [APPENDCHILD Function](#) PL/SQL function is provided.
- To perform `setAttribute` on a `DOMElement` `elem` [SETATTRIBUTE Procedures](#), use PL/SQL procedure .

DOM defines an inheritance hierarchy. For example, `Document`, `Element`, and `Attr` are defined to be subtypes of `Node` (see [Figure 222-1](#)). Thus, a method defined in the `Node` interface should be available in these as well. Since such inheritance is not supported in PL/SQL, it is implemented through direct invocation of the `MAKENODE` function. Calling `MAKENODE` on various DOM types converts these types into a `DOMNode`. The appropriate functions or procedures that accept `DOMNodes` can then be called to operate on these types. If, subsequently, type specific functionality is desired, the `DOMNode` can be converted back into the original type by the `makeXXX` functions, where `DOMXXX` is the desired DOM type.

Figure 222-1 Inheritance Diagram for DOM Types



The implementation of this interface follows the REC-DOM-Level-1-19981001.

222.2 DBMS_XMLDOM Security Model

Owned by XDB, the DBMS_XMLDOM package must be created by SYS or XDB. The EXECUTE privilege is granted to PUBLIC.

Subprograms in this package are executed using the privileges of the current user.

222.3 DBMS_XMLDOM Constants

The DBMS_XMLDOM package defines several constants that can be used for specifying parameter values.

These constants are listed in the following table.

Table 222-1 Defined Constants for DBMS_XMLDOM

Constant	Type	Value	Description
ELEMENT_NODE	PLS_INTEGER	1	The Node is an Element.
ATTRIBUTE_NODE	PLS_INTEGER	2	The Node is an Attribute.
TEXT_NODE	PLS_INTEGER	3	The Node is a Text node.
CDATA_SECTION_NODE	PLS_INTEGER	4	The Node is a CDATASection.
ENTITY_REFERENCE_NODE	PLS_INTEGER	5	The Node is an Entity Reference.
ENTITY_NODE	PLS_INTEGER	6	The Node is an Entity.
PROCESSING_INSTRUCTION_NODE	PLS_INTEGER	7	The Node is a Processing Instruction.
COMMENT_NODE	PLS_INTEGER	8	The Node is a Comment.
DOCUMENT_NODE	PLS_INTEGER	9	The Node is a Document.
DOCUMENT_TYPE_NODE	PLS_INTEGER	10	The Node is a Document Type Definition.
DOCUMENT_FRAGMENT_NODE	PLS_INTEGER	11	The Node is a Document fragment.
NOTATION_NODE	PLS_INTEGER	12	The Node is a Notation.

222.4 DBMS_XMLDOM Types

This table lists and briefly describes the types for the DBMS_XMLDOM, DOMTYPE package.

Table 222-2 XDB_XMLDOM Types

Type	Description
DOMATTR	Implements the DOM Attribute interface.
DOMCDATASECTION	Implements the DOM CDATASection interface.
DOMCHARACTERDATA	Implements the DOM Character Data interface.
DOMCOMMENT	Implements the DOM Comment interface.

Table 222-2 (Cont.) XDB_XMLDOM Types

Type	Description
DOMDOCUMENT	Implements the DOM Document interface.
DOMDOCUMENTFRAGMENT	Implements the DOM DocumentFragment interface.
DOMDOCUMENTTYPE	Implements the DOM Document Type interface.
DOMELEMENT	Implements the DOM Element interface.
DOMENTITY	Implements the DOM Entity interface.
DOMENTITYREFERENCE	Implements the DOM EntityReference interface.
DOMIMPLEMENTATION	Implements the DOM Implementation interface.
DOMNAMEDNODEMAP	Implements the DOM Named Node Map interface.
DOMNODE	Implements the DOM Node interface.
DOMNODELIST	Implements the DOM NodeList interface.
DOMNOTATION	Implements the DOM Notation interface.
DOMPROCESSINGINSTRUCTION	Implements the DOM Processing instruction interface.
DOMTEXT	Implements the DOM Text interface.

222.5 DBMS_XMLDOM Exceptions

DBMS_XMLDOM generates an exception when it encounters an issue.

This table lists the exceptions defined for DBMS_XMLDOM:

Table 222-3 Exceptions for DBMS_XMLDOM

Exception	Description
DOMSTRING_SIZE_ERR	If the specified range of text does not fit into a DOMString.
HIERARCHY_REQUEST_ERR	If any node is inserted somewhere it doesn't belong.
INDEX_SIZE_ERR	If index or size is negative, or greater than the allowed value.
INUSE_ATTRIBUTE_ERR	If an attempt is made to add an attribute that is already in use elsewhere.
INVALID_CHARACTER_ERR	If an invalid or illegal character is specified, such as in a name. See production 2 in the XML specification for the definition of a legal character, and production 5 for the definition of a legal name character.
NO_DATA_ALLOWED_ERROR	If data is specified for a node that does not support data.
NOT_FOUND_ERR	If an attempt is made to reference a node in a context where it does not exist.
NO_MODIFICATION_ALLOWED_ERR	If an attempt is made to modify an object where modifications are not allowed.
NOT_SUPPORTED_ERR	If the implementation does not support the requested type of object or operation.
WRONG_DOCUMENT_ERR	If a node is used in a different document than the one that created it (that doesn't support it).

222.6 DBMS_XMLDOM Subprogram Groups

DBMS_XMLDOM subprograms are divided into groups according to W3C Interfaces.

- [DOMNode Subprograms](#)
- [DOMAttr Subprograms](#)
- [DOMCDATASection Subprograms](#)
- [DOMCharacterData Subprograms](#)
- [DOMComment Subprograms](#)
- [DOMDocument Subprograms](#)
- [DOMDocumentFragment Subprograms](#)
- [DOMDocumentType Subprograms](#)
- [DOMElement Subprograms](#)
- [DOMEntity Subprograms](#)
- [DOMEntityReference Subprograms](#)
- [DOMImplementation Subprograms](#)
- [DOMNamedNodeMap Subprograms](#)
- [DOMNodeList Subprograms](#)
- [DOMNotation Subprograms](#)
- [DOMProcessingInstruction Subprograms](#)
- [DOMText Subprograms](#)

222.6.1 DBMS_XMLDOM DOMNode Subprograms

This table lists and briefly describes the `DOMNode` subprograms of `DBMS_XMLDOM`.

Table 222-4 Summary of DOMNode Subprograms; DBMS_XMLDOM

Subprogram	Description
ADOPTNODE Function	Adopts a node from another document
APPENDCHILD Function	Appends a new child to the node
CLONENODE Function	Clones the node
FREENODE Procedure	Frees all resources associated with the node
GETATTRIBUTES Function	Retrieves the attributes of the node
GETCHILDNODES Function	Retrieves the children of the node
GETEXPANDEDNAME Procedure and Functions	Retrieves the expanded name of the node
GETFIRSTCHILD Function	Retrieves the first child of the node
GETLASTCHILD Function	Retrieves the last child of the node
GETLOCALNAME Procedure and Functions	Retrieves the local part of the qualified name
GETNAMESPACE Procedure and Functions	Retrieves the node's namespace URI

Table 222-4 (Cont.) Summary of DOMNode Subprograms; DBMS_XMLDOM

Subprogram	Description
GETNEXTSIBLING Function	Retrieves the next sibling of the node
GETNODENAME Function	Retrieves the Name of the Node
GETNODETYPE Function	Retrieves the Type of the node
GETNODEVALUE Function	Retrieves the Value of the Node
GETNODEVALUEASBINARYSTREAM Function & Procedure	Retrieves Node Value as binary stream
GETNODEVALUEASCHARACTERSTREAM Function & Procedure	Retrieves Node Value as character stream
GETOWNERDOCUMENT Function	Retrieves the owner document of the node
GETPARENTNODE Function	Retrieves the parent of this node
GETPREFIX Function	Retrieves the namespace prefix
GETPREVIOUSIBLING Function	Retrieves the previous sibling of the node
GETSCHEMANODE Function	Retrieves the associated schema URI
HASATTRIBUTES Function	Tests if the node has attributes
HASCHILDNODES Function	Tests if the node has child nodes
IMPORTNODE Function	Imports a node from another document
INSERTBEFORE Function	Inserts a child before the reference child
ISNULL Functions	Tests if the node is NULL
MAKEATTR Function	Casts the node to an Attribute
MAKECDATASECTION Function	Casts the node to a CData Section
MAKECHARACTERDATA Function	Casts the node to Character Data
MAKECOMMENT Function	Casts the node to a Comment
MAKEDOCUMENT Function	Casts the node to a DOM Document
MAKEDOCUMENTFRAGMENT Function	Casts the node to a DOM Document Fragment
MAKEDOCUMENTTYPE Function	Casts the node to a DOM Document Type
MAKEELEMENT Function	Casts the node to a DOM Element
MAKEENTITY Function	Casts the node to a DOM Entity
MAKEENTITYREFERENCE Function	Casts the node to a DOM Entity Reference
MAKENOTATION Function	Casts the node to a DOM Notation
MAKEPROCESSINGINSTRUCTION Function	Casts the node to a DOM Processing Instruction
MAKETEXT Function	Casts the node to a DOM Text
REMOVECHILD Function	Removes a specified child from a node
REPLACECHILD Function	Replaces the old child with a new child
SETNODEVALUE Procedure	Sets the Value of the node
SETNODEVALUEASBINARYSTREAM Function & Procedure	Sets the Node Value as binary stream
SETNODEVALUEASCHARACTERSTREAM Function & Procedure	Sets the Node Value as a character stream
SETPREFIX Procedure	Sets the namespace prefix

Table 222-4 (Cont.) Summary of DOMNode Subprograms; DBMS_XMLDOM

Subprogram	Description
USEBINARYSTREAM Function	Establishes that the stream is valid
WRITETOBUFFER Procedures	Writes the contents of the node to a buffer
WRITETOCLOB Procedures	Writes the contents of the node to a CLOB
WRITETOFILE Procedures	Writes the contents of the node to a file

222.6.2 DBMS_XMLDOM DOMAttr Subprograms

This table lists the DOMAttr subprograms of DBMS_XMLDOM in alphabetical order and briefly describes them.

Table 222-5 Summary of DOMAttr Subprograms; DBMS_XMLDOM

Method	Description
GETEXPANDEDNAME Procedure and Functions	Retrieves the expanded name of the attribute
GETLOCALNAME Procedure and Functions	Retrieves the local name of the attribute
GETNAME Functions	Retrieves the name of the attribute
GETNAMESPACE Procedure and Functions	Retrieves the NS URI of the attribute
GETOWNERELEMENT Function	Retrieves the Element node, parent of the attribute
GETQUALIFIEDNAME Functions	Retrieves the Qualified Name of the attribute
GETSPECIFIED Function	Tests if attribute was specified in the element
GETVALUE Function	Retrieves the value of the attribute
ISNULL Functions	Tests if the Attribute node is NULL
MAKENODE Functions	Casts the Attribute to a node
SETVALUE Procedure	Sets the value of the attribute

222.6.3 DBMS_XMLDOM DOMCDataSection Subprograms

This table lists the DOMCdata subprograms of DBMS_XMLDOM in alphabetical order and briefly describes them.

Table 222-6 Summary of DOMCdata Subprograms; DBMS_XMLDOM

Method	Description
ISNULL Functions	Tests if the CDataSection is NULL
MAKENODE Functions	Casts the CDataSection to a node

222.6.4 DBMS_XMLDOM DOMCharacterData Subprograms

This table lists the DOMCharacterData subprograms of DBMS_XMLDOM in alphabetical order and briefly describes them.

Table 222-7 Summary of DOMCharacterData Subprograms; DBMS_XMLDOM

Method	Description
APPENDDATA Procedure	Appends the specified data to the node data
DELETEDATA Procedure	Deletes the data from the specified offSets
GETDATA Functions	Retrieves the data of the node
GETLENGTH Functions	Retrieves the length of the data
INSERTDATA Procedure	Inserts the data in the node at the specified offSets
ISNULL Functions	Tests if the CharacterData is NULL
MAKENODE Functions	Casts the CharacterData to a node
REPLACEDATA Procedure	Changes a range of characters in the node
SETDATA Procedures	Sets the data to the node
SUBSTRINGDATA Function	Retrieves the substring of the data

222.6.5 DBMS_XMLDOM DOMComment Subprograms

The table lists the DOMComment subprograms of DBMS_XMLDOM in alphabetical order and briefly describes them.

Table 222-8 Summary of DOMComment Subprograms; DBMS_XMLDOM

Method	Description
ISNULL Functions	Tests if the comment is NULL
MAKENODE Functions	Casts the Comment to a node

222.6.6 DBMS_XMLDOM DOMDocument Subprograms

This table lists the DOMDocument subprograms of DBMS_XMLDOM in alphabetical order and briefly describes them.

Table 222-9 Summary of DOMDocument Subprograms; DBMS_XMLDOM

Method	Description
CREATEATTRIBUTE Functions	Creates an Attribute
CREATECDATASECTION Function	Creates a CDataSection node
CREATECOMMENT Function	Creates a Comment node
CREATEDOCUMENT Function	Creates a new Document
CREATEDOCUMENTFRAGMENT Function	Creates a new Document Fragment
CREATEELEMENT Functions	Creates a new Element

**Table 222-9 (Cont.) Summary of DOMDocument Subprograms;
DBMS_XMLDOM**

Method	Description
CREATEENTITYREFERENCE Function	Creates an Entity reference
CREATEPROCESSINGINSTRUCTION Function	Creates a Processing Instruction
CREATETEXTNODE Function	Creates a Text node
FREEDOCFRAG Procedure	Frees the document fragment
FREEDOCUMENT Procedure	Frees the document
GETCHARSET Function	Retrieves the character set of the DOM document
GETDOCTYPE Function	Retrieves the DTD of the document
GETDOCUMENTELEMENT Function	Retrieves the root element of the document
GETELEMENTSBYTAGNAME Functions	Retrieves <ul style="list-style-type: none"> the elements in the DOMNODELIST by tag name elements in the subtree of a DOMNODELIST by tagname
GETIMPLEMENTATION Function	Retrieves the DOM implementation
GETSTANDALONE Function	Retrieves the standalone property of the document
GETVERSION Function	Retrieves the version of the document
GETXMLTYPE Function	Retrieves the XMLType associated with the DOM Document
ISNULL Functions	Tests if the document is NULL
MAKENODE Functions	Casts the document to a node
NEWDOMDOCUMENT Functions	Creates a new document
SETCHARSET Procedure	Sets the character set of the DOM document
SETDOCTYPE Procedure	Sets the DTD of the document
SETSTANDALONE Procedure	Sets the standalone property of the document
SETVERSION Procedure	Sets the version of the document
WRITETOBUFFER Procedures	Writes the document to a buffer
WRITETOCLOB Procedures	Writes the document to a CLOB
WRITETOFILE Procedures	Writes the document to a file

222.6.7 DBMS_XMLDOM DOMDocumentFragment Subprograms

This table lists the DOMDocumentFragment subprograms of DBMS_XMLDOM in alphabetical order and briefly describes them.

**Table 222-10 Summary of DOMDocumentFragment Subprograms;
DBMS_XMLDOM**

Method	Description
FREEDOCFRAG Procedure	Frees the specified document fragment
ISNULL Functions	Tests if the DocumentFragment is <code>NULL</code>
MAKENODE Functions	Casts the Document Fragment to a node
WRITETOBUFFER Procedures	Writes the contents of a document fragment into a buffer

222.6.8 DBMS_XMLDOM DOMDocumentType Subprograms

This table lists the DOMDocumentType subprograms of DBMS_XMLDOM in alphabetical order and briefly describes them.

Table 222-11 Summary of DOMDocumentType Subprograms; DBMS_XMLDOM

Method	Description
FINDENTITY Function	Finds the specified entity in the document type
FINDNOTATION Function	Finds the specified notation in the document type
GETENTITIES Function	Retrieves the nodemap of entities in the Document type
GETNAME Functions	Retrieves the name of the Document type
GETNOTATIONS Function	Retrieves the nodemap of the notations in the Document type
GETPUBLICID Functions	Retrieves the public ID of the document type
GETSYSTEMID Functions	Retrieves the system ID of the document type
ISNULL Functions	Tests if the Document Type is <code>NULL</code>
MAKENODE Functions	Casts the document type to a node

222.6.9 DBMS_XMLDOM DOMEElement Subprograms

This table lists the DOMEElement subprograms of DBMS_XMLDOM in alphabetical order and briefly describes them.

Table 222-12 Summary of DOMEElement Subprograms; DBMS_XMLDOM

Method	Description
FREEELEMENT Procedure	Frees memory allocated to a DOMEElement handle
GETATTRIBUTE Functions	Retrieves the attribute node by name
GETATTRIBUTENODE Functions	Retrieves the attribute node by name
GETCHILDRENBYTAGNAME Functions	Retrieves children of the element by tag name

Table 222-12 (Cont.) Summary of DOMElement Subprograms; DBMS_XMLDOM

Method	Description
GETELEMENTSBYTAGNAME Functions	Retrieves <ul style="list-style-type: none"> the elements in the DOMNODELIST by tag name elements in the subtree of a DOMNODELIST by tagname
GETEXPANDEDNAME Procedure and Functions	Retrieves the expanded name of the element
GETLOCALNAME Procedure and Functions	Retrieves the local name of the element
GETNAMESPACE Procedure and Functions	Retrieves the NS URI of the element
GETQUALIFIEDNAME Functions	Retrieves the qualified name of the element
GETTAGNAME Function	Retrieves the Tag name of the element
HASATTRIBUTE Functions	Tests if an attribute exists
ISNULL Functions	Tests if the Element is NULL
MAKENODE Functions	Casts the Element to a node
NORMALIZE Procedure	Normalizes the text children of the element
REMOVEATTRIBUTE Procedures	Removes the attribute specified by the name
REMOVEATTRIBUTENODE Function	Removes the attribute node in the element
RESOLVENAMESPACEPREFIX Function	Resolve the prefix to a namespace URI
SETATTRIBUTE Procedures	Sets the attribute specified by the name
SETATTRIBUTENODE Functions	Sets the attribute node in the element

222.6.10 DBMS_XMLDOM DOMEntity Subprograms

This table lists and briefly describes the `DOMEntity` subprograms of `DBMS_XMLDOM`.

Table 222-13 Summary of DOMEntity Subprograms; DBMS_XMLDOM

Method	Description
GETNOTATIONNAME Function	Retrieves the notation name of the entity
GETPUBLICID Functions	Retrieves the public Id of the entity
GETSYSTEMID Functions	Retrieves the system Id of the entity
ISNULL Functions	Tests if the Entity is NULL
MAKENODE Functions	Casts the Entity to a node

222.6.11 DBMS_XMLDOM DOMEntityReference Subprograms

This table lists and briefly describes the `DOMEntityReference` subprograms of `DBMS_XMLDOM`.

Table 222-14 Summary of DOMEntityReference Subprograms; DBMS_XMLDOM

Method	Description
ISNULL Functions	Tests if the <code>DOMEntityReference</code> is NULL
MAKENODE Functions	Casts the <code>DOMEntityReference</code> to NULL

222.6.12 DBMS_XMLDOM DOMImplementation Subprograms

This table lists and briefly describes the `DOMImplementation` subprograms of `DBMS_XMLDOM`.

Table 222-15 Summary of DOMImplementation Subprograms; DBMS_XMLDOM

Method	Description
ISNULL Functions	Tests if the <code>DOMImplementation</code> node is NULL
HASFEATURE Function	Tests if the <code>DOMImplementation</code> implements a feature

222.6.13 DBMS_XMLDOM DOMNamedNodeMap Subprograms

This table lists and briefly describes the `DOMNamedNodeMap` subprograms of `DBMS_XMLDOM`.

Table 222-16 Summary of DOMNamedNodeMap Subprograms; DBMS_XMLDOM

Method	Description
GETLENGTH Functions	Retrieves the number of items in the map
GETNAMEDITEM Function	Retrieves the item specified by the name
ISNULL Functions	Tests if the <code>NamedNodeMap</code> is NULL
ITEM Functions	Retrieves the item given the index in the map
REMOVENAMEDITEM Function	Removes the item specified by name
SETNAMEDITEM Function	Sets the item in the map specified by the name

222.6.14 DBMS_XMLDOM DOMNodeList Subprograms

This table lists and briefly describes the `DOMNodeList` subprograms of `DBMS_XMLDOM`.

Table 222-17 Summary of DOMNodeList Subprograms; DBMS_XMLDOM

Method	Description
FREENODELIST Procedure	Frees all resources associated with a nodelist
GETLENGTH Functions	Retrieves the number of items in the list
ISNULL Functions	Tests if the <code>NodeList</code> is NULL
ITEM Functions	Retrieves the item given the index in the list

222.6.15 DBMS_XMLDOM DOMNotation Subprograms

This table lists and briefly describes the `DOMNotation` subprograms of `DBMS_XMLDOM`.

Table 222-18 Summary of DOMNotation Subprograms; DBMS_XMLDOM

Method	Description
GETPUBLICID Functions	Retrieves the public Id of the notation
GETSYSTEMID Functions	Retrieves the system Id of the notation
ISNULL Functions	Tests if the Notation is <code>NULL</code>
MAKENODE Functions	Casts the notation to a node

222.6.16 DBMS_XMLDOM DOMProcessingInstruction Subprograms

This table lists and briefly describes the `DOMProcessingInstruction` subprograms of `DBMS_XMLDOM`.

Table 222-19 Summary of DOMProcessingInstruction Subprograms; DBMS_XMLDOM

Method	Description
GETDATA Functions	Retrieves the data of the processing instruction
GETTARGET Function	Retrieves the target of the processing instruction
ISNULL Functions	Tests if the Processing Instruction is <code>NULL</code>
MAKENODE Functions	Casts the Processing Instruction to a node
SETDATA Procedures	Sets the data of the processing instruction

222.6.17 DBMS_XMLDOM DOMText Subprograms

This table lists and briefly describes the `DOMText` subprograms of `DBMS_XMLDOM`.

Table 222-20 Summary of DOMText Subprograms; DBMS_XMLDOM

Method	Description
ISNULL Functions	Tests if the text is <code>NULL</code>
MAKENODE Functions	Casts the text to a node
SPLITTEXT Function	Splits the contents of the text node into 2 text nodes

222.7 Summary of DBMS_XMLDOM Subprograms

This table lists the `DBMS_XMLDOM` subprograms and briefly describes them.

Table 222-21 Summary of DBMS_XMLDOM Package Subprogram

Subprogram	Description	Group
ADOPTNODE Function	Adopts a node from another document	DOMNode Subprograms
APPENDCHILD Function	Appends a new child to the node	DOMNode Subprograms
APPENDDATA Procedure	Appends the specified data to the node data	DOMCharacterData Subprograms
CLONENODE Function	Clones the node	DOMNode Subprograms
CREATEATTRIBUTE Functions	Creates an Attribute	DOMDocument Subprograms
CREATECDATASECTION Function	Creates a <code>CDataSection</code> node	DOMDocument Subprograms
CREATECOMMENT Function	Creates a Comment node	DOMDocument Subprograms
CREATEDOCUMENT Function	Creates a new Document	DOMDocument Subprograms
CREATEDOCUMENTFRAGMENT Function	Creates a new Document Fragment	DOMDocument Subprograms
CREATEELEMENT Functions	Creates a new Element	DOMDocument Subprograms
CREATEENTITYREFERENCE Function	Creates an Entity reference	DOMDocument Subprograms
CREATEPROCESSINGINSTRUCTION Function	Creates a Processing Instruction	DOMDocument Subprograms
CREATETEXTNODE Function	Creates a Text node	DOMDocument Subprograms
DELETEDATA Procedure	Deletes the data from the specified <code>offsets</code>	DOMCharacterData Subprograms
FINDENTITY Function	Finds the specified entity in the document type	DOMDocumentType Subprograms
FINDNOTATION Function	Finds the specified notation in the document type	DOMDocumentType Subprograms
FREEDOCFRAG Procedure	Frees the document fragment	DOMDocument Subprograms and DOMDocumentFragment Subprograms
FREEDOCUMENT Procedure	Frees the document	DOMDocument Subprograms
FREEELEMENT Procedure	Frees memory allocated to a <code>DOMElement</code> handle	DOMElement Subprograms
FREENODE Procedure	Frees all resources associated with the node	DOMNode Subprograms
FREENODELIST Procedure	Frees all resources associated with a nodelist	DOMNodeList Subprograms
GETATTRIBUTE Functions	Retrieves the attribute node by name	DOMElement Subprograms
GETATTRIBUTENODE Functions	Retrieves the attribute node by name	DOMElement Subprograms

Table 222-21 (Cont.) Summary of DBMS_XMLDOM Package Subprogram

Subprogram	Description	Group
GETATTRIBUTES Function	Retrieves the attributes of the node	DOMNode Subprograms
GETCHARSET Function	Retrieves the character set of the DOM document	DOMDocument Subprograms
GETCHILDNODES Function	Retrieves the children of the node	DOMNode Subprograms
GETCHILDRENBYTAGNAME Functions	Retrieves children of the element by tag name	DOMCharacterData Subprograms
GETDATA Functions	Retrieves <ul style="list-style-type: none"> the data of the node the data of the processing instruction 	<ul style="list-style-type: none"> DOMCharacterData Subprograms DOMProcessingInstruction Subprograms
GETDOCTYPE Function	Retrieves the DTD of the document	DOMDocument Subprograms
GETDOCUMENTELEMENT Function	Retrieves the root element of the document	DOMDocument Subprograms
GETELEMENTSBYTAGNAME Functions	Retrieves <ul style="list-style-type: none"> the elements in the DOMNODELIST by tag name elements in the subtree of a DOMNODELIST by tagname 	<ul style="list-style-type: none"> DOMDocument Subprograms DOMElement Subprograms
GETENTITIES Function	Retrieves the nodemap of entities in the Document type	DOMDocumentType Subprograms
GETEXPANDEDNAME Procedure and Functions	Retrieves <ul style="list-style-type: none"> the expanded name of the node the expanded name of the attribute the expanded name of the element 	<ul style="list-style-type: none"> DOMNode Subprograms DOMAttr Subprograms DOMElement Subprograms
GETFIRSTCHILD Function	Retrieves the first child of the node	DOMNode Subprograms
GETIMPLEMENTATION Function	Retrieves the DOM implementation	DOMDocument Subprograms
GETLASTCHILD Function	Retrieves the last child of the node	DOMNode Subprograms
GETLENGTH Functions	Retrieves <ul style="list-style-type: none"> the length of the data the number of items in the map the number of items in the list 	<ul style="list-style-type: none"> DOMCharacterData Subprograms DOMNamedNodeMap Subprograms DOMNodeList Subprograms

Table 222-21 (Cont.) Summary of DBMS_XMLDOM Package Subprogram

Subprogram	Description	Group
GETLOCALNAME Procedure and Functions	Retrieves <ul style="list-style-type: none"> the local part of the qualified name the local name of the attribute the local name of the element 	<ul style="list-style-type: none"> DOMNode Subprograms DOMAttr Subprograms DOMElement Subprograms
GETNAME Functions	Retrieves <ul style="list-style-type: none"> the name of the attribute the name of the Document type 	<ul style="list-style-type: none"> DOMAttr Subprograms DOMDocumentType Subprograms
GETNAMEDITEM Function	Retrieves <ul style="list-style-type: none"> an item specified by name and namespace URI) 	<ul style="list-style-type: none"> DOMNamedNodeMap Subprograms DOMNamedNodeMap Subprograms
GETNAMESPACE Procedure and Functions	Retrieves <ul style="list-style-type: none"> the node's namespace URI the NS URI of the attribute the NS URI of the element 	<ul style="list-style-type: none"> DOMNode Subprograms DOMAttr Subprograms DOMElement Subprograms
GETNEXTSIBLING Function	Retrieves the next sibling of the node	DOMNode Subprograms
GETNODENAME Function	Retrieves the Name of the Node	DOMNode Subprograms
GETNODETYPE Function	Retrieves the Type of the node	DOMNode Subprograms
GETNODEVALUE Function	Retrieves the Value of the Node	DOMNode Subprograms
GETNODEVALUEASBINARYSTREAM Function & Procedure	Retrieves the Node Value as binary stream	DOMNode Subprograms
GETNODEVALUEASCHARACTERSTREAM Function & Procedure	Retrieves the Node Value as character stream	DOMNode Subprograms
GETNOTATIONNAME Function	Retrieves the notation name of the entity	DOMEntity Subprograms
GETNOTATIONS Function	Retrieves the nodemap of the notations in the Document type	DOMDocumentType Subprograms
GETTARGET Function	Retrieves the target of the processing instruction	DOMProcessingInstruction Subprograms
GETOWNERDOCUMENT Function	Retrieves the owner document of the node	DOMNode Subprograms
GETOWNERELEMENT Function	Retrieves the Element node, parent of the attribute	DOMAttr Subprograms
GETPARENTNODE Function	Retrieves the parent of this node	DOMNode Subprograms
GETPREFIX Function	Retrieves the namespace prefix)	DOMNode Subprograms
GETPREVIOUSIBLING Function	Retrieves the previous sibling of the node	DOMNode Subprograms

Table 222-21 (Cont.) Summary of DBMS_XMLDOM Package Subprogram

Subprogram	Description	Group
GETPUBLICID Functions	Retrieves <ul style="list-style-type: none"> the public ID of the document type the public Id of the entity the public Id of the notation 	<ul style="list-style-type: none"> DOMDocumentType Subprograms DOMEntity Subprograms DOMNotation Subprograms
GETQUALIFIEDNAME Functions	Retrieves <ul style="list-style-type: none"> the Qualified Name of the attribute the qualified name of the element 	<ul style="list-style-type: none"> DOMAttr Subprograms DOMElement Subprograms
GETSCHEMANODE Function	Retrieves the associated schema URI	DOMNode Subprograms
GETSPECIFIED Function	Tests if attribute was specified in the element.	DOMAttr Subprograms
GETSTANDALONE Function	Retrieves the standalone property of the document	DOMDocument Subprograms
GETSYSTEMID Functions	Retrieves <ul style="list-style-type: none"> the system ID of the document type the system Id of the entity the system Id of the notation 	<ul style="list-style-type: none"> DOMDocumentType Subprograms DOMEntity Subprograms DOMNotation Subprograms
GETTAGNAME Function	Retrieves the Tag name of the element	DOMElement Subprograms
GETVALUE Function	Retrieves the value of the attribute	DOMAttr Subprograms
GETVERSION Function	Retrieves the version of the document	DOMDocument Subprograms)
GETXMLTYPE Function	Retrieves the XMLType associated with the DOM Document	DOMDocument Subprograms
HASATTRIBUTES Function	Tests if the node has attributes	DOMNode Subprograms
HASATTRIBUTE Functions	Tests if an attribute exists	DOMElement Subprograms
HASCHILDNODES Function	Tests if the node has child nodes	DOMNode Subprograms
HASFEATURE Function	Tests if the DOMImplementation implements a feature	DOMImplementation Subprograms
IMPORTNODE Function	Imports a node from another document	DOMNode Subprograms
INSERTBEFORE Function	Inserts a child before the reference child	DOMNode Subprograms
INSERTDATA Procedure	Inserts the data in the node at the specified offSets	DOMCharacterData Subprograms

Table 222-21 (Cont.) Summary of DBMS_XMLDOM Package Subprogram

Subprogram	Description	Group
ISNULL Functions	Tests <ul style="list-style-type: none"> • if the node is NULL • if the Attribute node is NULL • if the CDataSection is NULL • if the CharacterData is NULL • if the comment is NULL • if the document is NULL • if the DocumentFragment is NULL • if the Document Type is NULL • if the Element is NULL • if the Entity is NULL • if the DOMEntityReference is NULL • if the DOMImplementation node is NULL • if the NamedNodeMap is NULL • if the NodeList is NULL • if the Notation is NULL • if the Processing Instruction is NULL • if the text is NULL 	<ul style="list-style-type: none"> • DOMNode Subprograms • DOMAttr Subprograms • DOMCDataSection Subprograms • DOMCharacterData Subprograms • DOMComment Subprograms • DOMDocument Subprograms • DOMDocumentFragment Subprograms • DOMDocumentType Subprograms • DOMELEMENT Subprograms • DOMEntity Subprograms • DOMEntityReference Subprograms • DOMImplementation Subprograms • DOMNamedNodeMap Subprograms • DOMNodeList Subprograms • DOMNotation Subprograms • DOMProcessingInstruction Subprograms • DOMText Subprograms
ITEM Functions	Retrieves <ul style="list-style-type: none"> • the item given the index in the map • the item given the index in the NodeList 	<ul style="list-style-type: none"> • DOMNamedNodeMap Subprograms • DOMNodeList Subprograms
MAKEATTR Function	Casts the node to an Attribute	DOMNode Subprograms
MAKECDATASECTION Function	Casts the node to a CData Section	DOMNode Subprograms
MAKECHARACTERDATA Function	Casts the node to Character Data	DOMNode Subprograms
MAKECOMMENT Function	Casts the node to a Comment	DOMNode Subprograms
MAKEDOCUMENT Function	Casts the node to a DOM Document	DOMNode Subprograms
MAKEDOCUMENTFRAGMENT Function	Casts the node to a DOM Document Fragment	DOMNode Subprograms)

Table 222-21 (Cont.) Summary of DBMS_XMLDOM Package Subprogram

Subprogram	Description	Group
MAKEDOCUMENTTYPE Function	Casts the node to a DOM Document Type	DOMNode Subprograms
MAKEELEMENT Function	Casts the node to a DOM Element	DOMNode Subprograms
MAKEENTITY Function	Casts the node to a DOM Entity	DOMNode Subprograms
MAKEENTITYREFERENCE Function	Casts the node to a DOM Entity Reference	DOMNode Subprograms
MAKENODE Functions	Casts <ul style="list-style-type: none"> • the Attribute to a node • the CDatasection to a node • the CharacterData to a node • the Comment to a node • the document to a node • the Document Fragment to a node • the document type to a node • the Element to a node • the Entity to a node • • the DOMEntityReference to NULL • the notation to a node • the Processing Instruction to a node • the text to a node 	<ul style="list-style-type: none"> • DOMAttr Subprograms • DOMCDataSection Subprograms • DOMCharacterData Subprograms • DOMComment Subprograms • DOMDocument Subprograms • DOMDocumentFragment Subprograms • DOMDocumentType Subprograms • DOMElement Subprograms • DOMEntity Subprograms • DOMEntityReference Subprograms • DOMNotation Subprograms • DOMProcessingInstruction Subprograms • DOMText Subprograms
MAKENOTATION Function	Casts the node to a DOM Notation	DOMNode Subprograms
MAKEPROCESSINGINSTRUCTION Function	Casts the node to a DOM Processing Instruction	DOMNode Subprograms
MAKETEXT Function	Casts the node to a DOM Text	DOMNode Subprograms
NEWDOMDOCUMENT Functions	Creates a new document	DOMDocument Subprograms
NORMALIZE Procedure	Normalizes the text children of the element	DOMElement Subprograms
REMOVEATTRIBUTE Procedures	Removes the attribute specified by the name	DOMElement Subprograms
REMOVEATTRIBUTENODE Function	Removes the attribute node in the element	DOMElement Subprograms
REMOVECHILD Function	Removes a specified child from a node	DOMNode Subprograms

Table 222-21 (Cont.) Summary of DBMS_XMLDOM Package Subprogram

Subprogram	Description	Group
REMOVENAMEITEM Function	Removes the item specified by name	DOMNamedNodeMap Subprograms
REPLACECHILD Function	Replaces the old child with a new child	DOMNode Subprograms
REPLACEDATA Procedure	Changes a range of characters in the node	DOMCharacterData Subprograms
RESOLVENAMESPACEPREFIX Function	Resolve the prefix to a namespace URI	DOMElement Subprograms
SETATTRIBUTE Procedures	Sets the attribute specified by the name	DOMElement Subprograms
SETATTRIBUTENODE Functions	Sets the attribute node in the element	DOMElement Subprograms
SETCHARSET Procedure	Sets the character set of the DOM document	DOMDocument Subprograms
SETDATA Procedures	Sets <ul style="list-style-type: none"> the data to the node the data of the processing instruction 	<ul style="list-style-type: none"> DOMCharacterData Subprograms DOMProcessingInstruction Subprograms
SETDOCTYPE Procedure	Sets the DTD of the document.	DOMDocument Subprograms
SETNAMEITEM Function	Sets the item in the map specified by the name	DOMNamedNodeMap Subprograms
SETNODEVALUE Procedure	Sets the Value of the node	DOMNode Subprograms
SETNODEVALUEASBINARYSTREAM Function & Procedure	Sets the Node Value as a binary stream	DOMNode Subprograms
SETNODEVALUEASCHARACTERSTREAM Function & Procedure	Sets the Node Value as a character stream	DOMNode Subprograms
SETPREFIX Procedure	Sets the namespace prefix	DOMNode Subprograms
SETSTANDALONE Procedure	Sets the standalone property of the document	DOMDocument Subprograms
SETVALUE Procedure	Sets the value of the attribute	DOMAttr Subprograms
SETVERSION Procedure	Sets the version of the document	DOMDocument Subprograms
SPLITTEXT Function	Splits the contents of the text node into 2 text nodes	DOMText Subprograms
SUBSTRINGDATA Function	Retrieves the substring of the data	DOMCharacterData Subprograms
USEBINARYSTREAM Function	Strabismus that the stream is valid for use	DOMNode Subprograms

Table 222-21 (Cont.) Summary of DBMS_XMLDOM Package Subprogram

Subprogram	Description	Group
WRITETOBUFFER Procedures	Writes <ul style="list-style-type: none"> the contents of the node to a buffer the document to a buffer the contents of a document fragment into a buffer 	<ul style="list-style-type: none"> DOMNode Subprograms DOMDocument Subprograms DOMDocumentFragment Subprograms
WRITETOCLOB Procedures	Writes <ul style="list-style-type: none"> the contents of the node to a CLOB the document to a CLOB 	<ul style="list-style-type: none"> DOMNode Subprograms DOMDocument Subprograms
WRITETOFILE Procedures	Writes <ul style="list-style-type: none"> the contents of the node to a file the document to a file 	<ul style="list-style-type: none"> DOMNode Subprograms DOMDocument Subprograms

222.7.1 ADOPTNODE Function

This function adopts a node from another document, and returns this new node.



See Also:

[DOMNode Subprograms](#) for other subprograms in this group

Syntax

```
DBMS_XMLDOM.ADOPTNODE (
    doc          IN  DOMDocument,
    importedNode IN  DOMNode)
RETURN DOMNODE;
```

Parameters

Table 222-22 ADOPTNODE Function Parameters

Parameter	Description
doc	Document that is adopting the node
importedNode	Node to adopt

Usage Notes

Note that the [ADOPTNODE Function](#) removes the node from the source document while the [IMPORTNODE Function](#) clones the node in the source document.

222.7.2 APPENDCHILD Function

This function adds the node `newchild` to the end of the list of children of this node, and returns the newly added node. If the `newchild` is already in the tree, it is first removed.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.APPENDCHILD(
  n          IN      DOMNode,
  newchild  IN      DOMNode)
RETURN DOMNODE;
```

Parameters

Table 222-23 APPENDCHILD Function Parameters

Parameter	Description
<code>n</code>	DOMNode
<code>newchild</code>	The child to be appended to the list of children of node <code>n</code>

222.7.3 APPENDDATA Procedure

This procedure appends the string to the end of the character data of the node. Upon success, data provides access to the concatenation of data and the specified string argument.



See Also:

[DOMCharacterData Subprograms](#)

Syntax

```
DBMS_XMLDOM.APPENDDATA(
  cd      IN      DOMCHARACTERDATA,
  arg     IN      VARCHAR2);
```

Parameters

Table 222-24 APPENDDATA Procedure Parameters

Parameter	Description
<code>cd</code>	DOMCHARACTERDATA

Table 222-24 (Cont.) APPENDDATA Procedure Parameters

Parameter	Description
arg	The data to append to the existing data

222.7.4 CLONENODE Function

This function returns a duplicate of this node, and serves as a generic copy constructor for nodes. The duplicate node has no parent, its parent node is `NULL`.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.CLONENODE (
    n          IN    DOMNODE,
    deep      IN    BOOLEAN)
RETURN DOMNODE;
```

Parameters

Table 222-25 CLONENODE Function Parameters

Parameter	Description
n	DOMNODE
deep	Determines if children are to be cloned

Usage Notes

- Cloning an Element copies all attributes and their values, including those generated by the XML processor to represent defaulted attributes, but this method does not copy any text it contains unless it is a deep clone, since the text is contained in a child Text node.
- Cloning an Attribute directly, as opposed to be cloned as part of an Element cloning operation, returns a specified attribute (specified is `TRUE`).
- Cloning any other type of node simply returns a copy of this node.

222.7.5 CREATEATTRIBUTE Functions

This function creates a `DOMATTR` node.



See Also:

[DOMDocument Subprograms](#)

Syntax

Creates a `DOMATTR` with the specified name:

```
DBMS_XMLDOM.CREATEATTRIBUTE (
  doc      IN      DOMDOCUMENT,
  name     IN      VARCHAR2)
RETURN DOMATTR;
```

Creates a `DOMATTR` with the specified name and namespace URI:

```
DBMS_XMLDOM.CREATEATTRIBUTE (
  doc      IN      DOMDOCUMENT,
  qname    IN      VARCHAR2,
  ns       IN      VARCHAR2)
RETURN DOMATTR;
```

Parameters

Table 222-26 CREATEATTRIBUTE Function Parameters

Parameter	Description
<code>doc</code>	DOMDOCUMENT
<code>qname</code>	New attribute qualified name
<code>ns</code>	Namespace

222.7.6 CREATECDATASECTION Function

This function creates a `DOMCDATASECTION` node.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.CREATECDATASECTION (
  doc      IN      DOMDOCUMENT,
  data     IN      VARCHAR2)
RETURN DOMCDATASECTION;
```

Parameters

Table 222-27 CREATECDATASECTION Function Parameters

Parameter	Description
<code>doc</code>	DOMDOCUMENT
<code>data</code>	Content of the DOMCDATASECTION node

222.7.7 CREATECOMMENT Function

This function creates a `DOMCOMMENT` node.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.CREATECOMMENT (  
    doc      IN      DOMDOCUMENT,  
    data     IN      VARCHAR2)  
RETURN DOMCOMMENT;
```

Parameters

Table 222-28 CREATECOMMENT Function Parameters

Parameter	Description
doc	DOMDOCUMENT
data	Content of the <code>DOMComment</code> node

222.7.8 CREATEDOCUMENT Function

This function creates a `DOMDOCUMENT` with specified namespace URI, root element name, DTD.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.CREATEDOCUMENT (  
    namespaceURI  IN  VARCHAR2,  
    qualifiedName IN  VARCHAR2,  
    doctype       IN  DOMTYPE := NULL)  
RETURN DOMDOCUMENT;
```

Parameters

Table 222-29 CREATEDOCUMENT Function Parameters

Parameter	Description
namespaceURI	Namespace URI

Table 222-29 (Cont.) CREATEDOCUMENT Function Parameters

Parameter	Description
qualifiedName	Root element name
doctype	Document type

222.7.9 CREATEDOCUMENTFRAGMENT Function

This function creates a `DOMDOCUMENTFRAGMENT`.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.CREATEDOCUMENTFRAGMENT (
    doc      IN      DOMDOCUMENT)
RETURN DOMDOCUMENTFRAGMENT;
```

Parameters

Table 222-30 CREATEDOCUMENTFRAGMENT Function Parameters

Parameter	Description
doc	DOMDocument

222.7.10 CREATEELEMENT Functions

This function creates a `DOMELEMENT`.



See Also:

[DOMDocument Subprograms](#)

Syntax

Creates a `DOMElement` with specified name:

```
DBMS_XMLDOM.CREATEELEMENT (
    doc      IN      DOMDOCUMENT,
    tagName  IN      VARCHAR2)
RETURN DOMELEMENT;
```

Creates a `DOMElement` with specified name and namespace URI:

```

DBMS_XMLDOM.CREATEELEMENT (
    doc          IN    DOMDOCUMENT,
    tagName     IN    VARCHAR2,
    ns          IN    VARCHAR2)
RETURN DOMELEMENT;

```

Parameters

Table 222-31 CREATEELEMENT Function Parameters

Parameter	Description
doc	DOMDOCUMENT
tagName	Tagname for new DOMELEMENT
ns	Namespace

222.7.11 CREATEENTITYREFERENCE Function

This function creates a DOMENTITYREFERENCE node.



See Also:

[DOMDocument Subprograms](#)

Syntax

```

DBMS_XMLDOM.CREATEENTITYREFERENCE (
    doc          IN    DOMDOCUMENT,
    name        IN    VARCHAR2)
RETURN DOMENTITYREFERENCE;

```

Parameters

Table 222-32 CREATEENTITYREFERENCE Function Parameters

Parameter	Description
doc	DOMDOCUMENT
name	New entity reference name

222.7.12 CREATEPROCESSINGINSTRUCTION Function

This function creates a DOMPROCESSINGINSTRUCTION node.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.CREATEPROCESSINGINSTRUCTION (
    doc      IN      DOMDocument,
    target   IN      VARCHAR2,
    data     IN      VARCHAR2)
RETURN DOMPROCESSINGINSTRUCTION;
```

Parameters

Table 222-33 CREATEPROCESSINGINSTRUCTION Function Parameters

Parameter	Description
doc	DOMDOCUMENT
target	Target of the new processing instruction
data	Content data of the new processing instruction

222.7.13 CREATETEXTNODE Function

This function creates a DOMTEXT node.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.CREATETEXTNODE (
    doc      IN      DOMDocument,
    data     IN      VARCHAR2)
RETURN DOMTEXT;
```

Parameters

Table 222-34 CREATETEXTNODE Function Parameters

Parameter	Description
doc	DOMDOCUMENT
data	Content of the DOMText node

222.7.14 DELETEDATA Procedure

This procedure removes a range of characters from the node. Upon success, data and length reflect the change.



See Also:

[DOMCharacterData Subprograms](#)

Syntax

```
DBMS_XMLDOM.DELETEDATA (  
    cd          IN      DOMCHARACTERDATA,  
    offset      IN      NUMBER,  
    cnt         IN      NUMBER);
```

Parameters

Table 222-35 DELETEDATA PROCEDURE Parameters

Parameter	Description
cd	DOMCHARACTERDATA
offset	The offset from which to delete the data
cnt	The number of characters (starting from offset) to delete

222.7.15 FINDENTITY Function

This function finds an entity in the specified DTD, and returns that entity if found.



See Also:

[DOMDocumentType Subprograms](#)

Syntax

```
DBMS_XMLDOM.FINDENTITY (  
    dt          IN      DOMDOCUMENTTYPE,  
    name        IN      VARCHAR2,  
    par         IN      BOOLEAN)  
RETURN DUMENTITY;
```

Parameters

Table 222-36 FINDENTITY Function Parameters

Parameter	Description
dt	The DTD
name	Entity to find
par	Flag to indicate type of entity; TRUE for parameter entity and FALSE for normal entity

222.7.16 FINDNOTATION Function

This function finds the notation in the specified DTD, and returns it, if found.

 **See Also:**
[DOMDocumentType Subprograms](#)

Syntax

```
DBMS_XMLDOM.FINDNOTATION (
    dt          IN      DOMDocumentType,
    name       IN      VARCHAR2)
RETURN DOMNOTATION;
```


Parameters

Table 222-37 FINDNOTATION Function Parameters

Parameter	Description
dt	The DTD
name	The notation to find

222.7.17 FREEDOCFRAG Procedure

This procedure frees the specified document fragment.

 **See Also:**
[DOMDocument Subprograms](#) and [DOMDocumentFragment Subprograms](#)

Syntax

```
DBMS_XMLDOM.FREEDOCFRAG (
    df      IN      DOMDOCUMENTFRAGMENT);
```

Parameters

Table 222-38 FREEDOCFRAG Procedure Parameters

Parameter	Description
df	DOM document fragment

222.7.18 FREEDOCUMENT Procedure

This procedure frees `DOMDOCUMENT` object.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.FREEDOCUMENT(  
    doc      IN      DOMDOCUMENT);
```

Parameters

Table 222-39 FREEDOCUMENT Procedure Parameters

Parameter	Description
doc	DOMDOCUMENT

222.7.19 FREEELEMENT Procedure

This procedure frees memory allocated to a `DOMElement` handle.



See Also:

[DBMS_XMLDOM DOMElement Subprograms](#)

Syntax

```
DBMS_XMLDOM.FREEELEMENT(  
    elem IN DOMELEMENT);
```

Parameters

Table 222-40 FREEELEMENT Procedure Parameters

Parameter	Description
elem	Of type <code>DOMELEMENT</code>

222.7.20 FREENODE Procedure

This procedure frees all resources associated with a `DOMNODE`.

**See Also:**

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.FREENODE (
    n          IN      DOMNODE);
```

Parameters

Table 222-41 FREENODE Procedure Parameters

Parameter	Description
n	<code>DOMNODE</code>

222.7.21 FREENODELIST Procedure

This procedure frees all resources associated with a `nodelist`.

**See Also:**

[DBMS_XMLDOM DOMNodeList Subprograms](#)

Syntax

```
DBMS_XMLDOM.FREENODELIST (
    n1 IN DOMNodeList);
```


Parameters

Table 222-42 FREENODELIST Procedure Parameters

Parameter	Description
nl	Of type DOMNODELIST

222.7.22 GETATTRIBUTE Functions

This function returns the value of an attribute of an `DOMELEMENT` by name.



See Also:

[DOMElement Subprograms](#)

Syntax

Returns the value of a `DOMELEMENT`'s attribute by name:

```
DBMS_XMLDOM.GETATTRIBUTE (
    elem      IN      DOMELEMENT,
    name      IN      VARCHAR2)
RETURN VARCHAR2;
```

Returns the value of a `DOMELEMENT`'s attribute by name and namespace URI:

```
DBMS_XMLDOM.GETATTRIBUTE (
    elem      IN      DOMELEMENT,
    name      IN      VARCHAR2,
    ns        IN      VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 222-43 GETATTRIBUTE Function Parameters

Parameter	Description
elem	The <code>DOMELEMENT</code>
name	Attribute name
ns	Namespace

222.7.23 GETATTRIBUTENODE Functions

This function returns an attribute node from the `DOMELEMENT` by name. The function is overloaded. The specific forms of functionality are described along with the syntax declarations.



See Also:

[DOMElement Subprograms](#)

Syntax

Returns an attribute node from the `DOMELEMENT` by name:

```
DBMS_XMLDOM.GETATTRIBUTENODE (
  elem      IN      DOMELEMENT,
  name      IN      VARCHAR2)
RETURN DOMATTR;
```

Returns an attribute node from the `DOMELEMENT` by name and namespace URI:

```
DBMS_XMLDOM.GETATTRIBUTENODE (
  elem      IN      DOMELEMENT,
  name      IN      VARCHAR2,
  ns        IN      VARCHAR2)
RETURN DOMATTR;
```

Parameters

Table 222-44 GETATTRIBUTENODE Function Parameters

Parameter	Description
elem	The <code>DOMELEMENT</code>
name	Attribute name; * matches any attribute
ns	Namespace

222.7.24 GETATTRIBUTES Function

This function retrieves a `NAMEDNODEMAP` containing the attributes of this node (if it is an Element) or `NULL` otherwise.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETATTRIBUTES (
    n          IN          DOMNode)
RETURN DOMNAMEDNODEMAP;
```

Parameters**Table 222-45** GETATTRIBUTES Function Parameters

Parameter	Description
n	DOMNode

222.7.25 GETCHARSET Function

This function retrieves the character set of the DOM document.

**See Also:**

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETCHARSET (
    doc IN    DOMDocument)
RETURN VARCHAR2;
```

Parameters**Table 222-46** GETCHARSET Function Parameters

Parameter	Description
doc	DOM document

Usage Notes

For a newly parsed document, we return the database character set. Once the `SETCHARSET` Procedure is called with a non-NULL value for `charset`, that `charset` is returned.

222.7.26 GETCHILDNODES Function

This function retrieves a `DOMNODELIST` that contains all children of this node. If there are no children, this is a `DOMNODELIST` containing no nodes.

**See Also:**

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETCHILDNODES (
  n          IN      DOMNode)
RETURN DOMNodeList;
```

Parameters**Table 222-47** GETCHILDNODES Function Parameters

Parameter	Description
n	DOMNode

222.7.27 GETCHILDRENBYTAGNAME Functions

This function returns the children of the `DOMELEMENT`.

**See Also:**

[DOMElement Subprograms](#)

Syntax

Returns children of the `DOMELEMENT` given the tag name:

```
DBMS_XMLDOM.GETCHILDRENBYTAGNAME (
  elem      IN      DOMELEMENT,
  name      IN      VARCHAR2)
RETURN DOMNODELIST;
```

Returns children of the `DOMELEMENT` given the tag name and namespace:

```
DBMS_XMLDOM.GETCHILDRENBYTAGNAME (
  elem      IN      DOMELEMENT,
  name      IN      VARCHAR2,
  ns        IN      VARCHAR2)
RETURN DOMNODELIST;
```

Parameters**Table 222-48** GETCHILDRENBYTAGNAME Function Parameters

Parameter	Description
elem	DOMELEMENT
name	Tag name
ns	Namespace

222.7.28 GETDATA Functions

This function is overloaded. The specific forms of functionality are described along with the syntax declarations.

Syntax

Gets the character data of the node that implements this interface (See Also: [DOMCharacterData Subprograms](#)):

```
DBMS_XMLDOM.GETDATA (
    cd      IN      DOMCHARACTERDATA)
RETURN VARCHAR2;
```

Returns the content data of the `DOMProcessingInstruction` (See Also: [DOMProcessingInstruction Subprograms](#)):

```
DBMS_XMLDOM.GETDATA (
    pi      IN      DOMPROCESSINGINSTRUCTION)
RETURN VARCHAR2;
```

Parameters

Table 222-49 GETDATA Function Parameters

Parameter	Description
cd	DOMCHARACTERDATA
pi	The DOMPROCESSINGINSTRUCTION

222.7.29 GETDOCTYPE Function

This function returns the DTD associated to the `DOMDOCUMENT`.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETDOCTYPE (
    doc      IN      DOMDOCUMENT)
RETURN DOMDOCUMENTTYPE;
```

Parameters

Table 222-50 GETDOCTYPE Function Parameters

Parameter	Description
doc	DOMDOCUMENT

222.7.30 GETDOCUMENTELEMENT Function

This function returns the root element of the `DOMDOCUMENT`.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETDOCUMENTELEMENT (
    doc      IN      DOMDOCUMENT)
RETURN DOMELEMENT;
```

Parameters

Table 222-51 GETDOCUMENTELEMENT Function Parameters

Parameter	Description
doc	DOMDOCUMENT

222.7.31 GETELEMENTSBYTAGNAME Functions

This function is overloaded. The specific forms of functionality are described along with the syntax declarations.

Syntax

Returns a `DOMNODELIST` of all the elements with a specified tagname (See Also: [DOMDocument Subprograms](#)):

```
DBMS_XMLDOM.GETELEMENTSBYTAGNAME (
    doc      IN      DOMDOCUMENT,
    tagname  IN      VARCHAR2)
RETURN DOMNODELIST;
```

Returns the element children of the `DOMELEMENT` given the tag name (See Also: [DOMEElement Subprograms](#)):

```
DBMS_XMLDOM.GETELEMENTSBYTAGNAME (
    elem     IN      DOMELEMENT,
    name     IN      VARCHAR2)
RETURN DOMNODELIST;
```

Returns the element children of the `DOMELEMENT` given the tag name and namespace (See Also: [DOMEElement Subprograms](#)):

```
DBMS_XMLDOM.GETELEMENTSBYTAGNAME (
    elem     IN      DOMELEMENT,
    name     IN      VARCHAR2,
    ns       IN      VARCHAR2)
RETURN DOMNODELIST;
```

Parameters

Table 222-52 GETELEMENTSBYTAGNAME Function Parameters

Parameter	Description
doc	DOMDOCUMENT
tagname	Name of the tag to match on
elem	The DOMELEMENT
name	Tag name; using a wildcard(*) would match any tag
ns	Namespace

222.7.32 GETENTITIES Function

This function retrieves a `DOMNAMEDNODEMAP` containing the general entities, both external and internal, declared in the DTD.



See Also:

[DOMDocumentType Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETENTITIES (
    dt      IN      DOMDocumentType)
RETURN DOMNAMEDNODEMAP;
```

Parameters

Table 222-53 GETENTITIES Function Parameters

Parameter	Description
dt	DOMDOCUMENTTYPE

222.7.33 GETEXPANDEDNAME Procedure and Functions

This subprogram is overloaded as a procedure and two functions. The specific forms of functionality are described along with the syntax declarations.

Syntax

Retrieves the expanded name of the `Node` if it is in an `Element` or `Attribute` type; otherwise, returns `NULL` (See Also: [DOMNode Subprograms](#))

```
DBMS_XMLDOM.GETEXPANDEDNAME (
    n      IN      DOMNODE
    data   OUT     VARCHAR);
```

Returns the expanded name of the `DOMAttr` (See Also: [DOMAttr Subprograms](#)):

```
DBMS_XMLDOM.GETEXPANDEDNAME (
    a          IN      DOMAttr)
RETURN VARCHAR2;
```

Returns the expanded name of the `DOMElement` (See Also: [DOMElement Subprograms](#)):

```
DBMS_XMLDOM.GETEXPANDEDNAME (
    elem      IN      DOMELEMENT)
RETURN VARCHAR2;
```

Parameters

Table 222-54 GETEXPANDEDNAME Procedure and Function Parameters

Parameter	Description
n	DOMNODE
data	Returned expanded name of the Node
a	DOMATTR
elem	DOMELEMENT

222.7.34 GETFIRSTCHILD Function

This function retrieves the first child of this node. If there is no such node, this returns NULL.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETFIRSTCHILD (
    n          IN      DOMNODE)
RETURN DOMNODE;
```

Parameters

Table 222-55 GETFIRSTCHILD Function Parameters

Parameter	Description
n	DOMNODE

222.7.35 GETIMPLEMENTATION Function

This function returns the `DOMIMPLEMENTATION` object that handles this `DOMDOCUMENT`.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETIMPLEMENTATION (  
    doc      IN      DOMDOCUMENT)  
RETURN DOMIMPLEMENTATION;
```

Parameters

Table 222-56 GETIMPLEMENTATION Function Parameters

Parameter	Description
doc	DOMDOCUMENT

222.7.36 GETLASTCHILD Function

This function retrieves the last child of this node. If there is no such node, this returns `NULL`.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETLASTCHILD (  
    n      IN      DOMNODE)  
RETURN DOMNODE;
```

Parameters

Table 222-57 GETLASTCHILD Function Parameters

Parameter	Description
n	DOMNODE

222.7.37 GETLENGTH Functions

This function is overloaded. The specific forms of functionality are described along with the syntax declarations.

Syntax

Gets the number of characters in the data. This may have the value zero, because `CharacterData` nodes may be empty (See Also: [DOMCharacterData Subprograms](#)):

```
DBMS_XMLDOM.GETLENGTH (
    cd      IN      DOMCHARACTERDATA)
RETURN NUMBER;
```

Gets the number of nodes in this map. The range of valid child node indexes is 0 to `length-1`, inclusive (See Also: [DOMNamedNodeMap Subprograms](#)):

```
DBMS_XMLDOM.GETLENGTH (
    nnm     IN      DOMNAMEDNODEMAP)
RETURN NUMBER;
```

Gets the number of nodes in the list. The range of valid child node indexes is 0 to `length-1`, inclusive (See Also: [DOMNodeList Subprograms](#)):

```
DBMS_XMLDOM.GETLENGTH (
    nl      IN      DOMNODELIST)
RETURN NUMBER;
```

Parameters

Table 222-58 GETLENGTH Function Parameters

Parameter	Description
<code>cd</code>	<code>DOMCHARACTERDATA</code>
<code>nnm</code>	<code>DOMNAMEDNODEMAP</code>
<code>nl</code>	<code>DOMNODELIST</code>

222.7.38 GETLOCALNAME Procedure and Functions

This function is overloaded as a procedure and two functions. The specific forms of functionality are described alongside the syntax declarations.

Syntax

Retrieves the local part of the node's qualified name (See Also: [DOMNode Subprograms](#)):

```
DBMS_XMLDOM.GETLOCALNAME (
    n       IN      DOMNODE,
    data    OUT     VARCHAR2);
```

Returns the local name of the `DOMAttr` (See Also: [DOMAttr Subprograms](#)):

```
DBMS_XMLDOM.GETLOCALNAME (
    a          IN      DOMATTR)
RETURN VARCHAR2;
```

Returns the local name of the `DOMElement` (See Also: [DOMElement Subprograms](#))

```
DBMS_XMLDOM.GETLOCALNAME (
    elem      IN      DOMELEMENT)
RETURN VARCHAR2;
```

Parameters

Table 222-59 GETLOCALNAME Procedure and Function Parameters

Parameter	Description
n	DOMNode
data	Returned local name.
a	DOMAttr.
elem	DOMElement.

222.7.39 GETNAME Functions

This function is overloaded. The specific forms of functionality are described with the syntax declarations.

Syntax

Returns the name of this attribute (See Also: [DOMAttr Subprograms](#)):

```
DBMS_XMLDOM.GETNAME (
    a          IN      DOMATTR)
RETURN VARCHAR2;
```

Retrieves the name of DTD, or the name immediately following the `DOCTYPE` keyword (See Also: [DOMDocumentType Subprograms](#)):

```
DBMS_XMLDOM.GETNAME (
    dt        IN      DOMDOCUMENTTYPE)
RETURN VARCHAR2;
```

Parameters

Table 222-60 GETNAME Function Parameters

Parameter	Description
a	DOMATTR
dt	DOMDOCUMENTTYPE

222.7.40 GETNAMEDITEM Function

GETNAMEDITEM retrieves a node specified by name.



See Also:

[DOMNamedNodeMap Subprograms](#)

Syntax

Retrieves a node specified by name:

```
DBMS_XMLDOM.GETNAMEDITEM(  
  nnm    IN  DOMNAMEDNODEMAP,  
  name   IN  VARCHAR2)  
RETURN DOMNODE;
```

Retrieves a node specified by name and namespace URI:

```
DBMS_XMLDOM.GETNAMEDITEM(  
  nnm    IN  DOMNAMEDNODEMAP,  
  name   IN  VARCHAR2,  
  ns     IN  VARCHAR2)  
RETURN DOMNODE;
```

Parameters

Table 222-61 GETNAMEDITEM Function Parameters

Parameter	Description
nnm	DOMNAMEDNODEMAP
name	Name of the item to be retrieved
ns	Namespace

222.7.41 GETNAMESPACE Procedure and Functions

This subprogram is overloaded as a procedure and two functions. The specific forms of functionality are described alongside the syntax declarations.

Syntax

Retrieves the namespace URI associated with the node (See Also: [DOMNode Subprograms](#)):

```
DBMS_XMLDOM.GETNAMESPACE(  
  n      IN  DOMNODE,  
  data   OUT VARCHAR2);
```

Retrieves the namespace of the DOMATTR (See Also: [DOMAttr Subprograms](#)):

```
DBMS_XMLDOM.GETNAMESPACE (
    a          IN      DOMATTR)
RETURN VARCHAR2;
```

Retrieves the namespace of the DOMELEMENT (See Also: [DOMELEMENT Subprograms](#)):

```
DBMS_XMLDOM.GETNAMESPACE (
    elem      IN      DOMELEMENT)
RETURN VARCHAR2;
```

Parameters

Table 222-62 GETNAMESPACE Procedure and Function Parameters

Parameter	Description
n	DOMNODE
data	Returned namespace URI
a	DOMATTR
elem	DOMELEMENT

222.7.42 GETNEXTSIBLING Function

This function retrieves the node immediately following this node. If there is no such node, this returns NULL.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETNEXTSIBLING (
    n          IN      DOMNODE)
RETURN DOMNode;
```

Parameters

Table 222-63 GETNEXTSIBLING Function Parameters

Parameter	Description
n	DOMNODE

222.7.43 GETNODETYPE Function

This function retrieves a code representing the type of the underlying object.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETNODETYPE (
    n          IN      DOMNODE)
RETURN NUMBER;
```

Parameters

Table 222-64 GETNODETYPE Function Parameters

Parameter	Description
n	DOMNODE

222.7.44 GETNODENAME Function

This function gets the name of the node depending on its type.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETNODENAME (
    n          IN      DOMNODE)
RETURN VARCHAR2;
```

Parameters

Table 222-65 GETNODENAME Function Parameters

Parameter	Description
n	DOMNODE

222.7.45 GETNODEVALUE Function

This function gets the value of this node, depending on its type.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETNODEVALUE (
    n          IN      DOMNODE)
RETURN VARCHAR2;*
```

Parameters

Table 222-66 GETNODEVALUE Function Parameters

Parameter	Description
n	DOMNODE

222.7.46 GETNODEVALUEASBINARYSTREAM Function & Procedure

The operation of these subprograms is described with each syntax implementation.



See Also:

[DOMNode Subprograms](#)

Syntax

This function returns an instance of the PL/SQL `XMLBinaryInputStream`. The node datatype must be `RAW` or `BLOB` – if not an exception is raised.

```
DBMS_XMLDOM.GETNODEVALUEASBINARYSTREAM (
    n          IN      DOMNODE)
RETURN SYS.UTL_BINARYINPUTSTREAM;
```

Using this procedure, the application passes an implementation of `SYS.UTL_BINARYOUTPUTSTREAM` into which XDB writes the contents of the node. The datatype of the node must be `RAW` or `CLOB` – if not an exception is raised.

```
DBMS_XMLDOM.GETNODEVALUEASBINARYSTREAM (
    n          in      DOMNODE,
    value      in      SYS.UTL_BINARYOUTPUTSTREAM);
```

Parameters

Table 222-67 GETNODEVALUEASBINARYSTREAM Function & Procedure Parameters

Parameter	Description
n	DOMNODE
value	BINARYOUTPUTSTREAM

222.7.47 GETNODEVALUEASCHARACTERSTREAM Function & Procedure

The operation of these subprograms is described with each syntax implementation.



See Also:

[DOMNode Subprograms](#)

Syntax

This function returns an instance of the PL/SQL `XMLCharacterInputStream`. If the node data is character it is converted to the current session character set. If the node data is not character data, it is first converted to character data.

```
DBMS_XMLDOM.GETNODEVALUEASCHARACTERSTREAM (
    n          IN      DOMNODE)
RETURN SYS.UTL_CHARACTERINPUTSTREAM;
```

Using this procedure, the node data is converted, as necessary, to the session character set and then "pushed" into the `SYS.UTL_CHARACTEROUTPUTSTREAM`.

```
DBMS_XMLDOM.GETNODEVALUEASCHARACTERSTREAM (
    n          IN      DOMNODE,
    value      IN      SYS.UTL_CHARACTEROUTPUTSTREAM);
```

Parameters

Table 222-68 GETNODEVALUEASCHARACTERSTREAM Function & Procedure Parameters

Parameter	Description
n	DOMNODE
value	CHARACTEROUTPUTSTREAM

222.7.48 GETNOTATIONNAME Function

This function returns the notation name of the `DOENTITY`.



See Also:

[DOMEntity Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETNOTATIONNAME (  
    ent      IN      DOENTITY)  
RETURN VARCHAR2;
```

Parameters

Table 222-69 GETNOTATIONNAME Function Parameters

Parameter	Description
ent	DOENTITY

222.7.49 GETNOTATIONS Function

This function retrieves a `DOMNAMEDNODEMAP` containing the notations declared in the DTD.



See Also:

[DOMDocumentType Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETNOTATIONS (  
    dt      IN      DOMDOCUMENTTYPE)  
RETURN DOMNAMEDNODEMAP;
```

Parameters

Table 222-70 GETNOTATIONS Function Parameters

Parameter	Description
dt	DOMDOCUMENTTYPE

222.7.50 GETTARGET Function

This function returns the target of the `DOMPROCESSINGINSTRUCTION`.



See Also:

[DOMProcessingInstruction Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETTARGET (  
    pi          IN      DOMPROCESSINGINSTRUCTION)  
RETURN VARCHAR2;
```

Parameters

Table 222-71 GETTARGET Function Parameters

Parameter	Description
pi	DOMPROCESSINGINSTRUCTION

222.7.51 GETOWNERDOCUMENT Function

This function retrieves the Document object associated with this node. This is also the Document object used to create new nodes. When this node is a Document or a Document Type that is not used with any Document yet, this is `NULL`.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETOWNERDOCUMENT (  
    n          IN      DOMNODE)  
RETURN DOMDOCUMENT;
```

Parameters

Table 222-72 GETOWNERDOCUMENT Function Parameters

Parameter	Description
n	DOMNODE

222.7.52 GETOWNERELEMENT Function

This function retrieves the Element node to which the specified Attribute is attached.



See Also:

[DOMAttr Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETOWNERELEMENT (  
    a          IN      DOMATTR)  
RETURN DOMELEMENT;
```

Parameters

Table 222-73 GETOWNERELEMENT Function Parameters

Parameter	Description
a	Attribute

222.7.53 GETPARENTNODE Function

This function retrieves the parent of this node. All nodes, except `Attr`, `Document`, `DocumentFragment`, `Entity`, and `Notation` may have a parent. However, if a node has just been created and not yet added to the tree, or if it has been removed from the tree, this is `NULL`.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETPARENTNODE (  
    n          IN      DOMNODE)  
RETURN DOMNODE;
```


Parameters

Table 222-74 GETPARENTNODE Function Parameters

Parameter	Description
n	DOMNODE

222.7.54 GETPREFIX Function

This function retrieves the namespace prefix of the node.

 **See Also:**
[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETPREFIX (  
    n          IN      DOMNODE)  
RETURN VARCHAR2;
```


Parameters

Table 222-75 GETPREFIX Function Parameters

Parameter	Description
n	DOMNODE

222.7.55 GETPREVIOUSIBLING Function

This function retrieves the node immediately preceding this node. If there is no such node, this returns `NULL`.

 **See Also:**
[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETPREVIOUSIBLING (  
    n          IN      DOMNODE)  
RETURN DOMNODE;
```

Parameters

Table 222-76 GETPREVIOUSIBLING Function Parameters

Parameter	Description
n	DOMNODE

222.7.56 GETPUBLICID Functions

This function is overloaded. The specific forms of functionality are described along with the syntax declarations.

Syntax

Returns the public identifier of the specified DTD (See Also: [DOMDocumentType Subprograms](#)):

```
DBMS_XMLDOM.GETPUBLICID (
    dt          IN      DOMDOCUMENTTYPE)
RETURN VARCHAR2;
```

Returns the public identifier of the `DOMENTITY` (See Also: [DOMEntity Subprograms](#)):

```
DBMS_XMLDOM.GETPUBLICID (
    ent        IN      DOMENTITY)
RETURN VARCHAR2;
```

Returns the public identifier of the `DOMNOTATION` (See Also: [DOMNotation Subprograms](#)):

```
DBMS_XMLDOM.GETPUBLICID (
    n          IN      DOMNOTATION)
RETURN VARCHAR2;
```

Parameters

Table 222-77 GETPUBLICID Function Parameters

Parameter	Description
dt	The DTD
ent	DOMENTITY
n	DOMNOTATION

222.7.57 GETQUALIFIEDNAME Functions

This function is overloaded. The specific forms of functionality are described along with the syntax declarations.

Syntax

Returns the qualified name of the `DOMATTR` (See Also: [DOMAttr Subprograms](#)):

```
DBMS_XMLDOM.GETQUALIFIEDNAME (
    a          IN      DOMATTR)
RETURN VARCHAR2;
```

Returns the qualified name of the `DOMELEMENT` (See Also: [DOMElement Subprograms](#)):

```
DBMS_XMLDOM.GETQUALIFIEDNAME (
    elem      IN      DOMELEMENT)
RETURN VARCHAR2;
```

Parameters

Table 222-78 GETQUALIFIEDNAME Functions Parameters

Parameter	Description
a	DOMATTR
elem	DOMELEMENT

222.7.58 GETSCHEMANODE Function

This function retrieves the schema URI associated with the node.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETSCHEMANODE (
  n      IN  DOMNODE)
RETURN DOMNODE;
```

Parameters

Table 222-79 GETSCHEMANODE Function Parameters

Parameter	Description
n	DOMNODE

222.7.59 GETSPECIFIED Function

If this attribute was explicitly specified, a value in the original document, this is true; otherwise, it is false.



See Also:

[DOMAttr Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETSPECIFIED (
  a      IN  DOMATTR)
RETURN BOOLEAN;
```

Parameters

Table 222-80 GETSPECIFIED Function Parameters

Parameter	Description
a	DOMATTR

222.7.60 GETSTANDALONE Function

This function returns the standalone property associated with the `DOMDOCUMENT`.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETSTANDALONE (
    doc      IN      DOMDOCUMENT)
RETURN VARCHAR2;
```

Parameters

Table 222-81 GETSTANDALONE Function Parameters

Parameter	Description
doc	DOMDOCUMENT.

222.7.61 GETSYSTEMID Functions

This function is overloaded. The specific forms of functionality are described along with the syntax declarations.

Syntax

Returns the system id of the specified DTD (See Also: [DOMDocumentType Subprograms](#)):

```
DBMS_XMLDOM.GETSYSTEMID (
    dt      IN      DOMDOCUMENTTYPE)
RETURN VARCHAR2;
```

Returns the system identifier of the `DOMENTITY` (See Also: [DOMEntity Subprograms](#)):

```
DBMS_XMLDOM.GETSYSTEMID (
    ent     IN      DOMENTITY)
RETURN VARCHAR2;
```

Returns the system identifier of the `DOMNOTATION` (See Also: [DOMNotation Subprograms](#)):

```
DBMS_XMLDOM.GETSYSTEMID (
    n          IN    DOMNOTATION)
RETURN VARCHAR2;
```

Parameters

Table 222-82 GETSYSTEMID Function Parameters

Parameter	Description
dt	The DTD.
ent	DOMEntity.
n	DOMNotation.

222.7.62 GETTAGNAME Function

This function returns the name of the `DOMELEMENT`.



See Also:

[DOMElement Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETTAGNAME (
    elem      IN    DOMELEMENT)
RETURN VARCHAR2;
```

Parameters

Table 222-83 GETTAGNAME Function Parameters

Parameter	Description
elem	The <code>DOMELEMENT</code>

222.7.63 GETVALUE Function

This function retrieves the value of the attribute.



See Also:

[DOMAttr Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETVALUE (
    a        IN    DOMATTR)
RETURN VARCHAR2;
```


Parameters

Table 222-84 GETVALUE Function Parameters

Parameter	Description
a	DOMATTR

222.7.64 GETVERSION Function

This function returns the version of the `DOMDOCUMENT`.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETVERSION (
    doc      IN      DOMDOCUMENT)
RETURN VARCHAR2;
```

Parameters

Table 222-85 GETVERSION Function Parameters

Parameter	Description
doc	DOMDOCUMENT

222.7.65 GETXMLTYPE Function

This function returns the `XMLType` associated with the `DOMDOCUMENT`.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.GETXMLTYPE (
    doc      IN      DOMDOCUMENT)
RETURN SYS.XMLTYPE;
```

Parameters

Table 222-86 GETXMLTYPE Function Parameters

Parameter	Description
doc	DOMDOCUMENT

222.7.66 HASATTRIBUTE Functions

Verifies whether an attribute has been defined for `DOMELEMENT`, or has a default value.



See Also:

[DOMElement Subprograms](#)

Syntax

Verifies whether an attribute with the specified name has been defined for `DOMElement`:

```
DBMS_XMLDOM.HASATTRIBUTE (
    elem      IN  DOMELEMENT,
    name      IN  VARCHAR2)
RETURN VARCHAR2;
```

Verifies whether an attribute with specified name and namespace URI has been defined for `DOMELEMENT`; namespace enabled:

```
DBMS_XMLDOM.HASATTRIBUTE (
    elem      IN  DOMELEMENT,
    name      IN  VARCHAR2,
    ns        IN  VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 222-87 HASATTRIBUTE Function Parameters

Parameter	Description
elem	The <code>DOMELEMENT</code>
name	Attribute name; * matches any attribute
ns	Namespace

222.7.67 HASATTRIBUTES Function

This function returns whether this node has any attributes.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.HASATTRIBUTES (  
    n          IN      DOMNODE)  
RETURN BOOLEAN;
```

Parameters

Table 222-88 HASATTRIBUTES Function Parameters

Parameter	Description
n	DOMNODE

222.7.68 HASCHILDNODES Function

This function determines whether this node has any children.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.HASCHILDNODES (  
    n          IN      DOMNODE)  
RETURN BOOLEAN;
```

Parameters

Table 222-89 HASCHILDNODES Function Parameters

Parameter	Description
n	DOMNODE

222.7.69 HASFEATURE Function

This function tests if the `DOMIMPLEMENTATION` implements a specific feature.



See Also:

[DOMImplementation Subprograms](#)

Syntax

```
DBMS_XMLDOM.HASFEATURE (  
    di          IN      DOMIMPLEMENTATION,  
    feature     IN      VARCHAR2,  
    version     IN      VARCHAR2)  
RETURN BOOLEAN;
```

Parameters

Table 222-90 HASFEATURE Function Parameters

Parameter	Description
di	DOMIMPLEMENTATION
feature	The feature to check for
version	The version of the DOM to check in

222.7.70 IMPORTNODE Function

This function imports a node from an external document and returns this new node.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.IMPORTNODE (  
    doc          IN      DOMDOCUMENT,  
    importedNode IN      DOMNODE,  
    deep         IN      BOOLEAN)  
RETURN DOMNODE;
```

Parameters

Table 222-91 IMPORTNODE Function Parameters

Parameter	Description
doc	Document from which the node is imported
importedNode	Node to import
deep	Setting for recursive import. <ul style="list-style-type: none"> If this value is <code>TRUE</code>, the entire subtree of the node will be imported with the node. If this value is <code>FALSE</code>, only the node itself will be imported.

Usage Notes

Note that the [ADOPTNODE Function](#) removes the node from the source document while the [IMPORTNODE Function](#) clones the node in the source document.

222.7.71 INSERTBEFORE Function

This function inserts the node `newchild` before the existing child node `refchild`. If `refchild` is `NULL`, insert `newchild` at the end of the list of children.

If `newchild` is a `DOCUMENTFRAGMENT` object, all of its children are inserted, in the same order, before `refchild`. If the `newchild` is already in the tree, it is first removed.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.INSERTBEFORE (
  n          IN      DOMNODE,
  newchild  IN      DOMNODE,
  refchild  IN      DOMNODE)
RETURN DOMNode;
```

Parameters

Table 222-92 INSERTBEFORE Function Parameters

Parameter	Description
n	DOMNODE
newChild	The child to be inserted in the DOMNODE
refChild	The reference node before which the <code>newchild</code> is to be inserted

222.7.72 INSERTDATA Procedure

This procedure inserts a string at the specified character offset.



See Also:

[DOMCharacterData Subprograms](#)

Syntax

```
DBMS_XMLDOM.INSERTDATA (
  cd      IN      DOMCHARACTERDATA,
  offset  IN      NUMBER,
  arg     IN      VARCHAR2);
```

Parameters

Table 222-93 INSERTDATA Procedure Parameters

Parameter	Description
cd	DOMCHARACTERDATA
offset	The offset at which to insert the data
arg	The value to be inserted

222.7.73 ISNULL Functions

This function is overloaded. The specific forms of functionality are described along with the syntax declarations.

Syntax

Checks if the specified `DOMNODE` is `NULL`. Returns `TRUE` if it is `NULL`, `FALSE` otherwise (See Also: [DOMNode Subprograms](#)):

```
DBMS_XMLDOM.ISNULL (
  n      IN      DOMNODE)
RETURN BOOLEAN;
```

Checks that the specified `DOMATTR` is `NULL`; returns `TRUE` if it is `NULL`, `FALSE` otherwise (See Also: [DOMAttr Subprograms](#)):

```
DBMS_XMLDOM.ISNULL (
  a      IN      DOMATTR)
RETURN BOOLEAN;
```

Checks that the specified `DOMCDATASECTION` is `NULL`; returns `TRUE` if it is `NULL`, `FALSE` otherwise (See Also: [DOMCDATASection Subprograms](#)):

```
DBMS_XMLDOM.ISNULL (
  cds   IN      DOMCDATASECTION)
RETURN BOOLEAN;
```

Checks that the specified DOMCHARACTERDATA is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMCharacterData Subprograms](#)):

```
DBMS_XMLDOM.ISNULL(  
    cd      IN      DOMCHARACTERDATA)  
RETURN BOOLEAN;
```

Checks that the specified DOMCOMMENT is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMComment Subprograms](#)):

```
DBMS_XMLDOM.ISNULL(  
    com     IN      DOMCOMMENT)  
RETURN BOOLEAN;
```

Checks that the specified DOMDOCUMENT is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMDocument Subprograms](#)):

```
DBMS_XMLDOM.ISNULL(  
    doc     IN      DOMDOCUMENT)  
RETURN BOOLEAN;
```

Checks that the specified DOMDOCUMENTFRAGMENT is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMDocumentFragment Subprograms](#)):

```
DBMS_XMLDOM.ISNULL(  
    df      IN      DOMDOCUMENTFRAGMENT)  
RETURN BOOLEAN;
```

Checks that the specified DOMDOCUMENTTYPE is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMDocumentType Subprograms](#)):

```
DBMS_XMLDOM.ISNULL(  
    dt      IN      DOMDOCUMENTTYPE)  
RETURN BOOLEAN;
```

Checks that the specified DOMELEMENT is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMElement Subprograms](#)):

```
DBMS_XMLDOM.ISNULL(  
    elem   IN      DOMELEMENT)  
RETURN BOOLEAN;
```

Checks that the specified DOMENTITY is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMEntity Subprograms](#)):

```
DBMS_XMLDOM.ISNULL(  
    ent    IN      DOMENTITY)  
RETURN BOOLEAN;
```

Checks that the specified DOMENTITYREFERENCE is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMEntityReference Subprograms](#)):

```
DBMS_XMLDOM.ISNULL(  
    EREF   IN      DOMENTITYREFERENCE)  
RETURN BOOLEAN;
```

Checks that the specified DOMIMPLEMENTATION is NULL; returns TRUE if it is NULL (See Also: [DOMImplementation Subprograms](#)):

```
DBMS_XMLDOM.ISNULL (
    di          IN      DOMIMPLEMENTATION)
RETURN BOOLEAN;
```

Checks that the specified DOMNAMEDNODEMAP is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMNamedNodeMap Subprograms](#)):

```
DBMS_XMLDOM.ISNULL (
    nnm        IN      DOMNAMEDNODEMAP)
RETURN BOOLEAN;
```

Checks that the specified DOMNODELIST is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMNodeList Subprograms](#)):

```
DBMS_XMLDOM.ISNULL (
    nl         IN      DOMNODELIST)
RETURN BOOLEAN;
```

Checks that the specified DOMNOTATION is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMNotation Subprograms](#)):

```
DBMS_XMLDOM.ISNULL (
    n          IN      DOMNOTATION)
RETURN BOOLEAN;
```

Checks that the specified DOMPROCESSINGINSTRUCTION is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMProcessingInstruction Subprograms](#)):

```
DBMS_XMLDOM.ISNULL (
    pi        IN      DOMPROCESSINGINSTRUCTION)
RETURN BOOLEAN;
```

Checks that the specified DOMTEXT is NULL; returns TRUE if it is NULL, FALSE otherwise (See Also: [DOMText Subprograms](#)):

```
DBMS_XMLDOM.ISNULL (
    t         IN      DOMTEXT)
RETURN BOOLEAN;
```

Parameters

Table 222-94 ISNULL Function Parameters

Parameter	Description
n	DOMNODE to check
a	DOMATTR to check
cds	DOMCDATASECTION to check
cd	DOMCHARACTERDATA to check
com	DOMCOMMENT to check
doc	DOMDOCUMENT to check
dF	DOMDOCUMENTFRAGMENT to check
dt	DOMDOCUMENTTYPE to check
elem	DOMELEMENT to check
ent	DOMENTITY to check

Table 222-94 (Cont.) ISNULL Function Parameters

Parameter	Description
eref	DOMENTITYREFERENCE to check
di	DOMIMPLEMENTATION to check
nnm	DOMNAMENODEMAP to check
nl	DOMNODELIST to check
n	DOMNOTATION to check
pi	DOMPROCESSINGINSTRUCTION to check
t	DOMTEXT to check

222.7.74 ITEM Functions

This function is overloaded. The specific forms of functionality are described along with the syntax declarations.

Syntax

Returns the item in the map which corresponds to the `INDEX` parameter. If `INDEX` is greater than or equal to the number of nodes in this map, this returns `NULL` (See Also: [DOMNamedNodeMap Subprograms](#)):

```
DBMS_XMLDOM.ITEM(
    nnm      IN      DOMNAMEDNODEMAP,
    index    IN      NUMBER)
RETURN DOMNODE;
```

Returns the item in the collection which corresponds to the `INDEX` parameter. If `index` is greater than or equal to the number of nodes in the list, this returns `NULL` (See Also: [DOMNodeList Subprograms](#)):

```
DBMS_XMLDOM.ITEM(
    nl       IN      DOMNODELIST,
    index    IN      NUMBER)
RETURN DOMNODE;
```

Parameters

Table 222-95 ITEM Function Parameters

Parameter	Description
nnm	DOMNAMEDNODEMAP
index	The index in the node map at which the item is to be retrieved
nl	DOMNODELIST
index	The index in the <code>NodeList</code> used to retrieve the item

222.7.75 MAKEATTR Function

This function casts a specified DOMNODE to a DOMATTR, and returns the DOMATTR.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKEATTR (  
    n          IN      DOMNODE)  
RETURN DOMATTR;
```

Parameters

Table 222-96 MAKEATTR Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.76 MAKECDATASECTION Function

This function casts a specified DOMNODE to a DOMCDATASECTION.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKECDATASECTION (  
    n          IN      DOMNODE)  
RETURN DOMCDATASECTION;
```

Parameters

Table 222-97 MAKECDATASECTION Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.77 MAKECHARACTERDATA Function

This function casts a specified DOMNODE to a DOMCHARACTERDATA, and returns the DOMCHARACTERDATA.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKECHARACTERDATA (  
    n          IN      DOMNode)  
RETURN DOMCharacterData;
```

Parameters

Table 222-98 MAKECHARACTERDATA Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.78 MAKECOMMENT Function

This function casts a specified DOMNODE to a DOMCOMMENT, and returns the DOMCOMMENT.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKECOMMENT (  
    n          IN      DOMNODE)  
RETURN DOMCOMMENT;
```

Parameters

Table 222-99 MAKECOMMENT Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.79 MAKEDOCUMENT Function

This function casts a specified `DOMNODE` to a `DOMDOCUMENT`, and returns the `DOMDOCUMENT`.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKEDOCUMENT (  
    n          IN      DOMNODE)  
RETURN DOMDocument;
```

Parameters

Table 222-100 MAKEDOCUMENT Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.80 MAKEDOCUMENTFRAGMENT Function

This function casts a specified `DOMNODE` to a `DOMDOCUMENTFRAGMENT`, and returns the `DOMDOCUMENTFRAGMENT`.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKEDOCUMENTFRAGMENT (  
    n          IN      DOMNODE)  
RETURN DOMDOCUMENTFRAGMENT;
```

Parameters

Table 222-101 MAKEDOCUMENTFRAGMENT Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.81 MAKEDOCUMENTTYPE Function

This function casts a specified `DOMNODE` to a `DOMDOCUMENTTYPE` and returns the `DOMDOCUMENTTYPE`.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKEDOCUMENTTYPE (  
    n          IN      DOMNODE)  
RETURN DOMDOCUMENTTYPE;
```

Parameters

Table 222-102 MAKEDOCUMENTTYPE Function Parameters

Parameter	Description
n	DOMNODE to cast.

222.7.82 MAKEELEMENT Function

This function casts a specified `DOMNODE` to a `DOMELEMENT`, and returns the `DOMELEMENT`.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKEELEMENT (  
    n          IN      DOMNODE)  
RETURN DOMELEMENT;
```

Parameters

Table 222-103 MAKEELEMENT Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.83 MAKEENTITY Function

This function casts a specified `DOMNODE` to a `DOMENTITY`, and returns the `DOMENTITY`.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKEENTITY (  
    n          IN      DOMNODE)  
RETURN DOENTITY;
```

Parameters

Table 222-104 MAKEENTITY Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.84 MAKEENTITYREFERENCE Function

This function casts a specified `DOMNODE` to a `DOENTITYREFERENCE`, and returns the `DOENTITYREFERENCE`.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKEENTITYREFERENCE (  
    n          IN      DOMNODE)  
RETURN DOENTITYREFERENCE;
```

Parameters

Table 222-105 MAKEENTITYREFERENCE Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.85 MAKENODE Functions

This function is overloaded. The specific forms of functionality are described along with the syntax declarations.

Syntax

Casts specified DOMATTR to a DOMNODE, and returns the DOMNODE (See Also: [DOMAttr Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (  
    a          IN      DOMATTR)  
RETURN DOMNODE;
```

Casts the DOMCDATASECTION to a DOMNODE, and returns that DOMNODE (See Also: [DOMCDATASection Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (  
    cds        IN      DOMCDATASECTION)  
RETURN DOMNODE;
```

Casts the specified DOMCHARACTERDATA as a DOMNODE, and returns that DOMNODE (See Also: [DOMCharacterData Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (  
    cd         IN      DOMCHARACTERDATA)  
RETURN DOMNODE;
```

Casts the specified DOMCOMMENT to a DOMNODE, and returns that DOMNODE (See Also: [DOMComment Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (  
    com        IN      DOMCOMMENT)  
RETURN DOMNODE;
```

Casts the DOMDOCUMENT to a DOMNODE, and returns that DOMNODE (See Also: [DOMDocument Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (  
    doc        IN      DOMDOCUMENT)  
RETURN DOMNODE;
```

Casts the specified DOMDOCUMENTFRAGMENT to a DOMNODE, and returns that DOMNODE (See Also: [DOMDocumentFragment Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (  
    df         IN      DOMDOCUMENTFRAGMENT)  
RETURN DOMNode;
```

Casts the specified DOMDOCUMENTTYPE to a DOMNODE, and returns that DOMNODE (See Also: [DOMDocumentType Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (  
    dt         IN      DOMDOCUMENTTYPE)  
RETURN DOMNODE;
```

Casts the specified DOMELEMENT to a DOMNODE, and returns that DOMNODE (See Also: [DOMElement Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (
    elem      IN      DOMELEMENT)
RETURN DOMNODE;
```

Casts specified `DOMENTITY` to a `DOMNODE`, and returns that `DOMNODE` (See Also: [DOMEntity Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (
    ent      IN      DOMENTITY)
RETURN DOMNODE;
```

Casts the `DOMENTITYREFERENCE` to a `DOMNODE`, and returns that `DOMNODE` (See Also: [DOMEntityReference Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (
    eref     IN      DOMENTITYREFERENCE)
RETURN DOMNODE;
```

Casts the `DOMNOTATION` to a `DOMNODE`, and returns that `DOMNODE` (See Also: [DOMNotation Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (
    n      IN      DOMNOTATION)
RETURN DOMNODE;
```

Casts the `DOMPROCESSINGINSTRUCTION` to a `DOMNODE`, and returns the `DOMNODE` (See Also: [DOMProcessingInstruction Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (
    pi      IN      DOMPROCESSINGINSTRUCTION)
RETURN DOMNODE;
```

Casts the `DOMTEXT` to a `DOMNODE`, and returns that `DOMNODE` (See Also: [DOMText Subprograms](#)):

```
DBMS_XMLDOM.MAKENODE (
    t      IN      DOMTEXT)
RETURN DOMNODE;
```

Parameters

Table 222-106 MAKENODE Function Parameters

Parameter	Description
a	DOMATTR to cast
cds	DOMCDATASECTION to cast
cd	DOMCHARACTERDATA to cast
com	DOMCOMMENT to cast
doc	DOMDOCUMENT to cast
df	DOMDOCUMENTFRAGMENT to cast
dt	DOMDOCUMENTTYPE to cast
elem	DOMELEMENT to cast
ent	DOMENTITY to cast
eref	DOMENTITYREFERENCE to cast

Table 222-106 (Cont.) MAKENODE Function Parameters

Parameter	Description
n	DOMNOTATION to cast
pi	DOMPROCESSINGINSTRUCTION to cast
t	DOMTEXT to cast

222.7.86 MAKENOTATION Function

This function casts a specified DOMNODE to a DOMNOTATION, and returns the DOMNOTATION.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKENOTATION (
    n          IN      DOMNODE)
RETURN DOMNOTATION;
```

Parameters

Table 222-107 MAKENOTATION Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.87 MAKEPROCESSINGINSTRUCTION Function

This function casts a specified DOMNODE to a DOMPROCESSINGINSTRUCTION, and returns the Domprocessinginstruction.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKEPROCESSINGINSTRUCTION (
    n          IN      DOMNODE)
RETURN DOMPROCESSINGINSTRUCTION;
```

Parameters

Table 222-108 MAKEPROCESSINGINSTRUCTION Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.88 MAKETEXT Function

This function casts a specified DOMNODE to a DOMTEXT, and returns the DOMTEXT.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.MAKETEXT (
    n          IN      DOMNODE)
RETURN DOMTEXT;
```

Parameters

Table 222-109 MAKETEXT Function Parameters

Parameter	Description
n	DOMNODE to cast

222.7.89 NEWDOMDOCUMENT Functions

This function returns a new DOMDOCUMENT instance.



See Also:

[DOMDocument Subprograms](#)

Syntax

Returns a new DOMDOCUMENT instance:

```
DBMS_XMLDOM.NEWDOMDOCUMENT
RETURN DOMDOCUMENT;
```

Returns a new DOMDOCUMENT instance created from the specified XMLType object:

```
DBMS_XMLDOM.NEWDOMDOCUMENT (
    xmldoc    IN SYS.XMLTYPE)
RETURN DOMDOCUMENT;
```

Returns a new DOMDOCUMENT instance created from the specified CLOB:

```
DBMS_XMLDOM.NEWDOMDOCUMENT (
    clob      IN    CLOB)
RETURN DOMDOCUMENT;
```

Parameters

Table 222-110 NEWDOMDOCUMENT Function Parameters

Parameter	Description
xmldoc	XMLType source for the DOMDOCUMENT
clob	CLOB source for the DOMDOCUMENT

222.7.90 NORMALIZE Procedure

This procedure normalizes the text children of the DOMELEMENT.



See Also:

[DOMELEMENT Subprograms](#)

Syntax

```
DBMS_XMLDOM.NORMALIZE (
    elem      IN    DOMELEMENT);
```

Parameters

Table 222-111 NORMALIZE Procedure Parameters

Parameter	Description
elem	The DOMELEMENT

222.7.91 REMOVEATTRIBUTE Procedures

This procedure removes an attribute from the DOMELEMENT by name.



See Also:

[DOMELEMENT Subprograms](#)

Syntax

Removes the value of a `DOMELEMENT`'s attribute by name:

```
DBMS_XMLDOM.REMOVEATTRIBUTE (
  elem      IN   DOMELEMENT,
  name      IN   VARCHAR2);
```

Removes the value of a `DOMELEMENT`'s attribute by name and namespace URI.

```
DBMS_XMLDOM.REMOVEATTRIBUTE (
  elem      IN   DOMELEMENT,
  name      IN   VARCHAR2,
  ns        IN   VARCHAR2);
```

Parameters

Table 222-112 REMOVEATTRIBUTE Procedure Parameters

Parameter	Description
<code>elem</code>	The <code>DOMELEMENT</code>
<code>name</code>	Attribute name
<code>ns</code>	Namespace

222.7.92 REMOVEATTRIBUTENODE Function

This function removes the specified attribute node from the `DOMELEMENT`. The method returns the removed node.



See Also:

[DOMELEMENT Subprograms](#)

Syntax

```
DBMS_XMLDOM.REMOVEATTRIBUTENODE (
  elem      IN   DOMELEMENT,
  oldAttr   IN   DOMATTR)
RETURN DOMATTR;
```

Parameters

Table 222-113 REMOVEATTRIBUTENODE Function Parameters

Parameter	Description
<code>elem</code>	The <code>DOMELEMENT</code> .
<code>oldAttr</code>	The old <code>DOMATTR</code> .

222.7.93 REMOVECHILD Function

This function removes the child node indicated by `oldchild` from the list of children, and returns it.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.REMOVECHILD(  
    n            IN      DOMNode,  
    oldchild    IN      DOMNode)  
RETURN DOMNODE;
```

Parameters

Table 222-114 REMOVECHILD Function Parameters

Parameter	Description
<code>n</code>	DOMNODE
<code>oldChild</code>	The child of the node <code>n</code> to be removed

222.7.94 REMOVENAMEDITEM Function

This function removes a node, specified by name, from the map and returns this node.

When this map contains the attributes attached to an element, if the removed attribute is known to have a default value, an attribute immediately appears containing the default value as well as the corresponding namespace URI, local name, and prefix when applicable.



See Also:

[DOMNamedNodeMap Subprograms](#)

Syntax

Removes a node specified by name:

```
DBMS_XMLDOM.REMOVENAMEDITEM(  
    nnm        IN      DOMNamedNodeMap,  
    name       IN      VARCHAR2)  
RETURN DOMNode;
```

Removes a node specified by name and namespace URI:

```
DBMS_XMLDOM.REMOVENAMEDITEM(  
    nnm        IN      DOMNamedNodeMap,
```

```

name      IN      VARCHAR2,
ns        IN      VARCHAR2)
RETURN DOMNode;

```

Parameters

Table 222-115 REMOVE_NAMED_ITEM Function Parameters

Parameter	Description
nnm	DOMNamedNodeMap
name	The name of the item to be removed from the map
ns	Namespace

222.7.95 REPLACE_CHILD Function

This function replaces the child node `oldchild` with `newchild` in the list of children, and returns the `oldchild` node.

If `newchild` is a `DocumentFragment` object, `oldchild` is replaced by all of the `DocumentFragment` children, which are inserted in the same order. If the `newchild` is already in the tree, it is first removed.



See Also:

[DOMNode Subprograms](#)

Syntax

```

DBMS_XMLDOM.REPLACE_CHILD(
  n          IN      DOMNode,
  newchild   IN      DOMNode,
  oldchild   IN      DOMNode)
RETURN DOMNode;

```

Parameters

Table 222-116 REPLACE_CHILD Function Parameters

Parameter	Description
n	DOMNode
newchild	The new child which is to replace the old child
oldchild	The child of the node n which is to be replaced

222.7.96 REPLACEDATA Procedure

This procedure changes a range of characters in the node. Upon success, data and length reflect the change.



See Also:

[DOMCharacterData Subprograms](#)

Syntax

```
DBMS_XMLDOM.REPLACEDATA (  
    cd          IN      DOMCHARACTERDATA,  
    offset      IN      NUMBER,  
    cnt         IN      NUMBER,  
    arg         IN      VARCHAR2);
```

Parameters

Table 222-117 REPLACEDATA Procedure Parameters

Parameter	Description
cd	DOMCHARACTERDATA
offset	The offset at which to replace
cnt	The number of characters to replace
arg	The value to replace with

222.7.97 RESOLVENAMESPACEPREFIX Function

This function resolves the specified namespace prefix, and returns the resolved namespace.



See Also:

[DOMElement Subprograms](#)

Syntax

```
DBMS_XMLDOM.RESOLVENAMESPACEPREFIX (  
    elem        IN      DOMELEMENT,  
    prefix      IN      VARCHAR2)  
RETURN VARCHAR2;
```

Parameters

Table 222-118 RESOLVENAMESPACEPREFIX Function Parameters

Parameter	Description
elem	The DOMELEMENT
prefix	Namespace prefix

222.7.98 SETATTRIBUTE Procedures

This procedure sets the value of a DOMELEMENT's attribute by name.



See Also:

[DOMELEMENT Subprograms](#)

Syntax

Sets the value of a DOMELEMENT's attribute by name:

```
DBMS_XMLDOM.SETATTRIBUTE (
  elem      IN  DOMELEMENT,
  name      IN  VARCHAR2,
  newvalue  IN  VARCHAR2);
```

Sets the value of a DOMELEMENT's attribute by name and namespace URI:

```
DBMS_XMLDOM.SETATTRIBUTE (
  elem      IN  DOMELEMENT,
  name      IN  VARCHAR2,
  newvalue  IN  VARCHAR2,
  ns        IN  VARCHAR2);
```

Parameters

Table 222-119 SETATTRIBUTE Procedure Parameters

Parameter	Description
elem	The DOMELEMENT
name	Attribute name
newvalue	Attribute value
ns	Namespace

222.7.99 SETATTRIBUTENODE Functions

This function adds a new attribute node to the `DOMELEMENT`.



See Also:

[DOMElement Subprograms](#)

Syntax

Adds a new attribute node to the `DOMELEMENT`:

```
DBMS_XMLDOM.SETATTRIBUTENODE (
  elem      IN  DOMELEMENT,
  newAttr   IN  DOMATTR)
RETURN DOMATTR;
```

Adds a new attribute node to the `DOMElement`; namespace enabled:

```
DBMS_XMLDOM.SETATTRIBUTENODE (
  elem      IN  DOMELEMENT,
  newAttr   IN  DOMATTR,
  ns        IN  VARCHAR2)
RETURN DOMATTR;
```

Parameters

Table 222-120 SETATTRIBUTENODE Function Parameters

Parameter	Description
<code>elem</code>	The <code>DOMELEMENT</code>
<code>newAttr</code>	The new <code>DOMATTR</code>
<code>ns</code>	The namespace

222.7.100 SETCHARSET Procedure

This function sets the character set of the DOM document.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.SETCHARSET (
  doc      IN  DOMDocument,
  charset  IN  VARCHAR2);
```

Parameters

Table 222-121 SETCHARSET Procedure Parameters

Parameter	Description
doc	DOM document
charset	Character set

Usage Notes

This is used for [WRITETOFILE Procedures](#) if not explicitly specified at that time.

222.7.101 SETDATA Procedures

This overloaded procedure sets character data or `DOMPROCESSINGINSTRUCTION` content data. The specific functionality is described in the syntax declarations.

Syntax

Sets the character data of the node that implements this interface (See Also: [DOMCharacterData Subprograms](#)):

```
DBMS_XMLDOM.SETDATA (
    cd      IN      DOMCHARACTERDATA,
    data    IN      VARCHAR2);
```

Sets the content data of the `DOMPROCESSINGINSTRUCTION` (See Also: [DOMProcessingInstruction Subprograms](#)):

```
DBMS_XMLDOM.SETDATA (
    pi      IN      DOMPROCESSINGINSTRUCTION,
    data    IN      VARCHAR2);
```

Parameters

Table 222-122 SETDATA Procedure Parameters

Parameter	Description
cd	DOMCHARACTERDATA
data	The data to which the node is set
pi	DOMPROCESSINGINSTRUCTION
data	New processing instruction content data

222.7.102 SETDOCTYPE Procedure

Given a DOM document, this procedure creates a new DTD with the specified name, system id and public id and sets it in the document.

This DTD can later be retrieved using the [GETDOCTYPE Function](#).

Syntax

```
DBMS_XMLDOM.SETDOCTYPE (
  doc      IN   DOMDocument,
  name     IN   VARCHAR2,
  sysid   IN   VARCHAR2,
  pubid   IN   VARCHAR2);
```

Parameters

Table 222-123 SETDOCTYPE Procedure Parameters

Parameter	Description
doc	The document whose DTD has to be set
name	The name that the doctype needs to be initialized with
sysid	The system ID that the doctype needs to be initialized with
pubid	The public ID that the doctype needs to be initialized with

222.7.103 SETNAMEDITEM Function

This function adds a node using its `nodeName` attribute.

If a node with that name is already present in this map, it is replaced by the new one. The old node is returned on replacement; if no replacement is made, `NULL` is returned.

As the `nodeName` attribute is used to derive the name under which the node must be stored, multiple nodes of certain types, those that have a "special" string value, cannot be stored because the names would clash. This is seen as preferable to allowing nodes to be aliased.



See Also:

[DOMNamedNodeMap Subprograms](#)

Syntax

Adds a node using its `nodeName` attribute:

```
DBMS_XMLDOM.SETNAMEDITEM (
  nnm      IN   DOMNAMEDNODEMAP,
  arg      IN   DOMNODE)
RETURN DOMNode;
```

Adds a node using its `nodeName` attribute and namespace URI:

```
DBMS_XMLDOM.SETNAMEDITEM (
  nnm      IN   DOMNAMEDNODEMAP,
  arg      IN   DOMNODE,
  ns       IN   VARCHAR2)
RETURN DOMNode;
```

Parameters

Table 222-124 SETNAMEDITEM Function Parameters

Parameter	Description
nrm	DOMNAMEDNODEMAP
arg	The Node to be added using its <code>nodeName</code> attribute
ns	Namespace

222.7.104 SETNODEVALUE Procedure

This procedure sets the value of this node, depending on its type. When it is defined to be `NULL`, setting it has no effect.

**See Also:**[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.SETNODEVALUE (
    n          IN      DOMNODE,
    nodeValue IN      VARCHAR2);
```

Parameters

Table 222-125 SETNODEVALUE Procedure Parameters

Parameter	Description
n	DOMNode
nodeValue	The value to which node is set

222.7.105 SETNODEVALUEASBINARYSTREAM Function & Procedure

The operation of these subprograms is described in the syntax section.

**See Also:**[DOMNode Subprograms](#)

Syntax

This function returns an instance of the PL/SQL `XMLBINARYOUTPUTSTREAM` into which the caller can write the node value. The datatype of the node must be `RAW` or `BLOB` – if not, an exception is raised.

```
DBMS_XMLDOM.SETNODEVALUEASBINARYSTREAM (
  n      IN      DOMNODE)
RETURN SYS.UTL_BINARYOUTPUTSTREAM;
```

Using this procedure, the application passes in an implementation of `sys.utl_BinaryInputStream` from which XDB reads data to populate the node. The datatype of the node must be `RAW` or `BLOB` – if not an exception is raised.

```
DBMS_XMLDOM.SETNODEVALUEASBINARYSTREAM (
  n      in      DOMNODE,
  value  in      SYS.UTL_BINARYINPUTSTREAM);
```

Parameters

Table 222-126 SETNODEVALUEASBINARYSTREAM Function & Procedure Parameters

Parameter	Description
n	DOMNODE
value	BINARYINPUTSTREAM

222.7.106 SETNODEVALUEASCHARACTERSTREAM Function & Procedure

The operation of these subprograms is described in the syntax section.



See Also:

[DOMNode Subprograms](#)

Syntax

This function returns an instance of the PL/SQL `XMLCHARACTEROUTPUTSTREAM` type into which the caller can write the node value. The datatype of the node can be any valid XDB datatype. If the type is not `character` or `CLOB`, the character data written to the stream is converted to the node datatype. If the datatype of the node is `character` or `CLOB`, then the character data written to the stream is converted from PL/SQL session character set to the character set of the node.

```
DBMS_XMLDOM.SETNODEVALUEASCHARACTERSTREAM (
  n      IN      DOMNODE)
RETURN SYS.UTL_CHARACTEROUTPUTSTREAM;
```

Using this procedure, the application passes in an implementation of `SYS.UTL_CHARACTERINPUTSTREAM` from which XDB reads to populate the node. The datatype of

the node may be any valid type supported by XDB. If a non-character datatype, the character data read from the stream is converted to the datatype of the node. If the datatype of the node is either character or CLOB, then no conversion occurs and the character set of the node becomes the character set of the PL/SQL session.

```
DBMS_XMLDOM.SETNODEVALUEASCHARACTERSTREAM (
  n          IN    DOMNODE,
  value      IN    SYS.UTL_CHARACTERINPUTSTREAM);
```

Parameters

Table 222-127 SETNODEVALUEASCHARACTERSTREAM Function & Procedure Parameters

Parameter	Description
n	DOMNODE
value	CHARACTERINPUTSTREAM

222.7.107 SETPREFIX Procedure

This procedure sets the namespace prefix for this node to the specified value.



See Also:

[DOMNode Subprograms](#)

Syntax

```
DBMS_XMLDOM.SETPREFIX (
  n          IN    DOMNODE,
  prefix    IN    VARCHAR2);
```

Parameters

Table 222-128 SETPREFIX Procedure Parameters

Parameter	Description
n	DOMNODE
prefix	The value for the namespace prefix of the node

222.7.108 SETSTANDALONE Procedure

This procedure sets the standalone property of the DOMDOCUMENT.



See Also:

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.SETSTANDALONE (
  doc          IN    DOMDOCUMENT,
  newvalue     IN    VARCHAR2);
```

Parameters**Table 222-129 SETSTANDALONE Procedure Parameters**

Parameter	Description
doc	DOMDOCUMENT
newvalue	Value of the standalone property of the document

222.7.109 SETVALUE Procedure

This procedure sets the value of the attribute.

**See Also:**

[DOMAttr Subprograms](#)

Syntax

```
DBMS_XMLDOM.SETVALUE (
  a          IN    DOMATTR,
  value     IN    VARCHAR2);
```

Parameters**Table 222-130 SETVALUE Procedure Parameters**

Parameter	Description
a	DOMATTR
value	The value to which to set the attribute

222.7.110 SETVERSION Procedure

This procedure sets the version of the DOMDOCUMENT.

**See Also:**

[DOMDocument Subprograms](#)

Syntax

```
DBMS_XMLDOM.SETVERSION (
  doc      IN   DOMDOCUMENT,
  version  IN   VARCHAR2);
```

Parameters**Table 222-131 SETVERSION Procedure Parameters**

Parameter	Description
doc	DOMDOCUMENT
version	The version of the document

222.7.111 SPLITTEXT Function

This function breaks this `DOMTEXT` node into two `DOMTEXT` nodes at the specified offset.

**See Also:**

[DBMS_XMLDOM DOMText Subprograms](#)

Syntax

```
DBMS_XMLDOM.SPLITTEXT (
  t      IN   DOMTEXT,
  offset IN   NUMBER)
RETURN DOMText;
```

Parameters**Table 222-132 SPLITTEXT Function Parameters**

Parameter	Description
t	DOMTEXT
offset	Offset at which to split

222.7.112 SUBSTRINGDATA Function

This function extracts a range of data from the node.

**See Also:**

[DOMCharacterData Subprograms](#)

Syntax

```
DBMS_XMLDOM.SUBSTRINGDATA (
  cd          IN      DOMCHARACTERDATA,
  offset     IN      NUMBER,
  cnt        IN      NUMBER)
RETURN VARCHAR2;
```

Parameters**Table 222-133 SUBSTRINGDATA Function Parameters**

Parameter	Description
cd	DOMCHARACTERDATA
offset	The starting offset of the data from which to get the data
cnt	The number of characters (from the offset) of the data to get

222.7.113 USEBINARYSTREAM Function

This function returns `TRUE` if the datatype of the node is `RAW` or `BLOB`, so that the node value may be read or written using an `UTL_BINARYINPUTSTREAM` or `UTL_BINARYOUTPUTSTREAM`.

If a value of `FALSE` is returned, the node value may only be accessed through an `UTL_CHARACTERINPUTSTREAM` or `UTL_CHARACTEROUTPUTSTREAM`.

**See Also:**[DOMNode Subprograms](#)**Syntax**

```
DBMS_XMLDOM.USEBINARYSTREAM (
  n          IN      DOMNODE)
RETURN BOOLEAN;
```

Parameters**Table 222-134 USEBINARYSTREAM Function Parameters**

Parameter	Description
n	DOMNODE

222.7.114 WRITETOBUFFER Procedures

`WRITETOBUFFER` is an overloaded procedure that writes an XML node, XML document, or a document fragment to a specified buffer.

This procedure is overloaded. The specific forms of functionality are described along with the syntax declarations.

Syntax

Writes XML node to specified buffer using the database character set (See Also: [DOMNode Subprograms](#)):

```
DBMS_XMLDOM.WRITETOBUFFER (
  n          IN          DOMNODE,
  buffer     IN OUT     VARCHAR2);
```

Writes XML document to a specified buffer using database character set (See Also: [DOMDocument Subprograms](#)):

```
DBMS_XMLDOM.WRITETOBUFFER (
  doc        IN          DOMDOCUMENT,
  buffer     IN OUT     VARCHAR2);
```

Writes the contents of the specified document fragment into a buffer using the database character set (See Also: [DOMDocumentFragment Subprograms](#)):

```
DBMS_XMLDOM.WRITETOBUFFER (
  df         IN          DOMDOCUMENTFRAGMENT,
  buffer     IN OUT     VARCHAR2);
```

Parameters**Table 222-135 WRITETOBUFFER Procedure Parameters**

Parameter	Description
n	DOMNODE
buffer	Buffer to which to write
doc	DOMDOCUMENT
df	DOM document fragment

222.7.115 WRITETOCLOB Procedures

WRITETOCLOB is an overloaded procedure that writes an XML node or document to a specified CLOB.

The specific forms of functionality are described along with the syntax declarations.

Syntax

Writes XML node to specified CLOB using the database character set (See Also: [DOMNode Subprograms](#)):

```
DBMS_XMLDOM.WRITETOCLOB (
  n          IN          DOMNODE,
  cl         IN OUT     CLOB);
```

Writes XML document to a specified CLOB using database character set (See Also: [DOMDocument Subprograms](#)):

```
DBMS_XMLDOM.WRITETOCLOB (
  doc        IN          DOMDOCUMENT,
  cl         IN OUT     CLOB);
```

Parameters

Table 222-136 WRITETOCLOB Procedure Parameters

Parameter	Description
n	DOMNODE
clob	CLOB to which to write
doc	DOMDOCUMENT

222.7.116 WRITETOFILE Procedures

This overloaded procedure writes an XML node or XML document to a specified node.

The specific forms of functionality are described along with the syntax declarations.

Syntax

Writes XML node to specified file using the database character set (See Also: [DOMNode Subprograms](#)):

```
DBMS_XMLDOM.WRITETOFILE (
  n          IN      DOMNODE,
  fileName  IN      VARCHAR2);
```

Writes XML node to specified file using the specified character set, which is passed in as a separate parameter (See Also: [DOMNode Subprograms](#)):

```
DBMS_XMLDOM.WRITETOFILE (
  n          IN      DOMNODE,
  fileName  IN      VARCHAR2,
  charset   IN      VARCHAR2);
```

Writes an XML document to a specified file using database character set (See Also: [DOMDocument Subprograms](#)):

```
DBMS_XMLDOM.WRITETOFILE (
  doc       IN      DOMDOCUMENT,
  filename  IN      VARCHAR2);
```

Writes an XML document to a specified file using specified character set (See Also: [DOMDocument Subprograms](#)):

```
DBMS_XMLDOM.WRITETOFILE (
  doc       IN      DOMDOCUMENT,
  fileName  IN      VARCHAR2,
  charset   IN      VARCHAR2);
```

Parameters

Table 222-137 WRITETOFILE Procedure Parameters

Parameter	Description
n	DOMNODE

Table 222-137 (Cont.) WRITETOFILE Procedure Parameters

Parameter	Description
fileName	File to which to write. The filename should be in the format of database_directory_object_name/filename, for example mydir/filename (on windows, use \ instead of /).
charset	specified character set
doc	DOMDOCUMENT
charset	Character set

DBMS_XMLGEN

The `DBMS_XMLGEN` package converts the results of a SQL query to a canonical XML format.

Note:

The PL/SQL package `DBMS_XMLGEN` is deprecated in Oracle Database 23ai.

`DBMS_XMLGEN` is a non-standard Oracle-proprietary package that is provided to generate and convert XML documents from SQL queries or with PL/SQL. This package is deprecated, and can be desupported in a future release. Oracle recommends that you use SQL/XML operators to generate XML from relational columns instead. Using ANSI SQL/XML operators for any generation and modification of XML documents provides a standardized and future-proof way to work with XML documents.

The package takes an arbitrary SQL query as input, converts it to XML format, and returns the result as a `CLOB`. This package is similar to the `DBMS_XMLQUERY` package, except that it is written in C and compiled into the kernel. This package can only be run on the database.

This chapter contains the following topic:

- [Security Model](#)
- [Summary of DBMS_XMLGEN Subprograms](#)

See Also:

Oracle XML DB Developer's Guide, or more information on XML support and on examples of using `DBMS_XMLGEN`

223.1 DBMS_XMLGEN Security Model

Owned by `XDB`, the `DBMS_XMLGEN` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `PUBLIC`. Subprograms in this package are executed using the privileges of the current user.

223.2 Summary of DBMS_XMLGEN Subprograms

This table lists the `DBMS_XMLGEN` subprograms and briefly describes them.

Table 223-1 Summary of DBMS_XMLGEN Package Subprograms

Subprogram	Description
CLOSECONTEXT Procedure	Closes the context and releases all resources
CONVERT Functions	Converts the XML into the escaped or unescaped XML equivalent
GETNUMROWSPROCESSED Function	Gets the number of SQL rows that were processed in the last call to GETXML Functions
GETXML Functions	Gets the XML document
GETXMLTYPE Functions	Gets the XML document and returns it as <code>XMLType</code>
NEWCONTEXT Functions	Creates a new context handle
NEWCONTEXTFROMHIERARCHY Function	Obtains a handle to use in the GETXML Functions and other functions to get a hierarchical XML with recursive elements from the result
RESTARTQUERY Procedure	Restarts the query to start fetching from the beginning
SETCONVERTSPECIALCHARS Procedure	Sets whether special characters such as \$, which are non-XML characters, should be converted or not to their escaped representation
SETMAXROWS Procedure	Sets the maximum number of rows to be fetched each time
SETNULLHANDLING Procedure	Sets <code>NULL</code> handling options
SETROWSETTAG Procedure	Sets the name of the element enclosing the entire result
SETROWTAG Procedure	Sets the name of the element enclosing each row of the result
SETSKIPROWS Procedure	Sets the number of rows to skip every time before generating the XML.
USEITEMTAGSFORCOLL Procedure	Forces the use of the collection column name appended with the tag <code>_ITEM</code> for collection elements
USENULLATTRIBUTEINDICATOR Procedure	Specifies whether to use an XML attribute to indicate <code>NULL</code> ness, or to do it by omitting the inclusion of the particular entity in the XML document.

223.2.1 CLOSECONTEXT Procedure

This procedure closes a given context and releases all resources associated with it, including the SQL cursor and bind and define buffers. After this call, the handle cannot be used for a subsequent function call.

Syntax

```
DBMS_XMLGEN.CLOSECONTEXT (
    ctx IN ctxHandle);
```

Parameters

Table 223-2 CLOSECONTEXT Procedure Parameters

Parameter	Description
<code>ctx</code>	The context handle to close.

223.2.2 CONVERT Functions

This function converts the XML data into the escaped or unescapes XML equivalent, and returns XML CLOB data in encoded or decoded format. There are several version of the function.

Syntax

Uses XMLDATA in string form (VARCHAR2):

```
DBMS_XMLGEN.CONVERT (  
    xmlData IN VARCHAR2,  
    flag    IN NUMBER := ENTITY_ENCODE)  
RETURN VARCHAR2;
```

Uses XMLDATA in CLOB form:

```
DBMS_XMLGEN.CONVERT (  
    xmlData IN CLOB,  
    flag    IN NUMBER := ENTITY_ENCODE)  
RETURN CLOB;
```

Parameters

Table 223-3 CONVERT Function Parameters

Parameter	Description
xmlData	The XML CLOB data to be encoded or decoded.
flag	The flag setting; ENTITY_ENCODE (default) for encode, and ENTITY_DECODE for decode.

Usage Notes

This function escapes the XML data if the ENTITY_ENCODE is specified. For example, the escaped form of the character < is <. Unescaping is the reverse transformation.

223.2.3 GETNUMROWSPROCESSED Function

This function retrieves the number of SQL rows processed when generating the XML using the GETXML Functions call. This count does not include the number of rows skipped before generating the XML.

Note that GETXML Functions always generates an XML document, even if there are no rows present.

Syntax

```
DBMS_XMLGEN.GETNUMROWSPROCESSED (  
    ctx    IN    ctxHandle)  
RETURN NUMBER;
```

Parameters

Table 223-4 GETNUMROWSPROCESSED Function Parameters

Parameter	Description
ctx	The context handle obtained from the NEWCONTEXT Functions call.

Usage Notes

This function is used to determine the terminating condition if calling GETXML Functions in a loop.

Related Topics

- [GETXML Functions](#)
This function gets the XML document. The function is overloaded.

223.2.4 GETXML Functions

This function gets the XML document. The function is overloaded.

Syntax

Gets the XML document by fetching the maximum number of rows specified. It appends the XML document to the CLOB passed in. Use this version of [GETXML Functions](#) to avoid any extra CLOB copies and to reuse the same CLOB for subsequent calls. Because of the CLOB reuse, this [GETXML Functions](#) call is potentially more efficient:

```
DBMS_XMLGEN.GETXML (
    ctx          IN ctxHandle,
    tmpclob      IN OUT NCOPY CLOB,
    dtdOrSchema IN number := NONE)
RETURN BOOLEAN;
```

Generates the XML document and returns it as a temporary CLOB. The temporary CLOB obtained from this function must be freed using the DBMS_LOB.FREETEMPORARY call:

```
DBMS_XMLGEN.GETXML (
    ctx          IN ctxHandle,
    dtdOrSchema IN number := NONE)
RETURN CLOB;
```

Converts the results from the SQL query string to XML format, and returns the XML as a temporary CLOB, which must be subsequently freed using the

DBMS_LOB.FREETEMPORARY call:

```
DBMS_XMLGEN.GETXML (
    sqlQuery     IN VARCHAR2,
    dtdOrSchema  IN number := NONE)
RETURN CLOB;
```


Parameters

Table 223-5 GETXML Function Parameters

Parameter	Description
ctx	The context handle obtained from the <code>newContext</code> call.
tmpclob	The CLOB to which the XML document is appended.
sqlQuery	The SQL query string.
dtdOrSchema	Generate a DTD or a schema? Only <code>NONE</code> is supported.

Usage Notes

When the rows indicated by the [SETSKIPROWS Procedure](#) call are skipped, the maximum number of rows as specified by the [SETMAXROWS Procedure](#) call (or the entire result if not specified) is fetched and converted to XML. Use the [GETNUMROWSPROCESSED Function](#) to check if any rows were retrieved.

223.2.5 GETXMLTYPE Functions

This function gets the XML document and returns it as an `XMLTYPE`. `XMLTYPE` operations can be performed on the results. This function is overloaded.

Syntax

Generates the XML document and returns it as a `sys.XMLType`:

```
DBMS_XMLGEN.GETXMLTYPE (
    ctx             IN ctxhandle,
    dtdOrSchema    IN number := NONE)
RETURN sys.XMLType;
```

Converts the results from the SQL query string to XML format, and returns the XML as a `sys.XMLType`:

```
DBMS_XMLGEN.GETXMLTYPE (
    sqlQuery       IN VARCHAR2,
    dtdOrSchema    IN number := NONE)
RETURN sys.XMLType
```

Parameters

Table 223-6 GETXMLTYPE Function Parameters

Parameter	Description
ctx	The context handle obtained from the <code>newContext</code> call.
sqlQuery	The SQL query string.
dtdOrSchema	Generate a DTD or a schema? Only <code>NONE</code> is supported.

223.2.6 NEWCONTEXT Functions

This function generates and returns a new context handle.

This context handle is used in [GETXML Functions](#) and other functions to get XML back from the result. There are several version of the function.

Syntax

Generates a new context handle from a query:

```
DBMS_XMLGEN.NEWCONTEXT (  
    query      IN VARCHAR2)  
RETURN ctxHandle;
```

Generates a new context handle from a query string in the form of a PL/SQL ref cursor:

```
DBMS_XMLGEN.NEWCONTEXT (  
    queryString IN SYS_REFCURSOR)  
RETURN ctxHandle;
```

Parameters

Table 223-7 NEWCONTEXT Function Parameters

Parameter	Description
query	The query, in the form of a VARCHAR, the result of which must be converted to XML.
queryString	The query string in the form of a PL/SQL ref cursor, the result of which must be converted to XML.

223.2.7 NEWCONTEXTFROMHIERARCHY Function

This function obtains a handle to use in the GETXML Functions and other functions to get a hierarchical XML with recursive elements from the result.

Syntax

```
DBMS_XMLGEN.NEWCONTEXTFROMHIERARCHY (  
    queryString IN VARCHAR2)  
RETURN ctxHandle;
```

Parameters

Table 223-8 NEWCONTEXTFROMHIERARCHY Function Parameters

Parameter	Description
queryString	The query string, the result of which must be converted to XML. The query is a hierarchical query typically formed using a <code>CONNECT BY</code> clause, and the result must have the same property as the result set generated by a <code>CONNECT BY</code> query. The result set must have only two columns, the level number and an XML value. The level number is used to determine the hierarchical position of the XML value within the result XML document.

Related Topics

- [GETXML Functions](#)
This function gets the XML document. The function is overloaded.

223.2.8 RESTARTQUERY Procedure

This procedure restarts the query and generates the XML from the first row.

It can be used to start executing the query again, without having to create a new context.

Syntax

```
DBMS_XMLGEN.RESTARTQUERY (
  ctx IN ctxHandle);
```

Parameters

Table 223-9 RESTARTQUERY Procedure Parameters

Parameter	Description
ctx	The context handle corresponding to the current query.

223.2.9 SETCONVERTSPECIALCHARS Procedure

This procedure sets whether or not special characters in the XML data must be converted into their escaped XML equivalent. For example, the `<` sign is converted to `<`.

The default is to perform conversions.

This function improves performance of XML processing when the input data cannot contain any special characters such as `<`, `>`, `"`, `'`, which must be escaped. It is expensive to scan the character data to replace the special characters, particularly if it involves a lot of data.

Syntax

```
DBMS_XMLGEN.SETCONVERTSPECIALCHARS (
  ctx IN ctxHandle,
  conv IN BOOLEAN);
```

Parameters

Table 223-10 SETCONVERTSPECIALCHARS Procedure Parameters

Parameter	Description
ctx	The context handle obtained from one of the NEWCONTEXT Functions call.
conv	TRUE indicates that conversion is needed.

223.2.10 SETMAXROWS Procedure

This procedure sets the maximum number of rows to fetch from the SQL query result for every invocation of the GETXML Functions call.

It is used when generating paginated results. For example, when generating a page of XML or HTML data, restrict the number of rows converted to XML or HTML by setting the `maxRows` parameter.

Syntax

```
DBMS_XMLGEN.SETMAXROWS (
  ctx      IN ctxHandle,
  maxRows  IN NUMBER);
```

Parameters

Table 223-11 SETMAXROWS Procedure Parameters

Parameter	Description
ctx	The context handle corresponding to the query executed.
maxRows	The maximum number of rows to get for each call to GETXML Functions

Related Topics

- [GETXML Functions](#)
This function gets the XML document. The function is overloaded.

223.2.11 SETNULLHANDLING Procedure

This procedure sets NULL handling options, handled through the `flag` parameter setting.

Syntax

```
DBMS_XMLGEN.SETNULLHANDLING (
  ctx IN ctx,
  flag IN NUMBER);
```

Parameters

Table 223-12 SETNULLHANDLING Procedure Parameters

Parameter	Description
ctx	The context handle corresponding to the query executed.
flag	The NULL handling option set. <ul style="list-style-type: none"> DROP_NULLS CONSTANT NUMBER:= 0; (Default) Leaves out the tag for NULL elements. NULL_ATTR CONSTANT NUMBER:= 1; Sets xsi:nil="true". EMPTY_TAG CONSTANT NUMBER:= 2; Sets, for example, <foo/>.

223.2.12 SETROWSETTAG Procedure

This procedure sets the name of the root element of the document. The default name is ROWSET.

Syntax

```
DBMS_XMLGEN.SETROWSETTAG (
  ctx          IN ctxHandle,
  rowSetTagName IN VARCHAR2);
```

Parameters

Table 223-13 SETROWSETTAG Procedure Parameters

Parameter	Description
ctx	The context handle obtained from the NEWCONTEXT Functions call.
rowSetTagName	The name of the document element. Passing NULL indicates that you do not want the ROWSET element present.

Usage Notes

The user can set the rowSetTag to NULL to suppress the printing of this element. However, an error is produced if both the row and the rowset are NULL and there is more than one column or row in the output. This is because the generated XML would not have a top-level enclosing tag, and so would be invalid.

223.2.13 SETROWTAG Procedure

This procedure sets the name of the element separating all the rows. The default name is ROW.

Syntax

```
DBMS_XMLGEN.SETROWTAG (
  ctx          IN ctxHandle,
  rowTagName IN VARCHAR2);
```

Parameters

Table 223-14 SETROWTAG Procedure Parameters

Parameter	Description
ctx	The context handle obtained from the NEWCONTEXT Functions call.
rowTagName	The name of the ROW element. Passing NULL indicates that you do not want the ROW element present.

Usage Notes

The user can set the name of the element to NULL to suppress the ROW element itself. However, an error is produced if both the row and the rowset are NULL and there is more than one column or row in the output. This is because the generated XML would not have a top-level enclosing tag, and so would be invalid.

223.2.14 SETSKIPROWS Procedure

This procedure skips a given number of rows before generating the XML output for every call to the GETXML Functions. It is used when generating paginated results for stateless Web pages using this utility.

For example, when generating the first page of XML or HTML data, set `skiprows` to zero. For the next set, set the `skiprows` to the number of rows obtained in the first case. See [GETNUMROWSPROCESSED Function](#).

Syntax

```
DBMS_XMLGEN.SETSKIPROWS (
  ctx          IN ctxHandle,
  skipRows    IN NUMBER);
```

Parameters

Table 223-15 SETSKIPROWS Procedure Parameters

Parameter	Description
ctx	The context handle corresponding to the query executed.
skipRows	The number of rows to skip for each call to <code>getXML</code> .

Related Topics

- [GETXML Functions](#)
This function gets the XML document. The function is overloaded.

223.2.15 USEITEMTAGSFORCOLL Procedure

This procedure overrides the default name of the collection elements. The default name for collection elements is the type name itself.

Syntax

```
DBMS_XMLGEN.USEITEMTAGSFORCOLL (
    ctx IN ctxHandle);
```

Parameters

Table 223-16 USEITEMTAGSFORCOLL Procedure Parameters

Parameter	Description
ctx	The context handle.

Usage Notes

Using this procedure, you can override the default to use the name of the column with the `_ITEM` tag appended to it. If there is a collection of `NUMBER`, the default tag name for the collection elements is `NUMBER`.

223.2.16 USENULLATTRIBUTEINDICATOR Procedure

This procedure specifies whether to use an XML attribute to indicate `NULL`, or to do it by omitting the inclusion of the particular entity in the XML document.

It is used as a shortcut for the [SETNULLHANDLING Procedure](#).

Syntax

```
DBMS_XMLGEN.USENULLATTRIBUTEINDICATOR (
    ctx          IN    ctxType,
    attrind     IN    BOOLEAN := TRUE);
```

Parameters

Table 223-17 USENULLATTRIBUTEINDICATOR Procedure Parameters

Parameter	Description
ctx	Context handle.
attrind	Use attribute to indicate <code>NULL</code> ?

DBMS_XMLINDEX

The `DBMS_XMLINDEX` package provides an interface to implement asynchronous indexing.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_XMLINDEX Subprograms](#)



See Also:

Oracle XML DB Developer's Guide for more information about "XMLIndex"

224.1 DBMS_XMLINDEX Overview

`DBMS_XMLINDEX` provides a mechanism for asynchronous index maintenance.

Asynchronous Index Maintenance

The basic XMLIndex is maintained on every DML operation. However, given the computing costs, in many cases the availability of stale result is adequate. In such situations, it is desirable to defer index updates to a more convenient time, for example when the load on the database is low. `DBMS_XMLINDEX` provides this mechanism.

224.2 DBMS_XMLINDEX Security Model

Owned by `XDB`, the `DBMS_XMLINDEX` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `PUBLIC`.

Subprograms in this package are executed using the privileges of the current user.

224.3 Summary of DBMS_XMLINDEX Subprograms

This table lists the `DBMS_XMLINDEX` subprograms and briefly describes them.

Table 224-1 DBMS_XMLINDEX Package Subprograms

Subprogram	Description
CREATEDATEINDEX Procedure	Creates a secondary index for date values in the <code>VALUE</code> column of a <code>PATH TABLE</code> which is the storage table of an XMLIndex

Table 224-1 (Cont.) DBMS_XMLINDEX Package Subprograms

Subprogram	Description
CREATENUMBERINDEX Procedure	Creates a secondary index for number values in the <code>VALUE</code> column of a <code>PATH TABLE</code> which is the storage table of an <code>XMLIndex</code>
DROPPARAMETER Procedure	Drops the <code>XMLIndex</code> parameter string that is associated with a given parameter identifier.
MODIFYPARAMETER Procedure	Modifies the <code>XMLIndex</code> parameter string that is associated with a given parameter name
PROCESS_PENDING Procedure	Processes pending rows for a <code>NONBLOCKING ALTER INDEX OPERATION</code> on an <code>XMLIndex</code>
REGISTERPARAMETER Procedure	Registers a parameter string and <code>XMLIndex</code> parameter string pair in XDB
SYNCINDEX Procedure	Synchronizes the index manually

224.3.1 CREATEDATEINDEX Procedure

This procedure creates a secondary index for date values in the `VALUE` column of a `PATH TABLE` which is the storage table of an `XMLIndex`. The second form of the procedure allows for the `date_index_clause` to be set to an empty string.

Syntax

```
DBMS_XMLINDEX.CREATEDATEINDEX (
  xml_index_schema IN VARCHAR2,
  xml_index_name   IN VARCHAR2,
  date_index_name  IN VARCHAR2,
  xmltypename     IN VARCHAR2,
  date_index_clause IN VARCHAR2);
```

```
DBMS_XMLINDEX.CREATEDATEINDEX (
  xml_index_schema IN VARCHAR2,
  xml_index_name   IN VARCHAR2,
  date_index_name  IN VARCHAR2,
  xmltypename     IN VARCHAR2);
```

Parameters

Table 224-2 CREATEDATEINDEX Procedure Parameters

Parameter	Description
<code>xml_index_schema</code>	Name of the owner of the <code>XMLIndex</code>
<code>xml_index_name</code>	Name of the <code>XMLIndex</code>
<code>date_index_name</code>	Name of the secondary index to be created for date values in the <code>VALUE</code> column of the <code>PATH TABLE</code> of <code>XMLIndex</code> named <code>xml_index_name</code> and owned by <code>xml_index_schema</code>

Table 224-2 (Cont.) CREATDATEINDEX Procedure Parameters

Parameter	Description
xmltypename	The type to which values in the VALUE column of the path table are to be cast. Acceptable values are the following strings: DATETIME, TIME, DATE, GDAY, GMONTH, GYEAR, GYEARMONTH, GMONTHDAY.
date_index_clause	Storage clause to be applied to the date index during its creation. This is a string argument appended to the CREATE INDEX statement for creating the date index

224.3.2 CREATENUMBERINDEX Procedure

This procedure creates a secondary index for number values in the VALUE column of a PATH TABLE which is the storage table of an XMLIndex.

Syntax

```
DBMS_XMLINDEX.CREATENUMBERINDEX (
  xml_index_schema  IN  VARCHAR2,
  xml_index_name    IN  VARCHAR2,
  num_index_name    IN  VARCHAR2,
  num_index_clause  IN  VARCHAR2,
  xmltypename       IN  VARCHAR2);
```

Parameters

Table 224-3 CREATENUMBERINDEX Procedure Parameters

Parameter	Description
xml_index_schema	Name of the owner of the XMLIndex
xml_index_name	Name of the XMLIndex
num_index_name	Name of the secondary index to be created for number values in the VALUE column of the PATH TABLE of XMLIndex named xml_index_name and owned by xml_index_schema
num_index_clause	Storage clause to be applied to the number index during its creation. This is a string argument appended to the CREATE INDEX statement for creating the number index.
xmltypename	The type to which values in the VALUE column of the path table are to be cast. Acceptable values are the following strings: FLOAT, DOUBLE, DECIMAL, INTEGER, NONPOSITIVEINTEGER, NEGATIVEINTEGER, LONG, INT, SHORT, BYTE, NONNEGATIVEINTEGER, UNSIGNEDLONG, UNSIGNEDINT, UNSIGNEDSHORT, UNSIGNEDBYTE, POSITIVEINTEGER.

224.3.3 DROPPARAMETER Procedure

This procedure drops the XMLIndex parameter string that is associated with a given parameter identifier.

Syntax

```
DBMS_XMLINDEX.DROPPARAMETER (
    name          IN          VARCHAR2);
```

Parameters

Table 224-4 DROPPARAMETER Procedure Parameters

Parameter	Description
name	Identifier for parameter string

Examples

```
DBMS_XMLINDEX.DROPPARAMETER (
    'myIndexParam');
```

224.3.4 MODIFYPARAMETER Procedure

This procedure modifies the XMLIndex parameter string that is associated with a given parameter identifier.

Syntax

```
DBMS_XMLINDEX.MODIFYPARAMETER (
    name          IN          VARCHAR2,
    parameter     IN          CLOB);
```

Parameters

Table 224-5 MODIFYPARAMETER Procedure Parameters

Parameter	Description
name	Identifier for parameter string
parameter	XMLIndex parameter clause that can appear in a CREATE INDEX or an ALTER INDEX statement

Examples

```
DBMS_XMLINDEX.MODIFYPARAMETER (
    'myIndexParam',
    'PATH TABLE po_ptab
    PATH ID INDEX po_pidx
    ORDER KEY INDEX po_oidx
    VALUE INDEX po_vidx');
```

224.3.5 PROCESS_PENDING Procedure

This procedure processes executes DMLs required to complete a `NONBLOCKING ALTER INDEX ADD_GROUP/ADD_COLUMN` operation on an XMLIndex.

Syntax

```
DBMS_XMLINDEX.PROCESS_PENDING (
  xml_index_schema IN VARCHAR2,
  xml_index_name   IN VARCHAR2,
  pending_row_count OUT BINARY_INTEGER,
  error_row_count  OUT BINARY_INTEGER);
```

Parameters

Table 224-6 PROCESS_PENDING Procedure Parameters

Parameter	Description
<code>xml_index_schema</code>	Name of the owner of the XMLIndex
<code>xml_index_name</code>	Name of the XMLIndex to be altered using <code>NONBLOCKING ALTER INDEX OPERATION</code>
<code>pending_row_count</code>	Number of pending rows to be processed
<code>error_row_count</code>	Number of rows for which indexing may have failed because of an error

Usage Notes

- This procedure will iteratively attempt to index all necessary rows in small batches while skipping rows that are locked and rows for which index maintenance fails with an error. Therefore, it may have to be executed multiple times for an XMLIndex until all pending rows are processed. Once all pending rows are processed, user can complete the `NONBLOCKING ALTER INDEX OPERATION`.
- If it is not possible process all the pending rows after multiple trials, the user will have to manually triage the locking or error issues by examining unprocessed rows in `SYS_AIXSXI_#####_PENDINGTAB` and errors in `SYS_AIXSXI_#####_ERRORTAB`. Keeping track of rows and the errors is useful in triaging issues.

Examples

```
EXEC DBMS_XMLINDEX.PROCESS_PENDING(
  'SCOTT', 'PO_XMLINDEX_IX', out_param1, out_param2);
```

224.3.6 REGISTERPARAMETER Procedure

This procedure registers a parameter identifier and XMLIndex parameter string pair in XDB.

Syntax

```
DBMS_XMLINDEX.REGISTERPARAMETER (
  name          IN VARCHAR2,
  parameter     IN CLOB);
```

Parameters

Table 224-7 REGISTERPARAMETER Procedure Parameters

Parameter	Description
name	Identifier for parameter string
parameter	XMLIndex parameter clause that can appear in a CREATE INDEX or an ALTER INDEX statement

Examples

```
DBMS_XMLINDEX.REGISTERPARAMETER (
  'myIndexParam',
  'PATH TABLE po_ptab
  PATH ID INDEX po_pidx
  ORDER KEY INDEX po_oidx
  VALUE INDEX po_vidx
  PATHS (NAMESPACE MAPPING(xmlns:p="http://www.example.com/IPO"))
  GROUP MASTERGROUP XMLTABLE PO_TAB
  ('/p:PurchaseOrder'
   COLUMNS
     REFERENCE VARCHAR2(30) PATH 'p:Reference',
     REQUESTOR VARCHAR2(30) PATH 'p:Requestor' )
  GROUP ITEMGROUP XMLTABLE ITEMGROUP_TAB
  ('/p:PurchaseOrder/p:LineItems/p:LineItem'
   COLUMNS
     LINENUMBER NUMBER(38) PATH '@p:ItemNumber',
     QUANTITY NUMBER(38) PATH '@p:Quantity',
     DESCRIPTION VARCHAR2(256) PATH 'p:Description'));
```

224.3.7 SYNCINDEX Procedure

This function synchronizes an asynchronously maintained XMLIndex.

It applies to the XMLIndex changes that are logged in the pending table, and brings the path table up-to-date with the base XMLTYPE column.

Syntax

```
DBMS_XMLINDEX.SYNCINDEX (
  xml_index_schema    IN VARCHAR2,
  xml_index_name      IN VARCHAR2,
  partition_name      IN VARCHAR2 DEFAULT NULL,
  reindex             IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 224-8 SYNCINDEX Procedure Parameters

Parameter	Description
xml_index_schema	Name of the owner of the XMLIndex
xml_index_name	Name of the XMLIndex
partition_name	[Currently not supported]

Table 224-8 (Cont.) SYNCINDEX Procedure Parameters

Parameter	Description
reindex	Default is FALSE. If set to TRUE, this drops the secondary indexes and recreates them later so that they can be bulk-loaded.

Examples

```
EXEC DBMS_XMLINDEX.SYNCINDEX('USER1', 'SS_TAB_XMLI', REINDEX=>TRUE);
```

DBMS_XMLPARSER

Using `DBMS_XMLPARSER`, you can access the contents and structure of XML documents. XML describes a class of data XML document objects. It partially describes the behavior of computer programs which process them. By construction, XML documents are conforming SGML documents.

XML documents are made up of storage units called entities, which contain either parsed or unparsed data. Parsed data is made up of characters, some of which form character data, and some of which form markup. Markup encodes a description of the document's storage layout and logical structure. XML provides a mechanism to impose constraints on the storage layout and logical structure.

A software module called an XML processor is used to read XML documents and provide access to their content and structure. It is assumed that an XML processor is doing its work on behalf of another module, called the application. This PL/SQL implementation of the XML processor (or parser) follows the W3C XML specification REC-xml-19980210 and includes the required behavior of an XML processor in terms of how it must read XML data and the information it must provide to the application.

The default behavior for this PL/SQL XML parser is to build a parse tree that can be accessed by DOM APIs, validate it if a DTD is found (otherwise, it is non-validating), and record errors if an error log is specified. If parsing fails, an application error is raised.

This chapter contains the following topics:

- [Security Model](#)
- [Summary of DBMS_XMLPARSER Subprograms](#)



See Also:

Oracle XML DB Developer's Guide

225.1 DBMS_XMLPARSER Security Model

Owned by `XDB`, the `DBMS_XMLPARSER` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `PUBLIC`.

Subprograms in this package are executed using the privileges of the current user.

225.2 Summary of DBMS_XMLPARSER Subprograms

This table lists the `DBMS_XMLPARSER` subprograms and briefly describes them.

Table 225-1 DBMS_XMLPARSER Package Subprograms

Method	Description
FREEPARSER	Frees a parser object.
GETDOCTYPE	Gets parsed DTD.
GETDOCUMENT	Gets DOM document.
GETRELEASEVERSION	Returns the release version of Oracle XML Parser for PL/SQL.
GETVALIDATIONMODE	Returns validation mode.
NEWPARSER	Returns a new parser instance
PARSE	Parses XML stored in the given url/file.
PARSEBUFFER	Parses XML stored in the given buffer
PARSECLOB	Parses XML stored in the given clob
PARSEDTD	Parses DTD stored in the given url/file
PARSEDTDBUFFER	Parses DTD stored in the given buffer
PARSEDTDCLOB	Parses DTD stored in the given clob
SETBASEDIR	Sets base directory used to resolve relative URLs.
SETDOCTYPE	Sets DTD.
SETERRORLOG	Sets errors to be sent to the specified file
SETPRESERVEWHITESPACE	Sets white space preserve mode
SETVALIDATIONMODE	Sets validation mode.
SHOWWARNINGS	Turns warnings on or off.

225.2.1 FREEPARSER

This procedure frees a parser object.

Syntax

```
PROCEDURE freeParser(  
    p Parser);
```

Parameters

Table 225-2 FREEPARSER Procedure Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.

225.2.2 GETDOCTYPE

The `GETDOCTYPE` function returns the parsed DTD. This function must be called only after a DTD is parsed.

Syntax

```
FUNCTION getDoctype(  
    p Parser)  
RETURN DOMDocumentType;
```

Parameters

Table 225-3 GETDOCTYPE Function Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.

225.2.3 GETDOCUMENT

`GETDOCUMENT` returns the document node of a DOM tree document built by the parser. This function must be called only after a document is parsed.

Syntax

```
FUNCTION GETDOCUMENT(  
    p Parser)  
RETURN DOMDocument;
```

Parameters

Table 225-4 GETDOCUMENT Function Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.

225.2.4 GETRELEASEVERSION

`GETRELEASEVERSION` returns the release version of the Oracle XML parser for PL/SQL.

Syntax

```
FUNCTION getReleaseVersion  
RETURN VARCHAR2;
```

225.2.5 GETVALIDATIONMODE

The `GETVALIDATIONMODE` function retrieves the validation mode: `TRUE` for validating, `FALSE` otherwise.

Syntax

```
FUNCTION GETVALIDATIONMODE (  
    p Parser)  
RETURN BOOLEAN;
```

Parameters

Table 225-5 GETVALIDATIONMODE Function Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.

225.2.6 NEWPARSER

This function returns a new parser instance.

This function must be called before the default behavior of Parser can be changed and if other parse methods need to be used.

Syntax

```
FUNCTION newParser  
RETURN Parser;
```

225.2.7 PARSE

`PARSE` parses XML stored in the given URL or file. An application error is raised if parsing fails.

There are several versions of this method.

Syntax

Function. Use this when the default parser behavior is acceptable, and only a URL or file needs to be parsed. Returns the built DOM document.

```
FUNCTION parse(url VARCHAR2)  
RETURN DOMDocument;
```

Procedure. Any changes to the default parser behavior should be effected before calling this procedure.

```
PROCEDURE parse(
  p Parser,
  url VARCHAR2);
```

Parameters

Table 225-6 PARSE Subprogram Parameters

Parameter	IN / OUT	Description
url	(IN)	Complete path of the url/file to be parsed.
p	(IN)	Parser instance.

225.2.8 PARSEBUFFER

PARSEBUFFER parses XML stored in the given buffer.

Any changes to the default parser behavior should be effected before calling this procedure. An application error is raised if parsing fails.

Syntax

```
PROCEDURE PARSEBUFFER (
  p Parser,
  doc VARCHAR2);
```

Parameters

Table 225-7 PARSEBUFFER Procedure Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.
doc	(IN)	XML document buffer to parse.

225.2.9 PARSECLOB

PARSECLOB parses XML stored in the given clob.

Any changes to the default parser behavior should be effected before calling this procedure. An application error is raised if parsing fails.

Syntax

```
PROCEDURE PARSECLOB (
  p Parser,
  doc CLOB);
```

Parameters

Table 225-8 PARSECLOB Procedure Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.
doc	(IN)	XML document buffer to parse.

225.2.10 PARSEDTD

PARSEDTD parses the DTD stored in the given URL or file.

Any changes to the default parser behavior should be effected before calling this procedure. An application error is raised if parsing fails.

Syntax

```
PROCEDURE PARSEDTD(
  p      Parser,
  url    VARCHAR2,
  root   VARCHAR2);
```

Parameters

Table 225-9 PARSEDTD Procedure Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.
url	(IN)	Complete path of the URL or file to be parsed.
root	(IN)	Name of the root element.

225.2.11 PARSEDTDBUFFER

PARSEDTDBUFFER parses the DTD stored in the given buffer.

Any changes to the default parser behavior should be effected before calling this procedure. An application error is raised if parsing fails.

Syntax

```
PROCEDURE PARSEDTDBUFFER(
  p      Parser,
  dtd    VARCHAR2,
  root   VARCHAR2);
```

Parameters

Table 225-10 PARSEDTDBUFFER Procedure Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.
dtd	(IN)	DTD buffer to parse.
root	(IN)	Name of the root element.

225.2.12 PARSEDTDCLOB

PARSEDTDCLOB parses the DTD stored in the given clob.

Any changes to the default parser behavior should be effected before calling this procedure. An application error is raised if parsing fails.

Syntax

```
PROCEDURE PARSEDTDCLOB(  
  p    Parser,  
  dtd  CLOB,  
  root VARCHAR2);
```

Parameters

Table 225-11 PARSEDTDCLOB Procedure Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.
dtd	(IN)	DTD Clob to parse.
root	(IN)	Name of the root element.

225.2.13 SETBASEDIR

This procedure sets the base directory used to resolve relative URLs. An application error is raised if parsing fails.

Syntax

```
PROCEDURE setBaseDir(  
  p    Parser,  
  dir  VARCHAR2);
```

Parameters**Table 225-12 SETBASEDIR Procedure Parameters**

Parameter	IN / OUT	Description
p	(IN)	Parser instance.
dir	(IN)	Directory used as a base directory.

225.2.14 SETDOCTYPE Procedure

This procedure sets a DTD to be used by the parser for validation. This call should be made before the document is parsed.

Syntax

```
PROCEDURE setDoctype(
  p   Parser,
  dtd DOMDocumentType);
```

Parameters**Table 225-13 SETDOCTYPE Procedure Parameters**

Parameter	IN / OUT	Description
p	(IN)	Parser instance.
dtd	(IN)	DTD to set.

225.2.15 SETERRORLOG Procedure

This procedure sets errors to be sent to the specified file.

Syntax

```
PROCEDURE setErrorLog(
  p           Parser,
  fileName VARCHAR2);
```

Parameters**Table 225-14 SETERRORLOG Procedure Parameters**

Parameter	IN / OUT	Description
p	(IN)	Parser instance.
fileName	(IN)	Complete path of the file to use as the error log.

225.2.16 SETPRESERVEWHITESPACE

This procedure sets whitespace preserving mode.

Syntax

```
PROCEDURE setPreserveWhitespace(  
    p Parser,  
    yes BOOLEAN);
```

Parameters

Table 225-15 SETPRESERVEWHITESPACE Procedure Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.
yes	(IN)	Mode to set: TRUE - preserve, FALSE - don't preserve.

225.2.17 SETVALIDATIONMODE

This procedure sets the validation mode.

Syntax

```
PROCEDURE setValidationMode(  
    p Parser,  
    yes BOOLEAN);
```

Parameters

Table 225-16 SETVALIDATIONMODE Procedure Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.
yes	(IN)	Mode to set: TRUE - validate, FALSE - don't validate.

225.2.18 SHOWWARNINGS

This procedure turns warnings on or off.

Syntax

```
PROCEDURE showWarnings(  
    p Parser,  
    yes BOOLEAN);
```

Parameters

Table 225-17 SHOWWARNINGS Procedure Parameters

Parameter	IN / OUT	Description
p	(IN)	Parser instance.
yes	(IN)	Mode to set: TRUE - show warnings, FALSE - don't show warnings.

DBMS_XMLSCHEMA

DBMS_XMLSCHEMA package provides procedures to manage XML schemas.

It is created by script `dbmsxsch.sql` during Oracle database installation.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Views](#)
- [Operational Notes](#)
- [Summary of DBMS_XMLSCHEMA Subprograms](#)



See Also:

Oracle XML DB Developer's Guide

226.1 DBMS_XMLSCHEMA Overview

The DBMS_XMLSCHEMA package uses subprograms to manage XML schemas.

These subprograms provide the following XML schema management::

- Register an XML schema
- Delete a previously registered XML schema
- Re-compile a previously registered XML schema
- Generate an XML schema
- Evolves an XML schema

226.2 DBMS_XMLSCHEMA Security Model

Owned by XDB, the DBMS_XMLSCHEMA package must be created by SYS or XDB. The EXECUTE privilege is granted to PUBLIC. Subprograms in this package are executed using the privileges of the current user.

226.3 DBMS_XMLSCHEMA Constants

The `DBMS_XMLSCHEMA` package defines several constants to use when specifying parameter values.

These constants are shown in following tables.

- [Table 226-1](#)
- [Table 226-2](#)
- [Table 226-3](#)

Table 226-1 *DBMS_XMLSCHEMA Constants - Delete Option*

Constant	Type	Value	Description
<code>DELETE_RESTRICT</code>	NUMBER	1	Deletion of an XML schema fails if there are any tables or XML schemas that depend on it
<code>DELETE_INVALIDATE</code>	NUMBER	2	Deletion of an XML schema does not fail if there are tables or XML schemas that depend on it. All dependent tables and schemas are invalidated.
<code>DELETE_CASCADE</code>	NUMBER	3	Deletion of an XML schema also drops all SQL types and default tables associated with it. SQL types are dropped only if <code>gentypes</code> argument was set to <code>TRUE</code> during registration of the XML schema. However, deletion of the XML schema fails if there are any instance documents conforming to the schema or any dependent XML schemas.
<code>DELETE_CASCADE_FORCE</code>	NUMBER	4	This option is similar to <code>DELETE_CASCADE</code> except that it does not check for any stored instance documents conforming to the schema or any dependent XML schemas. Also, it ignores any errors.

Table 226-2 *DBMS_XMLSCHEMA Constants - Enable Hierarchy*

Constant	Type	Value	Description
<code>ENABLE_HIERARCHY_NONE</code>	PLS_INTEGER	1	The <code>ENABLE_HIERARCHY</code> procedure of the <code>DBMS_XDBZ</code> package will not be called on any tables created while registering that schema

Table 226-2 (Cont.) DBMS_XMLSCHEMA Constants - Enable Hierarchy

Constant	Type	Value	Description
ENABLE_HIERARCHY_CONTENTS	PLS_INTEGER	2	The ENABLE_HIERARCHY procedure of the DBMS_XDBZ package will be called for all tables created during schema registration with hierarchy_type as DBMS_XDBZ.ENABLE_CONTENTS
ENABLE_HIERARCHY_RESMETADATA	PLS_INTEGER	3	The ENABLE_HIERARCHY procedure of the DBMS_XDBZ package will be called on all tables created during schema registration with hierarchy_type as DBMS_XDBZ.ENABLE_RESMETADATA. Users should pass in DBMS_XMLSCHEMA.ENABLE_RESMETADATA for schemas they intend to use as resource metadata tables.

Table 226-3 DBMS_XMLSCHEMA Constants - Register CSID

Constant	Type	Value	Description
REGISTER_NODOCID	NUMBER	1	If a schema is registered for metadata use (using the value ENABLE_HIER_RESMETADATA for parameter enablehierarchy during registration), a column named DOCID is added to all tables created during schema registration. This constant can be used in the options argument of REGISTERSCHEMA to prevent the creation of this column if the user wishes to optimize on storage
REGISTER_CSID_NULL	NUMBER	-1	If user wishes to not specify the character set of the input schema document when invoking REGISTERSCHEMA, this value can be used for the csid parameter

226.4 Views

This table lists the views used by the DBMS_XMLSCHEMA package

The columns of these views are described in detail in the *Oracle Database Reference*

Table 226-4 Summary of Views used by DBMS_XMLSCHEMA

Schema	Description
USER_XML_SCHEMAS	All registered XML Schemas owned by the user
ALL_XML_SCHEMAS	All registered XML Schemas usable by the current user
DBA_XML_SCHEMAS	All registered XML Schemas in the database
DBA_XML_TABLES	All XMLType tables in the system
USER_XML_TABLES	All XMLType tables owned by the current user
ALL_XML_TABLES	All XMLType tables usable by the current user
DBA_XML_TAB_COLS	All XMLType table columns in the system
USER_XML_TAB_COLS	All XMLType table columns in tables owned by the current user
ALL_XML_TAB_COLS	All XMLType table columns in tables usable by the current user
DBA_XML_VIEWS	All XMLType views in the system
USER_XML_VIEWS	All XMLType views owned by the current user
ALL_XML_VIEWS	All XMLType views usable by the current user
DBA_XML_VIEW_COLS	All XMLType view columns in the system
USER_XML_VIEW_COLS	All XMLType view columns in views owned by the current user
ALL_XML_VIEW_COLS	All XMLType view columns in views usable by the current user

226.5 DBMS_XMLSCHEMA Operational Notes

There are guidelines for using in-place XML schema evolution.

Before you perform an in-place XML-schema evolution, you should follow these preparatory steps:

1. Back up all existing data (instance documents) for the XML schema that will be evolved.
2. Perform a dry run using trace only, that is, without actually evolving the XML schema or updating any instance documents, to produce a trace of the update operations that would be performed during evolution. To do this, set the flag parameter value to only `INPLACE_TRACE`. Do not also use `INPLACE_EVOLVE`. After performing the dry run, examine the trace file, verifying that the listed DDL operations are in fact those that you intend.

226.6 Summary of DBMS_XMLSCHEMA Subprograms

This table lists the `DBMS_XMLSCHEMA` subprograms and briefly describes them.

Table 226-5 DBMS_XMLSCHEMA Package Subprograms

Method	Description
COMPILESCHEMA Procedure	Used to re-compile an already registered XML schema. This is useful for bringing a schema in an invalid state to a valid state.
COPYEVOLVE Procedure	Evolves registered schemas so that existing XML instances remain valid
DELETESCHEMA Procedure	Removes the schema from the database
INPLACEEVOLVE Procedure	Evolves registered schemas by propagating schema changes to object types and tables
PURGESCHEMA Procedure	Removes the XML schema
REGISTERSCHEMA Procedures	Registers the specified schema for use by Oracle. This schema can then be used to store documents conforming to this.
REGISTERURI Procedure	Registers an XML schema specified by a URI name

226.6.1 COMPILESCHEMA Procedure

This procedure can be used to re-compile an already registered XML schema. This is useful for bringing a schema in an invalid state to a valid state. Can result in a `ORA-31001` exception: invalid resource handle or path name.

Syntax

```
DBMS_XMLSCHEMA.COMPILESCHEMA (
    schemaur1 IN VARCHAR2);
```

Parameters

Table 226-6 COMPILESCHEMA Procedure Parameters

Parameter	Description
<code>schemaur1</code>	URL identifying the schema

226.6.2 COPYEVOLVE Procedure

This procedure evolves registered schemas so that existing XML instances remain valid.

This procedure is accomplished in according to the following basic scenario (alternative actions are controlled by the procedure's parameters):

- copies data in schema based `XMLType` tables to temporary table storage
- drops old tables
- deletes old schemas
- registers new schemas
- creates new `XMLType` tables
- Populates new tables with data in temporary storage; auxiliary structures (constraints, triggers, indexes, and others) are not preserved

- drops temporary tables

 **See Also:**

- "Schema Evolution" chapter of the *Oracle XML DB Developer's Guide* for examples on how to evolve existing schemas
- *Oracle Database Error Messages* for information on exceptions specific to schema evolution, ORA-30142 through ORA-30946.

Syntax

```
DBMS_XMLSCHEMA.COPYEVOLVE (
  schemaurls      IN  XDB$STRUBG_LIST_T,
  newschemas      IN  XMLSequenceType,
  transforms      IN  XMLSequenceType :=NULL,
  preserveolddocs IN  BOOLEAN :=FALSE,
  maptablename    IN  VARCHAR2 :=NULL,
  generatetables IN  BOOLEAN :=TRUE,
  force           IN  BOOLEAN :=FALSE,
  schemaowners   IN  XDB$STRING_LIST_T :=NULL
  parallelDegree IN  PLS_INTEGER := 0,
  options        IN  PLS_INTEGER := 0);
```

Parameters

Table 226-7 COPYEVOLVE Procedure Parameters

Parameter	Description
schemaurls	VARRAY of URLs of all schemas to be evolved. Should include the dependent schemas. Unless the FORCE parameter is TRUE, URLs should be in the order of dependency.
newschemas	VARRAY of new schema documents. Should be specified in same order as the corresponding URLs.
transforms	VARRAY of transforming XSL documents to be applied to schema-based documents. Should be specified in same order as the corresponding URLs. Optional if no transformations are required.
preserveolddocs	Default is FALSE, and temporary tables with old data are dropped. If TRUE, these table are still available after schema evolution is complete.

Table 226-7 (Cont.) COPYEVOLVE Procedure Parameters

Parameter	Description
maptabname	<p>Specifies the name of the table mapping permanent to temporary tables during the evolution process. Valid columns are:</p> <ul style="list-style-type: none"> SCHEMA_URL - VARCHAR2 (700) - URL of schema to which this table conforms SCHEMA_OWNER - VARCHAR2 (30) - Owner of the schema ELEMENT_NAME - VARCHAR2 (256) - Element to which this table conforms TAB_NAME - VARCHAR2 (65) - Qualified table name: <code><owner_name>.<table_name></code> COL_NAME - VARCHAR2 (4000) - Name of the column (NULL for XMLType tables) TEMP_TABNAME - VARCHAR2 (30) - Name of temporary tables which holds data for this table.
generatetables	<p>Default is TRUE, and new tables will be generated.</p> <p>If FALSE:</p> <ul style="list-style-type: none"> new tables will not be generated after registration of new schemas preserveolddocs must be TRUE maptabname must be non-NULL
force	<p>Default is FALSE.</p> <p>If TRUE, ignores errors generated during schema evolution. Used when there are circular dependencies among schemas to ensure that all schemas are stored despite possible errors in registration.</p>
schemaowners	<p>VARRAY of names of schema owners. Should be specified in same order as the corresponding URLs. Default is NULL, assuming that all schemas are owned by the current user.</p>
paralleldegree	<p>Specifies the degree of parallelism to be used in a PARALLEL hint during the data copy stage of the evolution. If this is 0 (default), the PARALLEL hint will not be given in the data copy statements.</p>
options	<p>Currently, the only supported option is COPYEVOLVE_BINARY_XML which lets you register the new schemas for binary XML and create the new tables/columns with binary XML as the storage type.</p>

Usage Notes

You should back up all schemas and documents prior to invocation because [COPYEVOLVE Procedure](#) deletes all conforming documents prior to implementing the schema evolution.

226.6.3 DELETESCHEMA Procedure

This procedure deletes the XML Schema specified by the URL.

Syntax

```
DBMS_XMLSCHEMA.DELETESCHEMA (
    schemaurl      IN VARCHAR2,
    delete_option IN PLS_INTEGER := DELETE_RESTRICT);
```



See Also:

"XMLSCHEMA Storage and Query: Basic" chapter of the *Oracle XML DB Developer's Guide*

Parameters

Table 226-8 DELETESCHEMA Procedure Parameters

Parameter	Description
schemaurl	URL identifying the schema to be deleted
delete_option	Delete options: <ul style="list-style-type: none"> DELETE_RESTRICT - Schema deletion fails if there are any tables or schemas that depend on this schema DELETE_INVALIDATE - Schema deletion does not fail if there are any dependencies. Instead, it simply invalidates all dependent objects. DELETE_CASCADE - Schema deletion will also drop all default SQL types and default tables. However the deletion fails if there are any stored instances conforming to this schema. DELETE_CASCADE_FORCE - Similar to DELETE_CASCADE except that it does not check for any stored instances conforming to this schema. Also, it ignores any errors.

Exceptions

Table 226-9 DELETESCHEMA Procedure Exceptions

Exception	Description
ORA-31001	Invalid resource handle or path name

226.6.4 INPLACEEVOLVE Procedure

This procedure evolves registered schemas by propagating schema changes to object types and tables.

Syntax

```
DBMS_XMLSCHEMA.INPLACEEVOLVE (
  schemaURL  IN  VARCHAR2,
  diffXML    IN  XMLType,
  flags      IN  NUMBER);
```

Parameters

Table 226-10 INPLACEEVOLVE Procedure Parameters

Parameter	Description
schemaurl	URL of the schema to evolve
diffXML	Changes to be applied to the schema. This is an XML document conforming to the XDIFF schema and specifies what changes need to be applied and the locations in the schema document where the changes are to be applied.
flags	<p>The following bits may be set in this parameter to control the behavior of this procedure:</p> <ul style="list-style-type: none"> INPLACE_EVOLVE (value 1, meaning that bit 1 is on) – Perform in-place XML schema evolution: construct a new XML schema and validate it (against the XML schema for XML schemas); construct the DDL statements needed to evolve the instance-document disk structures, execute the DDL statements, and replace the old XML schema with the new. INPLACE_TRACE (value 2, meaning that bit 2 is on) – Perform all steps necessary for in-place evolution, except executing the DDL statements and overwriting the old XML schema with the new, then write both the DDL statements and the new XML schema to a trace file. <p>That is, each of the bits constructs the new XML schema, validates it, and determines the steps needed to evolve the disk structures underlying the instance documents. In addition:</p> <ul style="list-style-type: none"> Bit INPLACE_EVOLVE carries out those evolution steps and replaces the old XML schema with the new. Bit INPLACE_TRACE saves the evolution steps and the new XML schema in a trace file (it does not carry out the evolution steps)

Exceptions

The procedure raises exceptions in the following cases:

- An error will be raised for invalid XPATH expressions and for XDIFF documents that do not conform to the xdiff schema.
- Path expressions that are syntactically correct but result in an invalid node in the schema document will result in an error.
- If the schema change makes the schema an ill-formed XML document or an invalid XML schema, this will raise an error.

- Any errors resulting from `CREATE TYPE`, `ALTER TYPE` and like commands will generate error messages.

Usage Notes

- Users are required to backup all their data before attempting in-place evolution, as there is no rollback with this operation.
- A user must register their new XML schema with the database using the [REGISTERSHEMA Procedures](#) and the [REGISTERURI Procedure](#) at a schema URL that is different from that of the one to be evolved. If the new schema registers successfully and is usable, only then should the user attempt to evolve the existing schema to the new schema by means of this subprogram. If the registration of the new schema is successful, then the user must delete this schema (and all its dependent objects) before attempting to evolve the schema at the old schema URL.

226.6.5 PURGESHEMA Procedure

This procedure removes the XML schema.



See Also:

"XMLSCHEMA Storage and Query: Advanced" chapter of the *Oracle XML DB Developer's Guide*

Syntax

```
DBMS_XMLSCHEMA.PURGESHEMA (
    schemaid IN RAW);
```

Parameters

Table 226-11 PURGESHEMA Procedure Parameters

Parameter	Description
schemaid	ID of the schema to be purged

Usage Notes

- The schema should have been originally registered for binary encoding and should have been deleted in the `HIDE` mode.
- Once a schema has been deleted in `HIDE` mode, it continues to exist in the XML DB dictionary and is used for decoding already encoded documents. The user invokes this interface when there are no stored instances encoded with this schema.
- Once the schema is purged, any space used by that schema will be reclaimed and documents encoded using the schema will raise an error if an attempt is made to decode them.
- The Schema ID can be obtained from the catalog views.

226.6.6 REGISTERSHEMA Procedures

This procedure registers the specified schema for use by the database.

The procedure is overloaded. The different functionality of each form of syntax is presented along with the definition.

Note:

As of Oracle Database 11g Release 2 (11.2) the `genbean` parameter is deprecated. Oracle recommends that you do not use this parameter in new applications. Support for this feature is for backward compatibility only.

See Also:

"XMLSCHEMA Storage and Query: Basic" chapter of the *Oracle XML DB Developer's Guide*

Syntax

Registers a schema specified as a `VARCHAR2`:

```
DBMS_XMLSCHEMA.REGISTERSHEMA (
  schemaurl      IN  VARCHAR2,
  schemadoc      IN  VARCHAR2,
  local          IN  BOOLEAN := TRUE,
  gentypes       IN  BOOLEAN := TRUE,
  genbean        IN  BOOLEAN := FALSE,
  gentables      IN  BOOLEAN := TRUE,
  force          IN  BOOLEAN := FALSE,
  owner          IN  VARCHAR2 := NULL,
  enablehierarchy IN PLS_INTEGER := DBMS_XMLSCHEMA.ENABLE_CONTENTS,
  options        IN  PLS_INTEGER := 0);
```

Registers the schema specified as a `BFILE`. The contents of the schema document must be in the database character set:

```
DBMS_XMLSCHEMA.REGISTERSHEMA (
  schemaurl      IN  VARCHAR2,
  schemadoc      IN  BFILE,
  local          IN  BOOLEAN := TRUE,
  gentypes       IN  BOOLEAN := TRUE,
  genbean        IN  BOOLEAN := FALSE,
  force          IN  BOOLEAN := FALSE,
  owner          IN  VARCHAR2 := NULL,
  enablehierarchy IN PLS_INTEGER := DBMS_XMLSCHEMA.ENABLE_CONTENTS,
  options        IN  PLS_INTEGER := 0);
```

Registers the schema specified as a `BFILE` and identifies the character set id of the schema document:

```

DBMS_XMLSCHEMA.REGISTERSCHEMA (
  schemaurl      IN  VARCHAR2,
  schemadoc      IN  BFILE,
  local          IN  BOOLEAN := TRUE,
  gentypes       IN  BOOLEAN := TRUE,
  genbean        IN  BOOLEAN := TRUE,
  gentables      IN  BOOLEAN := TRUE,
  force          IN  BOOLEAN := TRUE,
  owner          IN  VARCHAR2 := '',
  csid           IN  NUMBER,
  enablehierarchy IN PLS_INTEGER := DBMS_XMLSCHEMA.ENABLE_CONTENTS,
  options        IN  PLS_INTEGER := 0);

```

Registers the schema specified as a BLOB. The contents of the schema document must be in the database character set:

```

DBMS_XMLSCHEMA.REGISTERSCHEMA (
  schemaurl      IN  VARCHAR2,
  schemadoc      IN  BLOB,
  local          IN  BOOLEAN := TRUE,
  genTypes       IN  BOOLEAN := TRUE,
  genBean        IN  BOOLEAN := FALSE,
  force          IN  BOOLEAN := FALSE,
  owner          IN  VARCHAR2 := NULL,
  enablehierarchy IN PLS_INTEGER := DBMS_XMLSCHEMA.ENABLE_CONTENTS,
  options        IN  PLS_INTEGER := 0);

```

Registers the schema specified as a BLOB and identifies the character set id of the schema document:

```

DBMS_XMLSCHEMA.REGISTERSCHEMA (
  schemaurl      IN  VARCHAR2,
  schemadoc      IN  BLOB,
  local          IN  BOOLEAN := TRUE,
  gentypes       IN  BOOLEAN := TRUE,
  genbean        IN  BOOLEAN := TRUE,
  gentables      IN  BOOLEAN := TRUE,
  force          IN  BOOLEAN := TRUE,
  owner          IN  VARCHAR2 := '',
  csid           IN  NUMBER,
  enablehierarchy IN PLS_INTEGER := DBMS_XMLSCHEMA.ENABLE_CONTENTS,
  options        IN  PLS_INTEGER := 0);

```

Registers the schema specified as a CLOB

```

DBMS_XMLSCHEMA.REGISTERSCHEMA (
  schemaurl      IN  VARCHAR2,
  schemadoc      IN  CLOB,
  local          IN  BOOLEAN := TRUE,
  gentypes       IN  BOOLEAN := TRUE,
  genbean        IN  BOOLEAN := FALSE,
  force          IN  BOOLEAN := FALSE,
  owner          IN  VARCHAR2 := NULL,
  options        IN  PLS_INTEGER := 0);

```

Registers the schema specified as an XMLTYPE.

```
DBMS_XMLSCHEMA.REGISTERSCHEMA(
  schemaurl      IN VARCHAR2,
  schemadoc      IN SYS.XMLTYPE,
  local          IN BOOLEAN := TRUE,
  gentypes       IN BOOLEAN := TRUE,
  genbean        IN BOOLEAN := FALSE,
  force          IN BOOLEAN := FALSE,
  owner          IN VARCHAR2 := NULL,
  enablehierarchy IN PLS_INTEGER := DBMS_XMLSCHEMA.ENABLE_CONTENTS,
  options        IN PLS_INTEGER := 0);
```

Registers the schema specified as a BLOB. The contents of the schema document must be in the database character set:

```
DBMS_XMLSCHEMA.REGISTERSCHEMA(
  schemaurl      IN VARCHAR2,
  schemadoc      IN SYS.URITYPE,
  local          IN BOOLEAN := TRUE,
  gentypes       IN BOOLEAN := TRUE,
  genbean        IN BOOLEAN := FALSE,
  force          IN BOOLEAN := FALSE,
  owner          IN VARCHAR2 := NULL,
  enablehierarchy IN PLS_INTEGER := DBMS_XMLSCHEMA.ENABLE_CONTENTS,
  options        IN PLS_INTEGER := 0);
```

Parameters

Table 226-12 REGSITERSHEMA Procedure Parameters

Parameter	Description
schemaurl	URL that uniquely identifies the schema document. This value is used to derive the path name of the schema document within the database hierarchy. Can be used inside <code>schemalocation</code> attribute of XML Schema import element.
schemadoc	A valid XML schema document
local	Is this a local or global schema? <ul style="list-style-type: none"> By default, all schemas are registered as local schemas, under <code>/sys/schemas/<username>/...</code> If a schema is registered as global, it is added under <code>/sys/schemas/PUBLIC/...</code> You need write privileges on the directory to be able to register a schema as global.
gentypes	Determines whether the schema compiler generates object types. By default, <code>TRUE</code> . If you use binary XML, you must be set <code>gentypes</code> to <code>FALSE</code> .
genbean	Determines whether the schema compiler generates Java beans. By default, <code>FALSE</code> . Oracle recommends that this parameter always be set to <code>FALSE</code> .
gentables	Determines whether the schema compiler generates default tables. By default, <code>TRUE</code>
force	If this parameter is set to <code>TRUE</code> , the schema registration will not raise errors. Instead, it creates an invalid XML schema object in case of any errors. By default, the value of this parameter is <code>FALSE</code> .

Table 226-12 (Cont.) REGSITERSchema Procedure Parameters

Parameter	Description
owner	This parameter specifies the name of the database user owning the XML schema object. By default, the user registering the schema owns the XML schema object. This parameter can be used to register a XML schema to be owned by a different database user.
csid	Identifies the character set of the input schema document. If this value is 0, the schema document's encoding is determined by the current rule for "text/xml" MIME type.
enablehierarchy	<ul style="list-style-type: none"> ENABLE_HIERARCHY_NONE - enable hierarchy will not be called on any tables created while registering that schema ENABLE_HIERARCHY_CONTENTS - enable hierarchy will be called for all tables created during schema registration with <code>hierarchy_type as DBMS_XDBZ.ENABLE_CONTENTS</code>. This is the default. ENABLE_HIERARCHY_RESMETADATA - enable hierarchy will be called on all tables created during schema registration with <code>hierarchy_type as DBMS_XDBZ.ENABLE_RESMETADATA</code>. Users should pass in <code>DBMS_XMLSCHEMA.ENABLE_RESMETADATA</code> for schemas they intend to use as resource metadata tables.
options	<p>Additional options to specify how the schema should be registered. The various options are represented as bits of an integer and the options parameter should be constructed by doing a <code>BITOR</code> of the desired bits. Possible bits:</p> <ul style="list-style-type: none"> REGISTER_NODOCID - this will suppress the creation of the <code>DOCID</code> column for out of line tables. This is a storage optimization which might be desirable when we do not need to join back to the document table (for example if we do not care about rewriting certain queries that could be rewritten by making use of the <code>DOCID</code> column) REGISTER_BINARYXML - Register the schema for Binary XML REGISTER_NT_AS_IOT - Store nested tables created during schema registration as index organized tables. The default is to store nested tables as heap tables

226.6.7 REGISTERURI Procedure

This procedure registers an XML Schema specified by a URI name.

Note:

As of Oracle Database 11g Release 2 (11.2) the `genbean` parameter is deprecated. Oracle recommends that you do not use this parameter in new applications. Support for this feature is for backward compatibility only.

Syntax

```
DBMS_XMLSCHEMA.REGISTERURI (
    schemaur1      IN  VARCHAR2,
    schemadocuri  IN  VARCHAR2,
```

```

local          IN BOOLEAN := TRUE,
gentypes      IN BOOLEAN := TRUE,
genbean       IN BOOLEAN := FALSE,
gentables     IN BOOLEAN := TRUE,
force         IN BOOLEAN := FALSE,
owner         IN VARCHAR2 := NULL,
options       IN PLS_INTEGER := 0);

```

Parameters

Table 226-13 REGISTERURI Procedure Parameters

Parameter	Description
schemaurl	Uniquely identifies the schema document. Can be used inside <code>schemaLocation</code> attribute of XML Schema import element.
schemadocuri	Pathname (URI) corresponding to the physical location of the schema document. The URI path could be based on HTTP, FTP, DB or Oracle XML DB protocols. This function constructs a <code>URIType</code> instance using the <code>urifactory</code> , and invokes the REGISTERSHEMA Procedures .
local	Determines whether this is a local or global schema. By default, all schemas are registered as local schemas, under <code>/sys/schemas/<username>/...</code> . If a schema is registered as global, it is added under <code>/sys/schemas/PUBLIC/...</code> . The user needs write privileges on the directory to register a global schema.
gentypes	Determines whether the compiler generate object types. By default, TRUE.
genbean	Determines whether the compiler generate Java beans. By default, FALSE.
gentables	Determines whether the compiler generate default tables. TRUE by default.
force	TRUE: schema registration will not raise errors. Instead, it creates an invalid XML schema object in case of any errors. By default, the value of this parameter is FALSE.
owner	This parameter specifies the name of the database user owning the XML schema object. By default, the user registering the schema owns the XML schema object. This parameter can be used to register a XML schema to be owned by a different database user.
options	Additional options to specify how the schema should be registered. The various options are represented as bits of an integer and the options parameter should be constructed by doing a <code>BITOR</code> of the desired bits. Possible bits: <ul style="list-style-type: none"> REGISTER_NODOCID - this will suppress the creation of the <code>DOCID</code> column for out of line tables. This is a storage optimization which might be desirable when we do not need to join back to the document table (for example if we do not care about rewriting certain queries that could be rewritten by making use of the <code>DOCID</code> column)

DBMS_XMLSCHEMA_ANNOTATE

The `DBMS_XMLSCHEMA_ANNOTATE` package provides an interface to manage and configure the structured storage model, mainly through the use of pre-registration schema annotations.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_XMLSCHEMA_ANNOTATE Subprograms](#)



See Also:

Oracle XML DB Developer's Guide

227.1 DBMS_XMLSCHEMA_ANNOTATE Overview

The `DBMS_XMLSCHEMA_ANNOTATE` package contains procedures to manage and configure the structured storage model, mainly through the use of pre-registration schema annotations.

Schema annotations influence the way the XML data is stored. For example, the default table annotation assigns a user-provided name to an XML element instead of allowing the database to generate a system name. Consequently, query plans are more readable and it is easier to create constraints on that table.

227.2 DBMS_XMLSCHEMA_ANNOTATE Security Model

Owned by `XDB`, the `DBMS_XMLSCHEMA_ANNOTATE` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `PUBLIC`. Subprograms in this package are executed using the privileges of the current user.

227.3 Summary of DBMS_XMLSCHEMA_ANNOTATE Subprograms

This table lists and describes the `DBMS_XMLSCHEMA_ANNOTATE` package subprograms.

Table 227-1 DBMS_XMLSCHEMA_ANNOTATE Package Subprograms

Subprogram	Description
ADDXDBNAMESPACE Procedure	Adds the XDB namespace required for XDB annotation

Table 227-1 (Cont.) DBMS_XMLSCHEMA_ANNOTATE Package Subprograms

Subprogram	Description
DISABLEDEFAULTTABLECREATION Procedure	Prevents the creation of a table for the top-level element by adding a default table attribute with an empty value to the element
DISABLEMAINTAINDOM Procedure	Sets the DOM fidelity attribute to <code>FALSE</code>
ENABLEDEFAULTTABLECREATION Procedure	Enables the creation of <code>ALL</code> top level tables by removing the empty default table name annotation
ENABLEMAINTAINDOM Procedure	Sets the DOM fidelity attribute to <code>TRUE</code>
GETSCHEMAANNOTATIONS Function	Creates a document containing the differences between the annotated XML schema and the original XML schema
GETSIDXDEFFROMVIEW Function	Takes a <code>XMLTABLE</code> view definition on a <code>xmltype</code> column or table and it returns a <code>CLOB</code> which can be used as parameter to create a structured <code>xmlindex</code> that backs up the <code>XMLTABLE</code> view as relational table
PRINTWARNINGS Procedure	Lets a user raise or suppress a warning if an annotation maps to zero nodes in the XML schema
REMOVEANYSSTORAGE Procedure	Removes the setting of the SQL type from the <code>ANY</code> child of the complex type with the given name
REMOVEDEFAULTTABLE Procedure	Removes any default table attribute given for the element. After calling this procedure, the system generates table names
REMOVEMAINAINDOM Procedure	Removes all annotations used to maintain DOM from the given schema
REMOVEOUTOFFLINE Procedure	Removes any existing <code>SQLInline</code> attributes to prevent out-of-line storage
REMOVESQLCOLLTYPE Procedure	Removes a SQL collection type.
REMOVESQLNAME Procedure	Removes a <code>SQLNAME</code> from a global element
REMOVESQLTYPE Procedure	Removes a SQL type
REMOVESQLTYPE MAPPING Procedure	Removes the SQL type mapping for the given schema type.
REMOVETABLEPROPS Procedure	Removes the table storage properties from the <code>CREATE TABLE</code> statement
REMOVETIMESTAMPWITHTIMEZONE Procedure	Removes the setting of the <code>TimeStampWithTimeZone</code> datatype from all <code>dateTime</code> typed elements in the XML schema
SETANYSSTORAGE Procedure	Assigns a SQL datatype to the <code>ANY</code> child of the complex type with the given name
SETDEFAULTTABLE Procedure	Sets the name of the table for the specified global element
SETOUTOFFLINE Procedure	Sets the <code>SQLInline</code> attribute to <code>FALSE</code>
SETSCHEMAANNOTATIONS Procedure	Takes the annotated differences resulting from a call to <code>DBMS_XMLSCHEMA_ANNOTATE.GETSCHEMAANNOTATIONS</code> and patches them into the provided XML schema
SETSQLCOLLTYPE Procedure	Assigns a SQL type name for a collection
SETSQLNAME Procedure	Assigns a name to the SQL attribute that corresponds to an element defined in the XML schema
SETSQLTYPE Procedure	Assigns a SQL type to a global object

Table 227-1 (Cont.) DBMS_XMLSCHEMA_ANNOTATE Package Subprograms

Subprogram	Description
SETSQLYPEMAPPING Procedure	Defines a mapping of schema type and SQL type
SETTABLEPROPS Procedure	Specifies properties in the TABLE storage clause that is appended to the default CREATE TABLE statement
SETTIMESTAMPWITHTIMEZONE Procedure	Sets the TIMESTAMPWITHTIMEZONE datatype to all dateTime typed elements in the XML schema

227.3.1 ADDXDBNAMESPACE Procedure

This procedure adds the XDB namespace required for XDB annotation.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.ADDXDBNAMESPACE (
    xmlschema      IN OUT XMLTYPE);
```

Parameters

Table 227-2 ADDXDBNAMESPACE Procedure Parameters

Parameter	Description
xmlschema	Gets an XML Schema as XMLTYPE, performs the annotation and returns it

Usage Notes

This procedure is called implicitly by any other procedure that adds a schema annotation. Since there is no reason to add an XDB namespace without other annotations, this procedure is most likely called by other annotations procedures and not by the user directly.

227.3.2 DISABLEDEFAULTTABLECREATION Procedure

This procedure prevents the creation of a table for the top-level element by adding a default table attribute with an empty value to the element. The first overload applies to a specified top-level element and the second applies to all top-level elements. The procedure always overwrites. This is equivalent to using the schema annotation `xdb:defaultTable=""` for the top-level element or elements.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.DISABLEDEFAULTTABLECREATION (
    xmlschema      IN OUT XMLType,
    globalElementName IN VARCHAR2);
```

```
DBMS_XMLSCHEMA_ANNOTATE.DISABLEDEFAULTTABLECREATION (
    xmlschema      IN OUT XMLType);
```

Parameters

Table 227-3 DISABLEDEFAULTTABLECREATION Procedure Parameters

Parameter	Description
xmlschema	XML schema to be annotated
globalElementName	Name of the global element in the schema

Example

The purchaseOrder element will have an annotation similar to `xdb:defaultTable=""`.

```
DECLARE
    xml_schema    XMLTYPE;
BEGIN
    SELECT out INTO xml_schema FROM annotation_tab;
    DBMS_XMLSCHEMA_ANNOTATE.DISABLEDEFAULTTABLECREATION(xml_schema,
                                                         'purchaseOrder');
    UPDATE annotation_tab SET out = xml_schema;
END;
/
```

227.3.3 DISABLEMAINTAINDOM Procedure

This procedure sets the DOM fidelity attribute to `FALSE`.

There are two overloads. The first sets DOM fidelity attribute to `FALSE` for all complex types, and the second sets it to `FALSE` for the named complex type. This is equivalent to adding `xdb:maintainDOM="false"` on all or specified complex types respectively.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.DISABLEMAINTAINDOM (
    xmlschema      IN OUT XMLType,
    overwrite      IN BOOLEAN default TRUE);
```

```
DBMS_XMLSCHEMA_ANNOTATE.DISABLEMAINTAINDOM (
    xmlschema      IN OUT XMLType,
    complexTypeName IN VARCHAR2,
    overwrite      IN BOOLEAN default TRUE);
```

Parameters

Table 227-4 DISABLEMAINTAINDOM Procedure Parameters

Parameter	Description
xmlschema	The XML schema to be annotated
complexTypeName	The name of the complex type
overwrite	A boolean that indicates whether or not the procedure overwrites element attributes. The default is <code>TRUE</code>

227.3.4 ENABLEDEFAULTTABLECREATION Procedure

This procedure enables the creation of ALL top level tables by removing the empty default table name annotation.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.ENABLEDEFAULTTABLECREATION (
    xmlschema          IN OUT  XMLTYPE);

DBMS_XMLSCHEMA_ANNOTATE.ENABLEDEFAULTTABLECREATION (
    xmlschema          IN OUT  XMLTYPE,
    globalelementName IN      VARCHAR2);;
```

Parameters

Table 227-5 ENABLEDEFAULTTABLECREATION Procedure Parameters

Parameter	Description
xmlschema	The XML schema to be annotated
gloablElementName	Name of the global element in the schema

Usage Notes

This procedure does not affect elements that have a default table name.

227.3.5 ENABLEMAINTAINDOM Procedure

This overloaded procedure sets the DOM fidelity attribute to `TRUE`.

There are two overloads. The first sets DOM fidelity attribute to `TRUE` for all complex types, and the second sets it to `TRUE` for the named complex type.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.ENABLEMAINTAINDOM (
    xmlschema          IN OUT XMLType,
    overwrite          IN BOOLEAN default TRUE);

DBMS_XMLSCHEMA_ANNOTATE.ENABLEMAINTAINDOM (
    xmlschema          IN OUT XMLType,
    complexTypeName   IN VARCHAR2,
    overwrite          IN BOOLEAN default TRUE);;
```

Parameters

Table 227-6 ENABLEMAINTAINDOM Procedure Parameters

Parameter	Description
xmlschema	The XML schema to be annotated
complexTypeName	The name of the complex type

Table 227-6 (Cont.) ENABLEMAINTAINDOM Procedure Parameters

Parameter	Description
overwrite	A boolean that indicates whether or not the procedure overwrites element attributes. The default is TRUE

227.3.6 GETSCHEMAANNOTATIONS Function

This function creates a document containing the differences between the annotated XML schema and the original XML schema.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.GETSCHEMAANNOTATIONS (
    xmlschema IN xmlType)
RETURN XMLType;
```

Parameters

Table 227-7 GETSCHEMAANNOTATIONS Function Parameters

Parameter	Description
xmlschema	The original XML schema

Return Values

This function returns the document `annotations.xml` as an XMLType.

Usage Notes

This function saves all annotations in one document, named `annotations`, and returns it. With this document, you can apply all annotations to a non-annotated schema, using `DBMS_XMLSCHEMA_ANNOTATE.GETSCHEMAANNOTATIONS`.

`DBMS_XMLSCHEMA_ANNOTATE.GETSCHEMAANNOTATIONS` is not available on Oracle Database release 10.2 (only Oracle Database release 11.x).



See Also:

[SETSCHEMAANNOTATIONS Procedure](#)

Example

For an example of `DBMS_XMLSCHEMA_ANNOTATE.GETSCHEMAANNOTATIONS`, see the example in [SETSCHEMAANNOTATIONS Procedure](#).

227.3.7 GETSIDXDEFFROMVIEW Function

This function takes a XMLTABLE view definition on a xmltype column or table and it returns a CLOB which can be used as parameter to create a structured xmlindex that backs up the XMLTABLE view as relational table.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.GETSIDXDEFFROMVIEW (
    viewName    IN xmlType)
    RETURN CLOB;
```

Parameters

Table 227-8 GETSIDXDEFFROMVIEW Function Parameters

Parameter	Description
viewName	The original XML schema

Return Values

This function returns a CLOB which can be used as parameter to create a structured xmlindex that backs up the XMLTABLE view as relational table.

227.3.8 PRINTWARNINGS Procedure

This procedure lets a user raise or suppress a warning if an annotation maps to zero nodes in the XML schema.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.PRINTWARNINGS (
    value      IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 227-9 PRINTWARNINGS Procedure Parameters

Parameter	Description
val	For the NO MATCHING ELEMENTS FOUND error message to be raised val must be set to TRUE. In cases in which user wishes to suppress this warning, set to FALSE.

Usage Notes

If an annotation maps to more than one node in the XML schema, this raise the error ANNOTATION MAPS TO MULTIPLE ELEMENTS. In this case no annotation is performed, and the user must correct the parameters to the procedure call to refer to a unique node in the XML schema.

227.3.9 REMOVEANYSTORAGE Procedure

This procedure removes the setting of the SQL type from the ANY child of the complex type with the given name.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.REMOVEANYSTORAGE (
    xmlschema          IN OUT XMLType,
    complexTypeName IN VARCHAR2);
```

Parameters

Table 227-10 REMOVEANYSTORAGE Procedure Parameters

Parameter	Description
xmlschema	The XML schema to be annotated.
complexTypeName	The name of the complex type.

Usage Notes

This procedure reverses the [SETANYSTORAGE Procedure](#).

227.3.10 REMOVEDEFAULTTABLE Procedure

This procedure removes any default table attribute given for the element.

After calling this procedure, the system generates table names. This procedure always overwrites.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.REMOVEDEFAULTTABLE (
    xmlschema          IN OUT XMLTYPE,
    globalElementName IN VARCHAR2);
```

Parameters

Table 227-11 REMOVEDEFAULTTABLE Procedure Parameters

Parameter	Description
xmlschema	XML schema to be annotated
globalElementName	Name of the global element in the schema

Example

Annotations can be verified anytime using "select out from annotation_tab".

```
--The purchaseOrder element will have no annotation for defaultTable.
DECLARE
    xml_schema XMLTYPE;
```

```

BEGIN
  SELECT out INTO xml_schema FROM annotation_tab;
  DBMS_XMLSCHEMA_ANNOTATE.REMOVEDEFAULTTABLE(xml_schema,
                                             'purchaseOrder');
  UPDATE annotation_tab SET out = xml_schema;
END;
/

```

227.3.11 REMOVEMAINTAINDOM Procedure

This procedure removes all annotations used to maintain DOM from the given schema.

Syntax

```

DBMS_XMLSCHEMA_ANNOTATE.REMOVEMAINTAINDOM (
  xmlschema      IN OUT XMLType);

```

Parameters

Table 227-12 REMOVEMAINTAINDOM Procedure Parameters

Parameter	Description
xmlschema	The XML schema to be annotated

227.3.12 REMOVEOUTOFLINE Procedure

This procedure removes any existing `SQLInline` attributes to prevent out-of-line storage.

There are three overloads.

Syntax

Removes the `SQLInline` attribute for the named element.

```

DBMS_XMLSCHEMA_ANNOTATE.REMOVEOUTOFLINE (
  xmlschema      IN OUT XMLType,
  elementName    IN      VARCHAR2,
  elementType    IN      VARCHAR2,
  overwrite      IN      BOOLEAN default TRUE);

```

Removes the `SQLInline` attribute for the object specified by its global object and local element names.

```

DBMS_XMLSCHEMA_ANNOTATE.REMOVEOUTOFLINE (
  xmlschema      IN OUT XMLType,
  globalObject    IN      VARCHAR2,
  globalObjectName IN     VARCHAR2,
  localElementName IN     VARCHAR2);

```

Removes the `SQLInline` attribute for the referenced global element.

```

DBMS_XMLSCHEMA_ANNOTATE.REMOVEOUTOFLINE (
  xmlschema      IN OUT XMLType,
  reference      IN      VARCHAR2);

```


Parameters

Table 227-13 REMOVEOUTOFFLINE Procedure Parameters

Parameter	Description
xmlschema	The XML schema to be annotated
elementName	The element name
elementType	The element type
globalObject	The global object (global complex type or global element)
globalObjectName	The name of the global object
localElementName	The name of a local element that descends from the global element
reference	A reference to a global element
overwrite	A boolean that indicates whether or not the procedure overwrites element attributes. The default is <code>TRUE</code> .

Usage Notes

This procedure reverses [SETOUTOFFLINE Procedure](#).

227.3.13 REMOVESQLCOLLTYPE Procedure

This procedure removes a SQL collection type.

The first overload removes the SQL collection type corresponding to the named element and the second overload removes the type from the XML element inside the complex type.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.REMOVESQLCOLLTYPE (
    xmlschema IN OUT XMLType,
    elementName IN VARCHAR2);
```

```
DBMS_XMLSCHEMA_ANNOTATE.REMOVESQLCOLLTYPE (
    xmlschema IN OUT XMLType,
    globalObject IN VARCHAR2,
    globalName IN VARCHAR2,
    localElementName IN VARCHAR2);
```

Parameters

Table 227-14 REMOVESQLCOLLTYPE Procedure Parameters

Parameter	Description
xmlschema	The XML schema to be annotated
elementName	The element name
globalObject	The global object (global complex type or global element)
globalName	The name of the global object

Table 227-14 (Cont.) REMOVESQLCOLLTYPE Procedure Parameters

Parameter	Description
localElementName	The name of a local element that descends from the global element

Usage Notes

This procedure reverses the [SETSQLCOLLTYPE Procedure](#).

227.3.14 REMOVESQLNAME Procedure

This procedure removes a `SQLNAME` from a global element.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.REMOVESQLNAME (
    xmlschema          IN OUT XMLType,
    globalObject       IN      VARCHAR2,
    globalObjectName   IN      VARCHAR2,
    localObject        IN      VARCHAR2,
    localObjectName    IN      VARCHAR2,
    sqlName            IN      VARCHAR2,
    overwrite          IN      BOOLEAN DEFAULT TRUE);
```

Parameters**Table 227-15 REMOVESQLNAME Procedure Parameters**

Parameter	Description
xmlschema	XML schema to be annotated
globalObject	Global object (global complex type or global element)
globalObjectName	Name of the global object
localObject	Object descended from the global object
localObjectName	Name of the local object
sqlName	Name of the SQL attribute that corresponds to the element defined in the XML schema
overwrite	Boolean that indicates whether or not the procedure overwrites element attributes. The default is <code>TRUE</code> .

Example

The `shipTo` element will have an annotation similar to `xdb:SQLName="SHIPTO_SQLNAME"`.

```
DECLARE
    xml_schema XMLTYPE;
BEGIN
    SELECT out INTO xml_schema FROM annotation_tab;
    DBMS_XMLSCHEMA_ANNOTATE.SETSQLNAME (xml_schema,
                                        'element', 'purchaseOrder',
                                        'element', 'shipTo',
                                        'SHIPTO_SQLNAME');
```

```

UPDATE annotation_tab SET out = xml_schema;
END;
/

```

227.3.15 REMOVESQLTYPE Procedure

This procedure removes a SQL type.

The first overload removes a SQL type from a global element and the second overload removes the type from a global element inside the complex type.

Syntax

```

DBMS_XMLSCHEMA_ANNOTATE.REMOVESQLTYPE (
  xmlschema in out XMLType,
  globalElementName IN VARCHAR2);

```

```

DBMS_XMLSCHEMA_ANNOTATE.REMOVESQLTYPE (
  xmlschema          IN OUT XMLType,
  globalObject       IN VARCHAR2,
  globalObjectName   IN VARCHAR2,
  localObject        IN VARCHAR2,
  localObjectName    IN VARCHAR2);

```

Parameters

Table 227-16 REMOVESQLTYPE Procedure Parameters

Parameter	Description
xmlschema	XML schema to be annotated.
globalObject	Global object (global complex type or global element)
globalElementName	Name of the global element.
globalObjectName	Name of the global object
localObject	Object descended from the global object
localObjectName	Name of the local object

Usage Notes

This procedure reverses the [SETSQLTYPE Procedure](#).

227.3.16 REMOVESQLTYPEEMAPPING Procedure

This procedure removes the SQL type mapping for the given schema type.

Syntax

```

DBMS_XMLSCHEMA_ANNOTATE.REMOVESQLTYPEEMAPPING (
  xmlschema          IN OUT XMLType,
  schemaTypeName     IN VARCHAR2);

```

Parameters

Table 227-17 REMOVESQLTYPE MAPPING Procedure Parameters

Parameter	Description
xmlschema	XML schema to be annotated
schemaTypeName	Name of the schema type

Usage Notes

This procedure reverses the [SETSQLTYPE MAPPING Procedure](#).

227.3.17 REMOVETABLEPROPS Procedure

This procedure removes the table storage properties from the `CREATE TABLE` statement.

This procedure is overloaded. Each overload has different parameter requirements as indicated.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.REMOVETABLEPROPS (
  xmlschema          IN OUT XMLTYPE,
  globalElementName IN     VARCHAR2);
```

```
DBMS_XMLSCHEMA_ANNOTATE.REMOVETABLEPROPS (
  xmlschema          IN OUT XMLTYPE,
  globalObject       IN     VARCHAR2,
  globalObjectName   IN     VARCHAR2,
  localElementName   IN     VARCHAR2);
```

Parameters

Table 227-18 REMOVETABLEPROPS Procedure Parameters

Parameter	Description
xmlschema	XML schema to be annotated
globalElementName	Name of the global element in the schema
globalObject	Global object (global complex type or global element)
globalObjectName	Name of the global object
localElementName	Name of a local element that descends from the global element

Usage Notes

This procedure reverses the [SETTABLEPROPS Procedure](#).

227.3.18 REMOVETIMESTAMPWITHTIMEZONE Procedure

This procedure removes the setting of the `TimeStampWithTimeZone` datatype from all `dateTime` typed elements in the XML schema.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.REMOVETIMESTAMPWITHTIMEZONE (
    xmlschema          IN OUT  XMLTYPE);
```

```
DBMS_XMLSCHEMA_ANNOTATE.REMOVETIMESTAMPWITHTIMEZONE (
    xmlschema          IN OUT  XMLTYPE,
    schemaTypeName     IN      VARCHAR2);
```

Parameters

Table 227-19 REMOVETIMESTAMPWITHTIMEZONE Procedure Parameters

Parameter	Description
<code>xmlschema</code>	XML schema to be annotated
<code>schemaTypeName</code>	Name of the schema type

Usage Notes

This procedure reverses the [SETTIMESTAMPWITHTIMEZONE Procedure](#).

227.3.19 SETANYSTORAGE Procedure

This procedure assigns a SQL datatype to the `ANY` child of the complex type with the given name.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.SETANYSTORAGE (
    xmlschema          IN OUT  XMLType,
    complexTypeName   IN      VARCHAR2,
    sqlTypeName        IN      VARCHAR2,
    overwrite          IN      BOOLEAN DEFAULT TRUE);
```

Parameters

Table 227-20 SETANYSTORAGE Procedure Parameters

Parameter	Description
<code>xmlschema</code>	XML schema to be annotated
<code>complexTypeName</code>	Name of the complex type
<code>sqlTypeName</code>	Name of the SQL type
<code>overwrite</code>	Boolean that indicates whether or not the procedure overwrites element attributes. The default is <code>TRUE</code> .

Example

The `xsd:any child of complex type Items` is assigned an annotation similar to `xdb:SQLType="VARCHAR"`.

```
DECLARE xml_schema XMLTYPE; BEGIN SELECT out INTO xml_schema FROM
annotation_tab; DBMS_XMLSCHEMA_ANNOTATE.setAnyStorage
(xml_schema,
'Items', 'VARCHAR'); UPDATE annotation_tab
SET out = xml_schema; END;
/
```

227.3.20 SETDEFAULTTABLE Procedure

This procedure sets the name of the table for the specified global element. This is equivalent to using the schema annotation `xdb:defaultTable="<default_table_name>"` for the top-level element.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.SETDEFAULTTABLE (
xmlschema          IN OUT XMLTYPE,
globalElementName IN      VARCHAR2,
tableName          IN      VARCHAR2,
overwrite          IN      BOOLEAN  DEFAULT TRUE);
```

Parameters

Table 227-21 SETDEFAULTTABLE Procedure Parameters

Parameter	Description
<code>xmlschema</code>	XML schema to be annotated
<code>globalElementName</code>	Name of the global element in the schema
<code>tableName</code>	Name being assigned to the table
<code>overwrite</code>	Boolean that indicates whether or not the procedure overwrites element attributes. The default is <code>TRUE</code> .

227.3.21 SETOUTOFFLINE Procedure

This procedure sets the `SQLInline` attribute to `FALSE`, that is, it sets `xdb:SQLInLine=FALSE`.

This forces XDB to store the corresponding elements in the XML document out-of-line as rows in a separate `XMLType` table. XDB stores references to each row of the `XMLType` table in a link table that is maintained by the main table

This procedure can improve performance in some situations if the out-of-line table acts as the driver for the query. Storing elements in an out-of-line table also reduces the numbers of columns in the base table, thus avoiding '4096 column limit' errors during XML schema registration, when some elements have complex types with many elements.



Also See:

Oracle XML DB Developer's Guide

There are three overloads.

Syntax

Sets the `SQLInline` attribute to `FALSE`, forcing out-of-line storage for the named element.

```
DBMS_XMLSCHEMA_ANNOTATE.SETOUTOFFLINE (
  xmlschema          IN OUT XMLType,
  elementName        IN      VARCHAR2,
  elementType        IN      VARCHAR2,
  defaultTableName   IN      VARCHAR2,
  overwrite          IN      BOOLEAN DEFAULT TRUE);
```

Sets the `SQLInline` attribute to `FALSE`, forcing out-of-line storage for the element specified by its local and global name.

```
DBMS_XMLSCHEMA_ANNOTATE.SETOUTOFFLINE (
  xmlschema          IN OUT XMLType,
  globalObject       IN      VARCHAR2,
  globalObjectName   IN      VARCHAR2,
  localElementName   IN      VARCHAR2,
  defaultTableName   IN      VARCHAR2,
  overwrite          IN      BOOLEAN DEFAULT TRUE);
```

Sets the `SQLInline` attribute to `FALSE` to force out-of-line storage and sets the default table name for all references to a particular global element.

```
DBMS_XMLSCHEMA_ANNOTATE.SETOUTOFFLINE (
  xmlschema          IN OUT XMLType,
  reference          IN      VARCHAR2,
  defaultTableName   IN      VARCHAR2,
  overwrite          IN      BOOLEAN DEFAULT TRUE);
```

Parameters

Table 227-22 SETOUTOFFLINE Procedure Parameters

Parameter	Description
<code>xmlschema</code>	The XML schema to be annotated.
<code>elementName</code>	The element name
<code>elementType</code>	The element type
<code>defaultTableName</code>	The name of the default table.
<code>globalObject</code>	The global object (global complex type or global element)
<code>globalObjectName</code>	The name of the global object
<code>localElementName</code>	The name of a local element that descends from the global element.
<code>reference</code>	A reference to a global element

Table 227-22 (Cont.) SETOUTOFLINE Procedure Parameters

Parameter	Description
overwrite	A boolean that indicates whether or not the procedure overwrites element attributes. The default is TRUE.

Usage Notes

After XML schema registration and before loading XML instance data, use `DBMS_XMLSTORAGE_MANAGE.SCOPEXMLREFERENCES()` to make these references scope to the out-of-line table only. This ensures better query performance later on.

Example

The following example illustrates the third overloaded method. The element comment will have an annotation similar to `xdb:defaultTable="CMMNT_DEFAULT_TABLE"`

```
DECLARE
    xml_schema xmltype;
BEGIN
    SELECT OUT INTO xml_schema FROM annotation_tab;

    DBMS_XMLSCHEMA_ANNOTATE.SETOUTOFLINE (xml_schema,
                                          'ipo:comment',
                                          'CMMNT_DEFAULT_TABLE');

    UPDATE annotation_tab SET OUT = xml_schema;
END;
/
```

227.3.22 SETSCHEMAANNOTATIONS Procedure

This procedure takes the annotated differences resulting from a call to `DBMS_XMLSCHEMA_ANNOTATE.GETSCHEMAANNOTATIONS` and patches them into the provided XML schema.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.SETSCHEMAANNOTATIONS (
    xmlschema      IN OUT xmlType,
    annotations    IN VARCHAR2);
```

Parameters

Table 227-23 SETSCHEMAANNOTATIONS Procedure Parameters

Parameter	Description
xmlschema	An XML schema to be patched.
annotations	The differences document produced by calling <code>DBMS_XMLSCHEMA_ANNOTATE.GETSCHEMAANNOTATIONS</code> on the original XML schema and an annotated XML schema.

Usage Notes

DBMS_XMLSCHEMA_ANNOTATE.SETSCHEMAANNOTATIONS is not available on Oracle Database release 10.2 (only Oracle Database release 11.x).



See Also:

[GETSCHEMAANNOTATIONS Function](#)

Example

The following example illustrates DBMS_XMLSCHEMA_ANNOTATE.SETSCHEMAANNOTATIONS shown here and [GETSCHEMAANNOTATIONS Function](#).

```

-- test getannotations and apply them
declare
  xml_schema xmltype;
  xml_schema2 xmltype;
  annotations xmltype;
begin
  select out into xml_schema from annotation_tab;

  -- get the annotations from the schema
  annotations := DBMS_XMLSCHEMA_ANNOTATE.getSchemaAnnotations (xml_schema);

  -- apply the annotations to the schema
  select inp into xml_schema2 from annotation_tab;

  DBMS_XMLSCHEMA_ANNOTATE.setSchemaAnnotations(xml_schema2, annotations);

  update annotation_tab t set t.out = xml_schema2;
end;
/

```

227.3.23 SETSQLCOLLTYPE Procedure

This procedure assigns a SQL type name for a collection. A collection is a global or local element with `maxOccurs>1`.

Using this procedure, XDB creates SQLTypes with the user-defined names provided.

There are two overloads. The first sets the name of the SQL collection type corresponding to an XML element and the second to an XML element inside the specified complex type.

Syntax

```

DBMS_XMLSCHEMA_ANNOTATE.SETSQLCOLLTYPE (
  xmlschema          IN OUT  XMLTYPE,
  elementName       IN      VARCHAR2,
  sqlCollType       IN      VARCHAR2,
  overwrite         IN      BOOLEAN DEFAULT TRUE);

```

```

DBMS_XMLSCHEMA_ANNOTATE.SETSQLCOLLTYPE (
  xmlschema          IN OUT XMLType,
  globalObject       IN  VARCHAR2,

```

```

globalObjectName IN VARCHAR2,
localElementName IN VARCHAR2,
sqlCollType     IN VARCHAR2,
overwrite       IN BOOLEAN default TRUE );

```

Parameters

Table 227-24 SETSQLCOLLTYPE Procedure Parameters

Parameter	Description
xmlschema	The XML schema to be annotated
elementName	The element name
sqlCollType	The SQL collection type
globalObject	The global object (global complex type or global element)
globalObjectName	The name of the global object
localElementName	The name of a local element that descends from the global element
overwrite	A boolean that indicates whether or not the procedure overwrites element attributes. The default is TRUE.

Example

The `item` element will have an annotation similar to `xdb:SQLCollType="ITEM_SQL_COL_TYPE"`.

```

declare
  xml_schema xmltype;
begin
  SELECT out INTO xml_schema FROM annotation_tab;
  DBMS_XMLSCHEMA_ANNOTATE.setSQLCollType (xml_schema,
                                          'item',
                                          'ITEM_SQL_COL_TYPE',TRUE);
  UPDATE annotation_tab SET out = xml_schema;
end;

```

227.3.24 SETSQLNAME Procedure

This procedure assigns a name to the SQL attribute that corresponds to an element defined in the XML schema.

Syntax

```

DBMS_XMLSCHEMA_ANNOTATE.SETSQLNAME (
  xmlschema          IN OUT XMLType,
  globalObject       IN      VARCHAR2,
  globalObjectName   IN      VARCHAR2,
  localObject        IN      VARCHAR2,
  localObjectName    IN      VARCHAR2,
  sqlName            IN      VARCHAR2,
  overwrite          IN      BOOLEAN DEFAULT TRUE);

```

Parameters

Table 227-25 SETSQLNAME Procedure Parameters

Parameter	Description
xmlschema	XML schema to be annotated
globalObject	Global object (global complex type or global element)
globalObjectName	Name of the global object
localObject	Object descended from the global object
localObjectName	Name of the local object
sqlName	Name of the SQL attribute that corresponds to the element defined in the XML schema
overwrite	Boolean that indicates whether or not the procedure overwrites element attributes. The default is TRUE.

Example

The `shipTo` element will have an annotation similar to `xdb:SQLName="SHIPTO_SQLNAME"`.

```

DECLARE
    xml_schema    XMLTYPE;
BEGIN
    SELECT out INTO xml_schema FROM annotation_tab;
    DBMS_XMLSCHEMA_ANNOTATE.SETSQLNAME (xml_schema,
                                        'element', 'purchaseOrder',
                                        'element', 'shipTo',
                                        'SHIPTO_SQLNAME');
    UPDATE annotation_tab SET out = xml_schema;
END;
/

```

227.3.25 SETSQLTYPE Procedure

This procedure assigns a SQL type to a global object.

There are two overloads. The first overload assigns a SQL Type to a global object, such as a global element or global complex type and the second to a local object.

Syntax

```

DBMS_XMLSCHEMA_ANNOTATE.SETSQLTYPE (
    xmlschema          IN OUT  XMLTYPE,
    globalElementName IN     VARCHAR2,
    sqlType            IN     VARCHAR2,
    overwrite          IN     BOOLEAN DEFAULT TRUE);

```

```

DBMS_XMLSCHEMA_ANNOTATE.SETSQLTYPE (
    xmlschema          IN OUT  XMLTYPE,
    globalObject       IN     VARCHAR2,
    globalObjectName   IN     VARCHAR2,
    localObject        IN     VARCHAR2,
    localObjectName    IN     VARCHAR2,

```

```

sqlType          IN      VARCHAR2,
overwrite        IN      BOOLEAN DEFAULT TRUE);

```

Parameters

Table 227-26 SETSQLTYPE Procedure Parameters

Parameter	Description
xmlschema	XML schema to be annotated
globalObject	Global object (global complex type or global element)
globalObjectName	Name of the global object
globalElementName	Name of the global element
localObject	Object descended from the global object
localObjectName	Name of the local object
sqlType	SQL type assigned to the named global element
overwrite	Boolean that indicates whether or not the procedure overwrites element attributes. The default is TRUE.

Example

The `purchaseOrder` element will have an annotation similar to `xdb:SQLType="PO_SQLTYPE"` and the `shipTo` element has one similar to `xdb:SQLType="VARCHAR"`.

```

DECLARE
    xml_schema xmltype;
BEGIN
    SELECT out INTO xml_schema FROM annotation_tab;
    DBMS_XMLSCHEMA_ANNOTATE.setSQLType (xml_schema,
                                        'purchaseOrder',
                                        'PO_SQLTYPE');

    UPDATE annotation_tab SET out = xml_schema;
END;
/

DECLARE xml_schema xmltype;BEGIN SELECT out INTO xml_schema FROM annotation_tab;
DBMS_XMLSCHEMA_ANNOTATE.setSQLType
(xml_schema,
'element','purchaseOrder',
'element','shipTo',
'VARCHAR'); UPDATE
annotation_tab SET out = xml_schema;END;
/

```

227.3.26 SETSQLTYPE MAPPING Procedure

This procedure defines a mapping of schema type and SQL type.

If you use this procedure, you do not need to call the `SETSQLTYPE` procedure on all instances of the schema type; instead the procedure traverses the schema and assigns the SQL type automatically.

Syntax

```

DBMS_XMLSCHEMA_ANNOTATE.SETSQLTYPE MAPPING (
    xmlschema          IN OUT  XMLType,

```

```

schemaTypeName    IN      VARCHAR2,
sqlTypeName       IN      VARCHAR2,
overwrite         IN      BOOLEAN DEFAULT TRUE);

```

Parameters

Table 227-27 SETSQLTYPE_MAPPING Procedure Parameters

Parameter	Description
xmlschema	XML schema to be annotated
schemaTypeName	Schema type
sqlTypeName	Name of the SQL type
overwrite	Boolean that indicates whether or not the procedure overwrites element attributes. The default is TRUE

Example

The attribute `orderDate` will have an annotation similar to `xdb:SQLType="DATE"`.

```

declare  xml_schema xmltype;beginSELECT out INTO xml_schema FROM
annotation_tab;DBMS_XMLSCHEMA_ANNOTATE.setSQLTypeMapping
(xml_schema,
'date',
                                'DATE');UPDATE annotation_tab
SET out = xml_schema;end;
/

```

227.3.27 SETTABLEPROPS Procedure

This procedure specifies properties in the `TABLE` storage clause that is appended to the default `CREATE TABLE` statement.

There are two overloads with different parameter requirements, as indicated:

Syntax

```

DBMS_XMLSCHEMA_ANNOTATE.SETTABLEPROPS (
  xmlschema        IN OUT XMLType,
  globalelementName  IN   VARCHAR2,
  tableProps       IN   VARCHAR2,
  overwrite        IN   BOOLEAN DEFAULT TRUE);

```

```

DBMS_XMLSCHEMA_ANNOTATE.SETTABLEPROPS (
  xmlschema        IN OUT XMLTYPE,
  globalObject     IN   VARCHAR2,
  globalObjectName IN   VARCHAR2,
  localelementName IN   VARCHAR2,
  tableProps       IN   VARCHAR2,
  overwrite        IN   BOOLEAN DEFAULT TRUE);

```

Parameters

Table 227-28 SETTABLEPROPS Procedure Parameters

Parameter	Description
xmlschema	XML schema to be annotated
globalElementName	Name of the global element in the schema
tableProps	Table properties
globalObject	Global object (global complex type or global element)
globalObjectName	Name of the global object
localElementName	Name of a local element that descends from the global element
overwrite	Boolean that indicates whether or not the procedure overwrites element attributes. The default is TRUE.

Example

The `purchaseOrder` element will have an annotation similar to `xdb:tableProps="CACHE"`.

```
DECLARE xml_schema XMLTYPE; BEGIN SELECT out INTO xml_schema FROM annotation_tab;
DBMS_XMLSCHEMA_ANNOTATE.SETTABLEPROPS(xml_schema,
'purchaseOrder' , 'CACHE'); UPDATE annotation_tab SET out = xml_schema; END;
/
```

227.3.28 SETTIMESTAMPWITHTIMEZONE Procedure

This procedure sets the `TIMESTAMPWITHTIMEZONE` datatype to all `dateTime` typed elements in the XML schema.

This is equivalent to adding `xdb:SQLType="TIMESTAMP WITH TIME ZONE"` to all `dateTime` objects.

Syntax

```
DBMS_XMLSCHEMA_ANNOTATE.SETTIMESTAMPWITHTIMEZONE (
xmlschema IN OUT XMLTYPE,
overwrite IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 227-29 SETTIMESTAMPWITHTIMEZONE Procedure Parameters

Parameter	Description
xmlschema	XML schema to be annotated
overwrite	Boolean that indicates whether or not the procedure overwrites element attributes. The default is TRUE.

DBMS_XMLSCHEMA_UTIL

The `DBMS_XMLSCHEMA_UTIL` package provides an interface for XML schema validation.

This chapter contains the following topics:

- [DBMS_XMLSCHEMA_UTIL Security Model](#)
- [Summary of DBMS_XMLSCHEMA_UTIL Subprograms](#)

See Also:

- *Oracle XML DB Developer's Guide*

228.1 DBMS_XMLSCHEMA_UTIL Security Model

Applications must have the `EXECUTE` privilege on the `DBMS_XMLSCHEMA_UTIL` package

228.2 Summary of DBMS_XMLSCHEMA_UTIL Subprograms

This topic lists the `DBMS_XMLSCHEMA_UTIL` subprograms in alphabetical order and briefly describes them.

Table 228-1 *DBMS_XMLSCHEMA_UTIL Package Subprograms*

Subprogram	Description
CONFORMING Function	Validates an XML document against a schema
VALIDATE Procedure	Validates an XML document against a schema

228.2.1 CONFORMING Function

This function is used to validate an XML document against a schema.

Syntax

```
DBMS_XMLSCHEMA_UTIL.CONFORMING (
  doc          IN NUMBER,
  sch          IN NUMBER)
RETURN NUMBER;
```

Parameters

Table 228-2 CONFORMING Function Parameters

Parameter	Description
doc	The XML instance
sch	The XML schema

Function Exceptions

The exceptions of DBMS_XMLSCHEMA_UTIL.CONFORMING function are as follows:

- The function returns zero if the schema is legal and the document conforms to the schema; otherwise it returns an LSX error code from the schema validation.



Note:

The function takes an xml data instance and xml schema instance. The user does not have to register the schema.

Example: The document conforms to the schema

```
SELECT DBMS_XMLSCHEMA_UTIL.CONFORMING(
    XMLType('<A/>'),
    XMLType(
        '<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
          <xs:element name="A" type="xs:string"/>
        </xs:schema>')) "LSX CODE"
FROM DUAL;
```

228.2.2 VALIDATE Procedure

This procedure is used to validate an XML document against a schema.

Syntax

```
DBMS_XMLSCHEMA_UTIL.VALIDATE (
    doc          IN XMLTYPE,
    sch          IN XMLTYPE);
```

Parameters

Table 228-3 VALIDATE Procedure Parameters

Parameter	Description
doc	The XML instance
sch	The XML schema

Procedure Exceptions

The exceptions of `DBMS_XMLSCHEMA_UTIL.VALIDATE` procedure are as follows:

- The procedure raises `ORA-31154` if either the schema is not legal, or the document does not conform to the schema.

 **Note:**

The procedure takes an xml data instance and xml schema instance. The user does not have to register the schema.

Example: The document conforms to the schema

```
BEGIN
  DBMS_XMLSCHEMA_UTIL.VALIDATE (
    XMLType ('<A/>'),
    XMLType (
      '<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
        <xs:element name="A" type="xs:string"/>
      </xs:schema>');
END;
/
```

DBMS_XMLSTORAGE_MANAGE

The `DBMS_XMLSTORAGE_MANAGE` package provides an interface to manage and modify XML storage after schema registration has been completed.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of DBMS_XMLSTORAGE_MANAGE Subprograms](#)



See Also:

Oracle XML DB Developer's Guide

229.1 DBMS_XMLSTORAGE_MANAGE Overview

`DBMS_XMLSTORAGE_MANAGE` contains procedures to manage and modify XML storage after schema registration has been completed.

Use subprograms from this package to improve the performance of bulk load operations. You can disable indexes and constraints before doing a bulk load process and to enable them afterwards.

229.2 DBMS_XMLSTORAGE_MANAGE Security Model

Owned by XDB, the `DBMS_XMLSTORAGE_MANAGE` package must be created by `SYS` or `XDB`. The `EXECUTE` privilege is granted to `PUBLIC`.

Subprograms in this package are executed using the privileges of the current user.

229.3 Summary of DBMS_XMLSTORAGE_MANAGE Subprograms

This table lists and describes the `DBMS_XML_STORAGE` package subprograms.

Table 229-1 DBMS_XMLSTORAGE_MANAGE Package Subprograms

Subprogram	Description
DISABLEINDEXESANDCONSTRAINTS Procedure	Disables the indexes and constraints for <code>XMLType</code> tables and <code>XMLType</code> columns

Table 229-1 (Cont.) DBMS_XMLSTORAGE_MANAGE Package Subprograms

Subprogram	Description
ENABLEINDEXESANDCONSTRAINTS Procedure	Rebuilds all indexes and enables the constraints on an XMLType table including its child tables and out-of-line tables
EXCHANGEPOSTPROC Procedure	Enable constraints after exchange partition
EXCHANGEPREPROC Procedure	Disable constraints before exchange partition
INDEXXMLREFERENCES Procedure	Creates unique indexes on the REF columns of the given XML type table or the XML type column of a given table
REFPARTITIONEXCHANGEIN Procedure	This is an auxiliary procedure to load data through exchange partition operation into a partitioned table and its reference-partitioned child table provided the child table has an xmltype column with a local xmlindex.
REFPARTITIONEXCHANGEOUT Procedure	Auxiliary procedure to load data through exchange partition operation out of a partitioned table and its reference-partitioned child table provided that the child table has an xmltype column with a local xmlindex.
RENAMECOLLECTIONTABLE Procedure	Renames a collection table to the given table name
SCOPEXMLREFERENCES Procedure	Scopes all XML references. Scoped REF types require less storage space and allow more efficient access than unscoped REF types
XPATHT2TABCOLMAPPING Function	Maps a path expression (in XPath notation or DOT notations) to the corresponding table name and column name

229.3.1 DISABLEINDEXESANDCONSTRAINTS Procedure

This procedure disables the indexes and constraints for XMLType tables and XMLType columns.

Syntax

```
DBMS_XMLSTORAGE_MANAGE.DISABLEINDEXESANDCONSTRAINTS (
    owner_name    IN  VARCHAR2 DEFAULT USER,
    table_name    IN  VARCHAR2,
    column_name   IN  VARCHAR2 DEFAULT NULL,
    clear         IN  BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 229-2 DISABLEINDEXESANDCONSTRAINTS Procedure Parameters

Parameter	Description
owner_name	Owner's name
table_name	Name of the XMLType table that the procedure is being performed on
column_name	XMLType column name

Table 229-2 (Cont.) DISABLEINDEXESANDCONSTRAINTS Procedure Parameters

Parameter	Description
clear	Boolean that when set to TRUE clears all stored index and constraint data for the table before the procedure executes. The default is FALSE, which does not clear them.

Usage Notes

Passing XMLTYPE tables

For XMLType tables, you must pass the XMLType table name on which the bulk load operation is to be performed. For XMLType columns, you must pass the relational table name and the corresponding XMLType column name.

Using clear to Enable and Disable Indexes and Constraints

**Note:**

If the `DISABLEINDEXESANDCONSTRAINTS` procedure is called with `clear` set to `TRUE`, it removes any index or constraint information about the XMLTYPE table or column memorized during earlier executions of the procedure.

Therefore, you must ensure that all disabled indexes and constraints are re-enabled on the table or column before you call the `DISABLEINDEXESANDCONSTRAINTS` procedure with `clear` set to `TRUE`.

Ideally, it is recommended that you set `clear` set to `TRUE` for the first execution. For any subsequent executions (due to errors while disabling or enabling indexes) `clear` should be set to `FALSE`, the default value. Once you have successfully re-enabled all the indexes and constraints following the bulk load operation, you can call this procedure again with `clear` set to `TRUE` for the next bulk load operation.

Example

The following example illustrates the use of `clear` in the `DISABLEINDEXESANDCONSTRAINTS` procedure and the [ENABLEINDEXESANDCONSTRAINTS Procedure](#).

First, add a not-NULL constraint on `comment` element of the `PURCHASEORDER_TAB` table:

```
ALTER TABLE PURCHASEORDER_TAB ADD CONSTRAINT c1 check          ("XMLDATA"."comment"
IS NOT NULL);
```

Then, disable all the indexes and constraints by passing the `clear` as `TRUE`, by calling the `DISABLEINDEXESANDCONSTRAINTS` procedure:

```
BEGIN
  XDB.DBMS_XMLSTORAGE_MANAGE.DISABLEINDEXESANDCONSTRAINTS
    ( USER, 'PURCHASEORDER_TAB', NULL, TRUE );
END;
/
```

Next, perform a bulk load operation (such as datapump import) which violates constraint `c1` in the `ALTER` table statement. This does not raise an error because the constraint is disabled:

```
host impdp orexample/orexample directory=dir dumpfile=dmp.txt
  tables=OREXAMPLE.PURCHASEORDER_TAB content = DATA_ONLY;
```

NOTE: To view the disabled constraints and indexes use:

```
SELECT constraint_name,table_name,status FROM all_constraints
  WHERE owner = user;
```

Finally, try to enable the constraint using the `ENABLEINDEXESANDCONSTRAINTS` procedure. It raises an error because `c1`, the not null constraint, is violated by the bulk load operation:

```
BEGIN
  XDB.DBMS_XMLSTORAGE_MANAGE.ENABLEINDEXESANDCONSTRAINTS
    ( USER, 'PURCHASEORDER_TAB' );
END;
/
```

To disable all the indexes and constraints, again use `DISABLEINDEXESANDCONSTRAINTS`, but set `clear= FALSE` (because the `ENABLEINDEXESANDCONSTRAINTS` failed to complete successfully). Note: `clear = FALSE` by default, so we do not need to pass it explicitly in the next call.

```
BEGIN
  xdb.DBMS_XMLSTORAGE_MANAGE.DISABLEINDEXESANDCONSTRAINTS
    ( USER, 'PURCHASEORDER_TAB' );
END;
/
```

Then, delete the incorrect rows entered into the table

```
DELETE FROM purchaseorder_tab p
  WHERE p.xmldata."comment" IS NULL;
```

Re-enable the indexes and constraints using `ENABLEINDEXESANDCONSTRAINTS`, which completes successfully.

```
BEGIN
  xdb.DBMS_XMLSTORAGE_MANAGE.ENABLEINDEXESANDCONSTRAINTS
    ( USER, 'PURCHASEORDER_TAB' );
END;
/
```

229.3.2 ENABLEINDEXESANDCONSTRAINTS Procedure

This procedure rebuilds all indexes and enables the constraints on an `XMLType` table including its child tables and out-of-line tables.

When `column_name` is passed, it does the same for this `XMLType` column.

Syntax

```
DBMS_XMLSTORAGE_MANAGE.ENABLEINDEXESANDCONSTRAINTS (
    owner_name    IN VARCHAR2 DEFAULT USER,
    table_name    IN VARCHAR2,
    column_name   IN VARCHAR2 DEFAULT NULL);
```

Parameters**Table 229-3** ENABLEINDEXESANDCONSTRAINTS Procedure Parameters

Parameter	Description
owner_user	Owner's name
table_name	Name of the table that the indexes and constraints are being removed from
column_name	Column name

Usage Notes

This procedure reverses [DISABLEINDEXESANDCONSTRAINTS Procedure](#).

Example

See [DISABLEINDEXESANDCONSTRAINTS Procedure](#)

229.3.3 EXCHANGEPOSTPROC Procedure

This procedure enable constraints after exchange partition.

Syntax

```
DBMS_XMLSTORAGE_MANAGE.EXCHANGEPOSTPROC (
    owner_name    IN VARCHAR2 DEFAULT USER,
    table_name    IN VARCHAR2);
```

Parameters**Table 229-4** EXCHANGEPOSTPROC Procedure Parameters

Parameter	Description
owner_user	Owner's name
table_name	Name of the table that the indexes and constraints are being removed from

229.3.4 EXCHANGEPROC Procedure

This procedure disable constraints before exchange partition.

Syntax

```
DBMS_XMLSTORAGE_MANAGE.EXCHANGEPROC (
    owner_name IN VARCHAR2 DEFAULT USER,
    table_name IN VARCHAR2);
```

Parameters

Table 229-5 EXCHANGEPROC Procedure Parameters

Parameter	Description
owner_user	Owner's name
table_name	Name of the table that the indexes and constraints are being removed from

229.3.5 INDEXXMLREFERENCES Procedure

This procedure creates unique indexes on the REF columns of the given XML type table or the XML type column of a given table.

If the procedure creates multiple REF columns, it appends `_1`, `_2`, and so on to their names.

Syntax

```
DBMS_XMLSTORAGE_MANAGE.INDEXXMLREFERENCES (
    owner_name IN VARCHAR2 DEFAULT USER,
    table_name IN VARCHAR2,
    column_name IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 229-6 INDEXXMLREFERENCES Procedure Parameters

Parameter	Description
owner_name	The owner's name
table_name	The table being indexed
column_name	A column name. Not needed for XML type tables.
index_name	The name of the newly created index

Usage Notes

This procedure is only used if the REFS are scoped. See [SCOPEXMLREFERENCES Procedure](#).

Indexed REFS lead to better performance when joins between the base table and a child table occur in the query plan.

- If the base table has a higher selectivity than the child table, there is no need to index the REFS.
- If the selectivity of the child table is higher than that of the base table and if no indexes are present, then the join of one row in the child table with the base table leads to a full table scan of the base table.

INDEXXMLREFERENCES does not index REFS recursively in child tables of a table it is called on. To do this, Oracle recommends calling the procedure from within a loop over the XML_OUT_OF_LINE_TABLES or XML_NESTED_TABLES view. This creates the index names from the current value of a column in the view.

 **Note:**

This procedure is limited to the structured storage model.

229.3.6 REFPARTITIONEXCHANGEIN Procedure

This is an auxiliary procedure to load data through exchange partition operation into a partitioned table and its reference-partitioned child table provided that the child table has an xmltype column with a local xmlindex.

Syntax

```
DBMS_XMLSTORAGE_MANAGE.REFPARTITIONEXCHANGEIN (
  owner_name           IN VARCHAR2,
  parent_table_name    IN VARCHAR2,
  child_table_name     IN VARCHAR2,
  parent_exchange_table_name IN VARCHAR2,
  child_exchange_table_name IN VARCHAR2,
  parent_exchange_stmt IN CLOB,
  child_exchange_stmt  IN CLOB);
```

Parameters

Table 229-7 REFPARTITIONEXCHANGEIN Parameters

Parameter	Description
owner_name	owner's name
parent_table_name	the partitioned base table
child_table_name	a partitioned table with reference partitioning based on the table named parent_table_name
parent_exchange_table_name	an exchange table for the partitioned base table
child_exchange_table_name	an exchange table for the table named child_table_name
parent_exchange_stmt	SQL statement to execute exchange partition operation between the table named parent_table_name and the table named parent_exchange_table_name

Table 229-7 (Cont.) REFPARTITIONEXCHANGEIN Parameters

Parameter	Description
child_exchange_stmt	SQL statement to execute exchange partition operation between the table named child_table_name and the table named child_exchange_table_name

229.3.7 REFPARTITIONEXCHANGEOUT Procedure

This is an auxiliary procedure to load data through exchange partition operation out of a partitioned table and its reference-partitioned child table provided that the child table has an xmltype column with a local xmlindex.

Syntax

```
DBMS_XMLSTORAGE_MANAGE.REFPARTITIONEXCHANGEOUT (
    owner_name           IN VARCHAR2,
    parent_table_name    IN VARCHAR2,
    child_table_name     IN VARCHAR2,
    parent_exchange_table_name IN VARCHAR2,
    child_exchange_table_name IN VARCHAR2,
    parent_exchange_stmt IN CLOB,
    child_exchange_stmt  IN CLOB);
```

Parameters

Table 229-8 REFPARTITIONEXCHANGEOUT Parameters

Parameter	Description
owner_name	owner's name
parent_table_name	the partitioned base table
child_table_name	a partitioned table with reference partitioning based on the table named parent_table_name
parent_exchange_table_name	an exchange table for the partitioned base table
child_exchange_table_name	an exchange table for the table named child_table_name
parent_exchange_stmt	SQL statement to execute exchange partition operation between the table named parent_table_name and the table named parent_exchange_table_name
child_exchange_stmt	SQL statement to execute exchange partition operation between the table named child_table_name and the table named child_exchange_table_name

229.3.8 RENAMECOLLECTIONTABLE Procedure

This procedure renames a collection table to the given table name.

An XPath expression specifies the collection table, starting from the `XMLType` base table or an `XMLType` column of the base table.

This procedure provides the only way to derive a collection table name from the corresponding collection type name because there is no direct schema annotation for the purpose.

Syntax

```
DBMS_XMLSTORAGE_MANAGE.RENAMECOLLECTIONTABLE (
  owner_name          IN VARCHAR2 DEFAULT USER,
  table_name          IN VARCHAR2,
  column_name         IN VARCHAR2 DEFAULT NULL,
  xpath               IN VARCHAR2,
  collection_table_name IN VARCHAR2
  namespaces          IN VARCHAR2 default NULL); // For release 11.2 only
```

Parameters

Table 229-9 RENAMECOLLECTIONTABLE Procedure Parameters

Parameter	Description
<code>owner_name</code>	The name of the owner
<code>table_name</code>	The name of a base table that can be used as the starting point for specifying the collection table
<code>column_name</code>	An <code>XMLType</code> column that can be the starting point for specifying the collection table
<code>xpath</code>	The XPath expression that specifies the collection table
<code>collection_table_name</code>	The name of the collection table
<code>namespaces</code>	For Oracle Database 11g Release 2 (11.2) and higher. The namespaces used in XPath.

Usage Notes

Call this procedure after registering the XML schema.

The table name serves as a prefix to the index names.

Oracle recommends using this function because it makes query execution plans more readable.

Report errors that occur while this procedure runs to the user that called the procedure.



Note:

This procedure is limited to the structured storage model.

For Oracle Database 11g Release 2 (11.2) and higher, only, this function accepts XPath notation as well as DOT notation. If XPath notation is used, a `namespaces` parameter may also be required.

Example

The collection table name will be `EMP_TAB_NAMELIST`. You can verify this using `SELECT * FROM user_nested_tables`.

Using DOT Notation:

```
call XDB.DBMS_XMLSTORAGE_MANAGE.RENAMECOLLECTIONTABLE (
    USER,
    'EMP_TAB',
    NULL,
    '"XMLDATA"."EMPLOYEE"."NAME"',
    'EMP_TAB_NAMELIST);
```

Using XPath Notation:

XPath notation is available with Oracle Database 11g Release 2 (11.2) and higher.

```
call XDB.DBMS_XMLSTORAGE_MANAGE.RENAMECOLLECTIONTABLE (
    USER,
    'EMP_TAB',
    NULL,
    '/e:Employee/Name',
    'EMP_TAB_NAMELIST',
    '''http://www.oracle.com/emp.xsd'' as "e"');
```

229.3.9 SCOPEXMLREFERENCES Procedure

This procedure scopes all XML references. Scoped `REF` types require less storage space and allow more efficient access than unscoped `REF` types.

Syntax

```
DBMS_XMLSTORAGE_MANAGE.SCOPEXMLREFERENCES;
```

Usage Notes

- If you have used [SETOUTOFFLINE Procedure](#) in the `DBMS_XMLSTORAGE_MANAGE` package to avoid raising '4096 column limit' errors during XML schema registration, you should also use [SCOPEXMLREFERENCES Procedure](#).
- Using `SCOPEXMLREFERENCES` after XML schema registration and before loading XML instance data, makes these reference scoped to the out-of-line table only.



Note:

This procedure is limited to the structured storage model.

229.3.10 XPATH2TABCOLMAPPING Function

This function maps a path expression (in XPath notation or DOT notations) to the corresponding table name and column name. This is necessary in cases in which the user wants to create an index on this table, or to add a constraint, or to rename a table to make query execution plans more readable.

Syntax

```
DBMS_XMLSTORAGE_MANAGE.XPATH2TABCOLMAPPING (
  owner_name  IN  VARCHAR2 DEFAULT USER,
  table_name  IN  VARCHAR2,
  column_name IN  VARCHAR2 DEFAULT NULL,
  xpath       IN  VARCHAR2,
  namespaces  IN  VARCHAR2 DEFAULT NULL)
RETURN XMLTYPE;
```

Parameters

Table 229-10 XPATH2TABCOLMAPPING Procedure Parameters

Parameter	Description
owner_user	Owner's name
table_name	Name of the base table
column_name	Optional name of the XML type column if table_name is not an XMLtype table. If table_name refers to XMLtype table then column_name should be NULL.
xpath	Path expression in DOT notation or XPath notation (see examples below)
namespaces	Optional namespace definitions for path expression

Examples

XPath2TabColMapping evaluated on XMLType table with XPath Notation, namespaces provided

```
SELECT XDB.DBMS_XMLSTORAGE_MANAGE.XPATH2TABCOLMAPPING (
  USER, 'XML_TAB', '', '//n1:item/n1:location','xdbXmark' as "n1")
FROM DUAL;
```

This produces a result, for example:

```
<Result>
<Mapping TableName="SYS_NT12345" ColumnName="location"/>
</Result>
```

This allows us to define an index or constraint on table SYS_NT12345 and column location.

XPath2TabColMapping evaluated on table not of XMLType but with XMLType column by means of DOT notation

```
SELECT XDB.DBMS_XMLSTORAGE_MANAGE.XPATH2TABCOLMAPPING (
  USER, 'PurchaseOrderTab', 'XMLCOL', 'xmldata.LineItems.LineItem', '')
FROM DUAL;
```

DBMS_XMLSTORE

DBMS_XMLSTORE provides the ability to store XML data in relational tables.

Note:

The PL/SQL package DBMS_XMLSTORE is deprecated in Oracle Database 23ai.

DBMS_XMLSTORE is a non-standard Oracle-proprietary package that enables you to store and manipulate XML data in Oracle Database. This package is deprecated, and can be desupported in a future release. Oracle recommends that you use regular SQL DML and with standard XQuery and SQL/XML to store and manage XML data. Using standard functionality provides future-proof way to store and manipulate XML data.

This chapter contains the following sections:

- [Security Model](#)
- [Types](#)
- [Summary of DBMS_XMLSTORE Subprograms](#)

See Also:

Oracle XML DB Developer's Guide

230.1 DBMS_XMLSTORE Security Model

Owned by XDB, the DBMS_XMLSTORE package must be created by SYS or XDB. The EXECUTE privilege is granted to PUBLIC. Subprograms in this package are executed using the privileges of the current user.

230.2 Types

The DBMS_XMLSTORE subprograms use the ctxType Type.

Table 230-1 *Types of DBMS_XMLSTORE*

Type	Description
ctxType	The type of the query context handle. This is the return type of NEWCONTEXT .

230.3 Summary of DBMS_XMLSTORE Subprograms

This table lists the DBMS_XMLSTORE subprograms and briefly describes them.

Table 230-2 DBMS_XMLSTORE Package Subprograms

Method	Description
CLEARKEYCOLUMNLIST	Clears the key column list.
CLEARUPDATECOLUMNLIST	Clears the update column list.
CLOSECONTEXT	It closes/deallocates a particular save context.
DELETEXML	Deletes records specified by data from the XML document, from the table specified at the context creation time.
INSERTXML	Inserts the XML document into the table specified at the context creation time.
NEWCONTEXT	Creates a save context, and returns the context handle.
SETKEYCOLUMN	This method adds a column to the key column list.
SETROWTAG	Names the tag used in the XML document., to enclose the XML elements corresponding to the database.
SETUPDATECOLUMN	Adds a column to the "update column list".
UPDATERXML	Updates the table given the XML document.

230.3.1 CLEARKEYCOLUMNLIST

This procedure clears the key column list.

Syntax

```
PROCEDURE clearKeyColumnList(
    ctxHdl IN ctxType);
```

Table 230-3 CLEARKEYCOLUMNLIST Procedure Parameters

Parameter	IN / OUT	Description
ctxHdl	(IN)	Context handle.

230.3.2 CLEARUPDATECOLUMNLIST

This procedure clears the update column list.

Syntax

```
PROCEDURE clearUpdateColumnList(
    ctxHdl IN ctxType);
```

Table 230-4 CLEARUPDATECOLUMNLIST Procedure Parameters

Parameter	IN / OUT	Description
ctxHdl	(IN)	Context handle.

230.3.3 CLOSECONTEXT

This procedure closes/deallocates a particular save context.

Syntax

```
PROCEDURE closeContext(ctxHdl IN ctxType);
```

Table 230-5 CLOSECONTEXT Procedure Parameters

Parameter	IN / OUT	Description
ctxHdl	(IN)	Context handle.

230.3.4 DELETEXML

DELETEXML deletes records specified by data from the XML document from the table specified at the context creation time, and returns the number of rows deleted.

Syntax

The following syntax uses a VARCHAR2 type for the xDoc parameter.

```
FUNCTION deleteXML(  
    ctxHdl IN ctxPType,  
    xDoc IN VARCHAR2)  
RETURN NUMBER;
```

The following syntax uses a CLOB type for the xDoc parameter.

```
FUNCTION deleteXML(  
    ctxHdl IN ctxType,  
    xDoc IN CLOB)  
RETURN NUMBER;
```

The following syntax uses an XMLType type for the xDoc parameter.

```
FUNCTION deleteXML(  
    ctxHdl IN ctxType,  
    xDoc IN XMLType)  
RETURN NUMBER;
```

Parameters

Table 230-6 DELETXML Function Parameters

Parameter	IN / OUT	Description
ctxHdl	(IN)	Context handle.
xDoc	(IN)	String containing the XML document.

230.3.5 INSERTXML

Inserts the XML document into the table specified at the context creation time, and returns the number of rows inserted.

Note that if a user passes an XML file for `insertXML` to `DBMS_XMLSTORE` that contains extra elements (elements that do not match any columns in the table), Oracle tries to insert into those columns unless `SETUPDATECOLUMN` is used. The use of `setUpdateColumn` is optional only if the elements in the XML file match up to the columns in the table.

Syntax

```
FUNCTION insertXML(
  ctxHdl IN ctxType,
  xDoc IN VARCHAR2)
RETURN NUMBER;
```

```
FUNCTION insertXML(
  ctxHdl IN ctxType,
  xDoc IN CLOB)
RETURN NUMBER;
```

```
FUNCTION insertXML(
  ctxHdl IN ctxType,
  xDoc IN XMLType)
RETURN NUMBER;
```

Parameters

Table 230-7 INSERTXML Function Parameters

Parameter	IN / OUT	Description
ctxHdl	(IN)	Context handle.
xDoc	(IN)	String containing the XML document.

230.3.6 NEWCONTEXT

`NEWCONTEXT` creates a save context and returns the context handle.

Syntax

```
FUNCTION newContext(  
    targetTable IN VARCHAR2)  
RETURN ctxType;
```

Table 230-8 `NEWCONTEXT` Function Parameters

Parameter	IN / OUT	Description
targetTable	(IN)	The target table into which to load the XML document.

230.3.7 SETKEYCOLUMN

This method adds a column to the "key column list".

The value for the column cannot be `NULL`. In case of update or delete, the columns in the key column list make up the `WHERE` clause of the statement. The key columns list must be specified before updates can complete; this is optional for delete operations

Syntax

```
PROCEDURE setKeyColumn(  
    ctxHdl IN ctxType,  
    colName IN VARCHAR2);
```

Table 230-9 `SETKEYCOLUMN` Procedure Parameters

Parameter	IN / OUT	Description
ctxHdl	(IN)	Context handle.
colName	(IN)	Column to be added to the key column list; cannot be <code>NULL</code> .

230.3.8 SETROWTAG

This procedure names the tag used in the XML document, to enclose the XML elements corresponding to database records.

Syntax

```
PROCEDURE setRowTag(  
    ctxHdl IN ctxType,  
    tag IN VARCHAR2);
```

Table 230-10 `SETROWTAG` Procedure Parameters

Parameter	IN / OUT	Description
ctxHdl	(IN)	Context handle.

Table 230-10 (Cont.) SETROWTAG Procedure Parameters

Parameter	IN / OUT	Description
tag	(IN)	Tag name.

230.3.9 SETUPDATECOLUMN

SETUPDATECOLUMN adds a column to the update column list.

In case of insert, the default is to insert values to all the columns in the table. In case of updates, the default is to only update the columns corresponding to the tags present in the `ROW` element of the XML document. When the update column list is specified, the columns making up this list alone will get updated or inserted into.

Note that if a user passes an XML file for `INSERTXML` to `DBMS_XMLSTORE` which contains extra elements (ones that do not match up to any columns in the table), Oracle will try to insert into those columns unless `setUpdateColumn` is used. The use of `setUpdateColumn` is optional only if the elements in the XML file match up to the columns in the table.

Syntax

```
PROCEDURE setUpdateColumn(
    ctxHdl IN ctxType,
    colName IN VARCHAR2);
```

Table 230-11 SETUPDATECOLUMN Procedure Parameters

Parameter	IN / OUT	Description
ctxHdl	(IN)	Context handle.
colName	(IN)	Column to be added to the update column list.

230.3.10 UPDATEXML

Updates the table specified at the context creation time with data from the XML document, and returns the number of rows updated.

The options are described in the following table.

Syntax

The following syntax passes the `xDoc` parameter as a `VARCHAR2`.

```
FUNCTION updateXML(
    ctxHdl IN ctxType,
    xDoc IN VARCHAR2)
RETURN NUMBER;
```

The following syntax passes the `xDoc` parameter as a CLOB.

```
FUNCTION updateXML(  
  ctxHdl IN ctxType,  
  xDoc IN CLOB)  
RETURN NUMBER;
```

The following syntax passes the `xDoc` parameter as a XMLType.

```
FUNCTION updateXML(  
  ctxHdl IN ctxType,  
  xDoc IN XMLType)  
RETURN NUMBER;
```

Parameters

Table 230-12 UPDATEXML Function Parameters

Parameter	IN / OUT	Description
<code>ctxHdl</code>	(IN)	Context handle.
<code>xDoc</code>	(IN)	String containing the XML document.

DBMS_XPLAN

The `DBMS_XPLAN` package provides an easy way to display the output of the `EXPLAIN PLAN` command in several, predefined formats.

You can also use the `DBMS_XPLAN` package to display the plan of a statement stored in the Automatic Workload Repository (AWR) or stored in a SQL tuning set. It further provides a way to display the SQL execution plan and SQL execution runtime statistics for cached SQL cursors based on the information stored in the `V$SQL_PLAN` and `V$SQL_PLAN_STATISTICS_ALL` fixed views. Finally, it displays plans from a SQL plan baseline.

See Also:

- For more information on the `EXPLAIN PLAN` command, the AWR, and SQL tuning set, see *Oracle Database SQL Tuning Guide*.
- For more information on the `V$SQL_PLAN` fixed view, see *Oracle Database Reference*
- For more information on the `V$SQL_PLAN_STATISTICS` fixed view, see *Oracle Database Reference*

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Examples](#)
- [Summary of DBMS_XPLAN Subprograms](#)

231.1 DBMS_XPLAN Overview

The `DBMS_XPLAN` package supplies five table functions.

These functions are listed below:

- `DISPLAY` - to format and display the contents of a plan table.
- `DISPLAY_AWR` - to format and display the contents of the execution plan of a stored SQL statement in the AWR.
- `DISPLAY_CURSOR` - to format and display the contents of the execution plan of any loaded cursor.
- `DISPLAY_SQL_PLAN_BASELINE` - to display one or more execution plans for the SQL statement identified by SQL handle
- `DISPLAY_SQLSET` - to format and display the contents of the execution plan of statements stored in a SQL tuning set.

231.2 DBMS_XPLAN Security Model

This package runs with the privileges of the calling user, not the package owner (`SYS`). The table function `DISPLAY_CURSOR` requires `SELECT` or `READ` privileges on the following fixed views: `V$SQL_PLAN`, `V$SESSION` and `V$SQL_PLAN_STATISTICS_ALL`. This function also requires `SELECT/READ` permissions on `V$SQL`.

`DISPLAY_AWR` Function requires the user to have `SELECT` or `READ` privileges on `DBA_HIST_SQL_PLAN`, `AWR_ROOT_SQL_PLAN`, `AWR_PDB_SQL_PLAN`, `AWR_ROOT_SQLTEXT`, `DBA_HIST_SQLTEXT`, `AWR_PDB_SQLTEXT`, and `V$DATABASE`.

`DISPLAY_SQLSET` Function requires the user to have the `SELECT` or `READ` privilege on `ALL_SQLSET_STATEMENTS` and `ALL_SQLSET_PLANS`.

`DISPLAY_SQL_PLAN_BASELINE` Function requires the user to have the `SELECT` or `READ` privilege on `DBA_SQL_PLAN_BASELINES` as well as the privileges to execute the SQL statement for which the user is trying to get the plan.

The preceding privileges are granted automatically as part of `SELECT_CATALOG_ROLE`.

231.3 DBMS_XPLAN Data Structures

The `DBMS_XPLAN` package defines a `TABLE` type.

Table Types

- `DBMS_XPLAN PLAN_OBJECT_LIST` Table Type

231.3.1 DBMS_XPLAN PLAN_OBJECT_LIST Table Type

This type allows for a list of generic objects as input to the `COMPARE_PLANS` function.

Syntax

```
TYPE plan_object_list IS TABLE OF generic_plan_object;
```

The generic object abstracts the common attributes of plans from all plan sources. Every plan source is a subclass of the `plan_object_list` superclass. The following table summarizes the different plan sources. Note that when an optional parameter is null, it can correspond to multiple objects. For example, if you do not specify a child number for `cursor_cache_object`, then it matches all cursor cache statements with the specified SQL ID.

Table 231-1 Plan Sources for PLAN_OBJECT_LIST

Plan Source	Specification	Description
Plan table	<code>plan_table_object(owner, plan_table_name, statement_id, plan_id)</code>	The parameters are as follows: <ul style="list-style-type: none"> • <code>owner</code>—The owner of the plan table • <code>plan_table_name</code>—The name of the plan table • <code>statement_id</code>—The ID of the statement (optional) • <code>plan_id</code>—The ID of the plan (optional)
Cursor cache	<code>cursor_cache_object(sql_id, child_number)</code>	The parameters are as follows: <ul style="list-style-type: none"> • <code>sql_id</code>—The SQL ID of the plan • <code>child_number</code>—The child number of the plan in the cursor cache (optional)
AWR	<code>awr_object(sql_id, dbid, con_dbid, plan_hash_value)</code>	The parameters are as follows: <ul style="list-style-type: none"> • <code>sql_id</code>—The SQL ID of the plan • <code>dbid</code>—The database ID (optional) • <code>con_dbid</code>—The CDB ID (optional) • <code>plan_hash_value</code>—The hash value of the plan (optional)
SQL tuning set	<code>sqlset_object (sqlset_owner, sqlset_name, sql_id, plan_hash_value)</code>	The parameters are as follows: <ul style="list-style-type: none"> • <code>sqlset_owner</code>—The owner of the SQL tuning set • <code>sqlset_name</code>—The name of the SQL tuning set • <code>sql_id</code>—The SQL ID of the plan • <code>plan_hash_value</code>—The hash value of the plan (optional)
SQL plan management	<code>spm_object (sql_handle, plan_name)</code>	The parameters are as follows: <ul style="list-style-type: none"> • <code>sql_handle</code>—The SQL handle of plans protected by SQL plan management • <code>plan_name</code>—The name of the SQL plan baseline (optional)
SQL profile	<code>sql_profile_object (profile_name)</code>	The <code>profile_name</code> parameter specifies the name of the SQL profile.
Advisor	<code>advisor_object (task_name, execution_name, sql_id, plan_id)</code>	The parameters are as follows: <ul style="list-style-type: none"> • <code>task_name</code>—The name of the advisor task • <code>execution_name</code>—The name of the task execution • <code>sql_id</code>—The SQL ID of the plan • <code>plan_id</code>—The advisor plan ID (optional)

231.4 Examples

These examples show sample uses of DBMS_XPLAN.

Displaying a Plan Table Using DBMS_XPLAN.DISPLAY

Execute an explain plan command on a SELECT statement:

```
EXPLAIN PLAN FOR
SELECT * FROM emp e, dept d
      WHERE e.deptno = d.deptno
      AND e.ename='benoit';
```

Display the plan using the DBMS_XPLAN.DISPLAY table function

```
SET LINESIZE 130
SET PAGESIZE 0
SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);
```

This query produces the following output:

Plan hash value: 3693697075

```
-----
| Id | Operation          | Name | Rows | Bytes | Cost (%CPU)| Time     |
-----
|  0 | SELECT STATEMENT   |      |      |      |  6  (34)| 00:00:01 |
|*  1 |  HASH JOIN         |      |      |      |  6  (34)| 00:00:01 |
|*  2 |    TABLE ACCESS FULL| EMP  |      |      |  3  (34)| 00:00:01 |
|  3 |    TABLE ACCESS FULL| DEPT |      |      |  3  (34)| 00:00:01 |
-----
```

Predicate Information (identified by operation id):

```
-----
  1 - access("E"."DEPTNO"="D"."DEPTNO")
  2 - filter("E"."ENAME"='benoit')
```

15 rows selected.

Displaying a Cursor Execution Plan Using DBMS_XPLAN.DISPLAY_CURSOR

By default, the table function DISPLAY_CURSOR formats the execution plan for the last SQL statement executed by the session. For example:

```
SELECT ename FROM emp e, dept d
      WHERE e.deptno = d.deptno
      AND e.empno=7369;
```

```
ENAME
-----
SMITH
```

To display the execution plan of the last executed statement for that session:

```
SET PAGESIZE 0
SELECT * FROM DBMS_XPLAN.DISPLAY_CURSOR();
```

This query produces the following output:

Plan hash value: 3693697075, SQL hash value: 2096952573, child number: 0

```
SELECT ename FROM emp e, dept d WHERE e.deptno = d.deptno
AND e.empno=7369
```

```
-----
```

Id	Operation	Name	Rows	Bytes	Cost (%CPU)	Time
0	SELECT STATEMENT					
* 1	HASH JOIN		1	16	6 (34)	00:00:01
* 2	TABLE ACCESS FULL	EMP	1	13	3 (34)	00:00:01
3	TABLE ACCESS FULL	DEPT	4	12	3 (34)	00:00:01

```
-----
```

```
Predicate Information (identified by operation id):
```

```
-----
```

- 1 - access("E"."DEPTNO"="D"."DEPTNO")
- 2 - filter("E"."EMPNO"=7369)

```
21 rows selected.
```

You can also use the table function `DISPLAY_CURSOR` to display the execution plan for any loaded cursor stored in the cursor cache. In that case, you must supply a reference to the child cursor to the table function. This includes the SQL ID of the statement and optionally the child number.

Run a query with a distinctive comment:

```
SELECT /* TOTO */ ename, dname
FROM dept d join emp e USING (deptno);
```

Get `sql_id` and `child_number` for the preceding statement:

```
SELECT sql_id, child_number
FROM v$sql
WHERE sql_text LIKE '%TOTO%';
```

```
SQL_ID          CHILD_NUMBER
-----
gwp663cqh5qbf    0
```

Display the execution plan for the cursor:

```
SELECT * FROM DBMS_XPLAN.DISPLAY_CURSOR('gwp663cqh5qbf',0);
```

```
Plan hash value: 3693697075, SQL ID: gwp663cqh5qbf, child number: 0
```

```
-----
```

```
SELECT /* TOTO */ ename, dname
FROM dept d JOIN emp e USING (deptno);
```

```
-----
```

Id	Operation	Name	Rows	Bytes	Cost (%CPU)	Time
0	SELECT STATEMENT				7 (100)	
1	SORT GROUP BY		4	64	7 (43)	00:00:01
* 2	HASH JOIN		14	224	6 (34)	00:00:01
3	TABLE ACCESS FULL	DEPT	4	44	3 (34)	00:00:01
4	TABLE ACCESS FULL	EMP	14	70	3 (34)	00:00:01

```
-----
```

```
Predicate Information (identified by operation id):
```

```
-----
```

- 2 - access("E"."DEPTNO"="D"."DEPTNO")

Instead of issuing two queries, one to get the `sql_id` and `child_number` pair and one to display the plan, you can combine these in a single query:

Display the execution plan of all cursors matching the string 'TOTO':

```
SELECT t.*
FROM v$sql s, DBMS_XPLAN.DISPLAY_CURSOR(s.sql_id, s.child_number) t WHERE
sql_text LIKE '%TOTO%';
```

Displaying a Plan Table with Parallel Information

By default, only relevant information is reported by the `display` and `display_cursor` table functions. In [Displaying a Plan Table Using DBMS_XPLAN.DISPLAY](#), the query does not execute in parallel. Hence, information related to the parallelization of the plan is not reported. As shown in the following example, parallel information is reported only if the query executes in parallel.

```
ALTER TABLE emp PARALLEL;
EXPLAIN PLAN for
SELECT * FROM emp e, dept d
WHERE e.deptno = d.deptno
AND e.ename = 'hermann'
ORDER BY e.empno;
```

Display the plan using the `DBMS_XPLAN.DISPLAY` table function

```
SET LINESIZE 130
SET PAGESIZE 0
SELECT * FROM DBMS_XPLAN.DISPLAY();
Plan hash value: 3693697345
```

Id	Operation	Name	Rows	Bytes	Cost (%CPU)	Time	TQ	INOUT	PQ Distrib
0	SELECT STATEMENT		1	117	6 (50)	00:00:01			
1	PX COORDINATOR								
2	PX SEND QC (ORDER)	:TQ10003	1	117	6 (50)	00:00:01	Q1,03	P->S	QC (ORDER)
3	SORT ORDER BY		1	117	6 (50)	00:00:01	Q1,03	PCWP	
4	PX RECEIVE		1	117	5 (40)	00:00:01	Q1,03	PCWP	
5	PX SEND RANGE	:TQ10002	1	117	5 (40)	00:00:01	Q1,02	P->P	RANGE
* 6	HASH JOIN		1	117	5 (40)	00:00:01	Q1,02	PCWP	
7	PX RECEIVE		1	87	2 (50)	00:00:01	Q1,02	PCWP	
8	PX SEND HASH	:TQ10001	1	87	2 (50)	00:00:01	Q1,01	P->P	HASH
9	PX BLOCK ITERATOR		1	87	2 (50)	00:00:01	Q1,01	PCWC	
* 10	TABLE ACCESS FULL	EMP	1	87	2 (50)	00:00:01	Q1,01	PCWP	
11	BUFFER SORT						Q1,02	PCWC	
12	PX RECEIVE		4	120	3 (34)	00:00:01	Q1,02	PCWP	
13	PX SEND HASH	:TQ10000	4	120	3 (34)	00:00:01		S->P	HASH
14	TABLE ACCESS FULL	DEPT	4	120	3 (34)	00:00:01			

Predicate Information (identified by operation id):

```
6 - access("E"."DEPTNO"="D"."DEPTNO")
10 - filter("E"."ENAME"='hermann')
```

When the query is parallel, information related to parallelism is reported: table queue number (TQ column), table queue type (INOUT) and table queue distribution method (PQ Distrib).

By default, if several plans in the plan table match the `statement_id` parameter passed to the display table function (default value is NULL), only the plan corresponding to the last EXPLAIN PLAN command is displayed. Hence, there is no

need to purge the plan table after each `EXPLAIN PLAN`. However, you should purge the plan table regularly to ensure good performance in the execution of the `DISPLAY` table function. If no plan table is created, Oracle uses a global temporary table to store any plan information for individual users and preserves its content throughout the lifespan of a session. Note that you cannot truncate the content of a global temporary table.

For ease of use, you can define a view on top of the display table function and then use that view to display the output of the `EXPLAIN PLAN` command:

Using a View to Display Last Explain Plan

```
# define plan view
CREATE VIEW PLAN AS SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

# display the output of the last explain plan command
SELECT * FROM PLAN;
```

231.5 Summary of DBMS_XPLAN Subprograms

This table lists the DBMS_XPLAN subprograms and briefly describes them.

Table 231-2 *DBMS_XPLAN Package Subprograms*

Subprogram	Description
COMPARE_PLANS Function	Compares each plan in a list with a reference plan and returns the report
DIFF_PLAN Function	Compares plans
DISPLAY Function	Displays the contents of the plan table
DISPLAY_AWR Function	Displays the contents of an execution plan stored in the AWR
DISPLAY_CURSOR Function	Displays the execution plan of any cursor in the cursor cache
DISPLAY_PLAN Function	Displays the contents of the plan table in a variety of formats with CLOB output type
DISPLAY_SQL_PLAN_BASELINE Function	Displays one or more execution plans for the specified SQL handle of a SQL plan baseline
DISPLAY_SQLSET Function	Displays the execution plan of a given statement stored in a SQL tuning set

231.5.1 COMPARE_PLANS Function

This function compares each plan in a list with a reference plan and returns the report.

Syntax

```
DBMS_XPLAN.COMPARE_PLANS (
  reference_plan    IN generic_plan_object,
  compare_plan_list IN plan_object_list,
  type              IN VARCHAR2 := 'TEXT',
  level            IN VARCHAR2 := 'TYPICAL',
  section          IN VARCHAR2 := 'ALL')
RETURN CLOB;
```

Parameters

Table 231-3 COMPARE_PLANS Function Parameters

Parameter	Description
reference_plan	The reference plan. This plan should always evaluate to a single plan.
compare_plan_list	List of plans to compare with reference plan. The compare_plan_list is a list of generic_object and each generic_object could correspond to one or more plans.
type	Type of the report. Possible values are: <ul style="list-style-type: none"> • TEXT • HTML • XML
level	Format of the report. Possible values are: <ul style="list-style-type: none"> • BASIC • TYPICAL • ALL
section	A particular section in the report. Possible values are: <ul style="list-style-type: none"> • SUMMARY • FINDINGS • PLANS • INFORMATION • ERRORS

Example 231-1 Examples

The following examples illustrate the usage of COMPARE_PLANS Function.

```
var report clob;
exec :report := dbms_xplan.compare_plans(cursor_cache_object('8mkxm7ur07za0',
2),
- plan_object_list (cursor_cache_object('8mkxm7ur07za0', 4)));

print report
```

The above example compares the plan of child cursor number 2 for the SQL ID '8mkxm7ur07za0' with that of the child cursor number 4 for the same SQL ID. Returns the report in the text format (default).

```
var report clob;
exec :report := dbms_xplan.compare_plans(cursor_cache_object('8mkxm7ur07za0',
2),
plan_object_list( spm_object('SQL_024d0f7d21351f5d',
'SQL_PLAN_sdfjkd')));

print report
```

The above example compares the plan of child cursor number 2 for the SQL ID '8mkxm7ur07za0' with that of the plan baseline captured by SPM for query whose SQL handle is 'SQL_024d0f7d21351f5d' and plan name is 'SQL_PLAN_sdfjkd'. Returns the report in the text format (default).

```

var report clob;
exec :report = dbms_xplan.compare_plans(cursor_cache_object('8mkxm7ur07za0', 2),
                                     plan_object_list(cursor_cache_object('8mkxm7ur07za0'),
                                     sqlset_object('SH', 'SQLT_WORKLOAD', '6vfvqav0rgyad'),
awr_object('6vfvqav0rgyad', 5), spm_object('SQL_024d0f7d21351f5d',
'SQL_PLAN_
                                     sdfjkd'), plan_table_object('SH', 'plan_table', NULL, 38),
sql_profile_object('pe3r3ejsfd'), a
                                     dvisor_object('TASK_1228',
'EXEC_1928', '8mkxm7ur07za0')), type => 'XML',
                                     level => 'ALL', section => 'SUMMARY');

```

The above example compares the plan of child cursor number 2 for the SQL ID '8mkxm7ur07za0' with each of the plans in the following list:

- cursor_cache_object('8mkxm7ur07za0'): All the plans in the cursor cache that are generated for the SQL ID '8mkxm7ur07za0'.
- sqlset_object('SH', 'SQLT_WORKLOAD', '6vfvqav0rgyad'): All the plans generated in the SQL tuning set SH. SQLT_WORKLOAD for the SQL ID '6vfvqav0rgyad'.
- awr_object('6vfvqav0rgyad', 5): All the plans in AWR that are captured for database ID 5 and SQL ID '6vfvqav0rgyad'.
- spm_object('SQL_024d0f7d21351f5d', 'SQL_PLAN_sdfjkd'): The plan baseline for the query with SQL handle 'SQL_024d0f7d21351f5d' with name 'SQL_PLAN_sdfjkd'.
- plan_table_object('SH', 'plan_table', NULL, 38): Plan stored in SH.plan_table identified by plan_id=38.
- sql_profile_object('pe3r3ejsfd'): Plan identified by the SQL profile name 'pe3r3ejsfd'.
- advisor_object('TASK_1228', 'EXEC_1928', '8mkxm7ur07za0'): All the plans stored in SQL advisor identified by task name 'TASK_1228', execution name 'EXEC_1928' and SQL ID '8mkxm7ur07za0'.

231.5.2 DIFF_PLAN Function

This function compares two sql plans, the reference plan and the target plan. This function returns a task_id that can be used to retrieve the report of findings.

Syntax

```

DBMS_XPLAN.DIFF_PLAN(
  sql_text      IN   CLOB,
  outline       IN   CLOB,
  user_name     IN   VARCHAR2 := 'NULL')
RETURN VARCHAR2;

```

Parameters

Table 231-4 DIFF_PLAN Function Parameters

Parameter	Description
sql_text	The text of the SQL statement.
outline	Used to generate the target plan.
user_name	The parsing schema name default to current user.

231.5.3 DISPLAY Function

This table function displays the contents of the plan table.

In addition, you can use this table function to display any plan (with or without statistics) stored in a table as long as the columns of this table are named the same as columns of the plan table (or `V$SQL_PLAN_STATISTICS_ALL` if statistics are included). You can apply a predicate on the specified table to select rows of the plan to display.

Syntax

```
DBMS_XPLAN.DISPLAY(  
  table_name      IN  VARCHAR2  DEFAULT 'PLAN_TABLE',  
  statement_id   IN  VARCHAR2  DEFAULT NULL,  
  format         IN  VARCHAR2  DEFAULT 'TYPICAL',  
  filter_preds   IN  VARCHAR2  DEFAULT NULL);
```

Parameters

Table 231-5 DISPLAY Function Parameters

Parameter	Description
<code>table_name</code>	Specifies the table name where the plan is stored. This parameter defaults to <code>PLAN_TABLE</code> , which is the default plan table for the <code>EXPLAIN PLAN</code> command. If <code>NULL</code> is specified it also defaults to <code>PLAN_TABLE</code> .
<code>statement_id</code>	Specifies the <code>statement_id</code> of the plan to be displayed. This parameter defaults to <code>NULL</code> , which is the default when the <code>EXPLAIN PLAN</code> command is executed without a <code>set statement_id</code> clause. If no <code>statement_id</code> is specified, the function shows you the plan of the most recent explained statement.

Table 231-5 (Cont.) DISPLAY Function Parameters

Parameter	Description
format	<p>Controls the level of details for the plan. It accepts the following values:</p> <ul style="list-style-type: none"> • BASIC: Displays the minimum information in the plan—the operation ID, the operation name and its option. • TYPICAL: This is the default. Displays the most relevant information in the plan (operation id, name and option, #rows, #bytes and optimizer cost). Pruning, parallel and predicate information are only displayed when applicable. Excludes only PROJECTION, ALIAS, and REMOTE SQL information (see below). • SERIAL: Like TYPICAL except that the parallel information is not displayed, even if the plan executes in parallel. • ALL: Maximum user level. Includes information displayed with the TYPICAL level with additional information (PROJECTION, ALIAS and information about REMOTE SQL if the operation is distributed). <p>For finer control on the display output, the following keywords can be added to the above three standard format options to customize their default behavior. Each keyword either represents a logical group of plan table columns (such as PARTITION) or logical additions to the base plan table output (such as PREDICATE). Format keywords must be separated by either a comma or a space:</p> <ul style="list-style-type: none"> • ROWS - if relevant, shows the number of rows estimated by the optimizer • BYTES - if relevant, shows the number of bytes estimated by the optimizer • COST - if relevant, shows optimizer cost information • PARTITION - if relevant, shows partition pruning information • PARALLEL - if relevant, shows PX information (distribution method and table queue information) • PREDICATE - if relevant, shows the predicate section • PROJECTION -if relevant, shows the projection section • ALIAS - if relevant, shows the "Query Block Name / Object Alias" section • REMOTE - if relevant, shows the information for distributed query (for example, remote from serial distribution and remote SQL) • NOTE - if relevant, shows the note section of the explain plan <p>Format keywords can be prefixed by the sign '-' to exclude the specified information. For example, '-PROJECTION' excludes projection information.</p> <p>If the target plan table (see table_name parameter) also stores plan statistics columns (for example, it is a table used to capture the content of the fixed view V\$SQL_PLAN_STATISTICS_ALL), additional format keywords can be used to specify which class of statistics to display when using the DISPLAY Function. These additional format keywords are IOSTATS, MEMSTATS, ALLSTATS, and LAST (see the DISPLAY_CURSOR Function or the DISPLAY_SQLSET Function for a full description of these four keywords).</p>

Table 231-5 (Cont.) DISPLAY Function Parameters

Parameter	Description
<code>filter_preds</code>	SQL filter predicate(s) to restrict the set of rows selected from the table where the plan is stored. When value is <code>NULL</code> (the default), the plan displayed corresponds to the last executed explain plan. For example: <code>filter_preds=>'plan_id = 10'</code> Can reference any column of the table where the plan is stored and can contain any SQL construct (for example, sub-query, function calls (see WARNING under Usage Notes)

Usage Notes

Here are some ways you might use variations on the `format` parameter:

- Use `'ALL -PROJECTION -NOTE'` to display everything except the projection and note sections.
- Use `'TYPICAL PROJECTION'` to display using the typical format with the additional projection section (which is normally excluded under the typical format). Since typical is default, using simply `'PROJECTION'` is equivalent.
- Use `'-BYTES -COST -PREDICATE'` to display using the typical format but excluding optimizer cost and byte estimates as well as the predicate section.
- Use `'BASIC ROWS'` to display basic information with the additional number of rows estimated by the optimizer.

WARNING:

Application developers should expose the `filter_preds` parameter to end-users only after careful consideration because this could expose the application to SQL injection. Indeed, `filter_preds` can potentially reference any table or execute any server function for which the database user invoking the table function has privileges.

Examples

To display the result of the last `EXPLAIN PLAN` command stored in the plan table:

```
SELECT * FROM TABLE (DBMS_XPLAN.DISPLAY);
```

To display from other than the default plan table, "my_plan_table":

```
SELECT * FROM table (DBMS_XPLAN.DISPLAY('my_plan_table'));
```

To display the minimum plan information:

```
SELECT * FROM table (DBMS_XPLAN.DISPLAY('plan_table', null, 'basic'));
```

To display the plan for a statement identified by 'foo', such as `statement_id='sales_query'`:

```
SELECT * FROM table (DBMS_XPLAN.DISPLAY('plan_table', 'sales_query'));
```

231.5.4 DISPLAY_AWR Function

This table function displays the contents of an execution plan stored in AWR.



Note:

This function is deprecated. Use `DISPLAY_WORKLOAD_REPOSITORY` instead. `DISPLAY_AWR` only works with snapshots for the local DBID, whereas `DISPLAY_WORKLOAD_REPOSITORY` supports all snapshots inside AWR, including remote and imported snapshots.

Syntax

```
DBMS_XPLAN.DISPLAY_AWR (
  sql_id          IN      VARCHAR2,
  plan_hash_value IN      NUMBER DEFAULT NULL,
  db_id           IN      NUMBER DEFAULT NULL,
  format          IN      VARCHAR2 DEFAULT TYPICAL);
```

Parameters

Table 231-6 DISPLAY_AWR Table Function Parameters

Parameter	Description
<code>sql_id</code>	Specifies the <code>SQL_ID</code> of the SQL statement. You can retrieve the appropriate value for the SQL statement of interest by querying the column <code>SQL_ID</code> in <code>DBA_HIST_SQLTEXT</code> .
<code>plan_hash_value</code>	Specifies the <code>PLAN_HASH_VALUE</code> of a SQL statement. This parameter is optional. If omitted, the table function returns all stored execution plans for a given <code>SQL_ID</code> .
<code>db_id</code>	Specifies the <code>database_id</code> for which the plan of the SQL statement, identified by <code>SQL_ID</code> should be displayed. If not supplied, the <code>database_id</code> of the local database is used, as shown in <code>V\$DATABASE</code> .

Table 231-6 (Cont.) DISPLAY_AWR Table Function Parameters

Parameter	Description
format	<p>Controls the level of details for the plan. It accepts four values:</p> <ul style="list-style-type: none"> BASIC: Displays the minimum information in the plan—the operation ID, the operation name and its option. TYPICAL: This is the default. Displays the most relevant information in the plan (operation id, name and option, #rows, #bytes and optimizer cost). Pruning, parallel and predicate information are only displayed when applicable. Excludes only PROJECTION, ALIAS and REMOTE SQL information (see below). SERIAL: Like TYPICAL except that the parallel information is not displayed, even if the plan executes in parallel. ALL: Maximum user level. Includes information displayed with the TYPICAL level with additional information (PROJECTION, ALIAS and information about REMOTE SQL if the operation is distributed). <p>For finer control on the display output, the following keywords can be added to the above four standard format options to customize their default behavior. Each keyword either represents a logical group of plan table columns (such as PARTITION) or logical additions to the base plan table output (such as PREDICATE). Format keywords must be separated by either a comma or a space:</p> <ul style="list-style-type: none"> ROWS - if relevant, shows the number of rows estimated by the optimizer BYTES - if relevant, shows the number of bytes estimated by the optimizer COST - if relevant, shows optimizer cost information PARTITION - if relevant, shows partition pruning information PARALLEL - if relevant, shows PX information (distribution method and table queue information) PREDICATE - if relevant, shows the predicate section PROJECTION -if relevant, shows the projection section ALIAS - if relevant, shows the "Query Block Name / Object Alias" section REMOTE - if relevant, shows the information for distributed query (for example, remote from serial distribution and remote SQL) NOTE - if relevant, shows the note section of the explain plan <p>Format keywords can be prefixed by the sign '-' to exclude the specified information. For example, '-PROJECTION' excludes projection information.</p>

Usage Notes

- To use the DISPLAY_AWR functionality, the calling user must have SELECT or READ privilege on DBA_HIST_SQL_PLAN, AWR_ROOT_SQL_PLAN, AWR_PDB_SQL_PLAN, DBA_HIST_SQLTEXT, AWR_ROOT_SQLTEXT, AWR_PDB_SQLTEXT, and V\$DATABASE, otherwise it shows an appropriate error message. By default, select privilege for these views is granted to the select_catalog role.
- The following examples show different ways of using the format parameter:
 - Use 'BASIC ROWS' to display basic information with the additional number of rows estimated by the optimizer.
 - Use 'ALL -PROJECTION -NOTE' to display everything except the projection and note sections.

- Use 'TYPICAL PROJECTION' to display using the typical format with the additional projection section (which is normally excluded under the typical format). Since typical is default, using simply 'PROJECTION' is equivalent.
- Use '-BYTES -COST -PREDICATE' to display using the typical format but excluding optimizer cost and byte estimates and the predicate section.

Examples

To display the different execution plans associated with the SQL ID 'atfwcg8anrykp':

```
SELECT * FROM table(DBMS_XPLAN.DISPLAY_AWR('atfwcg8anrykp'));
```

To display all execution plans of all stored SQL statements containing the string 'TOTO':

```
SELECT tf.*
FROM   DBA_HIST_SQLTEXT ht, table(DBMS_XPLAN.DISPLAY_AWR(ht.sql_id,null,
null, 'ALL' )) tf
WHERE  ht.sql_text like '%TOTO%';
```

231.5.5 DISPLAY_CURSOR Function

This table function displays the explain plan of any cursor loaded in the cursor cache. In addition to the explain plan, various plan statistics (such as I/O, memory and timing) can be reported (based on the V\$SQL_PLAN_STATISTICS_ALL VIEWS).

Syntax

```
DBMS_XPLAN.DISPLAY_CURSOR(
  sql_id          IN  VARCHAR2  DEFAULT NULL,
  cursor_child_no IN  NUMBER    DEFAULT 0,
  format         IN  VARCHAR2  DEFAULT 'TYPICAL');
```

Parameters

Table 231-7 DISPLAY_CURSOR Function Parameters

Parameter	Description
sql_id	Specifies the SQL_ID of the SQL statement in the cursor cache. You can retrieve the appropriate value by querying the column SQL_ID in V\$SQL or V\$SQLAREA. Alternatively, you could choose the column PREV_SQL_ID for a specific session out of V\$SESSION. This parameter defaults to NULL in which case the plan of the last cursor executed by the session is displayed.
cursor_child_no	Child number of the cursor to display. If not supplied, the execution plan of the child_number=0 cursor matching the supplied sql_id parameter are displayed. The child_number can be specified only if sql_id is specified.

Table 231-7 (Cont.) DISPLAY_CURSOR Function Parameters

Parameter	Description
format	<p>Controls the level of details for the plan. It accepts five values:</p> <ul style="list-style-type: none"> • BASIC: Displays the minimum information in the plan—the operation ID, the operation name and its option. • TYPICAL: This is the default. Displays the most relevant information in the plan (operation id, name and option, #rows, #bytes and optimizer cost). Pruning, parallel and predicate information are only displayed when applicable. Excludes only PROJECTION, ALIAS and REMOTE SQL information (see below). • SERIAL: Like TYPICAL except that the parallel information is not displayed, even if the plan executes in parallel. • ALL: Maximum user level. Includes information displayed with the TYPICAL level with additional information (PROJECTION, ALIAS and information about REMOTE SQL if the operation is distributed). • ADAPTIVE: <ul style="list-style-type: none"> – Displays the final plan, or the current plan if the execution has not completed. This section includes notes about runtime optimizations that affect the plan, such as switching from a Nested Loops join to a Hash join. – Plan lineage. This section shows the plans that were run previously due to automatic reoptimization. It also shows the default plan, if the plan changed due to dynamic plans. – Recommended plan. In reporting mode, the plan is chosen based on execution statistics displayed. Note that displaying the recommended plan for automatic reoptimization requires re-compiling the query with the optimizer adjustments collected in the child cursor. Displaying the recommended plan for a dynamic plan does not require this. – Dynamic plans. This summarizes the portions of the plan that differ from the default plan chosen by the optimizer. <p>For finer control on the display output, you can add the following keywords to the preceding format options to customize their default behavior. Each keyword either represents a logical group of plan table columns (such as PARTITION) or logical additions to the base plan table output (such as PREDICATE).</p> <p>Format keywords must be separated by either a comma or a space:</p> <ul style="list-style-type: none"> • ROWS - if relevant, shows the number of rows estimated by the optimizer • BYTES - if relevant, shows the number of bytes estimated by the optimizer • COST - if relevant, shows optimizer cost information • PARTITION - if relevant, shows partition pruning information • PARALLEL - if relevant, shows PX information (distribution method and table queue information) • PREDICATE - if relevant, shows the predicate section • PROJECTION -if relevant, shows the projection section • ALIAS - if relevant, shows the "Query Block Name / Object Alias" section • REMOTE - if relevant, shows the information for distributed query (for example, remote from serial distribution and remote SQL) • NOTE - if relevant, shows the note section of the explain plan • IOSTATS - assuming that basic plan statistics are collected when SQL statements are executed (either by using the

Table 231-7 (Cont.) DISPLAY_CURSOR Function Parameters

Parameter	Description
	<p><code>gather_plan_statistics</code> hint or by setting the parameter <code>statistics_level</code> to ALL), this format shows IO statistics for ALL (or only for the LAST as shown below) executions of the cursor.</p> <ul style="list-style-type: none"> MEMSTATS - Assuming that PGA memory management is enabled (that is, <code>pga_aggregate_target</code> parameter is set to a non 0 value), this format allows to display memory management statistics (for example, execution mode of the operator, how much memory was used, number of bytes spilled to disk, and so on). These statistics only apply to memory intensive operations like hash-joins, sort or some bitmap operators. ALLSTATS - A shortcut for 'IOSTATS MEMSTATS' LAST - By default, plan statistics are shown for all executions of the cursor. The keyword LAST can be specified to see only the statistics for the last execution. <p>The following formats are deprecated but supported for backward compatibility:</p> <ul style="list-style-type: none"> RUNSTATS_TOT - Same as IOSTATS, that is, displays IO statistics for all executions of the specified cursor. RUNSTATS_LAST - Same as IOSTATS LAST, that is, displays the runtime statistics for the last execution of the cursor <p>You can prefix format keywords with the sign '-' to exclude the specified information. For example, '-PROJECTION' excludes projection information.</p>

Usage Notes

- To use the DISPLAY_CURSOR functionality, the calling user must have SELECT or READ privilege on the fixed views V\$SQL_PLAN_STATISTICS_ALL, V\$SQL and V\$SQL_PLAN, otherwise it shows an appropriate error message.
- Here are some ways you might use variations on the format parameter:
 - Use 'ALL -PROJECTION -NOTE' to display everything except the projection and note sections.
 - Use 'TYPICAL PROJECTION' to display using the typical format with the additional projection section (which is normally excluded under the typical format). Since typical is default, using simply 'PROJECTION' is equivalent.
 - Use '-BYTES -COST -PREDICATE' to display using the typical format but excluding optimizer cost and byte estimates as well as the predicate section.
 - Use 'BASIC ROWS' to display basic information with the additional number of rows estimated by the optimizer.

Examples

To display the execution plan of the last SQL statement executed by the current session:

```
SELECT * FROM table (
  DBMS_XPLAN.DISPLAY_CURSOR);
```

To display the execution plan of all children associated with the SQL ID 'atfwcg8anrykp':

```
SELECT * FROM table (
    DBMS_XPLAN.DISPLAY_CURSOR('atfwcg8anrykp'));
```

To display runtime statistics for the cursor included in the preceding statement:

```
SELECT * FROM table (
    DBMS_XPLAN.DISPLAY_CURSOR('atfwcg8anrykp', NULL, 'ALLSTATS LAST'));
```

231.5.6 DISPLAY_PLAN Function

This table function displays the contents of the plan table in a variety of formats with CLOB output type.

Syntax

```
DBMS_XPLAN.DISPLAY_PLAN (
    table_name      IN    VARCHAR2    DEFAULT 'PLAN_TABLE',
    statement_id    IN    VARCHAR2    DEFAULT NULL,
    format          IN    VARCHAR2    DEFAULT 'TYPICAL',
    filter_preds    IN    VARCHAR2    DEFAULT NULL,
    type            IN    VARCHAR2    DEFAULT 'TEXT')
RETURN CLOB;
```

Parameters

Table 231-8 DISPLAY_PLAN Function Parameters

Parameter	Description
table_name	Specifies the table name where the plan is stored. This parameter defaults to <code>PLAN_TABLE</code> , which is the default plan table for the <code>EXPLAIN PLAN</code> command. If <code>NULL</code> is specified it also defaults to <code>PLAN_TABLE</code> .
statement_id	Specifies the <code>statement_id</code> of the plan to be displayed. This parameter defaults to <code>NULL</code> , which is the default when the <code>EXPLAIN PLAN</code> command is executed without a <code>set statement_id</code> clause. If no <code>statement_id</code> is specified, the function shows you the plan of the most recent explained statement.
filter_preds	SQL filter predicate(s) to restrict the set of rows selected from the table where the plan is stored. When value is <code>NULL</code> (the default), the plan displayed corresponds to the last executed explain plan. For example: <code>filter_preds=>'plan_id = 10'</code> Can reference any column of the table where the plan is stored and can contain any SQL construct (for example, sub-query, function calls (see WARNING under Usage Notes)

Table 231-8 (Cont.) DISPLAY_PLAN Function Parameters

Parameter	Description
format	<p>Controls the level of details for the plan. It accepts five values:</p> <ul style="list-style-type: none"> BASIC: Displays the minimum information in the plan—the operation ID, the operation name and its option. TYPICAL: This is the default. Displays the most relevant information in the plan (operation id, name and option, #rows, #bytes and optimizer cost). Pruning, parallel and predicate information are only displayed when applicable. Excludes only PROJECTION, ALIAS and REMOTE SQL information (see below). SERIAL: Like TYPICAL except that the parallel information is not displayed, even if the plan executes in parallel. ALL: Maximum user level. Includes information displayed with the TYPICAL level with additional information (PROJECTION, ALIAS and information about REMOTE SQL if the operation is distributed). ADAPTIVE: Displays the default plan, and for each dynamic subplan (if stipulated): <ul style="list-style-type: none"> - A list of the rowsources from the original which may be replaced, and the rowsources to replace them - If outline display is specified in the format argument, the hints for each option in the dynamic subplan are displayed <p>For finer control on the display output, the following keywords can be added to the above three standard format options to customize their default behavior. Each keyword either represents a logical group of plan table columns (such as PARTITION) or logical additions to the base plan table output (such as PREDICATE). Format keywords must be separated by either a comma or a space:</p> <ul style="list-style-type: none"> ROWS - if relevant, shows the number of rows estimated by the optimizer BYTES - if relevant, shows the number of bytes estimated by the optimizer COST - if relevant, shows optimizer cost information PARTITION - if relevant, shows partition pruning information PARALLEL - if relevant, shows PX information (distribution method and table queue information) PREDICATE - if relevant, shows the predicate section PROJECTION -if relevant, shows the projection section ALIAS - if relevant, shows the "Query Block Name / Object Alias" section REMOTE - if relevant, shows the information for distributed query (for example, remote from serial distribution and remote SQL) NOTE - if relevant, shows the note section of the explain plan <p>Format keywords can be prefixed by the sign '-' to exclude the specified information. For example, '-PROJECTION' excludes projection information.</p> <p>If the target plan table (see table_name parameter) also stores plan statistics columns (for example, it is a table used to capture the content of the fixed view V\$SQL_PLAN_STATISTICS_ALL), additional format keywords can be used to specify which class of statistics to display when using the DISPLAY Function. These additional format keywords are IOSTATS, MEMSTATS, ALLSTATS and LAST (see the</p>

Table 231-8 (Cont.) DISPLAY_PLAN Function Parameters

Parameter	Description
	DISPLAY_CURSOR Function or the DISPLAY_SQLSET Function for a full description of these four keywords).
type	Output type, one of: 'TEXT', 'ACTIVE', 'HTML', or 'XML' (see Usage Notes regarding type ACTIVE).

Return Values

Returns the requested report as CLOB

Usage Notes

Active reports have a rich, interactive user interface akin to that found in Enterprise Manager while not requiring any EM installation. The report file built is in HTML format, so it can be interpreted by most modern browsers. The code powering the active report is downloaded transparently by the web browser when the report is first viewed, hence viewing it requires outside connectivity.

WARNING:

Application developers should expose the `filter_preds` parameter to end-users only after careful consideration because this could expose the application to SQL injection. Indeed, `filter_preds` can potentially reference any table or execute any server function for which the database user invoking the table function has privileges.

231.5.7 DISPLAY_SQL_PLAN_BASELINE Function

This table function displays one or more execution plans for the specified SQL handle of a SQL plan baseline.

Syntax

```
DBMS_XPLAN.DISPLAY_SQL_PLAN_BASELINE (
  sql_handle      IN VARCHAR2 := NULL,
  plan_name       IN VARCHAR2 := NULL,
  format          IN VARCHAR2 := 'TYPICAL')
RETURN dbms_xplan_type_table;
```

Parameters

Table 231-9 DISPLAY_SQL_PLAN_BASELINE Function Parameters

Parameter	Description
sql_handle	SQL statement handle. It identifies a SQL statement whose plans are to be displayed.

Table 231-9 (Cont.) DISPLAY_SQL_PLAN_BASELINE Function Parameters

Parameter	Description
plan_name	Plan name. It identifies a specific plan. Default NULL means all plans associated with identified SQL statement are explained and displayed.
format	Format string determines what information stored in the plan displayed. The following format values are possible, each representing a common use case: BASIC, TYPICAL, and ALL.

Return Values

A PL/SQL type table

Usage Notes

This function uses plan information stored in the plan baseline to explain and display the plans. The plan_id stored in the SQL management base may not match the plan_id of the generated plan. A mismatch between the stored plan_id and generated plan_id means that it is a non-reproducible plan. Such a plan is deemed invalid and is bypassed by the optimizer during SQL compilation.

Examples

Display all plans of a SQL statement identified by the SQL handle

SYS_SQL_b1d49f6074ab95af using TYPICAL format

```
SET LINESIZE 150
SET PAGESIZE 2000
SELECT t.*
FROM TABLE(DBMS_XPLAN.DISPLAY_SQL_PLAN_BASELINE('SYS_SQL_b1d49f6074ab95af'))
t;
```

Display all plans of one or more SQL statements containing the string HR2 using BASIC format:

```
SET LINESIZE 150
SET PAGESIZE 2000
SELECT t.*
FROM (SELECT DISTINCT sql_handle FROM dba_sql_plan_baselines WHERE sql_text
LIKE '%HR2%') pb,
TABLE(DBMS_XPLAN.DISPLAY_SQL_PLAN_BASELINE(pb.sql_handle, NULL,
'BASIC')) t;
```

231.5.8 DISPLAY_SQLSET Function

This table function displays the execution plan of a given statement stored in a SQL tuning set.

Syntax

```
DBMS_XPLAN.DISPLAY_SQLSET(
    sqlset_name      IN VARCHAR2,
```



```

sql_id          IN VARCHAR2,
plan_hash_value IN NUMBER := NULL,
format         IN VARCHAR2 := 'TYPICAL',
sqlset_owner   IN VARCHAR2 := NULL)
RETURN DBMS_XPLAN_TYPE_TABLE PIPELINED;

```

Parameters

Table 231-10 DISPLAY_SQLSET Function Parameters

Parameter	Description
sqlset_name	Name of the SQL Tuning Set
sql_id	Specifies the sql_id value for a SQL statement having its plan stored in the SQL tuning set. You can find all stored SQL statements by querying table function <code>DBMS_SQLTUNE.SELECT_SQLSET</code>
plan_hash_value	Optional parameter. Identifies a specific stored execution plan for a SQL statement. If suppressed, all stored execution plans are shown.

Table 231-10 (Cont.) DISPLAY_SQLSET Function Parameters

Parameter	Description
format	<p>Controls the level of details for the plan. It accepts four values:</p> <ul style="list-style-type: none"> • BASIC: Displays the minimum information in the plan—the operation ID, the operation name and its option. • TYPICAL: This is the default. Displays the most relevant information in the plan (operation id, name and option, #rows, #bytes and optimizer cost). Pruning, parallel and predicate information are only displayed when applicable. Excludes only PROJECTION, ALIAS and REMOTE SQL information (see below). • SERIAL: Like TYPICAL except that the parallel information is not displayed, even if the plan executes in parallel. • ALL: Maximum user level. Includes information displayed with the TYPICAL level with additional information (PROJECTION, ALIAS and information about REMOTE SQL if the operation is distributed). <p>For finer control on the display output, the following keywords can be added to the above three standard format options to customize their default behavior. Each keyword either represents a logical group of plan table columns (such as PARTITION) or logical additions to the base plan table output (such as PREDICATE). Format keywords must be separated by either a comma or a space:</p> <ul style="list-style-type: none"> • ROWS - if relevant, shows the number of rows estimated by the optimizer • BYTES - if relevant, shows the number of bytes estimated by the optimizer • COST - if relevant, shows optimizer cost information • PARTITION - if relevant, shows partition pruning information • PARALLEL - if relevant, shows PX information (distribution method and table queue information) • PREDICATE - if relevant, shows the predicate section • PROJECTION -if relevant, shows the projection section • ALIAS - if relevant, shows the "Query Block Name / Object Alias" section • REMOTE - if relevant, shows the information for distributed query (for example, remote from serial distribution and remote SQL) • NOTE - if relevant, shows the note section of the explain plan • IOSTATS - assuming that basic plan statistics are collected when SQL statements are executed (either by using the gather_plan_statistics hint or by setting the parameter STATISTICS_LEVEL to ALL), this format shows IO statistics for ALL (or only for the LAST as shown below) executions of the cursor. • MEMSTATS - Assuming that PGA memory management is enabled (that is, pga_aggregate_target parameter is set to a non 0 value), this format allows to display memory management statistics (for example, execution mode of the operator, how much memory was used, number of bytes spilled to disk, and so on). These statistics only apply to memory intensive operations like hash-joins, sort or some bitmap operators. • ALLSTATS - A shortcut for 'IOSTATS MEMSTATS'

Table 231-10 (Cont.) DISPLAY_SQLSET Function Parameters

Parameter	Description
	<ul style="list-style-type: none"> LAST - By default, plan statistics are shown for all executions of the cursor. The keyword LAST can be specified to see only the statistics for the last execution. <p>The following two formats are deprecated but supported for backward compatibility:</p> <ul style="list-style-type: none"> RUNSTATS_TOT - Same as IOSTATS, that is, displays IO statistics for all executions of the specified cursor. RUNSTATS_LAST - Same as IOSTATS LAST, that is, displays the runtime statistics for the last execution of the cursor <p>Format keywords can be prefixed by the sign '-' to exclude the specified information. For example, '-PROJECTION' excludes projection information.</p>
sqlset_owner	The owner of the SQL tuning set. The default is the current user.

Usage Notes

Here are some ways you might use variations on the `format` parameter:

- Use 'ALL -PROJECTION -NOTE' to display everything except the projection and note sections.
- Use 'TYPICAL PROJECTION' to display using the typical format with the additional projection section (which is normally excluded under the typical format). Since typical is default, using simply 'PROJECTION' is equivalent.
- Use '-BYTES -COST -PREDICATE' to display using the typical format but excluding optimizer cost and byte estimates as well as the predicate section.
- Use 'BASIC ROWS' to display basic information with the additional number of rows estimated by the optimizer.

Examples

To display the execution plan for the SQL statement associated with SQL ID 'gwp663cqh5qbf' and PLAN HASH 3693697075 in the SQL Tuning Set called 'OLTP_optimization_0405':

```
SELECT * FROM table
(DBMS_XPLAN.DISPLAY_SQLSET('OLTP_optimization_0405','gwp663cqh5qbf',
3693697075));
```

To display all execution plans of the SQL ID 'atfwcg8anrykp' stored in the SQL tuning set:

```
SELECT * FROM table
(DBMS_XPLAN.DISPLAY_SQLSET('OLTP_optimization_0405','gwp663cqh5qbf'));
```

To display runtime statistics for the SQL statement included in the preceding statement:

```
SELECT * FROM table (
  DBMS_XPLAN.DISPLAY_SQLSET(
    'OLTP_optimization_0405', 'gwp663cqh5qbfb', NULL, 'ALLSTATS LAST');
```

231.5.9 DISPLAY_WORKLOAD_REPOSITORY Function

This table function displays the contents of an execution plan stored in AWR.



Note:

This function replaces `DISPLAY_AWR`, which is deprecated.

Syntax

```
DBMS_XPLAN.DISPLAY_WORKLOAD_REPOSITORY(
  sql_id          IN          VARCHAR2,
  plan_hash_value IN          NUMBER   DEFAULT NULL,
  format          IN          VARCHAR2 DEFAULT 'TYPICAL',
  dbid           IN          NUMBER   DEFAULT NULL,
  con_dbid       IN          NUMBER   DEFAULT NULL,
  awr_location   IN          VARCHAR2 DEFAULT 'AWR_ROOT'
);
```

Parameters

Table 231-11 DISPLAY_WORKLOAD_REPOSITORY Table Function Parameters

Parameter	Description
sql_id	Specifies the <code>SQL_ID</code> of the SQL statement. You can retrieve the appropriate value for the SQL statement of interest by querying the column <code>SQL_ID</code> in <code>DBA_HIST_SQLTEXT</code> .
plan_hash_value	Specifies the <code>PLAN_HASH_VALUE</code> of a SQL statement. This parameter is optional. If omitted, the table function returns all stored execution plans for a given <code>SQL_ID</code> .

Table 231-11 (Cont.) DISPLAY_WORKLOAD_REPOSITORY Table Function Parameters

Parameter	Description
format	<p>Controls the level of details for the plan. It accepts four values:</p> <ul style="list-style-type: none"> BASIC: Displays the minimum information in the plan—the operation ID, the operation name and its option. TYPICAL: This is the default. Displays the most relevant information in the plan (operation id, name and option, #rows, #bytes and optimizer cost). Pruning, parallel and predicate information are only displayed when applicable. Excludes only PROJECTION, ALIAS and REMOTE SQL information (see below). SERIAL: Like TYPICAL except that the parallel information is not displayed, even if the plan executes in parallel. ALL: Maximum user level. Includes information displayed with the TYPICAL level with additional information (PROJECTION, ALIAS and information about REMOTE SQL if the operation is distributed). <p>For finer control on the display output, the following keywords can be added to the above four standard format options to customize their default behavior. Each keyword either represents a logical group of plan table columns (such as PARTITION) or logical additions to the base plan table output (such as PREDICATE). Format keywords must be separated by either a comma or a space:</p> <ul style="list-style-type: none"> ROWS - if relevant, shows the number of rows estimated by the optimizer BYTES - if relevant, shows the number of bytes estimated by the optimizer COST - if relevant, shows optimizer cost information PARTITION - if relevant, shows partition pruning information PARALLEL - if relevant, shows PX information (distribution method and table queue information) PREDICATE - if relevant, shows the predicate section PROJECTION -if relevant, shows the projection section ALIAS - if relevant, shows the "Query Block Name / Object Alias" section REMOTE - if relevant, shows the information for distributed query (for example, remote from serial distribution and remote SQL) NOTE - if relevant, shows the note section of the explain plan <p>Format keywords can be prefixed by the sign '-' to exclude the specified information. For example, '-PROJECTION' excludes projection information.</p>
dbid	<p>Identifies the plans for a specific database.</p> <p>If this parameter is omitted, then the value defaults to the DBID of the AWR repository pointed to by the initialization parameter AWR_LOCATION. In a CDB, if AWR_LOCATION is set to AWR_ROOT, then the value is set to the DBID of the CDB root. If it is set to AWR_PDB, then the value is set to the DBID of the container.</p>
con_dbid	<p>Identifies the plans for a specific container.</p> <p>If this parameter is omitted, then the value defaults to SYS_CONTEXT('userenv', 'con_id').</p>
awr_location	<p>Specifies the location of the AWR repository. Supported values are:</p> <ul style="list-style-type: none"> AWR_ROOT when the AWR to be accessed is in the root container. This is the default. 'AWR_PDB', if the AWR to be accessed is in the local container.

Example 231-2 Querying an AWR Plan

Assume that you log in as an administrator and issue the following query:

```
select count(*) from sh.sAleS
```

You create an AWR snapshot as follows:

```
EXEC DBMS_WORKLOAD_REPOSITORY.CREATE_SNAPSHOT;
```

You query joint DBA_HIST_SQLTEXT to the function output as follows:

```
SET LINESIZE 150
SET PAGESIZE 5000
```

```
SELECT t.*
FROM   DBA_HIST_SQLTEXT ht,
       TABLE(DBMS_XPLAN.DISPLAY_WORKLOAD_REPOSITORY
              (ht.sql_id, null, '-PREDICATE +ALIAS',null,null,'AWR_ROOT')) t
WHERE  ht.SQL_TEXT LIKE '%sAleS%';
```

```
SQL_ID 2f4cx9qjnqd70
-----
select count(*) from sh.sAleS
```

Plan hash value: 1123225294

```
-----
```

Id	Operation	Name	Rows	Cost
(%CPU)	Time	Pstart	Pstop	
0	SELECT STATEMENT			27
(100)				
1	SORT AGGREGATE		1	
2	PARTITION RANGE ALL		918K	27
(0)	00:00:01	1	28	
3	BITMAP CONVERSION COUNT		918K	27
(0)	00:00:01			
4	BITMAP INDEX FAST FULL SCAN	SALES_PROMO_BIX		
			1	28

```
-----
```

Query Block Name / Object Alias (identified by operation id):

```
-----
1 - SEL$1
3 - SEL$1 / "SALES"@"SEL$1"
```

DBMS_XSLPROCESSOR

The `DBMS_XSLPROCESSOR` package provides an interface to manage the contents and structure of XML documents.

This chapter contains the following topics:

- [DBMS_XSLPROCESSOR Overview](#)
- [DBMS_XSLPROCESSOR Security Model](#)
- [Summary of DBMS_XSLPROCESSOR Subprograms](#)

 **See Also:**

- *Oracle XML DB Developer's Guide*

232.1 DBMS_XSLPROCESSOR Overview

The `DBMS_XSLPROCESSOR` package provides an interface to manage the contents and structure of XML documents.

Standards

This PL/SQL implementation of the XSL processor follows the W3C XSLT working draft rev WD-xslt-19990813 and includes the required behavior of an XSL processor in terms of how it must read XSLT stylesheets and the transformation it must effect.

Concepts

The Extensible Stylesheet Language Transformation (XSLT) describes rules for transforming a source tree into a result tree. A transformation expressed in XSLT is called a stylesheet. The transformation specified is achieved by associating patterns with templates defined in the stylesheet. A template is instantiated to create part of the result tree.

Implementation

The following is the default behavior for this PL/SQL XSL Processor:

- A result tree which can be accessed by DOM programmatic interface
- Errors are not recorded unless an error log is specified; however, an application error will be raised if parsing fails

232.2 DBMS_XSLPROCESSOR Security Model

Owned by XDB, the DBMS_XSLPROCESSOR package must be created by SYS or XDB. The EXECUTE privilege is granted to PUBLIC. Subprograms in this package are executed using the privileges of the current user.

232.3 Summary of DBMS_XSLPROCESSOR Subprograms

This table lists the DBMS_XSLPROCESSOR subprograms and briefly describes them.

Table 232-1 DBMS_XSLPROCESSOR Package Subprograms

Method	Description
FREEPROCESSOR Procedure	Frees a processor object
FREESTYLESHEET Procedure	Frees a stylesheet object
NEWPROCESSOR Function	Returns a new processor instance
NEWSTYLESHEET Functions	Creates a new stylesheet from input and reference URLs
PROCESSXSL Functions and Procedures	Transforms an input XML document
REMOVEPARAM Procedure	Removes a top-level stylesheet parameter
RESETPARAMS Procedure	Resets the top-level stylesheet parameters
SELECTNODES Function	Selects nodes from a DOM tree that match a pattern
SELECTSINGLENODE Function	Selects the first node from the tree that matches a pattern
SETERRORLOG Procedure	Sets errors to be sent to the specified file
SETPARAM Procedure	Sets a top-level parameter in the stylesheet
SHOWWARNINGS Procedure	Turns warnings on or off
TRANSFORMNODE Function	Transforms a node in a DOM tree using a stylesheet
VALUEOF Function and Procedure	Gets the value of the first node that matches a pattern

232.3.1 FREEPROCESSOR Procedure

This procedure frees a Processor object.

Syntax

```
DBMS_XSLPROCESSOR.FREEPROCESSOR(
  p IN Processor);
```

Parameters

Table 232-2 FREEPROCESSOR Procedure Parameters

Parameter	Description
p	Processor

232.3.2 FREESTYLESHEET Procedure

This procedure frees a `Stylesheet` object.

Syntax

```
DBMS_XSLPROCESSOR.FREESTYLESHEET(  
    ss IN Stylesheet);
```

Parameters

Table 232-3 FREESTYLESHEET Procedure Parameters

Parameter	Description
ss	Stylesheet

232.3.3 NEWPROCESSOR Function

This function returns a new `Processor` instance.

The function must be called before the default behavior of `Processor` can be changed and if other processor methods need to be used.

Syntax

```
DBMS_XSLPROCESSOR.NEWPROCESSOR  
RETURN Processor;
```

232.3.4 NEWSTYLESHEET Functions

This function creates and returns a new `Stylesheet` instance.

The options are described in the following table.

Syntax

Creates and returns a new stylesheet instance using the given `DOMDOCUMENT` and reference URLs:

```
DBMS_XSLPROCESSOR.NEWSTYLESHEET(  
    xmldoc IN DOMDOCUMENT,  
    ref    IN VARCHAR2)  
RETURN Stylesheet;
```

Creates and returns a new `Stylesheet` instance using the given input and reference URLs:

```
DBMS_XSLPROCESSOR.NEWSTYLESHEET(  
    inp    IN VARCHAR2,  
    ref    IN VARCHAR2)  
RETURN Stylesheet;
```

Parameters

Table 232-4 NEWSTYLESHEET Function Parameters

Parameter	Description
xmlDoc	DOMDocument to use for construction
inp	Input URL to use for construction
ref	Reference URL

232.3.5 PROCESSXSL Functions and Procedures

This function transforms input `XMLDocument`.

Any changes to the default processor behavior should be effected before calling this procedure. An application error is raised if processing fails.

Syntax

Transforms input `XMLDocument` using given `DOMDocument` and stylesheet, and returns the resultant document fragment:

```
DBMS_XSLPROCESSOR.PROCESSXSL(
  p      IN  Processor,
  ss     IN  Stylesheet,
  xmlDoc IN  DOMDOCUMENT),
RETURN DOMDOCUMENTFRAGMENT;
```

Transforms input `XMLDocument` using given document as URL and the `Stylesheet`, and returns the resultant document fragment:

```
DBMS_XSLPROCESSOR.PROCESSXSL(
  p      IN  Processor,
  ss     IN  Stylesheet,
  url   IN  VARCHAR2,
RETURN DOMDOCUMENTFRAGMENT;
```

Transforms input `XMLDocument` using given document as `CLOB` and the `Stylesheet`, and returns the resultant document fragment:

```
DBMS_XSLPROCESSOR.PROCESSXSL(
  p      IN  Processor,
  ss     IN  Stylesheet,
  clb   IN  CLOB)
RETURN DOMDOCUMENTFRAGMENT;
```

Transforms input `XMLDocument` using given `DOMDOCUMENT` and the stylesheet, and writes the output to the specified file:

```
DBMS_XSLPROCESSOR.DBMS_XSLPROCESSOR.(
  p          IN  Processor,
  ss         IN  Stylesheet,
  xmlDoc     IN  DOMDOCUMENT,
  dir        IN  VARCHAR2,
  fileName   IN  VARCHAR2);
```

Transforms input `XMLDocument` using given URL and the stylesheet, and writes the output to the specified file in a specified directory:

```
DBMS_XSLPROCESSOR.PROCESSXSL(  
  p          IN    Processor,  
  ss         IN    Stylesheet,  
  url        IN    VARCHAR2,  
  dir        IN    VARCHAR2,  
  fileName   IN    VARCHAR2);
```

Transforms input `XMLDocument` using given `DOMDOCUMENT` and the stylesheet, and writes the output to a CLOB:

```
DBMS_XSLPROCESSOR.PROCESSXSL(  
  p          IN    Processor,  
  ss         IN    Stylesheet,  
  xmldoc     IN    DOMDOCUMENT,  
  cl         IN OUT CLOB);
```

Transforms input `XMLDocument` using given `DOMDOCUMENTFRAGMENT` and the stylesheet, and returns the resultant document fragment:

```
DBMS_XSLPROCESSOR.PROCESSXSL(  
  p          IN    Processor,  
  ss         IN    Stylesheet,  
  xmldf      IN    DOMDOCUMENTFRAGMENT)  
RETURN DOMDOCUMENTFRAGMENT;
```

Transforms input `XMLDocumentFragment` using given `DOMDocumentFragment` and the stylesheet, and writes the output to the specified file in a specified directory:

```
DBMS_XSLPROCESSOR.PROCESSXSL(  
  p          IN    Processor,  
  ss         IN    Stylesheet,  
  xmldf      IN    DOMDOCUMENTFRAGMENT,  
  dir        IN    VARCHAR2,  
  filename   IN    VARCHAR2);
```

Transforms input `XMLDocumentFragment` using given `DOMDOCUMENTFRAGMENT` and the stylesheet, and writes the output to a buffer:

```
DBMS_XSLPROCESSOR.PROCESSXSL(  
  p          IN    Processor,  
  ss         IN    Stylesheet,  
  xmldf      IN    DOMDOCUMENTFRAGMENT,  
  buf        IN OUT VARCHAR2);
```

Transforms input `XMLDocumentFragment` using given `DOMDOCUMENTFRAGMENT` and the stylesheet, and writes the output to a CLOB:

```
DBMS_XSLPROCESSOR.PROCESSXSL(  
  p          IN    Processor,  
  ss         IN    Stylesheet,  
  xmldf      IN    DOMDOCUMENTFRAGMENT,  
  cl         IN OUT CLOB);
```

Parameters

Table 232-5 PROCESSXSL Function and Procedure Parameters

Parameter	Description
p	Processor instance
ss	Stylesheet instance
xml doc	XML document being transformed
url	URL for the information being transformed
clb	CLOB containing information to be transformed
dir	Directory where processing output file is saved
filename	Processing output file
cl	CLOB to which the processing output is saved
xml df	XMLDocumentFragment being transformed

232.3.6 REMOVEPARAM Procedure

This procedure removes a top level stylesheet parameter.

Syntax

```
DBMS_XSLPROCESSOR.REMOVEPARAM(
    ss      IN  Stylesheet,
    name    IN  VARCHAR2);
```

Parameters

Table 232-6 REMOVEPARAM Procedure Parameters

Parameter	Description
ss	Stylesheet instance
name	Name of the parameter

232.3.7 RESETPARAMS Procedure

This procedure resets the top-level stylesheet parameters.

Syntax

```
DBMS_XSLPROCESSOR.RESETPARAMS(
    ss IN  Stylesheet);
```

Parameters

Table 232-7 RESETPARAMS Procedure Parameters

Parameter	Description
ss	Stylesheet instance

232.3.8 SELECTNODES Function

This function selects nodes which match the supplied path expression from a DOM tree, and returns the result of the selection.

Syntax

```
DBMS_XSLPROCESSOR.SELECTNODES (
  n          IN  DBMS_XMLDOM.DOMNODE,
  pattern    IN  VARCHAR2,
  namespace  IN  VARCHAR2 := NULL)
RETURN DBMS_XMLDOM.DOMNODELIST;
```

Parameters

Table 232-8 SELECTNODES Function Parameters

Parameter	Description
n	Root DOMNode of the tree
pattern	Pattern to use
namespace	Namespace declared

232.3.9 SELECTSINGLENODE Function

This function selects the first node from the tree that match the supplied path expression, and returns that node.

Syntax

```
DBMS_XSLPROCESSOR.SELECTSINGLENODE (
  n          IN  DBMS_XMLDOM.DOMNODE,
  pattern    IN  VARCHAR2,
  namespace  IN  VARCHAR2 := NULL)
RETURN DBMS_XMLDOM.DOMNODE;
```

Parameters

Table 232-9 SELECTSINGLENODE Function Parameters

Parameter	Description
n	Root DOMNode of the tree
pattern	Pattern to use

Table 232-9 (Cont.) SELECTSINGLENODE Function Parameters

Parameter	Description
namespace	Namespace declared

232.3.10 SETERRORLOG Procedure

This deprecated procedure sets errors to be sent to the specified file.



Note:

This subprogram has been deprecated, and is included only for reasons of backward compatibility.

Syntax

```
DBMS_XSLPROCESSOR.SETERRORLOG(
    p          IN  Processor,
    fileName  IN  VARCHAR2);
```

Parameters

Table 232-10 SETERRORLOG Procedure Parameters

Parameter	Description
p	Processor instance
fileName	Complete path of the file to use as the error log

232.3.11 SETPARAM Procedure

This procedure sets a top level parameter in the stylesheet.

The parameter value must be a valid XPath expression. Literal string values must be quoted.

Syntax

```
DBMS_XSLPROCESSOR.SETPARAM(
    ss      IN  Stylesheet,
    name   IN  VARCHAR2,
    value  IN  VARCHAR2);
```

Parameters

Table 232-11 SETPARAM Procedure Parameters

Parameter	Description
ss	Stylesheet instance

Table 232-11 (Cont.) SETPARAM Procedure Parameters

Parameter	Description
name	Name of the parameter
value	Value of the parameter

232.3.12 SHOWWARNINGS Procedure

This procedure turns warnings on (TRUE) or off (FALSE).

Syntax

```
DBMS_XSLPROCESSOR.SHOWWARNINGS (
  p      IN  Processor,
  yes    IN  BOOLEAN);
```

Parameters

Table 232-12 SHOWWARNINGS Procedure Parameters

Parameter	Description
p	Processor instance
yes	Mode to set: TRUE to show warnings, FALSE otherwise

232.3.13 TRANSFORMNODE Function

This function transforms a node in a DOM tree using the given stylesheet, and returns the result of the transformation as a DOMDocumentFragment.

Syntax

```
DBMS_XSLPROCESSOR.TRANSFORMNODE (
  n      IN  DOMNODE,
  ss     IN  Stylesheet)
RETURN DOMDocumentFragment;
```

Parameters

Table 232-13 TRANSFORMNODE Function Parameters

Parameter	Description
n	DOMNode to transform
ss	Stylesheet to use

232.3.14 VALUEOF Function and Procedure

This subprogram retrieves the value of the first node from the tree that matches the given pattern. You can use either a function or a procedure.

Syntax

```
DBMS_XSLPROCESSOR.VALUEOF (
  n          IN    DBMS_XMLDOM.DOMNODE,
  pattern    IN    VARCHAR2,
  namespace  IN    VARCHAR2 := NULL)
RETURN VARCHAR2;
```

```
DBMS_XSLPROCESSOR.VALUEOF (
  n          IN    DBMS_XMLDOM.DOMNODE,
  pattern    IN    VARCHAR2,
  val       OUT   VARCHAR2,
  namespace  IN    VARCHAR2 := NULL);
```

Parameters

Table 232-14 VALUEOF Function and Procedure Parameters

Parameter	Description
n	Node whose value is being retrieved
pattern	Pattern to use
val	Retrieved value
namespace	Namespace to use

DBMS_XSTREAM_ADM

This `DBMS_XSTREAM_ADM` package provides interfaces for streaming database changes between an Oracle database and other systems. XStream enables applications to stream out or stream in database changes.

This chapter contains the following topic:

- [Overview](#)
- [Security Model](#)
- [Operational Notes](#)
- [Summary of DBMS_XSTREAM_ADM Subprograms](#)

See Also:

- *Oracle Database XStream Guide*
- *Oracle Call Interface Programmer's Guide*
- *Oracle Database XStream Java API Reference*

233.1 DBMS_XSTREAM_ADM Overview

The package provides interfaces for configuring outbound servers that stream database changes from an Oracle database to other systems. The package also provides interfaces for configuring inbound servers that stream database changes from other systems to an Oracle database.

In both cases, the database changes are encapsulated in logical change records (LCRs). Also, the other systems can be Oracle systems or a non-Oracle systems, such as non-Oracle databases or file systems.

XStream outbound servers can stream out LCRs from an Oracle database programmatically using C or Java. After receiving the LCRs, the other system can process them in any customized way. For example, the other system can save the contents of the LCRs to a file, send the LCRs to an Oracle database through an XStream inbound server, or generate SQL statements and execute them on any Oracle or non-Oracle databases.

XStream inbound servers accept LCRs from another system and either apply them to an Oracle database or process them in a customized way using apply handlers.

XStream can be used in a multitenant container database (CDB). A CDB is an Oracle database that includes zero, one, or many user-created pluggable databases (PDBs).

 **See Also:**

- *Oracle Database XStream Guide*
- *Oracle Database Concepts* for more information about CDBs and PDBs

233.2 DBMS_XSTREAM_ADM Security Model

To ensure that the user who runs the subprograms in this package has the necessary privileges, configure an XStream administrator and connect as the XStream administrator when using this package.

An administrator must be granted the `DBA` role when the administrator is performing any of the following actions:

- Running the `ADD_OUTBOUND` procedure while connected as a user that is different from the configured connect user for an outbound server
- Running the `ALTER_OUTBOUND` procedure to change the capture user for a capture process or the connect user for an outbound server
- Running the `CREATE_OUTBOUND` procedure, because this procedure creates a capture process
- Running the `ALTER_INBOUND` procedure to change the apply user for an inbound server
- Running the `ADD_INBOUND` procedure while connected as a user that is different from the configured apply user for an inbound server

When the administrator does not need to perform the preceding tasks, the `DBA` role is not required.

 **See Also:**

- [GRANT_ADMIN_PRIVILEGE Procedure](#)
- *Oracle Database XStream Guide, Chapter 4, "XStream Out and Security"* for more information about XStream and security.

233.3 DBMS_XSTREAM_ADM Operational Notes

Some subprograms in the `DBMS_APPLY_ADM` package can manage XStream outbound servers, and some subprograms in the `DBMS_APPLY_ADM` package can manage XStream inbound servers.



See Also:

[DBMS_APPLY_ADM](#) for details about which subprograms can manage outbound servers and inbound servers

233.4 Summary of DBMS_XSTREAM_ADM Subprograms

This table lists the `DBMS_XSTREAM_ADM` subprograms and briefly describes them.

Table 233-1 DBMS_XSTREAM_ADM Package Subprograms

Subprogram	Description
ADD_COLUMN Procedure	Either adds or removes a declarative rule-based transformation which adds a column to a row logical change record (row LCR) that satisfies the specified rule
ADD_GLOBAL_PROPAGATION_RULES Procedure	Either adds global rules to the positive rule set for a propagation, or adds global rules to the negative rule set for a propagation, and creates the specified propagation if it does not exist
ADD_GLOBAL_RULES Procedure	Adds global rules to either the positive or negative rule set of a capture process or apply process, and creates the specified capture process or apply process if it does not exist
ADD_OUTBOUND Procedure	Creates an XStream outbound server that dequeues LCRs from the specified queue
ADD_SCHEMA_PROPAGATION_RULES Procedure	Either adds schema rules to the positive rule set for a propagation, or adds schema rules to the negative rule set for a propagation, and creates the specified propagation if it does not exist
ADD_SCHEMA_RULES Procedure	Adds rules to a rule set of XStream clients.
ADD_SUBSET_OUTBOUND_RULES Procedure	Adds subset rules to an outbound server configuration
ADD_SUBSET_PROPAGATION_RULES Procedure	Adds subset rules to the positive rule set for a propagation, and creates the specified propagation if it does not exist
ADD_SUBSET_RULES Procedure	Adds subset rules to the positive rule set of a capture process or apply process, and creates the specified capture process or apply process if it does not exist

Table 233-1 (Cont.) DBMS_XSTREAM_ADM Package Subprograms

Subprogram	Description
ADD_TABLE_PROPAGATION_RULES Procedure	Either adds table rules to the positive rule set for a propagation, or adds table rules to the negative rule set for a propagation, and creates the specified propagation if it does not exist
ADD_TABLE_RULES Procedure	This procedure adds rules to a rule set of an XStream client.
ALTER_INBOUND Procedure	Modifies an XStream inbound server
ALTER_OUTBOUND Procedure	Modifies an XStream outbound server
CREATE_INBOUND Procedure	Creates an XStream inbound server and its queue
CREATE_OUTBOUND Procedure	Creates an XStream outbound server, queue, and capture process to enable XStream client applications to stream out Oracle database changes encapsulated in LCRs
DELETE_COLUMN Procedure	Either adds or removes a declarative rule-based transformation which deletes a column from a row LCR that satisfies the specified rule
DROP_INBOUND Procedure	Removes an inbound server configuration
DROP_OUTBOUND Procedure	Removes an outbound server configuration
ENABLE_GG_XSTREAM_FOR_STREAMS Procedure	Enables XStream performance optimizations for Oracle Replication components
GET_MESSAGE_TRACKING Function	Returns the tracking label for the current session
GET_TAG Function	Gets the binary tag for all redo entries generated by the current session
IS_GG_XSTREAM_FOR_STREAMS Function	Returns TRUE if XStream performance optimizations are enabled for Oracle Replication components, or returns FALSE if XStream performance optimizations are disabled for Oracle Replication components
KEEP_COLUMNS Procedure	Either adds or removes a declarative rule-based transformation which keeps a list of columns in a row LCR that satisfies the specified rule
MERGE_STREAMS Procedure	Merges a stream flowing from one capture process with a stream flowing from another capture process
MERGE_STREAMS_JOB Procedure	Determines whether the original capture process and the cloned capture are within the specified merge threshold and, if they are, runs the <code>MERGE_STREAMS</code> procedure to merge the two streams
PURGE_SOURCE_CATALOG Procedure	Removes all Oracle Replication data dictionary information at the local database for the specified object
RECOVER_OPERATION Procedure	Provides options for a split and merge operation that stopped because it encountered an error. This procedure either rolls forward the operation, rolls back the operation, or purges all of the metadata about the operation.
REMOVE_QUEUE Procedure	Removes the specified ANYDATA queue

Table 233-1 (Cont.) DBMS_XSTREAM_ADM Package Subprograms

Subprogram	Description
REMOVE_RULE Procedure	Removes the specified rule or all rules from the rule set associated with the specified capture process, apply process, or propagation.
REMOVE_SUBSET_OUTBOUND_RULES Procedure	Removes subset rules from an outbound server configuration
REMOVE_XSTREAM_CONFIGURATION Procedure	Removes the XStream configuration at the local database
RENAME_COLUMN Procedure	Either adds or removes a declarative rule-based transformation which renames a column in a row LCR that satisfies the specified rule
RENAME_SCHEMA Procedure	Either adds or removes a declarative rule-based transformation which renames a schema in a row LCR that satisfies the specified rule
RENAME_TABLE Procedure	Either adds or removes a declarative rule-based transformation which renames a table in a row LCR that satisfies the specified rule
SET_MESSAGE_TRACKING Procedure	Sets the tracking label for logical change records (LCRs) produced by the current session
SET_PARAMETER Procedure	Sets a parameter for an outbound server, an inbound server, or an outbound server's capture process
SET_TAG Procedure	Sets the binary tag for all redo entries subsequently generated by the current session
SET_UP_QUEUE Procedure	Creates a queue table and a queue for use with the capture, propagate, and apply functionality of XStream
SPLIT_STREAMS Procedure	Splits one stream flowing from a capture process off from all of the other streams flowing from the capture process
START_OUTBOUND Procedure	Starts an XStream outbound server
STOP_OUTBOUND Procedure	Stops an XStream outbound server

**Note:**

All subprograms commit unless specified otherwise.

233.4.1 ADD_COLUMN Procedure

This procedure either adds or removes a declarative rule-based transformation which adds a column to a row logical change record (row LCR) that satisfies the specified rule.

For the transformation to be performed when the specified rule evaluates to `TRUE`, the rule must be in the positive rule set of an XStream client. XStream clients include capture processes, propagations, and apply processes.

This procedure is overloaded. The `column_value` and `column_function` parameters are mutually exclusive.

 **Note:**

- `ADD_COLUMN` transformations cannot add columns of the following data types: BLOB, CLOB, NCLOB, BFILE, LONG, LONG RAW, ROWID, user-defined types (including object types, REFS, varrays, nested tables), and Oracle-supplied types (including any types, XML types, spatial types, and media types).
- Declarative transformations can transform row LCRs only. Therefore, a DML rule must be specified when you run this procedure. If a DDL rule is specified, then the procedure raises an error.

 **See Also:**

Oracle Database XStream Guide for more information about declarative rule-based transformations

Syntax

```
DBMS_XSTREAM_ADM.ADD_COLUMN (
    rule_name      IN  VARCHAR2,
    table_name     IN  VARCHAR2,
    column_name    IN  VARCHAR2,
    column_value   IN  ANYDATA,
    value_type     IN  VARCHAR2      DEFAULT 'NEW',
    step_number    IN  NUMBER        DEFAULT 0,
    operation      IN  VARCHAR2      DEFAULT 'ADD');
```

```
DBMS_XSTREAM_ADM.ADD_COLUMN (
    rule_name      IN  VARCHAR2,
    table_name     IN  VARCHAR2,
    column_name    IN  VARCHAR2,
    column_function IN VARCHAR2,
    value_type     IN  VARCHAR2      DEFAULT 'NEW',
    step_number    IN  NUMBER        DEFAULT 0,
    operation      IN  VARCHAR2      DEFAULT 'ADD');
```

Parameters

Table 233-2 ADD_COLUMN Procedure Parameters

Parameter	Description
<code>rule_name</code>	The name of the rule, specified as <code>[schema_name.]rule_name</code> . If NULL, then the procedure raises an error. For example, to specify a rule in the <code>hr</code> schema named <code>employees12</code> , enter <code>hr.employees12</code> . If the schema is not specified, then the current user is the default.
<code>table_name</code>	The name of the table to which the column is added in the row LCR, specified as <code>[schema_name.]object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default.

Table 233-2 (Cont.) ADD_COLUMN Procedure Parameters

Parameter	Description
<code>column_name</code>	The name of the column added to each row LCR that satisfies the rule.
<code>column_value</code>	The value of the added column. Specify the appropriate <code>ANYDATA</code> function for the column datatype and the column value. For example, if the datatype of the column being added is <code>NUMBER</code> and the value is <code>NULL</code> , then specify the <code>ANYDATA.ConvertNumber(NULL)</code> function. This parameter cannot be specified if the <code>column_function</code> parameter is specified.
<code>column_function</code>	Either the <code>'SYSDATE'</code> or the <code>'SYSTIMESTAMP'</code> SQL function. The <code>'SYSDATE'</code> SQL function returns the current date and time. <code>'SYSDATE'</code> uses the time zone of either the database host system or the database, depending on the setting of the <code>TIME_AT_DBTIMEZONE</code> initialization parameter. The datatype of the returned value is <code>DATE</code> , and the format returned depends on the value of the <code>NLS_DATE_FORMAT</code> initialization parameter. The <code>'SYSTIMESTAMP'</code> SQL function returns the system date, including fractional seconds. <code>'SYSTIMESTAMP'</code> uses the time zone of either the database host system or the database, depending on the setting of the <code>TIME_AT_DBTIMEZONE</code> initialization parameter. The return type is <code>TIMESTAMP WITH TIME ZONE</code> . The function executes when the rule evaluates to <code>TRUE</code> . This parameter cannot be specified if the <code>column_value</code> parameter is specified. See Also: <i>Oracle Database Reference</i> for more information about the <code>TIME_AT_DBTIMEZONE</code> parameter.
<code>value_type</code>	Specify <code>'NEW'</code> to add the column to the new values in the row LCR. Specify <code>'OLD'</code> to add the column to the old values in the row LCR.
<code>step_number</code>	The order of execution of the transformation. See Also: <i>Oracle Database XStream Guide</i> for more information about transformation ordering
<code>operation</code>	Specify <code>'ADD'</code> to add the transformation to the rule. Specify <code>'REMOVE'</code> to remove the transformation from the rule.

Usage Notes

When `'REMOVE'` is specified for the `operation` parameter, all of the add column declarative rule-based transformations for the specified rule are removed that match the specified `table_name`, `column_name`, and `step_number` parameters. Nulls specified for these parameters act as wildcards. The following table lists the behavior of the `ADD_COLUMN` procedures when one or more of these parameters is `NULL`:

table_name	column_name	step_number	Result
NULL	NULL	NULL	Remove all add column transformations for the specified rule.
NULL	NULL	non-NULL	Remove all add column transformations with the specified step_number for the specified rule.
NULL	non-NULL	non-NULL	Remove all add column transformations with the specified column_name and step_number for the specified rule.
non-NULL	NULL	non-NULL	Remove all add column transformations with the specified table_name and step_number for the specified rule.
NULL	non-NULL	NULL	Remove all add column transformations with the specified column_name for the specified rule.
non-NULL	non-NULL	NULL	Remove all add column transformations with the specified table_name and column_name for the specified rule.
non-NULL	NULL	NULL	Remove all add column transformations with the specified table_name for the specified rule.
non-NULL	non-NULL	non-NULL	Remove all add column transformations with the specified table_name, column_name, and step_number for the specified rule.

233.4.2 ADD_GLOBAL_PROPAGATION_RULES Procedure

This procedure either adds global rules to the positive rule set for a propagation, or adds global rules to the negative rule set for a propagation, and creates the specified propagation if it does not exist.

This procedure is overloaded. One version of this procedure contains two OUT parameters, and the other does not.

Syntax

```
DBMS_XSTREAM_ADM.ADD_GLOBAL_PROPAGATION_RULES (
    streams_name          IN  VARCHAR2  DEFAULT NULL,
    source_queue_name     IN  VARCHAR2,
    destination_queue_name IN  VARCHAR2,
    include_dml           IN  BOOLEAN   DEFAULT TRUE,
    include_ddl           IN  BOOLEAN   DEFAULT FALSE,
    include_tagged_lcr    IN  BOOLEAN   DEFAULT FALSE,
    source_database       IN  VARCHAR2  DEFAULT NULL,
    dml_rule_name         OUT VARCHAR2,
    ddl_rule_name         OUT VARCHAR2,
    inclusion_rule        IN  BOOLEAN   DEFAULT TRUE,
    and_condition         IN  VARCHAR2  DEFAULT NULL,
    queue_to_queue       IN  BOOLEAN   DEFAULT NULL);
```

```
DBMS_XSTREAM_ADM.ADD_GLOBAL_PROPAGATION_RULES (
    streams_name          IN  VARCHAR2  DEFAULT NULL,
```



```

source_queue_name      IN  VARCHAR2,
destination_queue_name IN  VARCHAR2,
include_dml            IN  BOOLEAN  DEFAULT TRUE,
include_ddl            IN  BOOLEAN  DEFAULT FALSE,
include_tagged_lcr     IN  BOOLEAN  DEFAULT FALSE,
source_database        IN  VARCHAR2  DEFAULT NULL,
inclusion_rule          IN  BOOLEAN  DEFAULT TRUE,
and_condition          IN  VARCHAR2  DEFAULT NULL,
queue_to_queue        IN  BOOLEAN  DEFAULT NULL);

```

Parameters

Table 233-3 ADD_GLOBAL_PROPAGATION_RULES Procedure Parameters

Parameter	Description
streams_name	<p>The name of the propagation. Do not specify an owner.</p> <p>If the specified propagation does not exist, then the procedure creates it automatically.</p> <p>If NULL and a propagation exists for the same source queue and destination queue (including database link), then the procedure uses this propagation.</p> <p>If NULL and no propagation exists for the same source queue and destination queue (including database link), then the procedure creates a propagation automatically with a system-generated name.</p>
source_queue_name	<p>The name of the source queue, specified as <code>[schema_name.]queue_name</code>. The current database must contain the source queue, and the queue must be ANYDATA type.</p> <p>For example, to specify a source queue named <code>streams_queue</code> in the <code>strmadmin</code> schema, enter <code>strmadmin.streams_queue</code> for this parameter.</p> <p>If the schema is not specified, then the current user is the default.</p>
destination_queue_name	<p>The name of the destination queue, including a database link, specified as <code>[schema_name.]queue_name[@dblink_name]</code>, if the destination queue is in a remote database. The queue must be ANYDATA type.</p> <p>For example, to specify a destination queue named <code>streams_queue</code> in the <code>strmadmin</code> schema and use a database link named <code>dbs2.net</code>, enter <code>strmadmin.streams_queue@dbs2.net</code> for this parameter.</p> <p>If the schema is not specified, then the current user is the default.</p> <p>If the database link is omitted, then the procedure uses the global name of the current database, and the source queue and destination queue must be in the same database.</p> <p>Note: Connection qualifiers are not allowed.</p>
include_dml	<p>If TRUE, then the procedure creates a rule for DML changes. If FALSE, then the procedure does not create a DML rule. NULL is not permitted.</p>
include_ddl	<p>If TRUE, then the procedure creates a rule for DDL changes. If FALSE, then the procedure does not create a DDL rule. NULL is not permitted.</p>

Table 233-3 (Cont.) ADD_GLOBAL_PROPAGATION_RULES Procedure Parameters

Parameter	Description
include_tagged_lcr	<p>If TRUE, then the procedure does not add a condition regarding Oracle Replication tags to the generated rules. Therefore, these rules can evaluate to TRUE regardless of whether a logical change record (LCR) has a non-NULL tag. If the rules are added to the positive rule set for the propagation, then an LCR is always considered for propagation, regardless of whether it has a non-NULL tag. If the rules are added to a positive rule set, then setting this parameter to TRUE is appropriate for a full (for example, standby) copy of a database. If the rules are added to the negative rule set for the propagation, then whether an LCR is discarded does not depend on the tag for the LCR.</p> <p>If FALSE, then the procedure adds a condition to each generated rule that causes the rule to evaluate to TRUE only if an LCR has a NULL Oracle Replication tag. If the rules are added to the positive rule set for the propagation, then an LCR is considered for propagation only when the LCR contains a NULL tag. If the rules are added to a positive rule set, then setting this parameter to FALSE might be appropriate in update-anywhere configurations to avoid sending a change back to its source database. If the rules are added to the negative rule set for the propagation, then an LCR can be discarded only if it has a NULL tag.</p> <p>Usually, specify TRUE for this parameter if the <code>inclusion_rule</code> parameter is set to FALSE.</p>
source_database	<p>The global name of the source database. The source database is where the changes originated. If NULL, then the procedure does not add a condition regarding the source database to the generated rules.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>.NET</code>, then the procedure specifies <code>DBS1.NET</code> automatically.</p> <p>Oracle recommends that you specify a source database for propagation rules.</p>
dml_rule_name	<p>If <code>include_dml</code> is TRUE, then this parameter contains the DML rule name.</p> <p>If <code>include_dml</code> is FALSE, then this parameter contains a NULL.</p>
ddl_rule_name	<p>If <code>include_ddl</code> is TRUE, then this parameter contains the DDL rule name.</p> <p>If <code>include_ddl</code> is FALSE, then this parameter contains a NULL.</p>
inclusion_rule	<p>If <code>inclusion_rule</code> is TRUE, then the procedure adds the rules to the positive rule set for the propagation.</p> <p>If <code>inclusion_rule</code> is FALSE, then the procedure adds the rules to the negative rule set for the propagation.</p> <p>In either case, the system creates the rule set if it does not exist.</p>

Table 233-3 (Cont.) ADD_GLOBAL_PROPAGATION_RULES Procedure Parameters

Parameter	Description
and_condition	<p>If non-NULL, appends the specified condition to the system-generated rule condition using an AND clause in the following way:</p> <pre>(system_condition) AND (and_condition)</pre> <p>The variable in the specified condition must be :lcr. For example, to specify that the global rules generated by the procedure evaluate to TRUE only if the Oracle Replication tag is the hexadecimal equivalent of '02', specify the following condition:</p> <pre>:lcr.get_tag() = HEXTORAW('02')</pre> <p>The :lcr in the specified condition is converted to :dml or :ddl, depending on the rule that is being generated. If you are specifying an LCR member subprogram that is dependent on the LCR type (row or DDL), then make sure the procedure only generates the appropriate rule.</p> <p>Specifically, if you specify an LCR member subprogram that is valid only for row LCRs, then specify TRUE for the include_dml parameter and FALSE for the include_ddl parameter. If you specify an LCR member subprogram that is valid only for DDL LCRs, then specify FALSE for the include_dml parameter and TRUE for the include_ddl parameter.</p> <p>See Also: Logical Change Record TYPEs</p>
queue_to_queue	<p>If TRUE or NULL, then a new propagation created by this procedure is a queue to queue propagation. A queue-to-queue propagation always has its own propagation job and uses a service for automatic failover when the destination queue is a buffered queue in an Oracle Real Application Clusters (Oracle RAC) database.</p> <p>If FALSE, then a new propagation created by this procedure is a queue-to-dblink propagation. A queue-to-dblink propagation can share a propagation job with other propagations that use the same database link and does not support automatic failover in an Oracle RAC environment.</p> <p>The procedure cannot change the queue to queue property of an exiting propagation. If the specified propagation exists, then the procedure behaves in the following way for each setting:</p> <ul style="list-style-type: none"> • If TRUE and the specified propagation is not a queue to queue propagation, then the procedure raises an error. • If FALSE and the specified propagation is a queue to queue propagation, then the procedure raises an error. • If NULL, then the procedure does not change the queue to queue property of the propagation.

Usage Notes

This procedure configures propagation using the current user. Only one propagation is allowed between a particular source queue and destination queue.

This procedure creates DML and DDL rules automatically based on include_dml and include_ddl parameter values, respectively. Each rule has a system-generated rule name that consists of the database name with a sequence number appended to it. The sequence

number is used to avoid naming conflicts. If the database name plus the sequence number is too long, then the database name is truncated. A propagation uses the rules for filtering.

Examples

The following is an example of a global rule condition created for DML changes:

```
(:dml.is_null_tag() = 'Y' and :dml.get_source_database_name() = 'DBS1.NET' )
```

233.4.3 ADD_GLOBAL_RULES Procedure

This procedure adds rules to an XStream clients rule set.

It adds rules to a rule set of one of the following types of XStream clients:

- When the `streams_type` parameter is set to `capture`, this procedure adds capture process rules for capturing changes to an entire database.

This procedure creates the specified capture process if it does not exist.

- When the `streams_type` parameter is set to `apply` and the `streams_name` parameter specifies the name of an apply process, outbound server, or inbound server, this procedure adds apply rules for applying all logical change records (LCRs) it receives. The rules can specify that the LCRs must be from a particular source database.

This procedure creates an apply process if no apply process, outbound server, or inbound server exists with the specified `streams_name`. This procedure can add rules to an outbound server or inbound server, but it cannot create an outbound server or inbound server.

This procedure is overloaded. One version of this procedure contains two `OUT` parameters, and the other does not.

Note:

If you add global rules to the positive rule set for a capture process, then make sure you add rules to the negative capture process rule set to exclude database objects that are not supported by Oracle Replication. Query the `DBA_XSTREAM_OUT_SUPPORT_MODE` data dictionary view to determine which database objects are not supported by Oracle Replication. If unsupported database objects are not excluded, then capture errors will result.

Syntax

```
DBMS_XSTREAM_ADM.ADD_GLOBAL_RULES (
  streams_type          IN  VARCHAR2,
  streams_name         IN  VARCHAR2 DEFAULT NULL,
  queue_name           IN  VARCHAR2 DEFAULT 'streams_queue',
  include_dml          IN  BOOLEAN  DEFAULT TRUE,
  include_ddl          IN  BOOLEAN  DEFAULT FALSE,
  include_tagged_lcr   IN  BOOLEAN  DEFAULT FALSE,
  source_database      IN  VARCHAR2 DEFAULT NULL,
  dml_rule_name        OUT  VARCHAR2,
  ddl_rule_name        OUT  VARCHAR2,
```

```

inclusion_rule          IN   BOOLEAN   DEFAULT TRUE,
and_condition          IN   VARCHAR2   DEFAULT NULL,
source_root_name      IN   VARCHAR2   DEFAULT NULL,
source_container_name IN   VARCHAR2   DEFAULT NULL);

DBMS_XSTREAM_ADM.ADD_GLOBAL_RULES (
  streams_type         IN   VARCHAR2,
  streams_name        IN   VARCHAR2   DEFAULT NULL,
  queue_name          IN   VARCHAR2   DEFAULT 'streams_queue',
  include_dml         IN   BOOLEAN   DEFAULT TRUE,
  include_ddl         IN   BOOLEAN   DEFAULT FALSE,
  include_tagged_lcr  IN   BOOLEAN   DEFAULT FALSE,
  source_database     IN   VARCHAR2   DEFAULT NULL,
  inclusion_rule      IN   BOOLEAN   DEFAULT TRUE,
  and_condition       IN   VARCHAR2   DEFAULT NULL,
  source_root_name    IN   VARCHAR2   DEFAULT NULL,
  source_container_name IN  VARCHAR2   DEFAULT NULL);

```

Parameters

Table 233-4 ADD_GLOBAL_RULES Procedure Parameters

Parameter	Description
streams_type	<p>The type of XStream client:</p> <ul style="list-style-type: none"> Specify <code>capture</code> for a capture process. Specify <code>apply</code> for an apply process.
streams_name	<p>The name of the capture process or apply process. Do not specify an owner.</p> <p>If NULL, if <code>streams_type</code> is <code>capture</code>, and if one relevant capture process for the queue exists, then the relevant XStream client is used. If no relevant XStream client exists for the queue, then an XStream client is created automatically with a system-generated name. If NULL and multiple XStream clients of the specified <code>streams_type</code> for the queue exist, then the procedure raises an error.</p> <p>If NULL, if <code>streams_type</code> is <code>apply</code>, and if one relevant apply process exists, then the procedure uses the relevant apply process. The relevant apply process is identified in one of the following ways:</p> <ul style="list-style-type: none"> If one existing apply process has the source database specified in <code>source_database</code> and uses the queue specified in <code>queue_name</code>, then the procedure uses this apply process. If <code>source_database</code> is NULL and one existing apply process is using the queue specified in <code>queue_name</code>, then the procedure uses this apply process. <p>If NULL and no relevant apply process exists, then the procedure creates an apply process automatically with a system-generated name.</p> <p>If NULL and multiple relevant apply processes exist, then the procedure raises an error.</p> <p>Each apply process must have a unique name.</p>

Table 233-4 (Cont.) ADD_GLOBAL_RULES Procedure Parameters

Parameter	Description
queue_name	<p>The name of the local queue, specified as <code>[schema_name.]queue_name</code>. The current database must contain the queue, and the queue must be ANYDATA type.</p> <p>For example, to specify a queue named <code>streams_queue</code> in the <code>strmadmin</code> schema, enter <code>strmadmin.streams_queue</code> for this parameter. If the schema is not specified, then the current user is the default.</p> <p>For capture process rules, this is the queue into which a capture process enqueues LCRs. For outbound server rules, this is the queue from which the outbound server dequeues LCRs. For inbound server rules, this is the queue into which an inbound server enqueues error transactions.</p>
include_dml	<p>If TRUE, then the procedure creates a rule for DML changes. If FALSE, then the procedure does not create a DML rule. NULL is not permitted.</p>
include_ddl	<p>If TRUE, then the procedure creates a rule for DDL changes. If FALSE, then the procedure does not create a DDL rule. NULL is not permitted.</p>
include_tagged_lcr	<p>If TRUE, then the procedure does not add a condition regarding Oracle Replication tags to the generated rules. Therefore, these rules can evaluate to TRUE regardless of whether a redo entry or LCR has a non-NULL tag. If the rules are added to the positive rule set for the process, then a redo entry is always considered for capture, and an LCR is always considered for apply, regardless of whether the redo entry or LCR has a non-NULL tag. If the rules are added to a positive rule set, then setting this parameter to TRUE is appropriate for a full (for example, standby) copy of a database. If the rules are added to the negative rule set for the process, then whether a redo entry or LCR is discarded does not depend on the tag.</p> <p>If FALSE, then the procedure adds a condition to each generated rule that causes the rule to evaluate to TRUE only if a redo entry or LCR has a NULL Oracle Replication tag. If the rules are added to the positive rule set for the process, then a redo entry is considered for capture, and an LCR is considered for apply, only when the redo entry or LCR contains a NULL tag. If the rules are added to a positive rule set, then setting this parameter to FALSE might be appropriate in update-anywhere configurations to avoid sending a change back to its source database. If the rules are added to the negative rule set for the process, then a redo entry or LCR can be discarded only if it has a NULL tag.</p> <p>Usually, specify TRUE for this parameter if the <code>inclusion_rule</code> parameter is set to FALSE.</p>

Table 233-4 (Cont.) ADD_GLOBAL_RULES Procedure Parameters

Parameter	Description
source_database	<p>The global name of the source database. If NULL, then the procedure does not add a condition regarding the source database to the generated rules.</p> <p>For capture process rules, specify NULL or the global name of the local database if you are creating a capture process locally at the source database. If you are adding rules to a downstream capture process rule set at a downstream database, then specify the source database of the changes that will be captured.</p> <p>For apply process rules, specify the source database of the changes that will be applied by the apply process. The source database is the database where the changes originated. If an apply process applies captured LCRs, then the apply process can apply LCRs from only one capture process at one source database.</p> <p>In a CDB, specify the global name of the container to which the rules pertain. The container can be the root or a PDB. For example, mycdb.example.com or hrpdb.example.com. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify DBS1 and the domain is .NET, then the procedure specifies DBS1.NET automatically.</p>
dml_rule_name	<p>If include_dml is TRUE, then this parameter contains the DML rule name.</p> <p>If include_dml is FALSE, then this parameter contains a NULL.</p>
ddl_rule_name	<p>If include_ddl is TRUE, then this parameter contains the DDL rule name.</p> <p>If include_ddl is FALSE, then this parameter contains a NULL.</p>
inclusion_rule	<p>If inclusion_rule is TRUE, then the procedure adds the rules to the positive rule set for the XStream client.</p> <p>If inclusion_rule is FALSE, then the procedure adds the rules to the negative rule set for the XStream client.</p> <p>In either case, the system creates the rule set if it does not exist.</p>

Table 233-4 (Cont.) ADD_GLOBAL_RULES Procedure Parameters

Parameter	Description
and_condition	<p>If non-NULL, appends the specified condition to the system-generated rule condition using an AND clause in the following way:</p> <pre>(system_condition) AND (and_condition)</pre> <p>The variable in the specified condition must be :lcr. For example, to specify that the global rules generated by the procedure evaluate to TRUE only if the Oracle Replication tag is the hexadecimal equivalent of '02', specify the following condition:</p> <pre>:lcr.get_tag() = HEXTORAW('02')</pre> <p>The :lcr in the specified condition is converted to :dml or :ddl, depending on the rule that is being generated. If you are specifying an LCR member subprogram that is dependent on the LCR type (row or DDL), then make sure this procedure only generates the appropriate rule. Specifically, if you specify an LCR member subprogram that is valid only for row LCRs, then specify TRUE for the include_dml parameter and FALSE for the include_ddl parameter. If you specify an LCR member subprogram that is valid only for DDL LCRs, then specify FALSE for the include_dml parameter and TRUE for the include_ddl parameter.</p> <p>See Also: Logical Change Record TYPES</p>
source_root_name	<p>The global name of the root in the source CDB. For example, mycdb.example.com.</p> <p>If this parameter is NULL, then the global name of the root in the local CDB is used. If you are configuring downstream capture, then this parameter must be a non-NULL value, and it must specify the global name of the root in the remote source CDB. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify DBS1 and the domain is EXAMPLE.COM, then the procedure specifies DBS1.EXAMPLE.COM automatically.</p> <p>Note: This parameter only applies to a CDB.</p>
source_container_name	<p>The short name of the source container. The container can be the root or a PDB. For example, CDB\$ROOT or hrpdb. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>Note: This parameter only applies to a CDB.</p>

Usage Notes

This procedure creates DML and DDL rules automatically based on include_dml and include_ddl parameter values, respectively. Each rule has a system-generated rule name that consists of the database name with a sequence number appended to it. The sequence number is used to avoid naming conflicts. If the database name plus the sequence number is too long, then the database name is truncated. A capture process or apply process uses the rules for filtering.

 **See Also:**

- "Operational Notes"
- "Security Model"

Examples

The following is an example of a global rule condition created for DML changes:

```
(:dml.is_null_tag() = 'Y' and :dml.get_source_database_name() = 'DBS1.NET' )
```

233.4.4 ADD_OUTBOUND Procedure

This procedure creates an XStream outbound server that dequeues LCRs from the specified queue. The outbound server streams out the LCRs to an XStream client application.

This procedure creates neither a capture process nor a queue. To create an outbound server, a capture process, and a queue with one procedure call, use the [CREATE_OUTBOUND Procedure](#).

To create the capture process individually, use one of the following packages:

- DBMS_XSTREAM_ADM
- DBMS_CAPTURE_ADM

To create a queue individually, use the `SET_UP_QUEUE` procedure in the `DBMS_XSTREAM_ADM` package.

This procedure is overloaded. One `table_names` parameter is type `VARCHAR2` and the other `table_names` parameter is type `DBMS_UTILITY.UNCL_ARRAY`. Also, one `schema_names` parameter is type `VARCHAR2` and the other `schema_names` parameter is type `DBMS_UTILITY.UNCL_ARRAY`. These parameters enable you to enter the lists of tables and schemas in different ways and are mutually exclusive.

 **Note:**

- A client application can create multiple sessions. Each session can attach to only one outbound server, and each outbound server can serve only one session at a time. However, different client application sessions can connect to different outbound servers. See *Oracle Call Interface Programmer's Guide* and *Oracle Database XStream Java API Reference* for information about attaching to an outbound server.
- This procedure enables the outbound server that it creates.
- Starting with Oracle Database 11g Release 2 (11.2.0.2), the `capture_name`, `start_scn`, and `start_time` parameters are included in this procedure.

Syntax

```
DBMS_XSTREAM_ADM.ADD_OUTBOUND(
  server_name          IN VARCHAR2,
  queue_name           IN VARCHAR2  DEFAULT NULL,
  source_database      IN VARCHAR2  DEFAULT NULL,
  table_names          IN DBMS_UTILITY.UNCL_ARRAY,
  schema_names         IN DBMS_UTILITY.UNCL_ARRAY,
  connect_user         IN VARCHAR2  DEFAULT NULL,
  comment              IN VARCHAR2  DEFAULT NULL,
  capture_name         IN VARCHAR2  DEFAULT NULL,
  start_scn            IN NUMBER     DEFAULT NULL,
  start_time           IN TIMESTAMP  DEFAULT NULL,
  include_dml          IN BOOLEAN    DEFAULT TRUE,
  include_ddl          IN BOOLEAN    DEFAULT FALSE,
  source_root_name     IN VARCHAR2  DEFAULT NULL,
  source_container_name IN VARCHAR2  DEFAULT NULL,
  lcr_version          IN NUMBER     DEFAULT NULL);
```

```
DBMS_XSTREAM_ADM.ADD_OUTBOUND(
  server_name          IN VARCHAR2,
  queue_name           IN VARCHAR2  DEFAULT NULL,
  source_database      IN VARCHAR2  DEFAULT NULL,
  table_names          IN VARCHAR2  DEFAULT NULL,
  schema_names         IN VARCHAR2  DEFAULT NULL,
  connect_user         IN VARCHAR2  DEFAULT NULL,
  comment              IN VARCHAR2  DEFAULT NULL,
  capture_name         IN VARCHAR2  DEFAULT NULL,
  start_scn            IN NUMBER     DEFAULT NULL,
  start_time           IN TIMESTAMP  DEFAULT NULL,
  include_dml          IN BOOLEAN    DEFAULT TRUE,
  include_ddl          IN BOOLEAN    DEFAULT FALSE,
  source_root_name     IN VARCHAR2  DEFAULT NULL,
  source_container_name IN VARCHAR2  DEFAULT NULL,
  lcr_version          IN NUMBER     DEFAULT NULL);
```

Parameters

Table 233-5 ADD_OUTBOUND Procedure Parameters

Parameter	Description
server_name	<p>The name of the outbound server being created. A NULL specification is not allowed. Do not specify an owner.</p> <p>The specified name must not match the name of an existing outbound server, inbound server, apply process, or messaging client.</p> <p>Note: The <code>server_name</code> setting cannot exceed 30 bytes, and it cannot be altered after the outbound server is created.</p>
queue_name	<p>The name of the local queue from which the outbound server dequeues LCRs, specified as [<code>schema_name.</code>]<code>queue_name</code>. The current database must contain the queue, and the queue must be ANYDATA type.</p> <p>For example, to specify a queue named <code>xstream_queue</code> in the <code>xstrmadmin</code> schema, enter <code>xstrmadmin.xstream_queue</code> for this parameter. If the schema is not specified, then the current user is the default.</p> <p>If NULL, the procedure raises an error.</p>

Table 233-5 (Cont.) ADD_OUTBOUND Procedure Parameters

Parameter	Description
source_database	<p>The global name of the source database. If NULL, then the procedure does not add a condition regarding the source database to the generated rules.</p> <p>In a CDB, specify the global name of the container to which the rules pertain. The container can be the root or a PDB. For example, mycdb.example.com or hrpdb.example.com. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify DBS1 and the domain is .NET, then the procedure specifies DBS1.NET automatically.</p>
table_names	<p>The tables for which data manipulation language (DML) and data definition language (DDL) changes are streamed out to the XStream client application. The tables can be specified in the following ways:</p> <ul style="list-style-type: none"> Comma-delimited list of type VARCHAR2. A PL/SQL associative array of type DBMS_UTILITY.UNCL_ARRAY, where each element is the name of a table. Specify the first table in position 1. The last position must be NULL. <p>Each table should be specified as [schema_name.]table_name. For example, you can specify hr.employees. If the schema is not specified, then the current user is the default.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>
schema_names	<p>The schemas for which DML and DDL changes are streamed out to the XStream client application. The schemas can be specified in the following ways:</p> <ul style="list-style-type: none"> Comma-delimited list of type VARCHAR2. A PL/SQL associative array of type DBMS_UTILITY.UNCL_ARRAY, where each element is the name of a schema. Specify the first schema in position 1. The last position must be NULL. <p>Note: This procedure does not concatenate the schema_names parameter with the table_names parameter. To specify tables, enter fully qualified table names in the table_names parameter (schema_name.table_name).</p> <p>See Also: "Usage Notes" for more information about this parameter</p>
connect_user	<p>The user who can attach to the specified outbound server to retrieve the LCR stream. The client application must attach to the outbound server as the specified connect user. See "CREATE_OUTBOUND Procedure" for information about the privileges required by a connect user.</p> <p>If NULL, then the current user is the default.</p>
comment	An optional comment associated with the outbound server.

Table 233-5 (Cont.) ADD_OUTBOUND Procedure Parameters

Parameter	Description
capture_name	<p>The name of the capture process configured to capture changes for the outbound server. Do not specify an owner.</p> <p>If the specified name matches the name of an existing capture process for another outbound server, then the procedure uses the existing capture process and adds the rules for capturing changes to the database to the positive capture process rule set.</p> <p>If the specified name matches the name of an existing capture process for an apply process, then an error is raised.</p> <p>If the specified name does not match the name of an existing capture process, then an error is raised.</p> <p>If NULL, then the outbound server is created without a capture process.</p>
start_scn	<p>A valid system change number (SCN) for the database from which the capture process starts capturing changes.</p> <p>If the capture_name parameter is NULL, then this parameter is ignored.</p> <p>If NULL and the capture_name parameter is non-NULL, then the start SCN of the capture process is not changed.</p> <p>An error is returned if an invalid SCN is specified.</p> <p>The start_scn and start_time parameters are mutually exclusive.</p>
start_time	<p>A valid time from which the capture process starts capturing changes.</p> <p>If the capture_name parameter is NULL, then this parameter is ignored.</p> <p>If NULL and the capture_name parameter is non-NULL, then the start SCN of the capture process is not changed.</p> <p>The start_scn and start_time parameters are mutually exclusive.</p>
include_dml	<p>If TRUE, then the procedure creates a rule for DML changes. If FALSE, then the procedure does not create a DML rule. NULL is not permitted.</p>
include_ddl	<p>If TRUE, then the procedure creates a rule for DDL changes. If FALSE, then the procedure does not create a DDL rule. NULL is not permitted.</p>
source_root_name	<p>The global name of the root in the source CDB. For example, mycdb.example.com.</p> <p>If this parameter is NULL, then the global name of the root in the local CDB is used. If you are configuring downstream capture, then this parameter must be a non-NULL value, and it must specify the global name of the root in the remote source CDB. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify DBS1 and the domain is EXAMPLE.COM, then the procedure specifies DBS1.EXAMPLE.COM automatically.</p> <p>Note: This parameter only applies to a CDB.</p>
source_container_name	<p>The short name of the source container. The container can be the root or a PDB. For example, CDB\$ROOT or hrpdb. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>Note: This parameter only applies to a CDB.</p>

Table 233-5 (Cont.) ADD_OUTBOUND Procedure Parameters

Parameter	Description
<code>lcrld_version</code>	<p>The LCRID version for captured LCRs, either 1 or 2.</p> <p>If 2, then the LCRs are compatible with a database with its compatibility level at 12.2.0 or higher.</p> <p>If 1, then the LCRs are compatible with a database with its compatibility level at 12.1.0 or lower.</p> <p>If NULL, the default, and the database compatibility level is 12.2.0 or higher, then the <code>lcrld_version</code> is set to 2 internally. If the database compatibility level is 12.1.0 or lower, then the <code>lcrld_version</code> is set to 1 internally.</p>

Usage Notes

The following list describes the behavior of the outbound server for various combinations of the `table_names` and `schema_names` parameters:

- If both the `table_names` and `schema_names` parameters are NULL or empty, then the outbound server streams all DML and DDL changes to the client application.
This procedure is overloaded. The `table_names` and `schema_names` parameters are defaulted to NULL. Do not specify NULL for both `table_names` and `schema_names` in the same call; otherwise, error PLS-00307 is returned.
- If both the `table_names` and `schema_names` parameters are specified, then the outbound server streams DML and DDL changes for the specified tables and schemas.
- If the `table_names` parameter is specified and the `schema_names` parameter is NULL or empty, then the outbound server streams DML and DDL changes for the specified tables.
- If the `table_names` parameter is NULL or empty and the `schema_names` parameter is specified, then the outbound server streams DML and DDL changes for the specified schemas.

For the procedure that uses the `DBMS_UTILITY.UNCL_ARRAY` type for the `table_names` and `schema_names` parameters, both parameters must be specified. To specify only tables, the `schema_names` parameter must be specified and empty. To specify only schemas, the `table_names` parameter must be specified and empty.

 **Note:**

An empty array includes one NULL entry.

233.4.5 ADD_SCHEMA_PROPAGATION_RULES Procedure

This procedure either adds schema rules to the positive rule set for a propagation, or adds schema rules to the negative rule set for a propagation, and creates the specified propagation if it does not exist.

This procedure is overloaded. One version of this procedure contains two `OUT` parameters, and the other does not.

Syntax

```
DBMS_XSTREAM_ADM.ADD_SCHEMA_PROPAGATION_RULES (
  schema_name          IN   VARCHAR2,
  streams_name         IN   VARCHAR2 DEFAULT NULL,
  source_queue_name    IN   VARCHAR2,
  destination_queue_name IN VARCHAR2,
  include_dml          IN   BOOLEAN  DEFAULT TRUE,
  include_ddl          IN   BOOLEAN  DEFAULT FALSE,
  include_tagged_lcr   IN   BOOLEAN  DEFAULT FALSE,
  source_database      IN   VARCHAR2 DEFAULT NULL,
  dml_rule_name        OUT  VARCHAR2,
  ddl_rule_name        OUT  VARCHAR2,
  inclusion_rule       IN   BOOLEAN  DEFAULT TRUE,
  and_condition        IN   VARCHAR2 DEFAULT NULL,
  queue_to_queue       IN   BOOLEAN  DEFAULT NULL);
```

```
DBMS_XSTREAM_ADM.ADD_SCHEMA_PROPAGATION_RULES (
  schema_name          IN   VARCHAR2,
  streams_name         IN   VARCHAR2 DEFAULT NULL,
  source_queue_name    IN   VARCHAR2,
  destination_queue_name IN VARCHAR2,
  include_dml          IN   BOOLEAN  DEFAULT TRUE,
  include_ddl          IN   BOOLEAN  DEFAULT FALSE,
  include_tagged_lcr   IN   BOOLEAN  DEFAULT FALSE,
  source_database      IN   VARCHAR2 DEFAULT NULL,
  inclusion_rule       IN   BOOLEAN  DEFAULT TRUE,
  and_condition        IN   VARCHAR2 DEFAULT NULL,
  queue_to_queue       IN   BOOLEAN  DEFAULT NULL);
```

Parameters

Table 233-6 ADD_SCHEMA_PROPAGATION_RULES Procedure Parameters

Parameter	Description
<code>schema_name</code>	The name of the schema. For example, <code>hr</code> .
<code>streams_name</code>	The name of the propagation. Do not specify an owner. If the specified propagation does not exist, then the procedure creates it automatically. If <code>NULL</code> and a propagation exists for the same source queue and destination queue (including database link), then the procedure uses this propagation. If <code>NULL</code> and no propagation exists for the same source queue and destination queue (including database link), then the procedure creates a propagation automatically with a system-generated name.
<code>source_queue_name</code>	The name of the source queue, specified as <code>[schema_name.]queue_name</code> . The current database must contain the source queue, and the queue must be <code>ANYDATA</code> type. For example, to specify a source queue named <code>streams_queue</code> in the <code>strmadmin</code> schema, enter <code>strmadmin.streams_queue</code> for this parameter. If the schema is not specified, then the current user is the default.

Table 233-6 (Cont.) ADD_SCHEMA_PROPAGATION_RULES Procedure Parameters

Parameter	Description
<code>destination_queue_name</code>	<p>The name of the destination queue, including a database link, specified as <code>[schema_name.]queue_name[@dblink_name]</code>, if the destination queue is in a remote database. The queue must be ANYDATA type.</p> <p>For example, to specify a destination queue named <code>streams_queue</code> in the <code>strmadmin</code> schema and use a database link named <code>db2.net</code>, enter <code>strmadmin.streams_queue@db2.net</code> for this parameter.</p> <p>If the schema is not specified, then the current user is the default.</p> <p>If the database link is omitted, then the procedure uses the global name of the current database, and the source queue and destination queue must be in the same database.</p> <p>Note: Connection qualifiers are not allowed.</p>
<code>include_dml</code>	<p>If <code>TRUE</code>, then the procedure creates a rule for DML changes. If <code>FALSE</code>, then the procedure does not create a DML rule. <code>NULL</code> is not permitted.</p>
<code>include_ddl</code>	<p>If <code>TRUE</code>, then the procedure creates a rule for DDL changes. If <code>FALSE</code>, then the procedure does not create a DDL rule. <code>NULL</code> is not permitted.</p>
<code>include_tagged_lcr</code>	<p>If <code>TRUE</code>, then the procedure does not add a condition regarding Oracle Replication tags to the generated rules. Therefore, these rules can evaluate to <code>TRUE</code> regardless of whether a logical change record (LCR) has a non-<code>NULL</code> tag. If the rules are added to the positive rule set for the propagation, then an LCR is always considered for propagation, regardless of whether it has a non-<code>NULL</code> tag. If the rules are added to a positive rule set, then setting this parameter to <code>TRUE</code> is appropriate for a full (for example, standby) copy of a database. If the rules are added to the negative rule set for the propagation, then whether an LCR is discarded does not depend on the tag for the LCR.</p> <p>If <code>FALSE</code>, then the procedure adds a condition to each generated rule that causes the rule to evaluate to <code>TRUE</code> only if an LCR has a <code>NULL</code> Oracle Replication tag. If the rules are added to the positive rule set for the propagation, then an LCR is considered for propagation only when the LCR contains a <code>NULL</code> tag. If the rules are added to a positive rule set, then setting this parameter to <code>FALSE</code> might be appropriate in update-anywhere configurations to avoid sending a change back to its source database. If the rules are added to the negative rule set for the propagation, then an LCR can be discarded only if it has a <code>NULL</code> tag.</p> <p>Usually, specify <code>TRUE</code> for this parameter if the <code>inclusion_rule</code> parameter is set to <code>FALSE</code>.</p>

Table 233-6 (Cont.) ADD_SCHEMA_PROPAGATION_RULES Procedure Parameters

Parameter	Description
source_database	<p>The global name of the source database. The source database is where the change originated. If <code>NULL</code>, then the procedure does not add a condition regarding the source database to the generated rules.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>.NET</code>, then the procedure specifies <code>DBS1.NET</code> automatically.</p> <p>Oracle recommends that you specify a source database for propagation rules.</p>
dml_rule_name	<p>If <code>include_dml</code> is <code>TRUE</code>, then this parameter contains the DML rule name.</p> <p>If <code>include_dml</code> is <code>FALSE</code>, then this parameter contains a <code>NULL</code>.</p>
ddl_rule_name	<p>If <code>include_ddl</code> is <code>TRUE</code>, then this parameter contains the DDL rule name.</p> <p>If <code>include_ddl</code> is <code>FALSE</code>, then this parameter contains a <code>NULL</code>.</p>
inclusion_rule	<p>If <code>inclusion_rule</code> is <code>TRUE</code>, then the procedure adds the rules to the positive rule set for the propagation.</p> <p>If <code>inclusion_rule</code> is <code>FALSE</code>, then the procedure adds the rules to the negative rule set for the propagation.</p> <p>In either case, the system creates the rule set if it does not exist.</p>

Table 233-6 (Cont.) ADD_SCHEMA_PROPAGATION_RULES Procedure Parameters

Parameter	Description
<code>and_condition</code>	<p>If non-NULL, appends the specified condition to the system-generated rule condition using an AND clause in the following way:</p> <pre>(system_condition) AND (and_condition)</pre> <p>The variable in the specified condition must be <code>:lcr</code>. For example, to specify that the schema rules generated by the procedure evaluate to TRUE only if the Oracle Replication tag is the hexadecimal equivalent of '02', specify the following condition:</p> <pre>:lcr.get_tag() = HEXTORAW('02')</pre> <p>The <code>:lcr</code> in the specified condition is converted to <code>:dml</code> or <code>:ddl</code>, depending on the rule that is being generated. If you are specifying an LCR member subprogram that is dependent on the LCR type (row or DDL), then make sure this procedure only generates the appropriate rule.</p> <p>Specifically, if you specify an LCR member subprogram that is valid only for row LCRs, then specify TRUE for the <code>include_dml</code> parameter and FALSE for the <code>include_ddl</code> parameter. If you specify an LCR member subprogram that is valid only for DDL LCRs, then specify FALSE for the <code>include_dml</code> parameter and TRUE for the <code>include_ddl</code> parameter.</p> <p>See Also: Logical Change Record TYPES</p>
<code>queue_to_queue</code>	<p>If TRUE or NULL, then a new propagation created by this procedure is a queue to queue propagation. A queue-to-queue propagation always has its own propagation job and uses a service for automatic failover when the destination queue is a buffered queue in an Oracle Real Application Clusters (Oracle RAC) database.</p> <p>If FALSE, then a new propagation created by this procedure is a queue-to-dblink propagation. A queue-to-dblink propagation can share a propagation job with other propagations that use the same database link and does not support automatic failover in an Oracle RAC environment.</p> <p>This procedure cannot change the queue to queue property of an exiting propagation. If the specified propagation exists, then the procedure behaves in the following way for each setting:</p> <ul style="list-style-type: none"> • If TRUE and the specified propagation is not a queue to queue propagation, then the procedure raises an error. • If FALSE and the specified propagation is a queue to queue propagation, then the procedure raises an error. • If NULL, then the procedure does not change the queue to queue property of the propagation.

Usage Notes

This procedure configures propagation using the current user. Only one propagation is allowed between a particular source queue and destination queue.

This procedure creates DML and DDL rules automatically based on `include_dml` and `include_ddl` parameter values, respectively. Each rule has a system-generated rule name that consists of the schema name with a sequence number appended to it. The sequence number is used to avoid naming conflicts. If the schema name plus the sequence number is too long, then the schema name is truncated. A propagation uses the rules for filtering.

Examples

The following is an example of a schema rule condition created for DML changes:

```
((:dml.get_object_owner() = 'HR') and :dml.is_null_tag() = 'Y'  
and :dml.get_source_database_name() = 'DBS1.NET' )
```

233.4.6 ADD_SCHEMA_RULES Procedure

This procedure adds rules to a rule set of one of the following types of XStream clients:

- When the `streams_type` parameter is set to `capture`, this procedure adds capture process rules for capturing changes to a specified schema.

This procedure creates the specified capture process if it does not exist.

- When the `streams_type` parameter is set to `apply` and the `streams_name` parameter specifies the name of an apply process, outbound server, or inbound server, this procedure adds apply rules for applying logical change records (LCRs) that contain changes to a specified schema. The rules can specify that the LCRs must be from a particular source database.

This procedure creates an apply process if no apply process, outbound server, or inbound server exists with the specified `streams_name`. This procedure can add rules to an outbound server or inbound server, but it cannot create an outbound server or inbound server.

This procedure is overloaded. One version of this procedure contains two `OUT` parameters, and the other does not.

Note:

If you add schema rules to the positive rule set for a capture process, then make sure you add rules to the negative capture process rule set to exclude database objects in the schema that are not supported by Oracle Replication. Query the `DBA_XSTREAM_OUT_SUPPORT_MODE` data dictionary view to determine which database objects are not supported by Oracle Replication. If unsupported database objects are not excluded, then capture errors will result.

Syntax

```
DBMS_XSTREAM_ADM.ADD_SCHEMA_RULES (
    schema_name          IN   VARCHAR2,
    streams_type         IN   VARCHAR2,
    streams_name        IN   VARCHAR2 DEFAULT NULL,
    queue_name          IN   VARCHAR2 DEFAULT 'streams_queue',
    include_dml         IN   BOOLEAN  DEFAULT TRUE,
    include_ddl         IN   BOOLEAN  DEFAULT FALSE,
    include_tagged_lcr  IN   BOOLEAN  DEFAULT FALSE,
    source_database     IN   VARCHAR2 DEFAULT NULL,
    dml_rule_name       OUT  VARCHAR2,
    ddl_rule_name       OUT  VARCHAR2,
    inclusion_rule      IN   BOOLEAN  DEFAULT TRUE,
    and_condition       IN   VARCHAR2 DEFAULT NULL,
    source_root_name    IN   VARCHAR2 DEFAULT NULL,
    source_container_name IN  VARCHAR2 DEFAULT NULL);
```

```
DBMS_XSTREAM_ADM.ADD_SCHEMA_RULES (
    schema_name          IN   VARCHAR2,
    streams_type         IN   VARCHAR2,
    streams_name        IN   VARCHAR2 DEFAULT NULL,
    queue_name          IN   VARCHAR2 DEFAULT 'streams_queue',
    include_dml         IN   BOOLEAN  DEFAULT TRUE,
    include_ddl         IN   BOOLEAN  DEFAULT FALSE,
    include_tagged_lcr  IN   BOOLEAN  DEFAULT FALSE,
    source_database     IN   VARCHAR2 DEFAULT NULL,
    inclusion_rule      IN   BOOLEAN  DEFAULT TRUE,
    and_condition       IN   VARCHAR2 DEFAULT NULL,
    source_root_name    IN   VARCHAR2 DEFAULT NULL,
    source_container_name IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 233-7 ADD_SCHEMA_RULES Procedure Parameters

Parameter	Description
schema_name	The name of the schema. For example, hr. You can specify a schema that does not yet exist, because Oracle Replication does not validate the existence of the schema.
streams_type	The type of XStream client: <ul style="list-style-type: none"> Specify capture for a capture process. Specify apply for an apply process.

Table 233-7 (Cont.) ADD_SCHEMA_RULES Procedure Parameters

Parameter	Description
streams_name	<p>The name of the capture process or apply process. Do not specify an owner.</p> <p>If NULL, if streams_type is capture, and if one relevant capture process for the queue exists, then the relevant XStream client is used. If no relevant XStream client exists for the queue, then an XStream client is created automatically with a system-generated name. If NULL and multiple XStream clients of the specified streams_type for the queue exist, then the procedure raises an error.</p> <p>If NULL, if streams_type is apply, and if one relevant apply process exists, then the procedure uses the relevant apply process. The relevant apply process is identified in one of the following ways:</p> <ul style="list-style-type: none"> • If one existing apply process has the source database specified in source_database and uses the queue specified in queue_name, then the procedure uses this apply process. • If source_database is NULL and one existing apply process is using the queue specified in queue_name, then the procedure uses this apply process. <p>If NULL and no relevant apply process exists, then the procedure creates an apply process automatically with a system-generated name.</p> <p>If NULL and multiple relevant apply processes exist, then the procedure raises an error.</p> <p>Each apply process must have a unique name.</p>
queue_name	<p>The name of the local queue, specified as [schema_name.]queue_name. The current database must contain the queue, and the queue must be ANYDATA type.</p> <p>For example, to specify a queue named streams_queue in the strmadmin schema, enter strmadmin.streams_queue for this parameter. If the schema is not specified, then the current user is the default.</p> <p>For capture process rules, this is the queue into which a capture process enqueues LCRs. For outbound server rules, this is the queue from which the outbound server dequeues LCRs. For inbound server rules, this is the queue into which an inbound server enqueues error transactions.</p>
include_dml	<p>If TRUE, then the procedure creates a rule for DML changes. If FALSE, then the procedure does not create a DML rule. NULL is not permitted.</p>
include_ddl	<p>If TRUE, then the procedure creates a rule for DDL changes. If FALSE, then the procedure does not create a DDL rule. NULL is not permitted.</p>

Table 233-7 (Cont.) ADD_SCHEMA_RULES Procedure Parameters

Parameter	Description
include_tagged_lcr	<p>If <code>TRUE</code>, then the procedure does not add a condition regarding Oracle Replication tags to the generated rules. Therefore, these rules can evaluate to <code>TRUE</code> regardless of whether a redo entry or LCR has a non-<code>NULL</code> tag. If the rules are added to the positive rule set for the process, then a redo entry is always considered for capture, and an LCR is always considered for apply, regardless of whether the redo entry or LCR has a non-<code>NULL</code> tag. If the rules are added to a positive rule set, then setting this parameter to <code>TRUE</code> is appropriate for a full (for example, standby) copy of a database. If the rules are added to the negative rule set for the process, then whether a redo entry or LCR is discarded does not depend on the tag.</p> <p>If <code>FALSE</code>, then the procedure adds a condition to each generated rule that causes the rule to evaluate to <code>TRUE</code> only if a redo entry or LCR has a <code>NULL</code> Oracle Replication tag. If the rules are added to the positive rule set for the process, then a redo entry is considered for capture, and an LCR is considered for apply, only when the redo entry or LCR contains a <code>NULL</code> tag. If the rules are added to a positive rule set, then setting this parameter to <code>FALSE</code> might be appropriate in update-anywhere configurations to avoid sending a change back to its source database. If the rules are added to the negative rule set for the process, then a redo entry or LCR can be discarded only if it has a <code>NULL</code> tag.</p> <p>Usually, specify <code>TRUE</code> for this parameter if the <code>inclusion_rule</code> parameter is set to <code>FALSE</code>.</p>
source_database	<p>The global name of the source database. If <code>NULL</code>, then the procedure does not add a condition regarding the source database to the generated rules.</p> <p>For capture process rules, specify <code>NULL</code> or the global name of the local database if you are creating a capture process locally at the source database. If you are adding rules to a downstream capture process rule set at a downstream database, then specify the source database of the changes that will be captured.</p> <p>For apply process rules, specify the source database of the changes that will be applied by the apply process. The source database is the database where the changes originated. If an apply process applies captured LCRs, then the apply process can apply LCRs from only one capture process at one source database.</p> <p>In a CDB, specify the global name of the container to which the rules pertain. The container can be the root or a PDB. For example, <code>mycdb.example.com</code> or <code>hrpdb.example.com</code>. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>.NET</code>, then the procedure specifies <code>DBS1.NET</code> automatically.</p>
dml_rule_name	<p>If <code>include_dml</code> is <code>TRUE</code>, then this parameter contains the DML rule name.</p> <p>If <code>include_dml</code> is <code>FALSE</code>, then this parameter contains a <code>NULL</code>.</p>
ddl_rule_name	<p>If <code>include_ddl</code> is <code>TRUE</code>, then this parameter contains the DDL rule name.</p> <p>If <code>include_ddl</code> is <code>FALSE</code>, then this parameter contains a <code>NULL</code>.</p>

Table 233-7 (Cont.) ADD_SCHEMA_RULES Procedure Parameters

Parameter	Description
inclusion_rule	<p>If <code>inclusion_rule</code> is <code>TRUE</code>, then the procedure adds the rules to the positive rule set for the XStream client.</p> <p>If <code>inclusion_rule</code> is <code>FALSE</code>, then the procedure adds the rules to the negative rule set for the XStream client.</p> <p>In either case, the system creates the rule set if it does not exist.</p>
and_condition	<p>If non-NULL, appends the specified condition to the system-generated rule condition using an <code>AND</code> clause in the following way:</p> <pre>(system_condition) AND (and_condition)</pre> <p>The variable in the specified condition must be <code>:lcr</code>. For example, to specify that the schema rules generated by the procedure evaluate to <code>TRUE</code> only if the Oracle Replication tag is the hexadecimal equivalent of '02', specify the following condition:</p> <pre>:lcr.get_tag() = HEXTORAW('02')</pre> <p>The <code>:lcr</code> in the specified condition is converted to <code>:dml</code> or <code>:ddl</code>, depending on the rule that is being generated. If you are specifying an LCR member subprogram that is dependent on the LCR type (row or DDL), then make sure this procedure only generates the appropriate rule. Specifically, if you specify an LCR member subprogram that is valid only for row LCRs, then specify <code>TRUE</code> for the <code>include_dml</code> parameter and <code>FALSE</code> for the <code>include_ddl</code> parameter. If you specify an LCR member subprogram that is valid only for DDL LCRs, then specify <code>FALSE</code> for the <code>include_dml</code> parameter and <code>TRUE</code> for the <code>include_ddl</code> parameter.</p> <p>See Also: Logical Change Record TYPES</p>
source_root_name	<p>The global name of the root in the source CDB. For example, <code>mycdb.example.com</code>.</p> <p>If this parameter is <code>NULL</code>, then the global name of the root in the local CDB is used. If you are configuring downstream capture, then this parameter must be a non-NULL value, and it must specify the global name of the root in the remote source CDB. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>EXAMPLE.COM</code>, then the procedure specifies <code>DBS1.EXAMPLE.COM</code> automatically.</p> <p>Note: This parameter only applies to a CDB.</p>
source_container_name	<p>The short name of the source container. The container can be the root or a PDB. For example, <code>CDB\$ROOT</code> or <code>hrpdb</code>. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>Note: This parameter only applies to a CDB.</p>

Usage Notes

This procedure creates DML and DDL rules automatically based on `include_dml` and `include_ddl` parameter values, respectively. Each rule has a system-generated rule name that consists of the schema name with a sequence number appended to it. The sequence number is used to avoid naming conflicts. If the schema name plus the

sequence number is too long, then the schema name is truncated. A capture process or apply process uses the rules for filtering.

See Also:

- ["Operational Notes"](#)
- ["Security Model"](#)

Examples

The following is an example of a schema rule condition created for DML changes:

```
(:dml.get_object_owner() = 'HR') and :dml.is_null_tag() = 'Y'
and :dml.get_source_database_name() = 'DBS1.NET' )
```

233.4.7 ADD_SUBSET_OUTBOUND_RULES Procedure

This procedure adds subset rules to an outbound server configuration. Subset rules instruct the outbound server to stream out a subset of the changes to the specified tables. Outbound servers can stream out a subset of both rows and columns.

This procedure is overloaded. One `column_list` parameter is type `VARCHAR2` and the other `column_list` parameter is type `DBMS_UTILITY.LNAME_ARRAY`. These parameters enable you to enter the list of columns in different ways and are mutually exclusive.

Note:

This procedure does not add rules to the outbound server's capture process.

Syntax

```
DBMS_XSTREAM_ADM.ADD_SUBSET_OUTBOUND_RULES (
  server_name      IN VARCHAR2,
  table_name       IN VARCHAR2,
  condition        IN VARCHAR2  DEFAULT NULL,
  column_list      IN DBMS_UTILITY.LNAME_ARRAY,
  keep             IN BOOLEAN    DEFAULT TRUE,
  source_database  IN VARCHAR2  DEFAULT NULL);
```

```
DBMS_XSTREAM_ADM.ADD_SUBSET_OUTBOUND_RULES (
  server_name      IN VARCHAR2,
  table_name       IN VARCHAR2,
  condition        IN VARCHAR2  DEFAULT NULL,
  column_list      IN VARCHAR2  DEFAULT NULL,
  keep             IN BOOLEAN    DEFAULT TRUE,
  source_database  IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 233-8 ADD_SUBSET_OUTBOUND_RULES Procedure Parameters

Parameter	Description
<code>server_name</code>	The name of the outbound server to which rules are being added. Specify an existing outbound server. Do not specify an owner.
<code>table_name</code>	<p>The name of the table specified as <code>[schema_name.]object_name</code>. For example, you can specify <code>hr.employees</code>. If the schema is not specified, then the current user is the default.</p> <p>If the outbound server configuration uses a local capture process, then the table must exist at the local source database. If the outbound server configuration uses a downstream capture process, then the table must exist at both the source database and at the downstream capture database.</p> <p>The specified table cannot have any LOB, LONG, or LONG RAW columns currently or in the future.</p>
<code>condition</code>	<p>The subset condition. Specify this condition similar to the way you specify conditions in a WHERE clause in SQL.</p> <p>For example, to specify rows in the <code>hr.employees</code> table where the <code>salary</code> is greater than 4000 and the <code>job_id</code> is <code>SA_MAN</code>, enter the following as the condition:</p> <pre>' salary > 4000 and job_id = 'SA_MAN' '</pre> <p>If NULL, then the procedure raises an error.</p> <p>Note: The quotation marks in the preceding example are all single quotation marks.</p>
<code>column_list</code>	<p>The list of columns either to include in the outbound server configuration or to exclude from the outbound server configuration. Whether the columns are included or excluded depends on the setting for the <code>keep</code> parameter.</p> <p>The columns can be specified in the following ways:</p> <ul style="list-style-type: none"> Comma-delimited list of type <code>VARCHAR2</code>. A PL/SQL associative array of type <code>DBMS_UTILITY.LNAME_ARRAY</code>, where each element is the name of a column. Specify the first column in position 1. The last position must be NULL. <p>To include or exclude all of the columns in a table, specify each column in the table in the list or array.</p> <p>If NULL, then the procedure raises an error.</p>
<code>keep</code>	<p>If <code>TRUE</code>, then the columns specified in the <code>column_list</code> parameter are kept as part of the outbound server configuration. Therefore, changes to these columns that satisfy the condition in the <code>condition</code> parameter are streamed to the outbound server's client application.</p> <p>If <code>FALSE</code>, then the columns specified in the <code>column_list</code> parameter are excluded from the outbound server configuration. Therefore, changes to these columns are not streamed to the outbound server's client application.</p> <p>See Also: "Usage Notes"</p>

Table 233-8 (Cont.) ADD_SUBSET_OUTBOUND_RULES Procedure Parameters

Parameter	Description
source_datab ase	<p>The global name of the container where the specified <code>table_names</code> and <code>schema_names</code> are located.</p> <p>If non-NULL, then a condition is added to the outbound server's rules to filter the LCRs based on the global name of the source database. If NULL, then the procedure does not add a condition regarding the source database to the generated rules.</p> <p>In a CDB, specify the global name of the container to which the rules pertain. The container can be the root or a PDB. For example, <code>mycdb.example.com</code> or <code>hrpdb.example.com</code>. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>EXAMPLE.COM</code>, then the procedure specifies <code>DBS1.EXAMPLE.COM</code> automatically.</p>

Usage Notes

When the `keep` parameter is set to `TRUE`, this procedure creates a keep columns declarative rule-based transformation for the columns listed in `column_list`.

When the `keep` parameter is set to `FALSE`, this procedure creates a delete column declarative rule-based transformation for each column listed in `column_list`.



See Also:

Oracle Database XStream Guide for information about declarative rule-based transformations

233.4.8 ADD_SUBSET_PROPAGATION_RULES Procedure

This procedure adds propagation rules that propagate the logical change records (LCRs) related to a subset of the rows in the specified table in a source queue to a destination queue, and creates the specified propagation if it does not exist.

This procedure is overloaded. One version of this procedure contains three `OUT` parameters, and the other does not.

Syntax

```
DBMS_XSTREAM_ADM.ADD_SUBSET_PROPAGATION_RULES (
  table_name          IN   VARCHAR2,
  dml_condition       IN   VARCHAR2,
  streams_name        IN   VARCHAR2  DEFAULT NULL,
  source_queue_name   IN   VARCHAR2,
  destination_queue_name IN  VARCHAR2,
  include_tagged_lcr  IN   BOOLEAN   DEFAULT FALSE,
  source_database     IN   VARCHAR2  DEFAULT NULL,
  insert_rule_name    OUT  VARCHAR2,
  update_rule_name    OUT  VARCHAR2,
```

```

delete_rule_name      OUT  VARCHAR2,
queue_to_queue        IN   BOOLEAN   DEFAULT NULL);

DBMS_XSTREAM_ADM.ADD_SUBSET_PROPAGATION_RULES (
  table_name           IN   VARCHAR2,
  dml_condition         IN   VARCHAR2,
  streams_name         IN   VARCHAR2   DEFAULT NULL,
  source_queue_name    IN   VARCHAR2,
  destination_queue_name IN  VARCHAR2,
  include_tagged_lcr   IN   BOOLEAN   DEFAULT FALSE,
  source_database      IN   VARCHAR2   DEFAULT NULL,
  queue_to_queue       IN   BOOLEAN   DEFAULT NULL);

```

Parameters

Table 233-9 ADD_SUBSET_PROPAGATION_RULES Procedure Parameters

Parameter	Description
table_name	<p>The name of the table specified as <code>[schema_name.]object_name</code>. For example, <code>hr.employees</code>. If the schema is not specified, then the current user is the default.</p> <p>The specified table must exist in the same database as the propagation. Also, the specified table cannot have any LOB, LONG, LONG RAW, or XMLType columns currently or in the future.</p>
dml_condition	<p>The subset condition. Specify this condition similar to the way you specify conditions in a WHERE clause in SQL.</p> <p>For example, to specify rows in the <code>hr.employees</code> table where the <code>salary</code> is greater than 4000 and the <code>job_id</code> is <code>SA_MAN</code>, enter the following as the condition:</p> <pre>' salary > 4000 and job_id = 'SA_MAN' '</pre> <p>Note: The quotation marks in the preceding example are all single quotation marks.</p>
streams_name	<p>The name of the propagation. Do not specify an owner.</p> <p>If the specified propagation does not exist, then the procedure creates it automatically.</p> <p>If <code>NULL</code> and a propagation exists for the same source queue and destination queue (including database link), then the procedure uses this propagation.</p> <p>If <code>NULL</code> and no propagation exists for the same source queue and destination queue (including database link), then the procedure creates a propagation automatically with a system-generated name.</p>
source_queue_name	<p>The name of the source queue, specified as <code>[schema_name.]queue_name</code>. The current database must contain the source queue, and the queue must be ANYDATA type.</p> <p>For example, to specify a source queue named <code>streams_queue</code> in the <code>strmadmin</code> schema, enter <code>strmadmin.streams_queue</code> for this parameter.</p> <p>If the schema is not specified, then the current user is the default.</p>

Table 233-9 (Cont.) ADD_SUBSET_PROPAGATION_RULES Procedure Parameters

Parameter	Description
<code>destination_queue_name</code>	<p>The name of the destination queue, including a database link, specified as <code>[schema_name.]queue_name[@dblink_name]</code>, if the destination queue is in a remote database. The queue must be ANYDATA type.</p> <p>For example, to specify a destination queue named <code>streams_queue</code> in the <code>strmadmin</code> schema and use a database link named <code>dbs2.net</code>, enter <code>strmadmin.streams_queue@dbs2.net</code> for this parameter.</p> <p>If the schema is not specified, then the current user is the default.</p> <p>If the database link is omitted, then the procedure uses the global name of the current database, and the source queue and destination queue must be in the same database.</p> <p>Note: Connection qualifiers are not allowed.</p>
<code>include_tagged_lcr</code>	<p>If <code>TRUE</code>, then an LCR is always considered for propagation, regardless of whether it has a non-NULL tag. This setting is appropriate for a full (for example, standby) copy of a database.</p> <p>If <code>FALSE</code>, then an LCR is considered for propagation only when the LCR contains a NULL tag. A setting of <code>FALSE</code> is often specified in update-anywhere configurations to avoid sending a change back to its source database.</p>
<code>source_database</code>	<p>The global name of the source database. The source database is where the change originated. If <code>NULL</code>, then the procedure does not add a condition regarding the source database to the generated rules.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>.NET</code>, then the procedure specifies <code>DBS1.NET</code> automatically.</p> <p>Oracle recommends that you specify a source database for propagation rules.</p>
<code>insert_rule_name</code>	<p>Contains the system-generated <code>INSERT</code> rule name. This rule handles inserts and updates that must be converted into inserts.</p>
<code>update_rule_name</code>	<p>Contains the system-generated <code>UPDATE</code> rule name. This rule handles updates that remain updates.</p>
<code>delete_rule_name</code>	<p>Contains the system-generated <code>DELETE</code> rule name. This rule handles deletes and updates that must be converted into deletes</p>

Table 233-9 (Cont.) ADD_SUBSET_PROPAGATION_RULES Procedure Parameters

Parameter	Description
queue_to_queue	<p>If TRUE or NULL, then a new propagation created by this procedure is a queue to queue propagation. A queue-to-queue propagation always has its own propagation job and uses a service for automatic failover when the destination queue is a buffered queue in an Oracle Real Application Clusters (Oracle RAC) database.</p> <p>If FALSE, then a new propagation created by this procedure is a queue-to-dblink propagation. A queue-to-dblink propagation can share a propagation job with other propagations that use the same database link and does not support automatic failover in an Oracle RAC environment.</p> <p>This procedure cannot change the queue to queue property of an exiting propagation. If the specified propagation exists, then the procedure behaves in the following way for each setting:</p> <ul style="list-style-type: none"> • If TRUE and the specified propagation is not a queue to queue propagation, then the procedure raises an error. • If FALSE and the specified propagation is a queue to queue propagation, then the procedure raises an error. • If NULL, then the procedure does not change the queue to queue property of the propagation.

Usage Notes

This procedure configures propagation using the current user. Only one propagation is allowed between a particular source queue and destination queue.

Running this procedure generates three rules for the specified propagation: one for **INSERT** statements, one for **UPDATE** statements, and one for **DELETE** statements. For **INSERT** and **DELETE** statements, only row LCRs that satisfy the condition specified for the `dml_condition` parameter are propagated. For **UPDATE** statements, the following variations are possible:

- If both the new and old values in a row LCR satisfy the specified `dml_condition`, then the row LCR is propagated without any changes.
- If neither the new or old values in a row LCR satisfy the specified `dml_condition`, then the row LCR is not propagated.
- If the old values for a row LCR satisfy the specified `dml_condition`, but the new values do not, then the update row LCR is converted into a delete row LCR.
- If the new values for a row LCR satisfy the specified `dml_condition`, but the old values do not, then the update row LCR is converted to an insert row LCR.

When an update is converted into an insert or a delete, it is called row migration.

A propagation uses the rules for filtering. If the propagation does not have a positive rule set, then the procedure creates a positive rule set automatically, and the rules for propagating changes to the table are added to the positive rule set. A subset rule can be added to positive rule set only, not to a negative rule set. Other rules in an existing positive rule set for the propagation are not affected. Additional rules can be added using either the `DBMS_XSTREAM_ADM` package or the `DBMS_RULE_ADM` package.

Rules for INSERT, UPDATE, and DELETE statements are created automatically when you run this procedure, and these rules are given a system-generated rule name. Each rule has a system-generated rule name that consists of the table name with a sequence number appended to it. The sequence number is used to avoid naming conflicts. If the table name plus the sequence number is too long, then the table name is truncated. The ADD_SUBSET_RULES procedure is overloaded, and the system-generated rule names for INSERT, UPDATE, and DELETE statements are returned.

When you create propagation subset rules for a table, you should create an unconditional supplemental log group at the source database with all the columns in the table. Supplemental logging is required if an update must be converted to an insert. The propagation rule must have all the column values to be able to perform this conversion correctly.

Note:

Subset rules should only reside in positive rule sets. You should not add subset rules to negative rule sets. Doing so might have unpredictable results because row migration would not be performed on LCRs that are not discarded by the negative rule set.

Examples

The following is an example of a rule condition created for filtering a row LCR containing an update operation when the dml_condition is region_id = 2, the table_name is hr.regions, and the source_database is dbs1.net:

```
:dml.get_object_owner()='HR' AND :dml.get_object_name()='REGIONS'
AND :dml.is_null_tag()='Y' AND :dml.get_source_database_name()='DBS1.NET'
AND :dml.get_command_type()='UPDATE'
AND (:dml.get_value('NEW','"REGION_ID"') IS NOT NULL)
AND (:dml.get_value('OLD','"REGION_ID"') IS NOT NULL)
AND (:dml.get_value('OLD','"REGION_ID"').AccessNumber()=2)
AND (:dml.get_value('NEW','"REGION_ID"').AccessNumber()=2)
```

233.4.9 ADD_SUBSET_RULES Procedure

This procedure adds rules to an XStream client.

It adds rules to a rule set of one of the following types of XStream clients:

- When the streams_type parameter is set to capture, this procedure adds capture process rules for capturing changes to a subset of rows in a specified table.
This procedure creates the specified capture process if it does not exist.
- When the streams_type parameter is set to apply and the streams_name parameter specifies the name of an apply process, outbound server, or inbound server, this procedure adds apply rules for applying logical change records (LCRs) that contain changes to a subset of rows in a specified table. The rules can specify that the LCRs must be from a particular source database.

This procedure creates an apply process if no apply process, outbound server, or inbound server exists with the specified streams_name. This procedure can add rules to

an outbound server or inbound server, but it cannot create an outbound server or inbound server.

This procedure is overloaded. One version of this procedure contains three OUT parameters, and the other does not.

Syntax

```
DBMS_XSTREAM_ADM.ADD_SUBSET_RULES (
    table_name          IN   VARCHAR2,
    dml_condition       IN   VARCHAR2,
    streams_type        IN   VARCHAR2 DEFAULT 'apply',
    streams_name        IN   VARCHAR2 DEFAULT NULL,
    queue_name          IN   VARCHAR2 DEFAULT 'streams_queue',
    include_tagged_lcr  IN   BOOLEAN  DEFAULT FALSE,
    source_database     IN   VARCHAR2 DEFAULT NULL,
    insert_rule_name    OUT  VARCHAR2,
    update_rule_name    OUT  VARCHAR2,
    delete_rule_name   OUT  VARCHAR2,
    source_root_name    IN   VARCHAR2  DEFAULT NULL,
    source_container_name IN VARCHAR2  DEFAULT NULL);
```

```
DBMS_XSTREAM_ADM.ADD_SUBSET_RULES (
    table_name          IN   VARCHAR2,
    dml_condition       IN   VARCHAR2,
    streams_type        IN   VARCHAR2 DEFAULT 'apply',
    streams_name        IN   VARCHAR2 DEFAULT NULL,
    queue_name          IN   VARCHAR2 DEFAULT 'streams_queue',
    include_tagged_lcr  IN   BOOLEAN  DEFAULT FALSE,
    source_database     IN   VARCHAR2 DEFAULT NULL,
    source_root_name    IN   VARCHAR2  DEFAULT NULL,
    source_container_name IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 233-10 ADD_SUBSET_RULES Procedure Parameters

Parameter	Description
table_name	The name of the table specified as <code>[schema_name.]object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default. The specified table must exist in the same database as the capture process or apply process. Also, the specified table cannot have any LOB, LONG, LONG RAW, or XMLType columns currently or in the future.
dml_condition	The subset condition. Specify this condition similar to the way you specify conditions in a WHERE clause in SQL. For example, to specify rows in the <code>hr.employees</code> table where the salary is greater than 4000 and the <code>job_id</code> is <code>SA_MAN</code> , enter the following as the condition: <code>' salary > 4000 and job_id = 'SA_MAN' '</code> Note: The quotation marks in the preceding example are all single quotation marks.
streams_type	The type of XStream client: <ul style="list-style-type: none"> Specify capture for a capture process. Specify apply for an apply process.

Table 233-10 (Cont.) ADD_SUBSET_RULES Procedure Parameters

Parameter	Description
streams_name	<p>The name of the capture process or apply process. Do not specify an owner.</p> <p>If <code>NULL</code>, if <code>streams_type</code> is <code>capture</code>, and if one relevant capture process for the queue exists, then the procedure uses the relevant XStream client. If no relevant XStream client exists for the queue, then the procedure creates an XStream client automatically with a system-generated name. If <code>NULL</code> and multiple XStream clients of the specified <code>streams_type</code> for the queue exist, then the procedure raises an error.</p> <p>If <code>NULL</code>, if <code>streams_type</code> is <code>apply</code>, and if one relevant apply process exists, then the procedure uses the relevant apply process. The relevant apply process is identified in one of the following ways:</p> <ul style="list-style-type: none"> • If one existing apply process has the source database specified in <code>source_database</code> and uses the queue specified in <code>queue_name</code>, then the procedure uses this apply process. • If <code>source_database</code> is <code>NULL</code> and one existing apply process is using the queue specified in <code>queue_name</code>, then the procedure uses this apply process. <p>If <code>NULL</code> and no relevant apply process exists, then the procedure creates an apply process automatically with a system-generated name.</p> <p>If <code>NULL</code> and multiple relevant apply processes exist, then the procedure raises an error.</p> <p>Each apply process must have a unique name.</p>
queue_name	<p>The name of the local queue, specified as <code>[schema_name.]queue_name</code>. The current database must contain the queue, and the queue must be <code>ANYDATA</code> type.</p> <p>For example, to specify a queue named <code>streams_queue</code> in the <code>strmadmin</code> schema, enter <code>strmadmin.streams_queue</code> for this parameter. If the schema is not specified, then the current user is the default.</p> <p>For capture process rules, this is the queue into which a capture process enqueues LCRs. For outbound server rules, this is the queue from which the outbound server dequeues LCRs. For inbound server rules, this is the queue into which an inbound server enqueues error transactions.</p>

Table 233-10 (Cont.) ADD_SUBSET_RULES Procedure Parameters

Parameter	Description
include_tagged_lcr	<p>If TRUE, then the XStream client performs its action regardless of the tag:</p> <ul style="list-style-type: none"> • A redo entry is always considered for capture by a capture process, regardless of whether the redo entry has a non-NULL tag. • An LCR is always considered for apply by an apply process, regardless of whether redo entry or LCR has a non-NULL tag. <p>If FALSE, then an XStream client performs its action only when the tag is NULL:</p> <ul style="list-style-type: none"> • A redo entry is considered for capture by a capture process only when the redo entry contains a NULL tag. • An LCR is considered for apply by an apply process only if the LCR contains a NULL tag. <p>A setting of FALSE is often specified in update-anywhere configurations to avoid sending a change back to its source database.</p>
source_database	<p>The global name of the source database. If NULL, then the procedure does not add a condition regarding the source database to the generated rules.</p> <p>For capture process rules, specify NULL or the global name of the local database if you are creating a capture process locally at the source database. If you are adding rules to a downstream capture process rule set at a downstream database, then specify the source database of the changes that will be captured.</p> <p>For apply process rules, specify the source database of the changes that will be applied by the apply process. The source database is the database where the changes originated. If an apply process applies captured LCRs, then the apply process can apply LCRs from only one capture process at one source database.</p> <p>In a CDB, specify the global name of the container to which the rules pertain. The container can be the root or a PDB. For example, <code>mycdb.example.com</code> or <code>hrpdb.example.com</code>. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>.NET</code>, then the procedure specifies <code>DBS1.NET</code> automatically.</p>
insert_rule_name	Contains the system-generated INSERT rule name. This rule handles inserts and updates that must be converted into inserts.
update_rule_name	Contains the system-generated UPDATE rule name. This rule handles updates that remain updates.
delete_rule_name	Contains the system-generated DELETE rule name. This rule handles deletes and updates that must be converted into deletes

Table 233-10 (Cont.) ADD_SUBSET_RULES Procedure Parameters

Parameter	Description
source_root_name	<p>The global name of the root in the source CDB. For example, mycdb.example.com.</p> <p>If this parameter is NULL, then the global name of the root in the local CDB is used. If you are configuring downstream capture, then this parameter must be a non-NULL value, and it must specify the global name of the root in the remote source CDB. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify DBS1 and the domain is EXAMPLE.COM, then the procedure specifies DBS1.EXAMPLE.COM automatically.</p> <p>Note: This parameter only applies to a CDB.</p>
source_container_name	<p>The short name of the source container. The container can be the root or a PDB. For example, CDB\$ROOT or hrpdb. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>Note: This parameter only applies to a CDB.</p>

Usage Notes

Running this procedure generates three rules for the specified capture process or apply process: one for INSERT statements, one for UPDATE statements, and one for DELETE statements. For INSERT and DELETE statements, only DML changes that satisfy the condition specified for the dml_condition parameter are captured or applied. For UPDATE statements, the following variations are possible:

- If both the new and old values in a DML change satisfy the specified dml_condition, then the DML change is captured or applied without any changes.
- If neither the new or old values in a DML change satisfy the specified dml_condition, then the DML change is not captured or applied.
- If the old values for a DML change satisfy the specified dml_condition, but the new values do not, then the DML change is converted into a delete.
- If the new values for a DML change satisfy the specified dml_condition, but the old values do not, then the DML change is converted to an insert.

When an update is converted into an insert or a delete, it is called row migration.

A capture process or apply process uses the rules for filtering. If the XStream client does not have a positive rule set, then this procedure creates a positive rule set automatically, and adds the rules for the table to the positive rule set. A subset rule can be added to positive rule set only, not to a negative rule set. Other rules in an existing rule set for the process are not affected. Additional rules can be added using either the DBMS_XSTREAM_ADM package or the DBMS_RULE_ADM package.

Rules for INSERT, UPDATE, and DELETE statements are created automatically when you run this procedure, and these rules are given a system-generated rule name. Each rule has a system-generated rule name that consists of the table name with a sequence number appended to it. The sequence number is used to avoid naming conflicts. If the table name

plus the sequence number is too long, then the table name is truncated. The `ADD_SUBSET_RULES` procedure is overloaded, and the system-generated rule names for `INSERT`, `UPDATE`, and `DELETE` statements are returned.

 **Note:**

Subset rules should only reside in positive rule sets. You should not add subset rules to negative rule sets. Doing so might have unpredictable results because row migration would not be performed on LCRs that are not discarded by the negative rule set.

Examples

The following is an example of a rule condition created for filtering DML changes containing an update operation when the `dml_condition` is `region_id = 2`, the `table_name` is `hr.regions`, and the `source_database` is `dbs1.net`:

```
:dml.get_object_owner()='HR' AND :dml.get_object_name()='REGIONS'
AND :dml.is_null_tag()='Y' AND :dml.get_source_database_name()='DBS1.NET'
AND :dml.get_command_type()='UPDATE'
AND (:dml.get_value('NEW','REGION_ID') IS NOT NULL)
AND (:dml.get_value('OLD','REGION_ID') IS NOT NULL)
AND (:dml.get_value('OLD','REGION_ID').AccessNumber()=2)
AND (:dml.get_value('NEW','REGION_ID').AccessNumber()=2)
```

233.4.10 ADD_TABLE_PROPAGATION_RULES Procedure

This procedure adds table rules to the positive rule set for a propagation, or adds table rules to the negative rule set for a propagation, and creates the specified propagation if it does not exist.

This procedure is overloaded. One version of this procedure contains two `OUT` parameters, and the other does not.

Syntax

```
DBMS_XSTREAM_ADM.ADD_TABLE_PROPAGATION_RULES (
    table_name          IN   VARCHAR2,
    streams_name        IN   VARCHAR2  DEFAULT NULL,
    source_queue_name   IN   VARCHAR2,
    destination_queue_name IN  VARCHAR2,
    include_dml         IN   BOOLEAN  DEFAULT TRUE,
    include_ddl         IN   BOOLEAN  DEFAULT FALSE,
    include_tagged_lcr  IN   BOOLEAN  DEFAULT FALSE,
    source_database     IN   VARCHAR2  DEFAULT NULL,
    dml_rule_name       OUT  VARCHAR2,
    ddl_rule_name       OUT  VARCHAR2,
    inclusion_rule      IN   BOOLEAN  DEFAULT TRUE,
    and_condition       IN   VARCHAR2  DEFAULT NULL,
    queue_to_queue      IN   BOOLEAN  DEFAULT NULL);
```

```
DBMS_XSTREAM_ADM.ADD_TABLE_PROPAGATION_RULES (
    table_name          IN   VARCHAR2,
    streams_name        IN   VARCHAR2  DEFAULT NULL,
    source_queue_name   IN   VARCHAR2,
    destination_queue_name IN  VARCHAR2,
```

```

include_dml          IN  BOOLEAN  DEFAULT TRUE,
include_ddl          IN  BOOLEAN  DEFAULT FALSE,
include_tagged_lcr   IN  BOOLEAN  DEFAULT FALSE,
source_database      IN  VARCHAR2  DEFAULT NULL,
inclusion_rule        IN  BOOLEAN  DEFAULT TRUE,
and_condition        IN  VARCHAR2  DEFAULT NULL,
queue_to_queue      IN  BOOLEAN  DEFAULT NULL);

```

Parameters

Table 233-11 ADD_TABLE_PROPAGATION_RULES Procedure Parameters

Parameter	Description
table_name	The name of the table specified as <code>[schema_name.]table_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default.
streams_name	The name of the propagation. Do not specify an owner. If the specified propagation does not exist, then the procedure creates it automatically. If NULL and a propagation exists for the same source queue and destination queue (including database link), then the procedure uses this propagation. If NULL and no propagation exists for the same source queue and destination queue (including database link), then the procedure creates a propagation automatically with a system-generated name.
source_queue_name	The name of the source queue, specified as <code>[schema_name.]queue_name</code> . The current database must contain the source queue, and the queue must be ANYDATA type. For example, to specify a source queue named <code>streams_queue</code> in the <code>strmadmin</code> schema, enter <code>strmadmin.streams_queue</code> for this parameter. If the schema is not specified, then the current user is the default.
destination_queue_name	The name of the destination queue, including a database link, specified as <code>[schema_name.]queue_name[@dblink_name]</code> , if the destination queue is in a remote database. The queue must be ANYDATA type. For example, to specify a destination queue named <code>streams_queue</code> in the <code>strmadmin</code> schema and use a database link named <code>dbs2.net</code> , enter <code>strmadmin.streams_queue@dbs2.net</code> for this parameter. If the schema is not specified, then the current user is the default. If the database link is omitted, then the procedure uses the global name of the current database, and the source queue and destination queue must be in the same database. Note: Connection qualifiers are not allowed.
include_dml	If TRUE, then the procedure creates a rule for DML changes. If FALSE, then the procedure does not create a DML rule. NULL is not permitted.

Table 233-11 (Cont.) ADD_TABLE_PROPAGATION_RULES Procedure Parameters

Parameter	Description
include_ddl	<p>If TRUE, then the procedure creates a rule for DDL changes. If FALSE, then the procedure does not create a DDL rule. NULL is not permitted.</p> <p>The generated rule evaluates to TRUE for any DDL change that operates on the table or on an object that is part of the table, such as an index or trigger on the table. The rule evaluates to FALSE for any DDL change that either does not refer to the table or refers to the table in a subordinate way. For example, the rule evaluates to FALSE for changes that create synonyms or views based on the table. The rule also evaluates to FALSE for a change to a PL/SQL subprogram that refers to the table.</p>
include_tagged_lcr	<p>If TRUE, then the procedure does not add a condition regarding Oracle Replication tags to the generated rules. Therefore, these rules can evaluate to TRUE regardless of whether a logical change record (LCR) has a non-NULL tag. If the rules are added to the positive rule set for the propagation, then an LCR is always considered for propagation, regardless of whether it has a non-NULL tag. If the rules are added to a positive rule set, then setting this parameter to TRUE is appropriate for a full (for example, standby) copy of a database. If the rules are added to the negative rule set for the propagation, then whether an LCR is discarded does not depend on the tag for the LCR.</p> <p>If FALSE, then the procedure adds a condition to each generated rule that causes the rule to evaluate to TRUE only if an LCR has a NULL Oracle Replication tag. If the rules are added to the positive rule set for the propagation, then an LCR is considered for propagation only when the LCR contains a NULL tag. If the rules are added to a positive rule set, then setting this parameter to FALSE might be appropriate in update-anywhere configurations to avoid sending a change back to its source database. If the rules are added to the negative rule set for the propagation, then an LCR can be discarded only if it has a NULL tag.</p> <p>Usually, specify TRUE for this parameter if the <code>inclusion_rule</code> parameter is set to FALSE.</p>
source_database	<p>The global name of the source database. The source database is where the change originated. If NULL, then the procedure does not add a condition regarding the source database to the generated rules.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>.NET</code>, then the procedure specifies <code>DBS1.NET</code> automatically.</p> <p>Oracle recommends that you specify a source database for propagation rules.</p>
dml_rule_name	<p>If <code>include_dml</code> is TRUE, then this parameter contains the DML rule name.</p> <p>If <code>include_dml</code> is FALSE, then this parameter contains a NULL.</p>

Table 233-11 (Cont.) ADD_TABLE_PROPAGATION_RULES Procedure Parameters

Parameter	Description
ddl_rule_name	<p>If <code>include_ddl</code> is <code>TRUE</code>, then this parameter contains the DDL rule name.</p> <p>If <code>include_ddl</code> is <code>FALSE</code>, then this parameter contains a <code>NULL</code>.</p>
inclusion_rule	<p>If <code>inclusion_rule</code> is <code>TRUE</code>, then the procedure adds the rules to the positive rule set for the propagation.</p> <p>If <code>inclusion_rule</code> is <code>FALSE</code>, then the procedure adds the rules to the negative rule set for the propagation.</p> <p>In either case, the system creates the rule set if it does not exist.</p>
and_condition	<p>If non-<code>NULL</code>, appends the specified condition to the system-generated rule condition using an <code>AND</code> clause in the following way:</p> <pre>(system_condition) AND (and_condition)</pre> <p>The variable in the specified condition must be <code>:lcr</code>. For example, to specify that the table rules generated by the procedure evaluate to <code>TRUE</code> only if the Oracle Replication tag is the hexadecimal equivalent of '02', specify the following condition:</p> <pre>:lcr.get_tag() = HEXTORAW('02')</pre> <p>The <code>:lcr</code> in the specified condition is converted to <code>:dml</code> or <code>:ddl</code>, depending on the rule that is being generated. If you are specifying an LCR member subprogram that is dependent on the LCR type (row or DDL), then make sure this procedure only generates the appropriate rule.</p> <p>Specifically, if you specify an LCR member subprogram that is valid only for row LCRs, then specify <code>TRUE</code> for the <code>include_dml</code> parameter and <code>FALSE</code> for the <code>include_ddl</code> parameter. If you specify an LCR member subprogram that is valid only for DDL LCRs, then specify <code>FALSE</code> for the <code>include_dml</code> parameter and <code>TRUE</code> for the <code>include_ddl</code> parameter.</p> <p>See Also: Logical Change Record TYPES</p>
queue_to_queue	<p>If <code>TRUE</code> or <code>NULL</code>, then a new propagation created by this procedure is a queue to queue propagation. A queue-to-queue propagation always has its own propagation job and uses a service for automatic failover when the destination queue is a buffered queue in an Oracle Real Application Clusters (Oracle RAC) database.</p> <p>If <code>FALSE</code>, then a new propagation created by this procedure is a queue-to-dblink propagation. A queue-to-dblink propagation can share a propagation job with other propagations that use the same database link and does not support automatic failover in an Oracle RAC environment.</p> <p>This procedure cannot change the queue to queue property of an exiting propagation. If the specified propagation exists, then the procedure behaves in the following way for each setting:</p> <ul style="list-style-type: none"> • If <code>TRUE</code> and the specified propagation is not a queue to queue propagation, then the procedure raises an error. • If <code>FALSE</code> and the specified propagation is a queue to queue propagation, then the procedure raises an error. • If <code>NULL</code>, then the procedure does not change the queue to queue property of the propagation.

Usage Notes

This procedure configures propagation using the current user. Only one propagation is allowed between a particular source queue and destination queue.

This procedure creates DML and DDL rules automatically based on `include_dml` and `include_ddl` parameter values, respectively. Each rule has a system-generated rule name that consists of the table name with a sequence number appended to it. The sequence number is used to avoid naming conflicts. If the table name plus the sequence number is too long, then the table name is truncated. A propagation uses the rules for filtering.

Examples

The following is an example of a table rule condition created for filtering DML statements:

```
((:dml.get_object_owner() = 'HR' and :dml.get_object_name() = 'LOCATIONS'))
and :dml.is_null_tag() = 'Y' and :dml.get_source_database_name() = 'DBS1.NET' )
```

233.4.11 ADD_TABLE_RULES Procedure

This procedure adds rules to an XStream client rule set.

It adds rules to a rule set of one of the following types of XStream clients:

- When the `streams_type` parameter is set to `capture`, this procedure adds capture process rules for capturing changes to a specified table.
 This procedure creates the specified capture process if it does not exist.
- When the `streams_type` parameter is set to `apply` and the `streams_name` parameter specifies the name of an apply process, outbound server, or inbound server, this procedure adds apply rules for applying logical change records (LCRs) that contain changes to a specified table. The rules can specify that the LCRs must be from a particular source database.

This procedure creates an apply process if no apply process, outbound server, or inbound server exists with the specified `streams_name`. This procedure can add rules to an outbound server or inbound server, but it cannot create an outbound server or inbound server.

This procedure is overloaded. One version of this procedure contains two `OUT` parameters, and the other does not.

Syntax

```
DBMS_XSTREAM_ADM.ADD_TABLE_RULES (
  table_name          IN   VARCHAR2,
  streams_type        IN   VARCHAR2,
  streams_name        IN   VARCHAR2 DEFAULT NULL,
  queue_name          IN   VARCHAR2 DEFAULT 'streams_queue',
  include_dml         IN   BOOLEAN  DEFAULT TRUE,
  include_ddl         IN   BOOLEAN  DEFAULT FALSE,
  include_tagged_lcr  IN   BOOLEAN  DEFAULT FALSE,
  source_database     IN   VARCHAR2 DEFAULT NULL,
  dml_rule_name       OUT  VARCHAR2,
  ddl_rule_name       OUT  VARCHAR2,
  inclusion_rule      IN   BOOLEAN  DEFAULT TRUE,
```

```

and_condition          IN   VARCHAR2  DEFAULT NULL,
source_root_name       IN   VARCHAR2  DEFAULT NULL,
source_container_name  IN   VARCHAR2  DEFAULT NULL);

DBMS_XSTREAM_ADM.ADD_TABLE_RULES (
  table_name           IN   VARCHAR2,
  streams_type         IN   VARCHAR2,
  streams_name         IN   VARCHAR2  DEFAULT NULL,
  queue_name           IN   VARCHAR2  DEFAULT 'streams_queue',
  include_dml          IN   BOOLEAN   DEFAULT TRUE,
  include_ddl          IN   BOOLEAN   DEFAULT FALSE,
  include_tagged_lcr   IN   BOOLEAN   DEFAULT FALSE,
  source_database      IN   VARCHAR2  DEFAULT NULL,
  inclusion_rule       IN   BOOLEAN   DEFAULT TRUE,
  and_condition        IN   VARCHAR2  DEFAULT NULL,
  source_root_name     IN   VARCHAR2  DEFAULT NULL,
  source_container_name IN   VARCHAR2  DEFAULT NULL);

```

Parameters

Table 233-12 ADD_TABLE_RULES Procedure Parameters

Parameter	Description
table_name	<p>The name of the table specified as <i>[schema_name.]object_name</i>. For example, <i>hr.employees</i>. If the schema is not specified, then the current user is the default.</p> <p>You can specify a table that does not yet exist, because Oracle Replication does not validate the existence of the table.</p>
streams_type	<p>The type of XStream client:</p> <ul style="list-style-type: none"> Specify <i>capture</i> for a capture process. Specify <i>apply</i> for an apply process.
streams_name	<p>The name of the capture process or apply process. Do not specify an owner.</p> <p>If <i>NULL</i>, if <i>streams_type</i> is <i>capture</i>, and if one relevant capture process for the queue exists, then the procedure uses the relevant XStream client. If no relevant XStream client exists for the queue, then the procedure creates an XStream client automatically with a system-generated name. If <i>NULL</i> and multiple XStream clients of the specified <i>streams_type</i> for the queue exist, then the procedure raises an error.</p> <p>If <i>NULL</i>, if <i>streams_type</i> is <i>apply</i>, and if one relevant apply process exists, then the procedure uses the relevant apply process. The relevant apply process is identified in one of the following ways:</p> <ul style="list-style-type: none"> If one existing apply process has the source database specified in <i>source_database</i> and uses the queue specified in <i>queue_name</i>, then the procedure uses this apply process. If <i>source_database</i> is <i>NULL</i> and one existing apply process is using the queue specified in <i>queue_name</i>, then the procedure uses this apply process. <p>If <i>NULL</i> and no relevant apply process exists, then the procedure creates an apply process automatically with a system-generated name.</p> <p>If <i>NULL</i> and multiple relevant apply processes exist, then the procedure raises an error.</p> <p>Each apply process must have a unique name.</p>

Table 233-12 (Cont.) ADD_TABLE_RULES Procedure Parameters

Parameter	Description
queue_name	<p>The name of the local queue, specified as <code>[schema_name.]queue_name</code>. The current database must contain the queue, and the queue must be <code>ANYDATA</code> type.</p> <p>For example, to specify a queue named <code>streams_queue</code> in the <code>strmadmin</code> schema, enter <code>strmadmin.streams_queue</code> for this parameter. If the schema is not specified, then the current user is the default.</p> <p>For capture process rules, this is the queue into which a capture process enqueues LCRs. For outbound server rules, this is the queue from which the outbound server dequeues LCRs. For inbound server rules, this is the queue into which an inbound server enqueues error transactions.</p>
include_dml	<p>If <code>TRUE</code>, then the procedure creates a DML rule for DML changes. If <code>FALSE</code>, then the procedure does not create a DML rule. <code>NULL</code> is not permitted.</p>
include_ddl	<p>If <code>TRUE</code>, then the procedure creates a DDL rule for DDL changes. If <code>FALSE</code>, then the procedure does not create a DDL rule. <code>NULL</code> is not permitted.</p> <p>The generated rule evaluates to <code>TRUE</code> for any DDL change that operates on the table or on an object that is part of the table, such as an index or trigger on the table. The rule evaluates to <code>FALSE</code> for any DDL change that either does not refer to the table or refers to the table in a subordinate way. For example, the rule evaluates to <code>FALSE</code> for changes that create synonyms or views based on the table. The rule also evaluates to <code>FALSE</code> for a change to a PL/SQL subprogram that refers to the table.</p>

Table 233-12 (Cont.) ADD_TABLE_RULES Procedure Parameters

Parameter	Description
include_tagged_lcr	<p>If TRUE, then the procedure does not add a condition regarding Oracle Replication tags to the generated rules. Therefore, these rules can evaluate to TRUE regardless of whether a redo entry, session, or LCR has a non-NULL tag. If the rules are added to the positive rule set for the XStream client, then the XStream client performs its action regardless of the tag:</p> <ul style="list-style-type: none">• A redo entry is always considered for capture by a capture process, regardless of whether the redo entry has a non-NULL tag.• An LCR is always considered for apply by an apply process, regardless of whether redo entry or LCR has a non-NULL tag. <p>If the rules are added to a positive rule set, then setting this parameter to TRUE is appropriate for a full (for example, standby) copy of a database. If the rules are added to the negative rule set for the XStream client, then whether a database change is discarded does not depend on the tag.</p> <p>If FALSE, then the procedure adds a condition to each generated rule that causes the rule to evaluate to TRUE only if a redo entry, session, or LCR has a NULL Oracle Replication tag. If the rules are added to the positive rule set for an XStream client, then the XStream client performs its action only when the tag is NULL:</p> <ul style="list-style-type: none">• A redo entry is considered for capture by a capture process only when the redo entry contains a NULL tag.• An LCR is considered for apply by an apply process only if the LCR contains a NULL tag. <p>If the rules are added to a positive rule set, then setting this parameter to FALSE might be appropriate in update-anywhere configurations to avoid sending a change back to its source database. If the rules are added to the negative rule set for the XStream client, then a database change can be discarded only if it has a NULL tag.</p> <p>A setting of FALSE is often specified in update-anywhere configurations to avoid sending a change back to its source database.</p> <p>Usually, specify TRUE for this parameter if the <code>inclusion_rule</code> parameter is set to FALSE.</p>

Table 233-12 (Cont.) ADD_TABLE_RULES Procedure Parameters

Parameter	Description
source_database	<p>The global name of the source database. If <code>NULL</code>, then the procedure does not add a condition regarding the source database to the generated rules.</p> <p>For capture process rules, specify <code>NULL</code> or the global name of the local database if you are creating a capture process locally at the source database. If you are adding rules to a downstream capture process rule set at a downstream database, then specify the source database of the changes that will be captured.</p> <p>For apply process rules, specify the source database of the changes that will be applied by the apply process. The source database is the database where the changes originated. If an apply process applies captured LCRs, then the apply process can apply LCRs from only one capture process at one source database.</p> <p>In a CDB, specify the global name of the container to which the rules pertain. The container can be the root or a PDB. For example, <code>mycdb.example.com</code> or <code>hrpdb.example.com</code>. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>.NET</code>, then the procedure specifies <code>DBS1.NET</code> automatically.</p>
dml_rule_name	<p>If <code>include_dml</code> is <code>TRUE</code>, then this parameter contains the DML rule name.</p> <p>If <code>include_dml</code> is <code>FALSE</code>, then this parameter contains a <code>NULL</code>.</p>
ddl_rule_name	<p>If <code>include_ddl</code> is <code>TRUE</code>, then this parameter contains the DDL rule name.</p> <p>If <code>include_ddl</code> is <code>FALSE</code>, then this parameter contains a <code>NULL</code>.</p>
inclusion_rule	<p>If <code>inclusion_rule</code> is <code>TRUE</code>, then the procedure adds the rules to the positive rule set for the XStream client.</p> <p>If <code>inclusion_rule</code> is <code>FALSE</code>, then the procedure adds the rules to the negative rule set for the XStream client.</p> <p>In either case, the system creates the rule set if it does not exist.</p>

Table 233-12 (Cont.) ADD_TABLE_RULES Procedure Parameters

Parameter	Description
<code>and_condition</code>	<p>If non-NULL, appends the specified condition to the system-generated rule condition using an AND clause in the following way:</p> <pre>(system_condition) AND (and_condition)</pre> <p>The variable in the specified condition must be <code>:lcr</code>. For example, to specify that the table rules generated by the procedure evaluate to TRUE only if the Oracle Replication tag is the hexadecimal equivalent of '02', specify the following condition:</p> <pre>:lcr.get_tag() = HEXTORAW('02')</pre> <p>The <code>:lcr</code> in the specified condition is converted to <code>:dml</code> or <code>:ddl</code>, depending on the rule that is being generated. If you are specifying an LCR member subprogram that is dependent on the LCR type (row or DDL), then make sure this procedure only generates the appropriate rule. Specifically, if you specify an LCR member subprogram that is valid only for row LCRs, then specify TRUE for the <code>include_dml</code> parameter and FALSE for the <code>include_ddl</code> parameter. If you specify an LCR member subprogram that is valid only for DDL LCRs, then specify FALSE for the <code>include_dml</code> parameter and TRUE for the <code>include_ddl</code> parameter.</p> <p>See Also: Logical Change Record TYPES</p>
<code>source_root_name</code>	<p>The global name of the root in the source CDB. For example, <code>mycdb.example.com</code>.</p> <p>If this parameter is NULL, then the global name of the root in the local CDB is used. If you are configuring downstream capture, then this parameter must be a non-NULL value, and it must specify the global name of the root in the remote source CDB. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>EXAMPLE.COM</code>, then the procedure specifies <code>DBS1.EXAMPLE.COM</code> automatically.</p> <p>Note: This parameter only applies to a CDB.</p>
<code>source_container_name</code>	<p>The short name of the source container. The container can be the root or a PDB. For example, <code>CDB\$ROOT</code> or <code>hrpdb</code>. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>Note: This parameter only applies to a CDB.</p>

Usage Notes

This procedure creates DML and DDL rules automatically based on `include_dml` and `include_ddl` parameter values, respectively. Each rule has a system-generated rule name that consists of the table name with a sequence number appended to it. The sequence number is used to avoid naming conflicts. If the table name plus the sequence number is too long, then the table name is truncated. A capture process or apply process uses the rules for filtering.

 **See Also:**

- ["Operational Notes"](#)
- ["Security Model"](#)

Examples

The following is an example of a table rule condition created for DML changes:

```
((:dml.get_object_owner() = 'HR' and :dml.get_object_name() = 'LOCATIONS'))
and :dml.is_null_tag() = 'Y' and :dml.get_source_database_name() = 'DBS1.NET' )
```

233.4.12 ALTER_INBOUND Procedure

This procedure modifies an XStream inbound server.

Syntax

```
DBMS_XSTREAM_ADM.ALTER_INBOUND(
    server_name IN VARCHAR2,
    apply_user  IN VARCHAR2  DEFAULT NULL,
    comment     IN VARCHAR2  DEFAULT NULL);
```

Parameters**Table 233-13 ALTER_INBOUND Procedure Parameters**

Parameter	Description
server_name	The name of the inbound server being altered. Specify an existing inbound server. Do not specify an owner.
apply_user	The user who applies all DML and DDL changes that satisfy the inbound server rule sets, who runs user-defined apply handlers, and who runs custom rule-based transformations configured for inbound server rules. The client application must attach to the inbound server as the apply user. Specify a user to change the apply user. In this case, the user who invokes the ALTER_INBOUND procedure must be granted the DBA role. Only the SYS user can set the apply_user to SYS. If NULL, then the apply user is not changed. See "CREATE_INBOUND Procedure" for information about the required privileges for an apply user.
comment	An optional comment associated with the inbound server. If non-NULL, then the specified comment replaces the existing comment. If NULL, then the existing comment is not changed.

233.4.13 ALTER_OUTBOUND Procedure

This procedure modifies an XStream outbound server configuration.

This procedure always alters the specified outbound server. This procedure can also alter the outbound server's capture process when either of the following conditions is met:

- The capture process was created by the `CREATE_OUTBOUND` procedure in this package.
- The queue used by the capture process was created by the `CREATE_OUTBOUND` procedure.

To check whether this procedure can alter the outbound server's capture process, query the `CAPTURE_NAME` column in the `ALL_XSTREAM_OUTBOUND` view. When the name of the capture process appears in the `CAPTURE_NAME` column of this view, the `ALTER_OUTBOUND` procedure can manage the capture process's rules or change the capture user for the capture process. When the `CAPTURE_NAME` column of this view is `NULL`, the `ALTER_OUTBOUND` procedure cannot manage the capture process.

This procedure is overloaded. One `table_names` parameter is type `VARCHAR2` and the other `table_names` parameter is type `DBMS_UTILITY.UNCL_ARRAY`. Also, one `schema_names` parameter is type `VARCHAR2` and the other `schema_names` parameter is type `DBMS_UTILITY.UNCL_ARRAY`. These parameters enable you to enter the list of tables and schemas in different ways and are mutually exclusive.



Note:

Starting with Oracle Database 11g Release 2 (11.2.0.2), the `start_scn` and `start_time` parameters are included in this procedure.

Syntax

```
DBMS_XSTREAM_ADM.ALTER_OUTBOUND(
  server_name          IN VARCHAR2,
  table_names          IN DBMS_UTILITY.UNCL_ARRAY,
  schema_names        IN DBMS_UTILITY.UNCL_ARRAY,
  add                  IN BOOLEAN    DEFAULT TRUE,
  capture_user         IN VARCHAR2   DEFAULT NULL,
  connect_user        IN VARCHAR2   DEFAULT NULL,
  comment              IN VARCHAR2   DEFAULT NULL,
  inclusion_rule       IN BOOLEAN    DEFAULT TRUE,
  start_scn            IN NUMBER     DEFAULT NULL,
  start_time           IN TIMESTAMP  DEFAULT NULL,
  include_dml          IN BOOLEAN    DEFAULT TRUE,
  include_ddl         IN BOOLEAN    DEFAULT FALSE,
  source_database      IN VARCHAR2   DEFAULT NULL,
  source_container_name IN VARCHAR2  DEFAULT NULL);
```

```
DBMS_XSTREAM_ADM.ALTER_OUTBOUND(
  server_name          IN VARCHAR2,
  table_names          IN VARCHAR2   DEFAULT NULL,
  schema_names        IN VARCHAR2   DEFAULT NULL,
  add                  IN BOOLEAN    DEFAULT TRUE,
  capture_user         IN VARCHAR2   DEFAULT NULL,
  connect_user        IN VARCHAR2   DEFAULT NULL,
  comment              IN VARCHAR2   DEFAULT NULL,
```

```

inclusion_rule          IN BOOLEAN          DEFAULT TRUE,
start_scn              IN NUMBER            DEFAULT NULL,
start_time            IN TIMESTAMP         DEFAULT NULL,
include_dml           IN BOOLEAN          DEFAULT TRUE,
include_ddl           IN BOOLEAN          DEFAULT FALSE,
source_database       IN VARCHAR2         DEFAULT NULL,
source_container_name IN VARCHAR2         DEFAULT NULL);

```

Parameters

Table 233-14 ALTER_OUTBOUND Procedure Parameters

Parameter	Description
server_name	The name of the outbound server being altered. Specify an existing outbound server. Do not specify an owner.
table_names	<p>The tables that are either added to or removed from the XStream Out configuration. Whether the tables are added or removed depends on the setting for the <code>add</code> parameter.</p> <p>The tables can be specified in the following ways:</p> <ul style="list-style-type: none"> Comma-delimited list of type <code>VARCHAR2</code>. A PL/SQL associative array of type <code>DBMS_UTILITY.UNCL_ARRAY</code>, where each element is the name of a table. Specify the first table in position 1. The last position must be <code>NULL</code>. <p>Each table should be specified as <code>[schema_name.]table_name</code>. For example, <code>hr.employees</code>. If the schema is not specified, then the current user is the default.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>
schema_names	<p>The schemas that are either added to or removed from the XStream Out configuration. Whether the schemas are added or removed depends on the setting for the <code>add</code> parameter.</p> <p>The schemas can be specified in the following ways:</p> <ul style="list-style-type: none"> Comma-delimited list of type <code>VARCHAR2</code>. A PL/SQL associative array of type <code>DBMS_UTILITY.UNCL_ARRAY</code>, where each element is the name of a schema. Specify the first schema in position 1. The last position must be <code>NULL</code>. <p>Note: This procedure does not concatenate the <code>schema_names</code> parameter with the <code>table_names</code> parameter. To specify tables, enter fully qualified table names in the <code>table_names</code> parameter (<code>schema_name.table_name</code>).</p> <p>See Also: "Usage Notes" for more information about this parameter</p>
add	<p>If <code>TRUE</code>, then the procedure adds to the XStream Out configuration the tables specified in the <code>table_names</code> parameter and the schemas specified in the <code>schema_names</code> parameter.</p> <p>If <code>FALSE</code>, then the procedure removes from the XStream Out configuration the tables specified in the <code>table_names</code> parameter and the schemas specified in the <code>schema_names</code> parameter.</p>

Table 233-14 (Cont.) ALTER_OUTBOUND Procedure Parameters

Parameter	Description
capture_user	<p>The user in whose security domain a capture process captures changes that satisfy its rule sets and runs custom rule-based transformations configured for capture process rules.</p> <p>Specify a user to change the capture user. In this case, the user who invokes the ALTER_OUTBOUND procedure must be granted the DBA role. Only the SYS user can set the capture_user to SYS.</p> <p>If NULL, then the capture user is not changed.</p> <p>If you change the capture user, then this procedure grants the new capture user enqueue privilege on the queue used by the capture process and configures the user as a secure queue user.</p> <p>Ensure that the capture user is granted the other required privileges. See "CREATE_OUTBOUND Procedure" for information about the privileges required by a capture user.</p> <p>The capture process is stopped and restarted automatically when you change the value of this parameter.</p> <p>Note: If the capture user for a capture process is dropped using DROP USER . . . CASCADE, then the capture process is also dropped automatically.</p>
connect_user	<p>The user who can attach to the specified outbound server to retrieve the change stream. The XStream client application must attach to the outbound server as the specified connect user.</p> <p>Specify a user to change the connect user. In this case, the user who invokes the ALTER_OUTBOUND procedure must be granted the DBA role. Only the SYS user can set the connect_user to SYS.</p> <p>If NULL, then the connect user is not changed.</p> <p>If you change the connect user, then this procedure grants the new connect user dequeue privileges on the queue used by the outbound server and configures the user as a secure queue user.</p> <p>Ensure that the connect user is granted the other required privileges. See "CREATE_OUTBOUND Procedure" for information about the privileges required by a connect user.</p>
comment	<p>An optional comment associated with the outbound server.</p> <p>If non-NULL, then the specified comment replaces the existing comment.</p> <p>If NULL, then the existing comment is not changed.</p>

Table 233-14 (Cont.) ALTER_OUTBOUND Procedure Parameters

Parameter	Description
<code>inclusion_rule</code>	<p>If <code>TRUE</code> and the <code>add</code> parameter is set to <code>TRUE</code>, then the procedure adds rules for the tables specified in the <code>table_names</code> parameter and the schemas specified in the <code>schema_names</code> parameter to the positive rule sets in the XStream Out configuration. When rules for tables and schemas are in positive rule sets, the XStream Out configuration streams DML and DDL changes to the tables and schemas out to the client application.</p> <p>If <code>TRUE</code> and the <code>add</code> parameter is set to <code>FALSE</code>, then the procedure removes rules for the tables specified in the <code>table_names</code> parameter and the schemas specified in the <code>schema_names</code> parameter from the positive rule sets in the XStream Out configuration.</p> <p>If <code>FALSE</code> and the <code>add</code> parameter is set to <code>TRUE</code>, then the procedure adds rules for the tables specified in the <code>table_names</code> parameter and the schemas specified in the <code>schema_names</code> parameter to the negative rule sets in the XStream Out configuration. When rules for tables and schemas are in negative rule sets, the XStream Out configuration does not stream changes to the tables and schemas out to the client application.</p> <p>If <code>FALSE</code> and the <code>add</code> parameter is set to <code>FALSE</code>, then the procedure removes rules for the tables specified in the <code>table_names</code> parameter and the schemas specified in the <code>schema_names</code> parameter from the negative rule sets in the XStream Out configuration.</p>
<code>start_scn</code>	<p>A valid SCN for the database from which the capture process starts capturing changes. To be valid, the SCN value must be greater than or equal to the first SCN for the capture process.</p> <p>If a valid SCN is specified, then the capture process captures changes from the specified SCN when it is restarted.</p> <p>An error is returned if an invalid SCN is specified.</p> <p>If <code>NULL</code> and the <code>start_time</code> parameter is <code>NULL</code>, then the start SCN is not changed.</p> <p>If <code>NULL</code> and the <code>start_time</code> parameter is non-<code>NULL</code>, then the start SCN is changed to match the specified start time.</p> <p>The <code>start_scn</code> and <code>start_time</code> parameters are mutually exclusive.</p> <p>Note: If the capture process is enabled, then the <code>ALTER_OUTBOUND</code> procedure automatically stops and restarts the capture process when the <code>start_scn</code> parameter is non-<code>NULL</code>. If the capture process is disabled, then the <code>ALTER_OUTBOUND</code> procedure automatically starts the capture process when the <code>start_scn</code> parameter is non-<code>NULL</code>.</p>

Table 233-14 (Cont.) ALTER_OUTBOUND Procedure Parameters

Parameter	Description
start_time	<p>A valid time from which the capture process starts capturing changes. To be valid, the time must correspond to an SCN value that is greater than or equal to the first SCN for the capture process.</p> <p>If a valid time is specified, then the capture process captures changes from the specified time when it is restarted.</p> <p>An error is returned if an invalid time is specified.</p> <p>If NULL and the start_scn parameter is NULL, then the start time is not changed.</p> <p>If NULL and the start_scn parameter is non-NULL, then the start time is changed to match the specified start SCN.</p> <p>The start_scn and start_time parameters are mutually exclusive.</p> <p>Note: If the capture process is enabled, then the ALTER_OUTBOUND procedure automatically stops and restarts the capture process when the start_time parameter is non-NULL. If the capture process is disabled, then the ALTER_OUTBOUND procedure automatically starts the capture process when the start_time parameter is non-NULL.</p>
include_dml	<p>If TRUE, then the procedure creates a DML rule for DML changes. If FALSE, then the procedure does not create a DML rule. NULL is not permitted.</p>
include_ddl	<p>If TRUE, then the procedure creates a DDL rule for DDL changes. If FALSE, then the procedure does not create a DDL rule. NULL is not permitted.</p>
source_database	<p>The global name of the container where the specified table_names and schema_names are located.</p> <p>If source_database is non-NULL, then a condition is added to the outbound server's rules to filter the LCRs based on the global name of the source database.</p>
source_container_name	<p>The short name of the source container. The container can be the root or a PDB. For example, CDB\$ROOT or hrpdb. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>Note: This parameter only applies to a CDB.</p>

Usage Notes

The following list describes the behavior of the outbound server for various combinations of the table_names and schema_names parameters:

- If both the table_names and schema_names parameters are NULL or empty, then no rules are changed for the XStream Out configuration.

This procedure is overloaded. The table_names and schema_names parameters are defaulted to NULL. Do not specify NULL for both table_names and schema_names in the same call; otherwise, error PLS-00307 is returned.
- If both the table_names and schema_names parameters are specified, then the rules for the tables and schemas are added to or removed from the XStream Out configuration, depending on the setting of the add parameter.

- If the `table_names` parameter is specified and the `schema_names` parameter is `NULL` or empty, then the rules for the tables are added to or removed from the XStream Out configuration, depending on the setting of the `add` parameter. The existing rules for schemas are not changed for the XStream Out configuration.
- If the `table_names` parameter is `NULL` or empty and the `schema_names` parameter is specified, then the rules for the schemas are added to or removed from the XStream Out configuration, depending on the setting of the `add` parameter. The existing rules for tables are not changed for the XStream Out configuration.

For the procedure that uses the `DBMS_UTILITY.UNCL_ARRAY` type for the `table_names` and `schema_names` parameters, both parameters must be specified. To specify only tables, the `schema_names` parameter must be specified and empty. To specify only schemas, the `table_names` parameter must be specified and empty.

 **Note:**

An empty array includes one `NULL` entry.

233.4.14 CREATE_INBOUND Procedure

This procedure creates an XStream inbound server and its queue.

 **Note:**

A client application can create multiple sessions. Each session can attach to only one inbound server, and each inbound server can serve only one session at a time. However, different client application sessions can connect to different inbound servers. See *Oracle Call Interface Programmer's Guide* and *Oracle Database XStream Java API Reference* for information about attaching to an inbound server.

Syntax

```
DBMS_XSTREAM_ADM.CREATE_INBOUND(  
    server_name IN VARCHAR2,  
    queue_name  IN VARCHAR2,  
    apply_user  IN VARCHAR2  DEFAULT NULL,  
    comment     IN VARCHAR2  DEFAULT NULL);
```

Parameters

Table 233-15 CREATE_INBOUND Procedure Parameters

Parameter	Description
server_name	<p>The name of the inbound server being created. A NULL specification is not allowed. Do not specify an owner.</p> <p>The specified name must not match the name of an existing outbound server, inbound server, apply process, or messaging client.</p> <p>Note: The <code>server_name</code> setting cannot exceed 30 bytes, and it cannot be altered after the inbound server is created.</p>
queue_name	<p>The name of the local queue used by the inbound server, specified as <code>[schema_name.]queue_name</code>.</p> <p>If the specified queue exists, then it is used. If the specified queue does not exist, then the procedure creates it.</p> <p>For example, to specify a queue named <code>xstream_queue</code> in the <code>xstrmadmin</code> schema, enter <code>xstrmadmin.xstream_queue</code> for this parameter. If the schema is not specified, then the current user is the default.</p> <p>Note: An inbound server's queue is used only to store error transactions.</p>
apply_user	<p>The apply user. If NULL, then the current user is the default.</p> <p>The client application must attach to the inbound server as the apply user.</p> <p>The apply user is the user in whose security domain an inbound server evaluates whether LCRs satisfy its rule sets, applies DML and DDL changes directly to database objects, runs custom rule-based transformations configured for inbound server rules, and runs apply handlers configured for the inbound server. This user must have the necessary privileges to perform these actions. This procedure grants the apply user dequeue privileges on the queue used by the inbound server and configures the user as a secure queue user.</p> <p>In addition to the privileges granted by this procedure, you must grant the following privileges to the apply user:</p> <ul style="list-style-type: none"> • The necessary privileges to perform DML and DDL changes on the apply objects • EXECUTE privilege on the rule sets used by the inbound server • EXECUTE privilege on all rule-based transformation functions used in the rule set • EXECUTE privilege on all apply handler procedures <p>You can grant these privileges directly to the apply user, or you can grant them through roles.</p> <p>In addition, the apply user must be granted EXECUTE privilege on all packages, including Oracle supplied packages, that are invoked in subprograms run by the inbound server. These privileges must be granted directly to the apply user. They cannot be granted through roles.</p> <p>Note: If the apply user for an inbound server is dropped using <code>DROP USER . . . CASCADE</code>, then the inbound server is also dropped automatically.</p>
comment	An optional comment associated with the inbound server.

Usage Notes

By default, an inbound server does not use rules or rule sets. Therefore, an inbound server applies all of the LCRs sent to it by an XStream client application. However, to filter the LCRs

sent to an inbound server, you can add rules and rule sets to an inbound server using the `DBMS_XSTREAM_ADM` and `DBMS_RULE_ADM` packages.

In a CDB, you can execute the `CREATE_INBOUND` procedure from either the root or a PDB. The inbound server is restricted to receiving LCRs from one source database and only applying the changes to its local container. If the inbound server is at the root level, then the apply user must be a common user.

 **See Also:**

Oracle Database XStream Guide

233.4.15 CREATE_OUTBOUND Procedure

This procedure creates an XStream outbound server, queue, and capture process to enable client applications to stream out Oracle database changes.

 **Note:**

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

This procedure is overloaded. One `table_names` parameter is type `VARCHAR2` and the other `table_names` parameter is type `DBMS_UTILITY.UNCL_ARRAY`. Also, one `schema_names` parameter is type `VARCHAR2` and the other `schema_names` parameter is type `DBMS_UTILITY.UNCL_ARRAY`. These parameters enable you to enter the list of tables and schemas in different ways and are mutually exclusive.

 **Note:**

- A client application can create multiple sessions. Each session can attach to only one outbound server, and each outbound server can serve only one session at a time. However, different client application sessions can connect to different outbound servers. See "OCIXStreamOutAttach()" in the *Oracle Call Interface Programmer's Guide* and *Oracle Database XStream Java API Reference* for information about attaching to an outbound server.
- If the `capture_name` parameter is `NULL`, then this procedure automatically generates a name for the capture process that it creates.
- This procedure automatically generates a name for the queue that it creates.
- This procedure enables both the capture process and outbound server that it creates.
- Starting with Oracle Database 11g Release 2 (11.2.0.2), the `capture_name` parameter is included in this procedure.

Syntax

```
DBMS_XSTREAM_ADM.CREATE_OUTBOUND(
  server_name          IN VARCHAR2,
  source_database      IN VARCHAR2  DEFAULT NULL,
  table_names          IN DBMS_UTILITY.UNCL_ARRAY,
  schema_names        IN DBMS_UTILITY.UNCL_ARRAY,
  capture_user         IN VARCHAR2  DEFAULT NULL,
  connect_user         IN VARCHAR2  DEFAULT NULL,
  comment              IN VARCHAR2  DEFAULT NULL,
  capture_name         IN VARCHAR2  DEFAULT NULL,
  include_dml          IN BOOLEAN   DEFAULT TRUE,
  include_ddl         IN BOOLEAN   DEFAULT FALSE,
  source_root_name     IN VARCHAR2  DEFAULT NULL,
  source_container_name IN VARCHAR2  DEFAULT NULL,
  lcrld_version        IN NUMBER    DEFAULT NULL);
```

```
DBMS_XSTREAM_ADM.CREATE_OUTBOUND(
  server_name          IN VARCHAR2,
  source_database      IN VARCHAR2  DEFAULT NULL,
  table_names          IN VARCHAR2  DEFAULT NULL,
  schema_names        IN VARCHAR2  DEFAULT NULL,
  capture_user         IN VARCHAR2  DEFAULT NULL,
  connect_user         IN VARCHAR2  DEFAULT NULL,
  comment              IN VARCHAR2  DEFAULT NULL,
  capture_name         IN VARCHAR2  DEFAULT NULL,
  include_dml          IN BOOLEAN   DEFAULT TRUE,
  include_ddl         IN BOOLEAN   DEFAULT FALSE,
  source_root_name     IN VARCHAR2  DEFAULT NULL,
  source_container_name IN VARCHAR2  DEFAULT NULL,
  lcrld_version        IN NUMBER    DEFAULT NULL);
```

Parameters

Table 233-16 CREATE_OUTBOUND Procedure Parameters

Parameter	Description
<code>server_name</code>	<p>The name of the outbound server being created. A <code>NULL</code> specification is not allowed. Do not specify an owner.</p> <p>The specified name must not match the name of an existing outbound server, inbound server, apply process, or messaging client.</p> <p>Note: The <code>server_name</code> setting cannot exceed 30 bytes, and it cannot be altered after the outbound server is created.</p>
<code>source_database</code>	<p>The global name of the source database. The source database is where the changes to be captured originated.</p> <p>If non-<code>NULL</code>, then a condition is added to the outbound server's rules to filter the LCRs based on the global name of the source database. If <code>NULL</code>, then the procedure does not add a condition regarding the source database to the generated rules.</p> <p>In a CDB, specify the global name of the container to which the rules pertain. The container can be the root or a PDB. For example, <code>mycdb.example.com</code> or <code>hrpdb.example.com</code>. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>In a non-CDB, if non-<code>NULL</code> and the specified name is different from the global name of the current database, then downstream capture is assumed. In this case, configure the transmission of redo data from the source database to the downstream database before running the <code>CREATE_OUTBOUND</code> procedure. See <i>Oracle Database XStream Guide</i> for instructions.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>EXAMPLE.COM</code>, then the procedure specifies <code>DBS1.EXAMPLE.COM</code> automatically.</p>
<code>table_names</code>	<p>The tables for which DML and DDL changes are streamed out to the XStream client application. The tables can be specified in the following ways:</p> <ul style="list-style-type: none"> • Comma-delimited list of type <code>VARCHAR2</code>. • A PL/SQL associative array of type <code>DBMS_UTILITY.UNCL_ARRAY</code>, where each element is the name of a table. Specify the first table in position 1. The last position must be <code>NULL</code>. <p>Each table should be specified as <code>[schema_name.]table_name</code>. For example, <code>hr.employees</code>. If the schema is not specified, then the current user is the default.</p> <p>See Also: "Usage Notes" for more information about this parameter</p>

Table 233-16 (Cont.) CREATE_OUTBOUND Procedure Parameters

Parameter	Description
schema_names	<p>The schemas for which DML and DDL changes are streamed out to the XStream client application. The schemas can be specified in the following ways:</p> <ul style="list-style-type: none"> Comma-delimited list of type <code>VARCHAR2</code>. A PL/SQL associative array of type <code>DBMS_UTILITY.UNCL_ARRAY</code>, where each element is the name of a schema. Specify the first schema in position 1. The last position must be <code>NULL</code>. <p>Note: This procedure does not concatenate the <code>schema_names</code> parameter with the <code>table_names</code> parameter. To specify tables, enter fully qualified table names in the <code>table_names</code> parameter (<code>schema_name.table_name</code>).</p> <p>See Also: "Usage Notes" for more information about this parameter</p>
capture_user	<p>The user in whose security domain a capture process captures changes that satisfy its rule sets and runs custom rule-based transformations configured for capture process rules. If <code>NULL</code>, then the current user is the default.</p> <p>This procedure grants the capture user enqueue privilege on the queue used by the capture process and configures the user as a secure queue user.</p> <p>In addition, ensure that the capture user has the following privileges:</p> <ul style="list-style-type: none"> <code>EXECUTE</code> privilege on the rule sets used by the capture process <code>EXECUTE</code> privilege on all rule-based transformation functions used in the positive rule set <p>You can grant these privileges directly to the apply user, or you can grant them through roles.</p> <p>In addition, the capture user must be granted <code>EXECUTE</code> privilege on all packages, including Oracle supplied packages, that are invoked in rule-based transformations run by the capture process. These privileges must be granted directly to the capture user. They cannot be granted through roles.</p> <p>Only a user who is granted the <code>DBA</code> role can set a capture user. Only the <code>SYS</code> user can set the <code>capture_user</code> to <code>SYS</code>.</p> <p>A capture user does not require privileges on a database object to capture changes made to it. The capture process can pass these changes to a custom rule-based transformation function. Therefore, ensure that you consider security implications when you configure a capture process.</p>

Table 233-16 (Cont.) CREATE_OUTBOUND Procedure Parameters

Parameter	Description
connect_user	<p>The user who can attach to the specified outbound server to retrieve the change stream. The client application must attach to the outbound server as the specified connect user.</p> <p>If NULL, then the current user is the default.</p> <p>The connect user is the user in whose security domain an outbound server evaluates LCRs against its rule sets and runs custom rule-based transformations configured for outbound server rules. This user must have the necessary privileges to perform these actions. This procedure grants the connect user dequeue privileges on the queue used by the outbound server and configures the user as a secure queue user.</p> <p>In addition to the privileges granted by this procedure, grant the following privileges to the connect user:</p> <ul style="list-style-type: none"> EXECUTE privilege on the rule sets used by the outbound server EXECUTE privilege on all rule-based transformation functions used in the rule set <p>You can grant these privileges directly to the connect user, or you can grant them through roles.</p> <p>In addition, the connect user must be granted EXECUTE privilege on all packages, including Oracle supplied packages, that are invoked in subprograms run by the outbound server. These privileges must be granted directly to the apply user. They cannot be granted through roles.</p>
comment	<p>An optional comment associated with the outbound server.</p>
capture_name	<p>The name of the capture process configured to capture changes for the outbound server. Do not specify an owner.</p> <p>The capture process must not exist. If the specified name matches the name of an existing capture process, then an error is raised.</p> <p>If the name does not match the name of an existing capture process, then the procedure creates a new capture process with the specified name.</p> <p>If NULL, then the system creates a new capture process with a system-generated name.</p> <p>Note: The capture process name cannot be altered after the capture process is created.</p>
include_dml	<p>If TRUE, then the procedure creates a DML rule for DML changes. If FALSE, then the procedure does not create a DML rule. NULL is not permitted.</p>
include_ddl	<p>If TRUE, then the procedure creates a DDL rule for DDL changes. If FALSE, then the procedure does not create a DDL rule. NULL is not permitted.</p>

Table 233-16 (Cont.) CREATE_OUTBOUND Procedure Parameters

Parameter	Description
<code>source_root_name</code>	<p>The global name of the root in the source CDB. For example, <code>mycdb.example.com</code>.</p> <p>If this parameter is <code>NULL</code>, then the global name of the root in the local CDB is used. If you are configuring downstream capture, then this parameter must be a non-<code>NULL</code> value, and it must specify the global name of the root in the remote source CDB. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>EXAMPLE.COM</code>, then the procedure specifies <code>DBS1.EXAMPLE.COM</code> automatically.</p> <p>Note: This parameter only applies to a CDB.</p>
<code>source_container_name</code>	<p>The short name of the source container. The container can be the root or a PDB. For example, <code>CDB\$ROOT</code> or <code>hrpdb</code>. See <i>Oracle Database XStream Guide</i> for more information about setting this parameter in a CDB.</p> <p>Note: This parameter only applies to a CDB.</p>
<code>lcrld_version</code>	<p>The LCRID version for captured LCRs, either 1 or 2.</p> <p>If 2, then the LCRs are compatible with a database with its compatibility level at 12.2.0 or higher.</p> <p>If 1, then the LCRs are compatible with a database with its compatibility level at 12.1.0 or lower.</p> <p>If <code>NULL</code>, the default, and the database compatibility level is 12.2.0 or higher, then the <code>lcrld_version</code> is set to 2 internally. If the database compatibility level is 12.1.0 or lower, then the <code>lcrld_version</code> is set to 1 internally.</p>

Usage Notes

The following list describes the behavior of the outbound server for various combinations of the `table_names` and `schema_names` parameters:

- If both the `table_names` and `schema_names` parameters are `NULL` or empty, then the outbound server streams all DML and DDL changes to the client application.
This procedure is overloaded. The `table_names` and `schema_names` parameters are defaulted to `NULL`. Do not specify `NULL` for both `table_names` and `schema_names` in the same call; otherwise, error `PLS-00307` is returned.
- If both the `table_names` and `schema_names` parameters are specified, then the outbound server streams DML and DDL changes for the specified tables and schemas.
- If the `table_names` parameter is specified and the `schema_names` parameter is `NULL` or empty, then the outbound server streams DML and DDL changes for the specified tables.
- If the `table_names` parameter is `NULL` or empty and the `schema_names` parameter is specified, then the outbound server streams DML and DDL changes for the specified schema.

For the procedure that uses the `DBMS_UTILITY.UNCL_ARRAY` type for the `table_names` and `schema_names` parameters, both parameters must be specified. To specify only tables, the `schema_names` parameter must be specified and empty. To specify only schemas, the `table_names` parameter must be specified and empty.

 **Note:**

An empty array includes one `NULL` entry.

233.4.16 DELETE_COLUMN Procedure

This procedure either adds or removes a declarative rule-based transformation which deletes a column from a row logical change record (LCR) that satisfies the specified rule.

For the transformation to be performed when the specified rule evaluates to `TRUE`, the rule must be in the positive rule set of an XStream client. XStream clients include capture processes, propagations, and apply processes.

 **Note:**

- The `DELETE_COLUMN` procedure supports the same data types supported by Oracle Replication capture processes.
- The `DELETE_COLUMN` procedure is useful when you want to delete a relatively small number of columns in a row LCR. To delete most of the columns in a row LCR and keep a relatively small number of columns, consider using the `KEEP_COLUMNS` procedure in this package.
- Declarative transformations can transform row LCRs only. Therefore, a DML rule must be specified when you run this procedure. If a DDL rule is specified, then the procedure raises an error.

 **See Also:**

- *Oracle Database XStream Guide* for more information about declarative rule-based transformations and about the data types supported by capture processes
- [KEEP_COLUMNS Procedure](#)

Syntax

```
DBMS_XSTREAM_ADM.DELETE_COLUMN (  
  rule_name      IN  VARCHAR2,  
  table_name     IN  VARCHAR2,  
  column_name    IN  VARCHAR2,  
  value_type     IN  VARCHAR2  DEFAULT '*',
```

```

step_number IN NUMBER DEFAULT 0,
operation   IN VARCHAR2 DEFAULT 'ADD');

```

Parameters

Table 233-17 DELETE_COLUMN Procedure Parameters

Parameter	Description
rule_name	The name of the rule, specified as <code>[schema_name.] rule_name</code> . If NULL, then the procedure raises an error. For example, to specify a rule in the <code>hr</code> schema named <code>employees12</code> , enter <code>hr.employees12</code> . If the schema is not specified, then the current user is the default.
table_name	The name of the table from which the column is deleted in the row LCR, specified as <code>[schema_name.] object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default.
column_name	The name of the column deleted from each row LCR that satisfies the rule.
value_type	Specify 'NEW' to delete the column from the new values in the row LCR. Specify 'OLD' to delete the column from the old values in the row LCR. Specify '*' to delete the column from both the old and new values in the row LCR.
step_number	The order of execution of the transformation. See Also: <i>Oracle Database XStream Guide</i> for more information about transformation ordering
operation	Specify 'ADD' to add the transformation to the rule. Specify 'REMOVE' to remove the transformation from the rule.

Usage Notes

When 'REMOVE' is specified for the `operation` parameter, all of the delete column declarative rule-based transformations for the specified rule are removed that match the specified `table_name`, `column_name`, and `step_number` parameters. Nulls specified for these parameters act as wildcards. The following table lists the behavior of the `DELETE_COLUMN` procedure when one or more of these parameters is NULL:

table_name	column_name	step_number	Result
NULL	NULL	NULL	Remove all delete column transformations for the specified rule.
NULL	NULL	non-NULL	Remove all delete column transformations with the specified <code>step_number</code> for the specified rule.
NULL	non-NULL	non-NULL	Remove all delete column transformations with the specified <code>column_name</code> and <code>step_number</code> for the specified rule.
non-NULL	NULL	non-NULL	Remove all delete column transformations with the specified <code>table_name</code> and <code>step_number</code> for the specified rule.
NULL	non-NULL	NULL	Remove all delete column transformations with the specified <code>column_name</code> for the specified rule.

table_name	column_name	step_number	Result
non-NULL	non-NULL	NULL	Remove all delete column transformations with the specified table_name and column_name for the specified rule.
non-NULL	NULL	NULL	Remove all delete column transformations with the specified table_name for the specified rule.
non-NULL	non-NULL	non-NULL	Remove all delete column transformations with the specified table_name, column_name, and step_number for the specified rule.

233.4.17 DROP_INBOUND Procedure

This procedure removes an inbound server configuration.

This procedure always removes the specified inbound server. This procedure also removes the queue for the inbound server if all of the following conditions are met:

- One call to the CREATE_INBOUND procedure created the queue.
- The inbound server is the only subscriber to the queue.



See Also:

"CREATE_INBOUND Procedure"

Syntax

```
DBMS_XSTREAM_ADM.DROP_INBOUND(
    server_name IN VARCHAR2);
```

Parameters

Table 233-18 DROP_INBOUND Procedure Parameters

Parameter	Description
server_name	The name of the inbound server being removed. Specify an existing inbound server. Do not specify an owner.

233.4.18 DROP_OUTBOUND Procedure

This procedure removes an outbound server configuration.

This procedure always drops the specified outbound server. This procedure also drops the queue used by the outbound server if both of the following conditions are met:

- The queue was created by the CREATE_OUTBOUND procedure in this package.
- The outbound server is the only subscriber to the queue.

If either one of the preceding conditions is not met, then the `DROP_OUTBOUND` procedure only drops the outbound server. It does not drop the queue.

This procedure also drops the capture process for the outbound server if both of the following conditions are met:

- The procedure can drop the outbound server's queue.
- The capture process was created by the `CREATE_OUTBOUND` procedure.

If the procedure can drop the queue but cannot manage the capture process, then it drops the queue without dropping the capture process.

See Also:

- ["ADD_OUTBOUND Procedure"](#)
- ["CREATE_OUTBOUND Procedure"](#)

Syntax

```
DBMS_XSTREAM_ADM.DROP_OUTBOUND (
    server_name IN VARCHAR2);
```

Parameters

Table 233-19 DROP_OUTBOUND Procedure Parameters

Parameter	Description
<code>server_name</code>	The name of the outbound server being removed. Specify an existing outbound server. Do not specify an owner.

233.4.19 ENABLE_GG_XSTREAM_FOR_STREAMS Procedure

This procedure enables XStream optimizations and performance optimizations for Oracle Replication components.

This procedure is intended for users of Oracle Replication who want to enable XStream optimizations and optimizations. For example, you can enable the optimizations for an Oracle Replication configuration that uses capture processes and apply processes to replicate changes between Oracle databases.

These capabilities and optimizations are enabled automatically for XStream components, such as outbound servers, inbound servers, and capture processes that send changes to outbound servers. It is not necessary to run this procedure for XStream components.

When XStream optimizations are enabled, Oracle Replication components can stream ID key LCRs and sequence LCRs. The XStream performance optimizations improve efficiency in various areas, including:

- LCR processing
- Handling large transactions
- DML execution during apply

- Dependency computation and scheduling
- Capture process parallelism

Syntax

```
DBMS_XSTREAM_ADM.ENABLE_GG_XSTREAM_FOR_STREAMS (
    enable IN BOOLEAN TRUE);
```

Parameters

Table 233-20 ENABLE_GG_XSTREAM_FOR_STREAMS Procedure Parameters

Parameter	Description
enable	If TRUE, then enable XStream performance optimizations for Oracle Replication components. If FALSE, then disable XStream performance optimizations for Oracle Replication components.

Usage Notes

The following usage notes apply to this procedure:

- When you run this procedure, all capture processes and apply processes are restarted.
- After you run this procedure, the `PURPOSE` column in the following views displays XStream Streams:
 - ALL_APPLY
 - DBA_APPLY
 - ALL_CAPTURE
 - DBA_CAPTURE
- A license for the Oracle GoldenGate product is required to enable XStream performance optimizations for Oracle Replication components.



See Also:

- [IS_GG_XSTREAM_FOR_STREAMS Function](#)
- *Oracle Database XStream Guide, Chapter 1, Prerequisites for XStream*

233.4.20 GET_MESSAGE_TRACKING Function

The `GET_MESSAGE_TRACKING` Function returns the tracking label for the current session.



See Also:

- [SET_MESSAGE_TRACKING Procedure](#)

Syntax

```
DBMS_XSTREAM_ADM.GET_MESSAGE_TRACKING  
RETURN VARCHAR2;
```

233.4.21 GET_TAG Function

This function gets the binary tag for all redo entries generated by the current session.



See Also:

["SET_TAG Procedure"](#)

Syntax

```
DBMS_XSTREAM_ADM.GET_TAG  
RETURN RAW;
```

Examples

The following example illustrates how to display the current logical change record (LCR) tag as output:

```
SET SERVEROUTPUT ON  
DECLARE  
    raw_tag RAW(2000);  
BEGIN  
    raw_tag := DBMS_XSTREAM_ADM.GET_TAG();  
    DBMS_OUTPUT.PUT_LINE('Tag Value = ' || RAWTOHEX(raw_tag));  
END;  
/
```

You can also display the value by querying the DUAL view:

```
SELECT DBMS_XSTREAM_ADM.GET_TAG FROM DUAL;
```

233.4.22 IS_GG_XSTREAM_FOR_STREAMS Function

This function returns `TRUE` if XStream performance optimizations are enabled for Oracle Replication components, or this function returns `FALSE` if XStream performance optimizations are disabled for Oracle Replication components.



See Also:

["ENABLE_GG_XSTREAM_FOR_STREAMS Procedure"](#)

Syntax

```
DBMS_XSTREAM_ADM.IS_GG_XSTREAM_FOR_STREAMS  
RETURN BOOLEAN;
```

233.4.23 KEEP_COLUMNS Procedure

This procedure either adds or removes a declarative rule-based transformation which keeps a list of columns in a row logical change record (LCR) that satisfies the specified rule. The transformation deletes columns that are not in the list from the row LCR.

For the transformation to be performed when the specified rule evaluates to `TRUE`, the rule must be in the positive rule set of an XStream client. XStream clients include capture processes, propagations, and apply processes.

This procedure is overloaded. The `column_list` parameter is type `VARCHAR2` and the `column_table` parameter is type `DBMS_UTILITY.LNAME_ARRAY`. These parameters enable you to enter the list of columns in different ways and are mutually exclusive.

Note:

- The `KEEP_COLUMNS` procedure supports the same data types supported by Oracle Replication capture processes.
- The `KEEP_COLUMNS` procedure is useful when you want to keep a relatively small number of columns in a row LCR. To keep most of the columns in a row LCR and delete a relatively small number of columns, consider using the `DELETE_COLUMN` procedure in this package.
- Declarative transformations can transform row LCRs only. Therefore, a DML rule must be specified when you run this procedure. If a DDL rule is specified, then the procedure raises an error.

See Also:

- *Oracle Database XStream Guide* for more information about declarative rule-based transformations and about the data types supported by Oracle Replication capture processes
- [DELETE_COLUMN Procedure](#)

Syntax

```
DBMS_XSTREAM_ADM.KEEP_COLUMNS(  
  rule_name      IN  VARCHAR2,  
  table_name     IN  VARCHAR2,  
  column_list    IN  VARCHAR2,  
  value_type     IN  VARCHAR2 DEFAULT '*',  
  step_number    IN  NUMBER DEFAULT 0,  
  operation      IN  VARCHAR2 DEFAULT 'ADD');
```

```
DBMS_XSTREAM_ADM.KEEP_COLUMNS(  
  rule_name      IN  VARCHAR2,  
  table_name     IN  VARCHAR2,  
  column_table   IN  DBMS_UTILITY.LNAME_ARRAY,  
  value_type     IN  VARCHAR2 DEFAULT '*',
```



```

step_number IN NUMBER DEFAULT 0,
operation   IN VARCHAR2 DEFAULT 'ADD');

```

Parameters

Table 233-21 KEEP_COLUMNS Procedure Parameters

Parameter	Description
rule_name	The name of the rule, specified as <code>[schema_name.]rule_name</code> . If NULL, then the procedure raises an error. For example, to specify a rule in the <code>hr</code> schema named <code>employees12</code> , enter <code>hr.employees12</code> . If the schema is not specified, then the current user is the default.
table_name	The name of the table for which the columns are kept in the row LCR, specified as <code>[schema_name.]object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default.
column_list	The names of the columns kept for each row LCR that satisfies the rule. Specify a comma-delimited list of type <code>VARCHAR2</code> . The transformation removes columns that are not in the list from the row LCR. If this parameter is set to NULL, and the <code>column_table</code> parameter is also set to NULL, then the procedure raises an error.
column_table	The names of the columns kept for each row LCR that satisfies the rule. Specify a PL/SQL associative array of type <code>DBMS_UTILITY.LNAME_ARRAY</code> , where each element is the name of a column. The first schema should be in position 1. The last position must be NULL. The transformation removes columns that are not in the table from the row LCR. If this parameter is set to NULL, and the <code>column_list</code> parameter is also set to NULL, then the procedure raises an error.
value_type	Specify 'NEW' to keep the columns in the new values in the row LCR. Specify 'OLD' to keep the columns in the old values in the row LCR. Specify '*' to keep the columns in both the old and new values in the row LCR.
step_number	The order of execution of the transformation. See Also: <i>Oracle Database XStream Guide</i> for more information about transformation ordering
operation	Specify 'ADD' to add the transformation to the rule. Specify 'REMOVE' to remove the transformation from the rule.

Usage Notes

When 'REMOVE' is specified for the `operation` parameter, all of the keep columns declarative rule-based transformations for the specified rule are removed that match the specified `table_name`, `column_list`, `column_table`, and `step_number` parameters. Nulls specified for these parameters act as wildcards. The following table lists the behavior of the `KEEP_COLUMNS` procedure when one or more of these parameters is NULL:

table_name	column_list/ column_table	step_number	Result
NULL	NULL	NULL	Remove all keep columns transformations for the specified rule.

table_name	column_list/ column_table	step_number	Result
NULL	NULL	non-NULL	Remove all keep columns transformations with the specified <code>step_number</code> for the specified rule.
NULL	non-NULL	non-NULL	Remove all keep columns transformations with the specified <code>column_list/column_table</code> and <code>step_number</code> for the specified rule.
non-NULL	NULL	non-NULL	Remove all keep columns transformations with the specified <code>table_name</code> and <code>step_number</code> for the specified rule.
NULL	non-NULL	NULL	Remove all keep columns transformations with the specified <code>column_list/column_table</code> for the specified rule.
non-NULL	non-NULL	NULL	Remove all keep columns transformations with the specified <code>table_name</code> and <code>column_list/column_table</code> for the specified rule.
non-NULL	NULL	NULL	Remove all keep columns transformations with the specified <code>table_name</code> for the specified rule.
non-NULL	non-NULL	non-NULL	Remove all keep columns transformations with the specified <code>table_name</code> , <code>column_list/column_table</code> , and <code>step_number</code> for the specified rule.

233.4.24 MERGE_STREAMS Procedure

This procedure merges a stream that is flowing from one capture process with a stream that is flowing from another capture process.

Typically, this procedure is used to merge two streams that were split using the `SPLIT_STREAMS` procedure in this package. The `SPLIT_STREAMS` procedure clones components of the original stream when it splits the streams. Therefore, the information in this section uses the following terminology:

- The stream before it was split off has the original queue, original capture process, and original propagation.
- The stream that was split off by the `SPLIT_STREAMS` procedure has a cloned queue, cloned capture process, and cloned propagation.

This procedure is called by the `MERGE_STREAMS_JOB` procedure. The `MERGE_STREAMS_JOB` procedure determines whether the streams are within a user-specified merge threshold so that the streams can be merged safely. If the streams are not within the merge threshold, then the `MERGE_STREAMS_JOB` procedure does nothing. Typically, it is best to run the `MERGE_STREAMS_JOB` procedure instead of running the `MERGE_STREAMS` procedure directly.

However, you can choose to run the `MERGE_STREAMS` procedure directly when the following conditions are met:

- The problem at the destination of the split stream has been corrected, and the destination queue can accept changes.
- The cloned capture process used by the split stream is started and is capturing changes.
- The apply process at the destination database is applying the changes captured by the cloned capture process.
- The `CAPTURE_MESSAGE_CREATE_TIME` in the `GV$XSTREAM_CAPTURE` view of the cloned capture process has caught up to, or nearly caught up to, the `CAPTURE_MESSAGE_CREATE_TIME` of the original capture process. The cloned capture process might never completely catch up to the original capture process. Therefore, you can merge the split stream when the cloned capture process has nearly caught up to the original capture process.

The `MERGE_STREAMS` procedure performs the following actions:

1. Stops the cloned capture process.
2. Stops the original capture process.
3. Copies the cloned propagation back to the original propagation. The propagation has the same name as the original propagation after it is copied back.
4. Starts the original capture process from the lower SCN value of these two SCN values:
 - The acknowledged SCN of the cloned propagation.
 - The lowest acknowledged SCN of the other propagations that propagate changes captured by the original capture process.

When the original capture process is started, it might recapture changes that it already captured, or it might capture changes that were already captured by the cloned capture process. In either case, the relevant apply processes will discard any duplicate changes they receive.

5. Drops the cloned propagation.
6. Drops the cloned capture process.
7. Drops the cloned queue.



See Also:

[SPLIT_STREAMS Procedure](#)

Syntax

```
DBMS_XSTREAM_ADM.MERGE_STREAMS (
    cloned_propagation_name  IN  VARCHAR2,
    propagation_name        IN  VARCHAR2  DEFAULT NULL,
    queue_name               IN  VARCHAR2  DEFAULT NULL,
    perform_actions          IN  BOOLEAN   DEFAULT TRUE,
    script_name              IN  VARCHAR2  DEFAULT NULL,
    script_directory_object  IN  VARCHAR2  DEFAULT NULL);
```

Parameters

Table 233-22 MERGE_STREAMS Procedure Parameters

Parameter	Description
<code>cloned_propagation_name</code>	<p>The name of the cloned propagation used by the stream that was split off from the original stream using the <code>SPLIT_STREAMS</code> procedure. The name of the cloned propagation also identifies the cloned queue and capture process used by the cloned propagation.</p> <p>You must specify an existing propagation name. Do not specify an owner.</p>
<code>propagation_name</code>	<p>The name of the propagation that is merged back to the original stream.</p> <p>If <code>NULL</code>, then the name of the original propagation in the original stream is used. Specify <code>NULL</code> only if the streams were split using the <code>SPLIT_STREAMS</code> procedure.</p> <p>Specify a non-<code>NULL</code> value to use a name that is different from the original propagation name or if you are merging two streams that were not split by the <code>SPLIT_STREAMS</code> procedure.</p> <p>If a non-<code>NULL</code> value is specified, then an error is raised under either of the following conditions:</p> <ul style="list-style-type: none"> • The queue specified in the <code>queue_name</code> parameter does not exist. • The queue specified in the <code>queue_name</code> parameter exists but is not used by a capture process.
<code>queue_name</code>	<p>The name of the queue that is the source queue for the propagation that is merged back.</p> <p>If <code>NULL</code>, then the existing, original queue is the source queue for the propagation that is merged back. Specify <code>NULL</code> only if the streams were split using the <code>SPLIT_STREAMS</code> procedure.</p> <p>Specify a non-<code>NULL</code> value if you are merging two streams that were not split by the <code>SPLIT_STREAMS</code> procedure. Specify the name of the existing queue used by the capture process that will capture changes in the merged stream.</p>
<code>perform_actions</code>	<p>If <code>TRUE</code>, then the procedure performs the necessary actions to merge the streams directly.</p> <p>If <code>FALSE</code>, then the procedure does not perform the necessary actions to merge the streams directly.</p> <p>Specify <code>FALSE</code> when this procedure is generating a script that you can edit and then run. The procedure raises an error if you specify <code>FALSE</code> and either of the following parameters is <code>NULL</code>:</p> <ul style="list-style-type: none"> • <code>script_name</code> • <code>script_directory_object</code>

Table 233-22 (Cont.) MERGE_STREAMS Procedure Parameters

Parameter	Description
<code>script_name</code>	<p>If non-NULL and the <code>perform_actions</code> parameter is FALSE, then specify the name of the script generated by this procedure. The script contains all of the statements used to merge the streams. If a file with the specified script name exists in the specified directory for the <code>script_directory_object</code> parameter, then the procedure appends the statements to the existing file.</p> <p>If non-NULL and the <code>perform_actions</code> parameter is TRUE, then the procedure generates the specified script and performs the actions to split the stream directly.</p> <p>If NULL and the <code>perform_actions</code> parameter is TRUE, then the procedure performs the actions to merge the streams directly and does not generate a script.</p> <p>If NULL and the <code>perform_actions</code> parameter is FALSE, then the procedure raises an error.</p>
<code>script_directory_object</code>	<p>The directory object for the directory on the local computer system into which the generated script is placed.</p> <p>If the <code>script_name</code> parameter is NULL, then the procedure ignores this parameter and does not generate a script.</p> <p>If NULL and the <code>script_name</code> parameter is non-NULL, then the procedure raises an error.</p> <p>Note: The specified directory object cannot point to an Oracle Automatic Storage Management (ASM) disk group.</p>

Usage Notes

You can use the `MERGE_STREAMS` procedure to merge two streams that were not split using the `SPLIT_STREAMS` procedure. Merging streams in this way can save resources and improve performance when a single database is running two or more capture processes.

233.4.25 MERGE_STREAMS_JOB Procedure

This procedure determines whether the original capture process and the cloned capture process are within the specified merge threshold. If they are within the merge threshold, then this procedure runs the `MERGE_STREAMS` procedure to merge the two streams.

Typically, this procedure is used to merge two streams that were split using the `SPLIT_STREAMS` procedure in this package. The `SPLIT_STREAMS` procedure clones components of the original stream when it splits the streams. Therefore, the information in this section uses the following terminology:

- The stream before it was split off has the original queue, original capture process, and original propagation.
- The stream that was split off by the `SPLIT_STREAMS` procedure has a cloned queue, cloned capture process, and cloned propagation.

If the `auto_merge_threshold` parameter was set to a positive number in the `SPLIT_STREAMS` procedure that split the streams, then a merge job runs the `MERGE_STREAMS_JOB` procedure automatically according to its schedule. The schedule name is specified for the `schedule_name` parameter, and the merge job name is specified for the `merge_job_name`

parameter when the `MERGE_STREAMS_JOB` procedure is run automatically. The merge job and its schedule were created by the `SPLIT_STREAMS` procedure.

If the `auto_merge_threshold` parameter was set to `NULL` or 0 (zero) in the `SPLIT_STREAMS` procedure that split the streams, then you can run the `MERGE_STREAMS_JOB` procedure manually. In this case, it is not run automatically.



See Also:

- [MERGE_STREAMS Procedure](#)
- [SPLIT_STREAMS Procedure](#)

Syntax

```
DBMS_XSTREAM_ADM.MERGE_STREAMS_JOB (
    cloned_propagation_name IN VARCHAR2,
    propagation_name       IN VARCHAR2 DEFAULT NULL,
    queue_name              IN VARCHAR2 DEFAULT NULL,
    merge_threshold         IN NUMBER,
    schedule_name           IN VARCHAR2 DEFAULT NULL,
    merge_job_name          IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 233-23 MERGE_STREAMS_JOB Procedure Parameters

Parameter	Description
<code>cloned_propagation_name</code>	<p>The name of the cloned propagation used by the stream that was split off from the original stream using the <code>SPLIT_STREAMS</code> procedure. The name of the cloned propagation also identifies the cloned queue and capture process used by the cloned propagation.</p> <p>You must specify an existing propagation name. Do not specify an owner.</p>
<code>propagation_name</code>	<p>The name of the propagation that is merged back to the original stream.</p> <p>If <code>NULL</code>, then the name of the original propagation in the original stream is used. Specify <code>NULL</code> only if the streams were split using the <code>SPLIT_STREAMS</code> procedure.</p> <p>Specify a non-<code>NULL</code> value to use a name that is different from the original propagation name or if you are merging two streams that were not split by the <code>SPLIT_STREAMS</code> procedure.</p> <p>If a non-<code>NULL</code> value is specified, then an error is raised under either of the following conditions:</p> <ul style="list-style-type: none"> • The queue specified in the <code>queue_name</code> parameter does not exist. • The queue specified in the <code>queue_name</code> parameter exists but is not used by a capture process.

Table 233-23 (Cont.) MERGE_STREAMS_JOB Procedure Parameters

Parameter	Description
queue_name	<p>The name of the queue that is the source queue for the propagation that is merged back.</p> <p>If NULL, then the existing, original queue is the source queue for the propagation that is merged back. Specify NULL only if the streams were split using the SPLIT_STREAMS procedure.</p> <p>Specify a non-NULL value if you are merging two streams that were not split by the SPLIT_STREAMS procedure. Specify the name of the existing queue used by the capture process that will capture changes in the merged stream.</p>
merge_threshold	<p>The merge threshold in seconds.</p> <p>The value of the CAPTURE_MESSAGE_CREATE_TIME column for each capture process in the GV\$XSTREAM_CAPTURE dynamic performance view determines whether the streams are merged. Specifically, if the difference, in seconds, between the CAPTURE_MESSAGE_CREATE_TIME of the cloned capture process and the original capture process is less than or equal to the value specified for this parameter, then this procedure runs the MERGE_STREAMS procedure to merge the streams. If the difference is greater than the value specified by this parameter, then this procedure does nothing.</p>
schedule_name	<p>The name of the schedule for the merge job.</p> <p>If NULL, then no schedule name is specified. Typically, you set this parameter to NULL when the auto_merge_threshold parameter was set to NULL or 0 (zero) in the SPLIT_STREAMS procedure that split the streams.</p> <p>Specify NULL if you run this procedure manually.</p>
merge_job_name	<p>The name of the job that merges the streams.</p> <p>If NULL, then no merge job name is specified. Typically, you set this parameter to NULL when the auto_merge_threshold parameter was set to NULL or 0 (zero) in the SPLIT_STREAMS procedure that split the streams.</p> <p>Specify NULL if you run this procedure manually.</p>

Usage Notes

You can use the MERGE_STREAMS_JOB procedure to merge two streams that were not split using the SPLIT_STREAMS procedure. Merging streams in this way can save resources and improve performance when a single database is running two or more capture processes.

After the MERGE_STREAMS_JOB procedure completes, you can query the DBA_CAPTURE and DBA_PROPAGATION views to determine whether the streams were merged. If the streams were merged, then the cloned capture process and cloned propagation do not appear in these views.

If the streams were merged and the schedule_name and merge_job_name parameters were non-NULL, then the specified schedule and merge job are deleted automatically.

233.4.26 PURGE_SOURCE_CATALOG Procedure

This procedure removes all Oracle Replication data dictionary information at the local database for the specified object.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

You can use this procedure to remove Oracle Replication metadata that is not needed currently and will not be needed in the future.

Syntax

```
DBMS_XSTREAM_ADM.PURGE_SOURCE_CATALOG (
    source_database    IN  VARCHAR2,
    source_object_name IN  VARCHAR2,
    source_object_type IN  VARCHAR2,
    source_root_name  IN  VARCHAR2);
```

Parameters

Table 233-24 PURGE_SOURCE_CATALOG Procedure Parameters

Parameter	Description
source_database	In a non-CDB, specify the global name of the source database containing the database object. In a CDB, specify the global name of the container containing the database object. The container can be the root or a PDB. If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify DBS1 and the domain is .NET, then the procedure specifies DBS1.NET automatically.
source_object_name	The name of the object specified as <code>[schema_name.]object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default.
source_object_type	Type of the object. Currently, <code>TABLE</code> is the only possible object type.

Table 233-24 (Cont.) PURGE_SOURCE_CATALOG Procedure Parameters

Parameter	Description
<code>source_root_name</code>	<p>The global name of the source root containing the object in a CDB. The source root is where the changes being captured originated in a CDB.</p> <p>If you do not include the domain name, then the procedure appends it to the database name automatically. For example, if you specify <code>DBS1</code> and the domain is <code>EXAMPLE.COM</code>, then the procedure specifies <code>DBS1.EXAMPLE.COM</code> automatically.</p> <p>If the <code>source_root_name</code> parameter is <code>NULL</code>, then the global name of the local root is the default.</p> <p>Note: This parameter only applies to a CDB.</p>

Usage Notes

The global name of the source database containing the object must be specified for the `source_database` parameter. If the current database is not the source database for the object, then the procedure removes data dictionary information about the object from the current database, not the source database.

For example, suppose changes to the `hr.employees` table at the `dbs1.net` source database are being applied to the `hr.employees` table at the `dbs2.net` destination database. Also, suppose `hr.employees` at `dbs2.net` is not a source at all. In this case, specifying `dbs2.net` as the `source_database` for this table results in an error. However, specifying `dbs1.net` as the `source_database` for this table while running the `PURGE_SOURCE_CATALOG` procedure at the `dbs2.net` database removes data dictionary information about the table at `dbs2.net`.

Do not run this procedure at a database if either of the following conditions is true:

- Logical change records (LCRs) captured by the capture process for the object are or might be applied locally without reinstantiating the object.
- LCRs captured by the capture process for the object are or might be forwarded by the database without reinstantiating the object.

Note:

These conditions do not apply to LCRs that were not created by the capture process. That is, these conditions do not apply to user-created LCRs.

233.4.27 RECOVER_OPERATION Procedure

This procedure provides options for split and merge operations that stopped because they encountered an errors.

This procedure either rolls forward the operation, rolls back the operation, or purges all of the metadata about the operation. Split and merge operations might be run in an XStream Out environment in which multiple outbound servers use the same capture process.

This procedure only can perform these actions for split and merge operations using the `split_threshold` and `merge_threshold` capture process parameters set to non-NULL values to enable automatic split and merge.

Information about the operation is stored in the following data dictionary views when the operation is in process:

- `DBA_RECOVERABLE_SCRIPT`
- `DBA_RECOVERABLE_SCRIPT_PARAMS`
- `DBA_RECOVERABLE_SCRIPT_BLOCKS`
- `DBA_RECOVERABLE_SCRIPT_ERRORS`

The data dictionary views are populated at the database that contains the capture process.

When the operation completes successfully, metadata about the operation is moved from the `DBA_RECOVERABLE_SCRIPT` view to the `DBA_RECOVERABLE_SCRIPT_HIST` view. The other views, `DBA_RECOVERABLE_SCRIPT_PARAMS`, `DBA_RECOVERABLE_SCRIPT_BLOCKS`, and `DBA_RECOVERABLE_SCRIPT_ERRORS`, retain information about the operation until it is purged automatically after 30 days.

When one of these operations encounters an error and stops, metadata about the operation remains in these views. In this case, you can either roll forward, roll back, or purge the metadata about the operation using the `RECOVER_OPERATION` procedure. If you choose to roll forward the operation, then correct conditions that caused the errors reported in `DBA_RECOVERABLE_SCRIPT_ERRORS` before proceeding.

Run the `RECOVER_OPERATION` procedure at the database that contains the capture process.



Note:

To run the `RECOVER_OPERATION` procedure, both databases must be Oracle Database 10g Release 2 or later databases.



See Also:

- ["SPLIT_STREAMS Procedure"](#)
- ["MERGE_STREAMS Procedure"](#)
- ["MERGE_STREAMS_JOB Procedure"](#)

Syntax

```
DBMS_XSTREAM_ADM.RECOVER_OPERATION(  
    script_id      IN RAW,  
    operation_mode IN VARCHAR2 DEFAULT 'FORWARD');
```

Parameters

Table 233-25 RECOVER_OPERATION Procedure Parameters

Parameter	Description
<code>script_id</code>	The operation id of the operation that is being rolled forward, rolled back, or purged. Query the <code>SCRIPT_ID</code> column of the <code>DBA_RECOVERABLE_SCRIPT</code> data dictionary view to determine the operation id.
<code>operation_mode</code>	<p>If <code>FORWARD</code>, then the procedure rolls forward the operation. Specify <code>FORWARD</code> to try to complete the operation.</p> <p>If <code>ROLLBACK</code>, then the procedure rolls back all of the actions performed in the operation. If the rollback is successful, then this option also moves the metadata about the operation from the <code>DBA_RECOVERABLE_SCRIPT</code> view to the <code>DBA_RECOVERABLE_SCRIPT_HIST</code> view. The other views retain information about the operation for 30 days.</p> <p>If <code>PURGE</code>, then the procedure moves the metadata about the operation from the <code>DBA_RECOVERABLE_SCRIPT</code> view to the <code>DBA_RECOVERABLE_SCRIPT_HIST</code> view without rolling the operation back. The other views retain information about the operation for 30 days.</p>

233.4.28 REMOVE_QUEUE Procedure

This procedure removes the specified `ANYDATA` queue.

Specifically, this procedure performs the following actions:

1. Waits until all current enqueue and dequeue transactions commit.
2. Stops the queue, which means that no further enqueues into the queue or dequeues from the queue are allowed.
3. Drops the queue.
4. If the `drop_unused_queue_table` parameter is set to `TRUE`, then drops the queue table if it is empty and no other queues are using it.
5. If the `cascade` parameter is set to `TRUE`, then drops all of the XStream clients that are using the queue.

 **Note:**

The specified queue must be a `ANYDATA` queue.

Syntax

```
DBMS_XSTREAM_ADM.REMOVE_QUEUE (
  queue_name          IN  VARCHAR2,
  cascade             IN  BOOLEAN  DEFAULT FALSE,
  drop_unused_queue_table IN  BOOLEAN  DEFAULT TRUE);
```

Parameters

Table 233-26 REMOVE_QUEUE Procedure Parameters

Parameter	Description
queue_name	The name of the queue to remove, specified as [<i>schema_name</i> .] <i>queue_name</i> . For example, <code>strmadmin.streams_queue</code> . If the schema is not specified, then the current user is the default.
cascade	If <code>TRUE</code> , then the procedure drops any XStream clients that use the queue. If <code>FALSE</code> , then the procedure raises an error if there are any XStream clients that use the queue. Before you run this procedure with the <code>cascade</code> parameter set to <code>FALSE</code> , make sure no XStream clients are using the queue currently.
drop_unused_queue_table	If <code>TRUE</code> and the queue table for the queue is empty, then the procedure drops the queue table. The queue table is not dropped if it contains any messages or if it is used by another queue. If <code>FALSE</code> , then the procedure does not drop the queue table.

233.4.29 REMOVE_RULE Procedure

This procedure removes the specified rule or all rules from the rule set associated with the specified capture process, apply process, or propagation.

Note:

If a rule was automatically created by the system, and you want to drop the rule, then you should use this procedure to remove the rule instead of the `DBMS_RULE_ADM.DROP_RULE` procedure. If you use the `DBMS_RULE_ADM.DROP_RULE` procedure, then some metadata about the rule might remain.

Syntax

```
DBMS_XSTREAM_ADM.REMOVE_RULE (
  rule_name          IN  VARCHAR2,
  streams_type       IN  VARCHAR2,
  streams_name       IN  VARCHAR2,
  drop_unused_rule   IN  BOOLEAN  DEFAULT TRUE,
  inclusion_rule     IN  BOOLEAN  DEFAULT TRUE);
```

Parameters

Table 233-27 REMOVE_RULE Procedure Parameters

Parameter	Description
<code>rule_name</code>	The name of the rule to remove, specified as <code>[schema_name.]rule_name</code> . If NULL, then the procedure removes all rules from the specified capture process, apply process, or propagation rule set. For example, to specify a rule in the <code>hr</code> schema named <code>prop_rule1</code> , enter <code>hr.prop_rule1</code> . If the schema is not specified, then the current user is the default.
<code>streams_type</code>	The type of XStream client: <ul style="list-style-type: none"> Specify <code>capture</code> for a capture process. Specify <code>propagation</code> for a propagation. Specify <code>apply</code> for an apply process.
<code>streams_name</code>	The name of the XStream client, which can be a capture process, propagation, or apply process. Do not specify an owner. If the specified XStream client does not exist, but there is metadata in the data dictionary that associates the rule with this client, then the procedure removes the metadata. If the specified XStream client does not exist, and there is no metadata in the data dictionary that associates the rule with this client, then the procedure raises an error.
<code>drop_unused_rule</code>	If TRUE and the rule is not in any rule set, then the procedure drops the rule from the database. If TRUE and the rule exists in any rule set, then the procedure does not drop the rule from the database. If FALSE, then the procedure does not drop the rule from the database.
<code>inclusion_rule</code>	If <code>inclusion_rule</code> is TRUE, then the procedure removes the rule from the positive rule set for the XStream client. If <code>inclusion_rule</code> is FALSE, then the procedure removes the rule from the negative rule set for the XStream client.

233.4.30 REMOVE_SUBSET_OUTBOUND_RULES Procedure

This procedure removes subset rules from an outbound server configuration.

The names of the specified insert, update, and delete rules must match those generated by the `ADD_SUBSET_OUTBOUND_RULES` procedure. To view the rule names for subset rules, run the following query:

```
SELECT RULE_OWNER, SUBSETTING_OPERATION, RULE_NAME
FROM ALL_XSTREAM_RULES
WHERE SUBSETTING_OPERATION IS NOT NULL;
```

 **Note:**

- This procedure removes the declarative rule-based transformation associated with each rule it removes.
- This procedure does not remove rules from the outbound server's capture process.

 **See Also:**

"ADD_SUBSET_OUTBOUND_RULES Procedure"

Syntax

```
DBMS_XSTREAM_ADM.REMOVE_SUBSET_OUTBOUND_RULES(
  server_name      IN VARCHAR2,
  insert_rule_name IN VARCHAR2,
  update_rule_name IN VARCHAR2,
  delete_rule_name IN VARCHAR2);
```

233.4.31 REMOVE_XSTREAM_CONFIGURATION Procedure

This procedure removes the XStream configuration at the local database.

Syntax

```
DBMS_XSTREAM_ADM.REMOVE_XSTREAM_CONFIGURATION(
  container IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 233-28 REMOVE_XSTREAM_CONFIGURATION Procedure Parameters

Parameter	Description
container	<p>If CURRENT, then the XStream configuration is removed from the current container. CURRENT can be specified while connected to the root or to a PDB in a CDB.</p> <p>If ALL, then the XStream configuration is removed from all of the containers in the CDB. To specify ALL, the procedure must be invoked in the root.</p> <p>If a container name, then the XStream configuration is removed from the specified container. To specify root, use CDB\$ROOT while connected to the root. To specify a PDB, the procedure must be invoked in the root.</p> <p>Note: This parameter only applies to a CDB.</p>

Usage Notes

Specifically, this procedure performs the following actions at the local database:

- Drops all capture processes

- If any tables have been prepared for instantiation, then aborts preparation for instantiation for the table using the `ABORT_TABLE_INSTANTIATION` procedure in the `DBMS_CAPTURE_ADM` package
- If any schemas have been prepared for instantiation, then aborts preparation for instantiation for the schema using the `ABORT_SCHEMA_INSTANTIATION` procedure in the `DBMS_CAPTURE_ADM` package
- If the database has been prepared for instantiation, then aborts preparation for instantiation for the database using the `ABORT_GLOBAL_INSTANTIATION` procedure in the `DBMS_CAPTURE_ADM` package
- Drops propagations that were created using either the `DBMS_XSTREAM_ADM` package or the `DBMS_PROPAGATION_ADM` package. Before a propagation is dropped, its propagation job is disabled. Does not drop propagations that were created using the `DBMS_AQADM` package.
- Disables all propagation jobs used by propagations
- Drops all apply processes. If there are apply errors in the error queue for an apply process, then this procedure deletes these apply errors before it drops the apply process.
- Removes specifications for DDL handlers used by apply processes, but does not delete the PL/SQL procedures used by these handlers
- Removes specifications for message handlers used by apply processes, but does not delete the PL/SQL procedures used by these handlers
- Removes specifications for precommit handlers used by apply processes, but does not delete the PL/SQL procedures used by these handlers
- Removes the instantiation SCN and ignore SCN for each apply object and schema and for the entire database
- Removes messaging clients
- Unsets message notification specifications that were set using the `SET_MESSAGE_NOTIFICATION` procedure in the `DBMS_XSTREAM_ADM` package
- Removes specifications for procedure DML handlers and error handlers, but does not delete the PL/SQL procedures used by these handlers
- Removes update conflict handlers
- Removes specifications for substitute key columns for apply tables
- Drops rule sets and rules that were created using the `DBMS_XSTREAM_ADM` package.
- Drops unused rule sets that were used by capture processes, propagations, apply processes, and messaging clients, and removes the rules in these rule sets. These rules and rule sets are removed regardless of whether they were created using the `DBMS_XSTREAM_ADM` package or the `DBMS_RULE_ADM` package.

This procedure stops capture processes and apply processes before it drops them.

This procedure does not drop rule sets or rules if they meet both of the following conditions:

- The rule sets or rules were created using the `DBMS_RULE_ADM` package.
- The rule sets or rules were not used by a capture process, propagation, apply process, or messaging client.

 **Note:**

Running this procedure is dangerous. You should run this procedure only if you are sure you want to remove the entire XStream configuration at a database. If an Oracle Replication configuration exists at the database, then this procedure also removes the entire Oracle Replication configuration.

 **Note:**

- Running this procedure repeatedly does not cause errors. If the procedure fails to complete, then you can run it again.
- This procedure commits multiple times.

233.4.32 RENAME_COLUMN Procedure

This procedure either adds or removes a declarative rule-based transformation which renames a column in a row logical change record (LCR) that satisfies the specified rule.

For the transformation to be performed when the specified rule evaluates to `TRUE`, the rule must be in the positive rule set of an XStream client. XStream clients include capture processes, propagations, and apply processes.

 **Note:**

- The `RENAME_COLUMN` procedure supports the same data types supported by Oracle Replication capture processes.
- Declarative transformations can transform row LCRs only. Therefore, a DML rule must be specified when you run this procedure. If a DDL rule is specified, then the procedure raises an error.

 **See Also:**

Oracle Database XStream Guide for more information about declarative rule-based transformations and about the data types supported by Oracle Replication capture processes

Syntax

```
DBMS_XSTREAM_ADM.RENAME_COLUMN (  
    rule_name          IN  VARCHAR2,  
    table_name         IN  VARCHAR2,  
    from_column_name   IN  VARCHAR2,  
    to_column_name     IN  VARCHAR2,
```



```
value_type      IN VARCHAR2 DEFAULT '*',
step_number    IN NUMBER   DEFAULT 0,
operation      IN VARCHAR2 DEFAULT 'ADD');
```

Parameters

Table 233-29 RENAME_COLUMN Procedure Parameters

Parameter	Description
rule_name	The name of the rule, specified as <code>[schema_name.]rule_name</code> . If NULL, then the procedure raises an error. For example, to specify a rule in the <code>hr</code> schema named <code>employees12</code> , enter <code>hr.employees12</code> . If the schema is not specified, then the current user is the default.
table_name	The name of the table in which the column is renamed in the row LCR, specified as <code>[schema_name.]object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default.
from_column_name	The name of the column to be renamed in each row LCR that satisfies the rule.
to_column_name	The new name of the column in each row LCR that satisfies the rule.
value_type	Specify 'NEW' to rename the column in the new values in the row LCR. Specify 'OLD' to rename the column in the old values in the row LCR. Specify '*' to rename the column in both the old and new values in the row LCR.
step_number	The order of execution of the transformation. See Also: <i>Oracle Database XStream Guide</i> for more information about transformation ordering
operation	Specify 'ADD' to add the transformation to the rule. Specify 'REMOVE' to remove the transformation from the rule.

Usage Notes

When 'REMOVE' is specified for the `operation` parameter, all of the rename column declarative rule-based transformations for the specified rule are removed that match the specified `table_name`, `column_name`, and `step_number` parameters. Nulls specified for these parameters act as wildcards. The following table lists the behavior of the `RENAME_COLUMN` procedure when one or more of these parameters is NULL:

table_name	from_column_name	to_column_name	step_number	Result
NULL	NULL	NULL	NULL	Remove all rename column transformations for the specified rule.
NULL	NULL	NULL	non-NULL	Remove all rename column transformations with the specified <code>step_number</code> for the specified rule.

table_name	from_column_name	to_column_name	step_number	Result
NULL	NULL	non-NULL	non-NULL	Remove all rename column transformations with the specified <code>to_column_name</code> and <code>step_number</code> for the specified rule.
NULL	non-NULL	non-NULL	non-NULL	Remove all rename column transformations with the specified <code>table_name</code> and <code>step_number</code> for the specified rule.
NULL	NULL	non-NULL	NULL	Remove all rename column transformations with the specified <code>column_name</code> for the specified rule.
non-NULL	NULL	non-NULL	NULL	Remove all rename column transformations with the specified <code>table_name</code> and <code>column_name</code> for the specified rule.
NULL	non-NULL	NULL	NULL	Remove all rename column transformations with the specified <code>table_name</code> for the specified rule.
NULL	non-NULL	non-NULL	NULL	Remove all rename column transformations with the specified <code>table_name</code> , <code>column_name</code> , and <code>step_number</code> for the specified rule.
non-NULL	NULL	non-NULL	NULL	Remove all rename column transformations with the specified <code>table_name</code> , <code>column_name</code> , and <code>step_number</code> for the specified rule.
non-NULL	non-NULL	non-NULL	NULL	Remove all rename column transformations with the specified <code>table_name</code> , <code>column_name</code> , and <code>step_number</code> for the specified rule.
non-NULL	non-NULL	non-NULL	non-NULL	Remove all rename column transformations with the specified <code>table_name</code> , <code>column_name</code> , and <code>step_number</code> for the specified rule.

233.4.33 RENAME_SCHEMA Procedure

This procedure either adds or removes a declarative rule-based transformation which renames a schema in a row logical change record (LCR) that satisfies the specified rule.

For the transformation to be performed when the specified rule evaluates to `TRUE`, the rule must be in the positive rule set of an XStream client. XStream clients include capture processes, propagations, and apply processes.

Note:

Declarative transformations can transform row LCRs only. Therefore, a DML rule must be specified when you run this procedure. If a DDL rule is specified, then the procedure raises an error.

See Also:

Oracle Database XStream Guide for more information about declarative rule-based transformations

Syntax

```
DBMS_XSTREAM_ADM.RENAME_SCHEMA (
  rule_name          IN  VARCHAR2,
  from_schema_name  IN  VARCHAR2,
  to_schema_name    IN  VARCHAR2,
  step_number       IN  NUMBER    DEFAULT 0,
  operation         IN  VARCHAR2  DEFAULT 'ADD');
```

Parameters

Table 233-30 RENAME_SCHEMA Procedure Parameters

Parameter	Description
rule_name	The name of the rule, specified as <code>[schema_name.]rule_name</code> . If <code>NULL</code> , then the procedure raises an error. For example, to specify a rule in the <code>hr</code> schema named <code>employees12</code> , enter <code>hr.employees12</code> . If the schema is not specified, then the current user is the default.
from_schema_name	The name of the schema to be renamed in each row LCR that satisfies the rule.
to_schema_name	The new name of the schema in each row LCR that satisfies the rule.
step_number	The order of execution of the transformation. See Also: <i>Oracle Database XStream Guide</i> for more information about transformation ordering
operation	Specify <code>'ADD'</code> to add the transformation to the rule. Specify <code>'REMOVE'</code> to remove the transformation from the rule.

Usage Notes

When 'REMOVE' is specified for the `operation` parameter, all of the rename schema declarative rule-based transformations for the specified rule are removed that match the specified `from_schema_name`, `to_schema_name`, and `step_number` parameters. Nulls specified for these parameters act as wildcards. The following table lists the behavior of the `RENAME_SCHEMA` procedure when one or more of these parameters is `NULL`:

<code>from_schema_name</code>	<code>to_schema_name</code>	<code>step_number</code>	Result
NULL	NULL	NULL	Remove all rename schema transformations for the specified rule.
NULL	NULL	non-NULL	Remove all rename schema transformations with the specified <code>step_number</code> for the specified rule.
NULL	non-NULL	non-NULL	Remove all rename schema transformations with the specified <code>to_schema_name</code> and <code>step_number</code> for the specified rule.
non-NULL	NULL	non-NULL	Remove all rename schema transformations with the specified <code>from_schema_name</code> and <code>step_number</code> for the specified rule.
NULL	non-NULL	NULL	Remove all rename schema transformations with the specified <code>to_schema_name</code> for the specified rule.
non-NULL	non-NULL	NULL	Remove all rename schema transformations with the specified <code>from_schema_name</code> and <code>to_schema_name</code> for the specified rule.
non-NULL	NULL	NULL	Remove all rename schema transformations with the specified <code>from_schema_name</code> for the specified rule.
non-NULL	non-NULL	non-NULL	Remove all rename schema transformations with the specified <code>from_schema_name</code> , <code>to_schema_name</code> , and <code>step_number</code> for the specified rule.

233.4.34 RENAME_TABLE Procedure

This procedure either adds or removes a declarative rule-based transformation which renames a table in a row logical change record (row LCR) that satisfies the specified rule.

For the transformation to be performed when the specified rule evaluates to `TRUE`, the rule must be in the positive rule set of an XStream client. XStream clients include capture processes, propagations, and apply processes.

Note:

Declarative transformations can transform row LCRs only. Therefore, a DML rule must be specified when you run this procedure. If a DDL rule is specified, then the procedure raises an error.

See Also:

Oracle Database XStream Guide for more information about declarative rule-based transformations

Syntax

```
DBMS_XSTREAM_ADM.RENAME_TABLE(
  rule_name          IN VARCHAR2,
  from_table_name    IN VARCHAR2,
  to_table_name      IN VARCHAR2,
  step_number        IN NUMBER    DEFAULT 0,
  operation           IN VARCHAR2  DEFAULT 'ADD');
```

Parameters

Table 233-31 RENAME_TABLE Procedure Parameters

Parameter	Description
<code>rule_name</code>	The name of the rule, specified as <code>[schema_name.]rule_name</code> . If <code>NULL</code> , then the procedure raises an error. For example, to specify a rule in the <code>hr</code> schema named <code>employees12</code> , enter <code>hr.employees12</code> . If the schema is not specified, then the current user is the default.
<code>from_table_name</code>	The name of the table to be renamed in each row LCR that satisfies the rule, specified as <code>[schema_name.]object_name</code> . For example, <code>hr.employees</code> . If the schema is not specified, then the current user is the default.
<code>to_table_name</code>	The new name of the table in each row LCR that satisfies the rule, specified as <code>[schema_name.]object_name</code> . For example, <code>humres.staff</code> . The transformation can rename the table only, the schema only, or the table and the schema. If the schema is not specified, then the current user is the default.

Table 233-31 (Cont.) RENAME_TABLE Procedure Parameters

Parameter	Description
step_number	The order of execution of the transformation. See Also: <i>Oracle Database XStream Guide</i> for more information about transformation ordering
operation	Specify 'ADD' to add the transformation to the rule. Specify 'REMOVE' to remove the transformation from the rule.

Usage Notes

When 'REMOVE' is specified for the `operation` parameter, all of the rename table declarative rule-based transformations for the specified rule are removed that match the specified `from_table_name`, `to_table_name`, and `step_number` parameters. Nulls specified for these parameters act as wildcards. The following table lists the behavior of the `RENAME_TABLE` procedure when one or more of these parameters is `NULL`:

from_table_name	to_table_name	step_number	Result
NULL	NULL	NULL	Remove all rename table transformations for the specified rule.
NULL	NULL	non-NULL	Remove all rename table transformations with the specified <code>step_number</code> for the specified rule.
NULL	non-NULL	non-NULL	Remove all rename table transformations with the specified <code>to_table_name</code> and <code>step_number</code> for the specified rule.
non-NULL	NULL	non-NULL	Remove all rename table transformations with the specified <code>from_table_name</code> and <code>step_number</code> for the specified rule.
NULL	non-NULL	NULL	Remove all rename table transformations with the specified <code>to_table_name</code> for the specified rule.
non-NULL	non-NULL	NULL	Remove all rename table transformations with the specified <code>from_table_name</code> and <code>to_table_name</code> for the specified rule.
non-NULL	NULL	NULL	Remove all rename table transformations with the specified <code>from_table_name</code> for the specified rule.

from_table_name	to_table_name	step_number	Result
non-NULL	non-NULL	non-NULL	Remove all rename table transformations with the specified from_table_name, to_table_name, and step_number for the specified rule.

233.4.35 SET_MESSAGE_TRACKING Procedure

This procedure sets the tracking label for logical change records (LCRs) produced by the current session.

This procedure affects only the current session. Any LCRs produced by the current session are tracked, including captured LCRs and persistent LCRs.



Note:

The tracking label set by this procedure does not track non-LCR messages.



See Also:

KAWGET_MESSAGE_TRACKING

Syntax

```
DBMS_XSTREAM_ADM.SET_MESSAGE_TRACKING(
    tracking_label IN VARCHAR2 DEFAULT 'Streams_tracking',
    actions       IN NUMBER   DEFAULT DBMS_XSTREAM_ADM.ACTION_MEMORY);
```

Parameters

Table 233-32 SET_MESSAGE_TRACKING Procedure Parameters

Parameter	Description
tracking_label	The label used to track the LCRs produced by the session. Set this parameter to NULL to stop message tracking in the current session. The size limit for a label is 4,000 bytes.
actions	When DBMS_XSTREAM_ADM.ACTION_MEMORY is specified, the LCRs are tracked in memory. Currently, DBMS_XSTREAM_ADM.ACTION_MEMORY is the only valid setting for this parameter. The value specified for this parameter is an enumerated constant. Enumerated constants must be prefixed with the package name.

233.4.36 SET_PARAMETER Procedure

This procedure sets a parameter for an outbound server, an inbound server, or an outbound server's capture process.

Syntax

```
DBMS_XSTREAM_ADM.SET_PARAMETER (
    streams_name    IN  VARCHAR2,
    streams_type    IN  VARCHAR2,
    parameter       IN  VARCHAR2,
    value           IN  VARCHAR2  DEFAULT NULL,
    no_wait         IN  BOOLEAN   DEFAULT FALSE,
    source_database IN  VARCHAR2  DEFAULT NULL);
```

Parameters

Table 233-33 SET_PARAMETER Procedure Parameters

Parameter	Description
streams_type	The type of XStream client: <ul style="list-style-type: none"> Specify <code>capture</code> for a capture process. Specify <code>apply</code> for an outbound server or inbound server.
streams_name	The name of the capture process, outbound server, or inbound server. Do not specify an owner.
parameter	The name of the parameter you are setting. See " Capture Process Parameters " for information about capture process parameters. See " Apply Component Parameters " for information about outbound server and inbound server parameters.
value	The value to which the parameter is set. If <code>NULL</code> , then the parameter is set to its default value.
no_wait	If <code>TRUE</code> , then the parameter is set immediately. If <code>FALSE</code> , then the parameter is set after synchronizing with the running capture process, inbound server, or outbound server. When you modify multiple parameters for the same process consecutively, setting this parameter to <code>TRUE</code> speeds up each call. However, if the process is currently running, you must set this parameter to <code>FALSE</code> in the last to the procedure to ensure that the process uses the modified parameter values. If the <code>no_wait</code> parameter is set to <code>TRUE</code> for the last call to the procedure, the running process might not detect the parameter changes.

Table 233-33 (Cont.) SET_PARAMETER Procedure Parameters

Parameter	Description
source_database	<p>If CURRENT, then the parameter is set only in the container where the procedure is invoked. CURRENT can be specified while connected to the root or to a PDB.</p> <p>If ALL, then the parameter is set in all containers in the CDB and all PDBs created after the procedure is invoked. To specify ALL, the procedure must be invoked in the root.</p> <p>If a container name, then the parameter is set in the specified container. To specify root, use CDB\$ROOT while connected to the root. To specify a PDB, the procedure must be invoked in the root.</p> <p>Note: This parameter only applies to CDBs. Also, a non-null value can be specified only for the following parameters:</p> <ul style="list-style-type: none"> include_objects capture parameter excludetag capture or apply parameter excludetrans capture or apply parameter excludeuser capture or apply parameter excludeuserid capture or apply parameter getreplicates capture or apply parameter getappls capture or apply parameter

233.4.37 SET_TAG Procedure

This procedure sets the binary tag for all redo entries subsequently generated by the current session.

Each redo entry generated by DML or DDL statements in the current session will have this tag. This procedure affects only the current session.

Syntax

```
DBMS_XSTREAM_ADM.SET_TAG(
    tag IN RAW DEFAULT NULL);
```

Parameters

Table 233-34 SET_TAG Procedure Parameters

Parameter	Description
tag	<p>The binary tag for all subsequent redo entries generated by the current session. A raw value is a sequence of bytes, and a byte is a sequence of bits.</p> <p>By default, the tag for a session is NULL.</p> <p>The size limit for a tag value is 2000 bytes.</p>

Usage Notes

To set the tag to the hexadecimal value of '17' in the current session, run the following procedure:

```
EXEC DBMS_XSTREAM_ADM.SET_TAG(tag => HEXTORAW('17'));
```

The following are considerations for the SET_TAG procedure:

- This procedure is not transactional. That is, the effects of SET_TAG cannot be rolled back.
- If the SET_TAG procedure is run to set a non-NULL session tag before a data dictionary build has been performed on the database, then the redo entries for a transaction that started before the dictionary build might not include the specified tag value for the session. Therefore, perform a data dictionary build before using the SET_TAG procedure in a session. A data dictionary build happens when the DBMS_CAPTURE_ADM.BUILD procedure is run. The BUILD procedure can be run automatically when a capture process is created.



See Also:

[BUILD Procedure](#)

233.4.38 SET_UP_QUEUE Procedure

This procedure creates a queue table and a ANYDATA queue.

Syntax

```
DBMS_XSTREAM_ADM.SET_UP_QUEUE (
  queue_table      IN  VARCHAR2  DEFAULT 'streams_queue_table',
  storage_clause  IN  VARCHAR2  DEFAULT NULL,
  queue_name      IN  VARCHAR2  DEFAULT 'streams_queue',
  queue_user      IN  VARCHAR2  DEFAULT NULL,
  comment        IN  VARCHAR2  DEFAULT NULL);
```

Parameters

Table 233-35 SET_UP_QUEUE Procedure Parameters

Parameter	Description
queue_table	The name of the queue table specified as <code>[schema_name.]queue_table_name</code> . For example, <code>strmadmin.streams_queue_table</code> . If the schema is not specified, then the current user is the default. If the queue table owner is not specified, then the procedure specifies the user who runs this procedure automatically as the queue table owner. Queue table names can be a maximum of 24 bytes.

Table 233-35 (Cont.) SET_UP_QUEUE Procedure Parameters

Parameter	Description
storage_clause	<p>The storage clause for queue table</p> <p>The storage parameter is included in the <code>CREATE TABLE</code> statement when the queue table is created. You can specify any valid table storage clause.</p> <p>If a tablespace is not specified here, then the procedure creates the queue table and all its related objects in the default user tablespace of the user who runs this procedure. If a tablespace is specified here, then the procedure creates the queue table and all its related objects in the tablespace specified in the storage clause.</p> <p>If <code>NULL</code>, then the procedure uses the storage characteristics of the tablespace in which the queue table is created.</p> <p>See Also: <i>Oracle Database SQL Language Reference</i> for more information about storage clauses</p>
queue_name	<p>The name of the queue that will function as the <code>ANYDATA</code> queue, specified as <code>[schema_name.]queue_name</code>. For example, <code>strmadmin.streams_queue</code>.</p> <p>If the schema is not specified, then the procedure uses the queue table owner. The owner of the queue table must also be the owner of the queue. The queue owner automatically has privileges to perform all queue operations on the queue.</p> <p>If the schema is not specified for this parameter, and the queue table owner is not specified in <code>queue_table</code>, then the current user is the default.</p> <p>Queue names can be a maximum of 24 bytes.</p>
queue_user	<p>The name of the user who requires <code>ENQUEUE</code> and <code>DEQUEUE</code> privileges for the queue. This user also is configured as a secure queue user of the queue. The queue user cannot grant these privileges to other users because they are not granted with the <code>GRANT</code> option.</p> <p>If <code>NULL</code>, then the procedure does not grant any privileges. You can also grant queue privileges to the appropriate users using the <code>DBMS_AQADM</code> package.</p>
comment	The comment for the queue

Usage Notes

Set up includes the following actions:

- If the specified queue table does not exist, then this procedure runs the `CREATE_QUEUE_TABLE` procedure in the `DBMS_AQADM` package to create the queue table with the specified storage clause. If this procedure creates the queue table, then it creates a multiple consumer `ANYDATA` queue that is both a secure queue and a transactional queue.

Also, if the database is Oracle Database 10g release 2 or later, the `sort_list` setting in `CREATE_QUEUE_TABLE` is set to `commit_time`. If the database is a release before Oracle Database 10g release 2, the `sort_list` setting in `CREATE_QUEUE_TABLE` is set to `enq_time`.

- If the specified queue table exists, then the queue uses the properties of the existing queue table.
- If the specified queue name does not exist, then this procedure runs the `CREATE_QUEUE` procedure in the `DBMS_AQADM` package to create the queue.
- This procedure starts the queue.
- If a queue user is specified, then this procedure configures this user as a secure queue user of the queue and grants `ENQUEUE` and `DEQUEUE` privileges on the queue to the specified queue user.

To configure the queue user as a secure queue user, this procedure creates an Advanced Queuing agent with the same name as the user name, if one does not exist. If an agent with this name exists and is associated with the queue user only, then it is used. `SET_UP_QUEUE` then runs the `ENABLE_DB_ACCESS` procedure in the `DBMS_AQADM` package, specifying the agent and the user.

Note:

If the agent that `SET_UP_QUEUE` tries to create exists and is associated with a user other than the user specified by `queue_user`, then the procedure raises an error. In this case, rename or remove the existing agent, and retry `SET_UP_QUEUE`.

233.4.39 SPLIT_STREAMS Procedure

This procedure splits one stream flowing from a capture process off from all of the other streams flowing from the capture process.

This procedure is intended for an Oracle Replication environment in which a capture process captures changes that are propagated to two or more destination databases. When one destination of a propagation stops accepting the captured changes, the changes remain in the capture process's queue. The queue can grow and begin to spill LCRs to the hard disk, degrading the performance of the Oracle Replication environment. A destination might stop accepting changes for several reasons. For example, the destination database might be down.

Specifically, this procedure performs the following actions:

1. Creates a new queue at the database running the capture process. The new queue is called the cloned queue because it is a clone of the queue used by the original stream. The new queue will be used by the new, cloned capture process, and it will be the source queue for the new, cloned propagation.
2. Creates a new propagation that propagates LCRs from the source queue created in Step 1 to the existing destination queue. The new propagation is called the cloned propagation because it is a clone of the propagation used by the original stream. The cloned propagation uses the same rule set as the original propagation.
3. Stops the capture process.
4. Queries the acknowledge SCN for the original propagation. The acknowledged SCN is the last SCN acknowledged by the apply process that applies the changes sent by the propagation.

5. Creates a new capture process. The new capture process is called the cloned capture process because it is a clone of the capture process used by the original stream. The procedure sets the start SCN for the cloned capture process to the value of the queried acknowledged SCN. The cloned capture process uses the same rule set as the original capture process.
6. Drops the original propagation.
7. Starts the original capture process with the start SCN set to the acknowledged SCN queried in Step 4.
8. If the `auto_merge_threshold` parameter is set to a positive number, then creates an Oracle Scheduler job to run the `MERGE_STREAMS_JOB` procedure at set intervals according to its schedule. When the two streams are within the specified merge threshold, the `MERGE_STREAMS_JOB` procedure runs the `MERGE_STREAMS` procedure to merge the streams automatically.

After the `SPLIT_STREAMS` procedure has finished running, the cloned capture process is disabled. When the problem at the destination database is solved, and the destination queue can accept changes, you should start the cloned capture process using the `START_CAPTURE` procedure in the `DBMS_CAPTURE_ADM` package.

Note:

If the original capture process is a downstream capture process, then you must configure the cloned capture process to read the redo log from the source database before you start the cloned capture process.

See Also:

- ["MERGE_STREAMS Procedure"](#)
- ["MERGE_STREAMS_JOB Procedure"](#)

Syntax

```
DBMS_XSTREAM_ADM.SPLIT_STREAMS (
  propagation_name          IN          VARCHAR2,
  cloned_propagation_name   IN          VARCHAR2 DEFAULT NULL,
  cloned_queue_name        IN          VARCHAR2 DEFAULT NULL,
  cloned_capture_name       IN          VARCHAR2 DEFAULT NULL,
  perform_actions          IN          BOOLEAN  DEFAULT TRUE,
  script_name              IN          VARCHAR2 DEFAULT NULL,
  script_directory_object  IN          VARCHAR2 DEFAULT NULL,
  auto_merge_threshold     IN          NUMBER   DEFAULT NULL,
  schedule_name            IN OUT     VARCHAR2,
  merge_job_name           IN OUT     VARCHAR2);
```

Parameters

Table 233-36 SPLIT_STREAMS Procedure Parameters

Parameter	Description
<code>propagation_name</code>	The name of the propagation that cannot send LCRs to its destination queue. The specified propagation is the propagation for the stream that is being split off from the other streams. You must specify an existing propagation name. Do not specify an owner.
<code>cloned_propagation_name</code>	The name of the new propagation created by this procedure for the stream that is split off. If <code>NULL</code> , then the system generates a propagation name.
<code>cloned_queue_name</code>	The name of the new queue created by this procedure for the stream that is split off. If <code>NULL</code> , then the system generates a queue name.
<code>cloned_capture_name</code>	The name of the new capture process created by this procedure for the stream that is split off. If <code>NULL</code> , then the system generates a capture process name.
<code>perform_actions</code>	<p>If <code>TRUE</code>, then the procedure performs the necessary actions to split the stream directly.</p> <p>If <code>FALSE</code>, then the procedure does not perform the necessary actions to split the stream directly.</p> <p>Specify <code>FALSE</code> when this procedure is generating a script that you can edit and then run. The procedure raises an error if you specify <code>FALSE</code> and either of the following parameters is <code>NULL</code>:</p> <ul style="list-style-type: none"> <code>script_name</code> <code>script_directory_object</code>
<code>script_name</code>	<p>If non-<code>NULL</code> and the <code>perform_actions</code> parameter is <code>FALSE</code>, then specify the name of the script generated by this procedure. The script contains all of the statements used to split the stream. If a file with the specified script name exists in the specified directory for the <code>script_directory_object</code> parameter, then the procedure appends the statements to the existing file.</p> <p>If non-<code>NULL</code> and the <code>perform_actions</code> parameter is <code>TRUE</code>, then the procedure generates the specified script and performs the actions to split the stream directly.</p> <p>If <code>NULL</code> and the <code>perform_actions</code> parameter is <code>TRUE</code>, then the procedure performs the actions to split the stream directly and does not generate a script.</p> <p>If <code>NULL</code> and the <code>perform_actions</code> parameter is <code>FALSE</code>, then the procedure raises an error.</p>

Table 233-36 (Cont.) SPLIT_STREAMS Procedure Parameters

Parameter	Description
<code>script_directory_object</code>	<p>The directory object for the directory on the local computer system into which the generated script is placed.</p> <p>If the <code>script_name</code> parameter is <code>NULL</code>, then the procedure ignores this parameter and does not generate a script.</p> <p>If <code>NULL</code> and the <code>script_name</code> parameter is non-<code>NULL</code>, then the procedure raises an error.</p> <p>Note: The specified directory object cannot point to an Oracle Automatic Storage Management (ASM) disk group.</p>
<code>auto_merge_threshold</code>	<p>If a positive number is specified, then the stream that was split off is automatically merged back into all of the other streams flowing from the capture process by an Oracle Scheduler job. The job runs the <code>MERGE_STREAMS_JOB</code> procedure at set intervals according to its schedule. The value of the <code>CAPTURE_MESSAGE_CREATE_TIME</code> column for each capture process in the <code>GV\$XSTREAM_CAPTURE</code> dynamic performance view determines when the streams are merged. Specifically, if the difference, in seconds, between <code>CAPTURE_MESSAGE_CREATE_TIME</code> of the cloned capture process and the original capture process is less than or equal to the value specified for the <code>auto_merge_threshold</code> parameter, then the two streams are merged automatically. The cloned capture process must be started before the split stream can be merged back with the original stream.</p> <p>If <code>NULL</code> or 0 (zero) is specified, then the split stream is not merged back with the original stream automatically. To merge the split stream with the original stream, run the <code>MERGE_STREAM</code> procedure manually when the <code>CAPTURE_MESSAGE_CREATE_TIME</code> of the cloned capture process catches up to, or nearly catches up to, the <code>CAPTURE_MESSAGE_CREATE_TIME</code> of the original capture process.</p> <p>The <code>CAPTURE_MESSAGE_CREATE_TIME</code> records the time when a captured change was recorded in the redo log.</p>
<code>schedule_name</code>	<p>The Oracle Scheduler schedule name, specified as <code>[schema_name.]schedule_name</code>. For example, <code>strmadmin.merge_schedule</code>. If the schema is not specified, then the current user is the default.</p> <p>If <code>auto_merge_threshold</code> is a non-<code>NULL</code> positive number, then the schedule is used by the job that will automatically merge the streams at the appropriate time. You can specify a schedule name to adhere to naming conventions or to track the schedule more easily.</p> <p>If <code>NULL</code> and <code>auto_merge_threshold</code> is a non-<code>NULL</code> positive number, then the system generates a schedule name.</p> <p>If <code>auto_merge_threshold</code> is <code>NULL</code> or 0 (zero), then this parameter must be <code>NULL</code>.</p> <p>If this procedure creates a schedule, the schedule starts when the procedure completes. You can modify the schedule to control how often the merge job is run.</p> <p>If an existing schedule name is specified, an error is raised.</p>

Table 233-36 (Cont.) SPLIT_STREAMS Procedure Parameters

Parameter	Description
merge_job_name	<p>The Oracle Scheduler job name, specified as <code>[schema_name.]merge_job_name</code>. For example, <code>strmadmin.merge_job</code>. If the schema is not specified, then the current user is the default.</p> <p>If <code>auto_merge_threshold</code> is a non-NULL positive number, then the job will automatically merge the streams at the appropriate time. Specify a merge job name to adhere to naming conventions or to track the job more easily.</p> <p>If NULL and <code>auto_merge_threshold</code> is a non-NULL positive number, then the system generates a job name.</p> <p>If <code>auto_merge_threshold</code> is NULL or 0 (zero), then this parameter must be NULL.</p> <p>If an existing job name is specified, an error is raised.</p>



See Also:

Oracle Database Administrator's Guide for information about Oracle Scheduler

233.4.40 START_OUTBOUND Procedure

This procedure starts an XStream outbound server. The outbound server streams out the LCRs to an XStream client application.

Syntax

```
DBMS_XSTREAM_ADM.START_OUTBOUND(
    server_name      IN VARCHAR2);
```

Parameters

Table 233-37 START_OUTBOUND Procedure Parameters

Parameter	Description
server_name	The name of the outbound server being started. A NULL specification is not allowed. Do not specify an owner.

233.4.41 STOP_OUTBOUND Procedure

This procedure stops an XStream outbound server. The outbound server streams out the LCRs to an XStream client application.

Syntax

```
DBMS_XSTREAM_ADM.STOP_OUTBOUND(  
    server_name IN VARCHAR2,  
    force       IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 233-38 STOP_OUTBOUND Procedure Parameters

Parameter	Description
server_name	The name of the outbound server being stopped. A NULL specification is not allowed. Do not specify an owner.
force	If TRUE, then the procedure stops the outbound server and its capture process as soon as possible. If FALSE, then the procedure stops the outbound server after ensuring that there are no gaps in the set of applied transactions. The behavior of the apply component depends on the setting specified for the force parameter and the setting specified for the commit_serialization apply component parameter.

XSTREAM_CAPTURE

The `XSTREAM_CAPTURE` package provides subprograms for granting privileges to and revoking privileges from XStream administrators.

This chapter contains the following topic:

- [Overview](#)
- [Security Model](#)

234.1 XSTREAM_CAPTURE Overview

This package provides subprograms for granting privileges to XStream administrators and revoking privileges from XStream administrators.

234.2 XSTREAM_CAPTURE Security Model

Security on this package can be controlled by either granting `EXECUTE` on this package to selected users or roles, or by granting `EXECUTE_CATALOG_ROLE` to selected users or roles.

The user executing the subprograms in the `XSTREAM_CAPTURE` package must have `SYSDBA` administrative privilege, and the user must exercise the privilege using `AS SYSDBA` at connect time.

If subprograms in the package are run from within a stored procedure, then the user who runs the subprograms must be granted `EXECUTE` privilege on the package directly. It cannot be granted through a role.

To ensure that the user who runs the subprograms in this package has the necessary privileges, connect as an administrative user who can create users, grant privileges, and create tablespaces when using this package.

234.3 Summary of XSTREAM_CAPTURE Subprograms

This table lists the `XSTREAM_CAPTURE` subprograms and briefly describes them.

Table 234-1 XSTREAM_CAPTURE Package Subprograms

Subprogram	Description
GRANT_ADMIN_PRIVILEGE Procedure	Either grants the privileges needed by a user to be an XStream administrator directly, or generates a script that grants these privileges
GRANT_REMOTE_ADMIN_ACCESS Procedure	Enables a remote XStream administrator to perform administrative actions at the local database by connecting to the grantee using a database link

Table 234-1 (Cont.) XSTREAM_CAPTURE Package Subprograms

Subprogram	Description
REVOKE_ADMIN_PRIVILEGE Procedure	Either revokes XStream administrator privileges from a user directly, or generates a script that revokes these privileges
REVOKE_REMOTE_ADMIN_ACCESS Procedure	Disables a remote XStream administrator from performing administrative actions by connecting to the grantee using a database link



Note:

All subprograms commit unless specified otherwise.

234.3.1 XSTREAM_APPLY Procedure

This procedure either grants the privileges needed by a user to be an XStream administrator directly, or generates a script that grants these privileges.



See Also:

["XSTREAM_APPLY Procedure"](#)

Syntax

```
XSTREAM_CAPTURE.XSTREAM_APPLY(
  grantee           IN VARCHAR2,
  privilege_type    IN VARCHAR2 DEFAULT '*',
  grant_select_privileges IN BOOLEAN DEFAULT FALSE,
  do_grants         IN BOOLEAN DEFAULT TRUE,
  file_name         IN VARCHAR2 DEFAULT NULL,
  directory_name    IN VARCHAR2 DEFAULT NULL,
  grant_optional_privileges IN VARCHAR2 DEFAULT NULL,
  container         IN VARCHAR2 DEFAULT 'CURRENT');
```

Parameters

Table 234-2 XSTREAM_APPLY Procedure Parameters

Parameter	Description
grantee	The user to whom privileges are granted

Table 234-2 (Cont.) XSTREAM_APPLY Procedure Parameters

Parameter	Description
privilege_type	<p>Specify one of the following values:</p> <ul style="list-style-type: none"> • CAPTURE Specifying CAPTURE grants the minimum privileges required by the user to administer capture processes. • APPLY Specifying APPLY grants the minimum privileges required by the user to administer outbound servers, inbound servers, and apply processes. • * Specifying * grants the minimum privileges required by the user to administer capture processes, outbound servers, inbound servers, and apply processes.
grant_select_privileges	<p>If TRUE, then the procedure grants a set of privileges, including SELECT_CATALOG_ROLE, to the user.</p> <p>If FALSE, then the procedure does not grant the set of privileges to the user.</p> <p>SELECT_CATALOG_ROLE enables the user to select from the data dictionary. Set this parameter to TRUE for the XStream trusted user model. Set this parameter to FALSE for the XStream untrusted user model.</p>
do_grants	<p>If TRUE, then the procedure grants the privileges to the specified grantee directly, and adds the grantee to the DBA_XSTREAM_ADMINISTRATOR data dictionary view with YES for both the LOCAL_PRIVILEGES column and the ACCESS_FROM_REMOTE column. If the user already has an entry in this data dictionary view, then the procedure does not make another entry, and no error is raised. If TRUE and any of the grant statements fails, then the procedure raises an error.</p> <p>If FALSE, then the procedure does not grant the privileges to the specified grantee directly, and does not add the grantee to the DBA_XSTREAM_ADMINISTRATOR data dictionary view.</p> <p>You specify FALSE when the procedure is generating a file that you will run later. If you specify FALSE and either the file_name or directory_name parameter is NULL, then the procedure raises an error.</p>
file_name	<p>The name of the file generated by the procedure. The file contains all of the statements that grant the privileges. If a file with the specified file name exists in the specified directory name, then the grant statements are appended to the existing file.</p> <p>If NULL, then the procedure does not generate a file.</p>

Table 234-2 (Cont.) XSTREAM_APPLY Procedure Parameters

Parameter	Description
directory_name	<p>The directory into which the generated file is placed. The specified directory must be a directory object created using the SQL statement <code>CREATE DIRECTORY</code>. If you specify a directory, then the user who invokes the procedure must have the <code>WRITE</code> privilege on the directory object.</p> <p>If the <code>file_name</code> parameter is <code>NULL</code>, then this parameter is ignored, and the procedure does not generate a file.</p> <p>If <code>NULL</code> and the <code>file_name</code> parameter is non-<code>NULL</code>, then the procedure raises an error.</p>
grant_optional_privileges	<p>A comma-separated list of optional privileges to grant to the grantee, such as the <code>DV_XSTREAM_ADMIN</code> and <code>DV_GOLDENGATE_ADMIN</code> privileges</p>
container	<p>If <code>CURRENT</code>, then grants privileges to the grantee only in the container where the procedure is invoked. <code>CURRENT</code> can be specified while connected to the root or to a PDB.</p> <p>If <code>ALL</code>, then grants privileges to the grantee in all containers in the CDB and all PDBs created after the procedure is invoked. To specify <code>ALL</code>, the procedure must be invoked in the root.</p> <p>If a container name, then grants privileges to the grantee only in the specified container. To specify root, use <code>CDB\$ROOT</code> while connected to the root. To specify a PDB, the procedure must be invoked in the root.</p> <p>Note: This parameter only applies to CDBs.</p>

Usage Notes

The user who runs the procedure must be an administrative user who can grant privileges to other users.

Specifically, the procedure grants the following privileges to the specified user:

- The `RESTRICTED SESSION` system privilege
- `EXECUTE` on the following packages:
 - `DBMS_APPLY_ADM`
 - `DBMS_AQ`
 - `DBMS_AQADM`
 - `DBMS_AQIN`
 - `DBMS_AQELM`
 - `DBMS_CAPTURE_ADM`
 - `DBMS_FLASHBACK`
 - `DBMS_LOCK`
 - `DBMS_PROPAGATION_ADM`
 - `DBMS_RULE_ADM`

- DBMS_TRANSFORM
- DBMS_XSTREAM_ADM
- Privileges to enqueue messages into and dequeue messages from any queue
- Privileges to manage any queue
- Privileges to create, alter, and execute any of the following types of objects in the user's own schema and in other schemas:
 - Evaluation contexts
 - Rule sets
 - Rules

In addition, the grantee can grant these privileges to other users.

- SELECT_CATALOG_ROLE
- SELECT or READ privilege on data dictionary views related to XStream and Oracle Replication
- The ability to allow a remote XStream administrator to perform administrative actions through a database link by connecting to the grantee

This ability is enabled by running the GRANT_REMOTE_ADMIN_ACCESS procedure in this package.

 **Note:**

- To view all of the statements run by the procedure in detail, you can use the procedure to generate a script and then view the script in a text editor.
- This procedure grants only the privileges necessary to configure and administer an XStream environment. You can grant additional privileges to the grantee if necessary.

 **See Also:**

- ["GRANT_REMOTE_ADMIN_ACCESS Procedure"](#)
- *Oracle Database SQL Language Reference* for information about the CREATE DIRECTORY SQL statement

234.3.2 GRANT_REMOTE_ADMIN_ACCESS Procedure

This procedure enables a remote XStream administrator to perform administrative actions at the local database by connecting to the grantee using a database link.

Syntax

```
DBMS_XSTREAM_AUTH.GRANT_REMOTE_ADMIN_ACCESS (
  grantee IN VARCHAR2);
```

Parameters

Table 234-3 GRANT_REMOTE_ADMIN_ACCESS Procedure Parameter

Parameter	Description
grantee	The user who allows remote access. The procedure adds the grantee to the DBA_XSTREAM_ADMINISTRATOR data dictionary view with YES for the ACCESS_FROM_REMOTE column. If the user already has an entry in this data dictionary view, then the procedure does not make another entry. Instead, it updates the ACCESS_FROM_REMOTE column to YES.

Usage Notes

Typically, you run the procedure and specify a grantee at a local source database if a downstream capture process captures changes originating at the local source database. The XStream administrator at a downstream capture database administers the source database using this connection.



Note:

The XSTREAM_APPLY procedure in this package runs this procedure.



See Also:

"XSTREAM_APPLY Procedure"

234.3.3 REVOKE_ADMIN_PRIVILEGE Procedure

This procedure either revokes XStream administrator privileges from a user directly, or generates a script that revokes these privileges.

Syntax

```
XSTREAM_CAPTURE.REVOKE_ADMIN_PRIVILEGE(
  grantee                IN  VARCHAR2,
  privilege_type         IN  VARCHAR2  DEFAULT '*',
  revoke_select_privileges IN  BOOLEAN  DEFAULT FALSE,
  do_revokes             IN  BOOLEAN  DEFAULT TRUE,
  file_name              IN  VARCHAR2  DEFAULT NULL,
  directory_name        IN  VARCHAR2  DEFAULT NULL,
  revoke_optional_privileges IN  VARCHAR2  DEFAULT NULL,
  container              IN  VARCHAR2  DEFAULT 'CURRENT');
```

Parameters

Table 234-4 REVOKE_ADMIN_PRIVILEGE Procedure Parameters

Parameter	Description
grantee	The user from whom privileges are revoked
privilege_type	Specify one of the following values: <ul style="list-style-type: none"> CAPTURE Specifying CAPTURE revokes the minimum privileges required by the user to administer capture processes. APPLY Specifying APPLY revokes the minimum privileges required by the user to administer outbound servers, inbound servers, and apply processes. * Specifying * revokes the minimum privileges required by the user to administer capture processes, outbound servers, inbound servers, and apply processes.
revoke_select_privileges	If TRUE, then the procedure revokes a set of privileges, including SELECT_CATALOG_ROLE, to the user. If FALSE, then the procedure does not revoke the set of privileges to the user. SELECT_CATALOG_ROLE enables the user to select from the data dictionary.
do_revokes	If TRUE, then the procedure revokes the privileges from the specified user directly, and removes the user from the DBA_XSTREAM_ADMINISTRATOR data dictionary view. If the user does not have a record in this data dictionary view, then the procedure does not remove a record from the view, and no error is raised. If TRUE and any of the revoke statements fails, then the procedure raises an error. A revoke statement fails if the user is not granted the privilege that is being revoked. If FALSE, then the procedure does not revoke the privileges from the specified user directly, and does not remove the user from the DBA_XSTREAM_ADMINISTRATOR data dictionary view. You specify FALSE when the procedure is generating a file that you will run later. If you specify FALSE and either the file_name or directory_name parameter is NULL, then the procedure does not raise an error.
file_name	The name of the file generated by this procedure. The file contains all of the statements that revoke the privileges. If a file with the specified file name exists in the specified directory name, then the revoke statements are appended to the existing file. If NULL, then the procedure does not generate a file.
directory_name	The directory into which the generated file is placed. The specified directory must be a directory object created using the SQL statement CREATE DIRECTORY. If you specify a directory, then the user who invokes the procedure must have the WRITE privilege on the directory object. If the file_name parameter is NULL, then this parameter is ignored, and the procedure does not generate a file. If NULL and the file_name parameter is non-NULL, then the procedure raises an error.

Table 234-4 (Cont.) REVOKE_ADMIN_PRIVILEGE Procedure Parameters

Parameter	Description
revoke_optional_privileges	A comma-separated list of optional privileges to revoke from the grantee, such as the DV_XSTREAM_ADMIN and DV_GOLDENGATE_ADMIN privileges
container	<p>If CURRENT, then revokes privileges from the grantee only in the container where the procedure is invoked. CURRENT can be specified while connected to the root or to a PDB.</p> <p>If ALL, then revokes privileges from the grantee in all containers in the CDB. To specify ALL, the procedure must be invoked in the root.</p> <p>If a container name, then revokes privileges from the grantee only in the specified container. To specify root, use CDB\$ROOT while connected to the root. To specify a PDB, the procedure must be invoked in the root.</p> <p>Note: This parameter only applies to CDBs.</p>

Usage Notes

The user who runs this procedure must be an administrative user who can revoke privileges from other users. Specifically, this procedure revokes the privileges granted by running the XSTREAM_APPLY procedure in this package.

Note:

To view all of the statements run by this procedure in detail, you can use the procedure to generate a script and then view the script in a text editor.

See Also:

- ["XSTREAM_APPLY Procedure"](#)
- *Oracle Database SQL Language Reference* for information about the CREATE DIRECTORY SQL statement

234.3.4 REVOKE_REMOTE_ADMIN_ACCESS Procedure

This procedure disables a remote XStream administrator from performing administrative actions by connecting to the grantee using a database link.

Note:

The REVOKE_ADMIN_PRIVILEGE procedure in this package runs this procedure.

**See Also:**

"REVOKE_ADMIN_PRIVILEGE Procedure"

Syntax

```
DBMS_XSTREAM_AUTH.REVOKE_REMOTE_ADMIN_ACCESS (  
    grantee IN VARCHAR2);
```

Parameters**Table 234-5 REVOKE_REMOTE_ADMIN_ACCESS Procedure Parameter**

Parameter	Description
grantee	<p>The user for whom access from a remote XStream administrator is disabled.</p> <p>If a row for the grantee exists in the <code>DBA_XSTREAM_ADMINISTRATOR</code> data dictionary view, then the procedure updates the <code>ACCESS_FROM_REMOTE</code> column for the grantee to <code>NO</code>. If, after this update, both the <code>LOCAL_PRIVILEGES</code> column and the <code>ACCESS_FROM_REMOTE</code> column are <code>NO</code> for the grantee, then the procedure removes the grantee from the view.</p> <p>If no row for the grantee exists in the <code>DBA_XSTREAM_ADMINISTRATOR</code> data dictionary view, then the procedure does not update the view and does not raise an error.</p>

DEBUG_EXTPROC

The `DEBUG_EXTPROC` package enables you to start up the extproc agent within a session. This utility package can help you debug external procedures.

This chapter contains the following topics:

- [Security Model](#)
- [Operational Notes](#)
- [Rules and Limits](#)
- [Summary of `DEBUG_EXTPROC` Subprograms](#)

235.1 `DEBUG_EXTPROC` Security Model

Your Oracle account must have `EXECUTE` privileges on the package and `CREATE LIBRARY` privileges.

235.2 `DEBUG_EXTPROC` Operational Notes

These operational notes apply to `DEBUG_EXTPROC`.

To install the package, run the script `DBGEXTP.SQL`.

- Install/load this package in the Oracle `USER` where you want to debug the 'extproc' process.
- Ensure that you have execute privileges on package `DEBUG_EXTPROC`

```
SELECT SUBSTR(OBJECT_NAME, 1, 20)
FROM USER_OBJECTS
WHERE OBJECT_NAME = 'DEBUG_EXTPROC';
```

- You can install this package as any other user, as long as you have `EXECUTE` privileges on the package.

 **Note:**

These notes assumes that you built your shared library with debug symbols to aid in the debugging process. Please check the C compiler manual pages for the appropriate C compiler switches to build the shared library with debug symbols.

Having installed the package, proceed accordingly:

- Start a new Oracle session through `SQL*Plus` or `OCI` program by connecting to `ORACLE`.

- Execute procedure `DEBUG_EXTPROC.STARTUP_EXTPROC_AGENT` to startup the extproc agent in this session; for example, execute `DEBUG_EXTPROC.STARTUP_EXTPROC_AGENT`; Do not exit this session, because that terminates the extproc agent.
- Determine the PID of the extproc agent that was started up for this session.
- Using a debugger (for example, gdb, dbx, or the native system debugger), load the extproc executable and attach to the running process.
- Set a breakpoint on function 'pextproc' and let the debugger continue with its execution.
- Now execute your external procedure in the same session where you first executed `DEBUG_EXTPROC.STARTUP_EXTPROC_AGENT`
- Your debugger should now break in function 'pextproc'. At this point in time, the shared library referenced by your PL/SQL external function would have been loaded and the function resolved. Now set a breakpoint in your C function and let the debugger continue its execution.

Because PL/SQL loads the shared library at runtime, the debugger you use may or may not automatically be able to track the new symbols from the shared library. You may have to issue some debugger command to load the symbols (for example, 'share' in gdb)

- The debugger should now break in your C function. Its assumed that you had built the shared library with debugging symbols.
- Now proceed with your debugging.

235.3 Rules and Limits

`DEBUG_EXTPROC` works only on platforms with debuggers that can attach to a running process.

235.4 Summary of `DEBUG_EXTPROC` Subprograms

The `STARTUP_EXTPROC_AGENT` procedure is the only `DEBUG_EXTPROC` subprogram.

Table 235-1 `DEBUG_EXTPROC` Package Subprograms

Subprogram	Description
STARTUP_EXTPROC_AGENT Procedure	Starts up the extproc agent process in the session

235.4.1 `STARTUP_EXTPROC_AGENT` Procedure

This procedure starts up the extproc agent process in the session. This enables you to get the PID of the executing process. This PID is needed to be able to attach to the running process using a debugger.

Syntax

```
DEBUG_EXTPROC.STARTUP_EXTPROC_AGENT;
```

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HTF

The `HTF` (hypertext functions) and `HTP` (hypertext procedures) packages generate HTML tags. For example, the `HTF.ANCHOR` function generates the HTML anchor tag, `<A>`.

See Also:

For more information about implementation of this package:

- *Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server*
- *Oracle Fusion Middleware User's Guide for mod_plsql*

This chapter contains the following topics:

- [Deprecated Subprograms](#)
- [Operational Notes](#)
- [Rules and Limits](#)
- [Examples](#)
- [Summary of Tags](#)
- [Summary of HTF Subprograms](#)

236.1 HTF Deprecated Subprograms

The `ESCAPE_URL` function is deprecated with Oracle Database 10g.

Note:

Oracle recommends that you do not use deprecated procedures in new applications. Support for deprecated features is for backward compatibility only.

Related Topics

- [ESCAPE_URL Function](#)
This deprecated function replaces characters that have special meaning in HTML and HTTP with their escape sequences.

236.2 HTF Operational Notes

These operational notes apply to the HTF package.

For every HTF function that generates one or more HTML tags, there is a corresponding HTP procedure with identical parameters with the following exception:

- The [PRINTS Procedure](#) and the [PS Procedure](#) do not have HTF function equivalents. Use the [ESCAPE_SC Function](#) or the [ESCAPE_URL Function](#) if you need a string conversion function. Note that while there is a [ESCAPE_SC Procedure](#) that performs the same operation as the [PRINTS Procedure](#) and the [PS Procedure](#), there is no procedural equivalent for the [ESCAPE_URL Function](#).
- The [FORMAT_CELL Function](#) does not have an HTP equivalent. The function formats column values inside an HTML table using [TABLEDATA Function](#) which does have an HTP equivalent in the [TABLEDATA Procedure](#). The advantage of this using the [FORMAT_CELL Function](#) is that it allows for better control over the HTML tables.

The function versions do not directly generate output in your Web page. Instead, they pass their output as return values to the statements that invoked them. Use these functions when you need to nest calls. To print the output of HTF functions, call the functions from within the HTF.PRINT function. It then prints its parameters to the generated Web page.

236.3 Rules and Limits

If you use values of the LONG datatype in functions such as HTF.PRINT, HTF.PRN, HTF.PA or OWA_UTIL.CELLSPRINT, only the first 32 K of the LONG data is used. The LONG data is bound to a VARCHAR2 datatype in the function.

236.4 HTF Examples

The commands in this example generate a simple HTML document.

```
CREATE OR REPLACE PROCEDURE hello AS
BEGIN
    HTP.P (HTF.HTMLOPEN); -- generates <HTML>
    HTP.P (HTF.HEADOPEN); -- generates <HEAD>
    HTP.P (HTF.TITLE('Hello')); -- generates <TITLE>Hello</TITLE>
    HTP.P (HTF.HEADCLOSE); -- generates </HEAD>
    HTP.P (HTF.BODYOPEN); -- generates <BODY>
    HTP.P (HTF.HEADER(1, 'Hello')); -- generates <H1>Hello</H1>
    HTP.P (HTF.BODYCLOSE); -- generates </BODY>
    HTP.P (HTF.HTMLCLOSE); -- generates </HTML>
END;
```

236.5 Summary of Tags

This list summarizes the HTML tags generated by the HTF package.

HTML, HEAD, and BODY Tags

[HTMLOPEN Function](#), [HTMLCLOSE Function](#) - generate <HTML> and </HTML>

[HEADOPEN Function](#), [HEADCLOSE Function](#) - generate <HEAD> and </HEAD>

[BODYOPEN Function](#), [BODYCLOSE Function](#) - generate <BODY> and </BODY>

Comment Tag

[COMMENT Function](#) - generates <!-- and -->

[http://www.w3.org.BASE Function](#) - generates <BASE>

[LINKREL Function](#) - generates <LINK> with the REL attribute

[LINKREV Function](#) - generates <LINK> with the REV attribute

[TITLE Function](#) - generates <TITLE>

[META Function](#) - generates <META>

[SCRIPT Function](#) - generates <SCRIPT>

[STYLE Function](#) - generates <STYLE>

[ISINDEX Function](#) - generates <ISINDEX>

Applet Tags

[APPLETOPEN Function](#), [APPLETCLOSE Function](#) - generate <APPLET> and </APPLET>

[PARAM Function](#) - generates <PARAM>

List Tags

[OLISTOPEN Function](#), [OLISTCLOSE Function](#) - generate and

[ULISTOPEN Function](#), [ULISTCLOSE Function](#) - generate and

[DLISTOPEN Function](#), [DLISTCLOSE Function](#) - generate <DL> and </DL>

[DLISTTERM Function](#) - generates <DT>

[DLISTDEF Function](#) - generates <DD>

[DIRLISTOPEN Function](#), [DIRLISTCLOSE Function](#) - generate <DIR> and </DIR>

[LISTHEADER Function](#) - generates <LH>

[LISTINGOPEN Function](#), [LISTINGCLOSE Function](#) - generate <LISTING> and </LISTING>

[MENULISTOPEN Function](#) - generate <MENU> and </MENU>

[LISTITEM Function](#) - generates

Form Tags

[FORMOPEN Function](#), [FORMCLOSE Function](#) - generate <FORM> and </FORM>

[FORMCHECKBOX Function](#) - generates <INPUT TYPE="CHECKBOX">

[FORMHIDDEN Function](#) - generates <INPUT TYPE="HIDDEN">

[FORMIMAGE Function](#) - generates <INPUT TYPE="IMAGE">

FORMPASSWORD Function - generates `<INPUT TYPE="PASSWORD">`

FORMRADIO Function - generates `<INPUT TYPE="RADIO">`

FORMSELECTOPEN Function, FORMSELECTCLOSE Function - generate `<SELECT>`
and `</SELECT>`

FORMSELETOPTION Function - generates `<OPTION>`

FORMTEXT Function - generates `<INPUT TYPE="TEXT">`

FORMTEXTAREA Function - generate `<TEXTAREA>`

FORMTEXTAREAOPEN Function, FORMTEXTAREACLOSE Function - generate
`<TEXTAREA>` and `</TEXTAREA>`

FORMRESET Function - generates `<INPUT TYPE="RESET">`

FORMSUBMIT Function - generates `<INPUT TYPE="SUBMIT">`

Table Tags

TABLEOPEN Function, TABLECLOSE Function - generate `<TABLE>` and `</TABLE>`

TABLECAPTION Function - generates `<CAPTION>`

TBLEROWOPEN Function, TBLEROWCLOSE Function - generate `<TR>` and `</TR>`

TABLEHEADER Function - generates `<TH>`

TABLEDATA Function - generates `<TD>`

IMG, HR, and A Tags

HR Function, LINE Function - generate `<HR>`

IMG Function, IMG2 Function - generate ``

ANCHOR Function, ANCHOR2 Function - generate `<A>`

MAOPEN Function, MAPCLOSE Function - generate `<MAP>` and `</MAP>`

Paragraph Formatting Tags

HEADER Function - generates heading tags (`<H1>` to `<H6>`)

PARA Function, PARAGRAPH Function - generate `<P>`

PRN Functions, PRINT Functions - generate any text that is passed in

PRN Functions, S Function - generate any text that is passed in; special characters in
HTML are escaped

PREOPEN Function, PRECLOSE Function - generate `<PRE>` and `</PRE>`

BLOCKQUOTEOPEN Function, BLOCKQUOTECLOSE Function - generate
`<BLOCKQUOTE>` and `</BLOCKQUOTE>`

DIV Function - generates `<DIV>`

NL Function, BR Function - generate `
`

[NOBR Function](#) - generates <NOBR>

[WBR Function](#) - generates <WBR>

[PLAINTEXT Function](#) - generates <PLAINTEXT>

[ADDRESS Function](#) - generates <ADDRESS>

[MAILTO Function](#) - generates <A> with the MAILTO attribute

[AREA Function](#) - generates <AREA>

[BGSOUND Function](#) - generates <BGSOUND>

Character Formatting Tags

[BASEFONT Function](#) - generates <BASEFONT>

[BIG Function](#) - generates <BIG>

[BOLD Function](#) - generates

[CENTER Function](#) - generates <CENTER> and </CENTER>

[CENTEROPEN Function](#), [CENTERCLOSE Function](#) - generate <CENTER> and </CENTER>

[CITE Function](#) - generates <CITE>

[CODE Function](#) - generates <CODE>

[DFN Function](#) - generates <DFN>

[EM Function](#), [EMPHASIS Function](#) - generate

[FONTOPEN Function](#), [FONTCLOSE Function](#) - generate and

[ITALIC Function](#) - generates <I>

[KBD Function](#), [KEYBOARD Function](#) - generate <KBD> and </KBD>

[S Function](#) - generates <S>

[SAMPLE Function](#) - generates <SAMP>

[SMALL Function](#) - generates <SMALL>

[STRIKE Function](#) - generates <STRIKE>

[STRONG Function](#) - generates

[SUB Function](#) - generates <SUB>

[SUP Function](#) - generates <SUP>

[TELETYPE Function](#) - generates <TT>

[UNDERLINE Function](#) - generates <U>

[VARIABLE Function](#) - generates <VAR>

Frame Tags

[FRAME Function](#) - generates <FRAME>

[FRAMESETOPEN Function](#), [FRAMESETCLOSE Function](#) - generate `<FRAMESET>` and `</FRAMESET>`

[NOFRAMESOPEN Function](#), [NOFRAMESCLOSE Function](#) - generate `<NOFRAMES>` and `</NOFRAMES>`

236.6 Summary of HTF Subprograms

This table lists the HTF subprograms and briefly describes them.

Table 236-1 HTF Package Subprograms

Subprogram	Description
ADDRESS Function	Generates the <code><ADDRESS></code> and <code></ADDRESS></code> tags which specify the address, author and signature of a document
ANCHOR Function	Generates the <code><A></code> and <code></code> tags which specify the source or destination of a hypertext link
ANCHOR2 Function	Generates the <code><A></code> and <code></code> tags which specify the source or destination of a hypertext link
APPLETCLOSE Function	Closes the applet invocation with the <code></APPLET></code> tag
APPLETOPEN Function	Generates the <code><APPLET></code> tag which begins the invocation of a Java applet
AREA Function	Generates the <code><AREA></code> tag, which defines a client-side image map
BASE Function	Generates the <code><BASE></code> tag which records the URL of the document
BASEFONT Function	Generates the <code><BASEFONT></code> tag which specifies the base font size for a Web page
BGSOUND Function	Generates the <code><BGSOUND></code> tag which includes audio for a Web page
BIG Function	Generates the <code><BIG></code> and <code></BIG></code> tags which direct the browser to render the text in a bigger font
BLOCKQUOTECLOSE Function	Generates the <code></BLOCKQUOTE></code> tag which mark the end of a section of quoted text
BLOCKQUOTEOPEN Function	Generates the <code><BLOCKQUOTE></code> tag, which marks the beginning of a section of quoted text
BODYCLOSE Function	Generates the <code></BODY></code> tag which marks the end of a body section of an HTML document
BODYOPEN Function	Generates the <code><BODY></code> tag which marks the beginning of the body section of an HTML document
BOLD Function	Generates the <code></code> and <code></code> tags which direct the browser to display the text in boldface
BR Function	Generates the <code>
</code> tag which begins a new line of text
CENTER Function	Generates the <code><CENTER></code> and <code></CENTER></code> tags which center a section of text within a Web page
CENTERCLOSE Function	Generates the <code></CENTER></code> tag which marks the end of a section of text to center

Table 236-1 (Cont.) HTF Package Subprograms

Subprogram	Description
CENTEROPEN Function	Generates the <CENTER> tag which mark the beginning of a section of text to center
CITE Function	Generates the <CITE> and </CITE> tags which direct the browser to render the text as a citation
CODE Function	Generates the <CODE> and </CODE> tags which direct the browser to render the text in monospace font or however "code" is defined stylistically
COMMENT Function	Generates the comment tags <!-- ctext -->
DFN Function	Generates the <DFN> and </DFN> tags which direct the browser to mark the text as italics or however "definition" is defined stylistically
DIRLISTCLOSE Function	Generates the </DIR> tag which ends a directory list section
DIRLISTOPEN Function	Generates the <DIR> which starts a directory list section
DIV Function	Generates the <DIV> tag which creates document divisions
DLISTCLOSE Function	Generates the </DL> tag which ends a definition list
DLISTDEF Function	Generates the <DD> tag, which inserts definitions of terms
DLISTOPEN Function	Generates the <DL> tag which starts a definition list
DLISTTERM Function	Generates the <DT> tag which defines a term in a definition list <DL>
EM Function	Generates the and tags, which define text to be emphasized
EMPHASIS Function	Generates the and tags, which define text to be emphasized
ESCAPE_SC Function	Replaces characters that have special meaning in HTML with their escape sequences
ESCAPE_URL Function	Replaces characters that have special meaning in HTML and HTTP with their escape sequences
FONTCLOSE Function	Generates the tag which marks the end of a section of text with the specified font characteristics
FONTOPEN Function	Generates the which marks the beginning of section of text with the specified font characteristics
FORMAT_CELL Function	formats column values inside an HTML table using the TABLEDATA Function
FORMCHECKBOX Function	Generates the <INPUT> tag with TYPE="checkbox" which inserts a checkbox element in a form
FORMCLOSE Function	Generates the </FORM> tag which marks the end of a form section in an HTML document
FORMFILE Function	Generates the <INPUT> tag with TYPE="file" which inserts a file form element, and is used for file uploading for a given page
FORMHIDDEN Function	Generates the <INPUT> tag with TYPE="hidden" which inserts a hidden form element

Table 236-1 (Cont.) HTF Package Subprograms

Subprogram	Description
FORMIMAGE Function	Generates the <INPUT> tag with TYPE="image" which creates an image field that the user clicks to submit the form immediately
FORMOPEN Function	Generates the <FORM> tag which marks the beginning of a form section in an HTML document
FORMPASSWORD Function	Generates the <INPUT> tag with TYPE="password" which creates a single-line text entry field
FORMRADIO Function	Generates the <INPUT> tag with TYPE="radio", which creates a radio button on the HTML form
FORMRESET Function	Generates the <INPUT> tag with TYPE="reset" which creates a button that, when selected, resets the form fields to their initial values
FORMSELECTCLOSE Function	Generates the </SELECT> tag which marks the end of a Select form element
FORMSELECTOPEN Function	Generates the </SELECT> tag which marks the beginning of a Select form element
FORMSELETOPTION Function	Generates the <OPTION> tag which represents one choice in a Select element
FORMSUBMIT Function	Generates the <INPUT> tag with TYPE="submit" which creates a button that, when clicked, submits the form
FORMTEXT Function	Generates the <INPUT> tag with TYPE="text", which creates a field for a single line of text
FORMTEXTAREA Function	Generates the <TEXTAREA> tag, which creates a text field that has no predefined text in the text area
FORMTEXTAREA2 Function	Generates the <TEXTAREA> tag, which creates a text field that has no predefined text in the text area with the ability to specify a wrap style
FORMTEXTAREACLOSE Function	Generates the </TEXTAREA> tag which ends a text area form element
FORMTEXTAREAOPEN Function	Generates the <TEXTAREA> which marks the beginning of a text area form element
FORMTEXTAREAOPEN2 Function	Generates the <TEXTAREA> which marks the beginning of a text area form element with the ability to specify a wrap style
FRAME Function	Generates the <FRAME> tag which defines the characteristics of a frame created by a <FRAMESET> tag
FRAMESETCLOSE Function	Generates the </FRAMESET> tag which ends a frameset section
FRAMESETOPEN Function	Generates the </FRAMESET> tag which begins a frameset section
HEADCLOSE Function	Generates the </HEAD> tag which marks the end of an HTML document head section
HEADER Function	Generates opening heading tags (<H1> to <H6>) and their corresponding closing tags (</H1> to </H6>)

Table 236-1 (Cont.) HTF Package Subprograms

Subprogram	Description
HEADOPEN Function	Generates the <HEAD> tag which marks the beginning of the HTML document head section
HR Function	Generates the <HR> tag, which generates a line in the HTML document
HTMLCLOSE Function	Generates the </HTML> tag which marks the end of an HTML document
HTMLOPEN Function	Generates the <HTML> tag which marks the beginning of an HTML document
IMG Function	Generates the tag which directs the browser to load an image onto the HTML page
IMG2 Function	Generates the tag which directs the browser to load an image onto the HTML page with the option of specifying values for the USEMAP attribute
ISINDEX Function	Creates a single entry field with a prompting text, such as "enter value," then sends that value to the URL of the page or program
ITALIC Function	Generates the <I> and </I> tags which direct the browser to render the text in italics
KBD Function	Generates the <KBD> and </KBD> tags which direct the browser to render the text in monospace font
KEYBOARD Function	Generates the <KBD> and </KBD> tags, which direct the browser to render the text in monospace font
LINE Function	Generates the <HR> tag, which generates a line in the HTML document
LINKREL Function	Generates the <LINK> tag with the REL attribute which delineates the relationship described by the hypertext link from the anchor to the target
LINKREV Function	Generates the <LINK> tag with the REV attribute which delineates the relationship described by the hypertext link from the target to the anchor
LISTHEADER Function	Generates the <LH> and </LH> tags which print an HTML tag at the beginning of the list
LISTINGCLOSE Function	Generates the </LISTING> tags which marks the end of a section of fixed-width text in the body of an HTML page
LISTINGOPEN Function	Generates the <LISTING> tag which marks the beginning of a section of fixed-width text in the body of an HTML page
LISTITEM Function	Generates the tag, which indicates a list item
MAILTO Function	Generates the <A> tag with the HREF set to 'mailto' prepended to the mail address argument
MAPCLOSE Function	Generates the </MAP> tag which marks the end of a set of regions in a client-side image map
MAPOPEN Function	Generates the <MAP> tag which mark the beginning of a set of regions in a client-side image map

Table 236-1 (Cont.) HTF Package Subprograms

Subprogram	Description
MENULISTCLOSE Function	Generates the <code></MENU></code> tag which ends a list that presents one line for each item
MENULISTOPEN Function	Generates the <code><MENU></code> tag which begins a list that presents one line for each item
META Function	Generates the <code><META></code> tag, which embeds meta-information about the document and also specifies values for HTTP headers
NL Function	Generates the <code>
</code> tag which begins a new line of text
NOBR Function	Generates the <code><NOBR></code> and <code></NOBR></code> tags which turn off line-breaking in a section of text
NOFRAMESCLOSE Function	Generates the <code></NOFRAMES></code> tag which marks the end of a no-frames section
NOFRAMESOPEN Function	Generates the <code><NOFRAMES></code> tag which mark the beginning of a no-frames section
OLISTCLOSE Function	Generates the <code></code> tag which defines the end of an ordered list
OLISTOPEN Function	Generates the <code></code> tag which marks the beginning of an ordered list
PARA Function	Generates the <code><P></code> tag which indicates that the text that comes after the tag is to be formatted as a paragraph
PARAGRAPH Function	Adds attributes to the <code><P></code> tag
PARAM Function	Generates the <code><PARAM></code> tag which specifies parameter values for Java applets
PLAINTEXT Function	Generates the <code><PLAINTEXT></code> and <code></PLAINTEXT></code> tags which direct the browser to render the text they surround in fixed-width type
PRECLOSE Function	Generates the <code></PRE></code> tag which marks the end of a section of preformatted text in the body of the HTML page
PREOPEN Function	Generates the <code><PRE></code> tag which marks the beginning of a section of preformatted text in the body of the HTML page
PRINT Functions	Generates the specified parameter as a string terminated with the <code>\n</code> newline character
PRN Functions	Generates the specified parameter as a string
S Function	Generates the <code><S></code> and <code></S></code> tags which direct the browser to render the text they surround in strikethrough type
SAMPLE Function	Generates the <code><SAMP></code> and <code></SAMP></code> tags which direct the browser to render the text they surround in monospace font or however "sample" is defined stylistically
SCRIPT Function	Generates the <code><SCRIPT></code> and <code></SCRIPT></code> tags which contain a script written in languages such as JavaScript and VBscript
SMALL Function	Generates the <code><SMALL></code> and <code></SMALL></code> tags, which direct the browser to render the text they surround using a small font

Table 236-1 (Cont.) HTF Package Subprograms

Subprogram	Description
STRIKE Function	Generates the <STRIKE> and </STRIKE> tags which direct the browser to render the text they surround in strikethrough type
STRONG Function	Generates the and tags which direct the browser to render the text they surround in bold or however "strong" is defined stylistically
STYLE Function	Generates the <STYLE> and </STYLE> tags which include a style sheet in a Web page
SUB Function	Generates the _{and} tags which direct the browser to render the text they surround as subscript
SUP Function	Generates the ^{and} tags which direct the browser to render the text they surround as superscript
TABLECAPTION Function	Generates the <CAPTION> and </CAPTION> tags which place a caption in an HTML table
TABLECLOSE Function	Generates the </TABLE> tag which marks the end of an HTML table
TABLEDATA Function	Generates the <TD> and </TD> tags which insert data into a cell of an HTML table
TABLEHEADER Function	Generates the <TH> and </TH> tags which insert a header cell in an HTML table.
TABLEOPEN Function	Generates the <TABLE> tag which marks the beginning of an HTML table
TABLEROWCLOSE Function	Generates the </TR> tag which marks the end of a new row in an HTML table
TABLEROWOPEN Function	Generates the <TR> tag which marks the beginning of a new row in an HTML table
TELETYPE Function	Generates the <TT> and </TT> tags which direct the browser to render the text they surround in a fixed width typewriter font, for example, the courier font
TITLE Function	Generates the <TITLE> and </TITLE> tags which specify the text to display in the titlebar of the browser window
ULISTCLOSE Function	Generates the tag which marks the end of an unordered list
ULISTOPEN Function	Generates the tag which marks the beginning of an unordered list
UNDERLINE Function	Generates the <U> and </U> tags, which direct the browser to render the text they surround with an underline
VARIABLE Function	Generates the <VAR> and </VAR> tags which direct the browser to render the text they surround in italics or however "variable" is defined stylistically.
WBR Function	Generates the <WBR> tag, which inserts a soft line break within a section of NOBR text

236.6.1 ADDRESS Function

This function generates the `<ADDRESS>` and `</ADDRESS>` tags which specify the address, author and signature of a document.

Syntax

```
HTF.ADDRESS (
  cvalue      IN      VARCHAR2
  cnowrap     IN      VARCHAR2  DEFAULT NULL
  cclear      IN      VARCHAR2  DEFAULT NULL
  cattributes IN      VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-2 ADDRESS Function Parameters

Parameter	Description
<code>cvalue</code>	The string that goes between the <code><ADDRESS></code> and <code></ADDRESS></code> tags.
<code>cnowrap</code>	If the value for this parameter is not NULL, the <code>NOWRAP</code> attribute is included in the tag
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag

Examples

This function generates

```
<ADDRESS CLEAR="cclear" NOWRAP cattributes>cvalue</ADDRESS>
```

236.6.2 ANCHOR Function

Like the `ANCHOR2` function, this function generates the `<A>` and `` HTML tags which specify the source or destination of a hypertext link.

The difference between these subprograms is that the [ANCHOR2 Function](#) provides a target and therefore can be used for a frame.

Syntax

```
HTF.ANCHOR (
  curl        IN      VARCHAR2,
  ctext       IN      VARCHAR2,
  cname       IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```


Parameters

Table 236-3 ANCHOR Function Parameters

Parameter	Description
curl	The value for the HREF attribute.
cctx	The string that goes between the <A> and tags.
cname	The value for the NAME attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<A HREF="curl" NAME="cname" cattributes>cctx</A>
```

Usage Notes

This tag accepts several attributes, but either HREF or NAME is required. HREF specifies to where to link. NAME allows this tag to be a target of a hypertext link.

236.6.3 ANCHOR2 Function

Like the ANCHOR function, this function generates the <A> and HTML tags which specify the source or destination of a hypertext link.

The difference between this and the ANCHOR function is that this function provides a target and therefore can be used for a frame.

Syntax

```
HTF.ANCHOR2 (
  curl          IN          VARCHAR2,
  cctx          IN          VARCHAR2,
  cname         IN          VARCHAR2  DEFAULT NULL,
  ctarget       IN          varchar2  DEFAULT NULL,
  cattributes   IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-4 ANCHOR2 Function Parameters

Parameter	Description
curl	The value for the HREF attribute.
cctx	The string that goes between the <A> and tags.
cname	The value for the NAME attribute
ctarget	The value for the TARGET attribute.
cattributes	The other attributes to be included as-is in the tag

Examples

This function generates

```
<A HREF="curl" NAME="cname" TARGET = "ctarget" cattributes>ctext</A>
```

236.6.4 APPLETCLOSE Function

This function closes the applet invocation with the `</APPLET>` tag.

You must first invoke the a Java applet using [APPLETOPEN Function](#)

Syntax

```
HTF.APPLETCLOSE  
RETURN VARCHAR2;
```

236.6.5 APPLETOPEN Function

This function generates the `<APPLET>` tag which begins the invocation of a Java applet.

You close the applet invocation with [APPLETCLOSE Function](#) which generates the `</APPLET>` tag.

Syntax

```
HTF.APPLETOPEN (  
    ccode          IN          VARCHAR2,  
    cheight        IN          NUMBER,  
    cwidth         IN          NUMBER,  
    cattributes    IN          VARCHAR2  DEFAULT NULL)  
RETURN VARCHAR2;
```

Parameters

Table 236-5 APPLETOPEN Function Parameters

Parameter	Description
ccode	The value for the <code>CODE</code> attribute which specifies the name of the applet class.
cheight	The value for the <code>HEIGHT</code> attribute.
cwidth	The value for the <code>WIDTH</code> attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<APPLET CODE=ccode HEIGHT=cheight WIDTH=cwidth cattributes>
```

so that, for example,

```
HTF.appletopen('testclass.class', 100, 200, 'CODEBASE="/ows-applets"')
```

generates

```
<APPLET CODE="testclass.class" height=100 width=200 CODEBASE="/ows-applets">
```

Usage Notes

- Specify parameters to the Java applet using the [PARAM Function](#) function.
- Use the `cattributes` parameter to specify the `CODEBASE` attribute since the PL/SQL cartridge does not know where to find the class files. The `CODEBASE` attribute specifies the virtual path containing the class files.

236.6.6 AREA Function

This function generates the `<AREA>` tag, which defines a client-side image map. The `<AREA>` tag defines areas within the image and destinations for the areas.

Syntax

```
HTF.AREA (
  ccoords      IN          VARCHAR2
  cshape       IN          VARCHAR2  DEFAULT NULL,
  chref        IN          VARCHAR2  DEFAULT NULL,
  cnohref      IN          VARCHAR2  DEFAULT NULL,
  ctargt       IN          VARCHAR2  DEFAULT NULL,
  cattributes  IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-6 AREA Function Parameters

Parameter	Description
<code>ccords</code>	The value for the <code>COORDS</code> attribute.
<code>cshape</code>	The value for the <code>SHAPE</code> attribute.
<code>chref</code>	The value for the <code>HREF</code> attribute.
<code>cnohref</code>	If the value for this parameter is not <code>NULL</code> , the <code>NOHREF</code> attribute is added to the tag.
<code>ctarget</code>	The value for the <code>TARGET</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<AREA COORDS="ccords" SHAPE="cshape" HREF="chref" NOHREF TARGET="ctarget" cattributes>
```

236.6.7 BASE Function

This function generates the `<BASE>` tag which records the URL of the document.

Syntax

```
HTF.BASE (
  ctargt       IN          VARCHAR2  DEFAULT NULL,
```

```

    cattributes    IN          VARCHAR2    DEFAULT NULL)
RETURN VARCHAR2;

```

Parameters

Table 236-7 BASE Function Parameters

Parameter	Description
ctarget	The value for the TARGET attribute which establishes a window name to which all links in this document are targeted.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<BASE HREF="<current URL>" TARGET="ctarget" cattributes>
```

236.6.8 BASEFONT Function

This function generates the <BASEFONT> tag which specifies the base font size for a Web page.

Syntax

```

HTF.BASEFONT (
    nsize    IN    INTEGER)
RETURN VARCHAR2;

```

Parameters

Table 236-8 BASEFONT Function Parameters

Parameter	Description
nsize	The value for the SIZE attribute.

Examples

This function generates

```
<BASEFONT SIZE="nsize">
```

236.6.9 BGSOUND Function

This function generates the <BGSOUND> tag which includes audio for a Web page.

Syntax

```

HTF.BGSOUND (
    csrc          IN          VARCHAR2,
    cloop         IN          VARCHAR2    DEFAULT NULL,
    cattributes   IN          VARCHAR2    DEFAULT NULL)
RETURN VARCHAR2;

```

Parameters

Table 236-9 BGSOUND Function Parameters

Parameter	Description
csrc	The value for the SRC attribute.
cloop	The value for the LOOP attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<BGSOUND SRC="csrc" LOOP="cloop" cattributes>
```

236.6.10 BIG Function

This function generates the <BIG> and </BIG> tags which direct the browser to render the text in a bigger font.

Syntax

```
HTF.BIG (
  ctext          IN          VARCHAR2,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-10 BIG Function Parameters

Parameter	Description
ctext	The text that goes between the tags.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<BIG cattributes>ctext</BIG>
```

236.6.11 BLOCKQUOTECLOSE Function

This function generates the </BLOCKQUOTE> tag which mark the end of a section of quoted text.

You mark the beginning of a section of text by means of the [BLOCKQUOTEOPEN Function](#).

Syntax

```
HTF.BLOCKQUOTECLOSE
RETURN VARCHAR2;
```

Examples

This function generates

```
</BLOCKQUOTE>
```

236.6.12 BLOCKQUOTEOPEN Function

This function generates the `<BLOCKQUOTE>` tag, which marks the beginning of a section of quoted text.

You mark the end of a section of text by means of the [BLOCKQUOTECLOSE Function](#).

Syntax

```
HTF.BLOCKQUOTEOPEN (
  cnowrap      IN          VARCHAR2  DEFAULT NULL,
  cclear       IN          VARCHAR2  DEFAULT NULL,
  cattributes  IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters**Table 236-11 BLOCKQUOTEOPEN Function Parameters**

Parameter	Description
cnowrap	If the value for this parameter is not NULL, the NOWRAP attribute is added to the tag.
cclear	The value for the CLEAR attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<BLOCKQUOTE CLEAR="cclear" NOWRAP cattributes>
```

236.6.13 BODYCLOSE Function

This function generates the `</BODY>` tag which marks the end of a body section of an HTML document.

You mark the beginning of a body section by means of the [BODYOPEN Function](#).

Syntax

```
HTF.BODYCLOSE
RETURN VARCHAR2;
```

Examples

This function generates

```
</BODY>
```

236.6.14 BODYOPEN Function

This function generates the <BODY> tag which marks the beginning of the body section of an HTML document.

You mark the end of a body section by means of the [BODYCLOSE Function](#).

Syntax

```
HTF.BODYOPEN (  
    cbackground    IN          VARCHAR2    DEFAULT NULL,  
    cattributes    IN          VARCHAR2    DEFAULT NULL)  
RETURN VARCHAR2;
```

Parameters

Table 236-12 BODYOPEN Function Parameters

Parameter	Description
cbackground	The value for the BACKGROUND attribute which specifies a graphic file to use for the background of the document.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<BODY background="cbackground" cattributes>
```

so that

```
HTF.BODYOPEN('/img/background.gif')  
RETURN VARCHAR2;
```

generates:

```
<BODY background="/img/background.gif">
```

236.6.15 BOLD Function

This function generates the and tags which direct the browser to display the text in boldface.

Syntax

```
HTF.BOLD (  
    ctext          IN          VARCHAR2,  
    cattributes    IN          VARCHAR2    DEFAULT NULL)  
RETURN VARCHAR2;
```

Parameters

Table 236-13 BOLD Function Parameters

Parameter	Description
c <code>text</code>	The text that goes between the tags.
c <code>attributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<B cattributes>ctext</B>
```

236.6.16 BR Function

This function generates the `
` tag which begins a new line of text.

It performs the same operation as the [NL Function](#).

Syntax

```
HTF.BR(
  cclear          IN          VARCHAR2  DEFAULT NULL,
  cattributes     IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-14 BR Function Parameters

Parameter	Description
c <code>clear</code>	The value for the <code>CLEAR</code> attribute.
c <code>attributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<BR CLEAR="cclear" cattributes>
```

236.6.17 CENTER Function

This function generates the `<CENTER>` and `</CENTER>` tags which center a section of text within a Web page.

Syntax

```
HTF.CENTER (
  ctext          IN          VARCHAR2)
RETURN VARCHAR2;
```


Parameters

Table 236-15 CENTER Parameters

Parameter	Description
c text	The text that goes between the tags.

Examples

This function generates

```
<CENTER>ctext</CENTER>
```

236.6.18 CENTERCLOSE Function

This function generates the `</CENTER>` tag which marks the end of a section of text to center.

You mark the beginning of a section of text to center with the [CENTEROPEN Function](#).

Syntax

```
HTF.CENTERCLOSE  
RETURN VARCHAR2;
```

Examples

This function generates

```
</CENTER>
```

236.6.19 CENTEROPEN Function

This function generates the `<CENTER>` tag which mark the beginning of a section of text to center.

You mark the beginning of a section of text to center with the [CENTERCLOSE Function](#).

Syntax

```
HTF.CENTEROPEN  
RETURN VARCHAR2;
```

Examples

This function generates

```
<CENTER>
```

236.6.20 CITE Function

This function generates the `<CITE>` and `</CITE>` tags which direct the browser to render the text as a citation.

Syntax

```
HTF.CITE (  
    ctext          IN          VARCHAR2,  
    cattributes    IN          VARCHAR2  DEFAULT NULL)  
RETURN VARCHAR2;
```

Parameters

Table 236-16 CITE Function Parameters

Parameter	Description
<code>ctext</code>	The text to render as citation.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<CITE cattributes>ctext</CITE>
```

236.6.21 CODE Function

This function generates the `<CODE>` and `</CODE>` tags which direct the browser to render the text in monospace font or however "code" is defined stylistically.

Syntax

```
HTF.CODE (  
    ctext          IN          VARCHAR2,  
    cattributes    IN          VARCHAR2  DEFAULT NULL)  
RETURN VARCHAR2;
```

Parameters

Table 236-17 CODE Function Parameters

Parameter	Description
<code>ctext</code>	The text to render as code.
<code>cattributes</code>	The other attributes to be included as-is in the tag

Examples

This function generates

```
<CODE cattributes>ctext</CODE>
```

236.6.22 COMMENT Function

This function generates the comment tags.

Syntax

```
HTF.COMMENT (  
    ctext          IN          VARCHAR2)  
    RETURN VARCHAR2;
```

Parameters

Table 236-18 COMMENT Function Parameters

Parameter	Description
ctext	The comment.

Examples

This function generates

```
<!-- ctext -->
```

236.6.23 DFN Function

This function generates the `<DFN>` and `</DFN>` tags which direct the browser to mark the text in italics or however "definition" is described stylistically.

Syntax

```
HTF.DFN (  
    ctext          IN          VARCHAR2)  
    RETURN VARCHAR2;
```

Parameters

Table 236-19 DFN Function Parameters

Parameter	Description
ctext	The text to render in italics.

Examples

This function generates

```
<DFN>ctext</DFN>
```

236.6.24 DIRLISTCLOSE Function

This function generates the `</DIR>` tag which ends a directory list section. You start a directory list section with the DIRLISTOPEN Function.

Syntax

```
HTF.DIRLISTCLOSE  
    RETURN VARCHAR2;
```

Usage Notes

A directory list presents a list of items that contains up to 20 characters. Items in this list are typically arranged in columns, 24 characters wide. Insert the `` tag directly or invoke the [LISTITEM Function](#) so that the `` tag appears directly after the `</DIR>` tag to define the items as a list.

Examples

This function generates

```
</DIR>
```

Related Topics

- [DIRLISTOPEN Function](#)
This function generates the `<DIR>` which starts a directory list section. You end a directory list section with the DIRLISTCLOSE Function.

236.6.25 DIRLISTOPEN Function

This function generates the `<DIR>` which starts a directory list section. You end a directory list section with the DIRLISTCLOSE Function.

Syntax

```
HTF.DIRLISTOPEN  
    RETURN VARCHAR2;
```

Usage Notes

A directory list presents a list of items that contains up to 20 characters. Items in this list are typically arranged in columns, 24 characters wide. Insert the `` tag directly or invoke the [LISTITEM Function](#) so that the `` tag appears directly after the `</DIR>` tag to define the items as a list.

Examples

This function generates

```
<DIR>
```

Related Topics

- [DIRLISTCLOSE Function](#)
This function generates the `</DIR>` tag which ends a directory list section. You start a directory list section with the DIRLISTOPEN Function.

236.6.26 DIV Function

This function generates the <DIV> tag which creates document divisions.

Syntax

```
HTF.DIV (  
    calign          IN          VARCHAR2  DEFAULT NULL,  
    cattributes    IN          VARCHAR2  DEFAULT NULL)  
RETURN VARCHAR2;
```

Parameters

Table 236-20 DIV Function Parameters

Parameter	Description
calign	The value for the ALIGN attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<DIV ALIGN="calign" cattributes>
```

236.6.27 DLISTCLOSE Function

This function generates the </DL> tag which ends a definition list. You start a definition list by means of the DLISTOPEN Function.

Syntax

```
HTF.DLISTCLOSE  
RETURN VARCHAR2;
```

Usage Notes

A definition list looks like a glossary: it contains terms and definitions. Terms are inserted using the [DLISTTERM Function](#) and definitions are inserted using the [DLISTDEF Function](#).

Examples

This function generates

```
</DL>
```

Related Topics

- [DLISTOPEN Function](#)
This function generates the <DL> tag which starts a definition list. You end a definition list by means of the DLISTCLOSE Function.

236.6.28 DLISTDEF Function

This function generates the <DD> tag, which inserts definitions of terms. Use this tag for a definition list <DL>. Terms are tagged <DT> and definitions are tagged <DD>.

Syntax

```
HTF.DLISTDEF (
  ctext          IN          VARCHAR2  DEFAULT NULL,
  cclear         IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-21 DLISTDEF Function Parameters

Parameter	Description
ctext	The definition of the term.
cclear	The value for the CLEAR attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<DD CLEAR="cclear" cattributes>ctext
```

236.6.29 DLISTOPEN Function

This function generates the <DL> tag which starts a definition list. You end a definition list by means of the DLISTCLOSE Function.

Syntax

```
HTF.DLISTOPEN (
  cclear         IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-22 DLISTOPEN Function Parameters

Parameter	Description
cclear	The value for the CLEAR attribute.
cattributes	The other attributes to be included as-is in the tag.

Usage Notes

A definition list looks like a glossary: it contains terms and definitions. Terms are inserted using the [DLISTTERM Function](#) and definitions are inserted using the [DLISTDEF Function](#).

Examples

This function generates

```
<DL CLEAR="cclear" cattributes>
```

Related Topics

- [DLISTCLOSE Function](#)
This function generates the `</DL>` tag which ends a definition list. You start a definition list by means of the [DLISTOPEN Function](#).

236.6.30 DLISTTERM Function

This function generates the `<DT>` tag which defines a term in a definition list `<DL>`.

Syntax

```
HTF.DLISTTERM (
  ctext          IN          VARCHAR2  DEFAULT NULL,
  cclear         IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-23 DLISTTERM Function Parameters

Parameter	Description
ctext	The term.
cclear	The value for the CLEAR attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<DT CLEAR="cclear" cattributes>ctext
```

236.6.31 EM Function

This function generates the `` and `` tags, which define text to be emphasized.

It performs the same task as the [EMPHASIS Function](#).

Syntax

```
HTF.EM(
  ctext          IN          VARCHAR2,
```

```

    cattributes    IN          VARCHAR2    DEFAULT NULL)
RETURN VARCHAR2;

```

Parameters

Table 236-24 EM Function Parameters

Parameter	Description
ctext	The text to emphasize.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<EM cattributes>ctext</EM>
```

236.6.32 EMPHASIS Function

This function generates the `` and `` tags, which define text to be emphasized.

It performs the same task as the [EM Function](#).

Syntax

```

HTF.EMPHASIS(
    ctext          IN          VARCHAR2,
    cattributes    IN          VARCHAR2    DEFAULT NULL)
RETURN VARCHAR2;

```

Parameters

Table 236-25 EMPHASIS Function Parameters

Parameter	Description
ctext	The text to emphasize.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<EM cattributes>ctext</EM>
```

236.6.33 ESCAPE_SC Function

This function replaces characters that have special meaning in HTML with their escape sequences.

The following characters are converted:

- `&` to `&`
- `"` to `"`

- < to <
- > to >

This function performs the same operation as HTTP. [PRINTS Procedure](#) and HTTP. [PS Procedure](#).

Syntax

```
HTF.ESCAPE_SC (
    ctext          IN          VARCHAR2);
```

Parameters

Table 236-26 ESCAPE_SC Function Parameters

Parameter	Description
ctext	The text string to convert.

236.6.34 ESCAPE_URL Function

This deprecated function replaces characters that have special meaning in HTML and HTTP with their escape sequences.

Note:

This procedure, deprecated in Release 10g, and provided here only for reasons of backward compatibility, does not comply with the Internet Engineering Task Force (IETF) Request for Comments (RFC) standards of URL encoding. If you need to encode URLs, it is recommended you use the [ESCAPE Function](#) in the [UTL_URL](#) package.

The following characters are converted:

- & to &
- " to "
- < to <
- > to >
- % to &25

Syntax

```
HTF.ESCAPE_URL (
    p_url          IN          VARCHAR2);
```

Parameters

Table 236-27 ESCAPE_URL Function Parameters

Parameter	Description
p_url	The string to convert.

236.6.35 FONTCLOSE Function

This function generates the `` tag which marks the end of a section of text with the specified font characteristics.

You mark the beginning of the section text by means of the [FONTOPEN Function](#).

Syntax

```
HTF.FONTCLOSE
  RETURN VARCHAR2;
```

Examples

This function generates

```
</FONT>
```

236.6.36 FONTOPEN Function

This function generates the `` which marks the beginning of section of text with the specified font characteristics.

You mark the end of the section text by means of the [FONTCLOSE Function](#).

Syntax

```
HTF.FONTOPEN(
  ccolor      IN      VARCHAR2  DEFAULT NULL,
  cface       IN      VARCHAR2  DEFAULT NULL,
  csize       IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL)
  RETURN VARCHAR2;
```

Parameters

Table 236-28 FONTOPEN Function Parameters

Parameter	Description
ccolor	The value for the <code>COLOR</code> attribute.
cface	The value for the <code>FACE</code> attribute
csize	The value for the <code>SIZE</code> attribute
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<FONT COLOR="ccolor" FACE="cface" SIZE="csize" cattributes>
```

236.6.37 FORMAT_CELL Function

This function formats column values inside an HTML table using the TABLEDATA Function. It allows for better control over the HTML tables.

Syntax

```
HTF.FORMAT_CELL(  
    columnValue      IN      VARCHAR2  
    format_numbers   IN      VARCHAR2  DEFAULT NULL  
    RETURN VARCHAR2;
```

Parameters

Table 236-29 FORMAT_CELL Function Parameters

Parameter	Description
columnValue	The value that needs to be formatted in an HTML table.
format_numbers	The format that numeric data is displayed in. If the value of this parameter is not NULL, the number fields are right-justified and rounded to two decimal places.

Examples

This function generates

```
<TD >columnValue</TD>
```

Related Topics

- [TABLEDATA Function](#)
This function generates the <TD> and </TD> tags which insert data into a cell of an HTML table.

236.6.38 FORMCHECKBOX Function

This function generates the <INPUT> tag with TYPE="checkbox" which inserts a checkbox element in a form.

A checkbox element is a button that the user toggles on or off.

Syntax

```
HTF.FORMCHECKBOX(  
    cname           IN      VARCHAR2,  
    cvalue          IN      VARCHAR2  DEFAULT 'ON',  
    cchecked        IN      VARCHAR2  DEFAULT NULL,  
    cattributes     IN      VARCHAR2  DEFAULT NULL)  
    RETURN VARCHAR2;
```

Parameters

Table 236-30 FORMCHECKBOX Function Parameters

Parameter	Description
cname	The value for the NAME attribute.
cvalue	The value for the VALUE attribute.
cchecked	If the value for this parameter is not NULL, the CHECKED attribute is added to the tag.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<INPUT TYPE="checkbox" NAME="cname" VALUE="cvalue" CHECKED cattributes>
```

236.6.39 FORMCLOSE Function

This function generates the `</FORM>` tag which marks the end of a form section in an HTML document.

You mark the beginning of the form section by means of the [FORMOPEN Function](#).

Syntax

```
HTF.FORMCLOSE
  RETURN VARCHAR2;
```

Examples

This function generates

```
</FORM>
```

236.6.40 FORMFILE Function

This function generates the `<INPUT>` tag with `TYPE="file"` which inserts a file form element. This is used for file uploading for a given page.

Syntax

```
HTF.FORMFILE(
  cname          IN          VARCHAR2,
  caccept       IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
  RETURN VARCHAR2;
```

Parameters

Table 236-31 FORMFILE Function Parameters

Parameter	Description
cname	The value for the <code>NAME</code> attribute.
caccept	A comma-delimited list of MIME types for upload.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<INPUT TYPE="file" NAME="cname" ACCEPT="caccept" cattributes>
```

236.6.41 FORMHIDDEN Function

This function generates the `<INPUT>` tag with `TYPE="hidden"`, which inserts a hidden form element.

This element is not seen by the user. It submits additional values to the script.

Syntax

```
HTF.FORMHIDDEN (
  cname          IN          VARCHAR2,
  cvalue         IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-32 FORMHIDDEN Function Parameters

Parameter	Description
cname	The value for the <code>NAME</code> attribute.
cvalue	The value for the <code>VALUE</code> attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<INPUT TYPE="hidden" NAME="cname" VALUE="cvalue" cattributes>
```

236.6.42 FORMIMAGE Function

This function generates the `<INPUT>` tag with `TYPE="image"` which creates an image field that the user clicks to submit the form immediately.

The coordinates of the selected point are measured in pixels, and returned (along with other contents of the form) in two name/value pairs. The x coordinate is submitted under the name

of the field with `.x` appended, and the `y` coordinate with `.y` appended. Any `VALUE` attribute is ignored.

Syntax

```
HTF.FORMIMAGE (
  cname      IN      VARCHAR2,
  csrc       IN      VARCHAR2,
  calign     IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-33 FORMIMAGE Function Parameters

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>csrc</code>	The value for the <code>SRC</code> attribute that specifies the image file.
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<INPUT TYPE="image" NAME="cname" SRC="csrc" ALIGN="calign" cattributes>
```

236.6.43 FORMOPEN Function

This function generates the `<FORM>` tag which marks the beginning of a form section in an HTML document.

You mark the end of the form section by means of the [FORMCLOSE Function](#).

Syntax

```
HTF.FORMOPEN (
  curl       IN      VARCHAR2,
  cmethod    IN      VARCHAR2  DEFAULT 'POST',
  ctarget    IN      VARCHAR2  DEFAULT NULL,
  cenctype   IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-34 FORMOPEN Function Parameters

Parameter	Description
<code>curl</code>	The URL of the Web Request Broker or CGI script where the contents of the form is sent. This parameter is required.
<code>cmethod</code>	The value for the <code>METHOD</code> attribute. The value can be "GET" or "POST".

Table 236-34 (Cont.) FORMOPEN Function Parameters

Parameter	Description
ctarget	The value for the TARGET attribute.
cenctype	The value for the ENCTYPE attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<FORM ACTION="curl" METHOD="cmethod" TARGET="ctarget" ENCTYPE="cenctype" cattributes>
```

236.6.44 FORMPASSWORD Function

This function generates the <INPUT> tag with TYPE="password" which creates a single-line text entry field.

When the user enters text in the field, each character is represented by one asterisk. This is used for entering passwords.

Syntax

```
HTF.FORMPASSWORD(
  cname          IN          VARCHAR2,
  csize          IN          VARCHAR2,
  cmaxlength    IN          VARCHAR2  DEFAULT NULL,
  cvalue        IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters**Table 236-35 FORMPASSWORD Function Parameters**

Parameter	Description
cname	The value for the NAME attribute.
csize	The value for the SIZE attribute.
cmaxlength	The value for the MAXLENGTH attribute.
cvalue	The value for the VALUE attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<INPUT TYPE="password" NAME="cname" SIZE="csize" MAXLENGTH="cmmaxlength" VALUE="cvalue"
cattributes>
```

236.6.45 FORMRADIO Function

This function generates the `<INPUT>` tag with `TYPE="radio"`, which creates a radio button on the HTML form. Within a set of radio buttons, the user selects only one. Each radio button in the same set has the same name, but different values. The selected radio button generates a name/value pair.

Syntax

```
HTF.FORMRADIO (
  cname          IN          VARCHAR2,
  cvalue         IN          VARCHAR2,
  cchecked       IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-36 FORMRADIO Function Parameters

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>cvalue</code>	The value for the <code>VALUE</code> attribute.
<code>cchecked</code>	If the value for this parameter is not <code>NULL</code> , the <code>CHECKED</code> attribute is added to the tag.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<INPUT TYPE="radio" NAME="cname" VALUE="cvalue" CHECKED cattributes>
```

236.6.46 FORMRESET Function

This function generates the `<INPUT>` tag with `TYPE="reset"` which creates a button that, when selected, resets the form fields to their initial values.

Syntax

```
HTF.FORMRESET (
  cvalue         IN          VARCHAR2  DEFAULT 'Reset',
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-37 FORMRESET Function Parameters

Parameter	Description
<code>cvalue</code>	The value for the <code>VALUE</code> attribute.

Table 236-37 (Cont.) FORMRESET Function Parameters

Parameter	Description
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<INPUT TYPE="reset" VALUE="cvalue" cattributes>
```

236.6.47 FORMSELECTCLOSE Function

This function generates the `</SELECT>` tag which marks the end of a Select form element.

A Select form element is a listbox where the user selects one or more values. You mark the beginning of Select form element by means of the [FORMSELECTOPEN Function](#). The values are inserted using [FORMSELETOPTION Function](#).

Syntax

```
HTF.FORMSELECTCLOSE  
RETURN VARCHAR2;
```

Examples

This function generates

```
</SELECT>
```

as shown under [Examples](#) of the [FORMSELECTOPEN Function](#).

236.6.48 FORMSELECTOPEN Function

This function generates the `<SELECT>` tags which begins a Select form element.

A Select form element is a listbox where the user selects one or more values. You mark the end of Select form element by means of the [FORMSELECTCLOSE Function](#). The values are inserted using [FORMSELETOPTION Function](#).

Syntax

```
HTF.FORMSELECTOPEN(  
  cname          IN   VARCHAR2,  
  cprompt        IN   VARCHAR2  DEFAULT NULL,  
  nsize          IN   INTEGER    DEFAULT NULL,  
  cattributes    IN   VARCHAR2  DEFAULT NULL)  
RETURN VARCHAR2;
```

Parameters

Table 236-38 FORMSELECTOPEN Function Parameters

Parameter	Description
cname	The value for the NAME attribute.
cprompt	The string preceding the list box.
nsize	The value for the SIZE attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
cprompt <SELECT NAME="cname" SIZE="nsize" cattributes>
</SELECT>
```

so that

```
HTF.FORMSELECTOPEN('greatest_player';
  'Pick the greatest player:');
HTF.FORMSELECTOPTION('Messier');
HTF.FORMSELECTOPTION('Howe');
HTF.FORMSELECTOPTION('Gretzky');.
HTF.FORMSELECTCLOSE;
```

generates

```
Pick the greatest player:
<SELECT NAME="greatest_player">
<OPTION>Messier
<OPTION>Howe
<OPTION>Gretzky
</SELECT>
```

236.6.49 FORMSELETOPTION Function

This function generates the <OPTION> tag which represents one choice in a Select element.

Syntax

```
HTF.FORMSELETOPTION(
  cvalue          IN          VARCHAR2,
  cselected       IN          VARCHAR2  DEFAULT NULL,
  cattributes     IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-39 FORMSELETOPTION Function Parameters

Parameter	Description
cvalue	The text for the option
cvalue	If the value for this parameter is not NULL, the <code>SELECTED</code> attribute is added to the tag.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates `<OPTION SELECTED cattributes>cvalue` as shown under the Examples section of the [FORMSELECTOPEN Function](#).

236.6.50 FORMSUBMIT Function

This function generates the `<INPUT>` tag with `TYPE="submit"` which creates a button that, when clicked, submits the form. If the button has a `NAME` attribute, the button contributes a name/value pair to the submitted data.

Syntax

```
HTF.FORMSUBMIT (
    cname          IN          VARCHAR2   DEFAULT NULL,
    cvalue         IN          VARCHAR2   DEFAULT 'Submit',
    cattributes    IN          VARCHAR2   DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-40 FORMSUBMIT Function Parameters

Parameter	Description
cname	The value for the <code>NAME</code> attribute.
cvalue	The value for the <code>VALUE</code> attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<INPUT TYPE="submit" NAME="cname" VALUE="cvalue" cattributes>
```

236.6.51 FORMTEXT Function

This function generates the `<INPUT>` tag with `TYPE="text"`, which creates a field for a single line of text.

Syntax

```
HTF.FORMTEXT (
  cname          IN          VARCHAR2,
  csize          IN          VARCHAR2  DEFAULT NULL,
  cmaxlength     IN          VARCHAR2  DEFAULT NULL,
  cvalue         IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-41 FORMTEXT Function Parameters

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>csize</code>	The value for the <code>SIZE</code> attribute.
<code>cmaxlength</code>	The value for the <code>MAXLENGTH</code> attribute.
<code>cvalue</code>	The value for the <code>VALUE</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<INPUT TYPE="text" NAME="cname" SIZE="csize" MAXLENGTH="cmmaxlength"
VALUE="cvalue" cattributes>
```

236.6.52 FORMTEXTAREA Function

This function generates the `<TEXTAREA>` tag, which creates a text field that has no predefined text in the text area. This field enables entering several lines of text.

The same operation is performed by the [FORMTEXTAREA2 Function](#) which in addition has the `cwrap` parameter that lets you specify a wrap style.

Syntax

```
HTF.FORMTEXTAREA (
  cname          IN          VARCHAR2,
  nrows         IN          INTEGER,
  ncolumns      IN          INTEGER,
  calign        IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-42 FORMTEXTAREA Function Parameters

Parameter	Description
cname	The value for the <code>NAME</code> attribute.
nrows	The value for the <code>ROWS</code> attribute. This is an integer.
ncolumns	The value for the <code>COLS</code> attribute. This is an integer.
calign	The value for the <code>ALIGN</code> attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<TEXTAREA NAME="cname" ROWS="nrows" COLS="ncolumns" ALIGN="calign" cattributes></
TEXTAREA>
```

236.6.53 FORMTEXTAREA2 Function

This function generates the `<TEXTAREA>` tag, which creates a text field that has no predefined text in the text area. This field enables entering several lines of text.

The same operation is performed by the [FORMTEXTAREA Function](#) except that in that case you cannot specify a wrap style.

Syntax

```
HTF.FORMTEXTAREA2 (
  cname          IN          VARCHAR2,
  nrows          IN          INTEGER,
  ncolumns      IN          INTEGER,
  calign        IN          VARCHAR2  DEFAULT NULL,
  cwrap         IN          VARCHAR2  DEFAULT NULL,
  cattributes   IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-43 FORMTEXTAREA2 Function Parameters

Parameter	Description
cname	The value for the <code>NAME</code> attribute.
nrows	The value for the <code>ROWS</code> attribute. This is an integer.
ncolumns	The value for the <code>COLS</code> attribute. This is an integer.
calign	The value for the <code>ALIGN</code> attribute.
cwrap	The value for the <code>WRAP</code> attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<TEXTAREA NAME="cname" ROWS="nrows" COLS="ncolumns" ALIGN="calign" WRAP="cwrap"
cattributes></TEXTAREA>
```

236.6.54 FORMTEXTAREACLOSE Function

This function generates the </TEXTAREA> tag which ends a text area form element.

You open a text area element by means of either [FORMTEXTAREAOPEN Function](#) or [FORMTEXTAREAOPEN2 Function](#).

Syntax

```
HTF.FORMTEXTAREACLOSE
RETURN VARCHAR2;
```

Examples

This function generates

```
</TEXTAREA>
```

236.6.55 FORMTEXTAREAOPEN Function

This function generates the <TEXTAREA> which marks the beginning of a text area form element.

The same operation is performed by the [FORMTEXTAREAOPEN2 Function](#) which in addition has the `cwrap` parameter that lets you specify a wrap style. You mark the end of a text area form element by means of the [FORMTEXTAREACLOSE Function](#).

Syntax

```
HTF.FORMTEXTAREAOPEN (
  cname          IN          VARCHAR2,
  nrows          IN          INTEGER,
  ncolumns      IN          INTEGER,
  calign        IN          VARCHAR2  DEFAULT NULL,
  cattributes   IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-44 FORMTEXTAREAOPEN Function Parameters

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>nrows</code>	The value for the <code>ROWS</code> attribute. This is an integer.
<code>ncolumns</code>	The value for the <code>COLS</code> attribute. This is an integer.
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<TEXTAREA NAME="cname" ROWS="nrows" COLS="ncolumns" ALIGN="calign" cattributes>
```

236.6.56 FORMTEXTAREAOPEN2 Function

This function generates the `<TEXTAREA>` which marks the beginning of a text area form element.

The same operation is performed by the [FORMTEXTAREAOPEN Function](#) except that in that case you cannot specify a wrap style. You mark the end of a text area form element by means of the [FORMTEXTAREACLOSE Function](#).

Syntax

```
HTF.FORMTEXTAREAOPEN2 (
  cname          IN          VARCHAR2,
  nrows          IN          INTEGER,
  ncolumns       IN          INTEGER,
  calign         IN          VARCHAR2  DEFAULT NULL,
  cwrap         IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-45 FORMTEXTAREAOPEN2 Function Parameters

Parameter	Description
cname	The value for the NAME attribute.
nrows	The value for the ROWS attribute. This is an integer.
ncolumns	The value for the COLS attribute. This is an integer.
calign	The value for the ALIGN attribute.
cwrap	The value for the WRAP attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<TEXTAREA NAME="cname" ROWS="nrows" COLS="ncolumns" ALIGN="calign" WRAP = "cwrap"
cattributes>
```

236.6.57 FRAME Function

This function generates the <FRAME> tag which begins the characteristics of a frame created by a <FRAMESET> tag.

Syntax

```
HTF.FRAME (
  csrc          IN          VARCHAR2,
  cname         IN          VARCHAR2  DEFAULT NULL,
  cmarginwidth IN          VARCHAR2  DEFAULT NULL,
  cmarginheight IN         VARCHAR2  DEFAULT NULL,
  cscrolling    IN          VARCHAR2  DEFAULT NULL,
  cnoresize     IN          VARCHAR2  DEFAULT NULL,
  cattributes   IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-46 FRAME Function Parameters

Parameter	Description
csrc	The URL to display in the frame.
cname	The value for the NAME attribute.
cmarginwidth	The value for the MARGINWIDTH attribute.
cscrolling	The value for the SCROLLING attribute.
cnoresize	If the value for this parameter is not NULL, the NORESIZE attribute is added to the tag.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<FRAME SRC="csrc" NAME="cname" MARGINWIDTH="cmarginwidth"
MARGINHEIGHT="cmarginheight" SCROLLING="cscrolling" NORESIZE cattributes>
```

236.6.58 FRAMESETCLOSE Function

This function generates the </FRAMESET> tag which ends a frameset section.

You mark the beginning of a frameset section by means of the [FRAMESETOPEN Function](#).

Syntax

```
HTF.FRAMESETCLOSE
RETURN VARCHAR2;
```

Examples

This function generates

```
</FRAMESET>
```


236.6.59 FRAMESETOPEN Function

This function generates the `<FRAMESET>` tag which define a frameset section.

You mark the end of a frameset section by means of the [FRAMESETCLOSE Function](#).

Syntax

```
HTF.FRAMESETOPEN (
    crows          IN          VARCHAR2  DEFAULT NULL,
    ccols          IN          VARCHAR2  DEFAULT NULL,
    cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-47 FRAMESETOPEN Function Parameters

Parameter	Description
<code>crows</code>	The value for the <code>ROWS</code> attribute.
<code>ccols</code>	The value for the <code>COLS</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<FRAMESET ROWS="crows" COLS="ccols" cattributes>
```

236.6.60 HEADCLOSE Function

This function generates the `</HEAD>` tag which marks the end of an HTML document head section.

You mark the beginning of an HTML document head section by means of the [HEADOPEN Function](#).

Syntax

```
HTF.HEADCLOSE
RETURN VARCHAR2;
```

Examples

This function generates

```
</HEAD>
```

236.6.61 HEADER Function

This function generates opening heading tags (<H1> to <H6>) and their corresponding closing tags (</H1> to </H6>).

Syntax

```
HTF.HEADER(
  nsize      IN      INTEGER,
  cheader    IN      VARCHAR2,
  calign     IN      VARCHAR2  DEFAULT NULL,
  cnowrap    IN      VARCHAR2  DEFAULT NULL,
  cclear     IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-48 HEADER Function Parameters

Parameter	Description
nsize	The heading level. This is an integer between 1 and 6.
cheader	The text to display in the heading.
calign	The value for the ALIGN attribute.
cnowrap	The value for the NOWRAP attribute.
cclear	The value for the CLEAR attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

```
HTF.header (1, 'Overview')
  RETURN VARCHAR2;
```

produces:

```
<H1>Overview</H1>
```

236.6.62 HEADOPEN Function

This function generates the <HEAD> tag which marks the beginning of the HTML document head section.

You mark the end of an HTML document head section by means of the [HEADCLOSE Function](#).

Syntax

```
HTF.HEADOPEN
  RETURN VARCHAR2;
```

Examples

This function generates

<HEAD>

236.6.63 HR Function

This function generates the <HR> tag, which generates a line in the HTML document.

This subprogram performs the same operation as the [LINE Function](#).

Syntax

```
HTF.HR (
  cclear      IN      VARCHAR2  DEFAULT NULL,
  csrc        IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-49 HR Function Parameters

Parameter	Description
cclear	The value for the CLEAR attribute.
csrc	The value for the SRC attribute which specifies a custom image as the source of the line.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<HR CLEAR="cclear" SRC="csrc" cattributes>
```

236.6.64 HTMLCLOSE Function

This function generates the </HTML> tag which marks the end of an HTML document.

You use the [HTMLOPEN Function](#) to mark the beginning of an HTML document.

Syntax

```
HTF.HTMLCLOSE
RETURN VARCHAR2;
```

Examples

This function generates

```
</HTML>
```

236.6.65 HTMLOPEN Function

This function generates the <HTML> tag which marks the beginning of an HTML document.

You use the [HTMLCLOSE Function](#) to mark the end of the an HTML document.

Syntax

```
HTF.HTMLOPEN
  RETURN VARCHAR2;
```

Examples

This function generates

```
<HTML>
```

236.6.66 IMG Function

This function generates the `` tag which directs the browser to load an image onto the HTML page.

The [IMG2 Function](#) performs the same operation but additionally uses the `cusemap` parameter.

Syntax

```
HTF.IMG (
  curl          IN          VARCHAR2  DEFAULT NULL,
  calign        IN          VARCHAR2  DEFAULT NULL,
  calt          IN          VARCHAR2  DEFAULT NULL,
  cismap        IN          VARCHAR2  DEFAULT NULL,
  cattributes   IN          VARCHAR2  DEFAULT NULL)
  RETURN VARCHAR2;
```

Parameters**Table 236-50 IMG Function Parameters**

Parameter	Description
<code>curl</code>	The value for the SRC attribute.
<code>calign</code>	The value for the ALIGN attribute.
<code>calt</code>	The value for the ALT attribute which specifies alternative text to display if the browser does not support images.
<code>cismap</code>	If the value for this parameter is not NULL, the ISMAP attribute is added to the tag. The attribute indicates that the image is an imagemap.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<IMG SRC="curl" ALIGN="calign" ALT="calt" ISMAP cattributes>
```

236.6.67 IMG2 Function

This function generates the tag, which directs the browser to load an image onto the HTML page.

The [IMG Function](#) performs the same operation but does not use the `cusemap` parameter.

Syntax

```
HTF.IMG2(
  curl          IN          VARCHAR2  DEFAULT NULL,
  calign        IN          VARCHAR2  DEFAULT NULL,
  calt          IN          VARCHAR2  DEFAULT NULL,
  cismap        IN          VARCHAR2  DEFAULT NULL,
  cusemap       IN          VARCHAR2  DEFAULT NULL,
  cattributes   IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-51 IMG2 Function Parameters

Parameter	Description
<code>curl</code>	The value for the SRC attribute.
<code>calign</code>	The value for the ALIGN attribute.
<code>calt</code>	The value for the ALT attribute which specifies alternative text to display if the browser does not support images.
<code>cismap</code>	If the value for this parameter is not NULL, the ISMAP attribute is added to the tag. The attribute indicates that the image is an imagemap.
<code>cusemap</code>	The value for the USEMAP attribute which specifies a client-side image map.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<IMG SRC="curl" ALIGN="calign" ALT="calt" ISMAP USEMAP="cusemap" cattributes>
```

236.6.68 ISINDEX Function

This function creates a single entry field with a prompting text, such as "*enter value*," then sends that value to the URL of the page or program.

Syntax

```
HTF.ISINDEX(
  cprompt       IN          VARCHAR2  DEFAULT NULL,
  curl          IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-52 ISINDEX Function Parameters

Parameter	Description
cprompt	The value for the PROMPT attribute.
curl	The value for the HREF attribute.

Examples

This function generates

```
<ISINDEX PROMPT="cprompt" HREF="curl">
```

236.6.69 ITALIC Function

This function generates the `<I>` and `</I>` tags which direct the browser to render the text in italics.

Syntax

```
HTF.ITALIC(
    ctext          IN          VARCHAR2,
    cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-53 ITALIC Function Parameters

Parameter	Description
ctext	The text to be rendered in italics.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<I cattributes>ctext</I>
```

236.6.70 KBD Function

This function generates the `<KBD>` and `</KBD>` tags which direct the browser to render the text in monospace font.

This subprogram performs the same operation as the [KEYBOARD Function](#).

Syntax

```
HTF.KBD(
    ctext          IN          VARCHAR2,
    cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-54 KBD Function Parameters

Parameter	Description
c <code>text</code>	The text to be rendered in monospace.
c <code>attributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<KBD cattributes>ctext</KBD>
```

236.6.71 KEYBOARD Function

This function generates the `<KBD>` and `</KBD>` tags, which direct the browser to render the text in monospace font.

This subprogram performs the same operation as the [KBD Function](#).

Syntax

```
HTF.KEYBOARD (
  ctext          IN          VARCHAR2,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-55 KEYBOARD Function Parameters

Parameter	Description
c <code>text</code>	The text to be rendered in monospace.
c <code>attributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<KBD cattributes>ctext</KBD>
```

236.6.72 LINE Function

This function generates the `<HR>` tag, which generates a line in the HTML document.

This subprogram performs the same operation as the [HR Function](#).

Syntax

```
HTF.LINE (
  cclear         IN          VARCHAR2  DEFAULT NULL,
  csrc           IN          VARCHAR2  DEFAULT NULL,
```

```

    cattributes    IN          VARCHAR2    DEFAULT NULL)
RETURN VARCHAR2;

```

Parameters

Table 236-56 LINE Function Parameters

Parameter	Description
cclear	The value for the CLEAR attribute.
csrc	The value for the SRC attribute which specifies a custom image as the source of the line.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<HR CLEAR="cclear" SRC="csrc" cattributes>
```

236.6.73 LINKREL Function

This function generates the <LINK> tag with the REL attribute which delineates the relationship described by the hypertext link from the anchor to the target. This is only used when the HREF attribute is present.

This is the opposite of [LINKREV Function](#). This tag indicates a relationship between documents but does not create a link. To create a link, use the [ANCHOR Function](#).

Syntax

```

HTF.LINKREL (
    crel          IN          VARCHAR2,
    curl         IN          VARCHAR2,
    cttitle      IN          VARCHAR2    DEFAULT NULL)
RETURN VARCHAR2;

```

Parameters

Table 236-57 LINKREL Function Parameters

Parameter	Description
crel	The value for the REL attribute.
curl	The value for the URL attribute.
ctitle	The value for the TITLE attribute.

Examples

This function generates

```
<LINK REL="crel" HREF="curl" TITLE="ctitle">
```


236.6.74 LINKREV Function

This function generates the `<LINK>` tag with the `REV` attribute which delineates the relationship described by the hypertext link from the target to the anchor.

This is the opposite of the [LINKREL Function](#). This tag indicates a relationship between documents, but does not create a link. To create a link, use the [ANCHOR Function](#).

Syntax

```
HTF.LINKREV (
  crev          IN          VARCHAR2,
  curl          IN          VARCHAR2,
  ctitle        IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-58 LINKREV Function Parameters

Parameter	Description
<code>crev</code>	The value for the <code>REV</code> attribute.
<code>curl</code>	The value for the <code>URL</code> attribute.
<code>ctitle</code>	The value for the <code>TITLE</code> attribute.

Examples

This function generates

```
<LINK REV="crev" HREF="curl" TITLE="ctitle">
```

236.6.75 LISTHEADER Function

This function generates the `<LH>` and `</LH>` tags which print an HTML tag at the beginning of the list.

Syntax

```
HTF.LISTHEADER (
  ctext          IN          VARCHAR2,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-59 LISTHEADER Function Parameters

Parameter	Description
<code>ctext</code>	The text to place between <code><LH></code> and <code></LH></code> .
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<LH cattributes>ctext</LH>
```

236.6.76 LISTINGCLOSE Function

This function generates the `</LISTING>` tags which marks the end of a section of fixed-width text in the body of an HTML page.

To mark the beginning of a section of fixed-width text in the body of an HTML page, use the [LISTINGOPEN Function](#).

Syntax

```
HTF.LISTINGCLOSE  
RETURN VARCHAR2;
```

Examples

This function generates

```
</LISTING>
```

236.6.77 LISTINGOPEN Function

This function generates the `<LISTING>` tag which marks the beginning of a section of fixed-width text in the body of an HTML page.

To mark the end of a section of fixed-width text in the body of an HTML page, use the [LISTINGCLOSE Function](#).

Syntax

```
HTF.LISTINGOPEN  
RETURN VARCHAR2;
```

Examples

This function generates

```
<LISTING>
```

236.6.78 LISTITEM Function

This function generates the `` tag, which indicates a list item.

Syntax

```
HTF.LISTITEM(  
  ctext          IN          VARCHAR2  DEFAULT NULL,  
  cclear         IN          VARCHAR2  DEFAULT NULL,  
  cdingbat       IN          VARCHAR2  DEFAULT NULL,  
  csrc           IN          VARCHAR2  DEFAULT NULL,  
  cattributes    IN          VARCHAR2  DEFAULT NULL)  
RETURN VARCHAR2;
```

Parameters

Table 236-60 LISTITEM Function Parameters

Parameter	Description
ctext	The text for the list item.
cclear	The value for the CLEAR attribute.
cdingbat	The value for the DINGBAT attribute.
csrc	The value for the SRC attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<LI CLEAR="cclear" DINGBAT="cdingbat" SRC="csrc" cattributes>ctext
```

236.6.79 MAILTO Function

This function generates the <A> tag with the HREF set to 'mailto' prepended to the mail address argument.

Syntax

```
HTF.MAILTO(
  caddress      IN          VARCHAR2,
  ctext         IN          VARCHAR2,
  cname         IN          VARCHAR2,
  cattributes   IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-61 MAILTO Function Parameters

Parameter	Description
caddress	The email address of the recipient.
ctext	The clickable portion of the link.
cname	The value for the NAME attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<A HREF="mailto:caddress" NAME="cname" cattributes>ctext</A>
```

so that

```
HTF.mailto('pres@white_house.gov','Send Email to the President');
```

generates:

```
<A HREF="mailto:pres@white_house.gov">Send Email to the President</A>
```

236.6.80 MAPCLOSE Function

This function generates the `</MAP>` tag which marks the end of a set of regions in a client-side image map

. To mark the beginning of a set of regions in a client-side image map, use the [MAOPEN Function](#).

Syntax

```
HTF.MAPCLOSE
  RETURN VARCHAR2;
```

Examples

This function generates

```
</MAP>
```

236.6.81 MAOPEN Function

This function generates the `<MAP>` tag which mark the beginning of a set of regions in a client-side image map.

To mark the end of a set of regions in a client-side image map, use the [MAPCLOSE Function](#).

Syntax

```
HTF.MAOPEN (
  cname          IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
  RETURN VARCHAR2;
```

Parameters

Table 236-62 MAOPEN Function Parameters

Parameter	Description
cname	The value for the NAME attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<MAP NAME="cname" cattributes>
```

236.6.82 MENULISTCLOSE Function

This function generates the `</MENU>` tag which ends a list that presents one line for each item.

To begin a list of this kind, use the [MENULISTOPEN Function](#). The items in the list appear more compact than an unordered list. The [LISTITEM Function](#) defines the list items in a menu list.

Syntax

```
HTF.MENULISTCLOSE  
    RETURN VARCHAR2;
```

Examples

This function generates

```
</MENU>
```

236.6.83 MENULISTOPEN Function

This function generates the `<MENU>` tag which begins a list that presents one line for each item.

To end a list of this kind, use the [MENULISTCLOSE Function](#). The items in the list appear more compact than an unordered list. The [LISTITEM Function](#) defines the list items in a menu list.

Syntax

```
HTF.MENULISTOPEN  
    RETURN VARCHAR2;
```

Examples

This function generates

```
<MENU>
```

236.6.84 META Function

This function generates the `<META>` tag, which embeds meta-information about the document and also specifies values for HTTP headers. For example, you can specify the expiration date, keywords, and author name.

Syntax

```
HTF.META(  
    chttp_equiv    IN    VARCHAR2,  
    cname          IN    VARCHAR2,  
    ccontent       IN    VARCHAR2)  
    RETURN VARCHAR2;
```

Parameters

Table 236-63 META Function Parameters

Parameter	Description
chttp_equiv	The value for the <code>CHTTP_EQUIV</code> attribute.
cname	The value for the <code>NAME</code> attribute.
ccontent	The value for the <code>CONTENT</code> attribute.

Examples

This function generates

```
<META HTTP-EQUIV="chttp_equiv" NAME ="cname" CONTENT="ccontent">
```

so that

```
HTF.meta ('Refresh', NULL, 120);
```

generates

```
<META HTTP-EQUIV="Refresh" CONTENT=120>
```

On some Web browsers, this causes the current URL to be reloaded automatically every 120 seconds.

236.6.85 NL Function

This function generates the `
` tag which begins a new line of text.

It performs the same operation as the [BR Function](#).

Syntax

```
HTF.NL(
  cclear          IN          VARCHAR2  DEFAULT NULL,
  cattributes     IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-64 NL Function Parameters

Parameter	Description
cclear	The value for the <code>CLEAR</code> attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<BR CLEAR="cclear" cattributes>
```

236.6.86 NOBR Function

This function generates the `<NOBR>` and `</NOBR>` tags which turn off line-breaking in a section of text.

Syntax

```
HTF.NOBR (  
  ctext          IN          VARCHAR2)  
  RETURN VARCHAR2;
```

Parameters

Table 236-65 NOBR Function Parameters

Parameter	Description
<code>ctext</code>	The text that is to be rendered on one line.

Examples

This function generates

```
<NOBR>ctext</NOBR>
```

236.6.87 NOFRAMESCLOSE Function

This function generates the `</NOFRAMES>` tag which marks the end of a no-frames section.

To mark the beginning of a no-frames section, use the [FRAMESETOPEN Function](#). See also [FRAME Function](#), [FRAMESETOPEN Function](#) and [FRAMESETCLOSE Function](#).

Syntax

```
HTF.NOFRAMESCLOSE  
  RETURN VARCHAR2;
```

Examples

This function generates

```
</NOFRAMES>
```

236.6.88 NOFRAMESOPEN Function

This function generates the `<NOFRAMES>` tag which mark the beginning of a no-frames section.

To mark the end of a no-frames section, use the [FRAMESETCLOSE Function](#). See also [FRAME Function](#), [FRAMESETOPEN Function](#) and [FRAMESETCLOSE Function](#).

Syntax

```
HTF.NOFRAMESOPEN  
  RETURN VARCHAR2;
```

Examples

This function generates

```
<NOFRAMES>
```

236.6.89 OLISTCLOSE Function

This function generates the `` tag which defines the end of an ordered list. An ordered list presents a list of numbered items.

To mark the beginning of a list of this kind, use the [OLISTOPEN Function](#). Numbered items are added using [LISTITEM Function](#).

Syntax

```
HTF.OLISTCLOSE  
  RETURN VARCHAR2;
```

Examples

This function generates

```
</OL>
```

236.6.90 OLISTOPEN Function

This function generates the `` tag which marks the beginning of an ordered list. An ordered list presents a list of numbered items.

To mark the end of a list of this kind, use the [OLISTCLOSE Function](#). Numbered items are added using [LISTITEM Function](#).

Syntax

```
HTF.OLISTOPEN(  
  cclear          IN          VARCHAR2  DEFAULT NULL,  
  cwrap           IN          VARCHAR2  DEFAULT NULL,  
  cattributes     IN          VARCHAR2  DEFAULT NULL)  
  RETURN VARCHAR2;
```

Parameters

Table 236-66 OLISTOPEN Function Parameters

Parameter	Description
cclear	The value for the CLEAR attribute.
cwrap	The value for the WRAP attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<OL CLEAR="cclear" WRAP="cwrap" cattributes>
```


236.6.91 PARA Function

This function generates the <P> tag which indicates that the text that comes after the tag is to be formatted as a paragraph.

You can add attributes to the tag by means of the [PARAGRAPH Function](#).

Syntax

```
HTF.PARA
  RETURN VARCHAR2;
```

Examples

This function generates

```
<P>
```

236.6.92 PARAGRAPH Function

You can use this function to add attributes to the <P> tag created by the PARA Function.

Syntax

```
HTF.PARAGRAPH(
  calign          IN          VARCHAR2  DEFAULT NULL,
  cnowrap         IN          VARCHAR2  DEFAULT NULL,
  cclear          IN          VARCHAR2  DEFAULT NULL,
  cattributes     IN          VARCHAR2  DEFAULT NULL)
  RETURN VARCHAR2;
```

Parameters

Table 236-67 PARAGRAPH Function Parameters

Parameter	Description
calign	The value for the ALIGN attribute.
cnowrap	If the value for this parameter is not NULL, the NOWRAP attribute is added to the tag.
cclear	The value for the CLEAR attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<P ALIGN="calign" NOWRAP CLEAR="cclear" cattributes>
```

Related Topics

- [PARA Function](#)
This function generates the <P> tag which indicates that the text that comes after the tag is to be formatted as a paragraph.

236.6.93 PARAM Function

This function generates the `<PARAM>` tag which specifies parameter values for Java applets.

The values can reference HTML variables. To invoke a Java applet from a Web page, use [APPLETOPEN Function](#) to begin the invocation. Use one [PARAM Function](#) for each desired name-value pair, and use [APPLETCLOSE Function](#) to end the applet invocation.

Syntax

```
HTF.PARAM(  
    cname          IN          VARCHAR2  
    cvalue         IN          VARCHAR2)  
RETURN VARCHAR2;
```

Parameters

Table 236-68 PARAM Function Parameters

Parameter	Description
cname	The value for the NAME attribute.
cvalue	The value for the VALUE attribute.

Examples

This function generates

```
<PARAM NAME=cname VALUE="cvalue">
```

236.6.94 PLAINTEXT Function

This function generates the `<PLAINTEXT>` and `</PLAINTEXT>` tags which direct the browser to render the text they surround in fixed-width type.

Syntax

```
HTF.PLAINTEXT(  
    ctext          IN          VARCHAR2,  
    cattributes    IN          VARCHAR2 DEFAULT NULL)  
RETURN VARCHAR2;
```

Parameters

Table 236-69 PLAINTEXT Function Parameters

Parameter	Description
ctext	The text to be rendered in fixed-width font.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<PLAINTEXT cattributes>ctext</PLAINTEXT>
```

236.6.95 PRECLOSE Function

This function generates the `</PRE>` tag which marks the end of a section of preformatted text in the body of the HTML page.

To mark the beginning of a section of preformatted text in the body of the HTML page, use the [PREOPEN Function](#).

Syntax

```
HTF.PRECLOSE  
    RETURN VARCHAR2;
```

Examples

This function generates

```
</PRE>
```

236.6.96 PREOPEN Function

This function generates the `<PRE>` tag which marks the beginning of a section of preformatted text in the body of the HTML page.

To mark the end of a section of preformatted text in the body of the HTML page, use the [PRECLOSE Function](#).

Syntax

```
HTF.PREOPEN (  
    cclear          IN          VARCHAR2  DEFAULT NULL,  
    cwidth          IN          VARCHAR2  DEFAULT NULL,  
    cattributes     IN          VARCHAR2  DEFAULT NULL)  
    RETURN VARCHAR2;
```

Parameters

Table 236-70 PREOPEN Function Parameters

Parameter	Description
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>cwidth</code>	The value for the <code>WIDTH</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<PRE CLEAR="cclear" WIDTH="cwidth" cattributes>
```

236.6.97 PRINT Functions

These functions generate the specified parameter as a string terminated with the `\n` newline character.

The [PRN Functions](#) performs the same operation but does not terminate with a newline character.

Syntax

```
HTF.PRINT (  
    cbuf      IN      VARCHAR2)  
    RETURN VARCHAR2;
```

```
HTF.PRINT (  
    dbuf      IN      DATE)  
    RETURN VARCHAR2;
```

```
HTF.PRINT (  
    nbuf      IN      NUMBER)  
    RETURN VARCHAR2;
```

Parameters

Table 236-71 PRINT Function Parameters

Parameter	Description
<code>cbuf</code>	The string to generate terminated by a newline.
<code>dbuf</code>	The string to generate terminated by a newline.
<code>nbuf</code>	The string to generate terminated by a newline.

Usage Notes

- The `\n` character is not the same as `
`. The `\n` character formats the HTML source but it does not affect how the browser renders the HTML source. Use `
` to control how the browser renders the HTML source.
- These functions do not have function equivalents.

236.6.98 PRN Functions

These functions generate the specified parameter as a string.

Unlike the [PRINT Functions](#) the string is not terminated with the `\n` newline character.

Syntax

```
HTF.PRN (  
    cbuf      IN      VARCHAR2)  
    RETURN VARCHAR2;
```

```
HTF.PRN (  
    dbuf      IN      DATE)  
    RETURN VARCHAR2;
```

```
HTF.PRN (
  nbuf      IN      NUMBER)
RETURN VARCHAR2;
```

Parameters

Table 236-72 PRN Function Parameters

Parameter	Description
cbuf	The string to generate (not terminated by a newline).
dbuf	The string to generate (not terminated by a newline).
nbuf	The string to generate (not terminated by a newline).

Usage Notes

These functions do not have function equivalents.

236.6.99 S Function

This function generates the `<S>` and `</S>` tags which direct the browser to render the text they surround in strikethrough type.

This performs the same operation as [STRIKE Function](#).

Syntax

```
HTF.S (
  ctext      IN      VARCHAR2,
  cattributes IN      VARCHAR2 DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-73 S Function Parameters

Parameter	Description
ctext	The text to be rendered in strikethrough type.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<S cattributes>ctext</S>
```

236.6.100 SAMPLE Function

This function generates the `<SAMP>` and `</SAMP>` tags which direct the browser to render the text they surround in monospace font or however "sample" is defined stylistically.

Syntax

```
HTF.SAMPLE (
    ctext          IN          VARCHAR2,
    cattributes   IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-74 SAMPLE Function Parameters

Parameter	Description
ctext	The text to be rendered in monospace font.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<SAMP cattributes>ctext</SAMP>
```

236.6.101 SCRIPT Function

This function generates the `<SCRIPT>` and `</SCRIPT>` tags which contain a script written in languages such as JavaScript and VBscript.

Syntax

```
HTF.SCRIPT (
    cscript       IN          VARCHAR2,
    clanguage     IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-75 SCRIPT Function Parameters

Parameter	Description
cscript	The text of the script. This is the text that makes up the script itself, not the name of a file containing the script.
clanguage	The language in which the script is written. If this parameter is omitted, the user's browser determines the scripting language.

Examples

This function generates

```
<SCRIPT LANGUAGE=clanguage>cscript</SCRIPT>
```

so that

```
HTF.script ('Erupting_Volcano', 'Javascript');
```

generates

```
<SCRIPT LANGUAGE=Javascript>"script text here"</SCRIPT>
```

This causes the browser to run the script enclosed in the tags.

236.6.102 SMALL Function

This function generates the `<SMALL>` and `</SMALL>` tags, which direct the browser to render the text they surround using a small font.

Syntax

```
HTF.SMALL (
    ctext          IN          VARCHAR2,
    cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-76 SMALL Function Parameters

Parameter	Description
ctext	The text to be rendered in small font.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<SMALL cattributes>ctext</SMALL>
```

236.6.103 STRIKE Function

This function generates the `<STRIKE>` and `</STRIKE>` tags which direct the browser to render the text they surround in strikethrough type.

This performs the same operation as [S Function](#).

Syntax

```
STRIKE (
    ctext          IN          VARCHAR2,
    cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-77 STRIKE Function Parameters

Parameter	Description
<code>c_{text}</code>	The text to be rendered in strikethrough type.
<code>c_{attributes}</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<STRIKE cattributes>ctext</STRIKE>
```

236.6.104 STRONG Function

This function generates the `` and `` tags which direct the browser to render the text they surround in bold, or however "strong" is defined.

Syntax

```
HTF.STRONG(  
  ctext          IN          VARCHAR2,  
  cattributes    IN          VARCHAR2  DEFAULT NULL)  
  RETURN VARCHAR2;
```

Parameters

Table 236-78 STRONG Function Parameters

Parameter	Description
<code>c_{text}</code>	The text to be emphasized.
<code>c_{attributes}</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<STRONG cattributes>ctext</STRONG>
```

236.6.105 STYLE Function

This function generates the `<STYLE>` and `</STYLE>` tags which include a style sheet in a Web page.

You can get more information about style sheets at <http://www.w3.org>. This feature is not compatible with browsers that support only HTML versions 2.0 or earlier. Such browsers will ignore this tag.

Syntax

```
HTF.STYLE (
    cstyle          IN          VARCHAR2)
RETURN VARCHAR2;
```

Parameters**Table 236-79** STYLE Function Parameters

Parameter	Description
cstyle	The style information to include.

Examples

This function generates

```
<STYLE>cstyle</STYLE>
```

236.6.106 SUB Function

This function generates the `_{` and `}` tags which direct the browser to render the text they surround as subscript.

Syntax

```
HTF.SUB (
    ctext          IN          VARCHAR2,
    calign         in          VARCHAR2  DEFAULT NULL,
    cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters**Table 236-80** SUB Function Parameters

Parameter	Description
ctext	The text to render in subscript.
calign	The value for the <code>ALIGN</code> attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<SUB ALIGN="calign" cattributes>ctext</SUB>
```

236.6.107 SUP Function

This function generates the `^{` and `}` tags which direct the browser to render the text they surround as superscript.

Syntax

```
HTF.SUP (
  ctext          IN          VARCHAR2,
  calign         in          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-81 SUP Function Parameters

Parameter	Description
ctext	The text to render in superscript.
calign	The value for the <code>ALIGN</code> attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<SUP ALIGN="calign" cattributes>ctext</SUP>
```

236.6.108 TABLECAPTION Function

This function generates the `<CAPTION>` and `</CAPTION>` tags which place a caption in an HTML table.

Syntax

```
HTF.TABLECAPTION (
  ccaption       IN          VARCHAR2,
  calign         in          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-82 TABLECAPTION Function Parameters

Parameter	Description
ctext	The text for the caption.
calign	The value for the <code>ALIGN</code> attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<CAPTION ALIGN="calign" cattributes>ccaption</CAPTION>
```

236.6.109 TABLECLOSE Function

This function generates the `</TABLE>` tag which marks the end of an HTML table.

To define the beginning of an HTML table, use the [TABLEOPEN Function](#).

Syntax

```
HTF.TABLECLOSE  
    RETURN VARCHAR2;
```

Examples

This function generates

```
</TABLE>
```

236.6.110 TABLEDATA Function

This function generates the `<TD>` and `</TD>` tags which insert data into a cell of an HTML table.

Syntax

```
HTF.TABLEDATA (  
    cvalue          IN          VARCHAR2  DEFAULT NULL,  
    calign          IN          VARCHAR2  DEFAULT NULL,  
    cdp            IN          VARCHAR2  DEFAULT NULL,  
    cnowrap        IN          VARCHAR2  DEFAULT NULL,  
    crowspan       IN          VARCHAR2  DEFAULT NULL,  
    ccolspan       IN          VARCHAR2  DEFAULT NULL,  
    cattributes    IN          VARCHAR2  DEFAULT NULL)  
    RETURN VARCHAR2;
```

Parameters

Table 236-83 TABLEDATA Function Parameters

Parameter	Description
cvalue	The data for the cell in the table.
calign	The value for the <code>ALIGN</code> attribute.
cdp	The value for the <code>DP</code> attribute.
cnowrap	If the value of this parameter is not <code>NULL</code> , the <code>NOWRAP</code> attribute is added to the tag.
ccolspan	The value for the <code>COLSPAN</code> attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<TD ALIGN="calign" DP="cdp" ROWSPAN="crowspan" COLSPAN="ccolspan" NOWRAP
cattributes>cvalue</TD>
```

236.6.111 TABLEHEADER Function

This function generates the <TH> and </TH> tags which insert a header cell in an HTML table.

The <TH> tag is similar to the <TD> tag except that the text in this case the rows are usually rendered in bold type.

Syntax

```
HTF.TABLEHEADER(
    cvalue      IN          VARCHAR2  DEFAULT NULL,
    calign      IN          VARCHAR2  DEFAULT NULL,
    cdp         IN          VARCHAR2  DEFAULT NULL,
    cnowrap     IN          VARCHAR2  DEFAULT NULL,
    crowspan    IN          VARCHAR2  DEFAULT NULL,
    ccolspan    IN          VARCHAR2  DEFAULT NULL,
    cattributes IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-84 TABLEHEADER Function Parameters

Parameter	Description
cvalue	The data for the cell in the table.
calign	The value for the ALIGN attribute.
cdp	The value for the DP attribute.
cnowrap	If the value of this parameter is not NULL, the NOWRAP attribute is added to the tag.
crispen	The value for the ROWSPAN attribute.
ccolspan	The value for the COLSPAN attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<TH ALIGN="calign" DP="cdp" ROWSPAN="crowspan" COLSPAN="ccolspan" NOWRAP
cattributes>cvalue</TH>
```

236.6.112 TABLEOPEN Function

This function generates the <TABLE> tag which marks the beginning of an HTML table.

To define the end of an HTML table, use the [TABLECLOSE Function](#).

Syntax

```
HTF.TABLEOPEN (
  cborder      IN      VARCHAR2  DEFAULT NULL
  calign       IN      VARCHAR2  DEFAULT NULL,
  cnowrap      IN      VARCHAR2  DEFAULT NULL,
  cclear       IN      VARCHAR2  DEFAULT NULL
  cattributes  IN      VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-85 TABLEOPEN Function Parameters

Parameter	Description
border	The value for the <code>BORDER</code> attribute.
calign	The value for the <code>ALIGN</code> attribute.
cnowrap	If the value of this parameter is not <code>NULL</code> , the <code>NOWRAP</code> attribute is added to the tag.
cclear	The value for the <code>CLEAR</code> attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<TABLE "cborder" NOWRAP ALIGN="calign" CLEAR="cclear" cattributes>
```

236.6.113 TABLEROWCLOSE Function

This function generates the </TR> tag which marks the end of a new row in an HTML table.

To mark the beginning of a new row, use the [TABLEROWOPEN Function](#).

Syntax

```
HTF.TABLEROWCLOSE
RETURN VARCHAR2;
```

Examples

This function generates

```
</TABLE>
```

236.6.114 TABLEROWOPEN Function

This function generates the <TR> tag which marks the beginning of a new row in an HTML table.

To mark the end of a new row, use the [TABLEROWCLOSE Function](#).

Syntax

```
HTF.TABLEROWOPEN (
  calign          IN          VARCHAR2  DEFAULT NULL,
  cvalign         IN          VARCHAR2  DEFAULT NULL,
  cdp             IN          VARCHAR2  DEFAULT NULL,
  cnowrap         IN          VARCHAR2  DEFAULT NULL,
  cattributes     IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-86 TABLEROWOPEN Function Parameters

Parameter	Description
calign	The value for the ALIGN attribute.
cvalign	The value for the VALIGN attribute.
cdp	The value for the DP attribute.
cnowrap	If the value of this parameter is not NULL, the NOWRAP attribute is added to the tag.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<<TR ALIGN="calign" VALIGN="cvalign" DP="cdp" NOWRAP cattributes>
```

236.6.115 TELETYPE Function

This function generates the <TT> and </TT> tags which direct the browser to render the text they surround in a fixed width typewriter font, for example, the courier font.

Syntax

```
HTF.TELETYPE (
  ctext          IN          VARCHAR2,
  cattributes     IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-87 TELETYPE Function Parameters

Parameter	Description
<code>c_{text}</code>	The text to render in a fixed width typewriter font.
<code>c_{attributes}</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<TT cattributes>ctext</TT>
```

236.6.116 TITLE Function

This function generates the `<TITLE>` and `</TITLE>` tags which specify the text to display in the titlebar of the browser window.

Syntax

```
HTF.TITLE(  
    ctitle          IN          VARCHAR2)  
    RETURN VARCHAR2;
```

Parameters

Table 236-88 TITLE Function Parameters

Parameter	Description
<code>c_{title}</code>	The text to display in the titlebar of the browser window.

Examples

This function generates

```
<TITLE>ctitle</TITLE>
```

236.6.117 ULISTCLOSE Function

This function generates the `` tag which marks the end of an unordered list. An unordered list presents items with bullets.

To mark the beginning of an unordered list, use the [ULISTOPEN Function](#). Add list items with [LISTITEM Function](#).

Syntax

```
HTF.ULISTCLOSE  
    RETURN VARCHAR2;
```

Examples

This function generates

```
</UL>
```

236.6.118 ULISTOPEN Function

This function generates the `` tag which marks the beginning of an unordered list. An unordered list presents items with bullets.

To mark the end of an unordered list, use the [ULISTCLOSE Function](#). Add list items with [LISTITEM Function](#).

Syntax

```
HTF.ULISTOPEN(
  cclear      IN      VARCHAR2  DEFAULT NULL,
  cwrap       IN      VARCHAR2  DEFAULT NULL,
  cdingbat    IN      VARCHAR2  DEFAULT NULL,
  csrc        IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters**Table 236-89** ULISTOPEN Function Parameters

Parameter	Description
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>cwrap</code>	The value for the <code>WRAP</code> attribute.
<code>cdingbat</code>	The value for the <code>DINGBAT</code> attribute.
<code>csrc</code>	The value for the <code>SRC</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<UL CLEAR="cclear" WRAP="cwrap" DINGBAT="cdingbat" SRC="csrc" cattributes>
```

236.6.119 UNDERLINE Function

This function generates the `<U>` and `</U>` tags, which direct the browser to render the text they surround with an underline.

Syntax

```
HTF.UNDERLINE(
  ctext      IN      VARCHAR2,
  cattributes IN      VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```


Parameters

Table 236-90 UNDERLINE Function Parameters

Parameter	Description
ctext	The text to render with an underline.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<U cattributes>ctext</U>
```

236.6.120 VARIABLE Function

This function generates the `<VAR>` and `</VAR>` tags which direct the browser to render the text they surround in italics or however "variable" is defined stylistically.

Syntax

```
HTF.VARIABLE(
  ctext          IN          VARCHAR2,
  cattributes    IN          VARCHAR2  DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 236-91 VARIABLE Function Parameters

Parameter	Description
ctext	The text to render in italics.
cattributes	The other attributes to be included as-is in the tag.

Examples

This function generates

```
<VAR cattributes>ctext</VAR>
```

236.6.121 WBR Function

This function generates the `<WBR>` tag, which inserts a soft line break within a section of NOBR text.

Syntax

```
HTF.WBR
RETURN VARCHAR2;
```

Examples

This function generates

<WBR>

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HTP

The `HTP` (hypertext procedures) and `HTF` (hypertext functions) packages generate HTML tags. For example, the `HTP.ANCHOR` procedure generates the HTML anchor tag, `<A>`.

This chapter contains the following topics:

- [Operational Notes](#)
- [Rules and Limits](#)
- [Examples](#)
- [Summary of Tags](#)
- [Summary of HTP Subprograms](#)



See Also:

For more information about implementation of this package:

- *Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server*
- *Oracle Fusion Middleware User's Guide for mod_plsql*

237.1 HTP Operational Notes

Certain operational notes apply to the `HTP` package.

For every `HTP` procedure that generates one or more HTML tags, there is a corresponding `HTF` function with identical parameters with the following exception:

- The [PRINTS Procedure](#) and the [PS Procedure](#) do not have `HTF` function equivalents. Use the [ESCAPE_SC Function](#) or the [ESCAPE_URL Function](#) if you need a string conversion function. Note that while there is a [ESCAPE_SC Procedure](#) that performs the same operation as the [PRINTS Procedure](#) and the [PS Procedure](#), there is no procedural equivalent for the [ESCAPE_URL Function](#).
- The [FORMAT_CELL Function](#) does not have an `HTP` equivalent. The function formats column values inside an HTML table using [TABLEDATA Function](#) which does have an `HTP` equivalent in the [TABLEDATA Procedure](#). The advantage of this using the [FORMAT_CELL Function](#) is that it allows for better control over the HTML tables.

The function versions do not directly generate output in your Web page. Instead, they pass their output as return values to the statements that invoked them. Use these functions when you need to nest calls. To print the output of `HTF` functions, call the functions from within the `HTP.PRINT` procedure. It then prints its parameters to the generated Web page.

237.2 HTP Rules and Limits

If you use values of the LONG datatype in procedures such as HTP.PRINT, HTP.PRN, HTP.PRINTS, HTP.PA or OWA_UTIL.CELLSPRINT, only the first 32 K of the LONG data is used. The LONG data is bound to a VARCHAR2 datatype in the procedure.

237.3 HTP Examples

These commands generate a simple HTML document.

```
CREATE OR REPLACE PROCEDURE hello AS
BEGIN
  HTP.HTMLOPEN;           -- generates <HTML>
  HTP.HEADOPEN;          -- generates <HEAD>
  HTP.TITLE('Hello');    -- generates <TITLE>Hello</TITLE>
  HTP.HEADCLOSE;        -- generates </HEAD>
  HTP.BODYOPEN;         -- generates <BODY>
  HTP.HEADER(1, 'Hello'); -- generates <H1>Hello</H1>
  HTP.BODYCLOSE;        -- generates </BODY>
  HTP.HTMLCLOSE;        -- generates </HTML>
END;
```

237.4 HTP Summary of Tags

HTP tags can be grouped by type, to make understanding them easier.

HTML, HEAD, and BODY Tags

[HTMLOPEN Procedure](#), [HTMLCLOSE Procedure](#) - generate <HTML> and </HTML>

[HEADOPEN Procedure](#), [HEADCLOSE Procedure](#) - generate <HEAD> and </HEAD>

[BODYOPEN Procedure](#), [BODYCLOSE Procedure](#) - generate <BODY> and </BODY>

Comment Tag

[COMMENT Procedure](#) - generates <!-- and -->

Tags in the <HEAD> Area

[BASE Procedure](#) - generates <BASE>

[LINKREL Procedure](#) - generates <LINK> with the REL attribute

[LINKREV Procedure](#) - generates <LINK> with the REV attribute

[TITLE Procedure](#) - generates <TITLE>

[META Procedure](#) - generates <META>

[SCRIPT Procedure](#) - generates <SCRIPT>

[STYLE Procedure](#) - generates <STYLE>

[ISINDEX Procedure](#) - generates <ISINDEX>

Applet Tags

[APPLETOPEN Procedure](#), [APPLETCLOSE Procedure](#) - generate `<APPLET>` and `</APPLET>`

[PARAM Procedure](#) - generates `<PARAM>`

List Tags

[OLISTOPEN Procedure](#), [OLISTCLOSE Procedure](#) - generate `` and ``

[ULISTOPEN Procedure](#), [ULISTCLOSE Procedure](#) - generate `` and ``

[DLISTOPEN Procedure](#), [DLISTCLOSE Procedure](#) - generate `<DL>` and `</DL>`

[DLISTTERM Procedure](#) - generates `<DT>`

[DLISTDEF Procedure](#) - generates `<DD>`

[DIRLISTOPEN Procedure](#), [DIRLISTCLOSE Procedure](#) - generate `<DIR>` and `</DIR>`

[LISTHEADER Procedure](#) - generates `<LH>`

[LISTINGOPEN Procedure](#), [LISTINGCLOSE Procedure](#) - generate `<LISTING>` and `</LISTING>`

[MENULISTOPEN Procedure](#) - generate `<MENU>` and `</MENU>`

[LISTITEM Procedure](#) - generates ``

Form Tags

[FORMOPEN Procedure](#), [FORMCLOSE Procedure](#) - generate `<FORM>` and `</FORM>`

[FORMCHECKBOX Procedure](#) - generates `<INPUT TYPE="CHECKBOX">`

[FORMHIDDEN Procedure](#) - generates `<INPUT TYPE="HIDDEN">`

[FORMIMAGE Procedure](#) - generates `<INPUT TYPE="IMAGE">`

[FORMPASSWORD Procedure](#) - generates `<INPUT TYPE="PASSWORD">`

[FORMRADIO Procedure](#) - generates `<INPUT TYPE="RADIO">`

[FORMSELECTOPEN Procedure](#), [FORMSELECTCLOSE Procedure](#) - generate `<SELECT>` and `</SELECT>`

[FORMSELETOPTION Procedure](#) - generates `<OPTION>`

[FORMTEXT Procedure](#) - generates `<INPUT TYPE="TEXT">`

[FORMTEXTAREA Procedure](#) - generate `<TEXTAREA>`

[FORMTEXTAREAOPEN Procedure](#), [FORMTEXTAREACLOSE Procedure](#) - generate `<TEXTAREA>` and `</TEXTAREA>`

[FORMRESET Procedure](#) - generates `<INPUT TYPE="RESET">`

[FORMSUBMIT Procedure](#) - generates `<INPUT TYPE="SUBMIT">`

Table Tags

[TABLEOPEN Procedure](#), [TABLECLOSE Procedure](#) - generate `<TABLE>` and `</TABLE>`

[TABLECAPTION Procedure](#) - generates `<CAPTION>`

[TABLEROWOPEN Procedure](#), [TABLEROWCLOSE Procedure](#) - generate `<TR>` and `</TR>`

[TABLEHEADER Procedure](#) - generates `<TH>`

[TABLEDATA Procedure](#) - generates `<TD>`

IMG, HR, and A Tags

[HR Procedure](#), [LINE Procedure](#) - generate `<HR>`

[IMG Procedure](#), [IMG2 Procedure](#) - generate ``

[ANCHOR Procedure](#), [ANCHOR2 Procedure](#) - generate `<A>`

[MAOPEN Procedure](#), [MAPCLOSE Procedure](#) - generate `<MAP>` and `</MAP>`

Paragraph Formatting Tags

[HEADER Procedure](#) - generates heading tags (`<H1>` to `<H6>`)

[PARA Procedure](#), [PARAGRAPH Procedure](#) - generate `<P>`

[PRN Procedures](#), [PRINT Procedures](#) - generate any text that is passed in

[PRINTS Procedure](#), [PS Procedure](#) - generate any text that is passed in; special characters in HTML are escaped

[PREOPEN Procedure](#), [PRECLOSE Procedure](#) - generate `<PRE>` and `</PRE>`

[BLOCKQUOTEOPEN Procedure](#), [BLOCKQUOTECLOSE Procedure](#) - generate `<BLOCKQUOTE>` and `</BLOCKQUOTE>`

[DIV Procedure](#) - generates `<DIV>`

[NL Procedure](#), [BR Procedure](#) - generate `
`

[NOBR Procedure](#) - generates `<NOBR>`

[WBR Procedure](#) - generates `<WBR>`

[PLAINTEXT Procedure](#) - generates `<PLAINTEXT>`

[ADDRESS Procedure](#) - generates `<ADDRESS>`

[MAILTO Procedure](#) - generates `<A>` with the `MAILTO` attribute

[AREA Procedure](#) - generates `<AREA>`

[BGSOUND Procedure](#) - generates `<BGSOUND>`

Character Formatting Tags

[BASEFONT Procedure](#) - generates `<BASEFONT>`

BIG Procedure - generates <BIG>

BOLD Procedure - generates

CENTER Procedure - generates <CENTER> and </CENTER>

CENTEROPEN Procedure, CENTERCLOSE Procedure - generate <CENTER> and </CENTER>

CITE Procedure - generates <CITE>

CODE Procedure - generates <CODE>

DFN Procedure - generates <DFN>

EM Procedure, EMPHASIS Procedure - generate

FONTOPEN Procedure, FONTCLOSE Procedure - generate and

ITALIC Procedure - generates <I>

KBD Procedure, KEYBOARD Procedure - generate <KBD> and </KBD>

S Procedure - generates <S>

SAMPLE Procedure - generates <SAMP>

SMALL Procedure - generates <SMALL>

STRIKE Procedure - generates <STRIKE>

STRONG Procedure - generates

SUB Procedure - generates <SUB>

SUP Procedure - generates <SUP>

TELETYPE Procedure - generates <TT>

UNDERLINE Procedure - generates <U>

VARIABLE Procedure - generates <VAR>

Frame Tags

FRAME Procedure - generates <FRAME>

FRAMESETOPEN Procedure, FRAMESETCLOSE Procedure - generate <FRAMESET> and </FRAMESET>

NOFRAMESOPEN Procedure, NOFRAMESCLOSE Procedure - generate <NOFRAMES> and </NOFRAMES>

237.5 Summary of HTP Subprograms

This table lists the HTP subprograms and briefly describes them.

Table 237-1 HTP Package Subprograms

Subprogram	Description
ADDRESS Procedure	Generates the <ADDRESS> and </ADDRESS> tags which specify the address, author and signature of a document
ANCHOR Procedure	Generates the <A> and tags which specify the source or destination of a hypertext link
ANCHOR2 Procedure	Generates the <A> and tags which specify the source or destination of a hypertext link
APPLETCLOSE Procedure	Closes the applet invocation with the </APPLET> tag
APPLETOPEN Procedure	Generates the <APPLET> tag which begins the invocation of a Java applet
AREA Procedure	Generates the <AREA> tag, which defines a client-side image map
BASE Procedure	Generates the <BASE> tag which records the URL of the document
BASEFONT Procedure	Generates the <BASEFONT> tag which specifies the base font size for a Web page
BGSOUND Procedure	Generates the <BGSOUND> tag which includes audio for a Web page
BIG Procedure	Generates the <BIG> and </BIG> tags which direct the browser to render the text in a bigger font
BLOCKQUOTECLOSE Procedure	Generates the </BLOCKQUOTE> tag which mark the end of a section of quoted text
BLOCKQUOTEOPEN Procedure	Generates the <BLOCKQUOTE> tag, which marks the beginning of a section of quoted text
BODYCLOSE Procedure	Generates the </BODY> tag which marks the end of a body section of an HTML document
BODYOPEN Procedure	Generates the <BODY> tag which marks the beginning of the body section of an HTML document
BOLD Procedure	Generates the and tags which direct the browser to display the text in boldface
BR Procedure	Generates the tag which begins a new line of text
CENTER Procedure	Generates the <CENTER> and </CENTER> tags which center a section of text within a Web page
CENTERCLOSE Procedure	Generates the </CENTER> tag which marks the end of a section of text to center
CENTEROPEN Procedure	Generates the <CENTER> tag which mark the beginning of a section of text to center
CITE Procedure	Generates the <CITE> and </CITE> tags which direct the browser to render the text as a citation
CODE Procedure	Generates the <CODE> and </CODE> tags which direct the browser to render the text in monospace font or however "code" is defined stylistically
COMMENT Procedure	Generates procedure generates the comment tags <!-- ctext -->

Table 237-1 (Cont.) HTP Package Subprograms

Subprogram	Description
DFN Procedure	Generates the <DFN> and </DFN> tags which direct the browser to mark the text as italics or however "definition" is defined stylistically
DIRLISTCLOSE Procedure	Generates the </DIR> tag which ends a directory list section
DIRLISTOPEN Procedure	Generates the <DIR> which starts a directory list section
DIV Procedure	Generates the <DIV> tag which creates document divisions
DLISTCLOSE Procedure	Generates the </DL> tag which ends a definition list
DLISTDEF Procedure	Generates the <DD> tag, which inserts definitions of terms
DLISTOPEN Procedure	Generates the <DL> tag which starts a definition list
DLISTTERM Procedure	Generates the <DT> tag which defines a term in a definition list <DL>
EM Procedure	Generates the and tags, which define text to be emphasized
EMPHASIS Procedure	Generates the and tags, which define text to be emphasized
ESCAPE_SC Procedure	Replaces characters that have special meaning in HTML with their escape sequences
FONTCLOSE Procedure	Generates the tag which marks the end of a section of text with the specified font characteristics
FONTOPEN Procedure	Generates the which marks the beginning of section of text with the specified font characteristics
FORMCHECKBOX Procedure	Generates the <INPUT> tag with TYPE="checkbox" which inserts a checkbox element in a form
FORMCLOSE Procedure	Generates the </FORM> tag which marks the end of a form section in an HTML document
FORMOPEN Procedure	Generates the <FORM> tag which marks the beginning of a form section in an HTML document
FORMFILE Procedure	Generates the <INPUT> tag with TYPE="file" which inserts a file form element, and is used for file uploading for a given page
FORMHIDDEN Procedure	Generates the <INPUT> tag with TYPE="hidden" which inserts a hidden form element
FORMIMAGE Procedure	Generates the <INPUT> tag with TYPE="image" which creates an image field that the user clicks to submit the form immediately
FORMPASSWORD Procedure	Generates the <INPUT> tag with TYPE="password" which creates a single-line text entry field
FORMRADIO Procedure	Generates the <INPUT> tag with TYPE="radio", which creates a radio button on the HTML form
FORMRESET Procedure	Generates the <INPUT> tag with TYPE="reset" which creates a button that, when selected, resets the form fields to their initial values

Table 237-1 (Cont.) HTP Package Subprograms

Subprogram	Description
FORMSELECTCLOSE Procedure	Generates the <code></SELECT></code> tag which marks the end of a Select form element
FORMSELECTOPEN Procedure	Generates the <code></SELECT></code> tag which marks the beginning of a Select form element
FORMSELECTOPTION Procedure	Generates the <code><OPTION></code> tag which represents one choice in a Select element
FORMSUBMIT Procedure	Generates the <code><INPUT></code> tag with <code>TYPE="submit"</code> which creates a button that, when clicked, submits the form
FORMTEXT Procedure	Generates the <code><INPUT></code> tag with <code>TYPE="text"</code> , which creates a field for a single line of text
FORMTEXTAREA Procedure	Generates the <code><TEXTAREA></code> tag, which creates a text field that has no predefined text in the text area
FORMTEXTAREA2 Procedure	Generates the <code><TEXTAREA></code> tag, which creates a text field that has no predefined text in the text area with the ability to specify a wrap style
FORMTEXTAREACLOSE Procedure	Generates the <code></TEXTAREA></code> tag which ends a text area form element
FORMTEXTAREAOPEN Procedure	Generates the <code><TEXTAREA></code> which marks the beginning of a text area form element
FORMTEXTAREAOPEN2 Procedure	Generates the <code><TEXTAREA></code> which marks the beginning of a text area form element with the ability to specify a wrap style
FRAME Procedure	Generates the <code><FRAME></code> tag which begins the characteristics of a frame created by a <code><FRAMESET></code> tag
FRAMESETCLOSE Procedure	Generates the <code></FRAMESET></code> tag which ends a frameset section
FRAMESETOPEN Procedure	Generates the <code></FRAMESET></code> tag which begins a frameset section
HEADCLOSE Procedure	Generates the <code></HEAD></code> tag which marks the end of an HTML document head section
HEADER Procedure	Generates opening heading tags (<code><H1></code> to <code><H6></code>) and their corresponding closing tags (<code></H1></code> to <code></H6></code>)
HEADOPEN Procedure	Generates the <code><HEAD></code> tag which marks the beginning of the HTML document head section
HR Procedure	Generates the <code><HR></code> tag, which generates a line in the HTML document
HTMLCLOSE Procedure	Generates the <code></HTML></code> tag which marks the end of an HTML document
HTMLOPEN Procedure	Generates the <code><HTML></code> tag which marks the beginning of an HTML document
IMG Procedure	Generates the <code></code> tag which directs the browser to load an image onto the HTML page
IMG2 Procedure	Generates the <code></code> tag which directs the browser to load an image onto the HTML page with the option of specifying values for the <code>USEMAP</code> attribute

Table 237-1 (Cont.) HTP Package Subprograms

Subprogram	Description
ISINDEX Procedure	Creates a single entry field with a prompting text, such as "enter value," then sends that value to the URL of the page or program
ITALIC Procedure	Generates the <I> and </I> tags which direct the browser to render the text in italics
KBD Procedure	Generates the <KBD> and </KBD> tags which direct the browser to render the text in monospace font
KEYBOARD Procedure	Generates the <KBD> and </KBD> tags, which direct the browser to render the text in monospace font
LINE Procedure	Generates the <HR> tag, which generates a line in the HTML document
LINKREL Procedure	Generates the <LINK> tag with the REL attribute which delineates the relationship described by the hypertext link from the anchor to the target
LINKREV Procedure	Generates the <LINK> tag with the REV attribute which delineates the relationship described by the hypertext link from the target to the anchor
LISTHEADER Procedure	Generates the <LH> and </LH> tags which print an HTML tag at the beginning of the list
LISTINGCLOSE Procedure	Generates the </LISTING> tags which marks the end of a section of fixed-width text in the body of an HTML page
LISTINGOPEN Procedure	Generates the <LISTING> tag which marks the beginning of a section of fixed-width text in the body of an HTML page
LISTITEM Procedure	Generates the tag, which indicates a list item
MAILTO Procedure	Generates the <A> tag with the HREF set to 'mailto' prepended to the mail address argument
MAPCLOSE Procedure	Generates the </MAP> tag which marks the end of a set of regions in a client-side image map
MAOPEN Procedure	Generates the <MAP> tag which mark the beginning of a set of regions in a client-side image map
MENULISTCLOSE Procedure	Generates the </MENU> tag which ends a list that presents one line for each item
MENULISTOPEN Procedure	Generates the <MENU> tag which begins a list that presents one line for each item
META Procedure	Generates the <META> tag, which embeds meta-information about the document and also specifies values for HTTP headers
NL Procedure	Generates the tag which begins a new line of text
NOBR Procedure	Generates the <NOBR> and </NOBR> tags which turn off line-breaking in a section of text
NOFRAMESCLOSE Procedure	Generates the </NOFRAMES> tag which marks the end of a no-frames section
NOFRAMESOPEN Procedure	Generates the <NOFRAMES> tag which mark the beginning of a no-frames section

Table 237-1 (Cont.) HTP Package Subprograms

Subprogram	Description
OLISTCLOSE Procedure	Generates the <code></code> tag which defines the end of an ordered list
OLISTOPEN Procedure	Generates the <code></code> tag which marks the beginning of an ordered list
PARA Procedure	Generates the <code><P></code> tag which indicates that the text that comes after the tag is to be formatted as a paragraph
PARAGRAPH Procedure	Adds attributes to the <code><P></code> tag
PARAM Procedure	Generates the <code><PARAM></code> tag which specifies parameter values for Java applets
PLAINTEXT Procedure	Generates the <code><PLAINTEXT></code> and <code></PLAINTEXT></code> tags which direct the browser to render the text they surround in fixed-width type
PRECLOSE Procedure	Generates the <code></PRE></code> tag which marks the end of a section of preformatted text in the body of the HTML page
PREOPEN Procedure	Generates the <code><PRE></code> tag which marks the beginning of a section of preformatted text in the body of the HTML page
PRINT Procedures	Generates the specified parameter as a string terminated with the <code>\n</code> newline character
PRINTS Procedure	Generates a string and replaces the following characters with the corresponding escape sequence
PRN Procedures	Generates the specified parameter as a string
PS Procedure	Generates a string and replaces the following characters with the corresponding escape sequence.
S Procedure	Generates the <code><S></code> and <code></S></code> tags which direct the browser to render the text they surround in strikethrough type
SAMPLE Procedure	Generates the <code><SAMP></code> and <code></SAMP></code> tags which direct the browser to render the text they surround in monospace font or however "sample" is defined stylistically
SCRIPT Procedure	Generates the <code><SCRIPT></code> and <code></SCRIPT></code> tags which contain a script written in languages such as JavaScript and VBscript
SMALL Procedure	Generates the <code><SMALL></code> and <code></SMALL></code> tags, which direct the browser to render the text they surround using a small font
STRIKE Procedure	Generates the <code><STRIKE></code> and <code></STRIKE></code> tags which direct the browser to render the text they surround in strikethrough type
STRONG Procedure	Generates the <code></code> and <code></code> tags which direct the browser to render the text they surround in bold or however "strong" is defined stylistically
STYLE Procedure	Generates the <code><STYLE></code> and <code></STYLE></code> tags which include a style sheet in a Web page
SUB Procedure	Generates the <code><SUB></code> and <code></SUB></code> tags which direct the browser to render the text they surround as subscript
SUP Procedure	Generates the <code><SUP></code> and <code></SUP></code> tags which direct the browser to render the text they surround as superscript

Table 237-1 (Cont.) HTP Package Subprograms

Subprogram	Description
TABLECAPTION Procedure	Generates the <CAPTION> and </CAPTION> tags which place a caption in an HTML table
TABLECLOSE Procedure	Generates the </TABLE> tag which marks the end of an HTML table
TABLEDATA Procedure	Generates the <TD> and </TD> tags which insert data into a cell of an HTML table
TABLEHEADER Procedure	Generates the <TH> and </TH> tags which insert a header cell in an HTML table.
TABLEOPEN Procedure	Generates the <TABLE> tag which marks the beginning of an HTML table
TABLEROWCLOSE Procedure	Generates the </TR> tag which marks the end of a new row in an HTML table
TABLEROWOPEN Procedure	Generates the <TR> tag which marks the beginning of a new row in an HTML table
TELETYPE Procedure	Generates the <TT> and </TT> tags which direct the browser to render the text they surround in a fixed width typewriter font, for example, the courier font
TITLE Procedure	Generates the <TITLE> and </TITLE> tags which specify the text to display in the titlebar of the browser window
ULISTCLOSE Procedure	Generates the tag which marks the end of an unordered list
ULISTOPEN Procedure	Generates the tag which marks the beginning of an unordered list
UNDERLINE Procedure	Generates the <U> and </U> tags, which direct the browser to render the text they surround with an underline
VARIABLE Procedure	Generates the <VAR> and </VAR> tags which direct the browser to render the text they surround in italics or however "variable" is defined stylistically.
WBR Procedure	Generates the <WBR> tag, which inserts a soft line break within a section of NOBR text

237.5.1 ADDRESS Procedure

This procedure generates the <ADDRESS> and </ADDRESS> tags which specify the address, author and signature of a document.

Syntax

```
HTP.ADDRESS (
    cvalue          IN          VARCHAR2
    cnowrap         IN          VARCHAR2  DEFAULT NULL
    cclear          IN          VARCHAR2  DEFAULT NULL
    cattributes     IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-2 ADDRESS Procedure Parameters

Parameter	Description
<code>cvalue</code>	The string that goes between the <code><ADDRESS></code> and <code></ADDRESS></code> tags.
<code>cnowrap</code>	If the value for this parameter is not NULL, the <code>NOWRAP</code> attribute is included in the tag
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag

Examples

This procedure generates

```
<ADDRESS CLEAR="cclear" NOWRAP cattributes>cvalue</ADDRESS>
```

237.5.2 ANCHOR Procedure

Like the `ANCHOR2` procedure, this procedure generates the `<A>` and `` HTML tags which specify the source or destination of a hypertext link.

The difference between these subprograms is that the [ANCHOR2 Procedure](#) provides a target and therefore can be used for a frame.

Syntax

```
HTP.ANCHOR (
  curl          IN          VARCHAR2,
  ctext         IN          VARCHAR2,
  cname         IN          VARCHAR2  DEFAULT NULL,
  cattributes   IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-3 ANCHOR Procedure Parameters

Parameter	Description
<code>curl</code>	The value for the <code>HREF</code> attribute.
<code>ctext</code>	The string that goes between the <code><A></code> and <code></code> tags.
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<A HREF="curl" NAME="cname" cattributes>ctext</A>
```

Usage Notes

This tag accepts several attributes, but either `HREF` or `NAME` is required. `HREF` specifies to where to link. `NAME` allows this tag to be a target of a hypertext link.

237.5.3 ANCHOR2 Procedure

Like the `ANCHOR` procedure, this procedure generates the `<A>` and `` HTML tags which specify the source or destination of a hypertext link.

The difference between this procedure and the `ANCHOR` procedure is that this procedure provides a target and therefore can be used for a frame.

Syntax

```
HTP.ANCHOR2 (
    curl          IN          VARCHAR2,
    ctext         IN          VARCHAR2,
    cname         IN          VARCHAR2  DEFAULT NULL,
    ctarget       in          varchar2  DEFAULT NULL,
    cattributes   IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-4 ANCHOR2 Procedure Parameters

Parameter	Description
<code>curl</code>	The value for the <code>HREF</code> attribute.
<code>ctext</code>	The string that goes between the <code><A></code> and <code></code> tags.
<code>cname</code>	The value for the <code>NAME</code> attribute
<code>ctarget</code>	The value for the <code>TARGET</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag

Examples

This procedure generates

```
<A HREF="curl" NAME="cname" TARGET = "ctarget" cattributes>ctext</A>
```

237.5.4 APPLETCLOSE Procedure

This procedure closes the applet invocation with the `</APPLET>` tag.

You must first invoke the a Java applet using [APPLETOPEN Procedure](#).

Syntax

```
HTP.APPLETCLOSE;
```

237.5.5 APPLETOPEN Procedure

This procedure generates the `<APPLET>` tag which begins the invocation of a Java applet.

You close the applet invocation with [APPLETCLOSE Procedure](#) which generates the `</APPLET>` tag.

Syntax

```
HTP.APPLETOPEN (  
    ccode          IN          VARCHAR2,  
    cheight       IN          NUMBER,  
    cwidth        IN          NUMBER,  
    cattributes   IN          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 237-5 APPLETOPEN Procedure Parameters

Parameter	Description
<code>ccode</code>	The the value for the <code>CODE</code> attribute which specifies the name of the applet class.
<code>cheight</code>	The value for the <code>HEIGHT</code> attribute.
<code>cwidth</code>	The value for the <code>WIDTH</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<APPLET CODE=ccode HEIGHT=cheight WIDTH=cwidth cattributes>
```

so that, for example,

```
HTP.appletopen('testclass.class', 100, 200, 'CODEBASE="/ows-applets"')
```

generates

```
<APPLET CODE="testclass.class" height=100 width=200 CODEBASE="/ows-applets">
```

Usage Notes

- Specify parameters to the Java applet using the [PARAM Procedure](#).
- Use the `cattributes` parameter to specify the `CODEBASE` attribute since the PL/SQL cartridge does not know where to find the class files. The `CODEBASE` attribute specifies the virtual path containing the class files.

237.5.6 AREA Procedure

This procedure generates the <AREA> tag, which defines a client-side image map. The <AREA> tag defines areas within the image and destinations for the areas.

Syntax

```
HTP.AREA (
  ccoords          IN          VARCHAR2
  cshape           IN          VARCHAR2  DEFAULT NULL,
  chref            IN          VARCHAR2  DEFAULT NULL,
  cnohref          IN          VARCHAR2  DEFAULT NULL,
  ctarger          IN          VARCHAR2  DEFAULT NULL,
  cattributes      IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-6 AREA Procedure Parameters

Parameter	Description
ccords	The the value for the COORDS attribute.
cshape	The value for the SHAPE attribute.
chref	The value for the HREF attribute.
cnohref	If the value for this parameter is not NULL, the NOHREF attribute is added to the tag.
ctarger	The value for the TARGET attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<AREA COORDS="ccoords" SHAPE="cshape" HREF="chref" NOHREF TARGET="ctarger" cattributes>
```

237.5.7 BASE Procedure

This procedure generates the <BASE> tag which records the URL of the document.

Syntax

```
HTP.BASE (
  ctarger          IN          VARCHAR2  DEFAULT NULL,
  cattributes      IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-7 BASE Procedure Parameters

Parameter	Description
ctarger	The value for the TARGET attribute which establishes a window name to which all links in this document are targeted.

Table 237-7 (Cont.) BASE Procedure Parameters

Parameter	Description
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<BASE HREF="<current URL>" TARGET="ctarget" cattributes>
```

237.5.8 BASEFONT Procedure

This procedure generates the `<BASEFONT>` tag which specifies the base font size for a Web page.

Syntax

```
HTP.BASEFONT (
    nsize    IN    INTEGER);
```

Parameters**Table 237-8 BASEFONT Procedure Parameters**

Parameter	Description
<code>nsize</code>	The value for the <code>SIZE</code> attribute.

Examples

This procedure generates

```
<BASEFONT SIZE="nsize">
```

237.5.9 BGSOUND Procedure

This procedure generates the `<BGSOUND>` tag which includes audio for a Web page.

Syntax

```
HTP.BGSOUND (
    csrc          IN    VARCHAR2,
    cloop         IN    VARCHAR2  DEFAULT NULL,
    cattributes   IN    VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-9 BGSOUND Procedure Parameters**

Parameter	Description
<code>csrc</code>	The value for the <code>SRC</code> attribute.

Table 237-9 (Cont.) BGSOUND Procedure Parameters

Parameter	Description
<code>cloop</code>	The value for the <code>LOOP</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<BGSOUND SRC="csrc" LOOP="cloop" cattributes>
```

237.5.10 BIG Procedure

This procedure generates the `<BIG>` and `</BIG>` tags which direct the browser to render the text in a bigger font.

Syntax

```
HTP.BIG (
    ctext          IN          VARCHAR2,
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-10 BIG Procedure Parameters**

Parameter	Description
<code>ctext</code>	The the text that goes between the tags.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<BIG cattributes>ctext</BIG>
```

237.5.11 BLOCKQUOTECLOSE Procedure

This procedure generates the `</BLOCKQUOTE>` tag which mark the end of a section of quoted text.

You mark the beginning of a section of text by means of the [BLOCKQUOTEOPEN Procedure](#).

Syntax

```
HTP.BLOCKQUOTECLOSE;
```

Examples

This procedure generates

`</BLOCKQUOTE>`

237.5.12 BLOCKQUOTEOPEN Procedure

This procedure generates the `<BLOCKQUOTE>` tag, which marks the beginning of a section of quoted text.

You mark the end of a section of text by means of the [BLOCKQUOTECLOSE Procedure](#).

Syntax

```
HTP.BLOCKQUOTEOPEN (
  cnowrap      IN      VARCHAR2  DEFAULT NULL,
  cclear       IN      VARCHAR2  DEFAULT NULL,
  cattributes  IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-11 BLOCKQUOTEOPEN Procedure Parameters

Parameter	Description
<code>cnowrap</code>	If the value for this parameter is not NULL, the NOWRAP attribute is added to the tag.
<code>cclear</code>	The value for the CLEAR attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<BLOCKQUOTE CLEAR="cclear" NOWRAP cattributes>
```

237.5.13 BODYCLOSE Procedure

This procedure generates the `</BODY>` tag which marks the end of a body section of an HTML document.

You mark the beginning of a body section by means of the [BODYOPEN Procedure](#).

Syntax

```
HTP.BODYCLOSE;
```

Examples

This procedure generates

```
</BODY>
```

237.5.14 BODYOPEN Procedure

This procedure generates the `<BODY>` tag which marks the beginning of the body section of an HTML document.

You mark the end of a body section by means of the [BODYCLOSE Procedure](#).

Syntax

```
HTP.BODYOPEN (
    cbackground IN VARCHAR2 DEFAULT NULL,
    cattributes IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 237-12 BODYOPEN Procedure Parameters

Parameter	Description
<code>cbackground</code>	The value for the <code>BACKGROUND</code> attribute which specifies a graphic file to use for the background of the document.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<BODY background="cbackground" cattributes>
```

so that

```
HTP.BODYOPEN('/img/background.gif');
```

generates:

```
<BODY background="/img/background.gif">
```

237.5.15 BOLD Procedure

This procedure generates the `` and `` tags which direct the browser to display the text in boldface.

Syntax

```
HTP.BOLD (
    ctext IN VARCHAR2,
    cattributes IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 237-13 BOLD Procedure Parameters

Parameter	Description
<code>ctext</code>	The text that goes between the tags.

Table 237-13 (Cont.) BOLD Procedure Parameters

Parameter	Description
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<B cattributes>ctext</B>
```

237.5.16 BR Procedure

This procedure generates the `
` tag which begins a new line of text.

It performs the same operation as the [NL Procedure](#).

Syntax

```
HTP.BR (
  cclear          IN          VARCHAR2  DEFAULT NULL,
  cattributes     IN          VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-14 BR Procedure Parameters**

Parameter	Description
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<BR CLEAR="cclear" cattributes>
```

237.5.17 CENTER Procedure

This procedure generates the `<CENTER>` and `</CENTER>` tags which center a section of text within a Web page.

Syntax

```
HTP.CENTER (
  ctext          IN          VARCHAR2);
```

Parameters

Table 237-15 CENTER Parameters

Parameter	Description
<code>c</code> <code>text</code>	The text that goes between the tags.

Examples

This procedure generates

```
<CENTER>c
```

`text`

```
</CENTER>
```

237.5.18 CENTERCLOSE Procedure

This procedure generates the `</CENTER>` tag which marks the end of a section of text to center.

You mark the beginning of a section of text to center with the [CENTEROPEN Procedure](#).

Syntax

```
HTP.CENTERCLOSE;
```

Examples

This procedure generates

```
</CENTER>
```

237.5.19 CENTEROPEN Procedure

This procedure generates the `<CENTER>` tag which mark the beginning of a section of text to center.

You mark the beginning of a of a section of text to center by means of the [CENTERCLOSE Procedure](#).

Syntax

```
HTP.CENTEROPEN;
```

Examples

This procedure generates

```
<CENTER>
```

237.5.20 CITE Procedure

This procedure generates the `<CITE>` and `</CITE>` tags which direct the browser to render the text as a citation.

Syntax

```
HTP.CITE (  
    ctext          IN          VARCHAR2,  
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-16 CITE Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to render as citation.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<CITE cattributes>ctext</CITE>
```

237.5.21 CODE Procedure

This procedure generates the `<CODE>` and `</CODE>` tags which direct the browser to render the text in monospace font or however "code" is defined stylistically.

Syntax

```
HTP.CODE (  
    ctext          IN          VARCHAR2,  
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-17 CODE Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to render as code.
<code>cattributes</code>	The other attributes to be included as-is in the tag

Examples

This procedure generates

```
<CODE cattributes>ctext</CODE>
```


237.5.22 COMMENT Procedure

This procedure generates the comment tags.

Syntax

```
HTP.COMMENT (  
    ctext          IN          VARCHAR2);
```

Parameters

Table 237-18 COMMENT Procedure Parameters

Parameter	Description
ctext	The comment.

Examples

This procedure generates

```
<!-- ctext -->
```

237.5.23 DFN Procedure

This procedure generates the `<DFN>` and `</DFN>` tags which direct the browser to mark the text in italics or however "definition" is described stylistically.

Syntax

```
HTP.DFN (  
    ctext          IN          VARCHAR2);
```

Parameters

Table 237-19 DFN Procedure Parameters

Parameter	Description
ctext	The text to render in italics.

Examples

This procedure generates

```
<DFN>ctext</DFN>
```

237.5.24 DIRLISTCLOSE Procedure

This procedure generates the `</DIR>` tag which ends a directory list section. You start a directory list section with the DIRLISTOPEN Procedure.

Syntax

```
HTP.DIRLISTCLOSE;
```

Usage Notes

A directory list presents a list of items that contains up to 20 characters. Items in this list are typically arranged in columns, 24 characters wide. Insert the tag directly or invoke the [LISTITEM Procedure](#) so that the tag appears directly after the </DIR> tag to define the items as a list.

Examples

This procedure generates

```
</DIR>
```

Related Topics

- [DIRLISTOPEN Procedure](#)
This procedure generates the <DIR> which starts a directory list section. You end a directory list section with the DIRLISTCLOSE Procedure.

237.5.25 DIRLISTOPEN Procedure

This procedure generates the <DIR> which starts a directory list section. You end a directory list section with the DIRLISTCLOSE Procedure.

Syntax

```
HTP.DIRLISTOPEN;
```

Usage Notes

A directory list presents a list of items that contains up to 20 characters. Items in this list are typically arranged in columns, 24 characters wide. Insert the tag directly or invoke the [LISTITEM Procedure](#) so that the tag appears directly after the </DIR> tag to define the items as a list.

Examples

This procedure generates

```
<DIR>
```

Related Topics

- [DIRLISTCLOSE Procedure](#)
This procedure generates the </DIR> tag which ends a directory list section. You start a directory list section with the DIRLISTOPEN Procedure.

237.5.26 DIV Procedure

This procedure generates the <DIV> tag which creates document divisions.

Syntax

```
HTP.DIV (  
    calign          IN          VARCHAR2    DEFAULT NULL,  
    cattributes    IN          VARCHAR2    DEFAULT NULL);
```

Parameters

Table 237-20 DIV Procedure Parameters

Parameter	Description
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<DIV ALIGN="calign" cattributes>
```

237.5.27 DLISTCLOSE Procedure

This procedure generates the `</DL>` tag which ends a definition list. You start a definition list by means of the [DLISTOPEN Procedure](#).

Syntax

```
HTP.DLISTCLOSE;
```

Usage Notes

A definition list looks like a glossary: it contains terms and definitions. Terms are inserted using the [DLISTTERM Procedure](#) and definitions are inserted using the [DLISTDEF Procedure](#).

Examples

This procedure generates

```
</DL>
```

Related Topics

- [DLISTOPEN Procedure](#)
This procedure generates the `<DL>` tag which starts a definition list. You end a definition list by means of the [DLISTCLOSE Procedure](#).

237.5.28 DLISTDEF Procedure

This procedure generates the `<DD>` tag, which inserts definitions of terms. Use this tag for a definition list `<DL>`. Terms are tagged `<DT>` and definitions are tagged `<DD>`.

Syntax

```
HTP.DLISTDEF (
  ctext          IN          VARCHAR2  DEFAULT NULL,
  cclear        IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-21 DLISTDEF Procedure Parameters

Parameter	Description
<code>c_{text}</code>	The definition of the term.
<code>c_{clear}</code>	The value for the <code>CLEAR</code> attribute.
<code>c_{attributes}</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<DD CLEAR="cclear" cattributes>ctext
```

237.5.29 DLISTOPEN Procedure

This procedure generates the `<DL>` tag which starts a definition list. You end a definition list by means of the `DLISTCLOSE` Procedure.

Syntax

```
HTP.DLISTOPEN (
  cclear          IN          VARCHAR2  DEFAULT NULL,
  cattributes     IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-22 DLISTOPEN Procedure Parameters

Parameter	Description
<code>c_{clear}</code>	The value for the <code>CLEAR</code> attribute.
<code>c_{attributes}</code>	The other attributes to be included as-is in the tag.

Usage Notes

A definition list looks like a glossary: it contains terms and definitions. Terms are inserted using the [DLISTTERM Procedure](#) and definitions are inserted using the [DLISTDEF Procedure](#).

Examples

This procedure generates

```
<DL CLEAR="cclear" cattributes>
```

Related Topics

- [DLISTCLOSE Procedure](#)
This procedure generates the `</DL>` tag which ends a definition list. You start a definition list by means of the `DLISTOPEN` Procedure.

237.5.30 DLISTTERM Procedure

This procedure generates the `<DT>` tag which defines a term in a definition list `<DL>`.

Syntax

```
HTP.DLISTTERM (
  ctext          IN          VARCHAR2  DEFAULT NULL,
  cclear         IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-23 DLISTTERM Procedure Parameters

Parameter	Description
<code>ctext</code>	The term.
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<DT CLEAR="cclear" cattributes>ctext
```

237.5.31 EM Procedure

This procedure generates the `` and `` tags, which define text to be emphasized.

It performs the same task as the [EMPHASIS Procedure](#).

Syntax

```
HTP.EM(
  ctext          IN          VARCHAR2,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-24 EM Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to emphasize.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<EM cattributes>ctext</EM>
```

237.5.32 EMPHASIS Procedure

This procedure generates the `` and `` tags, which define text to be emphasized.

It performs the same task as the [EM Procedure](#).

Syntax

```
HTP.EMPHASIS (  
    ctext          IN          VARCHAR2,  
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-25 EMPHASIS Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to emphasize.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<EM cattributes>ctext</EM>
```

237.5.33 ESCAPE_SC Procedure

This procedure replaces characters that have special meaning in HTML with their escape sequences.

The following characters are converted:

- `&` to `&`;
- `"` to `"`;
- `<` to `<`;
- `>` to `>`;

This procedure performs the same operation as [PRINTS Procedures](#) and [PS Procedure](#).

Syntax

```
HTP.ESCAPE_SC (  
    ctext          IN          VARCHAR2);
```

Parameters

Table 237-26 ESCAPE_SC Procedure Parameters

Parameter	Description
c <code>text</code>	The text string to convert.

237.5.34 FONTCLOSE Procedure

This procedure generates the `` tag which marks the end of a section of text with the specified font characteristics.

You mark the beginning of the section text by means of the [FONTOPEN Procedure](#).

Syntax

```
HTP.FONTCLOSE;
```

Examples

This procedure generates

```
</FONT>
```

237.5.35 FONTOPEN Procedure

This procedure generates the `` which marks the beginning of section of text with the specified font characteristics.

You mark the end of the section text by means of the [FONTCLOSE Procedure](#).

Syntax

```
HTP.FONTOPEN(
  ccolor      IN      VARCHAR2  DEFAULT NULL,
  cface       IN      VARCHAR2  DEFAULT NULL,
  csize       IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-27 FONTOPEN Procedure Parameters

Parameter	Description
c <code>color</code>	The value for the <code>COLOR</code> attribute.
c <code>face</code>	The value for the <code>FACE</code> attribute
c <code>size</code>	The value for the <code>SIZE</code> attribute
c <code>attributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<FONT COLOR="ccolor" FACE="cface" SIZE="csize" cattributes>
```

237.5.36 FORMCHECKBOX Procedure

This procedure generates the `<INPUT>` tag with `TYPE="checkbox"` which inserts a checkbox element in a form.

A checkbox element is a button that the user toggles on or off.

Syntax

```
HTP.FORMCHECKBOX (
  cname          IN          VARCHAR2,
  cvalue         IN          VARCHAR2  DEFAULT 'ON',
  cchecked       IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-28 FORMCHECKBOX Procedure Parameters

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>cvalue</code>	The value for the <code>VALUE</code> attribute.
<code>cchecked</code>	If the value for this parameter is not <code>NULL</code> , the <code>CHECKED</code> attribute is added to the tag.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<INPUT TYPE="checkbox" NAME="cname" VALUE="cvalue" CHECKED cattributes>
```

237.5.37 FORMCLOSE Procedure

This procedure generates the `</FORM>` tag which marks the end of a form section in an HTML document.

You mark the beginning of the form section by means of the [FORMOPEN Procedure](#).

Syntax

```
HTP.FORMCLOSE;
```

Examples

This procedure generates

```
</FORM>
```


237.5.38 FORMOPEN Procedure

This procedure generates the `<FORM>` tag which marks the beginning of a form section in an HTML document.

You mark the end of the form section by means of the [FORMCLOSE Procedure](#).

Syntax

```
HTP.FORMOPEN (
    curl           IN          VARCHAR2,
    cmethod       IN          VARCHAR2  DEFAULT 'POST',
    ctarget       IN          VARCHAR2  DEFAULT NULL,
    cenctype      IN          VARCHAR2  DEFAULT NULL,
    cattributes   IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-29 FORMOPEN Procedure Parameters

Parameter	Description
<code>curl</code>	The URL of the WRB or CGI script where the contents of the form is sent. This parameter is required.
<code>cmethod</code>	The value for the <code>METHOD</code> attribute. The value can be "GET" or "POST".
<code>ctarget</code>	The value for the <code>TARGET</code> attribute.
<code>cenctype</code>	The value for the <code>ENCTYPE</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<FORM ACTION="curl" METHOD="cmethod" TARGET="ctarget" ENCTYPE="cenctype" cattributes>
```

237.5.39 FORMFILE Procedure

This procedure generates the `<INPUT>` tag with `TYPE="file"` which inserts a file form element. This is used for file uploading for a given page.

Syntax

```
HTP.FORMFILE (
    cname         IN          VARCHAR2,
    caccept       IN          VARCHAR2  DEFAULT NULL,
    cattributes   IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-30 FORMFILE Procedure Parameters

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.

Table 237-30 (Cont.) FORMFILE Procedure Parameters

Parameter	Description
<code>caccept</code>	A comma-delimited list of MIME types for upload.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<INPUT TYPE="file" NAME="cname" ACCEPT="caccept" cattributes>
```

237.5.40 FORMHIDDEN Procedure

This procedure generates the `<INPUT>` tag with `TYPE="hidden"`, which inserts a hidden form element.

This element is not seen by the user. It submits additional values to the script.

Syntax

```
HTP.FORMHIDDEN (
  cname          IN          VARCHAR2,
  cvalue         IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-31 FORMHIDDEN Procedure Parameters**

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>cvalue</code>	The value for the <code>VALUE</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<INPUT TYPE="hidden" NAME="cname" VALUE="cvalue" cattributes>
```

237.5.41 FORMIMAGE Procedure

This procedure generates the `<INPUT>` tag with `TYPE="image"` which creates an image field that the user clicks to submit the form immediately.

The coordinates of the selected point are measured in pixels, and returned (along with other contents of the form) in two name/value pairs. The x coordinate is submitted under the name of the field with `.x` appended, and the y coordinate with `.y` appended. Any `VALUE` attribute is ignored.

Syntax

```
HTP.FORMIMAGE (
  cname      IN      VARCHAR2,
  csrc       IN      VARCHAR2,
  calign     IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-32 FORMIMAGE Procedure Parameters**

Parameter	Description
cname	The value for the NAME attribute.
csrc	The value for the SRC attribute that specifies the image file.
calign	The value for the ALIGN attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<INPUT TYPE="image" NAME="cname" SRC="csrc" ALIGN="calign" cattributes>
```

237.5.42 FORMPASSWORD Procedure

This procedure generates the <INPUT> tag with TYPE="password" which creates a single-line text entry field. When the user enters text in the field, each character is represented by one asterisk. This is used for entering passwords.

Syntax

```
HTP.FORMPASSWORD (
  cname      IN      VARCHAR2,
  csize      IN      VARCHAR2,
  cmaxlength IN      VARCHAR2  DEFAULT NULL,
  cvalue     IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-33 FORMPASSWORD Procedure Parameters**

Parameter	Description
cname	The value for the NAME attribute.
ctime	The value for the SIZE attribute.
cmmaxlength	The value for the MAXLENGTH attribute.
cvalue	The value for the VALUE attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<INPUT TYPE="password" NAME="cname" SIZE="csize" MAXLENGTH="cmaxlength"  
VALUE="cvalue" cattributes>
```

237.5.43 FORMRADIO Procedure

This procedure generates the `<INPUT>` tag with `TYPE="radio"`, which creates a radio button on the HTML form. Within a set of radio buttons, the user selects only one. Each radio button in the same set has the same name, but different values. The selected radio button generates a name/value pair.

Syntax

```
HTP.FORMRADIO(  
  cname          IN          VARCHAR2,  
  cvalue         IN          VARCHAR2,  
  cchecked       IN          VARCHAR2  DEFAULT NULL,  
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-34 FORMRADIO Procedure Parameters

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>cvalue</code>	The value for the <code>VALUE</code> attribute.
<code>cchecked</code>	If the value for this parameter is not <code>NULL</code> , the <code>CHECKED</code> attribute is added to the tag.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<INPUT TYPE="radio" NAME="cname" VALUE="cvalue" CHECKED cattributes>
```

237.5.44 FORMRESET Procedure

This procedure generates the `<INPUT>` tag with `TYPE="reset"` which creates a button that, when selected, resets the form fields to their initial values.

Syntax

```
HTP.FORMRESET(  
  cvalue         IN          VARCHAR2  DEFAULT 'Reset',  
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-35 FORMRESET Procedure Parameters

Parameter	Description
<code>cvalue</code>	The value for the <code>VALUE</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<INPUT TYPE="reset" VALUE="cvalue" cattributes>
```

237.5.45 FORMSELECTCLOSE Procedure

This procedure generates the `</SELECT>` tag which marks the end of a Select form element.

A Select form element is a listbox where the user selects one or more values. You mark the beginning of Select form element by means of the [FORMSELECTOPEN Procedure](#). The values are inserted using [FORMSELETOPTION Procedure](#).

Syntax

```
HTP.FORMSELECTCLOSE;
```

Examples

This procedure generates

```
</SELECT>
```

as shown under Examples of the [FORMSELECTOPEN Procedure](#).

237.5.46 FORMSELECTOPEN Procedure

This procedure generates the `<SELECT>` tags which creates a Select form element.

A Select form element is a listbox where the user selects one or more values. You mark the end of Select form element by means of the [FORMSELECTCLOSE Procedure](#). The values are inserted using [FORMSELETOPTION Procedure](#).

Syntax

```
FORMSELECTOPEN (
  cname          IN          VARCHAR2,
  cprompt        IN          VARCHAR2  DEFAULT NULL,
  nsize          IN          INTEGER   DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-36 FORMSELECTOPEN Procedure Parameters

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>cprompt</code>	The string preceding the list box.
<code>nsize</code>	The value for the <code>SIZE</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
cprompt <SELECT NAME="cname" SIZE="nsize" cattributes>
</SELECT>
```

so that

```
HTP.FORMSELECTOPEN('greatest_player';
  'Pick the greatest player:');
HTP.FORMSELECTOPTION('Messier');
HTP.FORMSELECTOPTION('Howe');
HTP.FORMSELECTOPTION('Gretzky');.
HTP.FORMSELECTCLOSE;
```

generates

```
Pick the greatest player:
<SELECT NAME="greatest_player">
<OPTION>Messier
<OPTION>Howe
<OPTION>Gretzky
</SELECT>
```

237.5.47 FORMSELECTOPTION Procedure

This procedure generates the `<OPTION>` tag which represents one choice in a Select element.

Syntax

```
HTP.FORMSELECTOPTION (
  cvalue          IN          VARCHAR2,
  cselected       IN          VARCHAR2  DEFAULT NULL,
  cattributes     IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-37 FORMSELECTOPTION Procedure Parameters

Parameter	Description
<code>cvalue</code>	The text for the option.

Table 237-37 (Cont.) FORMSELETOPTION Procedure Parameters

Parameter	Description
<code>cvalue</code>	If the value for this parameter is not NULL, the <code>SELECTED</code> attribute is added to the tag.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<OPTION SELECTED cattributes>cvalue
```

as shown under Examples of the [FORMSELETOPTION Procedure](#).

237.5.48 FORMSUBMIT Procedure

This procedure generates the `<INPUT>` tag with `TYPE="submit"` which creates a button that, when clicked, submits the form. If the button has a `NAME` attribute, the button contributes a name/value pair to the submitted data.

Syntax

```
HTP.FORMSUBMIT (
    cname          IN          VARCHAR2  DEFAULT NULL,
    cvalue         IN          VARCHAR2  DEFAULT 'Submit',
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-38 FORMSUBMIT Procedure Parameters**

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>cvalue</code>	The value for the <code>VALUE</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<INPUT TYPE="submit" NAME="cname" VALUE="cvalue" cattributes>
```

237.5.49 FORMTEXT Procedure

This procedure generates the `<INPUT>` tag with `TYPE="text"`, which creates a field for a single line of text.

Syntax

```
HTP.FORMTEXT (
    cname          IN          VARCHAR2,
```

```

csize          IN          VARCHAR2  DEFAULT NULL,
cmaxlength     IN          VARCHAR2  DEFAULT NULL,
cvalue        IN          VARCHAR2  DEFAULT NULL,
cattributes    IN          VARCHAR2  DEFAULT NULL);

```

Parameters

Table 237-39 FORMTEXT Procedure Parameters

Parameter	Description
cname	The value for the NAME attribute.
csize	The value for the SIZE attribute.
cmaxlength	The value for the MAXLENGTH attribute.
cvalue	The value for the VALUE attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```

<INPUT TYPE="text" NAME="cname" SIZE="csize" MAXLENGTH="cmaxlength"
VALUE="cvalue" cattributes>

```

237.5.50 FORMTEXTAREA Procedure

This procedure generates the <TEXTAREA> tag, which creates a text field that has no predefined text in the text area. This field enables entering several lines of text.

The same operation is performed by the [FORMTEXTAREA2 Procedure](#) which in addition has the `cwrap` parameter that lets you specify a wrap style.

Syntax

```

HTP.FORMTEXTAREA (
  cname          IN          VARCHAR2,
  nrows         IN          INTEGER,
  ncolumns      IN          INTEGER,
  calign        , IN          VARCHAR2  DEFAULT NULL,
  cattributes   IN          VARCHAR2  DEFAULT NULL);

```

Parameters

Table 237-40 FORMTEXTAREA Procedure Parameters

Parameter	Description
cname	The value for the NAME attribute.
nrows	The value for the ROWS attribute. This is an integer.
ncolumns	The value for the COLS attribute. This is an integer.
calign	The value for the ALIGN attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<TEXTAREA NAME="cname" ROWS="nrows" COLS="ncolumns" ALIGN="calign" cattributes></TEXTAREA>
```

237.5.51 FORMTEXTAREA2 Procedure

This procedure generates the `<TEXTAREA>` tag, which creates a text field that has no predefined text in the text area. This field enables entering several lines of text.

The same operation is performed by the [FORMTEXTAREA Procedure](#) except that in that case you cannot specify a wrap style.

Syntax

```
HTP.FORMTEXTAREA2 (
    cname          IN          VARCHAR2,
    nrows          IN          INTEGER,
    ncolumns       IN          INTEGER,
    calign         IN          VARCHAR2  DEFAULT NULL,
    cwrap         IN          VARCHAR2  DEFAULT NULL,
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-41 FORMTEXTAREA2 Procedure Parameters

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>nrows</code>	The value for the <code>ROWS</code> attribute. This is an integer.
<code>ncolumns</code>	The value for the <code>COLS</code> attribute. This is an integer.
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cwrap</code>	The value for the <code>WRAP</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<TEXTAREA NAME="cname" ROWS="nrows" COLS="ncolumns" ALIGN="calign" WRAP="cwrap" cattributes></TEXTAREA>
```

237.5.52 FORMTEXTAREACLOSE Procedure

This procedure generates the `</TEXTAREA>` tag which ends a text area form element.

You open a text area element by means of either [FORMTEXTAREAOPEN Procedure](#) or [FORMTEXTAREAOPEN2 Procedure](#).

Syntax

```
HTP.FORMTEXTAREACLOSE;
```

Examples

This procedure generates

```
</TEXTAREA>
```

237.5.53 FORMTEXTAREAOPEN Procedure

This procedure generates the `<TEXTAREA>` which marks the beginning of a text area form element.

The same operation is performed by the [FORMTEXTAREAOPEN2 Procedure](#) which in addition has the `cwrap` parameter that lets you specify a wrap style. You mark the end of a text area form element by means of the [FORMTEXTAREACLOSE Procedure](#).

Syntax

```
HTP.FORMTEXTAREAOPEN (
  cname          IN          VARCHAR2,
  nrows          IN          INTEGER,
  ncolumns       IN          INTEGER,
  calign         IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-42 FORMTEXTAREAOPEN Procedure Parameters

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>nrows</code>	The value for the <code>ROWS</code> attribute. This is an integer.
<code>ncolumns</code>	The value for the <code>COLS</code> attribute. This is an integer.
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<TEXTAREA NAME="cname" ROWS="nrows" COLS="ncolumns" ALIGN="calign" cattributes>
```

237.5.54 FORMTEXTAREAOPEN2 Procedure

This procedure generates the `<TEXTAREA>` which marks the beginning of a text area form element.

The same operation is performed by the [FORMTEXTAREAOPEN Procedure](#) except that in that case you cannot specify a wrap style. You mark the end of a text area form element by means of the [FORMTEXTAREACLOSE Procedure](#).

Syntax

```
HTP.FORMTEXTAREAOPEN2 (
  cname          IN          VARCHAR2,
```

```

nrows          IN          INTEGER,
ncolumns       IN          INTEGER,
calign         IN          VARCHAR2  DEFAULT NULL,
cwrap         IN          VARCHAR2  DEFAULT NULL,
cattributes    IN          VARCHAR2  DEFAULT NULL);

```

Parameters

Table 237-43 FORMTEXTAREAOPEN2 Procedure Parameters

Parameter	Description
cname	The value for the NAME attribute.
nrows	The value for the ROWS attribute. This is an integer.
ncolumns	The value for the COLS attribute. This is an integer.
calign	The value for the ALIGN attribute.
cwrap	The value for the WRAP attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```

<TEXTAREA NAME="cname" ROWS="nrows" COLS="ncolumns" ALIGN="calign" WRAP = "cwrap"
cattributes>

```

237.5.55 FRAME Procedure

This procedure generates the <FRAME> tag which begins the characteristics of a frame created by a <FRAMESET> tag.

Syntax

```

HTP.FRAME (
  csrc          IN          VARCHAR2,
  cname         IN          VARCHAR2  DEFAULT NULL,
  cmarginwidth  IN          VARCHAR2  DEFAULT NULL,
  cmarginheight IN          VARCHAR2  DEFAULT NULL,
  cscrolling    IN          VARCHAR2  DEFAULT NULL,
  cnoresize     IN          VARCHAR2  DEFAULT NULL,
  cattributes   IN          VARCHAR2  DEFAULT NULL);

```

Parameters

Table 237-44 FRAME Procedure Parameters

Parameter	Description
csrc	The URL to display in the frame.
cname	The value for the NAME attribute.
cmarginwidth	The value for the MARGINWIDTH attribute.
cscrolling	The value for the SCROLLING attribute.

Table 237-44 (Cont.) FRAME Procedure Parameters

Parameter	Description
<code>cnoresize</code>	If the value for this parameter is not NULL, the NORESIZE attribute is added to the tag.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<FRAME SRC="csrc" NAME="cname" MARGINWIDTH="cmarginwidth"
MARGINHEIGHT="cmarginheight" SCROLLING="cscrolling" NORESIZE cattributes>
```

237.5.56 FRAMESETCLOSE Procedure

This procedure generates the `</FRAMESET>` tag which ends a frameset section.

You mark the beginning of a frameset section by means of the [FRAMESETOPEN Procedure](#).

Syntax

```
HTP.FRAMESETCLOSE;
```

Examples

This procedure generates

```
</FRAMESET>
```

237.5.57 FRAMESETOPEN Procedure

This procedure generates the `<FRAMESET>` tag which define a frameset section.

You mark the end of a frameset section by means of the [FRAMESETCLOSE Procedure](#).

Syntax

```
HTP.FRAMESETOPEN (
    crows          IN          VARCHAR2   DEFAULT NULL,
    ccols          IN          VARCHAR2   DEFAULT NULL,
    cattributes    IN          VARCHAR2   DEFAULT NULL);
```

Parameters**Table 237-45 FRAMESETOPEN Procedure Parameters**

Parameter	Description
<code>crows</code>	The value for the ROWS attribute.
<code>ccols</code>	The value for the COLS attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<FRAMESET ROWS="rows" COLS="cols" cattributes>
```

237.5.58 HEADCLOSE Procedure

This procedure generates the `</HEAD>` tag which marks the end of an HTML document head section.

You mark the beginning of an HTML document head section by means of the [HEADOPEN Procedure](#).

Syntax

```
HTP.HEADCLOSE;
```

Examples

This procedure generates

```
</HEAD>
```

237.5.59 HEADER Procedure

This procedure generates opening heading tags (`<H1>` to `<H6>`) and their corresponding closing tags (`</H1>` to `</H6>`).

Syntax

```
HTP.HEADER(  
  nsize          IN          INTEGER,  
  cheader        IN          VARCHAR2,  
  calign         IN          VARCHAR2  DEFAULT NULL,  
  cnowrap        IN          VARCHAR2  DEFAULT NULL,  
  cclear         IN          VARCHAR2  DEFAULT NULL,  
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-46 HEADER Procedure Parameters

Parameter	Description
<code>nsize</code>	The the heading level. This is an integer between 1 and 6.
<code>cheader</code>	The text to display in the heading.
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cnowrap</code>	The value for the <code>NOWRAP</code> attribute.
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

```
HTP.header (1, 'Overview');
```

produces:

```
<H1>Overview</H1>
```

237.5.60 HEADOPEN Procedure

This procedure generates the `<HEAD>` tag which marks the beginning of the HTML document head section.

You mark the end of an HTML document head section by means of the [HEADCLOSE Procedure](#).

Syntax

```
HTP.HEADOPEN;
```

Examples

This procedure generates

```
<HEAD>
```

237.5.61 HR Procedure

This procedure generates the `<HR>` tag, which generates a line in the HTML document.

This subprogram performs the same operation as the [LINE Procedure](#).

Syntax

```
HTP.HR (
  cclear      IN      VARCHAR2  DEFAULT NULL,
  csrc        IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-47 HR Procedure Parameters

Parameter	Description
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>csrc</code>	The value for the <code>SRC</code> attribute which specifies a custom image as the source of the line.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<HR CLEAR="cclear" SRC="csrc" cattributes>
```

237.5.62 HTMLCLOSE Procedure

This procedure generates the `</HTML>` tag which marks the end of an HTML document.

You use the [HTMLOPEN Procedure](#) to mark the beginning of an HTML document.

Syntax

```
HTP.HTMLCLOSE;
```

Examples

This procedure generates

```
</HTML>
```

237.5.63 HTMLOPEN Procedure

This procedure generates the `<HTML>` tag which marks the beginning of an HTML document.

You use the [HTMLCLOSE Procedure](#) to mark the end of the an HTML document.

Syntax

```
HTP.HTMLOPEN;
```

Examples

This procedure generates

```
<HTML>
```

237.5.64 IMG Procedure

This procedure generates the `` tag which directs the browser to load an image onto the HTML page.

The [IMG2 Procedure](#) performs the same operation but additionally uses the `cusemap` parameter.

Syntax

```
HTP.IMG(  
    curl           IN          VARCHAR2  DEFAULT NULL,  
    calign         IN          VARCHAR2  DEFAULT NULL,  
    calt           IN          VARCHAR2  DEFAULT NULL,  
    cismap         IN          VARCHAR2  DEFAULT NULL,  
    cattributes   IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-48 IMG Procedure Parameters

Parameter	Description
<code>curl</code>	The value for the SRC attribute.

Table 237-48 (Cont.) IMG Procedure Parameters

Parameter	Description
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>calt</code>	The value for the <code>ALT</code> attribute which specifies alternative text to display if the browser does not support images.
<code>cismap</code>	If the value for this parameter is not <code>NULL</code> , the <code>ISMAP</code> attribute is added to the tag. The attribute indicates that the image is an imagemap.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<IMG SRC="curl" ALIGN="calign" ALT="calt" ISMAP cattributes>
```

237.5.65 IMG2 Procedure

This procedure generates the `` tag, which directs the browser to load an image onto the HTML page.

The [IMG Procedure](#) performs the same operation but does not use the `cusemap` parameter.

Syntax

```
HTP.IMG2(
  curl          IN          VARCHAR2  DEFAULT NULL,
  calign        IN          VARCHAR2  DEFAULT NULL,
  calt          IN          VARCHAR2  DEFAULT NULL,
  cismap        IN          VARCHAR2  DEFAULT NULL,
  cusemap       IN          VARCHAR2  DEFAULT NULL,
  cattributes   IN          VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-49 IMG2 Procedure Parameters**

Parameter	Description
<code>curl</code>	The value for the <code>SRC</code> attribute.
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>calt</code>	The value for the <code>ALT</code> attribute which specifies alternative text to display if the browser does not support images.
<code>cismap</code>	If the value for this parameter is not <code>NULL</code> , the <code>ISMAP</code> attribute is added to the tag. The attribute indicates that the image is an imagemap.
<code>cusemap</code>	The value for the <code>USEMAP</code> attribute which specifies a client-side image map.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates


```
<IMG SRC="curl" ALIGN="calign" ALT="calt" ISMAP USEMAP="cusemap" cattributes>
```

237.5.66 ISINDEX Procedure

This procedure creates a single entry field with a prompting text, such as "enter value," then sends that value to the URL of the page or program.

Syntax

```
HTP.ISINDEX(
  cprompt      IN      VARCHAR2      DEFAULT NULL,
  curl         IN      VARCHAR2      DEFAULT NULL);
```

Parameters

Table 237-50 ISINDEX Procedure Parameters

Parameter	Description
cprompt	The value for the PROMPT attribute.
curl	The value for the HREF attribute.

Examples

This procedure generates

```
<ISINDEX PROMPT="cprompt" HREF="curl">
```

237.5.67 ITALIC Procedure

This procedure generates the <I> and </I> tags which direct the browser to render the text in italics.

Syntax

```
HTP.ITALIC(
  ctext        IN      VARCHAR2,
  cattributes  IN      VARCHAR2      DEFAULT NULL);
```

Parameters

Table 237-51 ITALIC Procedure Parameters

Parameter	Description
ctext	The text to be rendered in italics.
cattributes	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<I cattributes>ctext</I>
```

237.5.68 KBD Procedure

This procedure generates the `<KBD>` and `</KBD>` tags which direct the browser to render the text in monospace font.

This subprogram performs the same operation as the [KEYBOARD Procedure](#).

Syntax

```
HTP.KBD (  
    ctext          IN          VARCHAR2,  
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-52 KBD Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to be rendered in monospace.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<KBD cattributes>ctext</KBD>
```

237.5.69 KEYBOARD Procedure

This procedure generates the `<KBD>` and `</KBD>` tags, which direct the browser to render the text in monospace font.

This subprogram performs the same operation as the [KBD Procedure](#).

Syntax

```
HTP.KEYBOARD (  
    ctext          IN          VARCHAR2,  
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-53 KEYBOARD Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to be rendered in monospace.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<KBD cattributes>ctext</KBD>
```

237.5.70 LINE Procedure

This procedure generates the `<HR>` tag, which generates a line in the HTML document.

This subprogram performs the same operation as the [HR Procedure](#).

Syntax

```
HTP.LINE (
  cclear      IN      VARCHAR2  DEFAULT NULL,
  csrc        IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-54 LINE Procedure Parameters

Parameter	Description
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>csrc</code>	The value for the <code>SRC</code> attribute which specifies a custom image as the source of the line.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<HR CLEAR="cclear" SRC="csrc" cattributes>
```

237.5.71 LINKREL Procedure

This procedure generates the `<LINK>` tag with the `REL` attribute which delineates the relationship described by the hypertext link from the anchor to the target. This is only used when the `HREF` attribute is present.

This is the opposite of [LINKREV Procedure](#). This tag indicates a relationship between documents but does not create a link. To create a link, use the [ANCHOR Procedure](#).

Syntax

```
HTP.LINKREL (
  crel        IN      VARCHAR2,
  curl        IN      VARCHAR2,
  ctitle      IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-55 LINKREL Procedure Parameters

Parameter	Description
<code>crel</code>	The value for the <code>REL</code> attribute.
<code>curl</code>	The value for the <code>URL</code> attribute.

Table 237-55 (Cont.) LINKREL Procedure Parameters

Parameter	Description
<code>ctitle</code>	The value for the <code>TITLE</code> attribute.

Examples

This procedure generates

```
<LINK REL="crel" HREF="curl" TITLE="ctitle">
```

237.5.72 LINKREV Procedure

This procedure generates the `<LINK>` tag with the `REV` attribute which delineates the relationship described by the hypertext link from the target to the anchor.

This is the opposite of the [LINKREL Procedure](#). This tag indicates a relationship between documents, but does not create a link. To create a link, use the [ANCHOR Procedure](#).

Syntax

```
HTP.LINKREV(
  crev      IN      VARCHAR2,
  curl      IN      VARCHAR2,
  ctitle    IN      VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-56 LINKREV Procedure Parameters**

Parameter	Description
<code>crel</code>	The value for the <code>REV</code> attribute.
<code>curl</code>	The value for the <code>URL</code> attribute.
<code>ctitle</code>	The value for the <code>TITLE</code> attribute.

Examples

This procedure generates

```
<LINK REV="crev" HREF="curl" TITLE="ctitle">
```

237.5.73 LISTHEADER Procedure

This procedure generates the `<LH>` and `</LH>` tags which print an HTML tag at the beginning of the list.

Syntax

```
HTP.LISTHEADER(
  ctext      IN      VARCHAR2,
  cattributes IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-57 LISTHEADER Procedure Parameters

Parameter	Description
<code>c_{text}</code>	The text to place between <code><LH></code> and <code></LH></code> .
<code>c_{attributes}</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<LH cattributes>ctext</LH>
```

237.5.74 LISTINGCLOSE Procedure

This procedure generates the `</LISTING>` tags which marks the end of a section of fixed-width text in the body of an HTML page.

To mark the beginning of a section of fixed-width text in the body of an HTML page, use the [LISTINGOPEN Procedure](#).

Syntax

```
HTP.LISTINGCLOSE;
```

Examples

This procedure generates

```
</LISTING>
```

237.5.75 LISTINGOPEN Procedure

This procedure generates the `<LISTING>` tag which marks the beginning of a section of fixed-width text in the body of an HTML page.

To mark the end of a section of fixed-width text in the body of an HTML page, use the [LISTINGCLOSE Procedure](#).

Syntax

```
HTP.LISTINGOPEN;
```

Examples

This procedure generates

```
<LISTING>
```

237.5.76 LISTITEM Procedure

This procedure generates the tag, which indicates a list item.

Syntax

```
HTP.LISTITEM(
  ctext          IN          VARCHAR2  DEFAULT NULL,
  cclear         IN          VARCHAR2  DEFAULT NULL,
  cdingbat       IN          VARCHAR2  DEFAULT NULL,
  csrc           IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-58 LISTITEM Procedure Parameters

Parameter	Description
ctext	The text for the list item.
cclear	The value for the CLEAR attribute.
cdingbat	The value for the DINGBAT attribute.
csrc	The value for the SRC attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<LI CLEAR="cclear" DINGBAT="cdingbat" SRC="csrc" cattributes>ctext
```

237.5.77 MAILTO Procedure

This procedure generates the <A> tag with the HREF set to 'mailto' prepended to the mail address argument.

Syntax

```
HTP.MAILTO(
  caddress       IN          VARCHAR2,
  ctext          IN          VARCHAR2,
  cname          IN          VARCHAR2,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-59 MAILTO Procedure Parameters

Parameter	Description
caddress	The email address of the recipient.
ctext	The clickable portion of the link.
cname	The value for the NAME attribute.

Table 237-59 (Cont.) MAILTO Procedure Parameters

Parameter	Description
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<A HREF="mailto:caddress" NAME="cname" cattributes>ctext</A>
```

so that

```
HTP.mailto('pres@white_house.gov','Send Email to the President');
```

generates:

```
<A HREF="mailto:pres@white_house.gov">Send Email to the President</A>
```

237.5.78 MAPCLOSE Procedure

This procedure generates the `</MAP>` tag which marks the end of a set of regions in a client-side image map.

To mark the beginning of a set of regions in a client-side image map, use the [MAPOPEN Procedure](#).

Syntax

```
HTP.MAPCLOSE;
```

Examples

This procedure generates

```
</MAP>
```

237.5.79 MAPOPEN Procedure

This procedure generates the `<MAP>` tag which mark the beginning of a set of regions in a client-side image map.

To mark the end of a set of regions in a client-side image map, use the [MAPCLOSE Procedure](#).

Syntax

```
HTP.MAPOPEN (
  cname          IN          VARCHAR2  DEFAULT NULL,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-60 MAPOPEN Procedure Parameters

Parameter	Description
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<MAP NAME="cname" cattributes>
```

237.5.80 MENULISTCLOSE Procedure

This procedure generates the `</MENU>` tag which ends a list that presents one line for each item.

To begin a list of this kind, use the [MENULISTOPEN Procedure](#). The items in the list appear more compact than an unordered list. The [LISTITEM Procedure](#) defines the list items in a menu list.

Syntax

```
HTP.MENULISTCLOSE;
```

Examples

This procedure generates

```
</MENU>
```

237.5.81 MENULISTOPEN Procedure

This procedure generates the `<MENU>` tag which begins a list that presents one line for each item.

To end a list of this kind, use the [MENULISTCLOSE Procedure](#). The items in the list appear more compact than an unordered list. The [LISTITEM Procedure](#) defines the list items in a menu list.

Syntax

```
HTP.MENULISTOPEN;
```

Examples

This procedure generates

```
<MENU>
```


237.5.82 META Procedure

This procedure generates the `<META>` tag, which embeds meta-information about the document and also specifies values for HTTP headers. For example, you can specify the expiration date, keywords, and author name.

Syntax

```
HTP.META(  
  chttp_equiv   IN      VARCHAR2,  
  cname         IN      VARCHAR2,  
  ccontent      IN      VARCHAR2);
```

Parameters

Table 237-61 META Procedure Parameters

Parameter	Description
<code>chttp_equiv</code>	The value for the <code>CHTTP_EQUIV</code> attribute.
<code>cname</code>	The value for the <code>NAME</code> attribute.
<code>ccontent</code>	The value for the <code>CONTENT</code> attribute.

Examples

This procedure generates

```
<META HTTP-EQUIV="chttp_equiv" NAME ="cname" CONTENT="ccontent">
```

so that

```
HTP.meta ('Refresh', NULL, 120);
```

generates

```
<META HTTP-EQUIV="Refresh" CONTENT=120>
```

On some Web browsers, this causes the current URL to be reloaded automatically every 120 seconds.

237.5.83 NL Procedure

This procedure generates the `
` tag which begins a new line of text.

It performs the same operation as the [BR Procedure](#).

Syntax

```
HTP.NL(  
  cclear        IN      VARCHAR2  DEFAULT NULL,  
  cattributes   IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-62 NL Procedure Parameters

Parameter	Description
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<BR CLEAR="cclear" cattributes>
```

237.5.84 NOBR Procedure

This procedure generates the `<NOBR>` and `</NOBR>` tags which turn off line-breaking in a section of text.

Syntax

```
HTP.NOBR(  
  ctext          IN          VARCHAR2);
```

Parameters

Table 237-63 NOBR Procedure Parameters

Parameter	Description
<code>ctext</code>	The text that is to be rendered on one line.

Examples

This procedure generates

```
<NOBR>ctext</NOBR>
```

237.5.85 NOFRAMESCLOSE Procedure

This procedure generates the `</NOFRAMES>` tag which marks the end of a no-frames section.

To mark the beginning of a no-frames section, use the [FRAMESETOPEN Procedure](#). See also [FRAME Procedure](#), [FRAMESETOPEN Procedure](#) and [FRAMESETCLOSE Procedure](#).

Syntax

```
HTP.NOFRAMESCLOSE;
```

Examples

This procedure generates

```
</NOFRAMES>
```

237.5.86 NOFRAMESOPEN Procedure

This procedure generates the `<NOFRAMES>` tag which mark the beginning of a no-frames section.

To mark the end of a no-frames section, use the [FRAMESETCLOSE Procedure](#). See also [FRAME Procedure](#), [FRAMESETOPEN Procedure](#) and [FRAMESETCLOSE Procedure](#).

Syntax

```
HTP.NOFRAMESOPEN;
```

Examples

This procedure generates

```
<NOFRAMES>
```

237.5.87 OLISTCLOSE Procedure

This procedure generates the `` tag which defines the end of an ordered list. An ordered list presents a list of numbered items.

To mark the beginning of a list of this kind, use the [OLISTOPEN Procedure](#). Numbered items are added using [LISTITEM Procedure](#).

Syntax

```
HTP.OLISTCLOSE;
```

Examples

This procedure generates

```
</OL>
```

237.5.88 OLISTOPEN Procedure

This procedure generates the `` tag which marks the beginning of an ordered list. An ordered list presents a list of numbered items.

To mark the end of a list of this kind, use the [OLISTCLOSE Procedure](#). Numbered items are added using [LISTITEM Procedure](#).

Syntax

```
HTP.OLISTOPEN(  
  cclear      IN      VARCHAR2  DEFAULT NULL,  
  cwrap       IN      VARCHAR2  DEFAULT NULL,  
  cattributes IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-64 OLISTOPEN Procedure Parameters

Parameter	Description
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>cwrap</code>	The value for the <code>WRAP</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<OL CLEAR="cclear" WRAP="cwrap" cattributes>
```

237.5.89 PARA Procedure

This procedure generates the `<P>` tag which indicates that the text that comes after the tag is to be formatted as a paragraph.

You can add attributes to the tag by means of the [PARAGRAPH Procedure](#).

Syntax

```
HTP.PARA;
```

Examples

This procedure generates

```
<P>
```

237.5.90 PARAGRAPH Procedure

You can use this procedure to add attributes to the `<P>` tag created by the `PARA` Procedure.

Syntax

```
HTP.PARAGRAPH (
    calign          IN          VARCHAR2  DEFAULT NULL,
    cnowrap         IN          VARCHAR2  DEFAULT NULL,
    cclear          IN          VARCHAR2  DEFAULT NULL,
    cattributes     IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-65 PARAGRAPH Procedure Parameters

Parameter	Description
<code>calign</code>	The value for the <code>ALIGN</code> attribute.

Table 237-65 (Cont.) PARAGRAPH Procedure Parameters

Parameter	Description
<code>cnowrap</code>	If the value for this parameter is not NULL, the NOWRAP attribute is added to the tag.
<code>cclear</code>	The value for the CLEAR attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<P ALIGN="calign" NOWRAP CLEAR="cclear" cattributes>
```

Related Topics

- [PARA Procedure](#)
This procedure generates the <P> tag which indicates that the text that comes after the tag is to be formatted as a paragraph.

237.5.91 PARAM Procedure

This procedure generates the <PARAM> tag which specifies parameter values for Java applets.

The values can reference HTML variables. To invoke a Java applet from a Web page, use [APPLETOPEN Procedure](#) to begin the invocation. Use one [PARAM Procedure](#) for each desired name-value pair, and use [APPLETCLOSE Procedure](#) to end the applet invocation.

Syntax

```
HTP.PARAM(  
  cname          IN          VARCHAR2  
  cvalue         IN          VARCHAR2);
```

Parameters**Table 237-66 PARAM Procedure Parameters**

Parameter	Description
<code>cname</code>	The value for the NAME attribute.
<code>cvalue</code>	The value for the VALUE attribute.

Examples

This procedure generates

```
<PARAM NAME=cname VALUE="cvalue">
```

237.5.92 PLAINTEXT Procedure

This procedure generates the `<PLAINTEXT>` and `</PLAINTEXT>` tags which direct the browser to render the text they surround in fixed-width type.

Syntax

```
HTP.PLAINTEXT (  
    ctext          IN          VARCHAR2,  
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-67 PLAINTEXT Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to be rendered in fixed-width font.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<PLAINTEXT cattributes>ctext</PLAINTEXT>
```

237.5.93 PRECLOSE Procedure

This procedure generates the `</PRE>` tag which marks the end of a section of preformatted text in the body of the HTML page.

To mark the beginning of a section of preformatted text in the body of the HTML page, use the [PREOPEN Procedure](#).

Syntax

```
HTP.PRECLOSE;
```

Examples

This procedure generates

```
</PRE>
```

237.5.94 PREOPEN Procedure

This procedure generates the `<PRE>` tag which marks the beginning of a section of preformatted text in the body of the HTML page.

To mark the end of a section of preformatted text in the body of the HTML page, use the [PRECLOSE Procedure](#).

Syntax

```
HTP.PREOPEN (  
    cclear          IN          VARCHAR2  DEFAULT NULL,
```

```

cwidth      IN      VARCHAR2  DEFAULT NULL,
cattributes IN      VARCHAR2  DEFAULT NULL);

```

Parameters

Table 237-68 PREOPEN Procedure Parameters

Parameter	Description
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>cwidth</code>	The value for the <code>WIDTH</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<PRE CLEAR="cclear" WIDTH="cwidth" cattributes>
```

237.5.95 PRINT Procedures

These procedures generate the specified parameter as a string terminated with the `\n` newline character.

The [PRN Procedures](#) performs the same operation but does not terminate with a newline character.

Syntax

```
HTP.PRINT (
  cbuf      IN      VARCHAR2);
```

```
HTP.PRINT (
  dbuf      IN      DATE);
```

```
HTP.PRINT (
  nbuf      IN      NUMBER);
```

Parameters

Table 237-69 PRINT Procedure Parameters

Parameter	Description
<code>cbuf</code>	The string to generate terminated by a newline.
<code>dbuf</code>	The string to generate terminated by a newline.
<code>nbuf</code>	The string to generate terminated by a newline.

Usage Notes

- The `\n` character is not the same as `
`. The `\n` character formats the HTML source but it does not affect how the browser renders the HTML source. Use `
` to control how the browser renders the HTML source.
- These procedures do not have function equivalents.

237.5.96 PRINTS Procedure

This procedure generates a string and replaces certain characters with a corresponding escape sequence.

The following characters are replaced with the corresponding escape sequence.

- < to <
- > to >
- " to "
- & to &

If not replaced, the special characters are interpreted as HTML control characters and produce garbled output. This procedure and the [PS Procedure](#) perform the same operation as the [PRN Procedures](#) but with character substitution.

Syntax

```
HTP.PRINTS (
    ctext      IN      VARCHAR2);
```

Parameters

Table 237-70 PRINTS Procedure Parameters

Parameter	Description
ctext	The string where to perform character substitution.

Usage Notes

This procedure does not have an HTF function equivalent (see [Operational Notes](#) for the HTF implementation).

237.5.97 PRN Procedures

These procedures generate the specified parameter as a string.

Unlike the [PRINT Procedures](#) the string is not terminated with the \n newline character.

Syntax

```
HTP.PRN (
    cbuf      IN      VARCHAR2);
```

```
HTP.PRN (
    dbuf      IN      DATE);
```

```
HTP.PRN (
    nbuf      IN      NUMBER);
```


Parameters

Table 237-71 PRN Procedure Parameters

Parameter	Description
cbuf	The string to generate (not terminated by a newline).
dbuf	The string to generate (not terminated by a newline).
nbuf	The string to generate (not terminated by a newline).

Usage Notes

These procedures do not have function equivalents.

237.5.98 PS Procedure

This procedure generates a string and replaces certain characters with the corresponding escape sequence.

This procedure replaces the following characters with the corresponding escape sequence.

- < to <
- > to >
- " to "
- & to &

If not replaced, the special characters are interpreted as HTML control characters and produce garbled output. This procedure and the [PRINTS Procedure](#) perform the same operation as the [PRN Procedures](#) but with character substitution.

Syntax

```
HTP.PS (
    ctext      IN      VARCHAR2);
```

Parameters

Table 237-72 PS Procedure Parameters

Parameter	Description
ctext	The string where to perform character substitution.

Usage Notes

This procedure does not have an HTF function equivalent (see [Operational Notes](#) for the HTF implementation).

237.5.99 S Procedure

This procedure generates the `<S>` and `</S>` tags which direct the browser to render the text they surround in strikethrough type.

This performs the same operation as [STRIKE Procedure](#).

Syntax

```
HTP.S (
  ctext          IN          VARCHAR2,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-73 S Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to be rendered in strikethrough type.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<S cattributes>ctext</S>
```

237.5.100 SAMPLE Procedure

This procedure generates the `<SAMP>` and `</SAMP>` tags which direct the browser to render the text they surround in monospace font or however "sample" is defined stylistically.

Syntax

```
HTP.SAMPLE (
  ctext          IN          VARCHAR2,
  cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-74 SAMPLE Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to be rendered in monospace font.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<SAMP cattributes>ctext</SAMP>
```

237.5.101 SCRIPT Procedure

This procedure generates the `<SCRIPT>` and `</SCRIPT>` tags which contain a script written in languages such as JavaScript and VBscript.

Syntax

```
HTP.SCRIPT (  
    cscript          IN          VARCHAR2,  
    clanguage        IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-75 SCRIPT Procedure Parameters

Parameter	Description
<code>cscript</code>	The text of the script. This is the text that makes up the script itself, not the name of a file containing the script.
<code>clanguage</code>	The language in which the script is written. If this parameter is omitted, the user's browser determines the scripting language.

Examples

This procedure generates

```
<SCRIPT LANGUAGE=clanguage>cscript</SCRIPT>
```

so that

```
HTP.script ('Erupting_Volcano', 'Javascript');
```

generates

```
<SCRIPT LANGUAGE=Javascript>"script text here"</SCRIPT>
```

This causes the browser to run the script enclosed in the tags.

237.5.102 SMALL Procedure

This procedure generates the `<SMALL>` and `</SMALL>` tags, which direct the browser to render the text they surround using a small font.

Syntax

```
HTP.SMALL (  
    ctext          IN          VARCHAR2,  
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-76 SMALL Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to be rendered in small font.

Table 237-76 (Cont.) SMALL Procedure Parameters

Parameter	Description
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<SMALL cattributes>ctext</SMALL>
```

237.5.103 STRIKE Procedure

This procedure generates the `<STRIKE>` and `</STRIKE>` tags which direct the browser to render the text they surround in strikethrough type.

This performs the same operation as [S Procedure](#).

Syntax

```
HTP.STRIKE (
    ctext          IN          VARCHAR2,
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-77 STRIKE Procedure Parameters**

Parameter	Description
<code>ctext</code>	The text to be rendered in strikethrough type.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<STRIKE cattributes>ctext</STRIKE>
```

237.5.104 STRONG Procedure

This procedure generates the `` and `` tags which direct the browser to render the text they surround in bold, or however "strong" is defined.

Syntax

```
HTP.STRONG (
    ctext          IN          VARCHAR2,
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-78 STRONG Procedure Parameters

Parameter	Description
<code>c_{text}</code>	The text to be emphasized.
<code>c_{attributes}</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<STRONG cattributes>ctext</STRONG>
```

237.5.105 STYLE Procedure

This procedure generates the `<STYLE>` and `</STYLE>` tags which include a style sheet in a Web page.

You can get more information about style sheets at <http://www.w3.org>. This feature is not compatible with browsers that support only HTML versions 2.0 or earlier. Such browsers will ignore this tag.

Syntax

```
HTP.STYLE(  
    cstyle          IN          VARCHAR2);
```

Parameters

Table 237-79 STYLE Procedure Parameters

Parameter	Description
<code>c_{style}</code>	The the style information to include.

Examples

This procedure generates

```
<STYLE>cstyle</STYLE>
```

237.5.106 SUB Procedure

This procedure generates the `_{` and `}` tags which direct the browser to render the text they surround as subscript.

Syntax

```
HTP.SUB(  
    ctext          IN          VARCHAR2,  
    calign         in          VARCHAR2  DEFAULT NULL,  
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-80 SUB Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to render in subscript.
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<SUB ALIGN="calign" cattributes>ctext</SUB>
```

237.5.107 SUP Procedure

This procedure generates the `^{` and `}` tags which direct the browser to render the text they surround as superscript.

Syntax

```
HTP.SUP (
    ctext          IN          VARCHAR2,
    calign         in          VARCHAR2  DEFAULT NULL,
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-81 SUP Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to render in superscript.
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<SUP ALIGN="calign" cattributes>ctext</SUP>
```

237.5.108 TABLECAPTION Procedure

This procedure generates the `<CAPTION>` and `</CAPTION>` tags which place a caption in an HTML table.

Syntax

```
HTP.TABLECAPTION (
    ccaption      IN          VARCHAR2,
```

```

calign      in      VARCHAR2  DEFAULT NULL,
cattributes IN      VARCHAR2  DEFAULT NULL);

```

Parameters

Table 237-82 TABLECAPTION Procedure Parameters

Parameter	Description
ctext	The text for the caption.
calign	The value for the ALIGN attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<CAPTION ALIGN="calign" cattributes>ccaption</CAPTION>
```

237.5.109 TABLECLOSE Procedure

This procedure generates the </TABLE> tag which marks the end of an HTML table.

To define the beginning of an HTML table, use the [TABLEOPEN Procedure](#).

Syntax

```
HTP.TABLECLOSE;
```

Examples

This procedure generates

```
</TABLE>
```

237.5.110 TABLEDATA Procedure

This procedure generates the <TD> and </TD> tags which insert data into a cell of an HTML table.

Syntax

```

HTP.TABLEDATA (
  cvalue      IN      VARCHAR2  DEFAULT NULL,
  calign      IN      VARCHAR2  DEFAULT NULL,
  cdp         IN      VARCHAR2  DEFAULT NULL,
  cnowrap     IN      VARCHAR2  DEFAULT NULL,
  crowspan    IN      VARCHAR2  DEFAULT NULL,
  ccolspan    IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL);

```

Parameters

Table 237-83 TABLEDATA Procedure Parameters

Parameter	Description
<code>cvalue</code>	The data for the cell in the table.
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cdp</code>	The value for the <code>DP</code> attribute.
<code>cnowrap</code>	If the value of this parameter is not <code>NULL</code> , the <code>NOWRAP</code> attribute is added to the tag.
<code>ccolspan</code>	The value for the <code>COLSPAN</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<TD ALIGN="calign" DP="cdp" ROWSPAN="crowspan" COLSPAN="ccolspan" NOWRAP
cattributes>cvalue</TD>
```

237.5.111 TABLEHEADER Procedure

This procedure generates the `<TH>` and `</TH>` tags which insert a header cell in an HTML table.

The `<TH>` tag is similar to the `<TD>` tag except that the text in this case the rows are usually rendered in bold type.

Syntax

```
HTP.TABLEHEADER (
  cvalue      IN          VARCHAR2  DEFAULT NULL,
  calign      IN          VARCHAR2  DEFAULT NULL,
  cdp         IN          VARCHAR2  DEFAULT NULL,
  cnowrap     IN          VARCHAR2  DEFAULT NULL,
  crowspan    IN          VARCHAR2  DEFAULT NULL,
  ccolspan    IN          VARCHAR2  DEFAULT NULL,
  cattributes IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-84 TABLEHEADER Procedure Parameters

Parameter	Description
<code>cvalue</code>	The data for the cell in the table.
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cdp</code>	The value for the <code>DP</code> attribute.
<code>cnowrap</code>	If the value of this parameter is not <code>NULL</code> , the <code>NOWRAP</code> attribute is added to the tag.
<code>crispen</code>	The value for the <code>ROWSPAN</code> attribute.

Table 237-84 (Cont.) TABLEHEADER Procedure Parameters

Parameter	Description
<code>c colspan</code>	The value for the <code>COLSPAN</code> attribute.
<code>c attributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<TH ALIGN="calign" DP="cdp" ROWSPAN="crowspan" COLSPAN="ccolspan" NOWRAP
cattributes>cvalue</TH>
```

237.5.112 TABLEOPEN Procedure

This procedure generates the `<TABLE>` tag which marks the beginning of an HTML table.

To define the end of an HTML table, use the [TABLECLOSE Procedure](#).

Syntax

```
HTP.TABLEOPEN (
  cborder          IN          VARCHAR2          DEFAULT NULL
  calign           IN          VARCHAR2          DEFAULT NULL,
  cnowrap         IN          VARCHAR2          DEFAULT NULL,
  cclear          IN          VARCHAR2          DEFAULT NULL
  cattributes     IN          VARCHAR2          DEFAULT NULL);
```

Parameters**Table 237-85 TABLEOPEN Procedure Parameters**

Parameter	Description
<code>border</code>	The value for the <code>BORDER</code> attribute.
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cnowrap</code>	If the value of this parameter is not <code>NULL</code> , the <code>NOWRAP</code> attribute is added to the tag.
<code>cclear</code>	The value for the <code>CLEAR</code> attribute.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<TABLE "cborder" NOWRAP ALIGN="calign" CLEAR="cclear" cattributes>
```

237.5.113 TABLEROWCLOSE Procedure

This procedure generates the `</TR>` tag which marks the end of a new row in an HTML table.

To mark the beginning of a new row, use the [TABLEROWOPEN Procedure](#).

Syntax

```
HTP.TABLEROWCLOSE;
```

Examples

This procedure generates

```
</TABLE>
```

237.5.114 TABLEROWOPEN Procedure

This procedure generates the `<TR>` tag which marks the beginning of a new row in an HTML table.

To mark the end of a new row, use the [TABLEROWCLOSE Procedure](#).

Syntax

```
HTP.TABLEROWOPEN (
  calign          IN          VARCHAR2  DEFAULT NULL,
  cvalign         IN          VARCHAR2  DEFAULT NULL,
  cdp             IN          VARCHAR2  DEFAULT NULL,
  cnowrap         IN          VARCHAR2  DEFAULT NULL,
  cattributes     IN          VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-86 TABLEROWOPEN Procedure Parameters**

Parameter	Description
<code>calign</code>	The value for the <code>ALIGN</code> attribute.
<code>cvalign</code>	The value for the <code>VALIGN</code> attribute.
<code>cdp</code>	The value for the <code>DP</code> attribute.
<code>cnowrap</code>	If the value of this parameter is not <code>NULL</code> , the <code>NOWRAP</code> attribute is added to the tag.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<<TR ALIGN="calign" VALIGN="cvalign" DP="cdp" NOWRAP cattributes>
```

237.5.115 TELETYPE Procedure

This procedure generates the `<TT>` and `</TT>` tags which direct the browser to render the text they surround in a fixed width typewriter font, for example, the courier font.

Syntax

```
HTP.TELETYPE (
  ctext          IN          VARCHAR2,
  cattributes     IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-87 TELETYPE Procedure Parameters

Parameter	Description
<code>ctext</code>	The text to render in a fixed width typewriter font.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<TT cattributes>ctext</TT>
```

237.5.116 TITLE Procedure

This procedure generates the `<TITLE>` and `</TITLE>` tags which specify the text to display in the titlebar of the browser window.

Syntax

```
HTP.TITLE(  
    ctitle          IN          VARCHAR2);
```

Parameters

Table 237-88 TITLE Procedure Parameters

Parameter	Description
<code>ctitle</code>	The text to display in the titlebar of the browser window.

Examples

This procedure generates

```
<TITLE>ctitle</TITLE>
```

237.5.117 ULISTCLOSE Procedure

This procedure generates the `` tag which marks the end of an unordered list. An unordered list presents items with bullets.

To mark the beginning of an unordered list, use the [ULISTOPEN Procedure](#). Add list items with [LISTITEM Procedure](#).

Syntax

```
HTP.ULISTCLOSE;
```

Examples

This procedure generates

```
</TABLE>
```

237.5.118 ULISTOPEN Procedure

This procedure generates the tag which marks the beginning of an unordered list. An unordered list presents items with bullets.

To mark the end of an unordered list, use the [ULISTCLOSE Procedure](#). Add list items with [LISTITEM Procedure](#).

Syntax

```
HTP.ULISTOPEN (
  cclear      IN      VARCHAR2  DEFAULT NULL,
  cwrap       IN      VARCHAR2  DEFAULT NULL,
  cdingbat    IN      VARCHAR2  DEFAULT NULL,
  csrc        IN      VARCHAR2  DEFAULT NULL,
  cattributes IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-89 ULISTOPEN Procedure Parameters

Parameter	Description
cclear	The value for the CLEAR attribute.
cwrap	The value for the WRAP attribute.
cdingbat	The value for the DINGBAT attribute.
csrc	The value for the SRC attribute.
cattributes	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<UL CLEAR="cclear" WRAP="cwrap" DINGBAT="cdingbat" SRC="csrc" cattributes>
```

237.5.119 UNDERLINE Procedure

This procedure generates the <U> and </U> tags, which direct the browser to render the text they surround with an underline.

Syntax

```
HTP.UNDERLINE (
  ctext      IN      VARCHAR2,
  cattributes IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 237-90 UNDERLINE Procedure Parameters

Parameter	Description
ctext	The text to render with an underline.

Table 237-90 (Cont.) UNDERLINE Procedure Parameters

Parameter	Description
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<U cattributes>ctext</U>
```

237.5.120 VARIABLE Procedure

This procedure generates the `<VAR>` and `</VAR>` tags which direct the browser to render the text they surround in italics or however "variable" is defined stylistically.

Syntax

```
HTP.VARIABLE (
    ctext          IN          VARCHAR2,
    cattributes    IN          VARCHAR2  DEFAULT NULL);
```

Parameters**Table 237-91 VARIABLE Procedure Parameters**

Parameter	Description
<code>ctext</code>	The text to render in italics.
<code>cattributes</code>	The other attributes to be included as-is in the tag.

Examples

This procedure generates

```
<VAR cattributes>ctext</VAR>
```

237.5.121 WBR Procedure

This procedure generates the `<WBR>` tag, which inserts a soft line break within a section of NOBR text.

Syntax

```
HTP.WBR;
```

Examples

This procedure generates

```
<WBR>
```

OWA_CACHE

The `OWA_CACHE` package provides an interface that enables the PL/SQL Gateway cache to improve the performance of PL/SQL Web applications.

See Also:

For more information about implementation of this package:

- [Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server](#)
- [Oracle Fusion Middleware User's Guide for mod_plsql](#)

The chapter contains the following topics:

- [Constants](#)
- [Summary of OWA_CACHE Subprograms](#)

238.1 OWA_CACHE Constants

`OWA_CACHE` defines several constants to use when specifying parameter values.

- `system_level` CONSTANT VARCHAR(6) := 'SYSTEM';
- `user_level` CONSTANT VARCHAR(4) := 'USER';

238.2 Summary of OWA_CACHE Subprograms

This table lists the `OWA_CACHE` subprograms and briefly describes them.

Table 238-1 OWA_CACHE Package Subprograms

Subprogram	Description
DISABLE Procedure	Disables the cache for this particular request
GET_ETAG Function	Returns the tag associated with the cached content (used in the Validation technique model only)
GET_LEVEL Function	Returns the caching level (used in the Validation technique model only)
SET_CACHE Procedure	Sets up the cache headers for validation model cache type
SET_EXPIRES Procedure	Sets up the cache headers for expires model cache type
SET_NOT_MODIFIED Procedure	Sets up the headers for a not modified cache hit (used in the Validation technique model only)
SET_SURROGATE_CONTROL Procedure	Sets up the headers for a surrogate-control header for Web cache

238.2.1 DISABLE Procedure

This procedure disables the cache for this particular request.

Syntax

```
OWA_CACHE.DISABLE;
```

238.2.2 GET_ETAG Function

This function returns the tag associated with the cached content. It is used in the Validation technique only.

Syntax

```
OWA_CACHE.GET_ETAG  
RETURN VARCHAR2;
```

Return Values

The tag for cache hit, otherwise NULL.

238.2.3 GET_LEVEL Function

This returns the caching level. It is used in the Validation technique model only.

Syntax

```
OWA_CACHE.GET_LEVEL  
RETURN VARCHAR2;
```

Return Values

The caching level string ('USER' or 'SYSTEM') for cache hit, otherwise NULL.

238.2.4 SET_CACHE Procedure

This procedure sets up the cache headers for validation model cache type.

Syntax

```
OWA_CACHE.SET_CACHE(  
  p_etag      IN      VARCHAR2,  
  p_level     IN      VARCHAR2);
```

Parameters

Table 238-2 *SET_CACHE Procedure Parameters*

Parameter	Description
p_etag	The etag associated with this content
p_level	The caching level ('USER' or 'SYSTEM').

Exceptions

VALUE_ERROR is thrown if

- p_etag is greater than 55
- p_level is not 'USER' or 'SYSTEM'

238.2.5 SET_EXPIRES Procedure

This procedure sets up the cache headers for expires model cache type.

Syntax

```
OWA_CACHE.SET_EXPIRES(  
    p_expires    IN      NUMBER,  
    p_level      IN      VARCHAR2);
```

Parameters

Table 238-3 SET_EXPIRES Procedure Parameters

Parameter	Description
p_expires	The number of minutes this content is valid.
p_level	The caching level ('USER' or 'SYSTEM').

Exceptions

VALUE_ERROR is thrown if

- p_expires is negative or zero
- p_level is not 'USER' or 'SYSTEM'
- p_expires is > 525600 (1 year)

238.2.6 SET_NOT_MODIFIED Procedure

This procedure sets up the headers for a not-modified cache hit. It is used in the Validation technique only.

Syntax

```
OWA_CACHE.SET_NOT_MODIFIED;
```

Exceptions

VALUE_ERROR is thrown if the etag was not passed in

238.2.7 SET_SURROGATE_CONTROL Procedure

This procedure sets the headers for a surrogate-control header for Web cache

Syntax

```
OWA_CACHE.SET_SURROGATE_CONTROL(  
    p_value      IN      VARCHAR2);
```

Parameters

Table 238-4 SET_SURROGATE_CONTROL Procedure Parameters

Parameter	Description
p_value	The value to be passed as the Surrogate-Control header.

Exceptions

VALUE_ERROR is thrown if p_value is greater than 55 in length.

OWA_COOKIE

The OWA_COOKIE package provides an interface for sending and retrieving HTTP cookies from the client's browser.



See Also:

For more information about implementation of this package:

- [Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server](#)
- [Oracle Fusion Middleware User's Guide for mod_plsql](#)

The chapter contains the following topics:

- [Overview](#)
- [Types](#)
- [Rules and Limits](#)
- [Summary of OWA_COOKIE Subprograms](#)

239.1 OWA_CUSTOM Overview

Cookies are opaque strings sent to the browser to maintain state between HTTP calls. State can be maintained throughout the client's sessions, or longer if an expiration date is included. The system date is calculated with reference to the information specified in the OWA_CUSTOM package.

239.2 OWA_COOKIE Types

This datatype contains cookie name-value pairs.

Since the HTTP standard allows cookie names to be overloaded (that is, multiple values can be associated with the same cookie name), there is a PL/SQL RECORD holding all values associated with a given cookie name.

```
TYPE vc_arr IS TABLE OF VARCHAR2(4000) INDEX BY BINARY_INTEGER.
```

```
TYPE COOKIE IS RECORD (
  name      VARCHAR2(4000),
  vals      vc_arr,
  num_vals  INTEGER);
```

239.3 OWA_COOKIE Rules and Limits

All HTTP headers must be in English and the ASCII character set. If the headers are generated from the database, verify they are created in the English language.

239.4 Summary of OWA_COOKIE Subprograms

This table lists the OWA_COOKIE subprograms and briefly describes them.

Table 239-1 OWA_COOKIE Package Subprograms

Subprogram	Description
GET Function	Gets the value of the specified cookie
GET_ALL Procedure	Gets all cookie name-value pairs
REMOVE Procedure	Removes the specified cookie
SEND procedure	Generates a "Set-Cookie" line in the HTTP header

239.4.1 GET Function

This function returns the values associated with the specified cookie. The values are returned in a OWA_COOKIE.COOKIE DATA TYPE .

Syntax

```
OWA_COOKIE.GET(  
    name          IN          VARCHAR2)  
    RETURN COOKIE;
```

Parameters

Table 239-2 GET Function Parameters

Parameter	Description
name	The name of the cookie.

Return Values

OWA_COOKIE.COOKIE DATA TYPE.

239.4.2 GET_ALL Procedure

This procedure returns all cookie names and their values from the client's browser. The values appear in the order in which they were sent from the browser.

Syntax

```
OWA_COOKIE.GET_ALL(  
    names      OUT          vc_arr,  
    vals       OUT          vc_arr,  
    num_vals   OUT          INTEGER);
```

Parameters

Table 239-3 GET_ALL Procedure Parameters

Parameter	Description
names	The names of the cookies.
vals	The values of the cookies.
num_vals	The number of cookie-value pairs.

239.4.3 REMOVE Procedure

This procedure forces a cookie to expire immediately by setting the "expires" field of a Set-Cookie line in the HTTP header to "01-Jan-1990".

This procedure must be called within the context of an HTTP header.

Syntax

```
OWA_COOKIE.REMOVE (
  name          IN          VARCHAR2,
  val           IN          VARCHAR2,
  path          IN          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 239-4 REMOVE Procedure Parameters

Parameter	Description
name	The name of the cookie to expire.
val	The value of the cookie.
path	[Currently unused]

239.4.4 SEND procedure

This procedure generates a Set-Cookie line, which transmits a cookie to the client.

This procedure must occur in the context of an HTTP header.

Syntax

```
OWA_COOKIE.SEND (
  name          in          varchar2,
  value         in          varchar2,
  expires       in          date      DEFAULT NULL,
  path          in          varchar2  DEFAULT NULL,
  domain        in          varchar2  DEFAULT NULL,
  secure        in          varchar2  DEFAULT NULL);
```

Parameters

Table 239-5 SEND Procedure Parameters

Parameter	Description
name	The name of the cookie.
value	The value of the cookie.
expires	The date at which the cookie will expire
path	The value for the path field.
domain	The value for the domain field.
secure	If the value of this parameter is not NULL, the "secure" field is added to the line.

OWA_CUSTOM

The `OWA_CUSTOM` package provides a Global PLSQL Agent Authorization callback function.

It is used when PLSQL Agent's authorization scheme is set to `GLOBAL` or `CUSTOM` when there is no overriding `OWA_CUSTOM` package.

See Also:

For more information about implementation of this package:

- [Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server](#)
- [Oracle Fusion Middleware User's Guide for `mod_plsql`](#)

The chapter contains the following topics:

- [Constants](#)
- [Summary of `OWA_CUSTOM` Subprograms](#)

240.1 `OWA_CUSTOM` Constants

`OWA_CUSTOM` defines several constants to use when specifying parameter values.

- `dbms_server_timezone` CONSTANT VARCHAR2(3) := 'PST';
- `dbms_server_gmtdiff` CONSTANT NUMBER := NULL;

240.2 Summary of `OWA_CUSTOM` Subprograms

The `AUTHORIZE` function is the only subprogram in the `OWA_CUSTOM` package.

Table 240-1 *`OWA_CUSTOM` Package Subprograms*

Subprogram	Description
AUTHORIZE Function	Provides a Global PLSQL Agent Authorization callback function

240.2.1 `AUTHORIZE` Function

This function is used when PLSQL Agent's authorization scheme is set to `GLOBAL` or `CUSTOM` when there is no overriding `OWA_CUSTOM` package.

Syntax

```
OWA_CUSTOM.AUTHORIZE
RETURN BOOLEAN;
```

OWA_IMAGE

The `OWA_IMAGE` package provides an interface to access the coordinates where a user clicked on an image.

The chapter contains the following topics:

- [Overview](#)
- [Types](#)
- [Variables](#)
- [Examples](#)
- [Summary of OWA_IMAGE Subprograms](#)



See Also:

For more information about implementation of this package:

- [Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server](#)
- [Oracle Fusion Middleware User's Guide for mod_plsql](#)

241.1 OWA_IMAGE Overview

Use this package when you have any image map whose destination links invoke the PL/SQL Gateway.

241.2 OWA_IMAGE Types

This datatype (`point`) contain the X and Y values of a coordinate, and so provides the coordinates of a user's click on an imagemap.

It is defined as:

```
TYPE POINT IS TABLE OF VARCHAR2(32767) INDEX BY BINARY_INTEGER
```

241.3 OWA_IMAGE Variables

This package variable (`null_point`) of `TYPE POINT` is used to default point parameters. Both the X and the Y fields of this variable are `NULL`.

241.4 OWA_IMAGE Examples

This example shows use of OWA_IMAGE.

```
CREATE OR REPLACE PROCEDURE process_image
  (my_img in OWA_IMAGE.POINT)
  AS
  x integer := OWA_IMAGE.GET_X(my_img);
  y integer := OWA_IMAGE.GET_Y(my_img);
BEGIN
  /* process the coordinate */
END
```

241.5 Summary of OWA_IMAGE Subprograms

This table lists the OWA_IMAGE subprograms and briefly describes them.

Table 241-1 OWA_IMAGE Package Subprograms

Subprogram	Description
GET_X Function	Gets the X value of a point type
GET_Y Function	Gets the Y value of a point type

241.5.1 GET_X Function

This function returns the X coordinate of the point where the user clicked on an image map.

Syntax

```
OWA_IMAGE.GET_X(
  p          IN          point)
RETURN INTEGER;

OWA_IMAGE.GET_X(
  p          IN          point)
RETURN INTEGER PARALLEL_ENABLE DETERMINISTIC;
```

Parameters

Table 241-2 GET_X Function Parameters

Parameter	Description
p	The point where the user clicked.

Return Values

The X coordinate as an integer.

241.5.2 GET_Y Function

This function returns the Y coordinate of the point where the user clicked on an image map.

Syntax

```
OWA_IMAGE.GET_Y(  
  p          IN          point)  
  RETURN INTEGER;  
  
OWA_IMAGE.GET_Y(  
  p          IN          point)  
  RETURN INTEGER PARALLEL_ENABLE DETERMINISTIC;
```

Parameters

Table 241-3 GET_Y Function Parameters

Parameter	Description
p	The point where the user clicked.

Return Values

The Y coordinate as an integer.

OWA_OPT_LOCK

The `OWA_OPT_LOCK` package contains subprograms that impose optimistic locking strategies so as to prevent lost updates.

This chapter contains the following topics:

- [Overview](#)
- [Types](#)
- [Summary of OWA_OPT_LOCK Subprograms](#)



See Also:

For more information about implementation of this package:

- [Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server](#)
- [Oracle Fusion Middleware User's Guide for mod_plsql](#)

242.1 OWA_OPT_LOCK Overview

The `OWA_OPT_LOCK` package contains subprograms that impose optimistic locking strategies, so as to prevent lost updates.

It checks if the row that the user is interested in updating has been changed by someone else in the meantime.

The PL/SQL Gateway cannot use conventional database locking schemes because HTTP is a stateless protocol. The `OWA_OPT_LOCK` package gives you two ways of dealing with the lost update problem:

- The hidden fields method stores the previous values in hidden fields in the HTML page. When the user requests an update, the PL/SQL Gateway checks these values against the current state of the database. The update operation is performed only if the values match. To use this method, call the `owa_opt_lock.store_values` procedure.
- The checksum method stores a checksum rather than the values themselves. To use this method, call the `owa_opt_lock.checksum` function.

These methods are optimistic. They do not prevent other users from performing updates, but they do reject the current update if an intervening update has occurred.

242.2 OWA_TEXT Types

This datatype is a PL/SQL table intended to hold ROWIDs.

```
TYPE VCARRAY IS TABLE OF VARCHAR2(2000) INDEX BY BINARY_INTEGER
```

Note that this is different from the `OWA_TEXT.VC_ARR` DATA TYPE.

242.3 Summary of OWA_OPT_LOCK Subprograms

This table lists the `OWA_OPT_LOCK` subprograms and briefly describes them.

Table 242-1 OWA_OPT_LOCK Package Subprograms

Subprogram	Description
CHECKSUM Functions	Returns the checksum value
GET_ROWID Function	Returns the ROWID value
STORE_VALUES Procedure	Stores unmodified values in hidden fields for later verification
VERIFY_VALUES Function	Verifies the stored values against modified values

242.3.1 CHECKSUM Functions

This function returns a `checksum` value for a specified string, or for a row in a table. For a row in a table, the function calculates the `checksum` value based on the values of the columns in the row. This function comes in two versions.

The first version returns a `checksum` based on the specified string. This is a "pure" 32-bit `checksum` executed by the database and based on the Internet 1 protocol.

The second version returns a `checksum` based on the values of a row in a table. This is a "impure" 32-bit `checksum` based on the Internet 1 protocol.

Syntax

```
OWA_OPT_LOCK.CHECKSUM(
  p_buff      IN      VARCHAR2)
RETURN NUMBER;
```

```
OWA_OPT_LOCK.CHECKSUM(
  p_buff      IN      VARCHAR2)
RETURN NUMBER PARALLEL_ENABLE DETERMINISTIC;
```

```
OWA_OPT_LOCK.CHECKSUM(
  p_owner     IN      VARCHAR2,
  p_tname     IN      VARCHAR2,
  p_rowid     IN      ROWID)
RETURN NUMBER;
```

Parameters

Table 242-2 CHECKSUM Function Parameters

Parameter	Description
<code>p_buff</code>	The nstring where you want to calculate the <code>checksum</code> .
<code>p_owner</code>	The owner of the table.
<code>p_tname</code>	The table name.

Table 242-2 (Cont.) CHECKSUM Function Parameters

Parameter	Description
p_rowid	The row in p_tname where you want to calculate the checksum value. Use the GET_ROWID Function to convert VCARRAY values to proper rowids.

242.3.2 GET_ROWID Function

This function returns the ROWID datatype from the specified OWA_OPT_LOCK.VCARRAY DATA TYPE.

Syntax

```
OWA_OPT_LOCK.GET_ROWID(
  p_old_values      IN      vccarray)
RETURN ROWID;
```

```
OWA_OPT_LOCK.GET_ROWID(
  p_old_values      IN      vccarray)
RETURN ROWID PARALLEL_ENABLE DETERMINISTIC;
```

Parameters

Table 242-3 GET_ROWID Function Parameters

Parameter	Description
p_old_values	This parameter is usually passed in from an HTML form.

242.3.3 STORE_VALUES Procedure

This procedure stores the column values of the row that you want to update later. The values are stored in hidden HTML form elements.

Syntax

```
OWA_OPT_LOCK.STORE_VALUES (
  p_owner          IN      VARCHAR2,
  p_tname          IN      VARCHAR2,
  p_rowid          IN      ROWID);
```

Parameters

Table 242-4 STORE_VALUES Procedure Parameters

Parameter	Description
p_owner	The owner of the table.
p_tname	The name of the table.
p_rowid	The row where you want to store values.

Usage Notes

Before updating the row, compare these values with the current row values to ensure that the values in the row have not been changed. If the values have changed, you can warn the users and let them decide if the update should take place.

The procedure generates series of hidden form elements:

- One hidden form element is created for the table owner. The name of the element is "old_p_tname", where p_tname is the name of the table. The value of the element is the owner name.
- One hidden form element is created for the table name. The name of the element is "old_p_tname", where p_tname is the name of the table. The value of the element is the table name.
- One element is created for each column in the row. The name of the element is "old_p_tname", where p_tname is the name of the table. The value of the element is the column value.

See also the [VERIFY_VALUES Function](#).

242.3.4 VERIFY_VALUES Function

This function verifies whether values in the specified row have been updated since the last query.

Use this function with the [STORE_VALUES Procedure](#).

Syntax

```
OWA_OPT_LOCK.VERIFY_VALUES(  
    p_old_values IN varray)  
RETURN BOOLEAN;
```

Parameters

Table 242-5 VERIFY_VALUES Function Parameters

Parameter	Description
p_old_values	<p>A PL/SQL table containing the following information:</p> <ul style="list-style-type: none"> • p_old_values(1) specifies the owner of the table. • p_old_values(2) specifies the table. • p_old_values(3) specifies the rowid of the row to verify. <p>The remaining indexes contain values for the columns in the table.</p> <p>Typically, this parameter is passed in from the HTML form, where you have previously called the STORE_VALUES Procedure to store the row values on hidden form elements.</p>

Return Values

TRUE if no other update has been performed, otherwise FALSE.

OWA_PATTERN

The OWA_PATTERN package provides an interface to locate text patterns within strings and replace the matched string with another string.



See Also:

For more information about implementation of this package, see the following:

- [Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server](#)
- [Oracle Fusion Middleware User's Guide for mod_plsql](#)

The chapter contains the following topics:

- [Types](#)
- [Operational Notes](#)
- [Summary of OWA_PATTERN Subprograms](#)

243.1 OWA_PATTERN Types

You can use a pattern as both an input and output parameter. Because of this, you can pass the same regular expression to OWA_PATTERN function calls, and it only has to be parsed once.

- `OWA_PATTERN.PATTERN`

243.2 OWA_PATTERN Operational Notes

The OWA_PATTERN subprograms are overloaded. Specifically, there are six versions of `MATCH`, and four each of `AMATCH` and `CHANGE`.

The subprograms use the following parameters:

- `line` - This is the target to be examined for a match. It can be more than one line of text or a `owa_text.multi_line` datatype.
- `pat` - This is the pattern that the subprograms attempt to locate in line. The pattern can contain regular expressions. In the `owa_pattern.change` function and procedure, this parameter is called `from_str`.
- `flags` - This specifies whether the search is case-sensitive or if substitutions are done globally.

Use regular expressions with the subprograms in this package. You Specify a regular expression by creating the string you want to match interspersed with various wildcard tokens and quantifiers.

- [Wildcards](#)

- [Quantifiers](#)
- [Flags](#)

243.2.1 OWA_PATTERN Wildcards

Wildcard tokens match something other than themselves.

Table 243-1 *Wildcard tokens recognized by OWA_PATTERN package*

Token	Description
<code>^</code>	Matches newline or the beginning of the target
<code>\$</code>	Matches newline or the end of the target
<code>\n</code>	Matches newline
<code>.</code>	Matches any character except newline
<code>\t</code>	Matches tab
<code>\d</code>	Matches digits [0-9]
<code>\D</code>	Matches non-digits [not 0-9]
<code>\w</code>	Matches word characters (0-9, a-z, A-Z, or <code>_</code>)
<code>\W</code>	Matches non-word characters (not 0-9, a-z, A-Z, or <code>_</code>)
<code>\s</code>	Matches whitespace characters (blank, tab, or newline).
<code>\S</code>	Matches non-whitespace characters (not blank, tab, or newline)
<code>\b</code>	Matches "word" boundaries (between <code>\w</code> and <code>\W</code>)
<code>\x<HEX></code>	Matches the value in the current character set of the two hexadecimal digits
<code>\<OCT></code>	Matches the value in the current character set of the two or three octal digits
<code>\</code>	Followed by any character not covered by another case matches that character
<code>&</code>	Applies only to <code>CHANGE</code> . This causes the string that matched the regular expression to be included in the string that replaces it. This differs from the other tokens in that it specifies how a target is changed rather than how it is matched. This is explained further under CHANGE Functions and Procedures .

243.2.2 OWA_PATTERN Quantifiers

Any tokens except `&` can have their meaning extended by any of the following quantifiers. You can also apply these quantifiers to literals.

Table 243-2 **Quantifiers**

Quantifier	Description
<code>?</code>	0 or 1 occurrence(s)
<code>*</code>	0 or more occurrences
<code>+</code>	1 or more occurrence(s)
<code>{n}</code>	Exactly <i>n</i> occurrences
<code>{n,}</code>	At least <i>n</i> occurrences

Table 243-2 (Cont.) Quantifiers

Quantifier	Description
{ <i>n</i> , <i>m</i> }	At least <i>n</i> , but not more than <i>m</i> , occurrences

243.2.3 OWA_PATTERN Flags

In addition to targets and regular expressions, the OWA_PATTERN functions and procedures use flags to affect how they are interpreted.

Table 243-3 Flags

Flag	Description
i	This indicates a case-insensitive search.
g	This applies only to CHANGE. It indicates a global replace. That is, all portions of the target that match the regular expression are replaced.

243.3 Summary of OWA_PATTERN Subprograms

This table lists the OWA_PATTERN subprograms and briefly describes them.

Table 243-4 OWA_PATTERN Package Subprograms

Subprogram	Description
AMATCH Function	Determines if a string contains the specified pattern. It lets you specify where in the string the match has to occur
CHANGE Functions and Procedures	Replaces a pattern within a string. If you call it as a function it returns the number of times the regular expression was found and replaced
GETPAT Procedure	Generates a pattern datatype from a VARCHAR2 type
MATCH Function	Determines if a string contains the specified pattern

243.3.1 AMATCH Function

This function specifies if a pattern occurs in a particular location in a string.

There are four versions to this function:

- The first and second versions of the function do not save the matched tokens (these are saved in the `backrefs` parameters in the third and fourth versions). The difference between the first and second versions is the `pat` parameter, which can be a VARCHAR2 or a pattern datatype.
- The third and fourth versions of the function save the matched tokens in the `backrefs` parameter. The difference between the third and fourth versions is the `pat` parameter, which can be a VARCHAR2 or a pattern datatype.

 **Note:**

If multiple overlapping strings match the regular expression, this function takes the longest match.

Syntax

```
OWA_PATTERN.AMATCH (
  line          IN          VARCHAR2,
  from_loc      IN          INTEGER,
  pat           IN          VARCHAR2,
  flags         IN          VARCHAR2  DEFAULT NULL)
RETURN INTEGER;
```

```
OWA_PATTERN.AMATCH (
  line          IN          VARCHAR2,
  from_loc      IN          INTEGER,
  pat           IN OUT     PATTERN,
  flags         IN          VARCHAR2  DEFAULT NULL)
RETURN INTEGER;
```

```
OWA_PATTERN.AMATCH (
  line          IN          VARCHAR2
  from_loc      IN          INTEGER
  pat           in          varchar2
  backrefs      OUT         owa_text.vc_arr
  flags         IN          VARCHAR2  DEFAULT NULL)
RETURN INTEGER;
```

```
OWA_PATTERN.AMATCH (
  line          IN          VARCHAR2
  from_loc      IN          INTEGER
  pat           IN OUT     PATTERN
  backrefs      OUT         owa_text.vc_arr
  flags         IN          VARCHAR2  DEFAULT NULL)
RETURN INTEGER;
```

Parameters

Table 243-5 AMATCH Function Parameters

Parameter	Description
line	The text to search in.
from_loc	The location (in number of characters) in line where the search is to begin.
pat	The string to match. It can contain regular expressions. This can be either a VARCHAR2 or a pattern. If it is a pattern, the output value of this parameter is the pattern matched.
backrefs	The text that is matched. Each token that is matched is placed in a cell in the OWA_TEXT.VC_ARR DATA TYPE PL/SQL table.
flags	Whether or not the search is case-sensitive. If the value of this parameter is "i", the search is case-insensitive. Otherwise the search is case-sensitive.

Return Values

The index of the character after the end of the match, counting from the beginning of `line`. If there was no match, the function returns 0.

243.3.2 CHANGE Functions and Procedures

This function or procedure searches and replaces a string or `multi_line` datatype. If multiple overlapping strings match the regular expression, this subprogram takes the longest match.

Syntax

```
OWA_PATTERN.CHANGE (
    line           IN OUT  VARCHAR2,
    from_str       IN      VARCHAR2,
    to_str         IN      VARCHAR2,
    flags          IN      VARCHAR2  DEFAULT NULL)
RETURN INTEGER;
```

```
OWA_PATTERN.CHANGE (
    line           IN OUT  VARCHAR2,
    from_str       IN      VARCHAR2,
    to_str         IN      VARCHAR2,
    flags          IN      VARCHAR2  DEFAULT NULL);
```

```
owa_pattern.change(
    mline         IN OUT  owa_text.multi_line,
    from_str      IN      VARCHAR2,
    to_str        IN      VARCHAR2,
    flags         IN      VARCHAR2  DEFAULT NULL)
RETURN INTEGER;
```

```
OWA_PATTERN.CHANGE (
    mline         IN OUT  owa_text.multi_line,
    from_str      IN      VARCHAR2,
    to_str        IN      VARCHAR2,
    flags         IN      VARCHAR2  DEFAULT NULL);
```

Parameters

Table 243-6 CHANGE Procedure Parameters

Parameter	Description
<code>line</code>	The text to search in. The output value of this parameter is the altered string.
<code>mline</code>	The text to search in. This is a <code>owa_text.multi_line</code> datatype. The output value of this parameter is the altered string.
<code>from_str</code>	The regular expression to replace.
<code>to_str</code>	The substitution pattern.
<code>flags</code>	Whether or not the search is case-sensitive, and whether or not changes are to be made globally. If "i" is specified, the search is case-insensitive. If "g" is specified, changes are made to all matches. Otherwise, the function stops after the first substitution is made.

Return Values

As a function, it returns the number of substitutions made. If the flag "g" is not used, this number can only be 0 or 1 and only the first match is replaced. The flag "g" specifies to replace all matches with the regular expression.

Examples

```
OWA_PATTERN.CHANGE('Cats in pajamas', 'C.+in', '& red ')
```

The regular expression matches the substring "Cats in". It then replaces this string with "& red". The ampersand character "&" indicates "Cats in" because that is what matched the regular expression. Thus, this procedure replaces the string "Cats in pajamas" with "Cats in red" If you call this as a function instead of a procedure, the value returned is 1, indicating that a single substitution has been made.

Example 2:

```
CREATE OR REPLACE PROCEDURE test_pattern as theline VARCHAR2(256);
num_found      INTEGER;
BEGIN
    theline := 'what is the goal?';
    num_found := OWA_PATTERN.CHANGE(theline, 'goal', 'idea', 'g');
    HTP.PRINT(num_found); -- num_found is 1
    HTP.PRINT(theline); -- theline is 'what is the idea?'
END;
/
SHOW ERRORS
```

243.3.3 GETPAT Procedure

This procedure converts a VARCHAR2 string into an OWA_PATTERN.PATTERN DATA TYPE.

Syntax

```
OWA_PATTERN.GETPAT(
    arg      IN      VARCHAR2,
    pat      IN OUT  pattern);
```

Parameters

Table 243-7 GETPAT Procedure Parameters

Parameter	Description
arg	The string to convert.
pat	the OWA_PATTERN.PATTERN DATA TYPE initialized with arg.

243.3.4 MATCH Function

This function determines if a string contains the specified pattern. The pattern can contain regular expressions. If multiple overlapping strings can match the regular expression, this function takes the longest match.

Syntax

```
owa_pattern.match(
  line      IN      VARCHAR2,
  pat       IN      VARCHAR2,
  flags     IN      VARCHAR2  DEFAULT NULL)
RETURN BOOLEAN;
```

```
owa_pattern.match(
  line      IN      VARCHAR2,
  pat       IN OUT  PATTERN,
  flags     IN      VARCHAR2  DEFAULT NULL)
RETURN BOOLEAN;
```

```
owa_pattern.match(
  line      IN      VARCHAR2,
  pat       IN      VARCHAR2,
  backrefs  OUT     owa_text.vc_arr,
  flags     IN      VARCHAR2  DEFAULT NULL)
RETURN BOOLEAN;
```

```
OWA_PATTERN.MATCH(
  line      IN      VARCHAR2,
  pat       IN OUT  PATTERN,
  backrefs  OUT     owa_text.vc_arr,
  flags     IN      VARCHAR2  DEFAULT NULL)
RETURN BOOLEAN;
```

```
owa_pattern.match(
  mline     IN      owa_text.multi_line,
  pat       IN      VARCHAR2,
  rlist     OUT     owa_text.row_list,
  flags     IN      VARCHAR2  DEFAULT NULL)
RETURN BOOLEAN;
```

```
OWA_PATTERN.MATCH(
  mline     IN      owa_text.multi_line,
  pat       IN OUT  pattern,
  rlist     OUT     owa_text.row_list,
  flags     IN      VARCHAR2  DEFAULT NULL)
RETURN BOOLEAN;
```

Parameters

Table 243-8 MATCH Function Parameters

Parameter	Description
line	The line to search in.
mline	The text to search in. This is a <code>owa_text.multi_line</code> datatype..

Table 243-8 (Cont.) MATCH Function Parameters

Parameter	Description
pat	The pattern to match. This is either a VARCHAR2 or a OWA_PATTERN.PATTERN DATA TYPE. It is a pattern, the output value of this parameter is the pattern matched.
backrefs	The text that is matched. Each token that is matched is placed in a cell in the OWA_TEXT.VC_ARR DATA TYPE PL/SQL table. This parameter is a row_list that holds each string in the target that was matched by a sequence of tokens in the regular expression.
rlist	An output parameter containing a list of matches.
flags	Whether or not the search is case-sensitive. If the value of this parameter is "i", the search is case-insensitive. Otherwise the search is case-sensitive.

Return Values

TRUE if a match was found, FALSE otherwise.

Examples

KAZOO is the target where it is searching for the zoo.* regular expression. The period indicates any character other than newline, and the asterisk matches 0 or more of the preceding characters. In this case, it matches any character other than the newline.

Therefore, this regular expression specifies that a matching target consists of zoo, followed by any set of characters neither ending in nor including a newline (which does not match the period). The i flag indicates to ignore case in the search. In this case, the function returns TRUE, which indicates that a match had been found.

```
boolean foundMatch;
foundMatch := owa_pattern.match('KAZOO', 'zoo.*', 'i');
```

The following example searches for the string "goal" followed by any number of characters in sometext. If found,

```
sometext VARCHAR2(256);
pat      VARCHAR2(256);

sometext := 'what is the goal?';
pat      := 'goal.*';
IF OWA_PATTERN.MATCH(sometext, pat)
THEN
    HTP.PRINT('Match found');
ELSE
    HTP.PRINT('Match not found');
END IF;
```

Operational Notes

- The regular expression in this function can be either a VARCHAR2 or an OWA_PATTERN.PATTERN DATA TYPE. Create an OWA_PATTERN.PATTERN DATA TYPE from a string using the OWA_PATTERN.GETPAT procedure.

- Create a `MULTI_LINE` DATA TYPE from a long string using the `OWA_TEXT.STREAM2MULTI` procedure. If a `multi_line` is used, the `rlist` parameter specifies a list of chunks where matches were found.
- If the line is a string and not a `multi_line`, you can add an optional output parameter called `backrefs`. This parameter is a `row_list` that holds each string in the target that was matched by a sequence of tokens in the regular expression.

OWA_SEC

The `OWA_SEC` package provides an interface for custom authentication.

See Also:

For more information about implementation of this package:

- [Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server](#)
- [Oracle Fusion Middleware User's Guide for `mod_plsql`](#)

The chapter contains the following topics:

- [Operational Notes](#)
- [Summary of OWA_SEC Subprograms](#)

244.1 OWA_SEC Operational Notes

Parameters that have default values are optional.

244.2 Summary of OWA_SEC Subprograms

This table lists the `OWA_SEC` subprograms in alphabetical order and briefly describes them.

Table 244-1 OWA_SEC Package Subprograms

Subprogram	Description
GET_CLIENT_HOSTNAME Function	Returns the client's hostname
GET_CLIENT_IP Function	Returns the client's IP address
GET_PASSWORD Function	Returns the password that the user entered
GET_USER_ID Function	Returns the username that the user entered
SET_AUTHORIZATION Procedure	Enables the PL/SQL application to use custom authentication
SET_PROTECTION_REALM Procedure	Defines the realm that the page is in

244.2.1 GET_CLIENT_HOSTNAME Function

This function returns the hostname of the client.

Syntax

```
OWA_SEC.GET_CLIENT_HOSTNAME  
RETURN VARCHAR2;
```

Return Values

The hostname.

244.2.2 GET_CLIENT_IP Function

This function returns the IP address of the client.

Syntax

```
OWA_SEC.GET_CLIENT_IP  
RETURN OWA_UTIL.IP_ADDRESS;
```

Return Values

The IP address. The `owa_util.ip_address` datatype is a PL/SQL table where the first four elements contain the four numbers of the IP address. For example, if the IP address is 123.45.67.89 and the variable `ipaddr` is of the `owa_util.ip_address` datatype, the variable would contain the following values:

```
ipaddr(1) = 123  
ipaddr(2) = 45  
ipaddr(3) = 67  
ipaddr(4) = 89
```

244.2.3 GET_PASSWORD Function

This function returns the password that the user used to log in.

Syntax

```
OWA_SEC.GET_PASSWORD  
RETURN VARCHAR2;
```

Return Values

The password.

Usage Notes

For security reasons, this function returns a true value only when custom authentication is used. If you call this function when you are not using custom authentication, the function returns an undefined value. Thus, the database passwords are not exposed.

244.2.4 GET_USER_ID Function

This function returns the username that the user used to log in.

Syntax

```
OWA_SEC.GET_USER_ID  
RETURN VARCHAR2;
```

Return Values

The username.

244.2.5 SET_AUTHORIZATION Procedure

This procedure, called in the initialization portion of the OWA_CUSTOM package, sets the authorization scheme for the PL/SQL Gateway.

This implements your `authorize` function, which authorizes the user before his requested procedure is run. The placement of the `authorize` function depends on the scheme you select.

Syntax

```
OWA_SEC.SET_AUTHORIZATION(  
    scheme          IN          INTEGER);
```

Parameters

Table 244-2 SET_AUTHORIZATION Procedure Parameters

Parameter	Description
scheme	<p>The authorization scheme. It is one of the following schemes for SET_AUTHORIZATION:</p> <ul style="list-style-type: none"> OWA_SEC.NO_CHECK - Specifies that the PL/SQL application is not to do any custom authentication. This is the default. OWA_SEC.GLOBAL - Defines an authorize function that is called for all users and all procedures. This is the OWA_CUSTOM.AUTHORIZE Function in the "sys" schema. OWA_SEC.PER_PACKAGE - Define an authorize function that is called when procedures in a package or anonymous procedures are called. If the procedures are in a package, the package.AUTHORIZE function in the user's schema is called to authorize the user. If the procedures are not in a package, then the anonymous authorize function in the user's schema is called. OWA_SEC.CUSTOM - Implements different authorize functions for each user. The function OWA_CUSTOM.AUTHORIZE Function in the user's schema is called to authorize the user. If the user's schema does not contain an OWA_CUSTOM.AUTHORIZE Function, the PL/SQL Gateway looks for it in the "sys" schema. <p>The custom authorize function has the following signature:</p> <pre>FUNCTION AUTHORIZE RETURN BOOLEAN;</pre> <p>If the function returns TRUE, authentication succeeded. If it returns FALSE, authentication failed. If the authorize function is not defined, the Gateway returns an error and fails.</p>

Related Topics

- [OWA_CUSTOM](#)
The OWA_CUSTOM package provides a Global PLSQL Agent Authorization callback function.

244.2.6 SET_PROTECTION_REALM Procedure

This procedure sets the realm of the page that is returned to the user. The user enters a username and login that already exist in the realm.

Syntax

```
OWA_SEC.SET_PROTECTION_REALM(
    realm          IN          VARCHAR2);
```

Parameters

Table 244-3 SET_PROTECTION_REALM Procedure Parameters

Parameter	Description
realm	The realm where the page belongs. This string is displayed to the user.

OWA_TEXT

The `OWA_TEXT` package contains subprograms used by `OWA_PATTERN` for manipulating strings. They are externalized so you can use them directly.

See Also:

For more information about implementation of this package:

- [Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server](#)
- [Oracle Fusion Middleware User's Guide for `mod_plsql`](#)

The chapter contains the following topics:

- [Types](#)
- [Summary of `OWA_TEXT` Subprograms](#)

245.1 OWA_OPT_LOCK Types

There are three `OWA_OPT_LOCK` lock types.

- [MULTI_LINE DATA TYPE](#)
- [ROW_LIST DATA TYPE](#)
- [VC_ARR DATA TYPE](#)

245.1.1 MULTI_LINE DATA TYPE

This datatype is a PL/SQL record that holds large amounts of text. The `rows` field, of type `OWA_TEXT.VC_ARR DATA TYPE`, contains the text data in the record.

```
TYPE multi_line IS RECORD (
    rows          vc_arr,
    num_rows      INTEGER,
    partial_row    BOOLEAN);
```

245.1.2 ROW_LIST DATA TYPE

This is the datatype for holding data to be processed.

```
TYPE row_list IS RECORD (
    rows          int_arr,
    num_rows      INTEGER);
```

```
int_arr IS DEFINED AS:
```

```
TYPE int_arr IS TABLE OF INTEGER INDEX BY BINARY_INTEGER;
```

245.1.3 VC_ARR DATA TYPE

This is a component of the MULTI_LINE DATA TYPE and is used for holding large amounts of text.

```
TYPE vc_arr IS TABLE OF VARCHAR2(32767) INDEX BY BINARY_INTEGER;
```

Related Topics

- [MULTI_LINE DATA TYPE](#)

This datatype is a PL/SQL record that holds large amounts of text. The rows field, of type OWA_TEXT.VC_ARR DATA TYPE, contains the text data in the record.

245.2 Summary of OWA_TEXT Subprograms

This table lists the OWA_TEXT subprograms and briefly describes them.

Table 245-1 OWA_TEXT Package Subprograms

Subprogram	Description
ADD2MULTI Procedure	Adds text to an existing multi_line type
NEW_ROW_LIST Function and Procedure	Creates a new row_list
PRINT_MULTI Procedure	Prints out the contents of a multi_list
PRINT_ROW_LIST Procedure	Prints out the contents of a row_list
STREAM2MULTI Procedure	Converts a varchar2 to a multi_line type

245.2.1 ADD2MULTI Procedure

This procedure adds content to an existing Multi_Line Data Type

Syntax

```
OWA_TEXT.ADD2MULTI (
    stream          IN          VARCHAR2,
    mline          IN OUT    multi_line,

    continue       IN          BOOLEAN DEFAULT TRUE);
```

Parameters

Table 245-2 ADD2MULTI Procedure Parameters

Parameter	Description
stream	The text to add.
mline	The OWA_TEXT.MULTI_LINE DATA TYPE. The output of this parameter contains <i>stream</i> .

Table 245-2 (Cont.) ADD2MULTI Procedure Parameters

Parameter	Description
continue	If TRUE, the procedure appends <i>stream</i> within the previous final row (assuming it is less than 32K). If FALSE, the procedure places <i>stream</i> in a new row.

245.2.2 NEW_ROW_LIST Function and Procedure

This function or procedure creates a new `OWA_TEX.ROW_LIST DATA TYPE`.

The function version uses no parameters and returns a new empty `row_list`. The procedure version creates the `row_list` datatype as an output parameter.

Syntax

```
OWA_TEXT.NEW_ROW_LIST
  RETURN ROW_LIST;

OWA_TEXT.NEW_ROW_LIST(
  rlist   OUT   row_list);
```

Parameters

Table 245-3 NEW_ROW_LIST Procedure Parameters

Parameter	Description
rlist	This is an output parameter containing the new <code>row_list</code> datatype

Return Values

The function version returns the new `row_list` datatype.

245.2.3 PRINT_MULTI Procedure

This procedure uses the PRINT Procedures or the PRN Procedures to print the "rows" field of the `OWA_TEXT.MULTI_LINE DATA TYPE`.

Syntax

```
OWA_TEXT.PRINT_MULTI(
  mline   IN   multi_line);
```

Parameters

Table 245-4 PRINT_MULTI Procedure Parameters

Parameter	Description
mline	The <code>multi_line</code> datatype to print.

Return Values

The contents of the `multi_line`.

Related Topics

- [PRINT Procedures](#)
These procedures generate the specified parameter as a string terminated with the `\n` newline character.
- [PRN Procedures](#)
These procedures generate the specified parameter as a string.

245.2.4 PRINT_ROW_LIST Procedure

This procedure uses the PRINT Procedures or the PRN Procedures to print the "rows" field of the `OWA_TEXT.ROW_LIST` DATA TYPE.

Syntax

```
OWA_TEXT.PRINT_ROW_LIST(  
    rlist      IN      multi_line);
```

Parameters**Table 245-5 PRINT_ROW_LIST Procedure Parameters**

Parameter	Description
<code>rlist</code>	The <code>row_list</code> datatype to print.

Return Values

The contents of the `row_list`.

Related Topics

- [PRINT Procedures](#)
These procedures generate the specified parameter as a string terminated with the `\n` newline character.
- [PRN Procedures](#)
These procedures generate the specified parameter as a string.

245.2.5 STREAM2MULTI Procedure

This procedure converts a string to a `multi_line` datatype.

Syntax

```
OWA_TEXT.STREAM2MULTI(  
    stream      IN      VARCHAR2  
    mline      OUT     multi_line);
```

Parameters

Table 245-6 STREAM2MULTI Procedure Parameters

Parameter	Description
stream	The string to convert.
mline	The stream in OWA_TEXT.MULTI_LINE DATA TYPE format

OWA_UTIL

The `OWA_UTIL` package contains utility subprograms for performing operations such as getting the value of CGI environment variables, printing the data that is returned to the client, and printing the results of a query in an HTML table.

See Also:

For more information about implementation of this package:

- [Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server](#)
- [Oracle Fusion Middleware User's Guide for `mod_plsql`](#)

This chapter contains the following topics:

- [Overview](#)
- [Types](#)
- [Summary of OWA_UTIL Subprograms](#)

246.1 OWA_UTIL Overview

The `OWA_UTIL` package contains three types of utility subprograms.

- Dynamic SQL Utilities enable you to produce pages with dynamically generated SQL code.
- HTML utilities enable you to retrieve the values of CGI environment variables and perform URL redirects.
- Date utilities enable correct date-handling. Date values are simple strings in HTML, but are treated as a datatype by the Oracle database.

246.2 OWA_UTIL Types

`OWA_UTIL` uses Types to specify creating information.

- [DATATYPE Datatype](#)
- [IDENT_ARR Datatype](#)
- [IP_ADDRESS Datatype](#)

246.2.1 DATETYPE Datatype

The TODATE Function converts an item of this type to the type `DATE`, which is understood and properly handled as data by the database. The procedure `CHOOSE_DATE` Procedure enables the user to select the desired date.

```
TYPE dateType IS TABLE OF VARCHAR2(10) INDEX BY BINARY_INTEGER;
```

Related Topics

- [TODATE Function](#)
This function converts the DATETYPE Datatype to the standard Oracle `DATE` type.
- [CHOOSE_DATE Procedure](#)
This procedure generates three HTML form elements that allow the user to select the day, the month, and the year.

246.2.2 IDENT_ARR Datatype

This datatype is used for an array.

```
TYPE ident_arr IS TABLE OF VARCHAR2(30) INDEX BY BINARY_INTEGER;
```

246.2.3 IP_ADDRESS Datatype

This datatype is used by the `GET_CLIENT_IP` Function in the `OWA_SEC` package.

```
TYPE ip_address IS TABLE OF INTEGER INDEX BY BINARY_INTEGER;
```

Related Topics

- [GET_CLIENT_IP Function](#)
This function returns the IP address of the client.
- [OWA_SEC](#)
The `OWA_SEC` package provides an interface for custom authentication.

246.3 Summary of OWA_UTIL Subprograms

This table lists the `OWA_UTIL` subprograms and briefly describes them.

Table 246-1 *OWA_UTIL Package Subprograms*

Subprogram	Description
BIND_VARIABLES Function	Prepares a SQL query and binds variables to it
CALENDARPRINT Procedures	Prints a calendar
CELLSPRINT Procedures	Prints the contents of a query in an HTML table
CHOOSE_DATE Procedure	Generates HTML form elements that allow the user to select a date
GET_CGI_ENV Function	Returns the value of the specified CGI environment variable
GET_OWA_SERVICE_PATH Function	Returns the full virtual path for the PL/SQL Gateway

Table 246-1 (Cont.) OWA_UTIL Package Subprograms

Subprogram	Description
GET_PROCEDURE Function	Returns the name of the procedure that is invoked by the PL/SQL Gateway
HTTP_HEADER_CLOSE Procedure	Closes the HTTP header
LISTPRINT Procedure	Generates a HTML form element that contains data from a query
MIME_HEADER Procedure	Generates the Content-type line in the HTTP header
PRINT_CGI_ENV Procedure	Generates a list of all CGI environment variables and their values
REDIRECT_URL Procedure	Generates the Location line in the HTTP header
SHOWPAGE Procedure	Prints a page generated by the HTP and HTF packages in SQL*Plus
SHOWSOURCE Procedure	Prints the source for the specified subprogram
SIGNATURE procedure	Prints a line that says that the page is generated by the PL/SQL Agent
STATUS_LINE Procedure	Generates the Status line in the HTTP header
TABLEPRINT Function	Prints the data from a table in the database as an HTML table
TODATE Function	Converts dateType data to the standard PL/SQL date type
WHO_CALLED_ME Procedure	Returns information on the caller of the procedure.

246.3.1 BIND_VARIABLES Function

This function prepares a SQL query by binding variables to it, and stores the output in an opened cursor. Use this function as a parameter to a procedure sending a dynamically generated query. Specify up to 25 bind variables.

Syntax

```
OWA_UTIL.BIND_VARIABLES (
  theQuery      IN      VARCHAR2  DEFAULT NULL,
  bv1Name       IN      VARCHAR2  DEFAULT NULL,
  bv1Value      IN      VARCHAR2  DEFAULT NULL,
  bv2Name       IN      VARCHAR2  DEFAULT NULL,
  bv2Value      IN      VARCHAR2  DEFAULT NULL,
  bv3Name       IN      VARCHAR2  DEFAULT NULL,
  bv3Value      IN      VARCHAR2  DEFAULT NULL,
  ...
  bv25Name      IN      VARCHAR2  DEFAULT NULL,
  bv25Value     IN      VARCHAR2  DEFAULT NULL)
RETURN INTEGER;
```

Parameters

Table 246-2 BIND_VARIABLES Function Parameters

Parameter	Description
theQuery	The SQL query statement which must be a SELECT statement
bv1Name	The name of the variable
bv1Value	The value of the variable

Return Values

An integer identifying the opened cursor.

246.3.2 CALENDARPRINT Procedures

These procedures creates a calendar in HTML with a visible border. Each date in the calendar can contain any number of hypertext links.

This procedure has 2 versions.

- Version 1 uses a hard-coded query stored in a varchar2 string.
- Version 2 uses a dynamic query prepared with the [BIND_VARIABLES Function](#).

Syntax

```
OWA_UTIL.CALENDARPRINT (
  p_query      IN      VARCHAR2,
  p_mf_only    IN      VARCHAR2  DEFAULT 'N');
```

```
OWA_UTIL.CALENDARPRINT (
  p_cursor     IN      INTEGER,
  p_mf_only    IN      VARCHAR2  DEFAULT 'N');
```

Parameters

Table 246-3 CALENDARPRINT Procedure Parameters

Parameter	Description
p_query	A PL/SQL query.
p_cursor	A PL/SQL cursor containing the same format as p_query.
p_mf_only	If "N" (the default), the generated calendar includes Sunday through Saturday. Otherwise, it includes Monday through Friday only.

Usage Notes

Design your query as follows:

- The first column is a DATE. This correlates the information produced by the query with the calendar output generated by the procedure.
- The query output must be sorted on this column using ORDER BY.

- The second column contains the text, if any, that you want printed for that date.
- The third column contains the destination for generated links. Each item in the second column becomes a hypertext link to the destination given in this column. If this column is omitted, the items in the second column are simple text, not links.

246.3.3 CELLSPRINT Procedures

This procedure generates an HTML table from the output of a SQL query. SQL atomic data items are mapped to HTML cells and SQL rows to HTML rows. You must write the code to begin and end the HTML table.

There are nine versions of this procedure:

- The first version passes the results of a query into an index table. Perform the query and CELLSPRINT does the formatting. To have more control in generating an HTML table from the output of an SQL query, use the [FORMAT_CELL Function](#) in the "HTF" package.
- The second and third versions display rows (up to the specified maximum) returned by the query or cursor.
- The fourth and fifth versions exclude a specified number of rows from the HTML table. Use the fourth and fifth versions to scroll through result sets by saving the last row seen in a hidden form element.
- The sixth through ninth versions are the same as the first four versions, except that they return a row count output parameter.

Syntax

```
OWA_UTIL.CELLSPRINT (
  p_colCnt      IN    INTEGER,
  p_resultTbl   IN    vc_arr,

  p_format_numbers IN  VARCHAR2  DEFAULT NULL);
```

```
OWA_UTIL.CELLSPRINT (
  p_theQuery    IN    VARCHAR2,
  p_max_rows    IN    NUMBER      DEFAULT 100,
  p_format_numbers IN  VARCHAR2  DEFAULT NULL);
```

```
OWA_UTIL.CELLSPRINT (
  p_theCursor   IN    INTEGER,
  p_max_rows    IN    NUMBER      DEFAULT 100,
  p_format_numbers IN  VARCHAR2  DEFAULT NULL);
```

```
OWA_UTIL.CELLSPRINT (
  p_theQuery    IN    VARCHAR2,
  p_max_rows    IN    NUMBER      DEFAULT 100,
  p_format_numbers IN  VARCHAR2  DEFAULT NULL,
  p_skip_rec    IN    NUMBER      DEFAULT 0,
  p_more_data   OUT   BOOLEAN);
```

```
OWA_UTIL.CELLSPRINT (
  p_theCursor   IN    INTEGER,
  p_max_rows    IN    NUMBER      DEFAULT 100,
  p_format_numbers IN  VARCHAR2  DEFAULT NULL,
  p_skip_rec    IN    NUMBER      DEFAULT 0,
  p_more_data   OUT   BOOLEAN);
```

```

OWA_UTIL.CELLSPRINT (
  p_theQuery      IN   VARCHAR2,
  p_max_rows      IN   NUMBER      DEFAULT 100,
  p_format_numbers IN   VARCHAR2    DEFAULT NULL,
  p_reccnt        OUT  NUMBER);

OWA_UTIL.CELLSPRINT (
  p_theCursor     IN   INTEGER,
  p_max_rows      IN   NUMBER      DEFAULT 100,
  p_format_numbers IN   VARCHAR2    DEFAULT NULL,
  p_reccnt        OUT  NUMBER);

OWA_UTIL.CELLSPRINT (
  p_theQuery      IN   VARCHAR2,
  p_max_rows      IN   NUMBER      DEFAULT 100,
  p_format_numbers IN   VARCHAR2    DEFAULT NULL,
  p_skip_rec      IN   NUMBER      DEFAULT 0,
  p_more_data     OUT  BOOLEAN,
  p_reccnt        OUT  NUMBER);

OWA_UTIL.CELLSPRINT (
  p_theCursor     IN   INTEGER,
  p_max_rows      IN   NUMBER      DEFAULT 100,
  p_format_numbers IN   VARCHAR2    DEFAULT NULL,
  p_skip_rec      IN   NUMBER      DEFAULT 0,
  p_more_data     OUT  BOOLEAN,
  p_reccnt        OUT  NUMBER);

```

Parameters

Table 246-4 CELLSPRINT Procedure Parameters

Parameter	Description
p_query	A PL/SQL query.
p_colCnt	The number of columns in the table.
p_theQuery	A SQL SELECT statement.
p_theCursor	A cursor ID. This can be the return value from the BIND_VARIABLES Function .
p_max_rows	The maximum number of rows to print.
p_format_numbers	If the value of this parameter is not NULL, number fields are right justified and rounded to two decimal places.
p_skip_rec	The number of rows to exclude from the HTML table.
p_more_data	TRUE if there are more rows in the query or cursor, FALSE otherwise.
p_reccnt	The number of rows that have been returned by the query. This value does not include skipped rows (if any).
p_resultTbl	The index table which will contain the result of the query. Each entry in the query will correspond to one column value.

Examples

This procedure generates

```
<tr><td>QueryResultItem</td><td>QueryResultItem</td></tr>...
```

246.3.4 CHOOSE_DATE Procedure

This procedure generates three HTML form elements that allow the user to select the day, the month, and the year.

Syntax

```
OWA_UTIL.CHOOSE_DATE (
    p_name      IN      VARCHAR2,
    p_date      IN      DATE      DEFAULT SYSDATE);
```

Parameters

Table 246-5 CHOOSE_DATE Procedure Parameters

Parameter	Description
p_name	The name of the form elements.
p_date	The initial date that is selected when the HTML page is displayed.

Usage Notes

- The parameter in the procedure that receives the data from these elements must be a [GET_CGI_ENV Function](#).
- Use the [TODATE Function](#) to convert the [GET_CGI_ENV Function](#) value to the standard Oracle DATE datatype.

Examples

```
<SELECT NAME="p_name" SIZE="1">
<OPTION value="01">1
...
<OPTION value="31">31
</SELECT>
-
<SELECT NAME="p_name" SIZE="1">
<OPTION value="01">JAN
...
<OPTION value="12">DEC
</SELECT>
-
<SELECT NAME="p_name" SIZE="1">
<OPTION value="1992">1992
...
<OPTION value="2002">2002
</SELECT>
```

246.3.5 GET_CGI_ENV Function

This function returns the value of the specified CGI environment variable.

Syntax

```
OWA_UTIL.GET_CGI_ENV(  
    param_name    IN    VARCHAR2)  
    RETURN VARCHAR2;
```

Parameters

Table 246-6 GET_CGI_ENV Function Parameters

Parameter	Description
param_name	The name of the CGI environment variable. It is case-insensitive.

Return Values

The value of the specified CGI environment variable. If the variable is not defined, the function returns `NULL`.

246.3.6 GET_OWA_SERVICE_PATH Function

This function returns the full virtual path of the PL/SQL Gateway that is handling the request.

Syntax

```
OWA_UTIL.GET_OWA_SERVICE_PATH  
    RETURN VARCHAR2;
```

Return Values

A virtual path of the PL/SQL Gateway that is handling the request.

246.3.7 GET_PROCEDURE Function

This function returns the name of the procedure that is being invoked by the PL/SQL Gateway.

Syntax

```
OWA_UTIL.GET_PROCEDURE  
    RETURN VARCHAR2;
```

Return Values

The name of a procedure, including the package name if the procedure is defined in a package.

246.3.8 HTTP_HEADER_CLOSE Procedure

This procedure generates a newline character to close the HTTP header.

Syntax

```
OWA_UTIL.HTTP_HEADER_CLOSE;
```

Return Values

A newline character, which closes the HTTP header.

Usage Notes

- Use this procedure if you have not closed the header by using the `bclose_header` parameter in calls such as [MIME_HEADER Procedure](#), [REDIRECT_URL Procedure](#), or [STATUS_LINE Procedure](#)
- The HTTP header must be closed before any `HTP.PRINT` or `HTP.PRN` calls.

246.3.9 LISTPRINT Procedure

This procedure generates an HTML selection list form element from the output of a SQL query.

There are two versions of this procedure.

- The first version contains a hard-coded SQL query.
- The second version uses a dynamic query prepared with the [BIND_VARIABLES Function](#).

Syntax

```
OWA_UTIL.LISTPRINT(
  p_theQuery    IN      VARCHAR2,
  p_cname       IN      VARCHAR2,
  p_nsize       IN      NUMBER,
  p_multiple    IN      BOOLEAN  DEFAULT FALSE);
```

```
OWA_UTIL.LISTPRINT(
  p_theCursor   IN      INTEGER,
  p_cname       IN      VARCHAR2,
  p_nsize       IN      NUMBER,
  p_multiple    IN      BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 246-7 LISTPRINT Procedure Parameters

Parameter	Description
<code>p_theQuery</code>	The SQL query.
<code>p_theCursor</code>	The cursor ID. This can be the return value from the BIND_VARIABLES Function .
<code>p_cname</code>	The name of the HTML form element.

Table 246-7 (Cont.) LISTPRINT Procedure Parameters

Parameter	Description
p_nsize	The size of the form element (this controls how many items the user can see without scrolling).
p_multiple	Whether multiple selection is permitted.

Usage Notes

The columns in the output of the query are handled in the following manner:

- The first column specifies the values that are sent back. These values are for the VALUE attribute of the OPTION tag.
- The second column specifies the values that the user sees.
- The third column specifies whether or not the row is marked as SELECTED in the OPTION tag. If the value is not NULL, the row is selected.

Examples

```
<SELECT NAME="p_cname" SIZE="p_nsize">
<OPTION SELECTED value='value_from_the_first_column'>value_from_the_second_column
<OPTION SELECTED value='value_from_the_first_column'>value_from_the_second_column
...
</SELECT>
```

246.3.10 MIME_HEADER Procedure

This procedure changes the default MIME header that the script returns. This procedure must come before any HTP.PRINT or HTP.PRN calls to direct the script not to use the default MIME header.

Syntax

```
OWA_UTIL.MIME_HEADER(
  ccontent_type IN VARCHAR2 DEFAULT 'text/html',
  bclose_header IN BOOLEAN DEFAULT TRUE,
  ccharset IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 246-8 MIME_HEADER Procedure Parameters

Parameter	Description
ccontent_type	The MIME type to generate
bclose_header	Whether or not to close the HTTP header. If TRUE, two newlines are sent, which closes the HTTP header. Otherwise, one newline is sent, and the HTTP header remains open.
ccharset	The character set to use. The character set only makes sense if the MIME type is of type 'text'. Therefore, the character set is only tagged on to the Content-Type header only if the MIME type passed in is of type 'text'. Any other MIME type, such as 'image', will not have any character set tagged on.

Examples

```
Content-type: <ccontent_type>; charset=<ccharset>
```

so that

```
owa_util.mime_header('text/plain', false, 'ISO-8859-4')
```

generates

```
Content-type: text/plain; charset=ISO-8859-4\n
```

246.3.11 PRINT_CGI_ENV Procedure

This procedure generates all the CGI environment variables and their values made available by the PL/SQL Gateway to the stored procedure.

Syntax

```
OWA_UTIL.PRINT_CGI_ENV;
```

Examples

This procedure generates a list in the following format:

```
cgi_env_var_name = value\n
```

246.3.12 REDIRECT_URL Procedure

This procedure specifies that the application server is to visit the specified URL. The URL may specify either a Web page to return or a program to execute.

Syntax

```
OWA_UTIL.REDIRECT_URL(  
    curl          IN          VARCHAR2  
    bclose_header IN          BOOLEAN    DEFAULT TRUE);
```

Parameters**Table 246-9 REDIRECT_URL Procedure Parameters**

Parameter	Description
curl	The URL to visit.
bclose_header	Whether or not to close the HTTP header. If <code>TRUE</code> , two newlines are sent, which closes the HTTP header. Otherwise, one newline is sent, and the HTTP header remains open.

Usage Notes

This procedure must come before any HTP procedure or HTF function call.

Examples

This procedure generates

Location: <curl>\n\n

246.3.13 SHOWPAGE Procedure

This procedure prints out the HTML output of a procedure in SQL*Plus.

The procedure must use the HTP or HTF packages to generate the HTML page, and this procedure must be issued after the HTP or HTF page-generating subprogram has been called and before any other HTP or HTF subprograms are directly or indirectly called.

Syntax

```
OWA_UTIL.SHOWPAGE;
```

Usage Notes

- This method is useful for generating pages filled with static data.
- This procedure uses the [DBMS_OUTPUT](#) package and is limited to 32767 characters for each line and an overall buffer size of 1,000,000 bytes.

Examples

The output of htp procedure is displayed in SQL*Plus, SQL*DBA, or Oracle Server Manager. For example:

```
SQL> set serveroutput on
SQL> spool gretzky.html
SQL> execute hockey.pass("Gretzky")
SQL> execute owa_util.showpage
SQL> exit
```

This would generate an HTML page that could be accessed from Web browsers.

246.3.14 SHOWSOURCE Procedure

This procedure prints the source of the specified procedure, function, or package. If a procedure or function which belongs to a package is specified, then the entire package is displayed.

Syntax

```
OWA_UTIL.SHOWSOURCE (
    cname      IN      VARCHAR2);
```

Parameters

Table 246-10 SHOWSOURCE Procedure Parameters

Parameter	Description
cname	The function or procedure whose source you want to show.

246.3.15 SIGNATURE procedure

This procedure generates an HTML line followed by a signature line on the HTML document.

If a parameter is specified, the procedure also generates a hypertext link to view the PL/SQL source for that procedure. The link calls the [SHOWSOURCE Procedure](#).

Syntax

```
OWA_UTIL.SIGNATURE;

OWA_UTIL.SIGNATURE (
    cname          IN          VARCHAR2);
```

Parameters

Table 246-11 SIGNATURE Procedure Parameters

Parameter	Description
cname	The function or procedure whose source you want to show.

Examples

Without a parameter, the procedure generates a line that looks like the following:

```
This page was produced by the PL/SQL Agent on August 9, 2001 09:30.
```

With a parameter, the procedure generates a signature line in the HTML document that looks like the following:

```
This page was produced by the PL/SQL Agent on 8/09/01 09:30
View PL/SQL Source
```

246.3.16 STATUS_LINE Procedure

This procedure sends a standard HTTP status code to the client.

This procedure must come before any `http.print` or `http.prn` calls so that the status code is returned as part of the header, rather than as "content data".

Syntax

```
OWA_UTIL.STATUS_LINE (
    nstatus        IN          INTEGER,
    creason        IN          VARCHAR2  DEFAULT NULL,
    bclose_header  IN          BOOLEAN   DEFAULT TRUE);
```

Parameters

Table 246-12 STATUS_LINE Procedure Parameters

Parameter	Description
nstatus	The status code.
creason	The string for the status code.

Table 246-12 (Cont.) STATUS_LINE Procedure Parameters

Parameter	Description
bclose_header	Whether or not to close the HTTP header. If TRUE, two newlines are sent, which closes the HTTP header. Otherwise, one newline is sent, and the HTTP header remains open.

Examples

This procedure generates

```
Status: <nstatus> <creason>\n\n
```

246.3.17 TABLEPRINT Function

This function generates either preformatted tables or HTML tables (depending on the capabilities of the user's browser) from database tables.

Syntax

```
OWA_UTIL.TABLEPRINT(
  ctable          IN          VARCHAR2,
  cattributes     IN          VARCHAR2  DEFAULT NULL,
  ntable_type     IN          INTEGER   DEFAULT HTML_TABLE,
  ccolumns        IN          VARCHAR2  DEFAULT '*',
  cclauses        IN          VARCHAR2  DEFAULT NULL,
  ccol_aliases    IN          VARCHAR2  DEFAULT NULL,
  nrow_min        IN          NUMBER    DEFAULT 0,
  nrow_max        IN          NUMBER    DEFAULT NULL)
RETURN BOOLEAN;
```

Parameters

Table 246-13 TABLEPRINT Function Parameters

Parameter	Description
ctable	The database table.
cattributes	Other attributes to be included as-is in the tag.
ntable_type	How to generate the table. Specify HTML_TABLE to generate the table using <TABLE> tags or PRE_TABLE to generate the table using the <PRE> tags. These are constants: <ul style="list-style-type: none"> HTML_TABLE CONSTANT INTEGER := 1; PRE_TABLE CONSTANT INTEGER := 2;
ccolumns	A comma-delimited list of columns from ctable to include in the generated table.
cclauses	WHERE or ORDER BY clauses, which specify which rows to retrieve from the database table, and how to order them.
ccol_aliases	A comma-delimited list of headings for the generated table.
nrow_min	The first row, of those retrieved, to display.
nrow_max	The last row, of those retrieved, to display.

Return Values

Returns `TRUE` if there are more rows beyond the `nrow_max` requested, `FALSE` otherwise.

Usage Notes

- RAW columns are supported, but LONG RAW columns are not. References to LONG RAW columns will print the result 'Not Printable'.
- Note that in this function, `cattributes` is the second rather than the last parameter.

Examples

For browsers that do not support HTML tables, create the following procedure:

```
CREATE OR REPLACE PROCEDURE showemps IS
    ignore_more BOOLEAN;
BEGIN
    ignore_more := OWA_UTIL.TABLEPRINT('emp', 'BORDER', OWA_UTIL.PRE_TABLE);
END;
```

Requesting a URL such as

`http://myhost:7777/pls/hr/showemps`

returns to the following to the client:

```
<PRE>
-----
| EMPNO |ENAME |JOB      |MGR  |HIREDATE  | SAL | COMM | DEPTNO |
-----|-----|-----|-----|-----|-----|-----|-----|
| 7369 | SMITH | CLERK   | 7902 | 17-DEC-80 | 800 |      | 20 |
| 7499 | ALLEN | SALESMAN| 7698 | 20-FEB-81 | 1600 | 300 | 30 |
| 7521 | WARD  | SALESMAN| 7698 | 22-FEB-81 | 1250 | 500 | 30 |
| 7566 | JONES | MANAGER | 7839 | 02-APR-81 | 2975 |      | 20 |
| 7654 | MARTIN | SALESMAN| 7698 | 28-SEP-81 | 1250 | 1400 | 30 |
| 7698 | BLAKE | MANAGER | 7839 | 01-MAY-81 | 2850 |      | 30 |
| 7782 | CLARK | MANAGER | 7839 | 09-JUN-81 | 2450 |      | 10 |
| 7788 | SCOTT | ANALYST | 7566 | 09-DEC-82 | 3000 |      | 20 |
| 7839 | KING  | PRESIDENT |      | 17-NOV-81 | 5000 |      | 10 |
| 7844 | TURNER | SALESMAN| 7698 | 08-SEP-81 | 1500 | 0 | 30 |
| 7876 | ADAMS | CLERK   | 7788 | 12-JAN-83 | 1100 |      | 20 |
| 7900 | JAMES | CLERK   | 7698 | 03-DEC-81 | 950 |      | 30 |
| 7902 | FORD  | ANALYST | 7566 | 03-DEC-81 | 3000 |      | 20 |
| 7934 | MILLER | CLERK   | 7782 | 23-JAN-82 | 1300 |      | 10 |
-----
</PRE>
```

To view the employees in department 10, and only their employee ids, names, and salaries, create the following procedure:

```
CREATE OR REPLACE PROCEDURE showemps_10 IS
    ignore_more BOOLEAN;
begin
    ignore_more := OWA_UTIL.TABLEPRINT
        ('EMP', 'BORDER', OWA_UTIL.PRE_TABLE,
        'empno, ename, sal', 'WHERE deptno=10 ORDER BY empno',
        'Employee Number, Name, Salary');
END;
```

A request for a URL like

http://myhost:7777/pls/hr/showemps_10

would return the following to the client:

```
<PRE>
-----
| Employee Number |Name      | Salary |
-----
| 7782             | CLARK    | 2450   |
| 7839             | KING     | 5000   |
| 7934             | MILLER   | 1300   |
-----
</PRE>
```

For browsers that support HTML tables, to view the department table in an HTML table, create the following procedure:

```
CREATE OR REPLACE PROCEDURE showdept IS
  ignore_more BOOLEAN;
BEGIN
  ignore_more := oWA_UTIL.TABLEPRINT('dept', 'BORDER');
END;
```

A request for a URL like

http://myhost:7777/pls/hr/showdept

would return the following to the client:

```
<TABLE BORDER>
<TR>
<TH>DEPTNO</TH>
<TH>DNAME</TH>
<TH>LOC</TH>
</TR>
<TR>
<TD ALIGN="LEFT">10</TD>
<TD ALIGN="LEFT">ACCOUNTING</TD>
<TD ALIGN="LEFT">NEW YORK</TD>
</TR>
<TR>
<TD ALIGN="LEFT">20</TD>
<TD ALIGN="LEFT">RESEARCH</TD>
<TD ALIGN="LEFT">DALLAS</TD>
</TR>
<TR>
<TD ALIGN="LEFT">30</TD>
<TD ALIGN="LEFT">SALES</TD>
<TD ALIGN="LEFT">CHICAGO</TD>
</TR>
<TR>
<TD ALIGN="LEFT">40</TD>
<TD ALIGN="LEFT">OPERATIONS</TD>
<TD ALIGN="LEFT">BOSTON</TD>
</TR>
</TABLE>
```

A Web browser would format this to look like the following table:

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO

246.3.18 TODATE Function

This function converts the DATETYPE Datatype to the standard Oracle DATE type.

Syntax

```
OWA_UTIL.TODATE(
    p_dateArray    IN    dateType)
RETURN DATE;
```

Parameters

Table 246-14 TODATE Function Parameters

Parameter	Description
p_dateArray	The value to convert.

Related Topics

- [DATETYPE Datatype](#)
The TODATE Function converts an item of this type to the type DATE, which is understood and properly handled as data by the database. The procedure CHOOSE_DATE Procedure enables the user to select the desired date.

246.3.19 WHO_CALLED_ME Procedure

This procedure returns information (in the form of output parameters) about the PL/SQL code unit that invoked it.

Syntax

```
OWA_UTIL.WHO_CALLED_ME (
    owner          OUT    VARCHAR2,
    name           OUT    VARCHAR2,
    lineno         OUT    NUMBER,
    caller_t       OUT    VARCHAR2);
```

Parameters

Table 246-15 WHO_CALLED_ME Procedure Parameters

Parameter	Description
owner	The owner of the program unit.

Table 246-15 (Cont.) WHO_CALLED_ME Procedure Parameters

Parameter	Description
name	The name of the program unit. This is the name of the package, if the calling program unit is wrapped in a package, or the name of the procedure or function if the calling program unit is a standalone procedure or function. If the calling program unit is part of an anonymous block, this is NULL.
lineno	The line number within the program unit where the call was made.
caller_t	The type of program unit that made the call. The possibilities are: package body, anonymous block, procedure, and function. Procedure and function are only for standalone procedures and functions.

SDO_CS

The `SDO_CS` package contains functions and procedures for working with coordinate systems.

You can perform explicit coordinate transformations on a single geometry or an entire layer of geometries (that is, all geometries in a specified column in a table).

For a complete description of this package within the context of Oracle Spatial, see `SDO_CS` in the *Oracle Spatial and Graph Developer's Guide*.

SDO_CSW_PROCESS

The `SDO_CSW_PROCESS` package contains subprograms for various processing operations related to support for Catalog Services for the Web (CSW).

For a complete description of this package within the context of Oracle Spatial, see `SDO_CSW_PROCESS` in the *Oracle Spatial and Graph Developer's Guide*.

SDO_GCDR

The `SDO_GCDR` package contains the Oracle Spatial geocoding subprograms, which let you geocode unformatted postal addresses.

For a complete description of this package within the context of Oracle Spatial, see `SDO_GCDR` in the *Oracle Spatial and Graph Developer's Guide*.

SDO_GEOM

The `SDO_GEOM` package contains the geometry functions.

These can be grouped into the following categories (with examples of each):

- **Relationship (True/False) between two objects:** `RELATE`, `WITHIN_DISTANCE`
- **Validation:** `VALIDATE_GEOMETRY_WITH_CONTEXT`, `VALIDATE_LAYER_WITH_CONTEXT`
- **Single-object operations:** `SDO_ARC_DENSIFY`, `SDO_AREA`, `SDO_BUFFER`, `SDO_CENTROID`, `SDO_CONVEXHULL`, `SDO_LENGTH`, `SDO_MBR`, `SDO_POINTONSURFACE`
- **Two-object operations:** `SDO_DISTANCE`, `SDO_DIFFERENCE`, `SDO_INTERSECTION`, `SDO_UNION`, `SDO_XOR`

For a complete description of this package within the context of Oracle Spatial, see `SDO_GEOM` in the *Oracle Spatial and Graph Developer's Guide*.

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SDO_GEOR

The `SDO_GEOR` package contains functions and procedures for the Oracle Spatial GeoRaster feature, which lets you store, index, query, analyze, and deliver raster image data and its associated spatial vector geometry data and metadata.

For complete description of this package within the context of Oracle Spatial, see `SDO_GEOR` in the *Oracle Spatial and Graph GeoRaster Developer's Guide*.

SDO_GEOR_ADMIN

The `SDO_GEOR_ADMIN` package contains subprograms for administrative operations related to GeoRaster.

For a complete description of this package within the context of Oracle Spatial, see `SDO_GEOR_ADMIN` in the *Oracle Spatial and Graph GeoRaster Developer's Guide*.

SDO_GEOR_AGGR

The `SDO_GEOR_AGGR` package provides an interface to the `SDO_GEOR_AGGR` package for performing aggregate operations on GeoRaster objects.

For a complete description of this package within the context of Oracle Spatial, see `SDO_GEOR_AGGR` in the *Oracle Spatial and Graph GeoRaster Developer's Guide*.

SDO_GEOR_RA

The `SDO_GEOR_RA` package provides an interface to the `SDO_GEOR_RA` package for performing raster algebra and analytic operations related to GeoRaster.

For a complete description of this package within the context of Oracle Spatial, see `SDO_GEOR_RA` in the *Oracle Spatial and Graph GeoRaster Developer's Guide*.

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SDO_GEOR_UTL

The `SDO_GEOR_UTL` package contains utility functions and procedures for the Oracle Spatial GeoRaster feature, including those related to using triggers with GeoRaster data.

For complete description of this package within the context of Oracle Spatial, see `SDO_GEOR_UTL` in the *Oracle Spatial and Graph GeoRaster Developer's Guide*.

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SDO_LRS

The `SDO_LRS` package contains functions that create, modify, query, and convert linear referencing elements.

For a complete description of this package within the context of Oracle Spatial, see `SDO_LRS` in the *Oracle Spatial and Graph Developer's Guide*.

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SDO_MIGRATE

The `SDO_MIGRATE` package lets you upgrade geometry tables from previous releases of Oracle Spatial.

For a complete description of this package within the context of Oracle Spatial, see `SDO_MIGRATE` in the *Oracle Spatial and Graph Developer's Guide*.

SDO_NET

The `SDO_NET` package contains functions and procedures for working with data modeled as nodes and links in a network.

For a complete description of this package within the context of Oracle Spatial, see `SDO_NET` in the *Oracle Spatial and Graph Topology Data Model and Network Data Model Graph Developer's Guide*.

259

SDO_NFE

The `SDO_NFE` package contains functions and procedures for performing network feature editing.

For a complete description of this package within the context of Oracle Spatial and Graph, see [SDO_NFE](#) in the *Oracle Spatial and Graph Topology Data Model and Network Data Model Graph Developer's Guide*.

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SDO_OLS

The `SDO_OLS` package contains subprograms for Spatial OpenLS support.

For a complete description of this package within the context of Oracle Spatial, see `SDO_OLS` in the *Oracle Spatial and Graph Developer's Guide*.

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SDO_PC_PKG

The `SDO_PC_PKG` package contains subprograms to support the use of point clouds in Spatial.

For a complete description of this package within the context of Oracle Spatial, see `SDO_PC_PKG` in the *Oracle Spatial and Graph Developer's Guide*.

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SDO_SAM

The `SDO_SAM` package contains functions and procedures for spatial analysis and data mining.

For a complete description of this package within the context of Oracle Spatial, see `SDO_SAM` in the *Oracle Spatial and Graph Developer's Guide*.

SDO_TIN_PKG

The `SDO_TIN_PKG` package contains subprograms to support the use of triangulated irregular networks (TINs) in Spatial.

For a complete description of this package within the context of Oracle Spatial, see `SDO_TIN_PKG` in the

SDO_TOPO

The `SDO_TOPO` package contains subprograms for creating and managing Oracle Spatial topologies.

For a complete description of this package within the context of Oracle Spatial, see `SDO_TOPO` in the *Oracle Spatial and Graph Topology Data Model and Network Data Model Graph Developer's Guide*.

SDO_TOPO_MAP

The `SDO_TOPO_MAP` package contains subprograms for editing Oracle Spatial topologies using a cache (TopoMap object).

For a complete description of this package within the context of Oracle Spatial, see `SDO_TOPO_MAP` in the *Oracle Spatial and Graph Topology Data Model and Network Data Model Graph Developer's Guide*.

SDO_TUNE

The `SDO_TUNE` package contains Spatial tuning functions and procedures.

For complete description of this package within the context of Oracle Spatial, see `SDO_TUNE` in the *Oracle Spatial and Graph Developer's Guide*.

267

SDO_UTIL

The `SDO_UTIL` package contains the utility functions and procedures for Oracle Spatial.

For complete description of this package within the context of Oracle Spatial, see `SDO_UTIL` in the *Oracle Spatial and Graph Developer's Guide*.

SDO_WFS_LOCK

The `SDO_WFS_LOCK` package contains subprograms for WFS support for registering and unregistering feature tables. Registering a feature table enables the table for WFS transaction locking; unregistering a feature table disables the table for WFS transaction locking.

For a complete description of this package within the context of Oracle Spatial, see `SDO_WFS_LOCK` in the *Oracle Spatial and Graph Developer's Guide*.

SDO_WFS_PROCESS

The `SDO_WFS_PROCESS` package contains subprograms for various processing operations related to support for Web Feature Services.

For a complete description of this package within the context of Oracle Spatial, see `SDO_WFS_PROCESS` in the *Oracle Spatial and Graph Developer's Guide*.

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SEM_APIS

The `SEM_APIS` package contains subprograms for working with the Resource Description Framework (RDF) and Web Ontology Language (OWL) in an Oracle database.

For a complete description of this package within the context of Oracle Database semantic technology support, see `SEM_APIS` in the *Oracle Spatial and Graph RDF Semantic Graph Developer's Guide*.

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SEM_OLS

The `SEM_OLS` package provides an interface to the `SEM_OLS` package for providing triple-level security to RDF data, using Oracle Label Security (OLS).

For a complete description of this package, see `SEM_OLS` in the *Oracle Spatial and Graph RDF Semantic Graph Developer's Guide*.

SEM_PERF

The `SEM_PERF` package contains subprograms for examining and enhancing the performance of the Resource Description Framework (RDF) and Web Ontology Language (OWL) support in an Oracle database.

For a complete description of this package within the context of Oracle Database semantic technology support, see `SEM_PERF` in the *Oracle Spatial and Graph RDF Semantic Graph Developer's Guide*.

SEM_RDFCTX

The `SEM_RDFCTX` package contains subprograms for managing extractor policies and semantic indexes created for documents.

For a complete description of this package within the context of Oracle Database semantic technology support, see `SEM_RDFCTX` in the *Oracle Spatial and Graph RDF Semantic Graph Developer's Guide*

SEM_RDFSA

The `SEM_RDFSA` package contains subprograms for providing fine-grained access control to RDF data, using either a virtual private database (VPD) or Oracle Label Security (OLS).

For a complete description of this package within the context of Oracle Database semantic technology support, see `SEM_RDFSA` in the *Oracle Spatial and Graph RDF Semantic Graph Developer's Guide*.

UTL_CALL_STACK

The `UTL_CALL_STACK` package provides an interface to provide information about currently executing subprograms.

Functions return subprogram names, unit names, owner names, edition names, and line numbers for given dynamic depths. Other functions return error stack information.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [UTL_CALL_STACK Operational Notes](#)
- [UTL_CALL_STACK Exceptions](#)
- [Data Structures](#)
- [Summary of UTL_CALL_STACK Subprograms](#)



See Also:

- *Oracle Database PL/SQL Language Reference* regarding Conditional Compilation
- *Oracle Database Development Guide* regarding Using PL/Scope and Using the PL/SQL Hierarchical Profiler

275.1 UTL_CALL_STACK Overview

The `UTL_CALL_STACK` package provides an interface for PL/SQL programmers to obtain information about currently executing programs including the subprogram name from dynamic and lexical stacks and the depths of those stacks.

Individual functions return subprogram names, unit names, owner names, edition names, and line numbers for given dynamic depths. More functions return error stack information. Such information can be used to create more revealing error logs and application execution traces.

Dynamic Depth

The dynamic depth of an executing instance of a PL/SQL subprogram is defined recursively.

- The dynamic depth of the currently executing subprogram instance is one.
- Otherwise, the dynamic depth of the subprogram instance is one more than the dynamic depth of the subprogram it invoked.
- If there is a SQL, Java, or other non-PL/SQL context that invoked or was invoked by an executing subprogram, it occupies a level on the call stack as if it were a subprogram.

In the case of a call stack in which A calls B, which calls C, which calls D, which calls E, which calls F, which calls E, this stack can be written as a line with the dynamic depths underneath:

```
A B C D E F E
7 6 5 4 3 2 1
```

Lexical Depth

The lexical depth of a PL/SQL subprogram is defined recursively.

- The lexical depth of a unit, an anonymous block, trigger, or ADT is one (1).
- The lexical depth of a subprogram defined within another object is one plus the lexical depth of that object.

Blocks do not affect lexical depth.

Error Depth

The error depth is the number of errors on the error stack.

For example, consider the following anonymous block.

```
BEGIN
  BEGIN
    ... (1)
    raise zero_divide;
  EXCEPTION
    when others then
      raise no_data_found;
  END;
EXCEPTION
  WHEN others THEN
    ... (2)
END;
```

The error depth at (1) is zero and at (2) is two.

Backtrace

The backtrace is a trace from where the exception was thrown to where the backtrace was examined.

Consider a call stack in which A calls B which calls C and C raises an exception. If the backtrace was examined in C, the backtrace would have one unit, C, and the backtrace depth would be one. If it was examined in A, it would have three units, A, B and C, and backtrace depth would be three.

The depth of a backtrace is zero in the absence of an exception.

275.2 UTL_CALL_STACK Security Model

EXECUTE on UTL_CALL_STACK is granted to PUBLIC.

The UTL_CALL_STACK package does not show wrapped program units. For example, consider a call stack in which program unit A calls B, which calls C, and in turn calls UTL_CALL_STACK to determine the subprogram list. If program unit B is wrapped, then the subprogram list only shows program unit C.

275.3 UTL_CALL_STACK Operational Notes

Certain operational notes apply to UTL_CALL_STACK.

- Compiler optimizations can change lexical, dynamic and backtrace depth.
- UTL_CALL_STACK is not supported past RPC boundaries. For example, if A calls remote procedure B, B will not be able to obtain information about A using UTL_CALL_STACK.
- Lexical unit information is available through the PL/SQL conditional compilation feature and is therefore not exposed through UTL_CALL_STACK.

275.4 UTL_CALL_STACK Exceptions

This table lists the exceptions raised by UTL_CALL_STACK.

Table 275-1 Exceptions Raised by UTL_CALL_STACK

Exception	Error Code	Description
BAD_DEPTH_INDICATOR	64610	This exception is raised when a provided depth is out of bounds. Dynamic and lexical depth are positive integer values. Error and backtrace depths are non-negative integer values and are zero only in the absence of an exception.

275.5 UTL_CALL_STACK Data Structures

The UTL_CALL_STACK package defines a VARRAY type, UNIT_QUALIFIED_NAME.

VARRAY Type

- [UNIT_QUALIFIED_NAME](#)

275.5.1 UNIT_QUALIFIED_NAME

This data structure is a varray whose individual elements are, in order, the unit name, any lexical parents of the subprogram, and the subprogram name.

```
TYPE UNIT_QUALIFIED_NAME IS VARRAY(256) OF VARCHAR2(32767);
```

Example

Consider the following contrived PL/SQL procedure:

```
PROCEDURE topLevel IS
  FUNCTION localFunction(...) RETURNS VARCHAR2 IS
    FUNCTION innerFunction(...) RETURNS VARCHAR2 IS
      BEGIN
        DECLARE
          localVar PLS_INTEGER;
        BEGIN
          ... (1)
        END;
      END;
    END;
```

```
BEGIN
  ...
END;
```

The unit qualified name at (1) would be

```
["topLevel", "localFunction", "innerFunction"]
```

If the unit were an anonymous block, the unit name would be "__anonymous_block"

275.6 Summary of UTL_CALL_STACK Subprograms

This table lists the subprograms in the UTL_CALL_STACK package.

Table 275-2 UTL_CALL_STACK Package Subprograms

Subprogram	Description
BACKTRACE_DEPTH Function	Returns the number of backtrace items in the backtrace
BACKTRACE_LINE Function	Returns the line number of the unit at the specified backtrace depth
BACKTRACE_UNIT Function	Returns the name of the unit at the specified backtrace depth
CURRENT_EDITION Function	Returns the current edition name of the unit of the subprogram at the specified dynamic depth
CONCATENATE_SUBPROGRAM Function	Returns a concatenated form of a unit-qualified name
DYNAMIC_DEPTH Function	Returns the number of subprograms on the call stack
ERROR_DEPTH Function	Returns the number of errors on the error stack
ERROR_MSG Function	Returns the error message of the error at the specified error depth
ERROR_NUMBER Function	Returns the error number of the error at the specified error depth
LEXICAL_DEPTH Function	Returns the lexical nesting level of the subprogram at the specified dynamic depth
OWNER Function	Returns the owner name of the unit of the subprogram at the specified dynamic depth
UNIT_LINE Function	Returns the line number of the unit of the subprogram at the specified dynamic depth
SUBPROGRAM Function	Returns the unit-qualified name of the subprogram at the specified dynamic depth

275.6.1 BACKTRACE_DEPTH Function

This function returns the number of backtrace items in the backtrace.

Syntax

```
UTL_CALL_STACK.BACKTRACE_DEPTH
RETURN PLS_INTEGER;
```

Return Values

The number of backtrace items in the backtrace, zero in the absence of an exception.

275.6.2 BACKTRACE_LINE Function

This function returns the line number of the unit at the specified backtrace depth.

Syntax

```
UTL_CALL_STACK.BACKTRACE_LINE (  
    backtrace_depth IN PLS_INTEGER)  
RETURN PLS_INTEGER;
```

Parameters

Table 275-3 *BACKTRACE_LINE Function Parameters*

Parameter	Description
backtrace_depth	Depth in backtrace

Return Values

The line number of the unit at the specified backtrace depth

275.6.3 BACKTRACE_UNIT Function

This function returns the name of the unit at the specified backtrace depth.

Syntax

```
UTL_CALL_STACK.BACKTRACE_UNIT (  
    backtrace_depth IN PLS_INTEGER)  
RETURN VARCHAR2;
```

Parameters

Table 275-4 *BACKTRACE_UNIT Function Parameters*

Parameter	Description
backtrace_depth	Depth in backtrace

Return Values

The name of the unit at the specified backtrace depth

275.6.4 CURRENT_EDITION Function

This function returns the current edition name of the unit of the subprogram at the specified dynamic depth.

Syntax

```
UTL_CALL_STACK.CURRENT_EDITION (  
    dynamic_depth    IN    PLS_INTEGER)  
    RETURN VARCHAR2;
```

Parameters

Table 275-5 *CURRENT_EDITION Function Parameters*

Parameter	Description
dynamic_depth	Depth in the error stack

Return Values

The current edition name of the unit of the subprogram at the specified dynamic depth

275.6.5 CONCATENATE_SUBPROGRAM Function

This function returns a concatenated form of a unit-qualified name.

Syntax

```
UTL_CALL_STACK.CONCATENATE_SUBPROGRAM (  
    qualified_name    IN    UNIT_QUALIFIED_NAME)  
    RETURN VARCHAR2;
```

Parameters

Table 275-6 *CONCATENATE_SUBPROGRAM Function Parameters*

Parameter	Description
qualified_name	A unit-qualified name

Return Values

A string of the form `UNIT.SUBPROGRAM.LOCAL_SUBPROGRAM`

275.6.6 DYNAMIC_DEPTH Function

This function returns the number of subprograms on the call stack.

Syntax

```
UTL_CALL_STACK.DYNAMIC_DEPTH  
    RETURN PLS_INTEGER;
```

Return Values

The number of subprograms on the call stack

275.6.7 ERROR_DEPTH Function

This function returns the number of errors on the error stack.

Syntax

```
UTL_CALL_STACK.ERROR_DEPTH  
RETURN PLS_INTEGER;
```

Return Values

The number of errors on the error stack

275.6.8 ERROR_MSG Function

This function returns the error message of the error at the specified error depth.

Syntax

```
UTL_CALL_STACK.ERROR_MSG (  
    error_depth IN PLS_INTEGER)  
RETURN VARCHAR2;
```

Parameters

Table 275-7 *ERROR_MSG Function Parameters*

Parameter	Description
error_depth	Depth in the error stack

Return Values

The error message of the error at the specified error depth.

275.6.9 ERROR_NUMBER Function

This function returns the error number of the error at the specified error depth.

Syntax

```
UTL_CALL_STACK.ERROR_NUMBER (  
    error_depth IN PLS_INTEGER)  
RETURN PLS_INTEGER;
```

Parameters

Table 275-8 *ERROR_NUMBER Function Parameters*

Parameter	Description
error_depth	Depth in the call stack

Return Values

The error number of the error at the specified error depth

275.6.10 LEXICAL_DEPTH Function

This function returns the lexical nesting level of the subprogram at the specified dynamic depth.

Syntax

```
UTL_CALL_STACK.LEXICAL_DEPTH (  
    dynamic_depth    IN    PLS_INTEGER)  
RETURN PLS_INTEGER;
```

Parameters

Table 275-9 *LEXICAL_DEPTH Function Parameters*

Parameter	Description
dynamic_depth	Depth in the call stack

Return Values

The lexical nesting level of the subprogram at the specified dynamic depth

275.6.11 OWNER Function

This function returns the owner name of the unit of the subprogram at the specified dynamic depth.

Syntax

```
UTL_CALL_STACK.OWNER (  
    dynamic_depth    IN    PLS_INTEGER)  
RETURN VARCHAR2;
```

Parameters

Table 275-10 *OWNER Function Parameters*

Parameter	Description
dynamic_depth	Depth in the call stack

Return Values

The owner name of the unit of the subprogram at the specified dynamic depth

275.6.12 UNIT_LINE Function

This function returns the line number of the unit of the subprogram at the specified dynamic depth.

Syntax

```
UTL_CALL_STACK.UNIT_LINE (  
    dynamic_depth IN PLS_INTEGER)  
RETURN PLS_INTEGER;
```

Parameters

Table 275-11 *UNIT_LINE Function Parameters*

Parameter	Description
dynamic_depth	Depth in the call stack

Return Values

The line number of the unit of the subprogram at the specified dynamic depth

275.6.13 SUBPROGRAM Function

This function returns the unit-qualified name of the subprogram at the specified dynamic depth.

Syntax

```
UTL_CALL_STACK.SUBPROGRAM (  
    dynamic_depth IN PLS_INTEGER)  
RETURN UNIT_QUALIFIED_NAME;
```

Parameters

Table 275-12 *SUBPROGRAM Function Parameters*

Parameter	Description
dynamic_depth	Depth in the call stack

Return Values

Returns the unit-qualified name of the subprogram at the specified dynamic depth

276

UTL_COLL

The UTL_COLL package lets PL/SQL programs use collection locators to query and update.

This chapter contains the following topics:

- [Summary of UTL_COLL Subprograms](#)

276.1 Summary of UTL_COLL Subprograms

The UTL_COLL package has one subprogram, the IS_LOCATOR function.

Table 276-1 UTL_COLL Package Subprograms

Subprogram	Description
IS_LOCATOR Function	Determines whether a collection item is actually a locator or not

276.1.1 IS_LOCATOR Function

This function determines whether a collection item is actually a locator or not.

Syntax

```
UTL_COLL.IS_LOCATOR (  
    coln IN STANDARD)  
    RETURNS BOOLEAN;
```

Pragmas

Asserts WNDS, WNPS and RNPS pragmas

Parameters

Table 276-2 IS_LOCATOR Function Parameters

Parameter	Description
coln	Nested table or varray item.

Return Values

Table 276-3 IS_LOCATOR Function Return Values

Return Value	Description
1	Collection item is indeed a locator.
0	Collection item is not a locator.

Examples

```
CREATE OR REPLACE TYPE list_t AS TABLE OF VARCHAR2(20);
/

CREATE OR REPLACE TYPE phone_book_t AS OBJECT (
    pno number,
    ph list_t );
/

CREATE TABLE phone_book OF phone_book_t
    NESTED TABLE ph STORE AS nt_ph;
CREATE TABLE phone_book1 OF phone_book_t
    NESTED TABLE ph STORE AS nt_ph_1 RETURN LOCATOR;

INSERT INTO phone_book VALUES(1, list_t('650-633-5707','650-323-0953'));
INSERT INTO phone_book1 VALUES(1, list_t('415-555-1212'));

CREATE OR REPLACE PROCEDURE chk_coll IS
    plist list_t;
    plist1 list_t;
BEGIN
    SELECT ph INTO plist FROM phone_book WHERE pno=1;

    SELECT ph INTO plist1 FROM phone_book1 WHERE pno=1;

    IF (UTL_COLL.IS_LOCATOR(plist)) THEN
        DBMS_OUTPUT.PUT_LINE('plist is a locator');
    ELSE
        DBMS_OUTPUT.PUT_LINE('plist is not a locator');
    END IF;

    IF (UTL_COLL.IS_LOCATOR(plist1)) THEN
        DBMS_OUTPUT.PUT_LINE('plist1 is a locator');
    ELSE
        DBMS_OUTPUT.PUT_LINE('plist1 is not a locator');
    END IF;

END chk_coll;

SET SERVEROUTPUT ON
EXECUTE chk_coll;
```

277

UTL_COMPRESS

The `UTL_COMPRESS` package provides a set of data compression utilities.

This chapter contains the following topics:

- [Constants](#)
- [Exceptions](#)
- [Operational Notes](#)
- [Summary of UTL_COMPRESS Subprograms](#)

277.1 UTL_COMPRESS Constants

The maximum number of handles for piecewise operations can be defined by a constant.

```
UTLCOMP_MAX_HANDLE CONSTANT PLS_INTEGER := 5;
```

277.2 UTL_COMPRESS Exceptions

This table describes exceptions raised by `UTL_COMPRESS` subprograms.

Table 277-1 UTL_COMPRESS Exceptions

Exception	Description
<code>BUFFER_TOO_SMALL</code>	The compressed representation is too big.
<code>DATA_ERROR</code>	The input or output data stream was found to be an invalid format.
<code>INVALID_ARGUMENT</code>	One of the arguments was an invalid type or value.
<code>INVALID_HANDLE</code>	Invalid handle for piecewise compress or uncompress.
<code>STREAM_ERROR</code>	An error occurred during compression or uncompression of the data stream

277.3 UTL_COMPRESS Operational Notes

Certain operational notes apply to `UTL_COMPRESS`.

- It is the caller's responsibility to free the temporary `LOB` returned by the `LZ*` functions with `DBMS_LOB.FREETEMPORARY` call.
- A `BFILE` passed into `LZ_COMPRESS*` or `LZ_UNCOMPRESS*` has to be opened by `DBMS_LOB.FILEOPEN`.
- Under special circumstances (especially if the input has already been compressed) the output produced by one of the `UTL_COMPRESS` subprograms may be the same size, or even slightly larger than, the input.

- The output of the UTL_COMPRESS compressed data is compatible with gzip(with -n option)/gunzip on a single file.

277.4 Summary of UTL_COMPRESS Subprograms

This table lists the UTL_COMPRESS subprograms and briefly describes them.

Table 277-2 UTL_COMPRESS Package Subprograms

Subprogram	Description
ISOPEN Function	Checks to see if the handle to a piecewise (un)compress context is open or closed
LZ_COMPRESS Functions and Procedures	Compresses data using Lempel-Ziv compression algorithm
LZ_COMPRESS_ADD Procedure	Adds a piece of compressed data
LZ_COMPRESS_CLOSE	Closes and finishes piecewise compress operation
LZ_COMPRESS_OPEN	Initializes a piecewise context that maintains the compress state and data
LZ_UNCOMPRESS Functions and Procedures	Accepts compressed input, verifies it to be a valid and uncompresses it
LZ_UNCOMPRESS_EXTRACT Procedure	Extracts a piece of uncompressed data
LZ_UNCOMPRESS_OPEN Function	Initializes a piecewise context that maintains the uncompress state and data
LZ_UNCOMPRESS_CLOSE Procedure	Closes and finishes the piecewise uncompress

277.4.1 ISOPEN Function

This function checks to see if the handle to a piecewise (un)compress context is open or closed.

Syntax

```
UTL_COMPRESS.ISOPEN(  
    handle in binary_integer)  
RETURN BOOLEAN;
```

Parameters

Table 277-3 ISOPEN Function Parameters

Parameter	Description
handle	The handle to a piecewise uncompress context.

Return Values

TRUE if the given piecewise handle is opened, otherwise FALSE.

Examples

```
IF (UTL_COMPRESS.ISOPEN(myhandle) = TRUE) then
    UTL_COMPRESS.LZ_COMPRESS_CLOSE(myhandle, lob_1);
END IF;
```

Alternatively:

```
IF (UTL_COMPRESS.ISOPEN(myhandle) = TRUE) THEN
    UTL_COMPRESS.LZ_UNCOMPRESS_CLOSE(myhandle);
END IF;
```

277.4.2 LZ_COMPRESS Functions and Procedures

These functions and procedures compress data using Lempel-Ziv compression algorithm.

Syntax

This function accept a RAW as input, compress it and return the compressed RAW result and metadata:

```
UTL_COMPRESS.LZ_COMPRESS (
    src      IN      RAW,
    quality  IN      BINARY_INTEGER DEFAULT 6)
RETURN RAW;
```

This function accept a BLOB as input, compress it and returns a temporary BLOB for the compressed data:

```
UTL_COMPRESS.LZ_COMPRESS (
    src      IN      BLOB,
    quality  IN      BINARY_INTEGER DEFAULT 6)
RETURN BLOB;
```

This procedure returns the compressed data into the existing BLOB(dst) which is trimmed to the compressed data size:

```
UTL_COMPRESS.LZ_COMPRESS (
    src      IN      BLOB,
    dst      IN OUT NOCOPY BLOB,
    quality  IN      BINARY_INTEGER DEFAULT 6);
```

This function returns a temporary BLOB for the compressed data:

```
UTL_COMPRESS.LZ_COMPRESS (
    src      IN      BFILE,
    quality  IN      BINARY_INTEGER DEFAULT 6)
RETURN BLOB;
```

This procedure will return the compressed data into the existing BLOB(dst) which is trimmed to the compressed data size:

```
UTL_COMPRESS.LZ_COMPRESS (
    src      IN      BFILE,
    dst      IN OUT NOCOPY BLOB,
    quality  IN      BINARY_INTEGER DEFAULT 6);
```

Parameters

Table 277-4 LZ_COMPRESS Function and Procedures Parameters

Parameter	Description
src	Data (RAW, BLOB or BFILE) to be compressed.
dst	Destination for compressed data
quality	An integer in the range 1 to 9, 1=fast compression, 9=best compression, default=6

Usage Notes

- `quality` is an optional compression tuning value. It allows the `UTL_COMPRESS` user to choose between speed and compression quality, meaning the percentage of reduction in size. A faster compression speed will result in less compression of the data. A slower compression speed will result in more compression of the data. Valid values are [1..9], with 1=fastest and 9=slowest. The default 'quality' value is 6.

277.4.3 LZ_COMPRESS_ADD Procedure

This procedure adds a piece of compressed data.

Syntax

```
UTL_COMPRESS.LZ_COMPRESS_ADD (
    handle IN          BINARY_INTEGER,
    dst    IN OUT NOCOPY BLOB,
    src    IN          RAW);
```

Parameters

Table 277-5 LZ_COMPRESS_ADD Procedure Parameters

Parameter	Description
handle	The handle to a piecewise compress context.
dst	The opened LOB from <code>LZ_COMPRESS_OPEN</code> to store compressed data.
src	The input data to be compressed.

Exceptions

- `invalid_handle` - out of range invalid or unopened handle.
- `invalid_argument` - NULL handle, src, dst, or invalid dst.

277.4.4 LZ_COMPRESS_CLOSE

This procedure closes and finishes piecewise compress operation.

Syntax

```
UTL_COMPRESS.LZ_COMPRESS_CLOSE (
    handle IN          BINARY_INTEGER,
    dst     IN OUT NOCOPY BLOB);
```

Parameters

Table 277-6 LZ_COMPRESS_CLOSE Procedure Parameters

Parameter	Description
handle	The handle to a piecewise compress context.
dst	The opened LOB from LZ_COMPRESS_OPEN to store compressed data.

Exceptions

- `invalid_handle` - out of range invalid or uninitialized handle.
- `invalid_argument` - NULL handle, dst, or invalid dst.

277.4.5 LZ_COMPRESS_OPEN

This function initializes a piecewise context that maintains the compress state and data.

Syntax

```
UTL_COMPRESS.LZ_COMPRESS_OPEN (
    dst     IN OUT NOCOPY BLOB,
    quality IN          BINARY_INTEGER DEFAULT 6)
RETURN BINARY_INTEGER;
```

Parameters

Table 277-7 LZ_COMPRESS_OPEN Function Parameters

Parameter	Description
dst	User supplied LOB to store compressed data.
quality	Speed versus efficiency of resulting compressed output. <ul style="list-style-type: none"> • Valid values are the range 1..9, with a default value of 6. • 1=fastest compression, 9=slowest compression and best compressed file size.

Return Values

A handle to an initialized piecewise compress context.

Exceptions

- `invalid_handle` - invalid handle, too many open handles.

- `invalid_argument` - NULL `dst` or invalid quality specified.

Usage Notes

Close the opened handle with `LZ_COMPRESS_CLOSE`

- once the piecewise compress is completed
 - in the event of an exception in the middle of process
- because lack of doing so will cause these handles to leak.

277.4.6 LZ_UNCOMPRESS Functions and Procedures

This procedure accepts as input a `RAW`, `BLOB` or `BFILE` compressed string, verifies it to be a valid compressed value, uncompresses it using Lempel-Ziv compression algorithm, and returns the uncompressed `RAW` or `BLOB` result.

Syntax

This function returns uncompressed data as `RAW`:

```
UTL_COMPRESS.LZ_UNCOMPRESS (
    src IN RAW)
RETURN RAW;
```

This function returns uncompressed data as a temporary `BLOB`:

```
UTL_COMPRESS.LZ_UNCOMPRESS (
    src IN BLOB)
RETURN BLOB;
```

This procedure returns the uncompressed data into the existing `BLOB(dst)`, which will be trimmed to the uncompressed data size:

```
UTL_COMPRESS.LZ_UNCOMPRESS (
    src IN BLOB,
    dst IN OUT NOCOPY BLOB);
```

This function returns a temporary `BLOB` for the uncompressed data:

```
UTL_COMPRESS.LZ_UNCOMPRESS (
    src IN BFILE)
RETURN BLOB;
```

This procedure returns the uncompressed data into the existing `BLOB(dst)`. The original `dst` data will be overwritten.

```
UTL_COMPRESS.LZ_UNCOMPRESS (
    src IN BFILE,
    dst IN OUT NOCOPY BLOB);
```

Parameters

Table 277-8 LZ_UNCOMPRESS Function and Procedures Parameters

Parameter	Description
<code>src</code>	Compressed data.

Table 277-8 (Cont.) LZ_UNCOMPRESS Function and Procedures Parameters

Parameter	Description
dst	Destination for uncompressed data.

277.4.7 LZ_UNCOMPRESS_EXTRACT Procedure

This procedure extracts a piece of uncompressed data.

Syntax

```
UTL_COMPRESS.LZ_UNCOMPRESS_EXTRACT (
  handle IN          BINARY_INTEGER,
  dst     OUT NOCOPY RAW);
```

Parameters

Table 277-9 LZ_UNCOMPRESS_EXTRACT Function Parameters

Parameter	Description
handle	The handle to a piecewise uncompress context.
dst	The uncompressed data.

Exceptions

- `no_data_found` - finished uncompress.
- `invalid_handle` - out of range invalid or uninitialized handle.
- `invalid_argument` - NULL handle.

277.4.8 LZ_UNCOMPRESS_OPEN Function

This function initializes a piecewise context that maintains the uncompress state and data.

Syntax

```
UTL_COMPRESS.LZ_UNCOMPRESS_OPEN (
  src IN BLOB)
RETURN BINARY_INTEGER;
```

Parameters

Table 277-10 LZ_UNCOMPRESS_OPEN Function Parameters

Parameter	Description
src	The input data to be uncompressed.

Return Values

A handle to an initialized piecewise compress context.

Exceptions

- `invalid_handle` - invalid handle, too many open handles.
- `invalid_argument` - NULL src.

Usage Notes

Close the opened handle with `LZ_UNCOMPRESS_CLOSE`

- once the piecewise uncompress is completed
- in the event of an exception in the middle of process because lack of doing so will cause these handles to leak.

277.4.9 LZ_UNCOMPRESS_CLOSE Procedure

This procedure closes and finishes the piecewise uncompress.

Syntax

```
UTL_COMPRESS.LZ_UNCOMPRESS_CLOSE (
    handle IN BINARY_INTEGER);
```

Parameters

Table 277-11 LZ_UNCOMPRESS_CLOSE Procedure Parameters

Parameter	Description
handle	The handle to a piecewise uncompress context.

Exceptions

- `invalid_handle` - out of range invalid or uninitialized handle.
- `invalid_argument` - NULL handle.

UTL_ENCODE

The `UTL_ENCODE` package provides functions that encode `RAW` data into a standard encoded format so that the data can be transported between hosts.

You can use `UTL_ENCODE` functions to encode the body of email text. The package also contains the decode counterpart functions of the encode functions. The functions follow published standards for encoding to accommodate non-Oracle utilities on the sending or receiving ends.

This chapter contains the following topic:

- [Summary of UTL_ENCODE Subprograms](#)

278.1 Summary of UTL_ENCODE Subprograms

This table lists the `UTL_ENCODE` subprograms and briefly describes them.

Table 278-1 UTL_ENCODE Package Subprograms

Subprogram	Description
BASE64_DECODE Function	Reads the base 64-encoded <code>RAW</code> input string and decodes it to its original <code>RAW</code> value
BASE64_ENCODE Function	Encodes the binary representation of the <code>RAW</code> value into base 64 elements and returns it in the form of a <code>RAW</code> string
MIMEHEADER_DECODE Function	Decodes a string from mime header format
MIMEHEADER_ENCODE Function	Encodes a string into mime header format
QUOTED_PRINTABLE_DECODE Function	Reads the <code>varchar2</code> quoted printable format input string and decodes it to the corresponding <code>RAW</code> string
QUOTED_PRINTABLE_ENCODE Function	Reads the <code>RAW</code> input string and encodes it to the corresponding quoted printable format string
TEXT_DECODE Function	Decodes a character set sensitive text string
TEXT_ENCODE Function	Encodes a character set sensitive text string
UUDECODE Function	Reads the <code>RAW</code> uuencode format input string and decodes it to the corresponding <code>RAW</code> string
UUENCODE Function	Reads the <code>RAW</code> input string and encodes it to the corresponding uuencode format string

278.1.1 BASE64_DECODE Function

This function reads the base 64-encoded `RAW` input string and decodes it to its original `RAW` value.

Syntax

```
UTL_ENCODE.BASE64_DECODE (  
    r IN RAW)  
RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(base64_decode, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 278-2 BASE64_DECODE Function Parameters

Parameter	Description
r	The RAW string containing base 64-encoded data. There are no defaults or optional parameters.

Return Values

Table 278-3 BASE64_DECODE Function Return Values

Return	Description
RAW	Contains the decoded string

278.1.2 BASE64_ENCODE Function

This function encodes the binary representation of the `RAW` value into base 64 elements and returns it in the form of a `RAW` string.

Syntax

```
UTL_ENCODE.BASE64_ENCODE (  
    r IN RAW)  
RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(base64_encode, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 278-4 BASE64_ENCODE Function Parameters

Parameter	Description
r	The RAW value to be encoded. There are no defaults or optional parameters.

Return Values

Table 278-5 BASE64_ENCODE Function Return Values

Return	Description
RAW	Contains the encoded base 64 elements

278.1.3 MIMEHEADER_DECODE Function

This function accepts as input an "encoded word."

It uses the form:

```
=?<charset>?<encoding>?<encoded text>?=
=?ISO-8859-1?Q?Here is some encoded text?=
```

The <encoded text> is encapsulated in mime header tags which give the `MIMEHEADER_DECODE` function information about how to decode the string. The mime header metadata tags are stripped from the input string and the <encoded text> is converted to the base database character set as follows:

- If this is a UTF16 platform, convert the encoded text from UTF16 to ASCII
- If this is an EBCDIC platform, convert the encoded text from EBCDIC to ASCII
- If this is an ASCII or UTF8 platform, no conversion needed

The string is decoded using either quoted-printable or base64 decoding, as specified by the <encoding> metadata tag in the encoded word. The resulting converted and decoded text is returned to the caller as a `VARCHAR2` string.

Syntax

```
UTL_ENCODE.MIMEHEADER_DECODE (
    buf    IN  VARCHAR2 CHARACTER SET ANY_CS)
RETURN data VARCHAR2 CHARACTER SET buf%CHARSET;
```

Parameters

Table 278-6 MIMEHEADER_DECODE Function Parameters

Parameter	Description
buf	The encoded text data with mime header format tags.

Return Values

Table 278-7 MIMEHEADER_DECODE Function Return Values

Return	Description
data	The encoded text data with mime header format tags

Examples

```
v2:=utl_encode.mimeheader_decode('=?ISO-8859-1?Q?Here is some encoded text?');
```

278.1.4 MIMEHEADER_ENCODE Function

This function returns as an output an "encoded word".

The output is in the following form:

```
=?<charset>?<encoding>?<encoded text>?=
=?ISO-8859-1?Q?Here is some text?=-
```

The `buf` input parameter is the text to be encoded and becomes the `<encoded text>`.

The `<encoding>` value is either "Q" or "B" for quoted-printable encode or base64 encoding respectively. The `ENCODING` input parameter accepts as valid values `UTL_ENCODE.QUOTED_PRINTABLE` or `UTL_ENCODE.BASE64` or `NULL`. If `NULL`, quoted-printable encoding is selected as a default value.

The `<charset>` value is specified as the input parameter `encode_charset`. If `NULL`, the database character set is selected as a default value.

The mimeheader encoding process includes conversion of the `buf` input string to the character set specified by the `encode_charset` parameter. The converted string is encoded to either quoted-printable or base64 encoded format. The mime header tags are appended and prepended.

Finally, the string is converted to the base character set of the database:

- If this is a UTF16 platform, convert the encoded text to UTF16
- If this is an EBCDIC platform, convert the encoded text to EBCDIC
- If this is an ASCII or UTF8 platform, no conversion needed.

Syntax

```
UTL_ENCODE.MIMEHEADER_ENCODE (
    buf          IN  VARCHAR2 CHARACTER SET ANY_CS,
    encode_charset IN VARCHAR2 DEFAULT NULL,
    encoding     IN  PLS_INTEGER DEFAULT NULL)
RETURN string VARCHAR2 CHARACTER SET buf%CHARSET;
```

Parameters

Table 278-8 MIMEHEADER_ENCODE Function Parameters

Parameter	Description
buf	The text data.
encode_charset	The target character set.
encoding	The encoding format. Valid values are UTL_ENCODE.BASE64, UTL_ENCODE.QUOTED_PRINTABLE and NULL

Return Values

Table 278-9 MIMEHEADER_ENCODE Function Return Values

Return	Description
string	A VARCHAR2 encoded string with mime header format tags.

278.1.5 QUOTED_PRINTABLE_DECODE Function

This function reads the `varchar2` quoted printable format input string and decodes it to the corresponding `RAW` string.

Syntax

```
UTL_ENCODE.QUOTED_PRINTABLE_DECODE (
    r IN RAW)
RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(quoted_printable_decode, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 278-10 QUOTED_PRINTABLE_DECODE Function Parameters

Parameters	Description
r	The RAW string containing a quoted printable data string. There are no defaults or optional parameters.

Return Values

Table 278-11 QUOTED_PRINTABLE_DECODE Function Return Values

Return	Description
RAW	The decoded string

278.1.6 QUOTED_PRINTABLE_ENCODE Function

This function reads the RAW input string and encodes it to the corresponding quoted printable format string.

Syntax

```
UTL_ENCODE.QUOTED_PRINTABLE_ENCODE (
    r IN RAW)
RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(quoted_printable_encode, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 278-12 QUOTED_PRINTABLE_ENCODE Function Parameters

Parameter	Description
r	The RAW string. There are no defaults or optional parameters.

Return Values

Table 278-13 QUOTED_PRINTABLE_ENCODE Function Return Values

Return	Description
RAW	Contains the quoted printable string

278.1.7 TEXT_DECODE Function

This function converts the input text to the target character set as specified by the `encode_charset` parameter, if not NULL.

The encoded text is converted to the base character set of database, as follows:

- If this is a UTF16 platform, convert the encoded text from UTF16 to ASCII
- If this is an EBCDIC platform, convert the encoded text from EBCDIC to ASCII
- If this is an ASCII or UTF8 platform, no conversion needed

You can decode from either quoted-printable or base64 format, with regard to each encoding parameter. If NULL, quoted-printable is selected as a default decoding format. If `encode_charset` is not NULL, you convert the string from the specified character set to the database character set. The resulting decoded and converted text string is returned to the caller.

Syntax

```
UTL_ENCODE.TEXT_DECODE (
    buf          IN  VARCHAR2 CHARACTER SET ANY_CS,
    encode_charset IN VARCHAR2 DEFAULT NULL,
```

```
encoding          IN PLS_INTEGER DEFAULT NULL)
RETURN string VARCHAR2 CHARACTER SET buf%CHARSET;
```

Parameters

Table 278-14 TEXT_DECODE Function Parameters

Parameter	Description
buf	The encoded text data.
encode_charset	The source character set.
encoding	The encoding format. Valid values are UTL_ENCODE.BASE64, UTL_ENCODE.QUOTED_PRINTABLE and NULL.

Return Values

Table 278-15 TEXT_DECODE Function Return Values

Return	Description
string	A VARCHAR2 decoded text string.

Examples

```
v2:=UTL_ENCODE.TEXT_DECODE(
    'Here is some text',
    WE8ISO8859P1,
    UTL_ENCODE.BASE64);
```

278.1.8 TEXT_ENCODE Function

This function converts the input text to the target character set as specified by the `encode_charset` parameter, if not NULL.

The text is encoded to either base64 or quoted-printable format, as specified by the `encoding` parameter. Quoted-printable is selected as a default if ENCODING is NULL.

The encoded text is converted to the base character set of the database:

- If this is a UTF16 platform, convert the encoded text to UTF16
- If this is an EBCDIC platform, convert the encoded text to EBCDIC
- If this is an ASCII or UTF8 platform, no conversion needed

The resulting encoded and converted text string is returned to the caller.

Syntax

```
UTL_ENCODE.TEXT_ENCODE (
    buf          IN VARCHAR2 CHARACTER SET ANY_CS,
    encode_charset IN VARCHAR2 DEFAULT NULL,
    encoding     IN PLS_INTEGER DEFAULT NULL)
RETURN string VARCHAR2 CHARACTER SET buf%CHARSET;
```


Parameters

Table 278-16 TEXT_ENCODE Function Parameters

Parameter	Description
buf	The text data.
encode_charset	The target character set.
encoding	The encoding format. Valid values are UTL_ENCODE.BASE64, UTL_ENCODE.QUOTED_PRINTABLE and NULL

Return Values

Table 278-17 TEXT_ENCODE Function Return Values

Return	Description
string	A VARCHAR2 encoded string with mime header format tags.

Examples

```
v2:=utl_encode.text_encode(
    'Here is some text',
    'WE8ISO8859P1',
    UTL_ENCODE.BASE64);
```

278.1.9 UUDECODE Function

This function reads the RAW uuencode format input string and decodes it to the corresponding RAW string.

See "[UUENCODE Function](#)" for discussion of the cumulative nature of UUENCODE and UUDECODE for data streams.

Syntax

```
UTL_ENCODE.UUDECODE (
    r IN RAW)
RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(uuencode, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 278-18 UUDECODE Function Parameters

Parameter	Description
r	The RAW string containing the uuencoded data string. There are no defaults or optional parameters.

Return Values

Table 278-19 UUECODE Function Return Values

Return	Description
RAW	The decoded RAW string

278.1.10 UUECODE Function

This function reads the RAW input string and encodes it to the corresponding uuencode format string.

The output of this function is cumulative, in that it can be used to encode large data streams, by splitting the data stream into acceptably sized RAW values, encoded, and concatenated into a single encoded string.

Syntax

```
UTL_ENCODE.UUECODE (
  r          IN RAW,
  type       IN PLS_INTEGER DEFAULT 1,
  filename   IN VARCHAR2 DEFAULT NULL,
  permission IN VARCHAR2 DEFAULT NULL) RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(uuencode, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 278-20 UUECODE Function Parameters

Parameter	Description
r	RAW string
type	Optional number parameter containing the type of uuencoded output. Options: complete—a defined PL/SQL constant with a value of 1. (default) header_piece ...middle_piece ...end_piece
filename	Optional varchar2 parameter containing the uuencode filename; the default is uuencode.txt
permission	Optional varchar2 parameter containing the permission mode; the default is 0 (a text string zero).

Return Values

Table 278-21 UUECODE Function Return Values

Return	Description
RAW	Contains the uuencode format string

UTL_FILE

With the `UTL_FILE` package, PL/SQL programs can read and write operating system text files. `UTL_FILE` provides a restricted version of operating system stream file I/O.

This chapter contains the following topics:

- [Security Model](#)
- [Operational Notes](#)
- [Rules and Limits](#)
- [Exceptions](#)
- [Examples](#)
- [Data Structures](#)
- [Summary of UTL_FILE Subprograms](#)

279.1 UTL_FILE Security Model

The set of files and directories that are accessible to the user through `UTL_FILE` is controlled by a number of factors and database parameters. Foremost of these is the set of directory objects that have been granted to the user.

The nature of directory objects is discussed in the *Oracle Database SQL Language Reference*.

Assuming the user has both `READ` and `WRITE` access to the directory object `USER_DIR`, the user can open a file located in the operating system directory described by `USER_DIR`, but not in subdirectories or parent directories of this directory.

Lastly, the client (text I/O) and server implementations are subject to operating system file permission checking.

`UTL_FILE` provides file access both on the client side and on the server side. When run on the server, `UTL_FILE` provides access to all operating system files that are accessible from the server. On the client side, as in the case for Forms applications, `UTL_FILE` provides access to operating system files that are accessible from the client.

Directory objects offer more flexibility and granular control to the `UTL_FILE` application administrator, can be maintained dynamically (that is, without shutting down the database), and are consistent with other Oracle tools. `CREATE ANY DIRECTORY` privilege is granted only to `SYS` and `SYSTEM` by default.



Note:

Use the `CREATE DIRECTORY` feature for directory access verification.

Note that neither hard nor symbolic links are supported.

On UNIX systems, the owner of a file created by the `FOPEN` function is the owner of the shadow process running the instance. Normally, this owner is `ORACLE`. Files created using `FOPEN` are always writable and readable using the `UTL_FILE` subprograms. However, non-privileged operating system users who need to read these files outside of PL/SQL may need access from a system administrator.

 **WARNING:**

The privileges needed to access files in a directory object are operating system specific. `UTL_FILE` directory object privileges give you read and write access to all files within the specified directory.

279.2 UTL_FILE Operational Notes

Keep these notes in mind when using `UTL_FILE`.

The file location and file name parameters are supplied to the `FOPEN` function as separate strings, so that the file location can be checked against the list of accessible directories as specified by the `ALL_DIRECTORIES` view of accessible directory objects. Together, the file location and name must represent a legal filename on the system, and the directory must be accessible. A subdirectory of an accessible directory is not necessarily also accessible; it too must be specified using a complete path name matching an `ALL_DIRECTORIES` object.

`UTL_FILE` implicitly interprets line terminators on read requests, thereby affecting the number of bytes returned on a `GET_LINE` call. For example, the `len` parameter of `UTL_FILE.GET_LINE` specifies the requested number of bytes of character data. The number of bytes actually returned to the user will be the lesser of:

- The `GET_LINE len` parameter, or
- The number of bytes until the next line terminator character, or
- The `max_linesize` parameter specified by `UTL_FILE.FOPEN`

The `FOPEN max_linesize` parameter must be a number in the range 1 and 32767. If unspecified, Oracle supplies a default value of 1024. The `GET_LINE len` parameter must be a number in the range 1 and 32767. If unspecified, Oracle supplies the default value of `max_linesize`. If `max_linesize` and `len` are defined to be different values, then the lesser value takes precedence.

`UTL_FILE.GET_RAW` ignores line terminators.

`UTL_FILE` expects that files opened by `UTL_FILE.FOPEN` in text mode are encoded in the database character set. It expects that files opened by `UTL_FILE.FOPEN_NCHAR` in text mode are encoded in the UTF8 character set. If an opened file is not encoded in the expected character set, the result of an attempt to read the file is indeterminate. When data encoded in one character set is read and Globalization Support is told (such as by means of `NLS_LANG`) that it is encoded in another character set, the result is indeterminate. If `NLS_LANG` is set, it should therefore be the same as the database character set.

279.3 UTL_FILE Rules and Limits

Operating system-specific parameters, such as C-shell environment variables under UNIX, cannot be used in the file location or file name parameters.

UTL_FILE I/O capabilities are similar to standard operating system stream file I/O (OPEN, GET, PUT, CLOSE) capabilities, but with some limitations. For example, you call the FOPEN function to return a file handle, which you use in subsequent calls to GET_LINE or PUT to perform stream I/O to a file. When file I/O is done, you call FCLOSE to complete any output and free resources associated with the file.

Note:

The UTL_FILE package is similar to the client-side TEXT_IO package currently provided by Oracle Procedure Builder. Restrictions for a server implementation require some API differences between UTL_FILE and TEXT_IO. In PL/SQL file I/O, errors are returned using PL/SQL exceptions.

279.4 UTL_FILE Exceptions

This table describes exceptions raised by UTL_FILE subprograms.

Table 279-1 UTL_FILE Package Exceptions

Exception Name	Description
INVALID_PATH	File location is invalid.
INVALID_MODE	The open_mode parameter in FOPEN is invalid.
INVALID_FILEHANDLE	File handle is invalid.
INVALID_OPERATION	File could not be opened or operated on as requested.
READ_ERROR	Destination buffer too small, or operating system error occurred during the read operation
WRITE_ERROR	Operating system error occurred during the write operation.
INTERNAL_ERROR	Unspecified PL/SQL error
CHARSETMISMATCH	A file is opened using FOPEN_NCHAR, but later I/O operations use nonchar functions such as PUTF or GET_LINE.
FILE_OPEN	The requested operation failed because the file is open.
INVALID_MAXLINESIZE	The MAX_LINESIZE value for FOPEN () is invalid; it should be within the range 1 to 32767.
INVALID_FILENAME	The filename parameter is invalid.
ACCESS_DENIED	Permission to access to the file location is denied.
INVALID_OFFSET	Causes of the INVALID_OFFSET exception: <ul style="list-style-type: none"> • ABSOLUTE_OFFSET = NULL and RELATIVE_OFFSET = NULL, or • ABSOLUTE_OFFSET < 0, or • Either offset caused a seek past the end of the file

Table 279-1 (Cont.) UTL_FILE Package Exceptions

Exception Name	Description
DELETE_FAILED	The requested file delete operation failed.
RENAME_FAILED	The requested file rename operation failed.

Procedures in UTL_FILE can also raise predefined PL/SQL exceptions such as NO_DATA_FOUND or VALUE_ERROR.

279.5 UTL_FILE Examples

These two examples show use of the procedure.

Example 1



Note:

The examples are UNIX-specific.

Given the following:

```
SQL> CREATE DIRECTORY log_dir AS '/appl/gl/log';
SQL> GRANT READ ON DIRECTORY log_dir TO DBA;
SQL> GRANT WRITE ON DIRECTORY log_dir TO DBA;

SQL> CREATE DIRECTORY USER_DIR AS '/appl/gl/user';
SQL> GRANT READ ON DIRECTORY USER_DIR TO PUBLIC;
SQL> GRANT WRITE ON DIRECTORY USER_DIR TO PUBLIC;
```

The following file locations and filenames are valid and accessible as follows:

File Location	Filename	READ and WRITE
/appl/gl/log	L12345.log	Users with DBA privilege
/appl/gl/user	u12345.tmp	All users

The following file locations and filenames are invalid:

File Location	Filename	Invalid Because
/appl/gl/log/backup	L12345.log	# subdirectories are not accessible
/APPL/gl/log	L12345.log	# directory strings must follow case sensitivity rules as required by the O/S
/appl/gl/log	backup/L1234.log	# filenames may not include portions of directory paths

File Location	Filename	Invalid Because
/user/tmp	L12345.log	# no corresponding CREATE DIRECTORY command has been issued

Example 2

```

DECLARE
  V1 VARCHAR2(32767);
  F1 UTL_FILE.FILE_TYPE;
BEGIN
  -- In this example MAX_LINESIZE is less than GET_LINE's length request
  -- so the number of bytes returned will be 256 or less if a line terminator is seen.
  F1 := UTL_FILE.FOPEN('USER_DIR', 'u12345.tmp', 'R', 256);
  UTL_FILE.GET_LINE(F1, V1, 32767);
  UTL_FILE.FCLOSE(F1);

  -- In this example, FOPEN's MAX_LINESIZE is NULL and defaults to 1024,
  -- so the number of bytes returned will be 1024 or less if a line terminator is
  -- seen.
  F1 := UTL_FILE.FOPEN('USER_DIR', 'u12345.tmp', 'R');
  UTL_FILE.GET_LINE(F1, V1, 32767);
  UTL_FILE.FCLOSE(F1);

  -- In this example, GET_LINE doesn't specify a number of bytes, so it defaults to
  -- the same value as FOPEN's MAX_LINESIZE which is NULL in this case and defaults to
  -- 1024.
  -- So the number of bytes returned will be 1024 or less if a line terminator is
  -- seen.
  F1 := UTL_FILE.FOPEN('USER_DIR', 'u12345.tmp', 'R');
  UTL_FILE.GET_LINE(F1, V1);
  UTL_FILE.FCLOSE(F1);
END;

```

279.6 UTL_FILE Data Structures

The UTL_FILE package defines a RECORD type.

Record Types

- [FILETYPE Record Type](#)

279.6.1 FILETYPE Record Type

The contents of FILE_TYPE are private to the UTL_FILE package. You should not reference or change components of this record.

```

TYPE file_type IS RECORD (
  id          BINARY_INTEGER,
  datatype    BINARY_INTEGER,
  byte_mode   BOOLEAN);

```

Fields

Table 279-2 FILE_TYPE Fields

Field	Description
id	A numeric value indicating the internal file handle number
datatype	Indicates whether the file is a CHAR file, Nchar file or other (binary)
byte_mode	Indicates whether the file was open as a binary file, or as a text file

▲ Caution:

Oracle does not guarantee the persistence of `FILE_TYPE` values between database sessions or within a single session. Attempts to clone file handles or use dummy file handles may have indeterminate outcomes.

279.7 Summary of UTL_FILE Subprograms

This table lists the `UTL_FILE` subprograms and briefly describes them.

Table 279-3 UTL_FILE Subprograms

Subprogram	Description
FCLOSE Procedure	Closes a file
FCLOSE_ALL Procedure	Closes all open file handles
FCOPY Procedure	Copies a contiguous portion of a file to a newly created file
FFLUSH Procedure	Physically writes all pending output to a file
FGETATTR Procedure	Reads and returns the attributes of a disk file
FGETPOS Function	Returns the current relative offset position within a file, in bytes
FOPEN Function	Opens a file for input or output
FOPEN_NCHAR Function	Opens a file in Unicode for input or output
FREMOVE Procedure	Deletes a disk file, assuming that you have sufficient privileges
FRENAME Procedure	Renames an existing file to a new name, similar to the UNIX <code>mv</code> function
FSEEK Procedure	Adjusts the file pointer forward or backward within the file by the number of bytes specified
GET_LINE Procedure	Reads text from an open file
GET_LINE_NCHAR Procedure	Reads text in Unicode from an open file
GET_RAW Procedure	Reads a RAW string value from a file and adjusts the file pointer ahead by the number of bytes read
IS_OPEN Function	Determines if a file handle refers to an open file

Table 279-3 (Cont.) UTL_FILE Subprograms

Subprogram	Description
NEW_LINE Procedure	Writes one or more operating system-specific line terminators to a file
PUT Procedure	Writes a string to a file
PUT_LINE Procedure	Writes a line to a file, and so appends an operating system-specific line terminator
PUT_LINE_NCHAR Procedure	Writes a Unicode line to a file
PUT_NCHAR Procedure	Writes a Unicode string to a file
PUTF Procedure	A <code>PUT</code> procedure with formatting
PUTF_NCHAR Procedure	A <code>PUT_NCHAR</code> procedure with formatting, and writes a Unicode string to a file, with formatting
PUT_RAW Procedure	Accepts as input a <code>RAW</code> data value and writes the value to the output buffer

279.7.1 FCLOSE Procedure

This procedure closes an open file identified by a file handle.

Syntax

```
UTL_FILE.FCLOSE (
    file IN OUT FILE_TYPE);
```

Parameters

Table 279-4 FCLOSE Procedure Parameters

Parameter	Description
<code>file</code>	Active file handle returned by an <code>FOPEN</code> or <code>FOPEN_NCHAR</code> call

Usage Notes

If there is buffered data yet to be written when `FCLOSE` runs, then you may receive a `WRITE_ERROR` exception when closing a file.

Exceptions

```
WRITE_ERROR
INVALID_FILEHANDLE
```

279.7.2 FCLOSE_ALL Procedure

This procedure closes all open file handles for the session. This should be used as an emergency cleanup procedure, for example, when a PL/SQL program exits on an exception.

Syntax

```
UTL_FILE.FCLOSE_ALL;
```

Usage Notes



Note:

`FCLOSE_ALL` does not alter the state of the open file handles held by the user. This means that an `IS_OPEN` test on a file handle after an `FCLOSE_ALL` call still returns `TRUE`, even though the file has been closed. No further read or write operations can be performed on a file that was open before an `FCLOSE_ALL`.

Exceptions

```
WRITE_ERROR
```

279.7.3 FCOPY Procedure

This procedure copies a contiguous portion of a file to a newly created file.

By default, the whole file is copied if the `start_line` and `end_line` parameters are omitted. The source file is opened in read mode. The destination file is opened in write mode. A starting and ending line number can optionally be specified to select a portion from the center of the source file for copying.

Syntax

```
UTL_FILE.FCOPY (
    src_location    IN VARCHAR2,
    src_filename    IN VARCHAR2,
    dest_location   IN VARCHAR2,
    dest_filename   IN VARCHAR2,
    start_line      IN BINARY_INTEGER DEFAULT 1,
    end_line        IN BINARY_INTEGER DEFAULT NULL);
```

Parameters

Table 279-5 FCOPY Procedure Parameters

Parameters	Description
<code>src_location</code>	Directory location of the source file, a <code>DIRECTORY_NAME</code> from the <code>ALL_DIRECTORIES</code> view (case sensitive)
<code>src_filename</code>	Source file to be copied

Table 279-5 (Cont.) FCOPY Procedure Parameters

Parameters	Description
dest_location	Destination directory where the destination file is created
dest_filename	Destination file created from the source file
start_line	Line number at which to begin copying. The default is 1 for the first line
end_line	Line number at which to stop copying. The default is NULL, signifying end of file

Exceptions

INVALID_FILENAME
 INVALID_PATH
 INVALID_OPERATION
 INVALID_OFFSET
 READ_ERROR
 WRITE_ERROR

279.7.4 FFLUSH Procedure

FFLUSH physically writes pending data to the file identified by the file handle. Normally, data being written to a file is buffered. The FFLUSH procedure forces the buffered data to be written to the file. The data must be terminated with a newline character.

Flushing is useful when the file must be read while still open. For example, debugging messages can be flushed to the file so that they can be read immediately.

Syntax

```
UTL_FILE.FFLUSH (
    file IN FILE_TYPE);
```

Parameters

Table 279-6 FFLUSH Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN or FOPEN_NCHAR call

Exceptions

INVALID_FILENAME
 INVALID_MAXLINESIZE
 INVALID_OPERATION
 WRITE_ERROR

279.7.5 FGETATTR Procedure

This procedure reads and returns the attributes of a disk file.

Syntax

```
UTL_FILE.FGETATTR(  
    location    IN VARCHAR2,  
    filename    IN VARCHAR2,  
    fexists     OUT BOOLEAN,  
    file_length OUT NUMBER,  
    block_size  OUT BINARY_INTEGER);
```

Parameters

Table 279-7 FGETATTR Procedure Parameters

Parameters	Description
location	Directory location of the source file, a DIRECTORY_NAME from the ALL_DIRECTORIES view (case sensitive)
filename	Name of the file to be examined
fexists	A BOOLEAN for whether or not the file exists
file_length	Length of the file in bytes. NULL if file does not exist.
block_size	File system block size in bytes. NULL if the file does not exist.

Exceptions

```
INVALID_PATH  
INVALID_FILENAME  
INVALID_OPERATION  
READ_ERROR  
ACCESS_DENIED
```

279.7.6 FGETPOS Function

This function returns the current relative offset position within a file, in bytes.

Syntax

```
UTL_FILE.FGETPOS (  
    file IN FILE_TYPE)  
RETURN PLS_INTEGER;
```

Parameters

Table 279-8 FGETPOS Parameters

Parameters	Description
file	Directory location of the source file

Return Values

FGETPOS returns the relative offset position for an open file, in bytes. It raises an exception if the file is not open. It returns 0 for the beginning of the file.

Exceptions

INVALID_FILEHANDLE

INVALID_OPERATION

READ_ERROR

Usage Notes

If file is opened for byte mode operations, then the INVALID OPERATION exception is raised.

279.7.7 FOPEN Function

This function opens a file. You can specify the maximum line size and have a maximum of 50 files open simultaneously.

See also [FOPEN_NCHAR Function](#).

Syntax

```
UTL_FILE.FOPEN (
    location      IN VARCHAR2,
    filename      IN VARCHAR2,
    open_mode     IN VARCHAR2,
    max_linesize  IN BINARY_INTEGER DEFAULT 1024)
RETURN FILE_TYPE;
```

Parameters

Table 279-9 FOPEN Function Parameters

Parameter	Description
location	Directory location of file. This string is a directory object name and must be specified in upper case. Read privileges must be granted on this directory object for the UTL_FILE user to run FOPEN.
filename	File name, including extension (file type), without directory path. If a directory path is given as a part of the filename, it is ignored by FOPEN. On Unix, the filename cannot end with /.

Table 279-9 (Cont.) FOPEN Function Parameters

Parameter	Description
<code>open_mode</code>	<p>Specifies how the file is opened. Modes include:</p> <ul style="list-style-type: none"> • <code>r</code> -- read text • <code>w</code> -- write text • <code>a</code> -- append text • <code>rb</code> -- read byte mode • <code>wb</code> -- write byte mode • <code>ab</code> -- append byte mode <p>If you try to open a file specifying 'a' or 'ab' for <code>open_mode</code> but the file does not exist, the file is created in <code>write</code> mode.</p>
<code>max_linesize</code>	<p>Maximum number of bytes for each line, including the newline character, for this file (minimum value 1, maximum value 32767). If unspecified, Oracle supplies a default value of 1024.</p>

Return Values

FOPEN returns a file handle, which must be passed to all subsequent procedures that operate on that file. The specific contents of the file handle are private to the UTL_FILE package, and individual components should not be referenced or changed by the UTL_FILE user.

Table 279-10 FOPEN Function Return Values

Return	Description
<code>FILE_TYPE</code>	Handle to open file

Exceptions

- INVALID_MAXILINESIZE
- INVALID_MODE
- INVALID_OPERATION
- INVALID_PATH
- INVALID_FILENAME

Usage Notes

The file location and file name parameters must be supplied to the FOPEN function as quoted strings so that the file location can be checked against the list of accessible directories as specified by the ALL_DIRECTORIES view of accessible directory objects.

279.7.8 FOPEN_NCHAR Function

This function opens a file in national character set mode for input or output, with the maximum line size specified. With this function, you can read or write a text file in Unicode instead of in the database character set.

You can have a maximum of 50 files open simultaneously.

Even though the contents of an `NVARCHAR2` buffer may be AL16UTF16 or UTF8 (depending on the national character set of the database), the contents of the file are always read and written in UTF8. `UTL_FILE` converts between UTF8 and AL16UTF16 as necessary.

See also [FOPEN Function](#).

Syntax

```
UTL_FILE.FOPEN_NCHAR (
    location      IN VARCHAR2,
    filename      IN VARCHAR2,
    open_mode     IN VARCHAR2,
    max_linesize  IN BINARY_INTEGER DEFAULT 1024)
RETURN FILE_TYPE;
```

Parameters

Table 279-11 FOPEN_NCHAR Function Parameters

Parameter	Description
location	Directory location of file
filename	File name (including extension)
open_mode	Open mode (r,w,a,rb,wb,ab)
max_linesize	Maximum number of characters for each line, including the newline character, for this file (minimum value 1, maximum value 32767)

Return Values

`FOPEN_NCHAR` returns a file handle, which must be passed to all subsequent procedures that operate on that file. The specific contents of the file handle are private to the `UTL_FILE` package, and individual components should not be referenced or changed by the `UTL_FILE` user.

Table 279-12 FOPEN_NCHAR Function Return Values

Return	Description
FILE_TYPE	Handle to open file

Exceptions

```
INVALID_MAXILINESIZE
INVALID_MODE
INVALID_OPERATION
```

INVALID_PATH

279.7.9 FREMOVE Procedure

This procedure deletes a disk file, assuming that you have sufficient privileges.

Syntax

```
UTL_FILE.FREMOVE (  
    location IN VARCHAR2,  
    filename IN VARCHAR2);
```

Parameters

Table 279-13 FREMOVE Procedure Parameters

Parameters	Description
location	Directory location of the file, a DIRECTORY_NAME from ALL_DIRECTORIES (case sensitive)
filename	Name of the file to be deleted

Exceptions

ACCESS_DENIED

DELETE_FAILED

INVALID_FILENAME

INVALID_OPERATION

INVALID_PATH

Usage Notes

The FREMOVE procedure does not verify privileges before deleting a file. The O/S verifies file and directory permissions. An exception is returned on failure.

279.7.10 FRENAME Procedure

This procedure renames an existing file to a new name, similar to the UNIX mv function.

Syntax

```
UTL_FILE.FRENAME (  
    src_location    IN    VARCHAR2,  
    src_filename    IN    VARCHAR2,  
    dest_location   IN    VARCHAR2,  
    dest_filename   IN    VARCHAR2,  
    overwrite       IN    BOOLEAN DEFAULT FALSE);
```


Parameters

Table 279-14 FRENAME Procedure Parameters

Parameters	Description
src_location	Directory location of the source file, a DIRECTORY_NAME from the ALL_DIRECTORIES view (case sensitive)
src_filename	Source file to be renamed
dest_location	Destination directory of the destination file, a DIRECTORY_NAME from the ALL_DIRECTORIES view (case sensitive)
dest_filename	New name of the file
overwrite	Default is FALSE. Permission on both the source and destination directories must be granted. You can use the overwrite parameter to specify whether or not to overwrite a file if one exists in the destination directory. The default is FALSE for no overwrite.

Exceptions

ACCESS_DENIED
INVALID_FILENAME
INVALID_PATH
RENAME_FAILED

279.7.11 FSEEK Procedure

This procedure adjusts the file pointer forward or backward within the file by the number of bytes specified.

Syntax

```
UTL_FILE.FSEEK (
    file           IN OUT  UTL_FILE.FILE_TYPE,
    absolute_offset IN      PL_INTEGER DEFAULT NULL,
    relative_offset IN      PLS_INTEGER DEFAULT NULL);
```

Parameters

Table 279-15 FSEEK Procedure Parameters

Parameters	Description
file	File handle
absolute_offset	Absolute location to which to seek; default = NULL
relative_offset	Number of bytes to seek forward or backward; positive = forward, negative integer = backward, zero = current position, default = NULL

Exceptions

INVALID_FILEHANDLE

```
INVALID_OFFSET
INVALID_OPERATION
READ_ERROR
```

Usage Notes

- Using `FSEEK`, you can read previous lines in the file without first closing and reopening the file. You must know the number of bytes by which you want to navigate.
- If `relative_offset`, the procedure seeks forward. If `relative_offset > 0`, or backward, if `relative_offset < 0`, the procedure seeks through the file by the number of `relative_offset` bytes specified.
- If the beginning of the file is reached before the number of bytes specified, then the file pointer is placed at the beginning of the file. If the end of the file is reached before the number of bytes specified, then an `INVALID_OFFSET` error is raised.
- If `absolute_offset`, the procedure seeks to an absolute location specified in bytes.
- If file is opened for byte mode operations, then the `INVALID OPERATION` exception is raised.

279.7.12 GET_LINE Procedure

This procedure reads text from the open file identified by the file handle and places the text in the output buffer parameter. Text is read up to, but not including, the line terminator, or up to the end of the file, or up to the end of the `len` parameter. It cannot exceed the `max_linesize` specified in `FOPEN`.

Syntax

```
UTL_FILE.GET_LINE (
    file          IN FILE_TYPE,
    buffer        OUT VARCHAR2,
    len           IN PLS_INTEGER DEFAULT NULL);
```

Parameters

Table 279-16 GET_LINE Procedure Parameters

Parameters	Description
<code>file</code>	Active file handle returned by an <code>FOPEN</code> call. The file must be open for reading (mode <code>r</code>); otherwise an <code>INVALID_OPERATION</code> exception is raised.
<code>buffer</code>	Data buffer to receive the line read from the file
<code>len</code>	The number of bytes read from the file. Default is <code>NULL</code> . If <code>NULL</code> , Oracle supplies the value of <code>max_linesize</code> .

Exceptions

```
INVALID_FILEHANDLE
```

```
INVALID_OPERATION
NO_DATA_FOUND
READ_ERROR
```

Usage Notes

If the line does not fit in the buffer, a `READ_ERROR` exception is raised. If no text was read due to end of file, the `NO_DATA_FOUND` exception is raised. If the file is opened for byte mode operations, the `INVALID_OPERATION` exception is raised.

Because the line terminator character is not read into the buffer, reading blank lines returns empty strings.

The maximum size of the `buffer` parameter is 32767 bytes unless you specify a smaller size in `FOPEN`. If unspecified, Oracle supplies a default value of 1024. See also "[GET_LINE_NCHAR Procedure](#)".

279.7.13 GET_LINE_NCHAR Procedure

This procedure reads text from the open file identified by the file handle and places the text in the output buffer parameter. With this function, you can read a text file in Unicode instead of in the database character set.

The file must be opened in national character set mode, and must be encoded in the UTF8 character set. The expected buffer datatype is `NVARCHAR2`. If a variable of another datatype, such as `NCHAR`, `NCLOB`, or `VARCHAR2` is specified, PL/SQL will perform standard implicit conversion from `NVARCHAR2` after the text is read.

See also [GET_LINE Procedure](#)

Syntax

```
UTL_FILE.GET_LINE_NCHAR (
    file          IN FILE_TYPE,
    buffer        OUT NVARCHAR2,
    len           IN PLS_INTEGER DEFAULT NULL);
```

Parameters

Table 279-17 GET_LINE_NCHAR Procedure Parameters

Parameters	Description
<code>file</code>	Active file handle returned by an <code>FOPEN_NCHAR</code> call. The file must be open for reading (mode <code>r</code>). If the file is opened by <code>FOPEN</code> instead of <code>FOPEN_NCHAR</code> , a <code>CHARSETMISMATCH</code> exception is raised.
<code>buffer</code>	Data buffer to receive the line read from the file
<code>len</code>	The number of bytes read from the file. Default is <code>NULL</code> . If <code>NULL</code> , Oracle supplies the value of <code>max_linesize</code> .

Exceptions

```
INVALID_FILEHANDLE
INVALID_OPERATION
```

NO_DATA_FOUND

READ_ERROR

279.7.14 GET_RAW Procedure

This procedure reads a RAW string value from a file and adjusts the file pointer ahead by the number of bytes read. UTL_FILE.GET_RAW ignores line terminators.

Syntax

```

UTL_FILE.GET_RAW (
    file      IN          UTL_FILE.FILE_TYPE,
    buffer    OUT NOCOPY RAW,
    len       IN          PLS_INTEGER DEFAULT NULL);

```

Parameters

Table 279-18 GET_RAW Procedure Parameters

Parameters	Description
file	File handle
buffer	RAW data
len	The number of bytes read from the file. Default is NULL. If NULL, len is assumed to be the maximum length of RAW.

Exceptions

INVALID_FILEHANDLE

INVALID_OPERATION

LENGTH_MISMATCH

NO_DATA_FOUND

READ_ERROR

Usage Notes

The subprogram will raise `No_Data_Found` when it attempts to read past the end of the file. Your application should allow for this by catching the exception in its processing loop.

```

PROCEDURE Sys.p (n IN VARCHAR2) IS
    h      UTL_FILE.FILE_TYPE := UTL_FILE.FOPEN('D', n, 'r', 32767);
    Buf    RAW(32767);
    Amnt   CONSTANT PLS_INTEGER := 32767;
BEGIN
    LOOP
        BEGIN
            Utl_File.Get_Raw(h, Buf, Amnt);
            -- Do something with this chunk
        EXCEPTION WHEN No_Data_Found THEN EXIT; END;
    END LOOP;
    UTL_FILE.FCLOSE (h);
END;

```

279.7.15 IS_OPEN Function

This function tests a file handle to see if it identifies an open file.

IS_OPEN reports only whether a file handle represents a file that has been opened, but not yet closed. It does not guarantee that there will be no operating system errors when you attempt to use the file handle.

Syntax

```
UTL_FILE.IS_OPEN (  
    file IN FILE_TYPE)  
    RETURN BOOLEAN;
```

Parameters

Table 279-19 IS_OPEN Function Parameters

Parameter	Description
file	Active file handle returned by an FOPEN or FOPEN_NCHAR call

Return Values

TRUE or FALSE

Exceptions

INVALID_FILEHANDLE

279.7.16 NEW_LINE Procedure

This procedure writes one or more line terminators to the file identified by the input file handle.

This procedure is separate from PUT because the line terminator is a platform-specific character or sequence of characters.

Syntax

```
UTL_FILE.NEW_LINE (  
    file IN FILE_TYPE,  
    lines IN BINARY_INTEGER := 1);
```

Parameters

Table 279-20 NEW_LINE Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN or FOPEN_NCHAR call
lines	Number of line terminators to be written to the file

Exceptions

INVALID_FILEHANDLE
 INVALID_OPERATION
 WRITE_ERROR

279.7.17 PUT Procedure

PUT writes the text string stored in the buffer parameter to the open file identified by the file handle.

The file must be open for write operations. No line terminator is appended by PUT; use NEW_LINE to terminate the line or use PUT_LINE to write a complete line with a line terminator. See also "[PUT_NCHAR Procedure](#)".

Syntax

```
UTL_FILE.PUT (
    file      IN FILE_TYPE,
    buffer    IN VARCHAR2);
```

Parameters**Table 279-21 PUT Procedure Parameters**

Parameters	Description
file	Active file handle returned by an FOPEN_NCHAR call. The file must be open for writing.
buffer	Buffer that contains the text to be written to the file. User must have opened the file using mode w or mode a; otherwise, an INVALID_OPERATION exception is raised.

Usage Notes

The maximum size of the buffer parameter is 32767 bytes unless you specify a smaller size in FOPEN. If unspecified, Oracle supplies a default value of 1024. The sum of all sequential PUT calls cannot exceed 32767 without intermediate buffer flushes.

Exceptions

INVALID_FILEHANDLE
 INVALID_OPERATION
 WRITE_ERROR

279.7.18 PUT_LINE Procedure

This procedure writes the text string stored in the buffer parameter to the open file identified by the file handle.

The file must be open for write operations. PUT_LINE terminates the line with the platform-specific line terminator character or characters.

See also "[PUT_LINE_NCHAR Procedure](#)".

Syntax

```
UTL_FILE.PUT_LINE (  
    file      IN FILE_TYPE,  
    buffer    IN VARCHAR2,  
    autoflush IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 279-22 PUT_LINE Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN call
buffer	Text buffer that contains the lines to be written to the file
autoflush	Flushes the buffer to disk after the WRITE

Exceptions

INVALID_FILEHANDLE

INVALID_OPERATION

WRITE_ERROR

Usage Notes

- The maximum size of the `buffer` parameter is 32767 bytes unless you specify a smaller size in `FOPEN`. If unspecified, Oracle supplies a default value of 1024. The sum of all sequential `PUT` calls cannot exceed 32767 without intermediate buffer flushes.
- If file is opened for byte mode operations, then the `INVALID OPERATION` exception is raised.

279.7.19 PUT_LINE_NCHAR Procedure

This procedure writes the text string stored in the `buffer` parameter to the open file identified by the file handle. With this function, you can write a text file in Unicode instead of in the database character set.

This procedure is equivalent to the [PUT_NCHAR Procedure](#), except that the line separator is appended to the written text. See also [PUT_LINE Procedure](#).

Syntax

```
UTL_FILE.PUT_LINE_NCHAR (  
    file      IN FILE_TYPE,  
    buffer    IN NVARCHAR2);
```

Parameters

Table 279-23 PUT_LINE_NCHAR Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN_NCHAR call. The file must be open for writing.
buffer	Text buffer that contains the lines to be written to the file

Exceptions

INVALID_FILEHANDLE

INVALID_OPERATION

WRITE_ERROR

Usage Notes

- The maximum size of the `buffer` parameter is 32767 bytes unless you specify a smaller size in `FOPEN`. If unspecified, Oracle supplies a default value of 1024. The sum of all sequential `PUT` calls cannot exceed 32767 without intermediate buffer flushes.
- If file is opened for byte mode operations, then the `INVALID_OPERATION` exception is raised.

279.7.20 PUT_NCHAR Procedure

This procedure writes the text string stored in the `buffer` parameter to the open file identified by the file handle.

With this function, you can write a text file in Unicode instead of in the database character set. The file must be opened in the national character set mode. The text string will be written in the UTF8 character set. The expected buffer datatype is `NVARCHAR2`. If a variable of another datatype is specified, PL/SQL will perform implicit conversion to `NVARCHAR2` before writing the text.

Syntax

```
UTL_FILE.PUT_NCHAR (
    file      IN FILE_TYPE,
    buffer    IN NVARCHAR2);
```

Parameters

Table 279-24 PUT_NCHAR Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN_NCHAR call. If the file is opened by <code>FOPEN</code> instead of <code>FOPEN_NCHAR</code> , a <code>CHARSETMISMATCH</code> exception is raised.

Table 279-24 (Cont.) PUT_NCHAR Procedure Parameters

Parameters	Description
<code>buffer</code>	Buffer that contains the text to be written to the file. User must have opened the file using mode <code>w</code> or mode <code>a</code> ; otherwise, an <code>INVALID_OPERATION</code> exception is raised.

Exceptions`INVALID_FILEHANDLE``INVALID_OPERATION``WRITE_ERROR`**Usage Notes**

The maximum size of the `buffer` parameter is 32767 bytes unless you specify a smaller size in `FOPEN`. If unspecified, Oracle supplies a default value of 1024. The sum of all sequential `PUT` calls cannot exceed 32767 without intermediate buffer flushes.

Related Topics

- [PUT Procedure](#)
`PUT` writes the text string stored in the `buffer` parameter to the open file identified by the file handle.

279.7.21 PUTF Procedure

This procedure is a formatted `PUT` procedure.

It works like a limited `printf()`.

Syntax

```
UTL_FILE.PUTF (
    file      IN FILE_TYPE,
    format    IN VARCHAR2,
    [arg1     IN VARCHAR2 DEFAULT NULL,
    . . .
    arg5      IN VARCHAR2 DEFAULT NULL]);
```

Parameters**Table 279-25 PUTF Procedure Parameters**

Parameters	Description
<code>file</code>	Active file handle returned by an <code>FOPEN</code> call
<code>format</code>	Format string that can contain text as well as the formatting characters <code>\n</code> and <code>%s</code>

Table 279-25 (Cont.) PUTF Procedure Parameters

Parameters	Description
arg1..arg5	From one to five operational argument strings. Argument strings are substituted, in order, for the %s formatters in the format string. If there are more formatters in the format parameter string than there are arguments, then an empty string is substituted for each %s for which there is no argument.

Usage Notes

- If file is opened for byte mode operations, then the INVALID_OPERATION exception is raised.
- The format string can contain any text, but the character sequences %s and \n have special meaning.

Character Sequence	Meaning
%s	Substitute this sequence with the string value of the next argument in the argument list.
\n	Substitute with the appropriate platform-specific line terminator.

Exceptions

INVALID_FILEHANDLE
INVALID_OPERATION
WRITE_ERROR

Examples

The following example writes the lines:

```
Hello, world!
I come from Zork with greetings for all earthlings.

my_world varchar2(4) := 'Zork';
...
PUTF(my_handle, 'Hello, world!\nI come from %s with %s.\n',
      my_world,
      'greetings for all earthlings');
```

If there are more %s formatters in the format parameter than there are arguments, then an empty string is substituted for each %s for which there is no matching argument.

Related Topics

- [PUTF_NCHAR Procedure](#)
This procedure is a formatted version of a PUT_NCHAR Procedure.

279.7.22 PUTF_NCHAR Procedure

This procedure is a formatted version of a PUT_NCHAR Procedure.

Using `PUTF_NCHAR`, you can write a text file in Unicode instead of in the database character set. It accepts a format string with formatting elements `\n` and `%s`, and up to five arguments to be substituted for consecutive instances of `%s` in the format string. The expected datatype of the format string and the arguments is `NVARCHAR2`.

If variables of another datatype are specified, PL/SQL will perform implicit conversion to `NVARCHAR2` before formatting the text. Formatted text is written in the UTF8 character set to the file identified by the file handle. The file must be opened in the national character set mode.

Syntax

```
UTL_FILE.PUTF_NCHAR (
    file      IN FILE_TYPE,
    format    IN NVARCHAR2,
    [arg1     IN NVARCHAR2  DEFAULT NULL,
    . . .
    arg5      IN NVARCHAR2  DEFAULT NULL]);
```

Parameters

Table 279-26 PUTF_NCHAR Procedure Parameters

Parameters	Description
<code>file</code>	Active file handle returned by an <code>FOPEN_NCHAR</code> call. The file must be open for reading (mode <code>r</code>). If the file is opened by <code>FOPEN</code> instead of <code>FOPEN_NCHAR</code> , a <code>CHARSETMISMATCH</code> exception is raised.
<code>format</code>	Format string that can contain text as well as the formatting characters <code>\n</code> and <code>%s</code>
<code>arg1..arg5</code>	From one to five operational argument strings. Argument strings are substituted, in order, for the <code>%s</code> formatters in the format string. If there are more formatters in the format parameter string than there are arguments, then an empty string is substituted for each <code>%s</code> for which there is no argument.

Exceptions

`INVALID_FILEHANDLE`

`INVALID_OPERATION`

`WRITE_ERROR`

Usage Notes

- The maximum size of the `buffer` parameter is 32767 bytes unless you specify a smaller size in `FOPEN`. If unspecified, Oracle supplies a default value of 1024. The sum of all sequential `PUT` calls cannot exceed 32767 without intermediate buffer flushes.

- If file is opened for byte mode operations, then the `INVALID_OPERATION` exception is raised.

Related Topics

- [PUT_NCHAR Procedure](#)
This procedure writes the text string stored in the `buffer` parameter to the open file identified by the file handle.

279.7.23 PUT_RAW Procedure

This procedure accepts as input a `RAW` data value and writes the value to the output buffer.

Syntax

```
UTL_FILE.PUT_RAW (  
    file           IN      UTL_FILE.FILE_TYPE,  
    buffer         IN      RAW,  
    autoflush      IN      BOOLEAN DEFAULT FALSE);
```

Parameters

Table 279-27 PUT_RAW Procedure Parameters

Parameters	Description
<code>file</code>	File handle
<code>buffer</code>	The <code>RAW</code> data written to the buffer
<code>autoflush</code>	If <code>TRUE</code> , then performs a flush after writing the value to the output buffer; default is <code>FALSE</code> .

Exceptions

`INVALID_FILEHANDLE`

`INVALID_OPERATION`

`WRITE_ERROR`

Usage Notes

You can request an automatic flush of the buffer by setting the third argument to `TRUE`.

The maximum size of the `buffer` parameter is 32767 bytes unless you specify a smaller size in `FOPEN`. If unspecified, Oracle supplies a default value of 1024. The sum of all sequential `PUT` calls cannot exceed 32767 without intermediate buffer flushes.

UTL_HTTP

The `UTL_HTTP` package makes Hypertext Transfer Protocol (HTTP) callouts from SQL and PL/SQL. You can use it to access data on the Internet over HTTP.

When the package fetches data from a Web site using HTTPS, it requires Oracle Wallet which can be created by `orapki` utility. Non-HTTPS fetches do not require an Oracle wallet.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Exceptions](#)
- [Examples](#)
- [Data Structures](#)
- [Operations](#)
- [Subprogram Groups](#)
- [Summary of UTL_HTTP Subprograms](#)



See Also:

- [UTL_URL](#)
- [UTL_SMTP](#)
- *Oracle Database Enterprise User Security Administrator's Guide* for more information on Wallet Manager

280.1 UTL_HTTP Overview

With the `UTL_HTTP` package, you can write PL/SQL programs that communicate with Web (HTTP) servers. `UTL_HTTP` also contains a function that can be used in SQL queries.

The package supports HTTP over the Secured Socket Layer protocol (SSL), also known as HTTPS. It also supports SSL client authentication by sending the client-certificate in a wallet to authenticate with the remote Web server.

Other Internet-related data-access protocols (such as the File Transfer Protocol (FTP) or the Gopher protocol) are also supported using an HTTP proxy server that supports those protocols.

280.2 UTL_HTTP Security Model

This package is an invoker's rights package. The invoking user will need the `connect` privilege granted in the access control list assigned to the remote network host to which he wants to connect, as well as the `use-client-certificates` or the `use-passwords` privilege to authenticate himself with the remote Web server using the credentials stored in an Oracle wallet.



Note:

For more information about managing fine-grained access, see *Oracle Database Security Guide*

280.3 UTL_HTTP Constants

The `UTL_HTTP` package defines several constants to use when specifying parameter values.

These are shown in following tables.

- [Table 280-1](#)
- [Table 280-2](#)
- [Table 280-3](#)

Table 280-1 UTL_HTTP Constants - HTTP Versions

Name	Type	Value	Description
HTTP_VERSION_1_0	VARCHAR2(10)	'HTTP/1.0'	Denotes HTTP version 1.0 that can be used in the function <code>BEGIN_REQUEST</code> .
HTTP_VERSION_1_1	VARCHAR2(10)	'HTTP/1.1'	Denotes HTTP version 1.1 that can be used in the function <code>BEGIN_REQUEST</code> .

Table 280-2 UTL_HTTP Constants - Default Ports

Name	Type	Value	Description
DEFAULT_HTTP_PORT	PLS_INTEGER	80	The default TCP/IP port (80) at which a Web server or proxy server listens
DEFAULT_HTTPS_PORT	PLS_INTEGER	443	The default TCP/IP port (443) at which an HTTPS Web server listens

Table 280-3 UTL_HTTP Constants - HTTP 1.1 Status Codes

Name	Type	Value	Description
HTTP_CONTINUE	PLS_INTEGER	100	The client should continue with its request. This interim response is used to inform the client that the initial part of the request has been received and has not yet been rejected by the server.
HTTP_SWITCHING_PROTOCOLS	PLS_INTEGER	101	The server understands and is willing to comply with the client's request, through the Upgrade message header field, for a change in the application protocol being used on this connection. The server will switch protocols to those defined by the response's Upgrade header field immediately after the empty line which terminates the 101 response.
HTTP_OK	PLS_INTEGER	200	The request has succeeded. The information returned with the response is dependent on the method used in the request
HTTP_CREATED_CONSTANT	PLS_INTEGER	201	The request has been fulfilled and resulted in a new resource being created.
HTTP_ACCEPTED	PLS_INTEGER	202	The request has been accepted for processing, but the processing has not been completed. The request might or might not eventually be acted upon, as it might be disallowed when processing actually takes place.
HTTP_NON_AUTHORITATIVE_INFO	PLS_INTEGER	203	The returned metainformation in the entity-header is not the definitive set as available from the origin server, but is gathered from a local or a third-party copy.
HTTP_NO_CONTENT	PLS_INTEGER	204	The server has fulfilled the request but does not need to return an entity-body, and might want to return updated metainformation.
HTTP_RESET_CONTENT	PLS_INTEGER	205	The server has fulfilled the request and the user agent should reset the document view which caused the request to be sent. The response must not include an entity.
HTTP_PARTIAL_CONTENT	PLS_INTEGER	206	The server has fulfilled the partial GET request for the resource.
HTTP_MULTIPLE_CHOICES	PLS_INTEGER	300	The requested resource corresponds to any one of a set of representations, each with its own specific location, and agent-driven negotiation information is being provided so that the user (or user agent) can select a preferred representation and redirect its request to that location.
HTTP_MOVED_PERMANENTLY	PLS_INTEGER	301	The requested resource has been assigned a new permanent URI and any future references to this resource should use one of the returned URIs.
HTTP_FOUND_CONSTANT	PLS_INTEGER	302	The requested resource resides temporarily under a different URI.

Table 280-3 (Cont.) UTL_HTTP Constants - HTTP 1.1 Status Codes

Name	Type	Value	Description
HTTP_SEE_OTHER	PLS_INTEGER	303	The response to the request can be found under a different URI and should be retrieved using a GET method on that resource.
HTTP_NOT_MODIFIED	PLS_INTEGER	304	If the client has performed a conditional GET request and access is allowed, but the document has not been modified, the server responds with this status code.
HTTP_USE_PROXY	PLS_INTEGER	305	The requested resource must be accessed through the proxy given by the Location field. The Location field gives the URI of the proxy.
HTTP_TEMPORARY_REDIRECT	PLS_INTEGER	307	The requested resource resides temporarily under a different URI.
HTTP_BAD_REQUEST	PLS_INTEGER	400	The request could not be understood by the server due to malformed syntax.
HTTP_UNAUTHORIZED	PLS_INTEGER	401	The request requires user authentication. The client may repeat the request with a suitable Authorization header field. If the request already included Authorization credentials, then the 401 response indicates that authorization has been refused for those credentials.
HTTP_PAYMENT_REQUIRED	PLS_INTEGER	402	This code is reserved for future use.
HTTP_FORBIDDEN	PLS_INTEGER	403	The server understood the request, but is refusing to fulfill it.
HTTP_NOT_FOUND	PLS_INTEGER	404	The server has not found anything matching the Request-URI.
HTTP_NOT_ACCEPTABLE	PLS_INTEGER	406	The resource identified by the request is only capable of generating response entities which have content characteristics not acceptable according to the accept headers sent in the request.
HTTP_PROXY_AUTH_REQUIRED	PLS_INTEGER	407	This code is similar to 401 (Unauthorized), but indicates that the client must first authenticate itself with the proxy.
HTTP_REQUEST_TIMEOUT	PLS_INTEGER	408	The client did not produce a request within the time that the server was prepared to wait.
HTTP_CONFLICT	PLS_INTEGER	409	The request could not be completed due to a conflict with the current state of the resource.
HTTP_GONE	PLS_INTEGER	410	The requested resource is no longer available at the server and no forwarding address is known.
HTTP_LENGTH_REQUIRED	PLS_INTEGER	411	The server refuses to accept the request without a defined Content-Length.
HTTP_PRECONDITION_FAILED	PLS_INTEGER	412	The precondition given in one or more of the request-header fields evaluated to false when it was tested on the server.

Table 280-3 (Cont.) UTL_HTTP Constants - HTTP 1.1 Status Codes

Name	Type	Value	Description
HTTP_REQUEST_ENTITY_TOO_LARGE_CONSTANT	PLS_INTEGER	413	The server is refusing to process a request because the request entity is larger than the server is willing or able to process.
HTTP_REQUEST_URI_TOO_LARGE	PLS_INTEGER	414	The server is refusing to service the request because the Request-URI is longer than the server is willing to interpret.
HTTP_UNSUPPORTED_MEDIA_TYPE	PLS_INTEGER	415	The server is refusing to service the request because the entity of the request is in a format not supported by the requested resource for the requested method.
HTTP_REQUEST_RANGE_NOT_SATISFIABLE	PLS_INTEGER	416	A server returns a response with this status code if a request included a Range request-header field, and none of the range-specifier values in this field overlap the current extent of the selected resource, and the request did not include an If-Range request-header field.
HTTP_EXPECTATION_FAILED	PLS_INTEGER	417	The expectation given in an Expect request-header field could not be met by this server, or, if the server is a proxy, the server has unambiguous evidence that the request could not be met by the next-hop server.
HTTP_NOT_IMPLEMENTED	PLS_INTEGER	501	The server does not support the functionality required to fulfill the request.
HTTP_BAD_GATEWAY	PLS_INTEGER	502	The server, while acting as a gateway or proxy, received an invalid response from the upstream server it accessed in attempting to fulfill the request.
HTTP_SERVICE_UNAVAILABLE	PLS_INTEGER	503	The server is currently unable to handle the request due to a temporary overloading or maintenance of the server.
HTTP_GATEWAY_TIMEOUT	PLS_INTEGER	504	The server, while acting as a gateway or proxy, did not receive a timely response from the upstream server specified by the URI (for example, HTTP, FTP, LDAP) or some other auxiliary server (for example, DNS) it needed to access in attempting to complete the request.
HTTP_VERSION_NOT_SUPPORTED	PLS_INTEGER	505	The server does not support, or refuses to support, the HTTP protocol version that was used in the request message.

280.4 UTL_HTTP Exceptions

Exceptions indicate that the UTL_HTTP package encountered issues.

The following table lists these exceptions. By default, UTL_HTTP raises the exception `request_failed` when a request fails to execute. If the package is set to raise a detailed exception by `set_detailed_excp_support`, the rest of the exceptions will be raised directly

(except for the exception `end_of_body`, which will be raised by `READ_TEXT`, `READ_LINE`, and `READ_RAW` regardless of the setting).

Table 280-4 UTL_HTTP Exceptions

Exception	Error Code	Reason	Where Raised
<code>BAD_ARGUMENT</code>	29261	The argument passed to the interface is bad	Any HTTP request or response interface when <code>detailed_exception</code> is enabled
<code>BAD_URL</code>	29262	The requested URL is badly formed	<code>BEGIN_REQUEST</code> , when <code>detailed_exception</code> is enabled
<code>END_OF_BODY</code>	29266	The end of HTTP response body is reached	<code>READ_RAW</code> , <code>READ_TEXT</code> , and <code>READ_LINE</code> , when <code>detailed_exception</code> is enabled
<code>HEADER_NOT_FOUND</code>	29265	The header is not found	<code>GET_HEADER</code> , <code>GET_HEADER_BY_NAME</code> , when <code>detailed_exception</code> is enabled
<code>HTTP_CLIENT_ERROR</code>	29268	From <code>GET_RESPONSE</code> , the response status code indicates that a client error has occurred (status code in 4xx range). Or from <code>begin_request</code> , the HTTP proxy returns a status code in the 4xx range when making an HTTPS request through the proxy.	<code>GET_RESPONSE</code> , <code>BEGIN_REQUEST</code> when <code>detailed_exception</code> is enabled
<code>HTTP_SERVER_ERROR</code>	29269	From <code>GET_RESPONSE</code> , the response status code indicates that a client error has occurred (status code in 5xx range). Or from <code>begin_request</code> , the HTTP proxy returns a status code in the 5xx range when making an HTTPS request through the proxy.	<code>GET_RESPONSE</code> , <code>BEGIN_REQUEST</code> when <code>detailed_exception</code> is enabled
<code>NETWORK_ACCESS_DENIED</code>	24247	Access to the remote network host or credentials in an Oracle wallet is denied	<code>BEGIN_REQUEST</code> and <code>SET_AUTHENTICATION_FROM_WALLET</code> when <code>detailed_exception</code> is enabled
<code>ILLEGAL_CALL</code>	29267	The call to <code>UTL_HTTP</code> is illegal at the current state of the HTTP request	<code>SET_HEADER</code> , <code>SET_AUTHENTICATION</code> , and <code>SET_PERSISTENT_CONN_SUPPORT</code> , when <code>detailed_exception</code> is enabled
<code>PARTIAL_MULTIBYTE_EXCEPTION</code>	29275	No complete character is read and a partial multibyte character is found at the end of the response body	<code>READ_TEXT</code> and <code>READ_LINE</code> , when <code>detailed_exception</code> is enabled
<code>PROTOCOL_ERROR</code>	29263	An HTTP protocol error occurs when communicating with the Web server	<code>SET_HEADER</code> , <code>GET_RESPONSE</code> , <code>READ_RAW</code> , <code>READ_TEXT</code> , and <code>READ_LINE</code> , when <code>detailed_exception</code> is enabled
<code>REQUEST_FAILED</code>	29273	The request fails to execute	Any HTTP request or response interface when <code>detailed_exception</code> is disabled
<code>TOO_MANY_REQUESTS</code>	29270	Too many requests or responses are open	<code>BEGIN_REQUEST</code> , when <code>detailed_exception</code> is enabled

Table 280-4 (Cont.) UTL_HTTP Exceptions

Exception	Error Code	Reason	Where Raised
TRANSFER_TIMEOUT	29276	No data is read and a read timeout occurred	READ_TEXT and READ_LINE, when detailed_exception is enabled
UNKNOWN_SCHEME	29264	The scheme of the requested URL is unknown	BEGIN_REQUEST and GET_RESPONSE, when detailed_exception is enabled

 **Note:**

The `partial_multibyte_char` and `transfer_timeout` exceptions are duplicates of the same exceptions defined in `UTL_TCP`. They are defined in this package so that the use of this package does not require the knowledge of the `UTL_TCP`. As those exceptions are duplicates, an exception handle that catches the `partial_multibyte_char` and `transfer_timeout` exceptions in this package also catch the exceptions in the `UTL_TCP`.

For `REQUEST` and `REQUEST_PIECES`, the `request_failed` exception is raised when any exception occurs and `detailed_exception` is disabled.

280.5 UTL_HTTP Examples

These five examples demonstrate how to use `UTL_HTTP`.

- [General Usage](#)
- [Retrieving HTTP Response Headers](#)
- [Handling HTTP Authentication](#)
- [Retrieving and Restoring Cookies](#)
- [Making HTTP Request with Private Wallet and Cookie Table](#)

280.5.1 UTL_HTTP General Usage

This is an general example of `UTL_HTTP` usage.

```
SET SERVEROUTPUT ON SIZE 40000

DECLARE
    req    UTL_HTTP.REQ;
    resp  UTL_HTTP.RESP;
    value VARCHAR2(1024);
BEGIN
    UTL_HTTP.SET_PROXY('proxy.my-company.com', 'corp.my-company.com');
    req := UTL_HTTP.BEGIN_REQUEST('http://www-hr.corp.my-company.com');
    UTL_HTTP.SET_HEADER(req, 'User-Agent', 'Mozilla/4.0');
    resp := UTL_HTTP.GET_RESPONSE(req);
    LOOP
        UTL_HTTP.READ_LINE(resp, value, TRUE);
```

```

        DBMS_OUTPUT.PUT_LINE(value);
    END LOOP;
    UTL_HTTP.END_RESPONSE(resp);
EXCEPTION
    WHEN UTL_HTTP.END_OF_BODY THEN
        UTL_HTTP.END_RESPONSE(resp);
END;
```

280.5.2 UTL_HTTP Retrieving HTTP Response Headers

This example shows how UTL_HTTP retrieves HTTP response headers.

```

SET SERVEROUTPUT ON SIZE 40000

DECLARE
    req    UTL_HTTP.REQ;
    resp   UTL_HTTP.RESP;
    name   VARCHAR2(256);
    value  VARCHAR2(1024);
BEGIN
    UTL_HTTP.SET_PROXY('proxy.my-company.com', 'corp.my-company.com');
    req := UTL_HTTP.BEGIN_REQUEST('http://www-hr.corp.my-company.com');
    UTL_HTTP.SET_HEADER(req, 'User-Agent', 'Mozilla/4.0');
    resp := UTL_HTTP.GET_RESPONSE(req);
    DBMS_OUTPUT.PUT_LINE('HTTP response status code: ' || resp.status_code);
    DBMS_OUTPUT.PUT_LINE('HTTP response reason phrase: ' || resp.reason_phrase);
    FOR i IN 1..UTL_HTTP.GET_HEADER_COUNT(resp) LOOP
        UTL_HTTP.GET_HEADER(resp, i, name, value);
        DBMS_OUTPUT.PUT_LINE(name || ': ' || value);
    END LOOP;
    UTL_HTTP.END_RESPONSE(resp);
END;
```

280.5.3 UTL_HTTP Handling HTTP Authentication

This code sample indicates how UTL_HTTP handles HTTP authentication.

```

SET serveroutput ON SIZE 40000

CREATE OR REPLACE PROCEDURE get_page (url          IN VARCHAR2,
                                       username    IN VARCHAR2 DEFAULT NULL,
                                       password    IN VARCHAR2 DEFAULT NULL,
                                       realm       IN VARCHAR2 DEFAULT NULL) AS

    req    UTL_HTTP.REQ;
    resp   UTL_HTTP.RESP;
    my_scheme VARCHAR2(256);
    my_realm VARCHAR2(256);
    name    VARCHAR2(256);
    value   VARCHAR2(256);
BEGIN
    -- Turn off checking of status code. We will check it by ourselves.
    UTL_HTTP.SET_RESPONSE_ERROR_CHECK(FALSE);
    req := UTL_HTTP.BEGIN_REQUEST(url);
    IF (username IS NOT NULL) THEN
        UTL_HTTP.SET_AUTHENTICATION(req, username, password); -- Use HTTP Basic
Authen. Scheme
    END IF;
    resp := UTL_HTTP.GET_RESPONSE(req);
    IF (resp.status_code = UTL_HTTP.HTTP_UNAUTHORIZED) THEN
        UTL_HTTP.GET_AUTHENTICATION(resp, my_scheme, my_realm, FALSE);
    END IF;
END;
```

```

        DBMS_OUTPUT.PUT_LINE('Web proxy server is protected.');
```

```

        DBMS_OUTPUT.PUT('Please provide the required ' || my_scheme || ' authentication
username/password for realm ' || my_realm || '
        for the proxy server.');
```

```

        UTL_HTTP.END_RESPONSE(resp);
        RETURN;
    ELSIF (resp.status_code = UTL_HTTP.HTTP_PROXY_AUTH_REQUIRED) THEN
        UTL_HTTP.GET_AUTHENTICATION(resp, my_scheme, my_realm, TRUE);
        DBMS_OUTPUT.PUT_LINE('Web page ' || url || ' is protected.');
```

```

        DBMS_OUTPUT.PUT('Please provide the required ' || my_scheme || ' authentication
username/password for realm ' || my_realm || '
        for the Web page.');
```

```

        UTL_HTTP.END_RESPONSE(resp);
        RETURN;
    END IF;
    FOR i IN 1..UTL_HTTP.GET_HEADER_COUNT(resp) LOOP
        UTL_HTTP.GET_HEADER(resp, i, name, value);
        DBMS_OUTPUT.PUT_LINE(name || ': ' || value);
    END LOOP;
    UTL_HTTP.END_RESPONSE(resp);
END;
```

280.5.4 UTL_HTTP Handling HTTP Digest Authentication

This code sample indicates how UTL_HTTP handles HTTP digest authentication.

```

declare
    url varchar2(32767);
    q utl_http.req;
    p utl_http.resp;
    pstatus pls_integer;
begin
    url := 'http://slc10tzv.us.oracle.com:3000/digest.html';
    q := utl_http.begin_request(url);
    utl_http.set_authentication(q,
                                username => 'utlhttp_user',
                                password => 'welcome',
                                scheme   => 'Digest');
    p := utl_http.get_response(q);
    pstatus := p.status_code;

    -- status code returned from get_response should be 200
    dbms_output.put_line('-- response status: ' || p.status_code);
    utl_http.end_response(p);
    utl_http.end_request(q);
EXCEPTION WHEN OTHERS THEN
    utl_http.end_request(q);
end;
/
-- response status: 200"
```

280.5.5 UTL_HTTP Retrieving and Restoring Cookies

This example show how UTL_HTTP can be used to retrieve and restore cookies.

```

CREATE TABLE my_cookies (
    session_id INTEGER,
    name       VARCHAR2(256),
    value      VARCHAR2(1024),
    domain     VARCHAR2(256),
```

```
        expire      DATE,
        path        VARCHAR2(1024),
        secure      VARCHAR2(1),
        version     INTEGER);

CREATE SEQUENCE session_id;
SET SERVEROUTPUT ON SIZE 40000

REM Retrieve cookies from UTL_HTTP
CREATE OR REPLACE FUNCTION save_cookies RETURN PLS_INTEGER AS
    cookies          UTL_HTTP.COOKIE_TABLE;
    my_session_id    PLS_INTEGER;
    secure           VARCHAR2(1);
BEGIN
    /* assume that some cookies have been set in previous HTTP requests. */
    UTL_HTTP.GET_COOKIES(cookies);
    SELECT session_id.nextval INTO my_session_id FROM DUAL;
    FOR i in 1..cookies.count LOOP
        IF (cookies(i).secure) THEN
            secure := 'Y';
        ELSE
            secure := 'N';
        END IF;
        INSERT INTO my_cookies
        VALUES (my_session_id, cookies(i).name, cookies(i).value,
                cookies(i).domain,
                cookies(i).expire, cookies(i).path, secure, cookies(i).version);
    END LOOP;
    RETURN my_session_id;
END;
/

REM Retrieve cookies from UTL_HTTP
CREATE OR REPLACE PROCEDURE restore_cookies (this_session_id IN PLS_INTEGER)
AS
    cookies          UTL_HTTP.COOKIE_TABLE;
    cookie           UTL_HTTP.COOKIE;
    i                PLS_INTEGER := 0;
    CURSOR c (c_session_id PLS_INTEGER) IS
        SELECT * FROM my_cookies WHERE session_id = c_session_id;
BEGIN
    FOR r IN c(this_session_id) LOOP
        i := i + 1;
        cookie.name      := r.name;
        cookie.value     := r.value;
        cookie.domain    := r.domain;
        cookie.expire    := r.expire;
        cookie.path      := r.path;
        IF (r.secure = 'Y') THEN
            cookie.secure := TRUE;
        ELSE
            cookie.secure := FALSE;
        END IF;
        cookie.version := r.version;
        cookies(i) := cookie;
    END LOOP;
    UTL_HTTP.CLEAR_COOKIES;
    UTL_HTTP.ADD_COOKIES(cookies);
END;
/
```

280.5.6 UTL_HTTP Making HTTP Request with Private Wallet and Cookie Table

This example shows how UTL_HTTP creates a request context with a wallet and cookie table, then makes an HTTP Request using that wallet and cookie table.

```
SET SERVEROUTPUT ON SIZE 40000

CREATE OR REPLACE PROCEDURE DISPLAY_PAGE(url IN VARCHAR2) AS
  request_context UTL_HTTP.REQUEST_CONTEXT_KEY;
  req             UTL_HTTP.REQ;
  resp           UTL_HTTP.RESP;
  data           VARCHAR2(1024);

BEGIN

  -- Create a request context with its wallet and cookie table
  request_context := UTL_HTTP.CREATE_REQUEST_CONTEXT(
    wallet_path      => 'file:/oracle/wallets/test/wallet',
    wallet_password  => '*****',
    enable_cookies   => TRUE,
    max_cookies      => 300,
    max_cookies_per_site => 20);

  -- Make a HTTP request using the private wallet and cookie
  -- table in the request context
  req := UTL_HTTP.BEGIN_REQUEST(
    url              => url,
    request_context => request_context);
  resp := UTL_HTTP.GET_RESPONSE(req);

  BEGIN
    LOOP
      UTL_HTTP.READ_TEXT(resp, data);
      DBMS_OUTPUT.PUT(data);
    END LOOP;
  EXCEPTION
    WHEN UTL_HTTP.END_OF_BODY THEN
      UTL_HTTP.END_RESPONSE(resp);
  END;

  -- Destroy the request context
  UTL_HTTP.DESTROY_REQUEST_CONTEXT(request_context);

END;

BEGIN
  DISPLAY_PAGE('https://www.example.com/');
END;
/
```

280.5.7 UTL_HTTP Using a Proxy Server

This example shows using a proxy server for an Oracle Database connection.

The `UTL_HTTP.REQUEST` procedure uses the proxy server host name and the port number to access the HTTPS URL from within the Oracle Database.

```
SELECT UTL_HTTP.REQUEST('<URL>',  
'<proxy_hostname>:<proxy_port_number>', '<wallet_directory>',  
'<wallet_password>') FROM DUAL;
```



Note:

By default, the `UTL_HTTP.REQUEST` procedure enables you to omit or set the "proxy" argument as `NULL`.

280.6 UTL_HTTP Data Structures

Data structures are used to represent requests, responses, cookies, connections, and request context.

- [REQ Type](#)
- [RESP Type](#)
- [COOKIE and COOKIE_TABLE Types](#)
- [CONNECTION Type](#)
- [REQUEST_CONTEXT_KEY Type](#)

280.6.1 REQ Type

Use this PL/SQL record type to represent an HTTP request.

Syntax

```
TYPE req IS RECORD (  
    url          VARCHAR2(32767),  
    method      VARCHAR2(64),  
    http_version VARCHAR2(64));
```

Parameters

Table 280-5 REQ Type Parameters

Parameter	Description
<code>url</code>	The URL of the HTTP request. It is set after the request is created by <code>BEGIN_REQUEST</code> .
<code>method</code>	The method to be performed on the resource identified by the URL. It is set after the request is created by <code>BEGIN_REQUEST</code> .

Table 280-5 (Cont.) REQ Type Parameters

Parameter	Description
<code>http_version</code>	The HTTP protocol version used to send the request. It is set after the request is created by <code>BEGIN_REQUEST</code> .

Usage Notes

The information returned in `REQ` from the interface `begin_request` is for read-only. Changing the field values in the record has no effect on the request.

There are other fields in `REQ` record type whose names begin with the prefix `private_`. The fields are private and are intended for use by implementation of the `UTL_HTTP` package. You should not modify the fields.

280.6.2 REQUEST_CONTEXT_KEY Type

This type is used to represent the key to a request context.

A request context is a context that holds a private wallet and cookie table to make a HTTP request. This private wallet and cookie table, unlike the session-wide ones maintained in the package, will not be shared with other HTTP requests within the database session.

Syntax

```
SUBTYPE request_context_key IS PLS_INTEGER;
```

Usage Notes

To provide enhanced security, `UTL_HTTP` allows PL/SQL programs to create request contexts. A request context is a private context that holds a wallet and a cookie table that will not be shared with other programs in the same database session when making HTTP requests and receiving HTTP responses. PL/SQL programs should use request contexts when they need to use wallets or cookies that contain sensitive information such as authentication credentials.

280.6.3 RESP Type

This PL/SQL record type is used to represent an HTTP response.

Syntax

```
TYPE resp IS RECORD (  
    status_code    PLS_INTEGER,  
    reason_phrase  VARCHAR2(256),  
    http_version   VARCHAR2(64));
```

Parameters

Table 280-6 RESP Type Parameters

Parameter	Description
status_code	The status code returned by the Web server. It is a 3-digit integer that indicates the results of the HTTP request as handled by the Web server. It is set after the response is processed by GET_RESPONSE.
reason_phrase	The short textual message returned by the Web server that describe the status code. It gives a brief description of the results of the HTTP request as handled by the Web server. It is set after the response is processed by GET_RESPONSE.
http_version	The HTTP protocol version used in the HTTP response. It is set after the response is processed by GET_RESPONSE.

Usage Notes

The information returned in `RESP` from the interface `GET_RESPONSE` is read-only. There are other fields in the `RESP` record type whose names begin with the prefix `private_`. The fields are private and are intended for use by implementation of the `UTL_HTTP` package. You should not modify the fields.

280.6.4 COOKIE and COOKIE_TABLE Types

The `COOKIE` type is the PL/SQL record type that represents an HTTP cookie. The `COOKIE_TABLE` type is a PL/SQL index-by-table type that represents a collection of HTTP cookies.

Syntax

```
TYPE cookie IS RECORD (
    name  VARCHAR2(256),
    value VARCHAR2(1024),
    domain VARCHAR2(256),
    expire TIMESTAMP WITH TIME ZONE,
    path  VARCHAR2(1024),
    secure BOOLEAN,
    version PLS_INTEGER,
    comment VARCHAR2(1024));

TYPE cookie_table IS TABLE OF cookie INDEX BY binary_integer;
```

Fields of COOKIE Record Type

[Table 280-7](#) shows the fields for the `COOKIE` and `COOKIE_TABLE` record types.

Table 280-7 Fields of COOKIE and COOKIE_TABLE Type

Field	Description
name	The name of the HTTP cookie
value	The value of the cookie

Table 280-7 (Cont.) Fields of COOKIE and COOKIE_TABLE Type

Field	Description
domain	The domain for which the cookie is valid
expire	The time by which the cookie will expire
path	The subset of URLs to which the cookie applies
secure	Should the cookie be returned to the Web server using secured means only.
version	The version of the HTTP cookie specification the cookie conforms. This field is <code>NULL</code> for Netscape cookies.
comment	The comment that describes the intended use of the cookie. This field is <code>NULL</code> for Netscape cookies.

Usage Notes

PL/SQL programs do not usually examine or change the cookie information stored in the `UTL_HTTP` package. The cookies are maintained by the package transparently. They are maintained inside the `UTL_HTTP` package, and they last for the duration of the database session only. PL/SQL applications that require cookies to be maintained beyond the lifetime of a database session can read the cookies using `GET_COOKIES`, store them persistently in a database table, and re-store the cookies back in the package using `ADD_COOKIES` in the next database session. All the fields in the `cookie` record, except for the `comment` field, must be stored. Do not alter the cookie information, which can result in an application error in the Web server or compromise the security of the PL/SQL and the Web server applications. See "[Retrieving and Restoring Cookies](#)".

280.6.5 CONNECTION Type

Use the PL/SQL record type to represent the remote hosts and TCP/IP ports of a network connection that is kept persistent after an HTTP request is completed, according to the HTTP 1.1 protocol specification. The persistent network connection may be reused by a subsequent HTTP request to the same host and port. The subsequent HTTP request may be completed faster because the network connection latency is avoided. `connection_table` is a PL/SQL table of `connection`.

For a direct HTTP persistent connection to a Web server, the `host` and `port` fields contain the host name and TCP/IP port number of the Web server. The `proxy_host` and `proxy_port` fields are not set. For an HTTP persistent connection that was previously used to connect to a Web server using a proxy, the `proxy_host` and `proxy_port` fields contain the host name and TCP/IP port number of the proxy server. The `host` and `port` fields are not set, which indicates that the persistent connection, while connected to a proxy server, is not bound to any particular target Web server. An HTTP persistent connection to a proxy server can be used to access any target Web server that is using a proxy.

The `SSL` field indicates if Secured Socket Layer (SSL) is being used in an HTTP persistent connection. An HTTPS request is an HTTP request made over SSL. For an HTTPS (SSL) persistent connection connected using a proxy, the `host` and `port` fields contain the host name and TCP/IP port number of the target HTTPS Web server and the fields will always be set. An HTTPS persistent connection to an HTTPS Web server using a proxy server can only be reused to make another request to the same target Web server.

Syntax

```
TYPE connection IS RECORD (  
    host VARCHAR2(256),  
    port PLS_INTEGER,  
    proxy_host VARCHAR2(256),  
    proxy_port PLS_INTEGER,  
    ssl BOOLEAN);
```

```
TYPE connection_table IS TABLE OF connection INDEX BY BINARY_INTEGER;
```

280.7 UTL_HTTP Operations

These topics provide information about how UTL_HTTP makes HTTP requests from SQL and PL/SQL.

- [Operational Flow](#)
- [Simple HTTP Fetches](#)
- [HTTP Requests](#)
- [HTTP Responses](#)
- [HTTP Persistent Connections](#)
- [Error Conditions](#)
- [Session Settings](#)
- [Request Context](#)
- [External Password Store](#)

280.7.1 UTL_HTTP Operational Flow

The UTL_HTTP package provides access to the HTTP protocol.

The interfaces must be called in the order shown in the following illustration, or an exception will be raised.

Figure 280-1 Flow of the Core UTL_HTTP Package

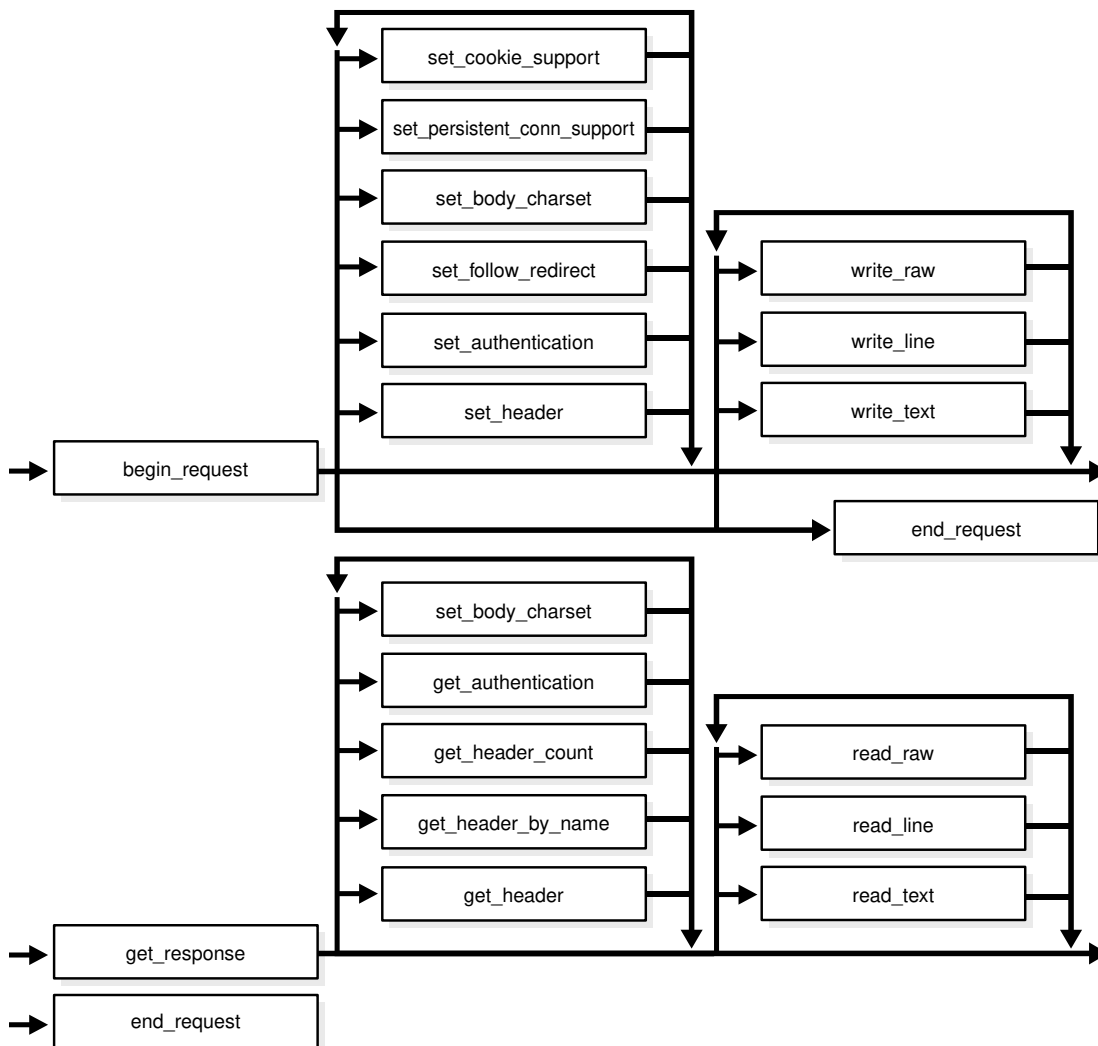


illustration: arpls006
release: 9
caption: The flow of the core UTL_HTTP Package API
date: 9/5/01
platform: pc

The following can be called at any time:

- **Non-protocol interfaces that manipulate cookies**
 - GET_COOKIE_COUNT
 - GET_COOKIES
 - ADD_COOKIES
 - CLEAR_COOKIES
- **Persistent connections**
 - GET_PERSISTENT_CONN_COUNT
 - GET_PERSISTENT_CONNS
 - CLOSE_PERSISTENT_CONN
 - CLOSE_PERSISTENT_CONNS
- **Interfaces that manipulate attributes and configurations of the UTL_HTTP package in the current session**
 - SET_PROXY
 - GET_PROXY
 - SET_COOKIE_SUPPORT
 - GET_COOKIE_SUPPORT
 - SET_FOLLOW_REDIRECT
 - GET_FOLLOW_REDIRECT
 - SET_BODY_CHARSET
 - GET_BODY_CHARSET
 - SET_PERSISTENT_CONN_SUPPORT
 - GET_PERSISTENT_CONN_SUPPORT
 - SET_DETAILED_EXCP_SUPPORT
 - GET_DETAILED_EXCP_SUPPORT
 - SET_WALLET
 - SET_TRANSFER_TIMEOUT
 - GET_TRANSFER_TIMEOUT
- **Interfaces that retrieve the last detailed exception code and message UTL_HTTP package in the current session**
 - GET_DETAILED_SQLCODE
 - GET_DETAILED_SQLERRM

 **Note:**

Some of the request and response interfaces bear the same name as the interface that manipulates the attributes and configurations of the package in the current session. They are overloaded versions of the interface that manipulate a request or a response.

280.7.2 UTL_HTTP Simple HTTP Fetches

`REQUEST` and `REQUEST_PIECES` take a string uniform resource locator (URL), contact that site, and return the data (typically HTML) obtained from that site.

You should not expect `REQUEST` or `REQUEST_PIECES` to succeed in contacting a URL unless you can contact that URL by using a browser on the same machine (and with the same privileges, environment variables, and so on.)

If `REQUEST` or `REQUEST_PIECES` fails (for example, if it raises an exception, or if it returns an HTML-formatted error message, but you believe that the URL argument is correct), then try contacting that same URL with a browser to verify network availability from your machine. You may have a proxy server set in your browser that needs to be set with each `REQUEST` or `REQUEST_PIECES` call using the optional `proxy` parameter.

 **Note:**

`UTL_HTTP` can also use environment variables to specify its proxy behavior. For example, on UNIX, setting the environment variable `http_proxy` to a URL uses that service as the proxy server for HTTP requests. Setting the environment variable `no_proxy` to a domain name does not use the HTTP proxy server for URLs in that domain. When the `UTL_HTTP` package is executed in the Oracle database server, the environment variables are the ones that are set when the database instance is started.

 **See Also:**

[Simple HTTP Fetches in a Single Call Subprograms](#)

280.7.3 UTL_HTTP HTTP Requests

The HTTP Requests group of subprograms begin an HTTP request, manipulate attributes, and send the request information to the Web server. When a request is created, it inherits the default settings of the HTTP cookie support, follow-redirect, body character set, persistent-

connection support, and transfer timeout of the current session. The settings can be changed by calling the request interface.

**See Also:**

[HTTP Requests Subprograms](#)

280.7.4 UTL_HTTP HTTP Responses

The HTTP Responses group of subprograms manipulate an HTTP response obtained from GET_RESPONSE and receive response information from the Web server.

When a response is created for a request, it inherits settings of the HTTP cookie support, follow-redirect, body character set, persistent-connection support, and transfer timeout from the request. Only the body character set can be changed by calling the response interface.

**See Also:**

[HTTP Responses Subprograms](#)

280.7.5 UTL_HTTP HTTP Cookies

The UTL_HTTP package provides subprograms to manipulate HTTP cookies.

**See Also:**

[HTTP Cookies Subprograms](#)

280.7.6 UTL_HTTP HTTP Persistent Connections

The UTL_HTTP package provides subprograms to manipulate persistent connections.

**See Also:**

[HTTP Persistent Connections Subprograms](#)

280.7.7 UTL_HTTP Error Conditions

The `UTL_HTTP` package provides subprograms to retrieve error information.



See Also:

[Error Conditions Subprograms](#)

280.7.8 UTL_HTTP Session Settings

Session settings manipulate the configuration and default behavior of `UTL_HTTP` when HTTP requests are executed within a database user session.

When a request is created, it inherits the default settings of the HTTP cookie support, follow-redirect, body character set, persistent-connection support, and transfer timeout of the current session. Those settings can be changed later by calling the request interface. When a response is created for a request, it inherits those settings from the request. Only the body character set can be changed later by calling the response interface.



See Also:

[Session Settings Subprograms](#)

280.7.9 UTL_HTTP Request Context

The `UTL_HTTP` package maintains a common wallet and cookie table within the database session that all HTTP requests and responses share. This makes it easy for users to share the wallet or to maintain application state in the cookies within the session. However, if an application stores private information in the wallet or in the cookies that it does not want to share with other applications in the same database session, it may define a request context to hold its own wallet and cookie table and use this request context to make HTTP requests.



See Also:

[HTTP Requests Subprograms](#)

280.7.10 UTL_HTTP External Password Store

The `UTL_HTTP` package allows HTTP password credentials to be stored in an Oracle wallet's external password store. The external password store provides an easy but secure storage

for passwords and frees the application developers from the need to maintain their own storage.



See Also:

[SET_AUTHENTICATION_FROM_WALLET Procedure](#)

280.8 UTL_HTTP Subprogram Groups

This section describes the `UTL_HTTP` subprograms. They are grouped by function.

- [Simple HTTP Fetches in a Single Call Subprograms](#)
- [Session Settings Subprograms](#)
- [HTTP Requests Subprograms](#)
- [HTTP Request Contexts Subprograms](#)
- [HTTP Responses Subprograms](#)
- [HTTP Cookies Subprograms](#)
- [HTTP Persistent Connections Subprograms](#)
- [Error Conditions Subprograms](#)

280.8.1 UTL_HTTP Simple HTTP Fetches in a Single Call Subprograms

`REQUEST` and `REQUEST_PIECES` take a string uniform resource locator (URL), contact that site, and return the data (typically HTML) obtained from that site.

Table 280-8 UTL_HTTP Subprograms—Simple HTTP Fetches in a Single Call

Subprogram	Description
REQUEST Function	Returns up to the first 2000 bytes of the data retrieved from the given URL. This function can be used directly in SQL queries.
REQUEST_PIECES Function	Returns a PL/SQL table of 2000-byte pieces of the data retrieved from the given URL.

280.8.2 UTL_HTTP Session Settings Subprograms

This table lists and briefly describes the `UTL_HTTP` Session Settings Subprograms.

Table 280-9 UTL_HTTP Subprograms—Session Settings

Subprogram	Description
GET_BODY_CHARSET Procedure	Retrieves the default character set of the body of all future HTTP requests
GET_COOKIE_SUPPORT Procedure	Retrieves the current cookie support settings

Table 280-9 (Cont.) UTL_HTTP Subprograms—Session Settings

Subprogram	Description
GET_DETAILED_EXCP_SUPPORT Procedure	Checks if the UTL_HTTP package will raise a detailed exception or not
GET_FOLLOW_REDIRECT Procedure	Retrieves the follow-redirect setting in the current session
GET_PERSISTENT_CONN_SUPPORT Procedure	Checks if the persistent connection support is enabled and gets the maximum number of persistent connections in the current session
GET_PROXY Procedure	Retrieves the current proxy settings
GET_RESPONSE_ERROR_CHECK Procedure	Checks if the response error check is set or not
GET_TRANSFER_TIMEOUT Procedure	Retrieves the current network transfer timeout value
SET_TRANSFER_TIMEOUT Procedure	Sets the default character set of the body of all future HTTP requests when the media type is <code>text</code> and the character set is not specified in the <code>Content-Type</code> header
SET_COOKIE_SUPPORT Procedures	Sets whether or not future HTTP requests will support HTTP cookies; sets the maximum number of cookies maintained in the current database user session
SET_DETAILED_EXCP_SUPPORT Procedure	Sets the UTL_HTTP package to raise a detailed exception
SET_FOLLOW_REDIRECT Procedures	Sets the maximum number of times UTL_HTTP follows the HTTP redirect instruction in the HTTP responses to future requests in the <code>GET_RESPONSE</code> function
SET_PERSISTENT_CONN_SUPPORT Procedure	Sets whether or not future HTTP requests will support the HTTP 1.1 persistent connection; sets the maximum number of persistent connections maintained in the current database user session
SET_PROXY Procedure	Sets the proxy to be used for requests of HTTP or other protocols
SET_RESPONSE_ERROR_CHECK Procedure	Sets whether or not <code>GET_RESPONSE</code> raises an exception when the Web server returns a status code that indicates an error—a status code in the 4xx or 5xx ranges
SET_TRANSFER_TIMEOUT Procedure	Sets the timeout value for UTL_HTTP to read the HTTP response from the Web server or proxy server
SET_WALLET Procedure	Sets the Oracle Wallet used for all HTTP requests over Secured Socket Layer (SSL), that is, HTTPS

280.8.3 UTL_HTTP HTTP Requests Subprograms

This table lists and briefly describes the UTL_HTTP HTTP Requests.

Table 280-10 UTL_HTTP Subprograms—HTTP Requests

Subprogram	Description
BEGIN_REQUEST Function	Begins a new HTTP request. UTL_HTTP establishes the network connection to the target Web server or the proxy server and sends the HTTP request line.
SET_HEADER Procedure	Sets an HTTP request header. The request header is sent to the Web server as soon as it is set.

Table 280-10 (Cont.) UTL_HTTP Subprograms—HTTP Requests

Subprogram	Description
SET_AUTHENTICATION Procedure	Sets HTTP authentication information in the HTTP request header. The Web server needs this information to authorize the request.
SET_AUTHENTICATION_FROM_WALLET Procedure	Sets the HTTP authentication information in the HTTP request header needed for the request to be authorized by the Web server using the username and password credential stored in the Oracle wallet.
SET_BODY_CHARSET Procedures	Sets the character set of the request body when the media type is text but the character set is not specified in the Content-Type header
SET_COOKIE_SUPPORT Procedures	Enables or disables support for the HTTP cookies in the request
SET_FOLLOW_REDIRECT Procedures	Sets the maximum number of times UTL_HTTP follows the HTTP redirect instruction in the HTTP response to this request in the GET_RESPONSE Function
SET_PERSISTENT_CONN_SUPPORT Procedure	Enables or disables support for the HTTP 1.1 persistent-connection in the request
SET_PROXY Procedure	Writes a text line in the HTTP request body and ends the line with new-line characters (CRLF as defined in UTL_TCP)
WRITE_RAW Procedure	Writes some binary data in the HTTP request body
WRITE_TEXT Procedure	Writes some text data in the HTTP request body

280.8.4 UTL_HTTP HTTP Request Contexts Subprograms

UTL_HTTP HTTP Request Contexts subprograms create or destroy a request context.

The following table lists and briefly describes the UTL_HTTP HTTP Request Contexts.

Table 280-11 UTL_HTTP Subprograms—HTTP Request Contexts

Subprogram	Description
CREATE_REQUEST_CONTEXT Function	Creates a request context in UTL_HTTP for a wallet and a cookie table
DESTROY_REQUEST_CONTEXT Procedure	Destroys a request context in UTL_HTTP

280.8.5 UTL_HTTP HTTP Responses Subprograms

This table lists and briefly describes the HTTP Responses Subprograms of UTL_HTTP.

Table 280-12 UTL_HTTP Subprograms—HTTP Responses

Subprogram	Description
END_RESPONSE Procedure	Ends the HTTP response. It completes the HTTP request and response.
GET_AUTHENTICATION Procedure	Retrieves the HTTP authentication information needed for the request to be accepted by the Web server as indicated in the HTTP response header

Table 280-12 (Cont.) UTL_HTTP Subprograms—HTTP Responses

Subprogram	Description
GET_HEADER Procedure	Returns the n th HTTP response header name and value returned in the response
GET_HEADER_BY_NAME Procedure	Returns the HTTP response header value returned in the response given the name of the header
GET_HEADER_COUNT Function	Returns the number of HTTP response headers returned in the response
GET_RESPONSE Function	Reads the HTTP response. When the function returns, the status line and the HTTP response headers have been read and processed.
READ_LINE Procedure	Reads the HTTP response body in text form until the end of line is reached and returns the output in the caller-supplied buffer
READ_RAW Procedure	Reads the HTTP response body in binary form and returns the output in the caller-supplied buffer
READ_TEXT Procedure	Reads the HTTP response body in text form and returns the output in the caller-supplied buffer
SET_BODY_CHARSET Procedures	Sets the character set of the response body when the media type is "text" but the character set is not specified in the <code>Content-Type</code> header

280.8.6 UTL_HTTP HTTP Cookies Subprograms

The HTTP cookies subprograms manages cookies in the `UTL_HTTP` package.

The following table lists and briefly describes the HTTP cookies subprograms of `UTL_HTTP`.

Table 280-13 UTL_HTTP Subprograms—HTTP Cookies

Subprogram	Description
ADD_COOKIES Procedure	Add the cookies either to a request context or to the <code>UTL_HTTP</code> package's session state
CLEAR_COOKIES Procedure	Clears all the cookies maintained either in a request context or in the <code>UTL_HTTP</code> package's session state
GET_COOKIE_COUNT Function	Returns the number of cookies maintained either in a request context or in the <code>UTL_HTTP</code> package's session states
GET_COOKIES Function	Returns all the cookies maintained either in a request context or in the <code>UTL_HTTP</code> package's session state.

280.8.7 UTL_HTTP HTTP Persistent Connections Subprograms

This table lists and briefly describes the `UTL_HTTP` HTTP Persistent Connections subprograms.

Table 280-14 UTL_HTTP Subprograms—HTTP Persistent Connections

Subprogram	Description
CLOSE_PERSISTENT_CONN Procedure	Closes an HTTP persistent connection maintained by the UTL_HTTP package in the current database session
CLOSE_PERSISTENT_CONNS Procedure	Closes a group of HTTP persistent connections maintained by the UTL_HTTP package in the current database session
GET_PERSISTENT_CONN_COUNT Function	Returns the number of network connections currently kept persistent by the UTL_HTTP package to the Web servers
GET_PERSISTENT_CONNS Procedure	Returns all the network connections currently kept persistent by the UTL_HTTP package to the Web servers

280.8.8 UTL_HTTP Error Conditions Subprograms

This table lists and briefly describes error conditions subprograms of UTL_HTTP .

Table 280-15 UTL_HTTP Subprograms—Error Conditions

Subprogram	Description
GET_DETAILED_SQLCODE Function	Retrieves the detailed SQLCODE of the last exception raised
GET_DETAILED_SQLERRM Function	Retrieves the detailed SQLERRM of the last exception raised

280.9 Summary of UTL_HTTP Subprograms

This table lists the UTL_HTTP subprograms and briefly describes them.

Table 280-16 UTL_HTTP Package Subprograms

Subprogram	Description	Group
ADD_COOKIES Procedure	Add the cookies either to a request context or to the UTL_HTTP package's session state	HTTP Cookies Subprograms
BEGIN_REQUEST Function	Begins a new HTTP request. UTL_HTTP establishes the network connection to the target Web server or the proxy server and sends the HTTP request line	HTTP Requests Subprograms
CLEAR_COOKIES Procedure	Clears all the cookies maintained either in a request context or in the UTL_HTTP package's session state	HTTP Cookies Subprograms
CLOSE_PERSISTENT_CONN Procedure	Closes an HTTP persistent connection maintained by the UTL_HTTP package in the current database session	HTTP Persistent Connections Subprograms

Table 280-16 (Cont.) UTL_HTTP Package Subprograms

Subprogram	Description	Group
CLOSE_PERSISTENT_CONNECTIONS Procedure	Closes a group of HTTP persistent connections maintained by the UTL_HTTP package in the current database session	HTTP Persistent Connections Subprograms
CREATE_REQUEST_CONTEXT Function	Creates a request context in UTL_HTTP for a wallet and a cookie table	HTTP Requests Subprograms
DESTROY_REQUEST_CONTEXT Procedure	Destroys a request context in UTL_HTTP for a wallet and a cookie table	HTTP Requests Subprograms
END_REQUEST Procedure	Ends the HTTP request	HTTP Requests Subprograms
END_RESPONSE Procedure	Ends the HTTP response. It completes the HTTP request and response	HTTP Responses Subprograms
GET_AUTHENTICATION Procedure	Retrieves the HTTP authentication information needed for the request to be accepted by the Web server as indicated in the HTTP response header	HTTP Responses Subprograms
GET_BODY_CHARSET Procedure	Retrieves the default character set of the body of all future HTTP requests	Session Settings Subprograms
GET_COOKIE_COUNT Function	Returns the number of cookies currently maintained by the UTL_HTTP package set by all Web servers	HTTP Cookies Subprograms
GET_COOKIE_SUPPORT Procedure	Retrieves the current cookie support settings	Session Settings Subprograms
GET_COOKIES Function	Returns all the cookies currently maintained by the UTL_HTTP package set by all Web servers	HTTP Cookies Subprograms
GET_DETAILED_EXCP_SUPPORT Procedure	Checks if the UTL_HTTP package will raise a detailed exception or not	Session Settings Subprograms
GET_DETAILED_SQLCODE Function	Retrieves the detailed SQLCODE of the last exception raised	Error Conditions Subprograms
GET_DETAILED_SQLERRM Function	Retrieves the detailed SQLERRM of the last exception raised	Error Conditions Subprograms
GET_FOLLOW_REDIRECT Procedure	Retrieves the follow-redirect setting in the current session	Session Settings Subprograms
GET_HEADER Procedure	Returns the n th HTTP response header name and value returned in the response	HTTP Responses Subprograms

Table 280-16 (Cont.) UTL_HTTP Package Subprograms

Subprogram	Description	Group
GET_HEADER_BY_NAME Procedure	Returns the HTTP response header value returned in the response given the name of the header	HTTP Responses Subprograms
GET_HEADER_COUNT Function	Returns the number of HTTP response headers returned in the response	HTTP Responses and HTTP Responses Subprograms
GET_PERSISTENT_CONNECTION_COUNT Function	Returns the number of network connections currently kept persistent by the UTL_HTTP package to the Web servers	HTTP Persistent Connections Subprograms
GET_HEADER_COUNT Function	Sees whether or not future HTTP requests will support the HTTP 1.1 persistent connection; sets the maximum number of persistent connections maintained in the current database user session	Session Settings Subprograms
GET_PERSISTENT_CONNECTION_SUPPORT Procedure	Checks if the persistent connection support is enabled and gets the maximum number of persistent connections in the current session (see Session Settings Subprograms)	HTTP Persistent Connections Subprograms
GET_PERSISTENT_CONNS Procedure	Returns all the network connections currently kept persistent by the UTL_HTTP package to the Web servers	HTTP Persistent Connections Subprograms
GET_PROXY Procedure	Retrieves the current proxy settings	Session Settings Subprograms
GET_RESPONSE Function	Reads the HTTP response. When the function returns, the status line and the HTTP response headers have been read and processed	HTTP Responses Subprograms
GET_RESPONSE_ERROR_CHECK Procedure	Checks if the response error check is set or no	Session Settings Subprograms
GET_TRANSFER_TIMEOUT Procedure	Retrieves the current network transfer timeout value	Session Settings Subprograms
READ_LINE Procedure	Reads the HTTP response body in text form until the end of line is reached and returns the output in the caller-supplied buffer	HTTP Responses Subprograms
READ_RAW Procedure	Reads the HTTP response body in binary form and returns the output in the caller-supplied buffer	HTTP Responses Subprograms

Table 280-16 (Cont.) UTL_HTTP Package Subprograms

Subprogram	Description	Group
READ_TEXT Procedure	Reads the HTTP response body in text form and returns the output in the caller-supplied buffer	HTTP Responses Subprograms
REQUEST Function	Returns up to the first 2000 bytes of the data retrieved from the given URL. This function can be used directly in SQL queries.	Simple HTTP Fetches in a Single Call Subprograms
REQUEST_PIECES Function	Returns a PL/SQL table of 2000-byte pieces of the data retrieved from the given URL	Simple HTTP Fetches in a Single Call Subprograms
SET_AUTHENTICATION Procedure	Sets HTTP authentication information in the HTTP request header. The Web server needs this information to authorize the request.	HTTP Requests Subprograms
SET_AUTHENTICATION_FROM_WALLET Procedure	Sets the HTTP authentication information in the HTTP request header needed for the request to be authorized by the Web server using the username and password credential stored in the Oracle wallet.	HTTP Requests Subprograms
SET_BODY_CHARSET Procedures	Sets the default character set of the body of all future HTTP requests when the media type is <code>text</code> and the character set is not specified in the <code>Content-Type</code> header	Session Settings Subprograms
SET_BODY_CHARSET Procedures	Sets the character set of the request body when the media type is <code>text</code> but the character set is not specified in the <code>Content-Type</code> header	HTTP Requests Subprograms
SET_BODY_CHARSET Procedures	Sets the character set of the response body when the media type is "text" but the character set is not specified in the <code>Content-Type</code> header	HTTP Responses Subprograms and Session Settings Subprograms
SET_COOKIE_SUPPORT Procedures	Enables or disables support for the HTTP cookies in the request	HTTP Requests Subprograms
SET_DETAILED_EXCP_SUPPORT Procedure	Sets whether or not future HTTP requests will support HTTP cookies; sets the maximum number of cookies maintained in the current database user session	Session Settings Subprograms
SET_DETAILED_EXCP_SUPPORT Procedure	Sets the UTL_HTTP package to raise a detailed exception	Session Settings Subprograms

Table 280-16 (Cont.) UTL_HTTP Package Subprograms

Subprogram	Description	Group
SET_FOLLOW_REDIRECT Procedures	Sets the maximum number of times UTL_HTTP follows the HTTP redirect instruction in the HTTP response to this request in the GET_RESPONSE function	HTTP Requests Subprograms
SET_HEADER Procedure	Sets the maximum number of times UTL_HTTP follows the HTTP redirect instruction in the HTTP responses to future requests in the GET_RESPONSE function	Session Settings Subprograms
SET_HEADER Procedure	Sets an HTTP request header. The request header is sent to the Web server as soon as it is set.	HTTP Requests Subprograms
SET_PERSISTENT_CONN_SUPPORT Procedure	Enables or disables support for the HTTP 1.1 persistent-connection in the request	HTTP Requests Subprograms
SET_PROXY Procedure	Sets the proxy to be used for requests of HTTP or other protocols	Session Settings and Session Settings Subprograms
SET_RESPONSE_ERROR_CHECK Procedure	Sets whether or not GET_RESPONSE raises an exception when the Web server returns a status code that indicates an error—a status code in the 4xx or 5xx ranges	Session Settings Subprograms
SET_TRANSFER_TIMEOUT Procedure	Sets the timeout value for UTL_HTTP to read the HTTP response from the Web server or proxy server	Session Settings and Session Settings Subprograms
SET_WALLET Procedure	Sets the Oracle Wallet used for all HTTP requests over Secured Socket Layer (SSL), that is, HTTPS	Session Settings Subprograms
WRITE_LINE Procedure	Writes a text line in the HTTP request body and ends the line with new-line characters (CRLF) as defined in UTL_TCP	HTTP Requests Subprograms
WRITE_RAW Procedure	Writes some binary data in the HTTP request body	HTTP Requests Subprograms
WRITE_TEXT Procedure	Writes some text data in the HTTP request body	HTTP Requests Subprograms

280.9.1 ADD_COOKIES Procedure

This procedure adds the cookies either to a request context or to the UTL_HTTP package's session state.



See Also:

[HTTP Cookies](#) and [HTTP Cookies Subprograms](#)

Syntax

```
UTL_HTTP.ADD_COOKIES (  
    cookies          IN  cookie_table,  
    request_context IN  request_context_key DEFAULT NULL);
```

Parameters

Table 280-17 ADD_COOKIES Procedure Parameters

Parameter	Description
cookies	The cookies to be added
request_context	Request context to add the cookies. If NULL, the cookies will be added to the UTL_HTTP package's session state instead.

Usage Notes

The cookies that the package currently maintains are not cleared before new cookies are added.

280.9.2 BEGIN_REQUEST Function

This function begins a new HTTP request. UTL_HTTP establishes the network connection to the target Web server or the proxy server and sends the HTTP request line. The PL/SQL program continues the request by calling some other interface to complete the request.

The URL may contain the username and password needed to authenticate the request to the server. The format is:

```
scheme://[user[:password]@]host[:port]/[...]
```



See Also:

[HTTP Requests](#) and [HTTP Requests Subprograms](#)

Syntax

```
UTL_HTTP.BEGIN_REQUEST (  
    url          IN  VARCHAR2,
```

```

method          IN  VARCHAR2 DEFAULT 'GET',
http_version    IN  VARCHAR2 DEFAULT NULL,
request_context IN  request_context_key DEFAULT NULL,
https_host      IN  VARCHAR2 DEFAULT NULL)
RETURN req;

```

Parameters

Table 280-18 BEGIN_REQUEST Function Parameters

Parameter	Description
url	The URL of the HTTP request
method	The method performed on the resource identified by the URL
http_version	The HTTP protocol version that sends the request. The format of the protocol version is HTTP/major-version.minor-version, where major-version and minor-version are positive numbers. If this parameter is set to NULL, UTL_HTTP uses the latest HTTP protocol version that it supports to send the request. The latest version that the package supports is 1.1 and it can be upgraded to a later version. The default is NULL.
request_context	Request context that holds the private wallet and the cookie table to use in this HTTP request. If this parameter is NULL, the wallet and cookie table shared in the current database session will be used instead.
https_host	A string representing the host name. If the string does not begin with a wildcard, the string will be used as the host name for server name indication (SNI). If the string begins with a wildcard, the string will be used to match against the common name (CN) of the remote server's certificate for an HTTPS request. If NULL, the host name in the given URL will be used for SNI.

Usage Notes

- The URL passed as an argument to this function is not examined for illegal characters, such as spaces, according to URL specification RFC 2396. You should escape those characters with the `UTL_URL` package to return illegal and reserved characters. URLs should consist of US-ASCII characters only. See [UTL_URL](#) for a list of legal characters in URLs. Note that URLs should consist of US-ASCII characters only. The use of non-US-ASCII characters in a URL is generally unsafe.
- `BEGIN_REQUEST` can send a URL whose length is up to 32767 bytes. However, different Web servers impose different limits on the length of the URL they can accept. This limit is often about 4000 bytes. If this limit is exceeded, the outcome will depend on the Web server. For example, a Web server might simply drop the HTTP connection without returning a response of any kind. If this happens, a subsequent invocation of the [GET_RESPONSE Function](#) will raise the `PROTOCOL_ERROR` exception.

A URL will be long when its `QUERY_STRING` (that is, the information that follows the question mark (?)) is long. In general, it is better to send this parameterization in the body of the request using the `POST` method.

```

req := UTL_HTTP.BEGIN_REQUEST (url=>the_url, method=>'POST');
UTL_HTTP.SET_HEADER (r      => req,
                    name   => 'Content-Type',
                    value  => 'application/x-www-form-urlencoded');
UTL_HTTP.SET_HEADER (r      => req,
                    name   => 'Content-Length',
                    value  => '<length of data posted in bytes>');
UTL_HTTP.WRITE_TEXT (r      => req,
                    data   => 'p1 = value1&p2=value2...');
resp := UTL_HTTP.GET_RESPONSE
      (r      => req);
...

```

The programmer must determine whether a particular Web server may, or may not, accept data provided in this way.

- An Oracle wallet must be set before accessing Web servers over HTTPS. See the [SET_WALLET Procedure](#) procedure on how to set up an Oracle wallet. To use SSL client authentication, the client certificate should be stored in the wallet and the caller must have the `use-client-certificates` privilege on the wallet. See "Managing Fine-grained Access to External Network Services" in the *Oracle Database Security Guide* to grant the privilege.
- To connect to the remote Web server directly, or indirectly through a HTTP proxy, the `UTL_HTTP` must have the `connect` ACL privilege to the remote Web server host or the proxy host respectively.

280.9.3 CLEAR_COOKIES Procedure

This procedure clears all the cookies maintained either in a request context or in the `UTL_HTTP` package's session state.



See Also:

[HTTP Cookies](#) and [HTTP Cookies Subprograms](#)

Syntax

```

UTL_HTTP.CLEAR_COOKIES (
    request_context IN request_context_key DEFAULT NULL);

```

Parameters

Table 280-19 CLEAR_COOKIES Procedure Parameters

Parameter	Description
<code>request_context</code>	Request context to clear the cookies. If <code>NULL</code> , the cookies maintained in the <code>UTL_HTTP</code> package's session state will be cleared instead.

280.9.4 CLOSE_PERSISTENT_CONN Procedure

This procedure closes an HTTP persistent connection maintained by the `UTL_HTTP` package in the current database session.



See Also:

[HTTP Persistent Connections](#) and [HTTP Persistent Connections Subprograms](#)

Syntax

```
UTL_HTTP.CLOSE_PERSISTENT_CONN (  
    conn IN connection);
```

Parameters

Table 280-20 CLOSE_PERSISTENT_CONN Procedure Parameters

Parameter	Description
conn	The HTTP persistent connection to close

280.9.5 CLOSE_PERSISTENT_CONNS Procedure

This procedure closes a group of HTTP persistent connections maintained by the `UTL_HTTP` package in the current database session. This procedure uses a pattern-match approach to decide which persistent connections to close.

To close a group of HTTP persistent connection that share a common property (for example, all connections to a particular host, or all SSL connections), set the particular parameters and leave the rest of the parameters `NULL`. If a particular parameter is set to `NULL` when this procedure is called, that parameter will not be used to decide which connections to close.

For example, the following call to the procedure closes all persistent connections to foobar:

```
UTL_HTTP.CLOSE_PERSISTENT_CONNS(host => 'foobar');
```

And the following call to the procedure closes all persistent connections through the foobar at TCP/IP port 80:

```
UTL_HTTP.CLOSE_PERSISTENT_CONNS(proxy_host => 'foobar',  
                                proxy_port => 80);
```

And the following call to the procedure closes all persistent connections:

```
UTL_HTTP.CLOSE_PERSISTENT_CONNS;
```

**See Also:**[HTTP Persistent Connections](#) and [HTTP Persistent Connections Subprograms](#)**Syntax**

```

UTL_HTTP.CLOSE_PERSISTENT_CONNS (
  host          IN VARCHAR2 DEFAULT NULL,
  port          IN PLS_INTEGER DEFAULT NULL,
  proxy_host    IN VARCHAR2 DEFAULT NULL,
  proxy_port    IN PLS_INTEGER DEFAULT NULL,
  ssl           IN BOOLEAN DEFAULT NULL);

```

Parameters**Table 280-21 CLOSE_PERSISTENT_CONNS Procedure Parameters**

Parameter	Description
host	The host for which persistent connections are to be closed
port	The port number for which persistent connections are to be closed
proxy_host	The proxy host for which persistent connections are to be closed
proxy_port	The proxy port for which persistent connections are to be closed
ssl	Close persistent SSL connection

Usage Notes

Connections to the same Web server at different TCP/IP ports are counted individually. The host names of the Web servers are identified as specified in the URL of the original HTTP requests. Therefore, fully qualified host names with domain names will be counted differently from the host names without domain names.

Note that the use of a NULL value in a parameter when this procedure is called means that the caller does not care about its value when the package decides which persistent connection to close. If you want a NULL value in a parameter to match only a NULL value of the parameter of a persistent connection (which is when you want to close a specific persistent connection), you should use the `CLOSE_PERSISTENT_CONN` procedure that closes a specific persistent connection.

280.9.6 CREATE_REQUEST_CONTEXT Function

This function creates a request context. A request context is a context that holds a wallet and a cookie for private use in making a HTTP request. This allows the HTTP request to use a wallet and a cookie table that will not be shared with other applications making HTTP requests in the same database session.

**See Also:**[Request Context](#) and [HTTP Request Contexts Subprograms](#)

Syntax

```
UTL_HTTP.CREATE_REQUEST_CONTEXT (
  wallet_path          IN VARCHAR2 DEFAULT NULL,
  wallet_password     IN VARCHAR2 DEFAULT NULL,
  enable_cookies      IN BOOLEAN  DEFAULT TRUE,
  max_cookies         IN PLS_INTEGER DEFAULT 300,
  max_cookies_per_site IN PLS_INTEGER DEFAULT 20)
RETURN request_context_key;
```

Parameters

Table 280-22 CREATE_REQUEST_CONTEXT Function Parameters

Parameter	Description
wallet_path	Directory path that contains the Oracle wallet. The format is <i>file:directory-path</i>
wallet_password	The password needed to open the wallet. If the wallet is auto-login enabled, the password may be omitted and should be set to NULL. See the <i>Oracle Database Enterprise User Security Administrator's Guide</i> for detailed information about wallets.
enable_cookies	Sets whether HTTP requests using this request context should support HTTP cookies or not: TRUE to enable the support, FALSE to disable it.
max_cookies	Sets the maximum total number of cookies that will be maintained in this request context
max_cookies_per_site	Sets the maximum number of cookies per each Web site that will be maintained in this request context

Return Values

The request context created.

Examples

```
DECLARE
  request_context UTL_HTTP.REQUEST_CONTEXT_KEY;
  req            utl_http.req;
BEGIN
  request_context := UTL_HTTP.CREATE_REQUEST_CONTEXT(
    wallet_path          => 'file:/oracle/wallets/test_wallets',
    wallet_password     => NULL,
    enable_cookies      => TRUE,
    max_cookies         => 300,
    max_cookies_per_site => 20);
  req := UTL_HTTP.BEGIN_REQUEST(
    url                 => 'http://www.example.com/',
    request_context     => request_context);
END;
```


280.9.7 DESTROY_REQUEST_CONTEXT Procedure

This procedure destroys a request context in `UTL_HTTP`. A request context cannot be destroyed when it is in use by a HTTP request or response.



See Also:

[Request Context](#) and [HTTP Request Contexts Subprograms](#)

Syntax

```
UTL_HTTP.DESTROY_REQUEST_CONTEXT (  
    request_context    request_context_key);
```

Parameters

Table 280-23 DESTROY_REQUEST_CONTEXT Procedure Parameters

Parameter	Description
<code>request_context</code>	Request context to destroy

Examples

```
DECLARE  
    request_context    UTL_HTTP.REQUEST_CONTEXT_KEY;  
BEGIN  
    request_context := UTL_HTTP.CREATE_REQUEST_CONTEXT(...);  
    ...  
    UTL_HTTP.DESTROY_REQUEST_CONTEXT(request_context);  
END;
```

280.9.8 END_REQUEST Procedure

This procedure ends the HTTP request. To terminate the HTTP request without completing the request and waiting for the response, the program can call this procedure. Otherwise, the program should go through the normal sequence of beginning a request, getting the response, and closing the response. The network connection will always be closed and will not be reused.



See Also:

[HTTP Requests](#) and [HTTP Requests Subprograms](#)

Syntax

```
UTL_HTTP.END_REQUEST (  
    r IN OUT NOCOPY req);
```

Parameters

Table 280-24 END_REQUEST Procedure Parameters

Parameter	Description
r	The HTTP request

280.9.9 END_RESPONSE Procedure

This procedure ends the HTTP response. It completes the HTTP request and response. Unless HTTP 1.1 persistent connection is used in this request, the network connection is also closed.

**See Also:**

[HTTP Responses](#) and [HTTP Responses Subprograms](#)

Syntax

```
UTL_HTTP.END_RESPONSE (  
    r IN OUT NOCOPY resp);
```

Parameters

Table 280-25 END_RESPONSE Procedure Parameters

Parameter	Description
r	The HTTP response

280.9.10 GET_AUTHENTICATION Procedure

This procedure retrieves the HTTP authentication information needed for the request to be accepted by the Web server as indicated in the HTTP response header.

**See Also:**

[HTTP Responses](#) and [HTTP Responses Subprograms](#)

Syntax

```
UTL_HTTP.GET_AUTHENTICATION(  
    r          IN OUT NOCOPY resp,  
    scheme    OUT VARCHAR2,  
    realm     OUT VARCHAR2,  
    for_proxy IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 280-26 GET_AUTHENTICATION Procedure Parameters

Parameter	Description
r	The HTTP response
scheme	The scheme for the required HTTP authentication
realm	The realm for the required HTTP authentication
for_proxy	Returns the HTTP authentication information required for the access to the HTTP proxy server instead of the Web server? Default is FALSE

Usage Notes

When a Web client is unaware that a document is protected, at least two HTTP requests are required for the document to be retrieved. In the first HTTP request, the Web client makes the request without supplying required authentication information; so the request is denied. The Web client can determine the authentication information required for the request to be authorized by calling `GET_AUTHENTICATION`. The Web client makes the second request and supplies the required authentication information with `SET_AUTHORIZATION`. If the authentication information can be verified by the Web server, the request will succeed and the requested document is returned. Before making the request, if the Web client knows that authentication information is required, it can supply the required authentication information in the first request, thus saving an extra request.

280.9.11 GET_BODY_CHARSET Procedure

This procedure retrieves the default character set of the body of all future HTTP requests.



See Also:

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```
UTL_HTTP.GET_BODY_CHARSET (
    charset OUT NOCOPY VARCHAR2);
```

Parameters

Table 280-27 GET_BODY_CHARSET Procedure Parameters

Parameter	Description
charset	The default character set of the body of all future HTTP requests

280.9.12 GET_COOKIE_COUNT Function

This function returns the number of cookies maintained either in a request context or in the UTL_HTTP package's session state.



See Also:

[HTTP Cookies](#) and [HTTP Cookies Subprograms](#)

Syntax

```
UTL_HTTP.GET_COOKIE_COUNT (  
    request_context IN request_context_key DEFAULT NULL)  
    RETURN PLS_INTEGER;
```

Parameters

Table 280-28 GET_COOKIE_COUNT Function Parameters

Parameter	Description
request_context	Request context to return the cookie count for. If NULL, the cookie count maintained in the UTL_HTTP package's session state will be returned instead.

280.9.13 GET_COOKIE_SUPPORT Procedure

This procedure retrieves the current cookie support settings.



See Also:

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```
UTL_HTTP.GET_COOKIE_SUPPORT (  
    enable          OUT BOOLEAN,  
    max_cookies     OUT PLS_INTEGER,  
    max_cookies_per_site OUT PLS_INTEGER);
```

Parameters

Table 280-29 GET_COOKIE_SUPPORT Procedure Parameters

Parameter	Description
enable	Indicates whether future HTTP requests should support HTTP cookies (TRUE) or not (FALSE)

Table 280-29 (Cont.) GET_COOKIE_SUPPORT Procedure Parameters

Parameter	Description
max_cookies	Indicates the maximum total number of cookies maintained in the current session
max_cookies_per_site	Indicates the maximum number of cookies maintained in the current session for each Web site

280.9.14 GET_COOKIES Function

This function returns all the cookies maintained either in a request context or in the UTL_HTTP package's session state.



See Also:

[HTTP Cookies](#) and [HTTP Cookies Subprograms](#)

Syntax

```
UTL_HTTP.GET_COOKIES (
    cookies          IN OUT NOCOPY cookie_table,
    request_context IN          request_context_key DEFAULT NULL);
```

Parameters

Table 280-30 GET_COOKIES Function Parameters

Parameter	Description
cookies	The cookies returned
request_context	Request context to return the cookies for. If NULL, the cookies maintained in the UTL_HTTP package's session state will be returned instead.

280.9.15 GET_DETAILED_EXCP_SUPPORT Procedure

This procedure checks if the UTL_HTTP package will raise a detailed exception or not.



See Also:

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```
UTL_HTTP.GET_DETAILED_EXCP_SUPPORT (
    enable OUT BOOLEAN);
```

Parameters

Table 280-31 GET_DETAILED_EXCP_SUPPORT Procedure Parameters

Parameter	Description
enable	TRUE if UTL_HTTP raises a detailed exception; otherwise FALSE

280.9.16 GET_DETAILED_SQLCODE Function

This function retrieves the detailed `SQLCODE` of the last exception raised.



See Also:

[Error Conditions](#) and [Error Conditions Subprograms](#)

Syntax

```
UTL_HTTP.GET_DETAILED_SQLCODE  
RETURN PLS_INTEGER;
```

280.9.17 GET_DETAILED_SQLERRM Function

This function retrieves the detailed `SQLERRM` of the last exception raised.



See Also:

[Error Conditions](#) and [Error Conditions Subprograms](#)

Syntax

```
UTL_HTTP.GET_DETAILED_SQLERRM  
RETURN VARCHAR2;
```

280.9.18 GET_FOLLOW_REDIRECT Procedure

This procedure retrieves the follow-redirect setting in the current session



See Also:

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```
UTL_HTTP.GET_FOLLOW_REDIRECT (  
    max_redirects OUT PLS_INTEGER);
```

Parameters

Table 280-32 GET_FOLLOW_REDIRECT Procedure Parameters

Parameter	Description
<code>max_redirects</code>	The maximum number of redirections for all future HTTP requests

280.9.19 GET_HEADER Procedure

This procedure returns the n^{th} HTTP response header name and value returned in the response.



See Also:

[HTTP Responses](#) and [HTTP Responses Subprograms](#)

Syntax

```
UTL_HTTP.GET_HEADER (  
    r      IN OUT NOCOPY resp,  
    n      IN PLS_INTEGER,  
    name   OUT NOCOPY VARCHAR2,  
    value  OUT NOCOPY VARCHAR2);
```

Parameters

Table 280-33 GET_HEADER Procedure Parameters

Parameter	Description
<code>r</code>	The HTTP response
<code>n</code>	The n^{th} header to return
<code>name</code>	The name of the HTTP response header
<code>value</code>	The value of the HTTP response header

Usage Notes

If the response body returned by the remote Web server is encoded in chunked transfer encoding format, the trailer headers that are returned at the end of the response body will be added to the response, and the response header count will be updated. You can retrieve the additional headers after the end of the response body is reached and before you end the response.

280.9.20 GET_HEADER_BY_NAME Procedure

This procedure returns the HTTP response header value returned in the response given the name of the header.



See Also:

[HTTP Responses](#) and [HTTP Responses Subprograms](#)

Syntax

```
UTL_HTTP.GET_HEADER_BY_NAME(  
  r      IN OUT NOCOPY resp,  
  name   IN VARCHAR2,  
  value  OUT NOCOPY VARCHAR2,  
  n      IN PLS_INTEGER DEFAULT 1);
```

Parameters

Table 280-34 GET_HEADER_BY_NAME Procedure Parameters

Parameter	Description
r	The HTTP response
name	The name of the HTTP response header for which the value is to return
value	The value of the HTTP response header
n	The n^{th} occurrence of an HTTP response header by the specified name to return. The default is 1.

Usage Notes

If the response body returned by the remote Web server is encoded in chunked transfer encoding format, the trailer headers that are returned at the end of the response body will be added to the response, and the response header count will be updated. You can retrieve the additional headers after the end of the response body is reached and before you end the response.

280.9.21 GET_HEADER_COUNT Function

This function returns the number of HTTP response headers returned in the response.



See Also:

[HTTP Responses](#) and [HTTP Responses Subprograms](#)

Syntax

```
UTL_HTTP.GET_HEADER_COUNT (  
    r IN OUT NOCOPY resp)  
RETURN PLS_INTEGER;
```

Parameters

Table 280-35 GET_HEADER_COUNT Function Parameters

Parameter	Description
r	The HTTP response

Usage Notes

If the response body returned by the remote Web server is encoded in chunked transfer encoding format, the trailer headers that are returned at the end of the response body will be added to the response, and the response header count will be updated. You can retrieve the additional headers after the end of the response body is reached and before you end the response.

280.9.22 GET_PERSISTENT_CONN_COUNT Function

This function returns the number of network connections currently kept persistent by the UTL_HTTP package to the Web servers.



See Also:

[HTTP Persistent Connections](#) and [HTTP Persistent Connections Subprograms](#)

Syntax

```
UTL_HTTP.GET_PERSISTENT_CONN_COUNT  
RETURN PLS_INTEGER;
```

Usage Notes

Connections to the same Web server at different TCP/IP ports are counted individually. The host names of the Web servers are identified as specified in the URL of the original HTTP requests. Therefore, fully qualified host names with domain names will be counted differently from the host names without domain names.

280.9.23 GET_PERSISTENT_CONN_SUPPORT Procedure

This procedure checks if the persistent connection support is enabled, and gets the maximum number of persistent connections in the current session.



See Also:

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```
UTL_HTTP.GET_PERSISTENT_CONN_SUPPORT (  
    enable      OUT BOOLEAN,  
    max_conns  OUT PLS_INTEGER);
```

Parameters

Table 280-36 GET_PERSISTENT_CONN_SUPPORT Procedure Parameters

Parameter	Description
enable	TRUE if persistent connection support is enabled; otherwise FALSE
max_conns	the maximum number of persistent connections maintained in the current session

280.9.24 GET_PERSISTENT_CONNS Procedure

This procedure returns all the network connections currently kept persistent by the UTL_HTTP package to the Web servers.



See Also:

[HTTP Persistent Connections](#) and [HTTP Persistent Connections Subprograms](#)

Syntax

```
UTL_HTTP.get_persistent_conns (  
    connections IN OUT NOCOPY connection_table);
```

Parameters

Table 280-37 GET_PERSISTENT_CONNS Procedure Parameters

Parameter	Description
connections	The network connections kept persistent

Usage Notes

Connections to the same Web server at different TCP/IP ports are counted individually. The host names of the Web servers are identified as specified in the URL of the original HTTP requests. Therefore, fully qualified host names with domain names will be counted differently from the host names without domain names.

280.9.25 GET_PROXY Procedure

This procedure retrieves the current proxy settings.



See Also:

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```
UTL_HTTP.GET_PROXY (  
    proxy          OUT NOCOPY VARCHAR2,  
    no_proxy_domains OUT NOCOPY VARCHAR2);
```

Parameters

Table 280-38 GET_PROXY Procedure Parameters

Parameter	Description
proxy	The proxy (host and an optional port number) currently used by the UTL_HTTP package
no_proxy_domains	The list of hosts and domains for which no proxy is used for all requests

280.9.26 GET_RESPONSE Function

This function reads the HTTP response.

When the function returns, the status line and the HTTP response headers have been read and processed. The status code, reason phrase, and the HTTP protocol version are stored in the response record. This function completes the HTTP headers section.



See Also:

[HTTP Responses](#) and [HTTP Responses Subprograms](#)

Syntax

```
UTL_HTTP.GET_RESPONSE (  
    r          IN OUT NOCOPY req,
```

```

    return_info_response    IN BOOLEAN DEFAULT FALSE)
RETURN resp;

```

Parameters

Table 280-39 GET_RESPONSE Function Parameters

Parameter	Description
r	The HTTP response
return_info_response	Return 100 informational response or not. <ul style="list-style-type: none"> TRUE means <code>get_response</code> should return 100 informational response when it is received from the HTTP server. The request will not be ended if a 100 response is returned. FALSE means the API should ignore any 100 informational response received from the HTTP server and should return the following non-100 response instead. The default is FALSE.

Exceptions

- When detailed-exception is disabled:
 - ORA-29273 REQUEST_FAILED - the request fails to execute. Use the [GET_DETAILED_EXCP_SUPPORT Procedure](#) and the [GET_DETAILED_SQLERRM Function](#) to get the detailed error message.
- When detailed-exception is enabled:
 - ORA-29261 BAD_ARGUMENT - some arguments passed are not valid
- When response error check is enabled:
 - ORA-29268 HTTP_CLIENT_ERROR - the response code is in 400 range
 - ORA-29269 HTTP_SERVER_ERROR - the response code is in 500 range

Usage Notes

- The request will be ended when this functions returns regardless of whether an exception is raised or not. There is no need to invoke the [END_REQUEST Procedure](#).
- If URL redirection occurs, the URL and method fields in the `req` record will be updated to the last redirected URL and the method used to access the URL.

Examples

In certain situations (initiated by the HTTP client or not), the HTTP server may return a 1xx informational response. The user who does not expect such a response may indicate to `GET_RESPONSE` to ignore the response and proceed to receive the regular response. In the case when the user expects such a response, the user can indicate to `GET_RESPONSE` to return the response.

For example, when a user is issuing a HTTP POST request with a large request body, the user may want to check with the HTTP server to ensure that the server will accept the request before sending the data. To do so, the user will send the additional `EXPECT: 100-CONTINUE` request header, and check for 100 CONTINUE response from

the server before proceeding to send the request body. Then, the user will get the regular HTTP response.

The following code example illustrates this:

```

DECLARE
  data  VARCHAR2(1024) := '...';
  req   utl_http.req;
  resp  utl_http.resp;
BEGIN

  req := utl_http.begin_request('http://www.acme.com/receiver', 'POST');
  utl_http.set_header(req, 'Content-Length', length(data));
  -- Ask HTTP server to return "100 Continue" response
  utl_http.set_header(req, 'Expect', '100-continue');
  resp := utl_http.get_response(req, TRUE);

  -- Check for and dispose "100 Continue" response
  IF (resp.status_code <> 100) THEN
    utl_http.end_response(resp);
    raise_application_error(20000, 'Request rejected');
  END IF;
  utl_http.end_response(resp);

  -- Now, send the request body
  utl_http.write_text(req, data);

  -- Get the regular response
  resp := utl_http.get_response(req);
  utl_http.read_text(resp, data);

  utl_http.end_response(resp);

END;
```

280.9.27 GET_RESPONSE_ERROR_CHECK Procedure

This procedure checks if the response error check is set or not.



See Also:

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```

UTL_HTTP.GET_RESPONSE_ERROR_CHECK (
  enable OUT BOOLEAN);
```

Parameters

Table 280-40 GET_RESPONSE_ERROR_CHECK Procedure Parameters

Parameter	Description
enable	TRUE if the response error check is set; otherwise FALSE

280.9.28 GET_TRANSFER_TIMEOUT Procedure

This procedure retrieves the default timeout value for all future HTTP requests.



See Also:

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```
UTL_HTTP.GET_TRANSFER_TIMEOUT (  
    timeout OUT PLS_INTEGER);
```

Parameters

Table 280-41 GET_TRANSFER_TIMEOUT Procedure Parameters

Parameter	Description
timeout	The network transfer timeout value in seconds

280.9.29 READ_LINE Procedure

This procedure reads the HTTP response body in text form until the end of line is reached and returns the output in the caller-supplied buffer.

The end of line is as defined in the function `read_line` of `UTL_TCP`. The `end_of_body` exception will be raised if the end of the HTTP response body is reached. Text data is automatically converted from the response body character set to the database character set.



See Also:

[HTTP Responses](#) and [HTTP Responses Subprograms](#)

Syntax

```
UTL_HTTP.READ_LINE (  
    r          IN OUT NOCOPY resp,  
    data      OUT NOCOPY VARCHAR2 CHARACTER SET ANY_CS,  
    remove_crlf IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 280-42 READ_LINE Procedure Parameters

Parameter	Description
r	The HTTP response

Table 280-42 (Cont.) READ_LINE Procedure Parameters

Parameter	Description
<code>data</code>	The HTTP response body in text form
<code>remove_crlf</code>	Removes the newline characters if set to <code>TRUE</code>

Usage Notes

The `UTL_HTTP` package supports HTTP 1.1 chunked transfer-encoding. When the response body is returned in chunked transfer-encoding format as indicated in the response header, the package automatically decodes the chunks and returns the response body in de-chunked format.

If transfer timeout is set in the request of this response, `read_line` waits for each data packet to be ready to read until timeout occurs. If it occurs, this procedure stops reading and returns all the data read successfully. If no data is read successfully, the `transfer_timeout` exception is raised. The exception can be handled and the read operation can be retried later.

If a partial multibyte character is found at the end of the response body, `read_line` stops reading and returns all the complete multibyte characters read successfully. If no complete character is read successfully, the `partial_multibyte_char` exception is raised. The exception can be handled and the bytes of that partial multibyte character can be read as binary by the `read_raw` procedure. If a partial multibyte character is seen in the middle of the response body because the remaining bytes of the character have not arrived and read timeout occurs, the `transfer_timeout` exception is raised instead. The exception can be handled and the read operation can be retried later.

When the `Content-Type` response header specifies the character set of the response body and the character set is unknown or unsupported by Oracle, the "ORA-01482: unsupported character set" exception is raised if you try to read the response body as text. You can either read the response body as binary using the `READ_RAW` procedure, or set the character set of the response body explicitly using the `SET_BODY_CHARSET` procedure and read the response body as text again.

280.9.30 READ_RAW Procedure

This procedure reads the HTTP response body in binary form and returns the output in the caller-supplied buffer.

The `end_of_body` exception is raised if the end of the HTTP response body is reached.

**See Also:**

[HTTP Responses](#) and [HTTP Responses Subprograms](#)

Syntax

```
UTL_HTTP.READ_RAW(
  r          IN OUT NOCOPY resp,
```

```
data OUT NOCOPY RAW,
len IN PLS_INTEGER DEFAULT NULL);
```

Parameters

Table 280-43 READ_RAW Procedure Parameters

Parameter	Description
r	The HTTP response
data	The HTTP response body in binary form
len	The number of bytes of data to read. If len is NULL, this procedure will read as much input as possible to fill the buffer allocated in data. The actual amount of data returned may be less than that specified if not much data is available before the end of the HTTP response body is reached or the transfer_timeout amount of time has elapsed. The default is NULL

Usage Notes

The `UTL_HTTP` package supports HTTP 1.1 chunked transfer-encoding. When the response body is returned in chunked transfer-encoding format as indicated in the response header, the package automatically decodes the chunks and returns the response body in de-chunked format.

If transfer timeout is set in the request of this response, `read_raw` waits for each data packet to be ready to read until timeout occurs. If it occurs, `read_raw` stops reading and returns all the data read successfully. If no data is read successfully, the `transfer_timeout` exception is raised. The exception can be handled and the read operation can be retried later.

280.9.31 READ_TEXT Procedure

This procedure reads the HTTP response body in text form and returns the output in the caller-supplied buffer.

The `end_of_body` exception is raised if the end of the HTTP response body is reached. Text data is automatically converted from the response body character set to the database character set.



See Also:

[HTTP Responses](#) and [HTTP Responses Subprograms](#)

Syntax

```
UTL_HTTP.READ_TEXT(
r IN OUT NOCOPY resp,
data OUT NOCOPY VARCHAR2 CHARACTER SET ANY_CS,
len IN PLS_INTEGER DEFAULT NULL);
```


Parameters

Table 280-44 READ_TEXT Procedure Parameters

Parameter	Description
<code>r</code>	The HTTP response
<code>data</code>	The HTTP response body in text form
<code>len</code>	The maximum number of characters of data to read. If <code>len</code> is NULL, this procedure will read as much input as possible to fill the buffer allocated in <code>data</code> . The actual amount of data returned may be less than that specified if little data is available before the end of the HTTP response body is reached or the <code>transfer_timeout</code> amount of time has elapsed. The default is NULL.

Usage Notes

The `UTL_HTTP` package supports HTTP 1.1 chunked transfer-encoding. When the response body is returned in chunked transfer-encoding format as indicated in the response header, the package automatically decodes the chunks and returns the response body in de-chunked format.

If transfer timeout is set in the request of this response, `read_text` waits for each data packet to be ready to read until timeout occurs. If it occurs, this procedure stops reading and returns all the data read successfully. If no data is read successfully, the `transfer_timeout` exception is raised. The exception can be handled and the read operation can be retried later.

If a partial multibyte character is found at the end of the response body, `read_text` stops reading and returns all the complete multibyte characters read successfully. If no complete character is read successfully, the `partial_multibyte_char` exception is raised. The exception can be handled and the bytes of that partial multibyte character can be read as binary by the `read_raw` procedure. If a partial multibyte character is seen in the middle of the response body because the remaining bytes of the character have not arrived and read timeout occurs, the `transfer_timeout` exception is raised instead. The exception can be handled and the read operation can be retried later.

When the `Content-Type` response header specifies the character set of the response body and the character set is unknown or unsupported by Oracle, the "ORA-01482: unsupported character set" exception is raised if you try to read the response body as text. You can either read the response body as binary using the `READ_RAW` procedure, or set the character set of the response body explicitly using the `SET_BODY_CHARSET` procedure and read the response body as text again.

280.9.32 REQUEST Function

This function returns up to the first 2000 bytes of data retrieved from the given URL.

This function can be used directly in SQL queries. The URL may contain the username and password needed to authenticate the request to the server. The format is

```
scheme://[user[:password]@]host[:port]/[...]
```

You can define a username/password for the proxy to be specified in the proxy string. The format is

```
[http://][user[:password]@]host[:port][/]
```



See Also:

[Simple HTTP Fetches](#) and [Simple HTTP Fetches in a Single Call Subprograms](#)

Syntax

```
UTL_HTTP.REQUEST (
    url          IN VARCHAR2,
    proxy        IN VARCHAR2 DEFAULT NULL,
    wallet_path  IN VARCHAR2 DEFAULT NULL,
    wallet_password IN VARCHAR2 DEFAULT NULL,
    https_host   IN VARCHAR2 DEFAULT NULL)
RETURN VARCHAR2;
```

Pragmas

```
pragma restrict_references (request, wnds, rnds, wnps, rnps);
```

Parameters

Table 280-45 REQUEST Function Parameters

Parameter	Description
url	Uniform resource locator
proxy	(Optional) Specifies a proxy server to use when making the HTTP request. See <code>SET_PROXY</code> for the full format of the proxy setting.
wallet_path	(Optional) Specifies a client-side wallet. The client-side wallet contains the list of trusted certificate authorities required for HTTPS request. The format of <code>wallet_path</code> on a PC is, for example, <code>file:c:\WINNT\Profiles\username\WALLETS</code> , and in Unix is, for example, <code>file:/home/username/wallets</code> When the <code>UTL_HTTP</code> package is executed in the Oracle database server, the wallet is accessed from the database server. Therefore, the wallet path must be accessible from the database server. See <code>SET_WALLET</code> for a description on how to set up an Oracle wallet. Non-HTTPS requests do not require an Oracle wallet.
wallet_password	(Optional) Specifies the password required to open the wallet
https_host	A string representing the host name. If the string does not begin with a wildcard, the string will be used as the host name for server name indication (SNI). If the string begins with a wildcard, the string will be used to match against the common name (CN) of the remote server's certificate for an HTTPS request. If NULL, the host name in the given URL will be used for SNI.

Return Values

The return type is a string of length 2000 or less, which contains up to the first 2000 bytes of the HTML result returned from the HTTP request to the argument URL.

Exceptions

```
INIT_FAILED
REQUEST_FAILED
```

Usage Notes

The URL passed as an argument to this function is not examined for illegal characters, for example, spaces, according to URL specification RFC 2396. The caller should escape those characters with the UTL_URL package. See the comments of the package for the list of legal characters in URLs. Note that URLs should consist of US-ASCII characters only. The use of non-US-ASCII characters in a URL is generally unsafe.

Please see the documentation of the function `SET_WALLET` on the use of an Oracle wallet, which is required for accessing HTTPS Web servers.

Unless response error check is turned on, this function does not raise an exception when a 4xx or 5xx response is received from the Web server. Instead, it returns the formatted error message from the Web server:

```
<HTML>
<HEAD>
<TITLE>Error Message</TITLE>
</HEAD>
<BODY>
<H1>Fatal Error 500</H1>
Can't Access Document:  http://home.nothing.comm.
<P>
<B>Reason:</B> Can't locate remote host:  home.nothing.comm.
<P>
<P><HR>
<ADDRESS><A HREF="http://www.w3.org">
CERN-HTTPD3.0A</A></ADDRESS>
</BODY>
</HTML>
```

Examples

```
SQL> SELECT UTL_HTTP.REQUEST('http://www.my-company.com/') FROM DUAL;
UTL_HTTP.REQUEST('HTTP://WWW.MY-COMPANY.COM/')
<html>
<head><title>My Company Home Page</title>
<!--changed Jan. 16, 19
1 row selected.
```

If you are behind a firewall, include the `proxy` parameter. For example, from within the Oracle firewall, where there might be a proxy server named `www-proxy.my-company.com`:

```
SQLPLUS> SELECT
UTL_HTTP.REQUEST('http://www.my-company.com', 'www-proxy.us.my-company.com') FROM DUAL;
```

280.9.33 REQUEST_PIECES Function

This function returns a PL/SQL table of 2000-byte pieces of the data retrieved from the given URL.

You can define a username/password for the proxy to be specified in the proxy string. The format is

```
[http://][user[:password]@]host[:port][/]
```



See Also:

[Simple HTTP Fetches](#) and [Simple HTTP Fetches in a Single Call Subprograms](#)

Syntax

```
TYPE html_pieces IS TABLE OF VARCHAR2(2000) INDEX BY BINARY_INTEGER;

UTL_HTTP.REQUEST_PIECES (
    url            IN VARCHAR2,
    max_pieces    IN NATURAL DEFAULT 32767,
    proxy         IN VARCHAR2 DEFAULT NULL,
    wallet_path   IN VARCHAR2 DEFAULT NULL,
    wallet_password IN VARCHAR2 DEFAULT NULL,
    https_host    IN VARCHAR2 DEFAULT NULL)
RETURN html_pieces;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES (request_pieces, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 280-46 REQUEST_PIECES Function Parameters

Parameter	Description
url	Uniform resource locator
max_pieces	(Optional) The maximum number of pieces (each 2000 characters in length, except for the last, which may be shorter), that REQUEST_PIECES should return. If provided, then that argument should be a positive integer.
proxy	(Optional) Specifies a proxy server to use when making the HTTP request. See SET_PROXY for the full format of the proxy setting.

Table 280-46 (Cont.) REQUEST_PIECES Function Parameters

Parameter	Description
wallet_path	<p>(Optional) Specifies a client-side wallet. The client-side wallet contains the list of trusted certificate authorities required for HTTPS request.</p> <p>The format of wallet_path on a PC is, for example, file:c:\WINNT\Profiles\username\WALLETS, and in Unix is, for example, file:/home/username/wallets. When the UTL_HTTP package is executed in the Oracle database server, the wallet is accessed from the database server. Therefore, the wallet path must be accessible from the database server.</p> <p>See SET_WALLET for the description on how to set up an Oracle wallet. Non-HTTPS requests do not require an Oracle wallet.</p>
wallet_password	(Optional) Specifies the password required to open the wallet
https_host	<p>A string representing the host name.</p> <p>If the string does not begin with a wildcard, the string will be used as the host name for server name indication (SNI).</p> <p>If the string begins with a wildcard, the string will be used to match against the common name (CN) of the remote server's certificate for an HTTPS request.</p> <p>If NULL, the host name in the given URL will be used for SNI.</p>

Return Values

REQUEST_PIECES returns a PL/SQL table of type UTL_HTTP.HTML_PIECES. Each element of that PL/SQL table is a string of maximum length 2000. The elements of the PL/SQL table returned by REQUEST_PIECES are successive pieces of the data obtained from the HTTP request to that URL.

Exceptions

INIT_FAILED
REQUEST_FAILED

Usage Notes

The URL passed as an argument to this function will not be examined for illegal characters, for example, spaces, according to URL specification RFC 2396. The caller should escape those characters with the UTL_URL package. See the comments of the package for the list of legal characters in URLs. Note that URLs should consist of US-ASCII characters only. The use of non-US-ASCII characters in a URL is generally unsafe.

Each entry of the PL/SQL table (the "pieces") returned by this function may not be filled to their fullest capacity. The function may start filling the data in the next piece before the previous "piece" is totally full.

Please see the documentation of the function SET_WALLET on the use of an Oracle wallet, which is required for accessing HTTPS Web servers.

Unless response error check is turned on, this function does not raise an exception when a 4xx or 5xx response is received from the Web server. Instead, it returns the formatted error message from the Web server:

```

<HTML>
<HEAD>
<TITLE>Error Message</TITLE>
</HEAD>
<BODY>
<H1>Fatal Error 500</H1>
Can't Access Document:  http://home.nothing.comm.
<P>
<B>Reason:</B> Can't locate remote host:  home.nothing.comm.
<P>
<P><HR>
<ADDRESS><A HREF="http://www.w3.org">
CERN-HTTPD3.0A</A></ADDRESS>
</BODY>
</HTML>

```

Examples

```

SET SERVEROUTPUT ON

DECLARE
    x    UTL_HTTP.HTML_PIECES;
    len  PLS_INTEGER;
BEGIN
    x := UTL_HTTP.REQUEST_PIECES('http://www.oracle.com/', 100);
    DBMS_OUTPUT.PUT_LINE(x.count || ' pieces were retrieved. ');
    DBMS_OUTPUT.PUT_LINE('with total length ');
    IF x.count < 1 THEN
        DBMS_OUTPUT.PUT_LINE('0');
    ELSE
        len := 0;
        FOR i in 1..x.count LOOP
            len := len + length(x(i));
        END LOOP;
        DBMS_OUTPUT.PUT_LINE(len);
    END IF;
END;
/
-- Output
Statement processed.
4 pieces were retrieved.
with total length
7687

```

280.9.34 SET_AUTHENTICATION Procedure

This procedure sets HTTP authentication information in the HTTP request header. The Web server needs this information to authorize the request.



See Also:

[HTTP Requests](#) and [HTTP Requests Subprograms](#)

UTL_HTTP Authentication Scheme

The following is the challenge and response work flow:

1. Client sends a HTTP request to the server.
2. The server responds to the client with a 401 (Unauthorized) response status. It also provides information on how to authorize using a WWW-Authenticate response header that contains at least one authentication scheme challenge.

 **Note:**

When server responds with multiple challenges, it will be in the order of preference, starting with the most preferred algorithm followed by the less preferred algorithm.

3. Client authenticates itself with the server by issuing the request that includes an Authorization request header along with the credentials build by using the values from challenge headers, such as algorithm, realm, and nonce.

 **Note:**

UTL_HTTP supports digest SHA-256 algorithm.

Digest Authentication

An authentication scheme is set in the HTTP request header that is authorized by the Web server using the UTL_HTTP.SET_AUTHENTICATION call. Digest is one of the authentication schemes that UTL_HTTP supports. The other authentication schemes are basic, AWS,AWS4, BMC, and AZURE.

The following is the UTL_HTTP request and response flow using the digest authentication scheme:

1. UTL_HTTP.BEGIN_REQUEST- This function sends an HTTP request to the Web server.
2. UTL_HTTP.SET_AUTHENTICATION- This function sets authentication information in the HTTP request header
3. UTL_HTTP.GET_RESPONSE- This function gets the response from the Web server
 - a. Server replies “401 Unauthorized” along with the challenge headers.
 - b. Build digests credentials with values from the challenge headers using the SHA 256 algorithm.
 - c. Resend request includes an authorization request header with the digest credentials.
 - d. Server processes request and replies (typically 200-OK).

Syntax

```
UTL_HTTP.SET_AUTHENTICATION(  
  r          IN OUT NOCOPY req,  
  username  IN VARCHAR2,  
  password  IN VARCHAR2,  
  scheme    IN VARCHAR2 DEFAULT 'Basic',  
  for_proxy IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 280-47 SET_AUTHENTICATION Procedure Parameters

Parameter	Description
r	HTTP request
username	Username for the HTTP authentication
password	Password for the HTTP authentication
scheme	HTTP authentication scheme. Either <code>Basic</code> for the HTTP basic or <code>AWS</code> for Amazon S3 authentication scheme. Default is <code>basic</code> .
for_proxy	Identifies if the HTTP authentication information is for access to the HTTP proxy server instead of the Web server. Default is <code>FALSE</code> .

Usage Notes

The supported authentication schemes are HTTP basic and Amazon S3 authentication.

280.9.35 SET_AUTHENTICATION_FROM_WALLET Procedure

This procedure sets the HTTP authentication information in the HTTP request header needed for the request to be authorized by the Web server using the username and password credential stored in the Oracle wallet.



See Also:

[External Password Store](#) on [Oracle Database](#), and [HTTP Requests Subprograms](#)

Syntax

```
UTL_HTTP.SET_AUTHENTICATION_FROM_WALLET (
    r          IN OUT NOCOPY req,
    alias      IN VARCHAR2,
    scheme     IN VARCHAR2 DEFAULT 'Basic',
    for_proxy  IN BOOLEAN   DEFAULT FALSE);
```

Parameters

Table 280-48 SET_AUTHENTICATION_FROM_WALLET Procedure Parameters

Parameter	Description
r	The HTTP request
alias	Alias to identify and retrieve the username and password credential stored in the Oracle wallet
scheme	HTTP authentication scheme. Either <code>Basic</code> for the HTTP basic or <code>AWS</code> for Amazon S3 authentication scheme. Default is <code>basic</code> .

Table 280-48 (Cont.) SET_AUTHENTICATION_FROM_WALLET Procedure Parameters

Parameter	Description
<code>for_proxy</code>	Identifies if the HTTP authentication information is for access to the HTTP proxy server instead of the Web server. Default is FALSE.

Usage Notes

- To use the password credentials in a wallet, the UTL_HTTP user must have the `use-passwords` privilege on the wallet.
- The supported authentication schemes are HTTP basic and Amazon S3 authentication schemes.

Examples**Creating a wallet and entering username and password in the wallet**

```
> mkstore -wrl /oracle/wallets/test_wallet -create
Enter password: *****
Enter password again: *****
> mkstore -wrl /oracle/wallets/test_wallet -createCredential hr-access jsmith
Your secret/Password is missing in the command line
Enter your secret/Password: ****
Re-enter your secret/Password: ****
Enter wallet password: *****
```

Granting the use-passwords privilege on the wallet to a user by the database administrator

```
BEGIN
  DBMS_NETWORK_ACL_ADMIN.CREATE_ACL(
    acl          => 'wallet-acl.xml',
    description => 'Wallet ACL',
    principal    => 'SCOTT',
    is_grant     => TRUE,
    privilege    => 'use-passwords');
  DBMS_NETWORK_ACL_ADMIN.ASSIGN_WALLET_acl(
    acl          => 'wallet-acl.xml',
    wallet_path  => 'file:/oracle/wallets/test_wallet');
END;
```

Using username and password from the wallet

```
DECLARE
  req UTL_HTTP.req;
BEGIN
  UTL_HTTP.SET_WALLET(path => 'file:/oracle/wallets/test_wallet');
  req := UTL_HTTP.BEGIN_REQUEST(...);
  UTL_HTTP.SET_AUTHENTICATION_FROM_WALLET(req, 'hr-access');
  ...
END;
```

280.9.36 SET_BODY_CHARSET Procedures

This procedure is overloaded. The description of different functionality is located alongside the syntax declarations.

See Also:

- [HTTP Responses](#) and [HTTP Responses Subprograms](#)
- [Session Settings](#) and [Session Settings Subprograms](#)

Syntax

Sets the default character set of the body of all future HTTP requests when the media type is `text` and the character set is not specified in the `Content-Type` header. Following the HTTP protocol standard specification, if the media type of a request or a response is `text`, but the character set information is missing in the `Content-Type` header, the character set of the request or response body should default to `ISO-8859-1`. A response created for a request inherits the default body character set of the request instead of the body character set of the current session. The default body character set is `ISO-8859-1` in a database user session. The default body character set setting affects only future requests and has no effect on existing requests. After a request is created, the body character set can be changed by using the other `SET_BODY_CHARSET` procedure that operates on a request:

```
UTL_HTTP.SET_BODY_CHARSET (  
    charset IN VARCHAR2 DEFAULT NULL);
```

Sets the character set of the request body when the media type is `text` but the character set is not specified in the `Content-Type` header. According to the HTTP protocol standard specification, if the media type of a request or a response is "text" but the character set information is missing in the `Content-Type` header, the character set of the request or response body should default to "ISO-8859-1". Use this procedure to change the default body character set a request inherits from the session default setting:

```
UTL_HTTP.SET_BODY_CHARSET (  
    r          IN OUT NOCOPY req,  
    charset IN VARCHAR2 DEFAULT NULL);
```

Sets the character set of the response body when the media type is "text" but the character set is not specified in the `Content-Type` header. For each the HTTP protocol standard specification, if the media type of a request or a response is "text" but the character set information is missing in the `Content-Type` header, the character set of the request or response body should default to "ISO-8859-1". Use this procedure to change the default body character set a response inherits from the request:

```
UTL_HTTP.SET_BODY_CHARSET (  
    r          IN OUT NOCOPY resp,  
    charset IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 280-49 SET_BODY_CHARSET Procedure Parameters

Parameter	Description
r	The HTTP response.
charset	The default character set of the response body. The character set can be in Oracle or Internet Assigned Numbers Authority (IANA) naming convention. If <code>charset</code> is <code>NULL</code> , the database character set is assumed.

280.9.37 SET_COOKIE_SUPPORT Procedures

This overloaded procedure handles cookie support. The description of different functionality is located alongside the syntax declarations.

 **See Also:**

- [HTTP Requests](#) and [HTTP Requests Subprograms](#)
- [Session Settings](#) and [Session Settings Subprograms](#)

Syntax

Enables or disables support for the HTTP cookies in the request. Use this procedure to change the cookie support setting a request inherits from the session default setting:

```
UTL_HTTP.SET_COOKIE_SUPPORT (
    r          IN OUT NOCOPY REQ,
    enable     IN BOOLEAN DEFAULT TRUE);
```

Sets whether or not future HTTP requests will support HTTP cookies, and the maximum number of cookies maintained in the current database user session:

```
UTL_HTTP.SET_COOKIE_SUPPORT (
    enable     IN BOOLEAN,
    max_cookies IN PLS_INTEGER DEFAULT 300,
    max_cookies_per_site IN PLS_INTEGER DEFAULT 20);
```

Parameters

Table 280-50 SET_COOKIE_SUPPORT Procedure Parameters

Parameter	Description
r	The HTTP request
enable	Set <code>enable</code> to <code>TRUE</code> to enable HTTP cookie support; <code>FALSE</code> to disable
max_cookies	Sets the maximum total number of cookies maintained in the current session

Table 280-50 (Cont.) SET_COOKIE_SUPPORT Procedure Parameters

Parameter	Description
<code>max_cookies_per_site</code>	Sets the maximum number of cookies maintained in the current session for each Web site

Usage Notes

If cookie support is enabled for an HTTP request, all cookies saved in the current session and applicable to the request are returned to the Web server in the request in accordance with HTTP cookie specification standards. Cookies set in the response to the request are saved in the current session for return to the Web server in the subsequent requests if cookie support is enabled for those requests. If the cookie support is disabled for an HTTP request, no cookies are returned to the Web server in the request and the cookies set in the response to the request are not saved in the current session, although the `Set-Cookie` HTTP headers can still be retrieved from the response.

Cookie support is enabled by default for all HTTP requests in a database user session. The default setting of the cookie support (enabled versus disabled) affects only the future requests and has no effect on the existing ones. After your request is created, the cookie support setting may be changed by using the other `SET_COOKIE_SUPPORT` procedure that operates on a request.

The default maximum number of cookies saved in the current session is 20 for each site and 300 total.

If you lower the maximum total number of cookies or the maximum number of cookies for each Web site, the oldest cookies will be purged first to reduce the number of cookies to the lowered maximum. HTTP cookies saved in the current session last for the duration of the database session only; there is no persistent storage for the cookies. Cookies saved in the current session are not cleared if you disable cookie support.

See "[Examples](#)" for how to use `GET_COOKIES` and `ADD_COOKIES` to retrieve, save, and restore cookies.

280.9.38 SET_DETAILED_EXCP_SUPPORT Procedure

This procedure sets the `UTL_HTTP` package to raise a detailed exception.

By default, `UTL_HTTP` raises the `request_failed` exception when an HTTP request fails. Use `GET_DETAILED_SQLCODE` and `GET_DETAILED_SQLERRM` for more detailed information about the error.

**See Also:**

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```
UTL_HTTP.SET_DETAILED_EXCP_SUPPORT (
    enable IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 280-51 SET_DETAILED_EXCP_SUPPORT Procedure Parameters

Parameter	Description
enable	Asks UTL_HTTP to raise a detailed exception directly if set to TRUE; otherwise FALSE

280.9.39 SET_FOLLOW_REDIRECT Procedures

This procedure sets the maximum number of times UTL_HTTP follows the HTTP redirect instruction in the HTTP response to this request, or future requests, in the GET_RESPONSE function.

See Also:

- [HTTP Requests](#) and [HTTP Requests Subprograms](#)
- [Session Settings](#) and [Session Settings Subprograms](#)

Syntax

Use this procedure to set the maximum number of redirections:

```
UTL_HTTP.SET_FOLLOW_REDIRECT (
    max_redirects IN PLS_INTEGER DEFAULT 3);
```

Use this procedure to change the maximum number of redirections a request inherits from the session default setting:

```
UTL_HTTP.SET_FOLLOW_REDIRECT(
    r IN OUT NOCOPY req,
    max_redirects IN PLS_INTEGER DEFAULT 3);
```

Parameters

Table 280-52 SET_FOLLOW_REDIRECT Procedure Parameters

Parameter	Description
r	The HTTP request
max_redirects	The maximum number of redirects. Set to zero to disable redirects.

Usage Notes

If `max_redirects` is set to a positive number, the [GET_RESPONSE Function](#) will automatically follow the redirected URL for the HTTP response status code 301, 302, and 307 for the HTTP HEAD and GET methods, and 303 for all HTTP methods, and retry the HTTP request (the request method will be changed to HTTP GET for the status code 303) at the new location. It follows the redirection until the final, non-redirect location is reached, or an error occurs, or the maximum number of redirections has been reached (to prevent an infinite loop). The URL and method fields in the `REQ` record will be updated to the last redirected URL and the method used to access the URL. Set the maximum number of redirects to zero to disable automatic redirection.

While it is set not to follow redirect automatically in the current session, it is possible to specify individual HTTP requests to follow redirect instructions the function `FOLLOW_REDIRECT` and vice versa.

The default maximum number of redirections in a database user session is 3. The default value affects only future requests and has no effect on existing requests.

The `SET_FOLLOW_REDIRECT` procedure must be called before `GET_RESPONSE` for any redirection to take effect.

280.9.40 SET_HEADER Procedure

This procedure sets an HTTP request header. The request header is sent to the Web server as soon as it is set.



See Also:

[HTTP Requests](#) and [HTTP Requests Subprograms](#)

Syntax

```
UTL_HTTP.SET_HEADER (
  r          IN OUT NOCOPY req,
  name      IN VARCHAR2,
  value     IN VARCHAR2);
```

Parameters

Table 280-53 SET_HEADER Procedure Parameters

Parameter	Description
<code>r</code>	The HTTP request
<code>name</code>	The name of the HTTP request header
<code>value</code>	The value of the HTTP request header

Usage Notes

Multiple HTTP headers with the same name are allowed in the HTTP protocol standard. Therefore, setting a header does not replace a prior header with the same name.

If the request is made using HTTP 1.1, `UTL_HTTP` sets the Host header automatically for you.

When you set the `Content-Type` header with this procedure, `UTL_HTTP` looks for the character set information in the header value. If the character set information is present, it is set as the character set of the request body. It can be overridden later by using the `SET_BODY_CHARSET` procedure.

When you set the `Transfer-Encoding` header with the value `chunked`, `UTL_HTTP` automatically encodes the request body written by the `WRITE_TEXT`, `WRITE_LINE` and `WRITE_RAW` procedures. Note that some HTTP-1.1-based Web servers or CGI programs do not support or accept the request body encoding in the HTTP 1.1 chunked transfer-encoding format.

280.9.41 SET_PERSISTENT_CONN_SUPPORT Procedure

This overloaded procedure provides persistent connection support. Descriptions of the different functionality are given in the syntax declarations.



See Also:

[HTTP Requests](#) and [HTTP Requests Subprograms](#)

Syntax

Sets whether future HTTP requests should support the HTTP 1.1 persistent connection or not, and the maximum numbers of persistent connections to be maintained in the current database user session.

```
UTL_HTTP.SET_PERSISTENT_CONN_SUPPORT(
  enable      IN BOOLEAN DEFAULT FALSE,
  max_conns   IN PLS_INTEGER DEFAULT 0);
```

Enables or disables support for the HTTP 1.1 persistent-connection in the request.

```
UTL_HTTP.SET_PERSISTENT_CONN_SUPPORT(
  r           IN OUT NOCOPY req,
  enable      IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 280-54 SET_PERSISTENT_CONN_SUPPORT Procedure Parameters

Parameter	Description
<code>enable</code>	TRUE to keep the network connection persistent. FALSE otherwise.
<code>maximum_conns</code>	Maximum number of connections
<code>r</code>	The HTTP request

Usage Notes

If the persistent-connection support is enabled for an HTTP request, the package will keep the network connections to a Web server or the proxy server open in the package after the request is completed properly for a subsequent request to the same server to reuse for each HTTP 1.1 protocol specification. With the persistent connection support, subsequent HTTP requests may be completed faster because the network connection latency is avoided. If the persistent-connection support is disabled for a request, the package will always send the HTTP header "Connection: close" automatically in the HTTP request and close the network connection when the request is completed. This setting has no effect on HTTP requests that follows HTTP 1.0 protocol, for which the network connections will always be closed after the requests are completed.

When a request is being made, the package attempts to reuse an existing persistent connection to the target Web server (or proxy server) if one is available. If none is available, a new network connection will be initiated. The persistent-connection support setting for a request affects only whether the network connection should be closed after a request completes.

Use this procedure to change the persistent-connection support setting a request inherits from the session default setting.

Users should note that while the use of persistent connections in `UTL_HTTP` may reduce the time it takes to fetch multiple Web pages from the same server, it consumes precious system resources (network connections) in the database server. Also, excessive use of persistent connections may reduce the scalability of the database server when too many network connections are kept open in the database server. Network connections should be kept open only if they will be used immediately by subsequent requests and should be closed immediately when they are no longer needed. Set the default persistent connection support as disabled in the session, and enable persistent connection in individual HTTP requests as shown in "Examples".

The default value of the maximum number of persistent connections in a database session is zero. To truly enable persistent connections, you must also set the maximum number of persistent connections to a positive value or no connections will be kept persistent.

Note that if you want to use persistent connections, you must call the overload that takes the `maximum_conns` parameter prior to calling the [BEGIN_REQUEST Function](#), otherwise persistent connections will not be enabled for the current request even if the other form of `SET_PERSISTENT_CONN_SUPPORT` is called.

Examples

Using `SET_PERSISTENT_CONN_SUPPORT` in http requests at the session level, showing the active persistent connection after each request

```
DECLARE
  pieces utl_http.html_pieces;
  conns utl_http.connection_table;
BEGIN

  -- Turns on persistent connection support for the request_pieces call.
  utl_http.set_persistent_conn_support(true, 1);

  FOR i IN 1..10 LOOP
```



```

pieces := utl_http.request_pieces('http://www.example.com/');

-- Shows the active persistent connection
utl_http.get_persistent_conns(conns);
FOR j IN 1..conns.count LOOP
    dbms_output.put_line('Persistent connection ' || j || ': ' || conns(j).host || ':' ||
conns(j).port);
END LOOP;

END LOOP;

-- Turns off persistent connection support. Set active max persistent connection to
0 to close all active connections.
utl_http.set_persistent_conn_support(false, 0);

END;
/

```

Using SET_PERSISTENT_CONN_SUPPORT in HTTP requests showing how to use persistent connection individually in each request to fetch multiple URLs at the same host

```

DECLARE
-- Table to store the URLs
TYPE vc2_table IS TABLE OF VARCHAR2(256) INDEX BY BINARY_INTEGER;
paths VC2_TABLE;

PROCEDURE fetch_pages(paths IN vc2_table) AS
    req UTL_HTTP.REQ;
    resp UTL_HTTP.RESP;
    data VARCHAR2(1024);

BEGIN
    -- Set the proxy server
    UTL_HTTP.SET_PROXY('www-proxy.example.com:80', '');

    FOR i IN 1..paths.count LOOP

        req := UTL_HTTP.BEGIN_REQUEST(paths(i));

        -- Use persistent connections except for the last request
        IF (i < paths.count) THEN
            -- Use a persistent connection for the current request
            UTL_HTTP.SET_PERSISTENT_CONN_SUPPORT(req, TRUE);
        END IF;

        resp := UTL_HTTP.GET_RESPONSE(req);

        -- Display the results of the response
        DBMS_OUTPUT.PUT_LINE('-');
        DBMS_OUTPUT.PUT_LINE('URL: ' || paths(i));
        DBMS_OUTPUT.PUT_LINE('HTTP Response Status Code: ' || resp.status_code);
        DBMS_OUTPUT.PUT_LINE('HTTP Response Reason Phrase: ' || resp.reason_phrase);
        DBMS_OUTPUT.PUT_LINE('HTTP Response Version: ' || resp.http_version);

    BEGIN
        LOOP
            UTL_HTTP.READ_TEXT(resp, data);
            -- do something with the data
        END LOOP;
    END LOOP;

```

```

EXCEPTION
  WHEN UTL_HTTP.END_OF_BODY THEN
    NULL;
END;
UTL_HTTP.END_RESPONSE(resp);
END LOOP;
END;

BEGIN
-- Set a maximum of 1 persistent connection, but start with persistent
connections
-- off
  UTL_HTTP.SET_PERSISTENT_CONN_SUPPORT(FALSE, 1);

  -- Create a list of URLs
  paths(1) := 'http://www.example.com/technetwork/index.html';
  paths(2) := 'http://www.example.com/us/products/index.html';

  fetch_pages(paths);
END;
/

```

280.9.42 SET_PROXY Procedure

This procedure sets the proxy to be used for requests of the HTTP or other protocols, excluding those for hosts that belong to the domain specified in `no_proxy_domains`.

`no_proxy_domains` is a comma-, semi-colon-, or space-separated list of domains or hosts for which HTTP requests should be sent directly to the destination HTTP server instead of going through a proxy server.



See Also:

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```

UTL_HTTP.SET_PROXY (
  proxy          IN VARCHAR2,
  no_proxy_domains IN VARCHAR2);

```

Parameters

Table 280-55 SET_PROXY Procedure Parameters

Parameter	Description
<code>proxy</code>	The proxy (host and an optional port number) to be used by the UTL_HTTP package
<code>no_proxy_domains</code>	The list of hosts and domains for which no proxy should be used for all requests

Usage Notes

The proxy may include an optional TCP/IP port number at which the proxy server listens. The syntax is `[http://]host[:port][/]`, for example, `www-proxy.my-company.com:80`. If the port is not specified for the proxy, port 80 is assumed.

Optionally, a port number can be specified for each domain or host. If the port number is specified, the no-proxy restriction is only applied to the request at the port of the particular domain or host, for example, `corp.my-company.com`, `eng.my-company.com:80`. When `no_proxy_domains` is `NULL` and the proxy is set, all requests go through the proxy. When the proxy is not set, `UTL_HTTP` sends requests to the target Web servers directly.

You can define a username/password for the proxy to be specified in the proxy string. The format is

```
[http://][user[:password]@]host[:port][/]
```

If proxy settings are set when the database server instance is started, the proxy settings in the environment variables `http_proxy` and `no_proxy` are assumed. Proxy settings set by this procedure override the initial settings.

280.9.43 SET_RESPONSE_ERROR_CHECK Procedure

This procedure sets whether or not `GET_RESPONSE` raises an exception when the Web server returns a status code that indicates an error—a status code in the 4xx or 5xx ranges.

For example, when the requested URL is not found in the destination Web server, a 404 (document not found) response status code is returned.



See Also:

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```
UTL_HTTP.SET_RESPONSE_ERROR_CHECK (
    enable IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 280-56 SET_RESPONSE_ERROR_CHECK Procedure Parameters

Parameter	Description
<code>enable</code>	TRUE to check for response errors; otherwise FALSE

Usage Notes

If the status code indicates an error—a 4xx or 5xx code—and this procedure is enabled, `GET_RESPONSE` will raise the `HTTP_CLIENT_ERROR` or `HTTP_SERVER_ERROR` exception. If `SET_RESPONSE_ERROR_CHECK` is set to `FALSE`, `GET_RESPONSE` will not raise an exception when the status code indicates an error.

Response error check is turned off by default.

The `GET_RESPONSE` function can raise other exceptions when `SET_RESPONSE_ERROR_CHECK` is set to `FALSE`.

280.9.44 SET_TRANSFER_TIMEOUT Procedure

This procedure sets the default time out value for all future HTTP requests that the `UTL_HTTP` package should attempt while reading the HTTP response from the Web server or proxy server.

This time out value may be used to avoid the PL/SQL programs from being blocked by busy Web servers or heavy network traffic while retrieving Web pages from the Web servers.



See Also:

[Session Settings](#) and [Session Settings Subprograms](#)

Syntax

```
UTL_HTTP.SET_TRANSFER_TIMEOUT (  
    timeout IN PLS_INTEGER DEFAULT 60);
```

Parameters

Table 280-57 SET_TRANSFER_TIMEOUT Procedure Parameters

Parameter	Description
timeout	The network transfer timeout value in seconds.

Usage Notes

The default value of the time out is 60 seconds.

280.9.45 SET_WALLET Procedure

This procedure sets the Oracle wallet used for all HTTP requests over Secured Socket Layer (SSL), namely HTTPS.

When the `UTL_HTTP` package communicates with an HTTP server over SSL, the HTTP server presents its digital certificate, which is signed by a certificate authority, to the `UTL_HTTP` package for identification purpose. The Oracle wallet contains the list of certificate authorities that are trusted by the user of the `UTL_HTTP` package. An Oracle wallet is required to make an HTTPS request.

 See Also:

- [Session Settings and Session Settings Subprograms](#)
- *Oracle Database Security Guide* managing fine-grained access

Syntax

```
UTL_HTTP.SET_WALLET (
    path          IN VARCHAR2,
    password     IN VARCHAR2 DEFAULT NULL);
```

Parameters**Table 280-58 SET_WALLET Procedure Parameters**

Parameter	Description
path	<p>The directory path that contains the Oracle wallet. The format is <code>file:directory-path</code>.</p> <p>The format of <code>wallet_path</code> on a PC is, for example, <code>file:c:\WINNT\Profiles\username\WALLETS</code>, and in Unix is, for example, <code>file:/home/username/wallets</code>. When the UTL_HTTP package is executed in the Oracle database server, the wallet is accessed from the database server. Therefore, the wallet path must be accessible from the database server.</p> <p>If you want to use the operating system certificate store to act in place of the Oracle wallet, then set the <code>path</code> parameter to <code>system:</code> (include the colon). Doing so greatly improves performance in the database.</p>
password	<p>The password needed to open the wallet. If the wallet is auto-login enabled, the password may be omitted and should be set to <code>NULL</code>. See <i>Oracle Database Security Guide</i> for information about using the <code>orapki</code> utility to create an auto-login wallet.</p> <p>If you set <code>path</code> to <code>system:</code>, then omit the password by setting it to <code>NULL</code>.</p>

Usage Notes

To set up an Oracle wallet, use the `ORAPKI` utility to create a wallet. In order for the HTTPS request to succeed, the certificate authority that signs the certificate of the remote HTTPS Web server must be a trust point set in the wallet.

When a wallet is created, it is populated with a set of well-known certificate authorities as trust points. If the certificate authority that signs the certificate of the remote HTTPS Web server is not among the trust points, or the certificate authority has new root certificates, you should obtain the root certificate of that certificate authority and install it as a trust point in the wallet.

 See Also:

Oracle Database Advanced Security Guide for more information on Wallet Manager

280.9.46 WRITE_LINE Procedure

This procedure writes a text line in the HTTP request body and ends the line with new-line characters (CRLF as defined in `UTL_TCP`).

As soon as some data is sent as the HTTP request body, the HTTP request headers section is completed. Text data is automatically converted from the database character set to the request body character set.



See Also:

[HTTP Requests](#) and [HTTP Requests Subprograms](#)

Syntax

```
UTL_HTTP.WRITE_LINE(  
  r      IN OUT NOCOPY req,  
  data  IN VARCHAR2 CHARACTER SET ANY_CS);
```

Parameters

Table 280-59 WRITE_LINE Procedure Parameters

Parameter	Description
r	The HTTP request
data	The text line to send in the HTTP request body

Usage Notes

An HTTP client must always let the remote Web server know the length of the request body it is sending. If the amount of data is known beforehand, you can set the `Content-Length` header in the request, where the length of the content is measured in bytes instead of characters. If the length of the request body is not known beforehand, you can send the request body using the HTTP 1.1 chunked transfer-encoding format. The request body is sent in chunks, where the length of each chunk is sent before the chunk is sent. The `UTL_HTTP` package performs chunked transfer-encoding on the request body transparently when the `Transfer-Encoding: chunked` header is set. Note that some HTTP-1.1-based Web servers or CGI programs do not support or accept the request body encoding in the HTTP 1.1 chunked transfer-encoding format. See the `SET_HEADER` procedure for details.

If you send the `Content-Length` header, you should note that the length specified in the header should be the byte-length of the textual request body after it is converted from the database character set to the request body character set. When either one of the two character sets is a multibyte character set, the precise byte-length of the request body in the request body character set cannot be known beforehand. In this case, you can perform the character set conversion explicitly, determine the byte-length of the results, send the `Content-Length` header, and the results using the `WRITE_RAW` procedure to avoid the automatic character set conversion. Or, if the remote Web server or CGI programs allow, you can send the request body using the

HTTP 1.1 chunked transfer-encoding format, where `UTL_HTTP` handles the length of the chunks transparently.

280.9.47 WRITE_RAW Procedure

This procedure writes some binary data in the HTTP request body. As soon as some data is sent as the HTTP request body, the HTTP request headers section is completed.



See Also:

[HTTP Requests](#) and [HTTP Requests Subprograms](#)

Syntax

```
UTL_HTTP.WRITE_RAW(  
    r      IN OUT NOCOPY REQ,  
    data  IN          RAW);
```

Parameters

Table 280-60 WRITE_RAW Procedure Parameters

Parameter	Description
<code>r</code>	The HTTP request
<code>data</code>	The binary data to send in the HTTP request body

Usage Notes

An HTTP client must always let the remote Web server know the length of the request body it is sending. If the amount of data is known beforehand, you can set the `Content-Length` header in the request, where the length of the content is measured in bytes instead of characters. If the length of the request body is not known beforehand, you can send the request body using the HTTP 1.1 chunked transfer-encoding format. The request body is sent in chunks, where the length of each chunk is sent before the chunk is sent. `UTL_HTTP` performs chunked transfer-encoding on the request body transparently when the `Transfer-Encoding:chunked` header is set. Note that some HTTP-1.1-based Web servers or CGI programs do not support or accept the request body encoding in the HTTP 1.1 chunked transfer-encoding format. See the `SET_HEADER` procedure for details.

280.9.48 WRITE_TEXT Procedure

This procedure writes some text data in the HTTP request body.

As soon as some data is sent as the HTTP request body, the HTTP request headers section is completed. Text data is automatically converted from the database character set to the request body character set.

**See Also:**[HTTP Requests](#) and [HTTP Requests Subprograms](#)**Syntax**

```
UTL_HTTP.WRITE_TEXT(  
    r      IN OUT NOCOPY REQ,  
    data  IN          VARCHAR2 CHARACTER SET ANY_CS);
```

Parameters**Table 280-61** WRITE_TEXT Procedure Parameters

Parameter	Description
r	The HTTP request
data	The text data to send in the HTTP request body

Usage Notes

An HTTP client must always let the remote Web server know the length of the request body it is sending. If the amount of data is known beforehand, you can set the `Content-Length` header in the request, where the length of the content is measured in bytes instead of characters. If the length of the request body is not known beforehand, you can send the request body using the HTTP 1.1 chunked transfer-encoding format. The request body is sent in chunks, where the length of each chunk is sent before the chunk is sent. `UTL_HTTP` performs chunked transfer-encoding on the request body transparently when the `Transfer-Encoding: chunked` header is set. Note that some HTTP-1.1-based Web servers or CGI programs do not support or accept the request body encoding in the HTTP 1.1 chunked transfer-encoding format. See the `SET_HEADER` procedure for details.

If you send the `Content-Length` header, you should note that the length specified in the header should be the byte-length of the textual request body after it is converted from the database character set to the request body character set. When either one of the two character sets is a multibyte character set, the precise byte-length of the request body in the request body character set cannot be known beforehand. In this case, you can perform the character set conversion explicitly, determine the byte-length of the results, send the `Content-Length` header, and the results using the `WRITE_RAW` procedure to avoid the automatic character set conversion. Or, if the remove Web server or CGI programs allow, you can send the request body using the HTTP 1.1 chunked transfer-encoding format, where `UTL_HTTP` handles the length of the chunks transparently.

UTL_I18N

UTL_I18N is a set of services that provides additional globalization functionality for applications written in PL/SQL.



See Also:

Oracle Database Globalization Support Guide

The chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Data Structures](#)
- [Summary of UTL_I18N Subprograms](#)

281.1 UTL_I18N Overview

UTL_I18N services provide additional globalization functionality for applications written in PL/SQL.

The UTL_I18N PL/SQL package consists of the following categories of services:

- String conversion functions for various datatypes.
- Functions that convert a text string to character references and vice versa.
- Functions that map between Oracle, Java, and ISO languages and territories.
- Functions that map between Oracle, Internet Assigned Numbers Authority (IANA), and e-mail safe character sets.
- A function that returns the Oracle character set name from an Oracle language name.
- A function that returns the maximum number of bytes for a character of an Oracle character set.
- A function that performs script transliteration.
- Functions that return the ISO currency code, local time zones, and local languages supported for a given territory.
- Functions that return the most appropriate linguistic sort, a listing of all the applicable linguistic sorts, and the local territories supported for a given language.
- Functions that map between the Oracle full and short language names.
- A function that returns the language translation of a given language and territory name.

- A function that returns a listing of the most commonly used time zones.
- Procedures that detect the most likely Oracle character sets and Oracle languages for a given data sample.

281.2 UTL_I18N Security Model

The functions and procedures of the `UTL_I18N` package neither read database contents nor modify them. They operate on their arguments only and/or they retrieve static internationalization information from NLS Data files. The execution privilege for the package is granted to `PUBLIC` by default.

281.3 UTL_I18N Constants

`UTL_I18N` defines constants to use when specifying parameter values.

These constants are shown in the following table.

Table 281-1 UTL_I18N Constants

Constant	Type	Value	Description
<code>GENERIC_CONTEXT</code>	<code>PLS_INTEGER</code>	0	Returns the default character set for general cases.
<code>MAIL_GENERIC</code>	<code>PLS_INTEGER</code>	0	Map from an Oracle character set name to an email safe character set name on a non-Windows platform.
<code>ORACLE_TO_IANA</code>	<code>PLS_INTEGER</code>	0	Map from an Oracle character set name to an IANA character set name.
<code>SHIFT_IN</code>	<code>PLS_INTEGER</code>	0	Used with <code>shift_status</code> . Must be set the first time it is called in piecewise conversion.
<code>IANA_TO_ORACLE</code>	<code>PLS_INTEGER</code>	1	Map from an IANA character set name to an Oracle character set name.
<code>MAIL_CONTEXT</code>	<code>PLS_INTEGER</code>	1	The mapping is between an Oracle character set name and an email safe character set name.
<code>MAIL_WINDOWS</code>	<code>PLS_INTEGER</code>	1	Map from an Oracle character set name to an email safe character set name on a Windows platform.
<code>SHIFT_OUT</code>	<code>PLS_INTEGER</code>	1	
<code>FWKATAKANA_HIRA GANA</code>	<code>VARCHAR2(30)</code>	'fwkatakana_hi ragana'	Converts only fullwidth Katakana characters to fullwidth Hiragana characters.
<code>FWKATAKANA_HWKA TAKANA</code>	<code>VARCHAR2(30)</code>	'fwkatakana_hw katakana'	Converts only fullwidth Katakana characters to halfwidth Katakana characters.
<code>HIRAGANA_FWKATA KANA</code>	<code>VARCHAR2(30)</code>	'hiragana_fwka takana'	Converts only fullwidth Hiragana characters to fullwidth Katakana characters.

Table 281-1 (Cont.) UTL_I18N Constants

Constant	Type	Value	Description
HIRAGANA_HWKATA KANA	VARCHAR2(30)	'hiragana_hwka takana'	Converts only fullwidth Hiragana characters to halfwidth Katakana characters.
HWKATAKANA_FWKA TAKANA	VARCHAR2(30)	'hwkatakana_fw katakana'	Converts only halfwidth Katakana characters to fullwidth Katakana characters.
HWKATAKANA_HIRA GANA	VARCHAR2(30)	'hwkatakana_hi ragana'	Converts only halfwidth Katakana characters to fullwidth Hiragana characters.
KANA_FWKATAKANA	VARCHAR2(30)	'kana_fwkatata na'	Converts any type of Kana character to a fullwidth Katakana character.
KANA_HIRAGANA	VARCHAR2(30)	'kana_hiragana '	Converts any type of Kana character to a fullwidth Hiragana character.
KANA_HWKATAKANA	VARCHAR2(30)	'kana_hwkatata na'	Converts any type of Kana character to a halfwidth Katakana character.
LATIN_ASCII_DIN 91379	VARCHAR2(30)	'latin_ascii_d in91379'	Converts Latin characters to ASCII characters.
CYRILLIC_LATIN_ ISO9	VARCHAR2(30)	'cyrillic_lati n_iso9'	Converts Cyrillic characters to Latin characters.
GREEK_LATIN_ISO 843	VARCHAR2(30)	'greek_latin_i so843'	Converts Greek characters to Latin characters.
ARABIC_LATIN_IS O233	VARCHAR2(30)	'arabic_latin_ iso233'	Converts Arabic characters to Latin characters.
HEBREW_LATIN_IS O259	VARCHAR2(30)	'hebrew_latin_ iso259'	Converts Hebrew characters to Latin characters.
MODERN_HEBREW_L ATIN_ISO259_2	VARCHAR2(30)	'modern_hebrew _latin_iso259_ 2'	Converts Modern Hebrew characters to Latin characters.
CYR_ASCII_ICAO9 303	VARCHAR2(30)	'cyr_ascii_ICA O9303'	Converts Cyrillic characters to ASCII characters.
CYR_BY_ASCII_IC AO9303	VARCHAR2(30)	'cyr_by_ascii_ ICA09303'	Converts Cyrillic Belarus characters to ASCII characters.
CYR_UA_ASCII_IC AO9303	VARCHAR2(30)	'cyr_ua_ascii_ ICA09303'	Converts Cyrillic Ukraine characters to ASCII characters.
CYR_RS_ASCII_IC AO9303	VARCHAR2(30)	'cyr_rs_ascii_ ICA09303'	Converts Cyrillic Serbia characters to ASCII characters.
CYR_BG_ASCII_IC AO9303	VARCHAR2(30)	'cyr_bg_ascii_ ICA09303'	Converts Cyrillic Bulgaria characters to ASCII characters.
CYR_MK_ASCII_IC AO9303	VARCHAR2(30)	'cyr_mk_ascii_ ICA09303'	Converts Cyrillic North Macedonia characters to ASCII characters.

281.4 UTL_I18N Data Structures

The `UTL_I18N` package defines `RECORD` types and `TABLE` types.

RECORD Types

- [CHARSET_RESULT_RECORD Record Type](#)
- [LANGUAGE_CHARSET_RESULT_RECORD Record Type](#)
- [LANGUAGE_RESULT_RECORD Record Type](#)

TABLE Types

- [CHARSET_RESULT_TABLE Table Type](#)
- [LANGUAGE_CHARSET_RESULT_TABLE Table Type](#)
- [LANGUAGE_RESULT_TABLE Table Type](#)

281.4.1 CHARSET_RESULT_RECORD Record Type

This record type contains information returned by the `DETECT_CHARSET` procedure in the `UTL_I18N` package.

Syntax

```
TYPE CHARSET_RESULT_RECORD IS RECORD (  
  charset      VARCHAR2(28),  
  score        NUMBER);
```

Fields

Table 281-2 CHARSET_RESULT_RECORD Fields

Field	Description
<code>charset</code>	Oracle character set
<code>score</code>	A numeric value representing the likelihood that <code>charset</code> is the Oracle character set for the given data sample. The value is between 0 (least likely) and 1 (most likely).

281.4.2 LANGUAGE_CHARSET_RESULT_RECORD Record Type

This record type contains information returned by the `DETECT_LANGUAGE_CHARSET` procedure in the `UTL_I18N` package.

Syntax

```
TYPE LANGUAGE_CHARSET_RESULT_RECORD IS RECORD (  
  language     VARCHAR2(28),  
  charset      VARCHAR2(28),  
  score        NUMBER);
```

Fields

Table 281-3 LANGUAGE_CHARSET_RESULT_RECORD Fields

Field	Description
language	Oracle language
charset	Oracle character set
score	A numeric value representing the likelihood that <code>language</code> is the Oracle language and <code>charset</code> is the Oracle character set for the given data sample. The value is between 0 (least likely) and 1 (most likely).

281.4.3 LANGUAGE_RESULT_RECORD Record Type

This record type contains information returned by the `DETECT_LANGUAGE` procedure in the `UTL_I18N` package.

Syntax

```
TYPE LANGUAGE_RESULT_RECORD IS RECORD (
  language    VARCHAR2(28),
  score       NUMBER);
```

Fields

Table 281-4 LANGUAGE_RESULT_RECORD Fields

Field	Description
language	Oracle language
score	A numeric value representing the likelihood that <code>language</code> is the Oracle language for the given data sample. The value is between 0 (least likely) and 1 (most likely).

281.4.4 CHARSET_RESULT_TABLE Table Type

This is a table of `CHARSET_RESULT_RECORD` Record Type.

Syntax

```
TYPE charset_result_table IS TABLE OF charset_result_record;
```

Related Topics

- [CHARSET_RESULT_RECORD Record Type](#)
This record type contains information returned by the `DETECT_CHARSET` procedure in the `UTL_I18N` package.

281.4.5 LANGUAGE_CHARSET_RESULT_TABLE Table Type

This is a table of LANGUAGE_CHARSET_RESULT_RECORD Record Type.

Syntax

```
TYPE language_charset_result_table IS TABLE OF language_charset_result_record;
```

Related Topics

- [LANGUAGE_CHARSET_RESULT_RECORD Record Type](#)
This record type contains information returned by the DETECT_LANGUAGE_CHARSET procedure in the UTL_I18N package.

281.4.6 LANGUAGE_RESULT_TABLE Table Type

This is a table of LANGUAGE_RESULT_RECORD Record Type.

Syntax

```
TYPE language_result_table IS TABLE OF language_result_record;
```

Related Topics

- [LANGUAGE_RESULT_RECORD Record Type](#)
This record type contains information returned by the DETECT_LANGUAGE procedure in the UTL_I18N package.

281.5 Summary of UTL_I18N Subprograms

This table lists the UTL_I18N subprograms and briefly describes them.

Table 281-5 UTL_I18N Package Subprograms

Procedure	Description
DETECT_CHARSET Procedure	Detects the most likely Oracle character sets for a given data sample.
DETECT_LANGUAGE Procedure	Detects the most likely Oracle languages for a given data sample.
DETECT_LANGUAGE_CHARSET Procedure	Detects the most likely Oracle languages and Oracle character sets for a given data sample.
ESCAPE_REFERENCE Function	Converts a given text string to its character reference counterparts, for characters that fall outside the document character set.
GET_COMMON_TIME_ZONES Function	Returns the list of common time zone IDs that are independent of the locales.
GET_DEFAULT_CHARSET Function	Returns the default Oracle character set name or the default e-mail safe character set name from an Oracle language name.
GET_DEFAULT_ISO_CURRENCY Function	Returns the default ISO 4217 currency code for the specified territory.

Table 281-5 (Cont.) UTL_I18N Package Subprograms

Procedure	Description
GET_DEFAULT_LINGUISTIC_SORT Function	Returns the default linguistic sort name for the specified language.
GET_LOCAL_LANGUAGES Function	Returns the local language names for the specified territory.
GET_LOCAL_LINGUISTIC_SORTS Function	Returns the local linguistic sort names for the specified language.
GET_LOCAL_TERRITORIES Function	Returns the local territory names for the specified language.
GET_LOCAL_TIME_ZONES Function	Returns the local time zone IDs for the specified territory.
GET_MAX_CHARACTER_SIZE Function	Returns the maximum character size of a given character set.
GET_TRANSLATION Function	Returns the translation of the language and territory name in the specified translation language.
MAP_CHARSET Function	<ul style="list-style-type: none"> • Maps an Oracle character set name to an IANA character set name. • Maps an IANA character set name to an Oracle character set name. • Maps an Oracle character set name to an e-mail safe character set name.
MAP_FROM_SHORT_LANGUAGE Function	Maps an Oracle short language name to an Oracle language name.
MAP_LANGUAGE_FROM_ISO Function	Returns an Oracle language name from an ISO locale name.
MAP_LOCALE_TO_ISO Function	Returns an ISO locale name from the Oracle language and territory name.
MAP_TERRITORY_FROM_ISO Function	Returns an Oracle territory name from an ISO locale name.
MAP_TO_SHORT_LANGUAGE Function	Maps an Oracle language name to an Oracle short language name.
RAW_TO_CHAR Functions	Converts RAW data that is not encoded in the database character set into a VARCHAR2 string
RAW_TO_NCHAR Functions	Converts RAW data that is not encoded in the national character set into an NVARCHAR2 string
STRING_TO_RAW Function	Converts a VARCHAR2 or NVARCHAR2 string to another character set. The result is returned as a RAW datatype.
TRANSLITERATE Function	Performs script transliteration.
UNESCAPE_REFERENCE Function	Converts an input string that contains character references to a text string.
VALIDATE_CHARACTER_ENCODING Function	Validates the character encoding of VARCHAR2, NVARCHAR2, CLOB, and NCLOB data.

281.5.1 DETECT_CHARSET Procedure

This procedure detects the most likely Oracle character sets for a given data sample.

The procedure is overloaded to accept data of type BFILE, BLOB, CLOB, VARCHAR2, or NVARCHAR2. The procedure analyzes the data and returns its possible Oracle character sets, ranked by likelihood. It stores the results in a table of type `CHARSET_RESULT_TABLE`.

Syntax

This procedure analyzes BFILE data:

```
UTL_I18N.DETECT_CHARSET (  
    result          OUT charset_result_table,  
    src             IN BFILE,  
    profile         IN BINARY_INTEGER DEFAULT 1,  
    num_results     IN BINARY_INTEGER DEFAULT NULL,  
    sample_size     IN BINARY_INTEGER DEFAULT NULL  
);
```

This procedure analyzes BLOB data:

```
UTL_I18N.DETECT_CHARSET (  
    result          OUT charset_result_table,  
    src             IN BLOB,  
    profile         IN BINARY_INTEGER DEFAULT 1,  
    num_results     IN BINARY_INTEGER DEFAULT NULL,  
    sample_size     IN BINARY_INTEGER DEFAULT NULL  
);
```

This procedure analyzes CLOB data:

```
UTL_I18N.DETECT_CHARSET (  
    result          OUT charset_result_table,  
    src             IN CLOB,  
    profile         IN BINARY_INTEGER DEFAULT 1,  
    num_results     IN BINARY_INTEGER DEFAULT NULL,  
    sample_size     IN BINARY_INTEGER DEFAULT NULL  
);
```

This procedure analyzes VARCHAR2 or NVARCHAR2 data:

```
UTL_I18N.DETECT_CHARSET (  
    result          OUT charset_result_table,  
    src             IN VARCHAR2,  
    profile         IN BINARY_INTEGER DEFAULT 1,  
    num_results     IN BINARY_INTEGER DEFAULT NULL,  
    sample_size     IN BINARY_INTEGER DEFAULT NULL  
);
```


Parameters

Table 281-6 DETECT_CHARSET Procedure Parameters

Parameter	Description
result	Result table of type <code>CHARSET_RESULT_TABLE</code> . Each result row consists of an Oracle character set name and its score. The rows are ordered by score in descending order, that is, the character set with the highest score (most likely) is listed first, and the character set with the lowest score (least likely) is listed last.
src	Data sample whose character set is to be detected.
profile	Language and character set detection profile identifier: <ul style="list-style-type: none"> 1 - Supports the languages and character sets supported by LCSSCAN and GDK. When this profile is used and the given sample data is binary data, the procedure does not return a reasonable result. 2 - Supports the languages and character sets supported by LCSSCAN and GDK, as well as the pseudo BINARY language and the pseudo BINARY character set. This profile does not support the AL16UTF16 character set. <p>The default profile identifier is 1.</p> <p>See Also: <i>Oracle Database Globalization Support Guide</i> for the list of languages and character sets supported by LCSSCAN and GDK</p>
num_results	Number of result rows to store in the result table. The default is NULL, meaning the procedure stores all result rows in the result table.
sample_size	Sampling size of the data (in bytes). If this value is greater than the length of the data, then the data length is used. The default is NULL, meaning the full length of the data is used.

Usage Notes

If the given data sample is NULL, then the procedure returns a result table with no rows.

Example

Create a table that contains a data sample of type VARCHAR2.

```
CREATE TABLE src_data (sample VARCHAR2(40));
INSERT INTO src_data VALUES ('Hello! How are you?');
```

Use the `DETECT_CHARSET` procedure to analyze the data sample.

```
VAR l_char VARCHAR2(40)
EXEC SELECT sample INTO :l_char FROM src_data;

VAR l_cur REFCURSOR

DECLARE
    l_result    UTL_I18N.CHARSET_RESULT_TABLE;
BEGIN
    UTL_I18N.DETECT_CHARSET(l_result, :l_char, 1, 5);
    OPEN :l_cur FOR SELECT * FROM TABLE(l_result);
```

```
END;
/

PRINT l_cur
```

The result table displays the top five likeliest Oracle character sets for the given data sample.

CHARSET	SCORE
US7ASCII	.853497
EE8ISO8859P2	.0933974
NEE8ISO8859P4	.0224543
AL16UTF16	.0100793
WE8ISO8859P9	.00778038

281.5.2 DETECT_LANGUAGE Procedure

This procedure detects the most likely Oracle languages for a given data sample.

The procedure is overloaded to accept data of type BFILE, BLOB, CLOB, VARCHAR2, or NVARCHAR2. The procedure analyzes the data and returns its possible Oracle languages, ranked by likelihood. It stores the results in a table of type LANGUAGE_RESULT_TABLE.

Syntax

This procedure analyzes BFILE data:

```
UTL_I18N.DETECT_LANGUAGE (
    result      OUT language_result_table,
    src         IN BFILE,
    profile     IN BINARY_INTEGER DEFAULT 1,
    num_results IN BINARY_INTEGER DEFAULT NULL,
    sample_size IN BINARY_INTEGER DEFAULT NULL
);
```

This procedure analyzes BLOB data:

```
UTL_I18N.DETECT_LANGUAGE (
    result      OUT language_result_table,
    src         IN BLOB,
    profile     IN BINARY_INTEGER DEFAULT 1,
    num_results IN BINARY_INTEGER DEFAULT NULL,
    sample_size IN BINARY_INTEGER DEFAULT NULL
);
```

This procedure analyzes CLOB data:

```
UTL_I18N.DETECT_LANGUAGE (
    result      OUT language_result_table,
    src         IN CLOB,
    profile     IN BINARY_INTEGER DEFAULT 1,
    num_results IN BINARY_INTEGER DEFAULT NULL,
    sample_size IN BINARY_INTEGER DEFAULT NULL
);
```

This procedure analyzes VARCHAR2 or NVARCHAR2 data:

```
UTL_I18N.DETECT_LANGUAGE (
    result      OUT language_result_table,
    src         IN VARCHAR2,
    profile     IN BINARY_INTEGER DEFAULT 1,
    num_results IN BINARY_INTEGER DEFAULT NULL,
    sample_size IN BINARY_INTEGER DEFAULT NULL
);
```

Parameters

Table 281-7 DETECT_LANGUAGE Procedure Parameters

Parameter	Description
result	Result table of type <code>LANGUAGE_RESULT_TABLE</code> . Each result row consists of an Oracle language name and its score. The rows are ordered by score in descending order, that is, the language with the highest score (most likely) is listed first, and the language with the lowest score (least likely) is listed last.
src	Data sample whose language is to be detected.
profile	Language and character set detection profile identifier: <ul style="list-style-type: none"> 1 - Supports the languages and character sets supported by LCSSCAN and GDK. When this profile is used and the given sample data is binary data, the procedure does not return a reasonable result. 2 - Supports the languages and character sets supported by LCSSCAN and GDK, as well as the pseudo BINARY language and the pseudo BINARY character set. This profile does not support the AL16UTF16 character set. <p>The default profile identifier is 1.</p> <p>See Also: <i>Oracle Database Globalization Support Guide</i> for the list of languages and character sets supported by LCSSCAN and GDK</p>
num_results	Number of result rows to store in the result table. The default is NULL, meaning the procedure stores all result rows in the result table.
sample_size	Sampling size of the data (in bytes). If this value is greater than the length of the data, then the data length is used. The default is NULL, meaning the full length of the data is used.

Usage Notes

If the given data sample is NULL, then the procedure returns a result table with no rows.

Examples

Create a table that contains a data sample of type VARCHAR2.

```
CREATE TABLE src_data (sample VARCHAR2(40));
INSERT INTO src_data VALUES ('Hello! How are you?');
```

Use the `DETECT_LANGUAGE` procedure to analyze the data sample.

```

VAR l_char VARCHAR2(40)
EXEC SELECT sample INTO :l_char FROM src_data;

VAR l_cur REFCURSOR

DECLARE
  l_result      UTL_I18N.LANGUAGE_RESULT_TABLE;
BEGIN
  UTL_I18N.DETECT_LANGUAGE(l_result, :l_char, 1, 5);
  OPEN :l_cur FOR SELECT * FROM TABLE(l_result);
END;
/

PRINT l_cur

```

The result table displays the top five likeliest Oracle languages for the given data sample.

LANGUAGE	SCORE
-----	-----
ENGLISH	.245638
ITALIAN	.0876835
POLISH	.0758762
FRENCH	.0744972
INDONESIAN	.0538222

281.5.3 DETECT_LANGUAGE_CHARSET Procedure

This procedure detects the most likely Oracle languages and Oracle character sets for a given data sample.

The procedure is overloaded to accept data of type `BFILE`, `BLOB`, `CLOB`, `VARCHAR2`, or `NVARCHAR2`. The procedure analyzes the data and returns its possible Oracle languages and Oracle character sets, ranked by likelihood. It stores the results in a table of type `LANGUAGE_CHARSET_RESULT_TABLE`.

Syntax

This procedure analyzes `BFILE` data:

```

UTL_I18N.DETECT_LANGUAGE_CHARSET (
  result      OUT language_charset_result_table,
  src         IN BFILE,
  profile     IN BINARY_INTEGER DEFAULT 1,
  num_results IN BINARY_INTEGER DEFAULT NULL,
  sample_size IN BINARY_INTEGER DEFAULT NULL
);

```

This procedure analyzes `BLOB` data:

```

UTL_I18N.DETECT_LANGUAGE_CHARSET (
  result      OUT language_charset_result_table,
  src         IN BLOB,

```

```

profile          IN BINARY_INTEGER DEFAULT 1,
num_results     IN BINARY_INTEGER DEFAULT NULL,
sample_size     IN BINARY_INTEGER DEFAULT NULL
);

```

This procedure analyzes CLOB data:

```

UTL_I18N.DETECT_LANGUAGE_CHARSET (
  result         OUT language_charset_result_table,
  src            IN CLOB,
  profile        IN BINARY_INTEGER DEFAULT 1,
  num_results    IN BINARY_INTEGER DEFAULT NULL,
  sample_size    IN BINARY_INTEGER DEFAULT NULL
);

```

This procedure analyzes VARCHAR2 or NVARCHAR2 data:

```

UTL_I18N.DETECT_LANGUAGE_CHARSET (
  result         OUT language_charset_result_table,
  src            IN VARCHAR2,
  profile        IN BINARY_INTEGER DEFAULT 1,
  num_results    IN BINARY_INTEGER DEFAULT NULL,
  sample_size    IN BINARY_INTEGER DEFAULT NULL
);

```

Parameters

Table 281-8 DETECT_LANGUAGE_CHARSET Procedure Parameters

Parameter	Description
result	Result table of type LANGUAGE_CHARSET_RESULT_TABLE. Each result row consists of an Oracle language, an Oracle character set name, and their score. The rows are ordered by score in descending order, that is, the language and character set with the highest score (most likely) is listed first, and the language and character set with the lowest score (least likely) is listed last.
src	Data sample whose language and character set are to be detected.
profile	Language and character set detection profile identifier: <ul style="list-style-type: none"> 1 - Supports the languages and character sets supported by LCSSCAN and GDK. When this profile is used and the given sample data is binary data, the procedure does not return a reasonable result. 2 - Supports the languages and character sets supported by LCSSCAN and GDK, as well as the pseudo BINARY language and the pseudo BINARY character set. This profile does not support the AL16UTF16 character set. <p>The default profile identifier is 1.</p> <p>See Also: <i>Oracle Database Globalization Support Guide</i> for the list of languages and character sets supported by LCSSCAN and GDK</p>
num_results	Number of result rows to store in the result table. The default is NULL, meaning the procedure stores all result rows in the result table.
sample_size	Sampling size of the data (in bytes). If this value is greater than the length of the data, then the data length is used. The default is NULL, meaning the full length of the data is used.

Usage Notes

If the given data sample is NULL, then the procedure returns a result table with no rows.

Examples

Create a table that contains a data sample of type VARCHAR2.

```
CREATE TABLE src_data (sample VARCHAR2(40));
INSERT INTO src_data VALUES ('Hello! How are you?');
```

Use the DETECT_LANGUAGE_CHARSET procedure to analyze the data sample.

```
VAR l_char VARCHAR2(40)
EXEC SELECT sample INTO :l_char FROM src_data;

VAR l_cur REFCURSOR

DECLARE
    l_result      UTL_I18N.LANGUAGE_CHARSET_RESULT_TABLE;
BEGIN
    UTL_I18N.DETECT_LANGUAGE_CHARSET(l_result, :l_char, 1, 5);
    OPEN :l_cur FOR SELECT * FROM TABLE(l_result);
END;
/

PRINT l_cur
```

The result table displays the top five likeliest Oracle languages and Oracle character sets for the given data sample.

LANGUAGE	CHARSET	SCORE
ENGLISH	US7ASCII	.245023
ITALIAN	US7ASCII	.0873574
FRENCH	US7ASCII	.0741715
INDONESIAN	US7ASCII	.0534795
POLISH	EE8ISO8859P2	.0380973

281.5.4 ESCAPE_REFERENCE Function

This function converts a text string to its character reference counterparts for characters that fall outside the character set used by the current document.

Character references are mainly used in HTML and XML documents to represent characters independently of the encoding of the document. Character references may appear in two forms, numeric character references and character entity references. Numeric character references specify the Unicode code point value of a character, while character entity references use symbolic names to refer to the same character. For example, `å` is the numeric character reference for the small letter "a" with a

ring above, whereas `å` is the character entity reference for the same character. Character entity references are also used to escape special characters, as an example, `<` represents the `<` (less than) sign. This is to avoid possible confusion with the beginning of a tag in Markup languages.

Syntax

```
UTL_I18N.ESCAPE_REFERENCE(  
    str          IN VARCHAR2 CHARACTER SET ANY_CS,  
    page_cs_name IN VARCHAR2 DEFAULT NULL)  
RETURN VARCHAR2 CHARACTER SET str%CHARSET;
```

Parameters

Table 281-9 ESCAPE_REFERENCE Function Parameters

Parameter	Description
<code>str</code>	Specifies the input string
<code>page_cs_name</code>	Specifies the character set of the document. If <code>page_cs_name</code> is <code>NULL</code> , then the database character set is used for <code>CHAR</code> data and the national character set is used for <code>NCHAR</code> data.

Usage Notes

If the user specifies an invalid character set or a `NULL` string, then the function returns a `NULL` string.

Examples

```
UTL_I18N.ESCAPE_REFERENCE('hello < '||chr(229),'us7ascii')
```

This returns `'hello < å'`.

281.5.5 GET_COMMON_TIME_ZONES Function

This function returns a listing of the most coemmonly used time zones. This list contains a subset of the time zones that are supported in the database.

Syntax

```
UTL_I18N.GET_COMMON_TIME_ZONES  
RETURN STRING_ARRAY;
```

Examples

Returns the list of the most commonly used time zones.

```
DECLARE  
    retval UTL_I18N.STRING_ARRAY;  
BEGIN  
    retval := UTL_I18N.GET_COMMON_TIME_ZONES;  
END;  
/
```

281.5.6 GET_DEFAULT_CHARSET Function

This function returns the default Oracle character set name or the default e-mail safe character set name from an Oracle language name.



See Also:

"[MAP_CHARSET Function](#)" for an explanation of an e-mail safe character set

Syntax

```
UTL_I18N.GET_DEFAULT_CHARSET(
    language IN VARCHAR2,
    context  IN PLS_INTEGER DEFAULT GENERIC_CONTEXT,
    iswindows IN BOOLEAN DEFAULT FALSE)
RETURN VARCHAR2;
```

Parameters

Table 281-10 GET_DEFAULT_CHARSET Function Parameters

Parameter	Description
language	Specifies a valid Oracle language
context	GENERIC_CONTEXT MAIL_CONTEXT GENERIC_CONTEXT: Returns the default character set for general cases MAIL_CONTEXT: Returns the default e-mail safe character set name
iswindows	If context is set as MAIL_CONTEXT, then iswindows should be set to TRUE if the platform is Windows and FALSE if the platform is not Windows. The default is FALSE. iswindows has no effect if context is set as GENERIC_CONTEXT.

Usage Notes

If the user specifies an invalid language name or an invalid flag, then the function returns a NULL string.

Examples

GENERIC_CONTEXT, iswindows=FALSE

```
UTL_I18N.GET_DEFAULT_CHARSET('French', UTL_I18N.GENERIC_CONTEXT, FALSE)
```

This returns 'WE8ISO8859P1'.

MAIL_CONTEXT, iswindows=TRUE

```
UTL_I18N.GET_DEFAULT_CHARSET('French', UTL_I18N.MAIL_CONTEXT, TRUE)
```

This returns 'WE8MSWIN1252'.


```
MAIL_CONTEXT, iswindows=FALSE
```

```
UTL_I18N.GET_DEFAULT_CHARSET('French', UTL_I18N.MAIL_CONTEXT, FALSE)
```

This returns 'WE8ISO8859P1'.

281.5.7 GET_DEFAULT_ISO_CURRENCY Function

This function returns the default ISO 4217 currency code for the specified territory.

Syntax

```
UTL_I18N.GET_DEFAULT_ISO_CURRENCY (  
    territory IN VARCHAR2 CHARACTER SET ANY_CS)  
RETURN VARCHAR2;
```

Parameters

Table 281-11 GET_DEFAULT_ISO_CURRENCY Function Parameters

Parameter	Description
territory	Specifies a valid Oracle territory. It is case-insensitive.

Usage Notes

If the user specifies an invalid territory name, then the function returns a NULL string.

Examples

Displays the default ISO currency code for China.

```
DECLARE  
    retval VARCHAR2(50);  
BEGIN  
    retval := UTL_I18N.GET_DEFAULT_ISO_CURRENCY('CHINA');  
    DBMS_OUTPUT.PUT_LINE(retval);  
END;  
/
```

281.5.8 GET_DEFAULT_LINGUISTIC_SORT Function

This function returns the most commonly used Oracle linguistic sort for the specified language.

Syntax

```
UTL_I18N.GET_DEFAULT_LINGUISTIC_SORT (  
    language IN VARCHAR2 CHARACTER SET ANY_CS)  
RETURN VARCHAR2;
```

Parameters

Table 281-12 GET_DEFAULT_LINGUISTIC_SORT Function Parameters

Parameter	Description
language	Specifies a valid Oracle language. It is case-insensitive.

Usage Notes

If the user specifies an invalid language name, then the function returns a `NULL` string.

Examples

Displays the name of the most appropriate linguistic sort name for the language used in the current SQL session.

```
DECLARE
    retval VARCHAR2(50);
BEGIN
    SELECT value INTO retval FROM nls_database_parameters
    WHERE parameter = 'NLS_LANGUAGE';
    retval := UTL_I18N.GET_DEFAULT_LINGUISTIC_SORT(retval);
    DBMS_OUTPUT.PUT_LINE(retval);
END;
/
```

281.5.9 GET_LOCAL_LANGUAGES Function

This function returns the local language names for the specified territory.

Syntax

```
UTL_I18N.GET_LOCAL_LANGUAGES (
    territory IN VARCHAR2 CHARACTER SET ANY_CS)
RETURN STRING_ARRAY;
```

Parameters

Table 281-13 GET_LOCAL_LANGUAGES Function Parameters

Parameter	Description
territory	Specifies a valid Oracle territory. It is case-insensitive.

Usage Notes

If the user specifies an invalid territory name, then the function returns a `NULL` string.

Examples

Returns the list of local languages used in Belgium.

```
DECLARE
    retval UTL_I18N.STRING_ARRAY;
    cnt INTEGER;
BEGIN
```

```

    retval := UTL_I18N.GET_LOCAL_LANGUAGES('BELGIUM');
    DBMS_OUTPUT.PUT('Count = ');
    DBMS_OUTPUT.PUT_LINE(retval.LAST);
    cnt := retval.FIRST;
    WHILE cnt IS NOT NULL LOOP
        DBMS_OUTPUT.PUT_LINE(retval(cnt));
        cnt := retval.NEXT(cnt);
    END LOOP;
END;
/
...
Count = 2
DUTCH
FRENCH

```

281.5.10 GET_LOCAL_LINGUISTIC_SORTS Function

This function returns a list of the Oracle linguistic sort names that are appropriate for the specified language. A `BINARY` sort is included for all languages.

Syntax

```

UTL_I18N.GET_LOCAL_LINGUISTIC_SORTS (
    language IN VARCHAR2 CHARACTER SET ANY_CS)
RETURN STRING_ARRAY;

```

Parameters

Table 281-14 GET_LOCAL_LINGUISTIC_SORTS Function Parameters

Parameter	Description
language	Specifies a valid Oracle language. It is case-insensitive.

Usage Notes

If the user specifies an invalid language name, then the function returns a `NULL` string.

Examples

Displays the local linguistic sort names for `JAPANESE`.

```

DECLARE
    retval UTL_I18N.STRING_ARRAY;
    cnt INTEGER;
BEGIN
    retval := UTL_I18N.GET_LOCAL_LINGUISTIC_SORTS('Japanese');
    DBMS_OUTPUT.PUT('Count = ');
    DBMS_OUTPUT.PUT_LINE(retval.COUNT);
    cnt := retval.FIRST;
    WHILE cnt IS NOT NULL LOOP
        DBMS_OUTPUT.PUT_LINE(retval(cnt));
        cnt := retval.NEXT(cnt);
    END LOOP;
END;
/
...
Count = 2

```

```
JAPANESE_M  
BINARY
```

281.5.11 GET_LOCAL_TERRITORIES Function

This function returns the local territory names for the specified language.

Syntax

```
UTL_I18N.GET_LOCAL_TERRITORIES (  
    language IN VARCHAR2 CHARACTER SET ANY_CS)  
RETURN STRING_ARRAY;
```

Parameters

Table 281-15 GET_LOCAL_TERRITORIES Function Parameters

Parameter	Description
language	Specifies a valid Oracle language. It is case-insensitive.

Usage Notes

If the user specifies an invalid language name, then the function returns a NULL string.

Examples

Returns the list of Oracle territories that use German as one of their local languages.

```
DECLARE  
    retval UTL_I18N.STRING_ARRAY;  
    cnt    INTEGER;  
BEGIN  
    retval := UTL_I18N.GET_LOCAL_TERRITORIES('GERMAN');  
    DBMS_OUTPUT.PUT('Count = ');  
    DBMS_OUTPUT.PUT_LINE(retval.LAST);  
    cnt := retval.FIRST;  
    WHILE cnt IS NOT NULL LOOP  
        DBMS_OUTPUT.PUT_LINE(retval(cnt));  
        cnt := retval.NEXT(cnt);  
    END LOOP;  
END;  
/  
...  
Count = 4  
GERMANY  
AUSTRIA  
LUXEMBOURG  
SWITZERLAND
```

281.5.12 GET_LOCAL_TIME_ZONES Function

This function returns the local time zone IDs for the specified territory.

Syntax

```
UTL_I18N.GET_LOCAL_TIME_ZONES (
    territory      IN VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL)
RETURN STRING_ARRAY;
```

Parameters

Table 281-16 GET_LOCAL_TIME_ZONES Function Parameters

Parameter	Description
territory	Specifies a valid Oracle territory. It is case-insensitive.

Usage Notes

If the user specifies an invalid territory name, then the function returns a NULL string.

Examples

Creates a function that returns the list of time zones locally used in the territory `AZERBAIJAN` followed by the general common time zones. This is useful for when the user's territory is known and the application still allows the user to choose other time zones as a user's preference.

```
CREATE OR REPLACE FUNCTION get_time_zones
(territory IN VARCHAR2 CHARACTER SET ANY_CS)
RETURN utl_i18n.string_array
IS
    retval  utl_i18n.string_array;
    retval2 utl_i18n.string_array;
    stpos   INTEGER;
BEGIN
    retval := utl_i18n.get_local_time_zones(
        territory);
    retval2 := utl_i18n.get_common_time_zones;
    stpos := retval.LAST + 1;
    retval(stpos) := '-----'; -- a separator
    FOR i IN retval2.FIRST..retval2.LAST LOOP
        stpos := stpos + 1;
        retval(stpos) := retval2(i);
    END LOOP;
    RETURN retval;
END;
```

Returns the list of local time zones for `AZERBAIJAN` followed by the common time zones with a separator string of five dashes (-----).

```
DECLARE
    retval UTL_I18N.STRING_ARRAY;
    cnt   INTEGER;
BEGIN
    DBMS_OUTPUT.ENABLE(100000);
```

```

    retval UTL_I18N.GET_TIME_ZONES('AZERBAIJAN');
    cnt := retval.FIRST;
WHILE cnt IS NOT NULL LOOP
    DBMS_OUTPUT.PUT_LINE(retval(cnt));
    cnt := retval.NEXT(cnt);
END LOOP;
END;
/

Asia/Baku
-----
Pacific/Pago_Pago
Pacific/Honolulu
America/Anchorage
America/Vancouver
America/Los_Angeles
America/Tijuana
America/Edmonton
America/Denver
America/Phoenix
America/Mazatlan
America/Winnipeg
America/Regina
America/Chicago
America/Mexico_City
America/Guatemala
America/El_Salvador
America/Managua
America/Costa_Rica
America/Montreal
...

```

281.5.13 GET_MAX_CHARACTER_SIZE Function

This function returns the maximum character size of a given character set.

Syntax

```

UTL_I18N.GET_MAX_CHARACTER_SIZE(
    charset_name      IN VARCHAR2 CHARACTER SET ANY_CS)
RETURN PLS_INTEGER;

```

Parameters

Table 281-17 GET_MAX_CHARACTER_SIZE Function Parameters

Parameter	Description
charset_name	Specifies a valid character set name. It is case-insensitive.

Usage Notes

For shift-sensitive character sets, the returned maximum character size will include the possible extra shift characters.

Examples

```

UTL_I18N.GET_MAX_CHARACTER_SIZE('AL32UTF8');

```

This returns 4.

281.5.14 GET_TRANSLATION Function

This function returns the translation of the language and territory name in the specified translation language.

Syntax

```
UTL_I18N.GET_TRANSLATION (
    parameter          IN VARCHAR2 CHARACTER SET ANY_CS,
    trans_language     IN VARCHAR2 'AMERICAN',
    flag               IN PLS_INTEGER DEFAULT LANGUAGE_TRANS)
RETURN VARCHAR2 CHARACTER SET parameter%CHARSET;
```

Parameters

Table 281-18 GET_TRANSLATION Function Parameters

Parameter	Description
parameter	Specifies a valid language name, territory name, or a combined string in the form of <i>language_territory</i> . It is case-insensitive.
trans_language	Specifies a translation language name. For example, ITALIAN is for the Italian language. The default is AMERICAN, which indicates American English.
flag	Specifies the translation type: <ul style="list-style-type: none"> LANGUAGE_TRANS: The function returns the language translation. TERRITORY_TRANS: The function returns the territory translation. LANGUAGE_TERRITORY_TRANS: The function returns the language and territory translation. The default translation type is LANGUAGE_TRANS.

Usage Notes

If VARCHAR2 is used as a parameter type, the returned translation text can be corrupted due to the conversion to the database character set. Using NVARCHAR2 as the parameter type will preserve the translation text because Unicode can encode all translated languages.

If the specified translation language is not available or an invalid name is provided, the default "American English" translations are returned. For example, Oracle does not provide GUJARATI translations, so the returned translation would be in American English.

Examples

The following returns the names of all the Oracle-supported languages in Italian.

```
DECLARE
    CURSOR c1 IS
        SELECT value FROM V$NLS_VALID_VALUES
        WHERE parameter = 'LANGUAGE'
        ORDER BY value;
    retval NVARCHAR2(100);
BEGIN
    FOR item IN c1 LOOP
        retval := UTL_I18N.GET_TRANSLATION (TO_NCHAR(item.value), 'italian');
```

```

        END LOOP;
    END;

```

281.5.15 MAP_CHARSET Function

This function maps a character set to another character set.

It maps the following:

- An Oracle character set name to an IANA character set name.
- An IANA character set name to an Oracle character set name.
- An Oracle character set to an e-mail safe character set name.

Syntax

```

UTL_I18N.MAP_CHARSET(
    charset    IN VARCHAR2,
    context    IN PLS_INTEGER DEFAULT GENERIC_CONTEXT,
    flag       IN PLS_INTEGER DEFAULT ORACLE_TO_IANA)
RETURN VARCHAR2;

```

Parameters

Table 281-19 MAP_CHARSET Function Parameters

Parameter	Description
charset	Specifies the character set name to be mapped. The mapping is case-insensitive.
context	<p>GENERIC_CONTEXT MAIL_CONTEXT</p> <p>GENERIC_CONTEXT: The mapping is between an Oracle character set name and an IANA character set name. This is the default value.</p> <p>MAIL_CONTEXT: The mapping is between an Oracle character set name and an email safe character set name.</p>
flag	<ul style="list-style-type: none"> • ORACLE_TO_IANA IANA_TO_ORACLE if GENERIC_CONTEXT is set <ul style="list-style-type: none"> ORACLE_TO_IANA: Map from an Oracle character set name to an IANA character set name. This is the default. IANA_TO_ORACLE: Map from an IANA character set name to an Oracle character set name. • MAIL_GENERIC MAIL_WINDOWS if MAIL_CONTEXT is set <ul style="list-style-type: none"> MAIL_GENERIC: Map from an Oracle character set name to an email safe character set name on a non-Windows platform. MAIL_WINDOWS: Map from an Oracle character set name to an email safe character set name on a Windows platform.

Usage Notes

An e-mail safe character set is an Oracle character set that is commonly used by applications when they submit e-mail messages. The character set is usually used to convert contents in the database character set to e-mail safe contents. To specify the character set name in the mail header, you should use the corresponding IANA character set name obtained by calling the `MAP_CHARSET` function with the `ORACLE_TO_IANA` option, providing the e-mail safe character set name as input.

For example, no e-mail client recognizes message contents in the WE8DEC character set, whose corresponding IANA name is DEC-MCS. If WE8DEC is passed to the MAP_CHARSET function with the MAIL_CONTEXT option, then the function returns WE8ISO8859P1. Its corresponding IANA name, ISO-8859-1, is recognized by most e-mail clients.

The steps in this example are as follows:

1. Call the MAP_CHARSET function with the MAIL_CONTEXT | MAIL_GENERIC option with the database character set name, WE8DEC. The result is WE8ISO8859P1.
2. Convert the contents stored in the database to WE8ISO8859P1.
3. Call the MAP_CHARSET function with the ORACLE_TO_IANA | GENERIC_CONTEXT option with the e-mail safe character set, WE8ISO8859P1. The result is ISO-8859-1.
4. Specify ISO-8859-1 in the mail header when the e-mail message is submitted.

The function returns a character set name if a match is found. If no match is found or if the flag is invalid, then it returns NULL.



Note:

Many Oracle character sets can map to one e-mail safe character set. There is no function that maps an e-mail safe character set to an Oracle character set name.

Examples

Generic Context

```
UTL_I18N.MAP_CHARSET('iso-8859-1',UTL_I18N.GENERIC_CONTEXT,UTL_I18N.IANA_TO_ORACLE)
```

This returns 'WE8ISO8859P1'.

Context

```
UTL_I18N.MAP_CHARSET('WE8DEC', utl_i18n.mail_context, utl_i18n.mail_generic)
```

This returns 'WE8ISO8859P1'.



See Also:

Oracle Database Globalization Support Guide for a list of valid Oracle character sets

281.5.16 MAP_FROM_SHORT_LANGUAGE Function

This function maps an Oracle short language name to an Oracle language name.

Syntax

```
UTL_I18N.MAP_FROM_SHORT_LANGUAGE (
    language          IN VARCHAR2 CHARACTER SET ANY_CS)
RETURN VARCHAR2;
```

Parameters

Table 281-20 MAP_FROM_SHORT_LANGUAGE Function Parameters

Parameter	Description
language	Specifies a valid short language name. It is case-insensitive.

Usage Notes

If the user specifies an invalid language name, then the function returns a `NULL` string.

Examples

Returns the default linguistic sort name for the customer with the ID of 9000. Note that the table `customers` is from the `oe` user in the Common Schema. Because the customer's language preference is stored using a short language name, you need to convert to a full language name by calling the `GET_DEFAULT_LINGUISTIC_SORT` procedure.

```
DECLARE
  short_n VARCHAR2(10);
  ling_n VARCHAR2(50);
BEGIN
  SELECT nls_language INTO short
  FROM customers WHERE customer_id = 9000;
  ling_n := UTL_I18N.GET_DEFAULT_LINGUISTIC_SORT (
  UTL_I18N.MAP_FROM_SHORT_LANGUAGE(short_n));
  DBMS_OUTPUT.PUT_LINE(ling_n);
END;
/
```

281.5.17 MAP_LANGUAGE_FROM_ISO Function

This function returns an Oracle language name from an ISO locale name.

Syntax

```
UTL_I18N.MAP_LANGUAGE_FROM_ISO(
  isocale IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 281-21 MAP_LANGUAGE_FROM_ISO Function Parameters

Parameter	Description
isocale	Specifies the ISO locale. The mapping is case-insensitive.

Usage Notes

If the user specifies an invalid locale string, then the function returns a `NULL` string.

If the user specifies a locale string that includes only the language (for example, `en_` instead of `en_US`), then the function returns the default language name for the specified language (for example, `American`).

Examples

```
UTL_I18N.MAP_LANGUAGE_FROM_ISO('en_US')
```

This returns 'American'.



See Also:

Oracle Database Globalization Support Guide for a list of valid Oracle languages

281.5.18 MAP_LOCALE_TO_ISO Function

This function returns an ISO locale name from an Oracle language name and an Oracle territory name.

A valid string must include at least one of the following: a valid Oracle language name or a valid Oracle territory name.

Syntax

```
UTL_I18N.MAP_LOCALE_TO_ISO (
    ora_language  IN VARCHAR2,
    ora_territory IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 281-22 MAP_LOCALE_TO_ISO Function Parameters

Parameter	Description
<code>ora_language</code>	Specifies an Oracle language name. It is case-insensitive.
<code>ora_territory</code>	Specifies an Oracle territory name. It is case-insensitive.

Usage Notes

If the user specifies an invalid string, then the function returns a `NULL` string.

Examples

```
UTL_I18N.MAP_LOCALE_TO_ISO('American','America')
```

This returns 'en_US'.

 **See Also:**

Oracle Database Globalization Support Guide for a list of valid Oracle languages and territories

281.5.19 MAP_TERRITORY_FROM_ISO Function

This function returns an Oracle territory name from an ISO locale.

Syntax

```
UTL_I18N.MAP_TERRITORY_FROM_ISO (  
    isolocale IN VARCHAR2)  
RETURN VARCHAR2;
```

Parameters

Table 281-23 MAP_TERRITORY_FROM_ISO Function Parameters

Parameter	Description
isolocale	Specifies the ISO locale. The mapping is case-insensitive.

Usage Notes

If the user specifies an invalid locale string, then the function returns a `NULL` string.

If the user specifies a locale string that includes only the territory (for example, `_fr` instead of `fr_fr`), then the function returns the default territory name for the specified territory (for example, `France`).

Examples

```
UTL_I18N.MAP_TERRITORY_FROM_ISO('en_US')
```

This returns 'America'.

 **See Also:**

Oracle Database Globalization Support Guide for a list of valid Oracle territories

281.5.20 MAP_TO_SHORT_LANGUAGE Function

This function maps an Oracle language name to an Oracle short language name.

Syntax

```
UTL_I18N.MAP_TO_SHORT_LANGUAGE (  
    language IN VARCHAR2 CHARACTER SET ANY_CS)  
RETURN VARCHAR2;
```

Parameters

Table 281-24 MAP_TO_SHORT_LANGUAGE Function Parameters

Parameter	Description
language	Specifies a valid full language name. It is case-insensitive.

Usage Notes

If the user specifies an invalid language name, then the function returns a NULL string.

Examples

Returns the short language name for the language.

```
DECLARE retval VARCHAR2(100);BEGIN retval :=
UTL_I18N.MAP_TO_SHORT_LANGUAGE('american'); DBMS_OUTPUT.PUT_LINE(retval);END;/US
```

281.5.21 RAW_TO_CHAR Functions

This function converts RAW data from a valid Oracle character set to a VARCHAR2 string in the database character set.

The function is overloaded. The different forms of functionality are described along with the syntax declarations.

Syntax

Buffer Conversion:

```
UTL_I18N.RAW_TO_CHAR(
    data          IN RAW,
    src_charset   IN VARCHAR2 DEFAULT NULL)
RETURN VARCHAR2;
```

Piecewise conversion converts raw data into character data piece by piece:

```
UTL_I18N.RAW_TO_CHAR (
    data          IN RAW,
    src_charset   IN VARCHAR2 DEFAULT NULL,
    scanned_length OUT PLS_INTEGER,
    shift_status  IN OUT PLS_INTEGER)
RETURN VARCHAR2;
```

Parameters

Table 281-25 RAW_TO_CHAR Function Parameters

Parameter	Description
data	Specifies the RAW data to be converted to a VARCHAR2 string
src_charset	Specifies the character set that the RAW data was derived from. If src_charset is NULL, then the database character set is used.
scanned_length	Specifies the number of bytes of source data scanned

Table 281-25 (Cont.) RAW_TO_CHAR Function Parameters

Parameter	Description
<code>shift_status</code>	<p>Specifies the shift status at the end of the scan. The user must set it to <code>SHIFT_IN</code> the first time it is called in piecewise conversion.</p> <p>Note: ISO 2022 character sets use escape sequences instead of shift characters to indicate the encoding method. <code>shift_status</code> cannot hold the encoding method information that is provided by the escape sequences for the next function call. As a result, this function cannot be used to reconstruct ISO 2022 character from raw data in a piecewise way unless each unit of input can be guaranteed to be a closed string. A closed string begins and ends in a 7-bit escape state.</p>

Usage Notes

If the user specifies an invalid character set, `NULL` data, or data whose length is 0, then the function returns a `NULL` string.

Examples

Buffer Conversion

```
UTL_I18N.RAW_TO_CHAR(hextoraw('616263646566C2AA'), 'utf8')
```

This returns the following string in the database character set:

```
'abcde' || chr(170)
```

Piecewise Conversion

```
UTL_I18N.RAW_TO_CHAR(hextoraw('616263646566C2AA'),'utf8',shf,slen)
```

This expression returns the following string in the database character set:

```
'abcde' || chr(170)
```

It also sets `shf` to `SHIFT_IN` and `slen` to 8.

The following example converts data from the Internet piece by piece to the database character set.

```
rvalue RAW(1050);
nvalue VARCHAR2(1024);
conversion_state PLS_INTEGER = 0;
converted_len PLS_INTEGER;
rtemp RAW(10) = '';
conn utl_tcp.connection;
tlen PLS_INTEGER;

...
conn := utl_tcp.open_connection ( remote_host => 'localhost',
                                remote_port => 2000);

LOOP
    tlen := utl_tcp.read_raw(conn, rvalue, 1024);
    rvalue := utl_raw.concat(rtemp, rvalue);
    nvalue := utl_i18n.raw_to_char(rvalue, 'JA16SJIS', converted_len,
conversion_stat);
    if (converted_len < utl_raw.length(rvalue) )
```

```

    then
        rtemp := utl_raw.substr(rvalue, converted_len+1);
    else
        rtemp := '';
    end if;
    /* do anything you want with nvalue */
    /* e.g htp.prn(nvalue); */
END LOOP;
utl_tcp.close_connection(conn);
EXCEPTION
    WHEN utl_tcp.end_of_input THEN
        utl_tcp.close_connection(conn);
END;
```

281.5.22 RAW_TO_NCHAR Functions

This function converts **RAW** data from a valid Oracle character set to an **NVARCHAR2** string in the national character set.

The function is overloaded. The different forms of functionality are described along with the syntax declarations.

Syntax

Buffer Conversion:

```

UTL_I18N.RAW_TO_NCHAR (
    data          IN RAW,
    src_charset   IN VARCHAR2 DEFAULT NULL)
RETURN NVARCHAR2;
```

Piecewise conversion converts raw data into character data piece by piece:

```

UTL_I18N.RAW_TO_NCHAR (
    data          IN RAW,
    src_charset   IN VARCHAR2 DEFAULT NULL,
    scanned_length OUT PLS_INTEGER,
    shift_status  IN OUT PLS_INTEGER)
RETURN NVARCHAR2;
```

Parameters

Table 281-26 RAW_TO_NCHAR Function Parameters

Parameter	Description
data	Specifies the RAW data to be converted to an NVARCHAR2 string
src_charset	Specifies the character set that the RAW data was derived from. If src_charset is NULL, then the database character set is used.
scanned_length	Specifies the number of bytes of source data scanned

Table 281-26 (Cont.) RAW_TO_NCHAR Function Parameters

Parameter	Description
<code>shift_status</code>	<p>Specifies the shift status at the end of the scan. The user must set it to <code>SHIFT_IN</code> the first time it is called in piecewise conversion.</p> <p>Note: ISO 2022 character sets use escape sequences instead of shift characters to indicate the encoding method. <code>shift_status</code> cannot hold the encoding method information that is provided by the escape sequences for the next function call. As a result, this function cannot be used to reconstruct ISO 2022 character from raw data in a piecewise way unless each unit of input can be guaranteed to be a closed string. A closed string begins and ends in a 7-bit escape state.</p>

Usage Notes

If the user specifies an invalid character set, `NULL` data, or data whose length is 0, then the function returns a `NULL` string.

Examples

Buffer Conversion

```
UTL_I18N.RAW_TO_NCHAR(hextoraw('616263646566C2AA'),'utf8')
```

This returns the following string in the national character set:

```
'abcde' || chr(170)
```

Piecewise Conversion

```
UTL_I18N.RAW_TO_NCHAR(hextoraw('616263646566C2AA'),'utf8', shf, slen)
```

This expression returns the following string in the national character set:

```
'abcde' || chr(170)
```

It also sets `shf` to `SHIFT_IN` and `slen` to 8.

The following example converts data from the Internet piece by piece to the national character set.

```
rvalue RAW(1050);
nvalue NVARCHAR2(1024);
conversion_state PLS_INTEGER = 0;
converted_len PLS_INTEGER;
rtemp RAW(10) = '';
conn utl_tcp.connection;
tlen PLS_INTEGER;

...
conn := utl_tcp.open_connection ( remote_host => 'localhost',
                                remote_port => 2000);

LOOP
    tlen := utl_tcp.read_raw(conn, rvalue, 1024);
    rvalue := utl_raw.concat(rtemp, rvalue);
    nvalue := utl_i18n.raw_to_nchar(rvalue, 'JA16SJIS', converted_len,
conversion_stat);
    if (converted_len < utl_raw.length(rvalue) )
```



```

then
    rtemp := utl_raw.substr(rvalue, converted_len+1);
else
    rtemp := '';
end if;
/* do anything you want with nvalue */
/* e.g htp.prn(nvalue); */
END LOOP;
utl_tcp.close_connection(conn);
EXCEPTION
WHEN utl_tcp.end_of_input THEN
    utl_tcp.close_connection(conn);
END;

```

281.5.23 STRING_TO_RAW Function

This function converts a `VARCHAR2` or `NVARCHAR2` string to another valid Oracle character set and returns the result as `RAW` data.

Syntax

```

UTL_I18N.STRING_TO_RAW(
    data          IN VARCHAR2 CHARACTER SET ANY_CS,
    dst_charset   IN VARCHAR2 DEFAULT NULL)
RETURN RAW;

```

Parameters

Table 281-27 STRING_TO_RAW Function Parameters

Parameter	Description
<code>data</code>	Specifies the <code>VARCHAR2</code> or <code>NVARCHAR2</code> string to convert.
<code>dst_charset</code>	Specifies the destination character set. If <code>dst_charset</code> is <code>NULL</code> , then the database character set is used for <code>CHAR</code> data and the national character set is used for <code>NCHAR</code> data.

Usage Notes

If the user specifies an invalid character set, a `NULL` string, or a string whose length is 0, then the function returns a `NULL` string.

Examples

```

DECLARE
    r raw(50);
    s varchar2(20);
BEGIN
    s:='abcdef'||chr(170);
    r:=utl_i18n.string_to_raw(s,'utf8');
    dbms_output.put_line(rawtohex(r));
end;
/

```

This returns a hex value of '6162636465666C2AA'.

281.5.24 TRANSLITERATE Function

This function performs script transliteration.

Syntax

```
UTL_I18N.TRANSLITERATE (
  data IN VARCHAR2 CHARACTER SET ANY_CS,
  name IN VARCHAR2)
RETURN VARCHAR2 CHARACTER SET data%CHARSET;
```

Parameters

Table 281-28 TRANSLITERATE Function Parameters

Parameter	Description
data	Specifies the data to be converted. Either CHAR or NCHAR datatype can be specified.
name	Specifies the transliteration name string. For a list of valid names, see Table 281-29 .

Constants

Table 281-29 TRANSLITERATE Function Constants

Constant Name	Value	Description
ARABIC_LATIN_ISO233	'arabic_latin_iso233'	Converts Arabic characters to Latin characters.
CYR_ASCII_ICA093	'cyr_ascii_ICA093'	Converts Cyrillic characters to ASCII characters.
CYR_BG_ASCII_ICA09303	'cyr_bg_ascii_ICA09303'	Converts Cyrillic Bulgaria characters to ASCII characters.
CYR_BY_ASCII_ICA09303	'cyr_by_ascii_ICA09303'	Converts Cyrillic Belarus characters to ASCII characters.
CYR_MK_ASCII_ICA09303	'cyr_mk_ascii_ICA09303'	Converts Cyrillic North Macedonia characters to ASCII characters.
CYR_RS_ASCII_ICA09303	'cyr_rs_ascii_ICA09303'	Converts Cyrillic Serbia characters to ASCII characters.
CYR_UA_ASCII_ICA09303	'cyr_ua_ascii_ICA09303'	Converts Cyrillic Ukraine characters to ASCII characters.
CYRILLIC_LATIN_ISO9	'cyrillic_latin_iso9'	Converts Cyrillic characters to Latin characters.
FWKATAKANA_HIRAGANA	'fwkatakana_hiragana'	Converts only fullwidth Katakana characters to fullwidth Hiragana characters.
FWKATAKANA_HWKATAKANA	'fwkatakana_hwkatakana'	Converts only fullwidth Katakana characters to halfwidth Katakana characters.
GREEK_LATIN_ISO843	'greek_latin_iso843'	Converts Greek characters to Latin characters.

Table 281-29 (Cont.) TRANSLITERATE Function Constants

Constant Name	Value	Description
HEBREW_LATIN_ISO259	'hebrew_latin_iso259'	Converts Hebrew characters to Latin characters.
HIRAGANA_FWKATAANA	'hiragana_fwkataana'	Converts only fullwidth Hiragana characters to fullwidth Katakana characters.
HIRAGANA_HWKATAANA	'hiragana_hwkataana'	Converts only fullwidth Hiragana characters to halfwidth Katakana characters.
HWKATAKANA_FWKATAKANA	'hwkatakana_fwkatakana'	Converts only halfwidth Katakana characters to fullwidth Katakana characters.
HWKATAKANA_HIRAGANA	'hwkatakana_hiragana'	Converts only halfwidth Katakana characters to fullwidth Hiragana characters.
KANA_FWKATAKANA	'kana_fwkatakana'	Converts any type of Kana character to a fullwidth Katakana character.
KANA_HIRAGANA	'kana_hiragana'	Converts any type of Kana character to a fullwidth Hiragana character.
KANA_HWKATAKANA	'kana_hwkatakana'	Converts any type of Kana character to a halfwidth Katakana character.
LATIN_ASCII_DIN91379	'latin_ascii_din91379'	Converts Latin characters to ASCII characters.
MODERN_HEBREW_LATIN_ISO259_2	'modern_hebrew_latin_iso259_2'	Converts Modern Hebrew characters to Latin Characters.

Usage Notes

- The user must provide the input data for transliteration in NFC form.
- The function returns the converted string.

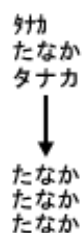
Examples

Given a table `japanese_emp`, containing an `NVARCHAR2` column `ename`, the following statement can be used to normalize all the kana names in `ename` to hiragana:

```
UPDATE japanese_emp
   SET ename = UTL_I18N.TRANSLITERATE (ename, 'kana_hiragana');
```

The following figure shows how this output might look.

Figure 281-1 Loading Locale-Specific Data to the Database



The following statement normalizes one kana name to hiragana:

```

DECLARE
  Name  japanese_emp.ename%TYPE;
  Eno   CONSTANT NUMBER(4) := 1;
BEGIN
  SELECT ename INTO name FROM japanese_emp WHERE enumber = eno;
  name := UTL_I18N.TRANSLITERATE(name, UTL_I18N.KANA_HIRAGANA);
  UPDATE japanese_emp SET ename = name WHERE enumber = eno;
EXCEPTION
  WHEN UTL_I18N.UNSUPPORTED_TRANSLITERATION THEN
    DBMS_OUTPUT.PUT_LINE('transliteration not supported');
END;
/

```

281.5.25 UNESCAPE_REFERENCE Function

This function returns a string from an input string that contains character references. It decodes each character reference to the corresponding character value.



See Also:

"[ESCAPE_REFERENCE Function](#)" for more information about escape sequences

Syntax

```

UTL_I18N.UNESCAPE_REFERENCE (
  str IN VARCHAR2 CHARACTER SET ANY_CS)
RETURN VARCHAR2 CHARACTER SET str%CHARSET;

```

Parameters

Table 281-30 UNESCAPE_REFERENCE Function Parameters

Parameter	Description
str	Specifies the input string

Usage Notes

If the user specifies a `NULL` string or a string whose length is 0, then the function returns a `NULL` string. If the function fails, then it returns the original string.

Examples

```

UTL_I18N.UNESCAPE_REFERENCE('hello &lt; &#xe5;')

```

This returns 'hello <' || chr(229).

281.5.26 VALIDATE_CHARACTER_ENCODING Functions

This function validates the character encoding of `VARCHAR2`, `NVARCHAR2`, `CLOB`, and `NCLOB` data. The validation is based on the database character set for

VARCHAR2 and CLOB data and national character set for NVARCHAR2 and NCLOB data.

For Unicode character sets, such as AL32UTF8, AL16UTF16, AL16UTF16LE, UTF8, and UTFE, any byte sequences mapped to the following Unicode code points are considered invalid:

- Unpaired surrogate code point
- Non-character code point

In addition, any irregular or illegal UTF-8 byte sequence is considered invalid for AL32UTF8 and UTF8 character sets.

The `VALIDATE_CHARACTER_ENCODING` function is overloaded. One function is for validating VARCHAR2 and NVARCHAR2 data, while the other function is for validating CLOB and NCLOB data.

- **Validating VARCHAR2 and NVARCHAR2 data**

A VARCHAR2 or NVARCHAR2 byte or its byte sequence is considered invalid for a character set, if it does not map to any of the characters defined in the character set.

- **Validating CLOB and NCLOB data**

A LOB character is considered invalid for a character set if a byte (in case of a single-byte database character set) or a byte pair (in case of UTF-16 encoding used with a multibyte database character set) corresponding to the encoding of the LOB character does not map to any of the characters defined in the character set.

Syntax

This function validates VARCHAR2 and NVARCHAR2 data:

```
UTL_I18N.VALIDATE_CHARACTER_ENCODING (
    data IN VARCHAR2 CHARACTER SET ANY_CS)
RETURN PLS_INTEGER;
```

This function validates CLOB and NCLOB data:

```
UTL_I18N.VALIDATE_CHARACTER_ENCODING (
    lob_loc IN CLOB CHARACTER SET ANY_CS)
RETURN PLS_INTEGER;
```

Parameters

Table 281-31 VALIDATE_CHARACTER_ENCODING Function Parameters

Parameter	Description
<code>data</code>	VARCHAR2 or NVARCHAR2 data to validate.
<code>lob_loc</code>	CLOB or NCLOB data to validate.

Usage Notes

This function returns the offset of the first invalid byte for the VARCHAR2 or NVARCHAR2 data. It returns the offset of the first invalid character for the CLOB or NCLOB data. It returns 0, if all the bytes in the character data are valid. It returns `NULL`, if the value of the parameter `data` or `lob_loc` is `NULL`.

Examples

This example validates the character encoding of NVARCHAR2 and CLOB data where the database character set is AL32UTF8 while the national character set is AL16UTF16.

```
CREATE TABLE temp(col1 NVARCHAR2(20), col2 CLOB);
INSERT INTO temp VALUES(UNISTR('foo\D800bar'), UNISTR('foo\D800bar'));
COMMIT;
SELECT UTL_I18N.VALIDATE_CHARACTER_ENCODING(col1) invalid_offset_column1,
       UTL_I18N.VALIDATE_CHARACTER_ENCODING(col2) invalid_offset_column2
FROM temp;
```

The query returns:

```
INVALID_OFFSET_COLUMN1  INVALID_OFFSET_COLUMN2
-----
                        7                      4
```

Here, the surrogate code point U+D800 is invalid. The number 7 is returned as INVALID_OFFSET_COLUMN1, because for col1, 'foo' is encoded in 6 bytes in NVARCHAR2 and the invalid code point U+D800 starts at offset 7. The number 4 is returned as INVALID_OFFSET_COLUMN2, because for col2, 'foo' is encoded in 3 UTF-16 code points in CLOB and the invalid code point U+D800 starts at offset 4.

282

UTL_IDENT

The `UTL_IDENT` package specifies which Database or client PL/SQL is running.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)

282.1 UTL_IDENT Overview

The `UTL_IDENT` package is intended for use for conditional compilation of PL/SQL packages that are supported by Oracle, TimesTen Database, and clients such as Oracle Forms.

282.2 UTL_IDENT Security Model

The `UTL_IDENT` package runs as the package owner `SYS`. The public synonym `UTL_IDENT`, and `EXECUTE` permission on this package is granted to `PUBLIC`.

282.3 UTL_IDENT Constants

The `UTL_IDENT` package defines several constants to use when specifying parameter values.

These constants are shown in the following table.

Table 282-1 UTL_IDENT Constants

Constant	Type	Value	Description
<code>IS_ORACLE_SERVER</code>	BOOLEAN	TRUE/FALSE	Stipulates if Oracle Server or not
<code>IS_ORACLE_CLIENT</code>	BOOLEAN	TRUE/FALSE	Stipulates if Oracle Client or not
<code>IS_TIMESTEN</code>	BOOLEAN	TRUE/FALSE	Stipulates if TimesTen or not
<code>IS_ORACLE_FORMS</code>	BOOLEAN	TRUE/FALSE	Stipulates if Oracle Forms or not

UTL_INADDR

The `UTL_INADDR` package provides a PL/SQL procedures to support internet addressing. It provides an API to retrieve host names and IP addresses of local and remote hosts.

This chapter contains the following topics:

- [Security Model](#)
- [Exceptions](#)
- [Examples](#)
- [Summary of UTL_INADDR Subprograms](#)

283.1 UTL_INADDR Security Model

This package is an invoker's rights package, which means that the invoking user must be granted the `connect` privilege in the access control list assigned to the remote network host to which he or she wishes to connect.



Note:

For more information about managing fine-grained access, see *Oracle Database Security Guide*.

283.2 UTL_INADDR Exceptions

This table describes exceptions raised by `UTL_INADDR` subprograms.

Table 283-1 *Exception - Internet Address Package*

Number	Exception	Description
ORA-24247	NETWORK_ACCESS_DENIED	Access to network is denied.
ORA-29257	UNKNOWN_HOST	The host is unknown.

283.3 UTL_INADDR Examples

This `UTL_INADDR` example retrieves the local host name and IP address.

```
SET serveroutput on
BEGIN
  DBMS_OUTPUT.PUT_LINE(UTL_INADDR.GET_HOST_NAME); -- get local host name
  DBMS_OUTPUT.PUT_LINE(UTL_INADDR.GET_HOST_ADDRESS); -- get local IP addr
END;
/
```


283.4 Summary of UTL_INADDR Subprograms

This table lists the UTL_INADDR subprograms and briefly describes them.

Table 283-2 UTL_INADDR Package Subprograms

Subprogram	Description
GET_HOST_ADDRESS Function	Retrieves the IP address of the local or remote host given its name
GET_HOST_NAME Function	Retrieves the name of the local or remote host given its IP address

283.4.1 GET_HOST_ADDRESS Function

This function retrieves the IP address of the specified host.

Syntax

```
UTL_INADDR.GET_HOST_ADDRESS (  
    host IN VARCHAR2 DEFAULT NULL)  
RETURN host_address VARCHAR2;
```

Parameters

Table 283-3 GET_HOST_ADDRESS Function Parameters

Parameter	Description
host	The name of the host to retrieve the IP address.

Return Values

Table 283-4 GET_HOST_ADDRESS Function Return Values

Parameter	Description
host_address	The IP address of the specified host, or that of the local host if host is NULL.

Exceptions

UNKNOWN_HOST: The specified IP address is unknown

Usage Notes

The permission to obtain the host name or IP address of the current host is controlled by the `resolve` privilege on `LOCALHOST`.

283.4.2 GET_HOST_NAME Function

This function retrieves the name of the local or remote host given its IP address.

Syntax

```
UTL_INADDR.GET_HOST_NAME (  
    ip IN VARCHAR2 DEFAULT NULL)  
RETURN host_name VARCHAR2;
```

Parameters

Table 283-5 GET_HOST_NAME Function Parameters

Parameter	Description
ip	The IP address of the host used to determine its host name. If ip is not NULL, the official name of the host with its domain name is returned. If this is NULL, the name of the local host is returned and the name does not contain the domain to which the local host belongs.

Return Values

Table 283-6 GET_HOST_NAME Function Return Values

Parameter	Description
host_name	The name of the local or remote host of the specified IP address.

Exceptions

UNKNOWN_HOST: The specified IP address is unknown

Usage Notes

The permission to obtain the host name or IP address of the current host is controlled by the `resolve` privilege granted through `DBMS_NETWORK_ACL_ADMIN` on `LOCALHOST`.

UTL_LMS

UTL_LMS retrieves and formats error messages in different languages.

This chapter contains the following topics:

- [Security Model](#)
- [Summary of UTL_LMS Subprograms](#)



See Also:

Oracle Database Globalization Support Guide

284.1 UTL_LMS Security Model

This package must be created as the user SYS.

284.2 Summary of UTL_LMS Subprograms

This table lists the UTL_LMS subprograms and briefly describes them.

Table 284-1 UTL_LMS Package Subprograms

Function	Description
FORMAT_MESSAGE Function	Formats a retrieved error message
GET_MESSAGE Function	Retrieves an error message based on error number, product, facility, language, and message specified

284.2.1 FORMAT_MESSAGE Function

This function formats a message retrieved by the GET_MESSAGE function and returns the formatted message. If the function fails, then it returns a NULL result.

The following table shows special characters that can be used in the format string.

Special Character	Description
'%s'	Substitute the next string argument
'%d'	Substitute the next integer argument
'%%'	Represents the special character %

Syntax

```

UTL_LMS.FORMAT_MESSAGE (
    format IN VARCHAR2 CHARACTER SET ANY_CS,
    args   IN VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL)
RETURN VARCHAR2 CHARACTER SET format%CHARSET;

```

Parameters

Table 284-2 FORMAT_MESSAGE Procedure Parameters

Parameter	Description
format	Specifies the string to format
args	Specifies the list of arguments

Examples

```

DECLARE
    s varchar2(200);
    i pls_integer;
BEGIN
    i:= utl_lms.get_message(26052, 'rdbms', 'ora', 'french', s);
    dbms_output.put_line('before format, message is: '||s);
    dbms_output.put_line('formatted message is: '||utl_lms.format_message(s, 9,
'my_column_name');
END;
/

```

The following is an unformatted message:

```
Type %d non pris en charge pour l'expression SQL sur la colonne %s.
```

The following is the formatted message:

```
Type 9 non pris en charge pour l'expression SQL sur la colonne my_column_name.
```

284.2.2 GET_MESSAGE Function

This function retrieves an Oracle error message. The user can define user-specific error messages with the `lmsgen` utility.

It returns 0 when it is successful. It returns -1 when it fails.



See Also:

Oracle Database Globalization Support Guide for more information about the `lmsgen` utility

Syntax

```

UTL_LMS.GET_MESSAGE (
    errnum   IN PLS_INTEGER,
    product  IN VARCHAR2,

```

```

    facility IN VARCHAR2,
    language IN VARCHAR2,
    message  OUT NOCOPY VARCHAR2CHARACTER SET ANY_CS)
RETURN PLS_INTEGER;

```

Parameters

Table 284-3 GET_MESSAGE Function Parameters

Parameter	Description
errnum	Specifies the error number. Example: '972' (for ORA-00972)
product	Specifies the product to which the error message applies Example: 'rdbms'
facility	Specifies the error message prefix Example: 'ora'
language	Specifies the language of the message. The parameter is case-insensitive. The default is NULL, which causes GET_MESSAGE to use the value of the NLS_LANGUAGE session parameter.
message	Specifies the output buffer for the retrieved message

Usage Notes

If the `language` parameter is set to `NULL`, then the value of the `NLS_LANGUAGE` session parameter is used as the default.

Examples

```

DECLARE
    s varchar2(200);
    i pls_integer;
BEGIN
    i:=utl_lms.get_message(601, 'rdbms', 'oci', 'french', s);
    dbms_output.put_line('OCI--00601 is: '||s);
END
/

```

The following output results:

```
OCI--00601 is: Echec du processus de nettoyage.
```

UTL_MAIL

The `UTL_MAIL` package is a utility for managing email which includes commonly used email features, such as attachments, CC, and BCC.

This chapter contains the following topics:

- [Security Model](#)
- [Operational Notes](#)
- [Rules and Limits](#)
- [Summary of UTL_MAIL Subprograms](#)

285.1 UTL_MAIL Security Model

`UTL_MAIL` is not installed by default because of the `SMTP_OUT_SERVER` configuration requirement and the security exposure this involves. In installing `UTL_MAIL`, you should take steps to prevent the port defined by `SMTP_OUT_SERVER` being swamped by data transmissions.

This package is now an invoker's rights package and the invoking user will need the connect privilege granted in the access control list assigned to the remote network host to which he wants to connect.



Note:

For more information about managing fine-grained access, see *Oracle Database Security Guide*.

285.2 UTL_MAIL Operational Notes

You must both install `UTL_MAIL` and define the `SMTP_OUT_SERVER`.

- To install `UTL_MAIL`:

```
sqlplus sys/<pwd>
SQL> @$ORACLE_HOME/rdbms/admin/utlmail.sql
SQL> @$ORACLE_HOME/rdbms/admin/prvtmail.plb
```

- You define the `SMTP_OUT_SERVER` parameter in the `init.ora` `rdbms` initialization file. However, if `SMTP_OUT_SERVER` is not defined, this invokes a default of `DB_DOMAIN` which is guaranteed to be defined to perform appropriately.

285.3 UTL_MAIL Rules and Limits

Use `UTL_MAIL` only within the context of the ASCII (American Standard Code for Information Interchange) and EBCDIC (Extended Binary-Coded Decimal Interchange Code) codes.

285.4 Summary of UTL_MAIL Subprograms

This table lists the `UTL_MAIL` subprograms and briefly describes them.

Table 285-1 UTL_MAIL Package Subprograms

Subprogram	Description
SEND Procedure	Packages an email message into the appropriate format, locates SMTP information, and delivers the message to the SMTP server for forwarding to the recipients
SEND_ATTACH_RAW Procedure	Represents the <code>SEND</code> Procedure overloaded for <code>RAW</code> attachments
SEND_ATTACH_VARCHAR2 Procedure	Represents the <code>SEND</code> Procedure overloaded for <code>VARCHAR2</code> attachments

285.4.1 SEND Procedure

This procedure packages an email message into the appropriate format, locates SMTP information, and delivers the message to the SMTP server for forwarding to the recipients.

It hides the SMTP API and exposes a one-line email facility for ease of use.

Syntax

```
UTL_MAIL.SEND (
  sender      IN  VARCHAR2 CHARACTER SET ANY_CS,
  recipients  IN  VARCHAR2 CHARACTER SET ANY_CS,
  cc          IN  VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  bcc        IN  VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  subject     IN  VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  message    IN  VARCHAR2 CHARACTER SET ANY_CS,
  mime_type   IN  VARCHAR2 DEFAULT 'text/plain; charset=us-ascii',
  priority    IN  PLS_INTEGER DEFAULT 3,
  replyto    IN  VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL);
```

Parameters

Table 285-2 SEND Procedure Parameters

Parameter	Description
<code>sender</code>	Email address of the sender
<code>recipients</code>	Email addresses of the recipient(s), separated by commas

Table 285-2 (Cont.) SEND Procedure Parameters

Parameter	Description
cc	Email addresses of the CC recipient(s), separated by commas, default is NULL
bcc	Email addresses of the BCC recipient(s), separated by commas, default is NULL
subject	String to be included as email subject string, default is NULL
message	Text message body
mime_type	Mime type of the message, default is 'text/plain; charset=us-ascii'
priority	Message priority, which maps to the X-priority field. 1 is the highest priority and 5 the lowest. The default is 3.
replyto	Defines to whom the reply email is to be sent

285.4.2 SEND_ATTACH_RAW Procedure

This procedure is the `SEND` Procedure overloaded for `RAW` attachments.

Syntax

```

UTL_MAIL.SEND_ATTACH_RAW (
  sender          IN  VARCHAR2 CHARACTER SET ANY_CS,
  recipients      IN  VARCHAR2 CHARACTER SET ANY_CS,
  cc              IN  VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  bcc             IN  VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  subject        IN  VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  message        IN  VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  mime_type      IN  VARCHAR2 DEFAULT CHARACTER SET ANY_CS
                  DEFAULT 'text/plain; charset=us-ascii',
  priority       IN  PLS_INTEGER DEFAULT 3,
  attachment     IN  RAW,
  att_inline     IN  BOOLEAN DEFAULT TRUE,
  att_mime_type  IN  VARCHAR2 CHARACTER SET ANY_CS
                  DEFAULT 'text/plain; charset=us-ascii',
  att_filename   IN  VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  replyto       IN  VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL);

```

Parameters

Table 285-3 SEND_ATTACH_RAW Procedure Parameters

Parameter	Description
sender	Email address of the sender
recipients	Email addresses of the recipient(s), separated by commas
cc	Email addresses of the CC recipient(s), separated by commas, default is NULL
bcc	Email addresses of the BCC recipient(s), separated by commas, default is NULL
subject	String to be included as email subject string, default is NULL

Table 285-3 (Cont.) SEND_ATTACH_RAW Procedure Parameters

Parameter	Description
message	Text message body
mime_type	Mime type of the message, default is 'text/plain; charset=us-ascii'
priority	Message priority, which maps to the X-priority field. 1 is the highest priority and 5 the lowest. The default is 3.
attachment	RAW attachment
att_inline	Specifies whether the attachment is viewable inline with the message body, default is TRUE
att_mime_type	Mime type of the attachment, default is 'application/octet'
att_filename	String specifying a filename containing the attachment, default is NULL
replyto	Defines to whom the reply email is to be sent

285.4.3 SEND_ATTACH_VARCHAR2 Procedure

This procedure is the SEND Procedure overloaded for VARCHAR2 attachments.

Syntax

```
UTL_MAIL.SEND_ATTACH_VARCHAR2 (
  sender          IN   VARCHAR2 CHARACTER SET ANY_CS,
  recipients      IN   VARCHAR2 CHARACTER SET ANY_CS,
  cc              IN   VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  bcc             IN   VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  subject         IN   VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  message        IN   VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  mime_type      IN   VARCHAR2 CHARACTER SET ANY_CS
                    DEFAULT 'text/plain; charset=us-
ascii',
  priority        IN   PLS_INTEGER DEFAULT 3,
  attachment      IN   VARCHAR2 CHARACTER SET ANY_CS, ,
  att_inline      IN   BOOLEAN DEFAULT TRUE,
  att_mime_type   IN   VARCHAR2 CHARACTER SET ANY_CS
                    DEFAULT 'text/plain; charset=us-ascii',
  att_filename    IN   VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL,
  replyto        IN   VARCHAR2 CHARACTER SET ANY_CS DEFAULT NULL);
```

Parameters

Table 285-4 SEND_ATTACH_VARCHAR2 Procedure Parameters

Parameter	Description
sender	Email address of the sender
recipients	Email addresses of the recipient(s), separated by commas
cc	Email addresses of the CC recipient(s), separated by commas, default is NULL
bcc	Email addresses of the BCC recipient(s), separated by commas, default is NULL

Table 285-4 (Cont.) SEND_ATTACH_VARCHAR2 Procedure Parameters

Parameter	Description
subject	String to be included as email subject string, default is NULL
message	Text message body
mime_type	Mime type of the message, default is 'text/plain; charset=us-ascii'
priority	Message priority, which maps to the X-priority field. 1 is the highest priority and 5 the lowest. The default is 3.
attachment	Text attachment
att_inline	Specifies whether the attachment is inline, default TRUE
att_mime_type	Mime type of the attachment, default is 'text/plain; charset=us-ascii'
att_filename	String specifying a filename containing the attachment, default is NULL
replyto	Defines to whom the reply email is to be sent

UTL_MATCH

The `UTL_MATCH` package facilitates matching two records. This is typically used to match names, such as two First Names or two Last Names.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of UTL_MATCH Subprograms](#)

286.1 UTL_MATCH Overview

`UTL_MATCH` can use either the Edit Distance algorithm or Jaro-Winkler algorithm when determining matches.

Edit Distance, also known as Levenshtein Distance (named after the Russian scientist Vladimir Levenshtein, who devised the algorithm in 1965), is a measure of similarity between two strings, `s1` and `s2`. The distance is the number of insertions, deletions or substitutions required to transform `s1` to `s2`.

The Edit Distance between strings `shackleford` and `shackelford` = 2.

The "Jaro-Winkler algorithm" is another way of calculating Edit distance between two strings. This method, developed at the U.S. Census, is a String Comparator measure that gives values of partial agreement between two strings. The string comparator accounts for length of strings and partially accounts for typical human errors made in alphanumeric strings.

The following table shows similarity values returned by Jaro-Winkler and Edit Distance

Table 286-1 Comparison between normalized values returned by Jaro-Winkler and Edit Distance algorithms

String 1	String 2	Jaro Winkler	Edit Distance
Dunningham	Cunnigham	89	80
Abroms	Abrams	92	83
Lampley	Campley	90	86
Marhta	Martha	96	67
Jonathon	Jonathan	95	88
Jeraldine	Geraldine	92	89

286.2 UTL_MATCH Security Model

The `UTL_MATCH` package runs with definer's rights. `UTL_MATCH` must be created under `SYS`. Operations provided by this package are performed with `SYS` privileges.

286.3 Summary of UTL_MATCH Subprograms

This table lists the UTL_MATCH subprograms and briefly describes them.

Table 286-2 UTL_MATCH Package Subprograms

Subprogram	Description
EDIT_DISTANCE Function	Calculates the number of changes required to transform string-1 into string-2
EDIT_DISTANCE_SIMILARITY Function	Calculates the number of changes required to transform string-1 into string-2, returning a value between 0 (no match) and 100 (perfect match)
JARO_WINKLER Function	Calculates the measure of agreement between string-1 and string-2
JARO_WINKLER_SIMILARITY Function	Calculates the measure of agreement between string-1 and string-2, returning a value between 0 (no match) and 100 (perfect match)

286.3.1 EDIT_DISTANCE Function

This function calculates the number of insertions, deletions or substitutions required to transform string-1 into string-2.

Syntax

```
UTL_MATCH.EDIT_DISTANCE (
  s1 IN VARCHAR2,
  s2 IN VARCHAR2)
RETURN PLS_INTEGER;
```

Parameters

Table 286-3 EDIT_DISTANCE Function Parameters

Parameter	Description
s1	The string to be transformed
s2	The string into which s1 is to be transformed

Examples

```
SELECT UTL_MATCH.EDIT_DISTANCE('shackleford', 'shackelford') FROM DUAL;
-----
returns 2
```

286.3.2 EDIT_DISTANCE_SIMILARITY Function

This function calculates the number of insertions, deletions or substations required to transform string-1 into string-2, and returns the Normalized value of the Edit Distance between two strings.

The value is typically between 0 (no match) and 100 (perfect match).

Syntax

```
UTL_MATCH.EDIT_DISTANCE_SIMILARITY (  
    s1 IN VARCHAR2,  
    s2 IN VARCHAR2)  
RETURN PLS_INTEGER;
```

Parameters

Table 286-4 EDIT_DISTANCE_SIMILARITY Function Parameters

Parameter	Description
s1	The string to be transformed
s2	The string into which s1 is to be transformed

Examples

```
SELECT UTL_MATCH.EDIT_DISTANCE_SIMILARITY('shackleford', 'shackelford') FROM DUAL;  
-----  
returns 82
```

286.3.3 JARO_WINKLER Function

This function calculates the measure of agreement between two strings.

Syntax

```
UTL_MATCH.JARO_WINKLER (  
    s1 IN VARCHAR2,  
    s2 IN VARCHAR2)  
RETURN BINARY_DOUBLE;
```

Parameters

Table 286-5 JARO_WINKLER Function Parameters

Parameter	Description
s1	Input
s2	input

Examples

```
SELECT UTL_MATCH.JARO_WINKLER('shackleford', 'shackelford') FROM DUAL;  
-----  
returns 9.818E-001
```

286.3.4 JARO_WINKLER_SIMILARITY Function

This function calculates the measure of agreement between two strings, and returns a score between 0 (no match) and 100 (perfect match).

Syntax

```
UTL_MATCH.JARO_WINKLER_SIMILARITY (  
    s1 IN VARCHAR2,  
    s2 IN VARCHAR2)  
RETURN PLS_INTEGER;
```

Parameters

Table 286-6 JARO_WINKLER_SIMILARITY Function Parameters

Parameter	Description
s1	Input
s2	input

Examples

```
SELECT UTL_MATCH.JARO_WINKLER_SIMILARITY('shackleford', 'shackelford') FROM DUAL;  
-----  
returns 98
```

UTL_NLA

The `UTL_NLA` package exposes a subset of the BLAS and LAPACK (Version 3.0) operations on vectors and matrices represented as `VARRAYS`.

This chapter contains the following topics:

- [Overview](#)
- [Rules and Limits](#)
- [Security Model](#)
- [Subprogram Groups](#)
 - [BLAS Level 1 \(Vector-Vector Operations\) Subprograms](#)
 - [BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#)
 - [BLAS Level 3 \(Matrix-Matrix Operations\) Subprograms](#)
 - [LAPACK Driver Routines \(Linear Equations\) Subprograms](#)
 - [LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#)
- [Summary of UTL_NLA Subprograms](#)

287.1 UTL_NLA Overview

The `UTL_NLA` package exposes a subset of the BLAS (Basic Linear Algebra Subprograms) and LAPACK (Linear Algebra PACKage) (Version 3.0) operations on vectors and matrices represented as `VARRAYS`.

Standards

For more information on the BLAS and LAPACK standards see

<http://www.netlib.org/blas/>

<http://www.netlib.org/lapack/>

Required Expertise

Users of this package are expected to have a sound grasp of linear algebra in general and of the BLAS and LAPACK libraries in particular.

Implementation

The mapping between BLAS and LAPACK procedures and their corresponding PL/SQL calls is one-to-one.

- All BLAS functions have the `BLAS_` prefix (for example, the [BLAS_ASUM Functions](#)). The subroutines and functions in BLAS are mapped to PL/SQL procedures and functions, respectively.

- All LAPACK functions have the `LAPACK_` prefix (for example, the [LAPACK_GBSV Procedures](#)). The subroutines in LAPACK are mapped to PL/SQL procedures. Procedures that perform the same operation but differ only on the datatype of the arguments have the same overloaded names.

The mapping between BLAS and LAPACK procedure parameters and those of their corresponding PL/SQL subprograms is almost one-to-one.

- Also in the PL/SQL interface for LAPACK, all `/work/` arguments have been removed. The `UTL_NLA` package manages the allocation and de-allocation of all work areas required by the libraries.
- A new optional parameter, `pack`, has been added to the end of each LAPACK procedure that specifies if the matrix has been linearized in the row-major or column-major (default) format.

287.2 UTL_NLA Rules and Limits

Vectors and matrices are stored in `VARRAYS` with a maximum size of one million entries. Given this restriction, `UTL_NLA` vectors can be up to one million entries but matrices need to be of size $R \times C \leq 1,000,000$.

287.3 UTL_NLA Security Model

The `UTL_NLA` package is owned by user `SYS` and is installed as part of database installation. Execution privilege on the package is granted to public. The routines in the package are run with invokers' rights (run with the privileges of the current user).

287.4 Subprogram Groups

The `UTL_NLA` package contains subprogram groups for BLAS and LAPACK operations.

- [BLAS Level 1 \(Vector-Vector Operations\) Subprograms](#)
- [BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#)
- [BLAS Level 3 \(Matrix-Matrix Operations\) Subprograms](#)
- [LAPACK Driver Routines \(Linear Equations\) Subprograms](#)
- [LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#)

287.4.1 UTL_NLA BLAS Level 1 (Vector-Vector Operations) Subprograms

This table lists and briefly describes the `UTL_NLA` BLAS Level 1 Vector-Vector Operations subprograms.

Table 287-1 BLAS Level 1 (Vector-Vector Operations) Subprograms

Subprogram	Description
BLAS_ASUM Functions	Computes the sum of the absolute values of the vector components

Table 287-1 (Cont.) BLAS Level 1 (Vector-Vector Operations) Subprograms

Subprogram	Description
BLAS_AXPY Procedures	Copies $\alpha X + Y$ into vector Y
BLAS_COPY Procedures	Copies the contents of vector X to vector Y
BLAS_DOT Functions	Returns the dot (scalar) product of two vectors X and Y
BLAS_IAMAX Functions	Computes the index of the first element of a vector that has the largest absolute value
BLAS_NRM2 Functions	Computes the vector 2-norm (Euclidean norm)
BLAS_ROT Procedures	Returns the plane rotation of points
BLAS_ROTG Procedures	Returns the Givens rotation of points
BLAS_SCAL Procedures	Scales a vector by a constant
BLAS_SWAP Procedures	Swaps the contents of two vectors each of size n

287.4.2 UTL_NLA BLAS Level 2 (Matrix-Vector Operations) Subprograms

This table lists and briefly describes the UTL_NLA BLAS Level 2 Matrix-Vector Operations subprograms.

Table 287-2 BLAS Level 2 (Matrix-Vector Operations) Subprograms

Subprogram	Description
BLAS_GBMV Procedures	Performs the matrix-vector operation $y := \alpha A^*x + \beta y$ or $y := \alpha A^T x + \beta y$ where α and β are scalars, x and y are vectors and A is an m by n band matrix, with k_l sub-diagonals and k_u super-diagonals
BLAS_GEMV Procedures	Performs the matrix-vector operations $y := \alpha A^*x + \beta y$ or $y := \alpha A^T x + \beta y$ where α and β are scalars, x and y are vectors and A is an m by n matrix
BLAS_GER Procedures	Performs a rank 1 operation $A := \alpha x x^T + A$ where α is a scalar, x is an m element vector, y is an n element vector and A is an m by n matrix
BLAS_SBMV Procedures	Performs a matrix-vector operation $y := \alpha A^*x + \beta y$ where α and β are scalars, x and y are n element vectors and A is an n by n symmetric band matrix, with k super-diagonals
BLAS_SPMV Procedures	Performs a matrix-vector operation $y := \alpha A^*x + \beta y$ where α and β are scalars, x and y are n element vectors and A is an n by n symmetric matrix, supplied in packed form
BLAS_SPR Procedures	Performs a symmetric rank 1 operation $A := \alpha x x^T + A$ where α is a real scalar, x is an n element vector, and A is an n by n symmetric matrix, supplied in packed form
BLAS_SPR2 Procedures	Performs a symmetric rank 2 operation $A := \alpha x x^T + \alpha y y^T + A$ where α is a scalar, x and y are n element vectors, and A is an n by n symmetric matrix, supplied in packed form

Table 287-2 (Cont.) BLAS Level 2 (Matrix-Vector Operations) Subprograms

Subprogram	Description
BLAS_SBMV Procedures	Performs a matrix-vector operation $y := \alpha A^*x + \beta y$ where α and β are scalars, x and y are n element vectors and A is an n by n symmetric band matrix, with k super-diagonals
BLAS_SYMV Procedures	Performs a matrix-vector operation $y := \alpha A^*x + \beta y$ where α and β are scalars, x and y are n element vectors and A is an n by n symmetric matrix
BLAS_SYR Procedures	Performs a symmetric rank 1 operation $A := \alpha x x^* + A$ where α is a real scalar, x is an n element vector, and A is an n by n symmetric matrix
BLAS_SYR2 Procedures	Performs a symmetric rank 2 operation $A := \alpha x y^* + \alpha y x^* + A$ where α is a scalar, x and y are n element vectors, and A is an n by n symmetric matrix
BLAS_TBMV Procedures	Performs a matrix-vector operation $x := A^*x$ or $A^*x = b$ where x is an n element vector and A is an n by n unit, or non-unit, upper or lower triangular band matrix, with $(k + 1)$ diagonals
BLAS_TBSV Procedures	Solves one of the systems of equation $A^*x = b$ or $A^*x = b$ where b and x are n element vectors and A is an n by n unit, or non-unit, upper or lower triangular band matrix, with $(k + 1)$ diagonals
BLAS_TPMV Procedures	Performs a matrix-vector operation $x := A^*x$ or $x := A^*x$ where x is an n element vector and A is an n by n unit, or non-unit, upper or lower triangular matrix, supplied in packed form
BLAS_TPSV Procedures	Solves one of the systems of equation $A^*x = b$ or $A^*x = b$ where b and x are n element vectors and A is an n by n unit, or non-unit, upper or lower triangular matrix, supplied in packed form
BLAS_TRMV Procedures	Performs a matrix-vector operation $x := A^*x$ or $x := A^*x$ where x is an n element vector and A is an n by n unit, or non-unit, upper or lower triangular matrix
BLAS_TRSV Procedures	Solves one of the systems of equation $A^*x = b$ or $A^*x = b$ where b and x are n element vectors and A is an n by n unit, or non-unit, upper or lower triangular matrix

287.4.3 UTL_NLA BLAS Level 3 (Matrix-Matrix Operations) Subprograms

This table lists and briefly describes the UTL_NLA BLAS Level 3 Matrix-Matrix Operations subprograms.

Table 287-3 BLAS Level 3 (Matrix-Matrix Operations) Subprograms

Subprogram	Description
BLAS_GEMM Procedures	Performs one of the matrix-vector operations $C := \alpha * \text{op}(A) * \text{op}(B) + \beta * C$ where $\text{op}(X)$ is one of $\text{op}(X) = X$ or $\text{op}(X) = X'$ where α and β are scalars, and A , B and C are matrices, with $\text{op}(A)$ an m by k matrix, $\text{op}(B)$ a k by n matrix and C an m by n matrix
BLAS_SYMM Procedures	Performs one of the matrix-vector operations $C := \alpha * A * B + \beta * C$ or $C := \alpha * B * A + \beta * C$ where α and β are scalars, A is a symmetric matrix, and B and C are m by n matrices
BLAS_SYR2K Procedures	Performs one of the symmetric rank2 k operations $C := \alpha * A * B' + \alpha * B * A' + \beta * C$ or $C := \alpha * A' * B + \alpha * B' * A + \beta * C$ where α and β are scalars, C is an n by n symmetric matrix and A and B are n by k matrices in the first case and k by n matrices in the second case
BLAS_SYRK Procedures	Performs one of the symmetric rank k operations $C := \alpha * A * A' + \beta * C$ or $C := \alpha * A' * A + \beta * C$ where α and β are scalars, C is an n by n symmetric matrix and A is an n by k matrix in the first case and a k by n matrix in the second case
BLAS_TRMM Procedures	Performs one of the matrix-vector operations $B := \alpha * \text{op}(A) * B$ or $B := \alpha * B * \text{op}(A)$ where α is a scalar, B is an m by n matrix, A is a unit, or non-unit, upper or lower triangular matrix and $\text{op}(A)$ is one of two alternatives
BLAS_TRSM Procedures	Performs one of the matrix-vector operations $\text{op}(A) * X = \alpha * B$ or $X * \text{op}(A) = \alpha * B$ where α is a scalar, X and B are m by n matrices, A is a unit, or non-unit, upper or lower triangular matrix, $\text{op}(A)$ is one of two alternatives. The matrix X is overwritten on B

287.4.4 UTL_NLA LAPACK Driver Routines (Linear Equations) Subprograms

This table lists and briefly describes the LAPACK Driver Routines (Linear Equations) subprograms.

Table 287-4 LAPACK Driver Routines (Linear Equations) Subprograms

Subprogram	Description
LAPACK_GBSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n matrix and x and b are n by $nrhs$ matrices. The LU decomposition with partial pivoting and row interchanges is used to factor A .
LAPACK_GESV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n matrix and x and b are n by $nrhs$ matrices. The LU decomposition with partial pivoting and row interchanges is used to factor A .

Table 287-4 (Cont.) LAPACK Driver Routines (Linear Equations) Subprograms

Subprogram	Description
LAPACK_GTSV Procedures	This procedure solves the equation $a * x = b$ where a is an n by n tridiagonal matrix, by Gaussian elimination with partial pivoting.
LAPACK_PBSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric positive definite band matrix and x and b are n by $nrhs$ matrices. The Cholesky decomposition is used to factor A .
LAPACK_POSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric positive definite matrix and x and b are n by $nrhs$ matrices. The Cholesky decomposition is used to factor A .
LAPACK_PPSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric positive definite matrix stored in packed format and x and b are n by $nrhs$ matrices. The Cholesky decomposition is used to factor A .
LAPACK_PTSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric positive definite tridiagonal matrix, and x and b are n by $nrhs$ matrices.
LAPACK_SPSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric matrix stored in packed format, and x and b are n by $nrhs$ matrices. The diagonal pivoting method is used to factor A .
LAPACK_SYSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric matrix, and x and b are n by $nrhs$ matrices. The diagonal pivoting method is used to factor A .

287.4.5 UTL_NLA LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms

This table lists and briefly describes the LAPACK Driver Routines (LLS and Eigenvalue) subprograms.

Table 287-5 LAPACK Driver Routines (LLS and Eigenvalue Problems)

Subprogram	Description
LAPACK_GEES Procedures	Computes for an n by n real nonsymmetric matrix A , the eigenvalues, the real Schur form T , and, optionally, the matrix of Schur vectors Z . This gives the Schur factorization $A = Z * T * (Z ** T)$.
LAPACK_GEEV Procedures	Computes for an n by n real nonsymmetric matrix A , the eigenvalues and, optionally, the left and/or right eigenvectors.
LAPACK_GELS Procedures	Solves overdetermined or underdetermined real linear systems involving an m by n matrix A , or its transpose, using a QR or LQ factorization of A . It is assumed that A has full rank.

Table 287-5 (Cont.) LAPACK Driver Routines (LLS and Eigenvalue Problems)

Subprogram	Description
LAPACK_GESDD Procedures	Computes the singular value decomposition (SVD) of a real m by n matrix A , optionally computing the left and right singular vectors. If singular vectors are desired, it uses a divide-and-conquer algorithm that makes mild assumptions about floating point arithmetic.
LAPACK_GESVD Procedures	Computes the singular value decomposition (SVD) of a real m by n matrix A , optionally computing the left and/or right singular vectors. The SVD is written $A = U * SIGMA * \text{transpose}(V)$.
LAPACK_SBEV Procedures	Computes all the eigenvalues and, optionally, eigenvectors of a real symmetric band matrix A
LAPACK_SBEVD Procedures	Computes all the eigenvalues and, optionally, eigenvectors of a real symmetric matrix A . If eigenvectors are desired, it uses a divide and conquer algorithm that makes mild assumptions about floating point arithmetic.
LAPACK_SPEV Procedures	Computes all the eigenvalues and, optionally, eigenvectors of a real symmetric matrix A in packed storage
LAPACK_SPEVD Procedures	Computes all the eigenvalues and, optionally, eigenvectors of a real symmetric matrix A in packed storage. If eigenvectors are desired, it uses a divide and conquer algorithm that makes mild assumptions about floating point arithmetic.
LAPACK_STEV Procedures	Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix A
LAPACK_STEVD Procedures	Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix A . If eigenvectors are desired, it uses a divide and conquer algorithm that makes mild assumptions about floating point arithmetic.
LAPACK_SYEV Procedures	Computes all eigenvalues and, optionally, eigenvectors of a real symmetric matrix A
LAPACK_SYEVD Procedures	Computes all the eigenvalues and, optionally, eigenvectors of a real symmetric matrix A . If eigenvectors are desired, it uses a divide and conquer algorithm that makes mild assumptions about floating point arithmetic.

287.5 Summary of UTL_NLA Subprograms

This table lists the UTL_NLA subprograms and briefly describes them.

Table 287-6 UTL_NLA Package Subprograms

Subprogram	Description	Group
BLAS_ASUM Functions	Computes the sum of the absolute values of the vector components	BLAS Level 1 (Vector-Vector Operations) Subprograms
BLAS_AXPY Procedures	Copies $\alpha * X + Y$ into vector Y	BLAS Level 1 (Vector-Vector Operations) Subprograms
BLAS_COPY Procedures	Copies the contents of vector X to vector Y	BLAS Level 1 (Vector-Vector Operations) Subprograms

Table 287-6 (Cont.) UTL_NLA Package Subprograms

Subprogram	Description	Group
BLAS_DOT Functions	Returns the dot (scalar) product of two vectors X and Y	BLAS Level 1 (Vector-Vector Operations) Subprograms
BLAS_GBMV Procedures	Performs the matrix-vector operation $y := \alpha * A * x + \beta * y$ or $y := \alpha * A' * x + \beta * y$ where alpha and beta are scalars, x and y are vectors and A is an m by n band matrix, with kl sub-diagonals and ku super-diagonals	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_GEMM Procedures	Performs one of the matrix-matrix operations where alpha and beta are scalars, and A, B and C are matrices, with op(A) an m by k matrix, op(B) a k by n matrix and C an m by n matrix	BLAS Level 3 (Matrix-Matrix Operations) Subprograms
BLAS_GEMV Procedures	Performs the matrix-vector operations $y := \alpha * A * x + \beta * y$ or $y := \alpha * A' * x + \beta * y$ where alpha and beta are scalars, x and y are vectors and A is an m by n matrix	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_GER Procedures	Performs a rank 1 operation $A := \alpha * x * y' + A$ where alpha is a scalar, x is an m element vector, y is an n element vector and A is an m by n matrix	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_IAMAX Functions	Computes the index of the first element of a vector that has the largest absolute value	BLAS Level 1 (Vector-Vector Operations) Subprograms
BLAS_NRM2 Functions	Computes the vector 2-norm (Euclidean norm)	BLAS Level 1 (Vector-Vector Operations) Subprograms
BLAS_ROT Procedures	Returns the plane rotation of points	BLAS Level 1 (Vector-Vector Operations) Subprograms
BLAS_ROTG Procedures	Returns the Givens rotation of points	BLAS Level 1 (Vector-Vector Operations) Subprograms
BLAS_SBMV Procedures	Performs a matrix-vector operation $y := \alpha * A * x + \beta * y$ where alpha and beta are scalars, x and y are n element vectors and A is an n by n symmetric band matrix, with k super-diagonals	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_SCAL Procedures	Scales a vector by a constant	BLAS Level 1 (Vector-Vector Operations) Subprograms

Table 287-6 (Cont.) UTL_NLA Package Subprograms

Subprogram	Description	Group
BLAS_SPMV Procedures	Performs a matrix-vector operation $y := \alpha A x + \beta y$ where α and β are scalars, x and y are n element vectors and A is an n by n symmetric matrix, supplied in packed form	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_SPR Procedures	Performs a symmetric rank 1 operation $A := \alpha x x' + A$ where α is a real scalar, x is an n element vector, and A is an n by n symmetric matrix, supplied in packed form	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_SPR2 Procedures	Performs a symmetric rank 2 operation where α is a scalar, x and y are n element vectors, and A is an n by n symmetric matrix, supplied in packed form	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_SWAP Procedures	Swaps the contents of two vectors each of size n	BLAS Level 1 (Vector-Vector Operations) Subprograms
BLAS_SYMM Procedures	Performs one of the matrix-vector operations where α and β are scalars, A is a symmetric matrix, and B and C are m by n matrices	BLAS Level 3 (Matrix-Matrix Operations) Subprograms
BLAS_SYMV Procedures	Performs a matrix-vector operation where α and β are scalars, x and y are n element vectors and A is an n by n symmetric matrix	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_SYR Procedures	Performs a symmetric rank 1 operation where α is a real scalar, x is an n element vector, and A is an n by n symmetric matrix	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_SYR2 Procedures	Performs a symmetric rank 2 operation where α is a scalar, x and y are n element vectors, and A is an n by n symmetric matrix	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_SYR2K Procedures	Performs one of the symmetric rank2 k operations where α and β are scalars, C is an n by n symmetric matrix and A and B are n by k matrices in the first case and k by n matrices in the second case	BLAS Level 3 (Matrix-Matrix Operations) Subprograms

Table 287-6 (Cont.) UTL_NLA Package Subprograms

Subprogram	Description	Group
BLAS_SYRK Procedures	Performs one of the symmetric rank k operations where α and β are scalars, C is an n by n symmetric matrix and A is an n by k matrix in the first case and a k by n matrix in the second case	BLAS Level 3 (Matrix-Matrix Operations) Subprograms
BLAS_TBMV Procedures	Performs a matrix-vector operation where x is an n element vector and A is an n by n unit, or non-unit, upper or lower triangular band matrix, with $(k + 1)$ diagonals	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_TBSV Procedures	Solves one of the systems of equation where b and x are n element vectors and A is an n by n unit, or non-unit, upper or lower triangular band matrix, with $(k + 1)$ diagonals	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_TPMV Procedures	Performs a matrix-vector operation where x is an n element vector and A is an n by n unit, or non-unit, upper or lower triangular matrix, supplied in packed form	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_TPSV Procedures	Solves one of the systems of equation where b and x are n element vectors and A is an n by n unit, or non-unit, upper or lower triangular matrix, supplied in packed form	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_TRMM Procedures	Performs one of the matrix-vector operations where α is a scalar, B is an m by n matrix, A is a unit, or non-unit, upper or lower triangular matrix and $op(A)$ is one of two alternatives	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_TRMV Procedures	Performs a matrix-vector operation where x is an n element vector and A is an n by n unit, or non-unit, upper or lower triangular matrix	BLAS Level 2 (Matrix-Vector Operations) Subprograms
BLAS_TRSM Procedures	Performs one of the matrix-vector operations $op(A) * X = \alpha * B$ or $X * op(A) = \alpha * B$ where α is a scalar, X and B are m by n matrices, A is a unit, or non-unit, upper or lower triangular matrix, $op(A)$ is one of two alternatives. The matrix X is overwritten on B	BLAS Level 3 (Matrix-Matrix Operations) Subprograms

Table 287-6 (Cont.) UTL_NLA Package Subprograms

Subprogram	Description	Group
BLAS_TRSV Procedures	Solves one of the systems of equation where b and x are n element vectors and A is an n by n unit, or non-unit, upper or lower triangular matrix	BLAS Level 2 (Matrix-Vector Operations) Subprograms
LAPACK_GBSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n matrix and x and b are n by $nrhs$ matrices. The LU decomposition with partial pivoting and row interchanges is used to factor A .	LAPACK Driver Routines (Linear Equations) Subprograms
LAPACK_GEES Procedures	Computes for an n by n real nonsymmetric matrix A , the eigenvalues, the real Schur form T , and, optionally, the matrix of Schur vectors Z . This gives the Schur factorization $A = Z * T * (Z ** T)$.	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms
LAPACK_GEEV Procedures	Computes for an n by n real nonsymmetric matrix A , the eigenvalues and, optionally, the left and/or right eigenvectors.	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms
LAPACK_GELS Procedures	Solves overdetermined or underdetermined real linear systems involving an m by n matrix A , or its transpose, using a QR or LQ factorization of A . It is assumed that A has full rank.	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms
LAPACK_GESDD Procedures	Computes the singular value decomposition (SVD) of a real m by n matrix A , optionally computing the left and right singular vectors. If singular vectors are desired, it uses a divide-and-conquer algorithm that makes mild assumptions about floating point arithmetic.	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms
LAPACK_GESV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n matrix and x and b are n by $nrhs$ matrices. The LU decomposition with partial pivoting and row interchanges is used to factor A .	LAPACK Driver Routines (Linear Equations) Subprograms

Table 287-6 (Cont.) UTL_NLA Package Subprograms

Subprogram	Description	Group
LAPACK_GESVD Procedures	Computes the singular value decomposition (SVD) of a real m by n matrix A , optionally computing the left and/or right singular vectors. The SVD is written $A = U * SIGMA * \text{transpose}(V)$.	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms
LAPACK_GTSV Procedures	This procedure solves the equation $a * x = b$ where a is an n by n tridiagonal matrix, by Gaussian elimination with partial pivoting.	LAPACK Driver Routines (Linear Equations) Subprograms
LAPACK_PBSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric positive definite band matrix and x and b are n by $nrhs$ matrices. The Cholesky decomposition is used to factor A .	LAPACK Driver Routines (Linear Equations) Subprograms
LAPACK_POSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric positive definite matrix and x and b are n by $nrhs$ matrices. The Cholesky decomposition is used to factor A .	LAPACK Driver Routines (Linear Equations) Subprograms
LAPACK_PPSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric positive definite matrix stored in packed format and x and b are n by $nrhs$ matrices. The Cholesky decomposition is used to factor A .	LAPACK Driver Routines (Linear Equations) Subprograms
LAPACK_PTSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric positive definite tridiagonal matrix, and x and b are n by $nrhs$ matrices.	LAPACK Driver Routines (Linear Equations) Subprograms
LAPACK_SBEV Procedures	Computes all the eigenvalues and, optionally, eigenvectors of a real symmetric band matrix A	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms
LAPACK_SBEVD Procedures	Computes all the eigenvalues and, optionally, eigenvectors of a real symmetric matrix A . If eigenvectors are desired, it uses a divide and conquer algorithm that makes mild assumptions about floating point arithmetic.	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms

Table 287-6 (Cont.) UTL_NLA Package Subprograms

Subprogram	Description	Group
LAPACK_SPEV Procedures	Computes all the eigenvalues and, optionally, eigenvectors of a real symmetric matrix A in packed storage	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms
LAPACK_SPEVD Procedures	Computes all the eigenvalues and, optionally, eigenvectors of a real symmetric matrix A in packed storage. If eigenvectors are desired, it uses a divide and conquer algorithm that makes mild assumptions about floating point arithmetic.	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms
LAPACK_SPSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric matrix stored in packed format, and x and b are n by $nrhs$ matrices. The diagonal pivoting method is used to factor A .	LAPACK Driver Routines (Linear Equations) Subprograms
LAPACK_STEV Procedures	Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix A	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms
LAPACK_STEVD Procedures	Computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix A . If eigenvectors are desired, it uses a divide and conquer algorithm that makes mild assumptions about floating point arithmetic.	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms
LAPACK_SYEVD Procedures	Computes all the eigenvalues and, optionally, eigenvectors of a real symmetric matrix A . If eigenvectors are desired, it uses a divide and conquer algorithm that makes mild assumptions about floating point arithmetic.	LAPACK Driver Routines (LLS and Eigenvalue Problems) Subprograms
LAPACK_SYSV Procedures	This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric matrix, and x and b are n by $nrhs$ matrices. The diagonal pivoting method is used to factor A .	LAPACK Driver Routines (Linear Equations) Subprograms

287.5.1 BLAS_ASUM Functions

This procedure computes the sum of the absolute values of the vector components.



See Also:

[BLAS Level 1 \(Vector-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_ASUM (
  n      IN      POSITIVEN,
  x      IN      UTL_NLA_ARRAY_DBL,
  incx   IN      POSITIVEN)
RETURN BINARY_DOUBLE;

UTL_NLA.BLAS_ASUM (
  n      IN      POSITIVEN,
  alpha  IN      SCALAR_DOUBLE,
  x      IN      UTL_NLA_ARRAY_FLT)
RETURN BINARY_FLOAT

```

Parameters

Table 287-7 BLAS_ASUM Function Parameters

Parameter	Description
n	Specifies the number of elements of the vectors x and y. n must be at least zero.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least (1 + (n - 1) * abs (incx))
incx	Specifies the increment for the elements of x. incx must not be zero.

287.5.2 BLAS_AXPY Procedures

This procedure copies $\alpha * X + Y$ into vector Y.



See Also:

[BLAS Level 1 \(Vector-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_AXPY (
  n      IN      POSITIVEN,
  alpha  IN      SCALAR_DOUBLE,
  x      IN      UTL_NLA_ARRAY_DBL,
  incx   IN      POSITIVEN,
  y      IN OUT  UTL_NLA_ARRAY_DBL,
  incy   IN      POSITIVEN);

```

```

UTL_NLA.BLAS_AXPY (
  n      IN      POSITIVEN,
  alpha  IN      SCALAR_DOUBLE,
  x      IN      UTL_NLA_ARRAY_FLT,
  incx   IN      POSITIVEN,
  y      IN OUT  UTL_NLA_ARRAY_FLT,
  incy   IN      POSITIVEN);

```

Parameters**Table 287-8 BLAS_AXPY Procedure Parameters**

Parameter	Description
n	Specifies the number of elements of the vectors x and y. n must be at least zero.
alpha	Specifies the scalar alpha.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least (1 + (n - 1) * abs(incx))
incx	Specifies the increment for the elements of x. incx must not be zero.
y	UTL_NLA_ARRAY_FLT/DBL of DIMENSION at least (1 + (n - 1) * abs(incy))
incy	Specifies the increment for the elements of y. incy must not be zero.

287.5.3 BLAS_COPY Procedures

This procedure copies the contents of vector X to vector Y.

**See Also:**

[BLAS Level 1 \(Vector-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_COPY (
  n      IN      POSITIVEN,
  x      IN      UTL_NLA_ARRAY_DBL,
  incx   IN      POSITIVEN,

```

```

y      IN OUT UTL_NLA_ARRAY_DBL,
incy   IN      POSITIVEN);

UTL_NLA.BLAS_COPY (
n      IN      POSITIVEN,
x      IN      UTL_NLA_ARRAY_FLT,
incx   IN      POSITIVEN,
y      IN OUT UTL_NLA_ARRAY_FLT,
incy   IN      POSITIVEN);

```

Parameters

Table 287-9 BLAS_COPY Procedure Parameters

Parameter	Description
n	Specifies the number of elements of the vectors x and y. n must be at least zero.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least (1 + (n - 1) * abs(incx))
incx	Specifies the increment for the elements of x. incx must not be zero.
y	UTL_NLA_ARRAY_FLT/DBL of dimension at least (1 + (n - 1) * abs(incy))
incy	Specifies the increment for the elements of y. incy must not be zero.

287.5.4 BLAS_DOT Functions

This function returns the dot (scalar) product of two vectors x and y.



See Also:

[BLAS Level 1 \(Vector-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_DOT (
n      IN      POSITIVEN,
x      IN      UTL_NLA_ARRAY_DBL,
incx   IN      POSITIVEN,
y      IN      UTL_NLA_ARRAY_DBL,
incy   IN      POSITIVEN)
RETURN BINARY_DOUBLE;

UTL_NLA.BLAS_DOT (
n      IN      POSITIVEN,
x      IN      UTL_NLA_ARRAY_FLT,
incx   IN      POSITIVEN,

```

```

y      IN    UTL_NLA_ARRAY_FLT,
incy  IN    POSITIVEN)
RETURN BINARY_FLOAT;

```

Parameters

Table 287-10 BLAS_DOT Function Parameters

Parameter	Description
n	Specifies the number of elements of the vectors x and y. n must be at least zero.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least (1 + (n - 1) * abs(incx))
incx	Specifies the increment for the elements of x. incx must not be zero.
y	UTL_NLA_ARRAY_FLT/DBL of dimension at least (1 + (n - 1) * abs(incy))
incy	Specifies the increment for the elements of y. incy must not be zero.

287.5.5 BLAS_GBMV Procedures

This procedure performs one of the matrix-vector operations $y := \alpha * A * x + \beta * y$ or $y := \alpha * A' * x + \beta * y$, where alpha and beta are scalars, x and y are vectors and A is an m by n band matrix, with k_l sub-diagonals and k_u super-diagonals.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_GBMV (
  trans IN      flag,
  m     IN      POSITIVEN,  n     IN      POSITIVEN,
  kl    IN      NATURALN,
  ku    IN      NATURALN,
  alpha IN      SCALAR_DOUBLE,
  a     IN      UTL_NLA_ARRAY_DBL,
  lda   IN      POSITIVEN,
  x     IN      UTL_NLA_ARRAY_DBL,
  incx  IN      POSITIVEN,
  beta  IN      SCALAR_DOUBLE,
  y     IN OUT  UTL_NLA_ARRAY_DBL,
  incy  IN      POSITIVEN,
  pack  IN      flag DEFAULT 'C');

```

```

UTL_NLA.BLAS_GBMV (
  trans IN      flag,
  m     IN      POSITIVEN,

```

```

n      IN      POSITIVEN,
kl     IN      NATURALN,
ku     IN      NATURALN,
alpha  IN      SCALAR_FLOAT,
a      IN      UTL_NLA_ARRAY_FLT,
lda    IN      POSITIVEN,
x      IN      UTL_NLA_ARRAY_FLT,
incx   IN      POSITIVEN,
beta   IN      SCALAR_FLOAT,
y      IN OUT  UTL_NLA_ARRAY_FLT,
incy   IN      POSITIVEN,
pack   IN      flag DEFAULT 'C');

```

Parameters

Table 287-11 BLAS_GBMV Procedure Parameters

Parameter	Description
trans	<p>Specifies the operation to be performed:</p> <ul style="list-style-type: none"> trans = 'N' or 'n': $y := \alpha * A * x + \beta * y$ trans = 'T' or 't': $y := \alpha * A^T * x + \beta * y$ trans = 'C' or 'c': $y := \alpha * A^H * x + \beta * y$
m	Specifies the number of rows of the matrix A. m must be at least zero.
n	Specifies the number of columns of the matrix A. n must be at least zero.
kl	Specifies the number of sub-diagonals of the matrix A. kl must satisfy $0 \leq kl$.
ku	Specifies the number of super-diagonals of the matrix A. ku must satisfy $0 \leq ku$.
alpha	SCALAR_FLOAT/DOUBLE. Specifies the scalar alpha.
a	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, n).</p> <p>Before entry, the leading (kl + ku + 1) by n part of the array A must contain the matrix of coefficients, supplied column by column, with the leading diagonal of the matrix in row (ku+1) of the array, the first super-diagonal starting at position 2 in row ku, the first sub-diagonal starting at position 1 in row (ku+2), and so on.</p> <p>Elements in the array A that do not correspond to elements in the band matrix (such as the top left ku by ku triangle) are not referenced.</p>
lda	Specifies the first dimension of a as declared in the calling (sub) program. lda must be at least (kl+ku+1).
x	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least</p> $(1 + (n - 1) * \text{abs}(incx))$ <p>when trans = 'N' or 'n' and at least</p> $(1 + (m - 1) * \text{abs}(incx))$ <p>otherwise. Before entry, the incremented array X must contain the vector x.</p>

Table 287-11 (Cont.) BLAS_GBMV Procedure Parameters

Parameter	Description
incx	Specifies the increment for the elements of <i>x</i> . Must not be zero.
beta	SCALAR_FLOAT/DOUBLE. Specifies the scalar beta. When beta is supplied as zero then <i>y</i> need not be set on input.
y	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (m - 1) * \text{abs}(\text{incy}))$ when <i>trans</i> = 'N' or 'n' and at least $(1 + (n - 1) * \text{abs}(\text{incy}))$ otherwise. Before entry with beta nonzero, the incremented array <i>Y</i> must contain the vector <i>y</i> . On exit, <i>Y</i> is overwritten by the updated vector <i>y</i> .
incy	Specifies the increment for the elements of <i>y</i> . Must not be zero.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.6 BLAS_GEMM Procedures

This procedure performs one of the matrix-matrix operations.

$$C := \text{alpha} * \text{op}(A) * \text{op}(B) + \text{beta} * C$$

where *op*(*X*) is one of

$$\text{op}(X) = X$$

or

$$\text{op}(X) = X'$$

where *alpha* and *beta* are scalars, and *A*, *B* and *C* are matrices, with *op*(*A*) an *m* by *k* matrix, *op*(*B*) a *k* by *n* matrix and *C* an *m* by *n* matrix.

See Also:

[BLAS Level 3 \(Matrix-Matrix Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_GEMM (
  transa IN      flag,
  transb IN      flag,
  m          IN  POSITIVEN,
  n          IN  POSITIVEN,
  k          IN  POSITIVEN,
```

```

alpha IN      SCALAR_DOUBLE,
a      IN      UTL_NLA_ARRAY_DBL,
lda    IN      POSITIVEN,
b      IN      UTL_NLA_ARRAY_DBL,
ldb    IN      POSITIVEN,
beta   IN      SCALAR_DOUBLE,
c      IN OUT  UTL_NLA_ARRAY_DBL,
ldc    IN      POSITIVEN,
pack   IN      flag DEFAULT 'C');

UTL_NLA.BLAS_GEMM (
  transa IN      flag,
  transb IN      flag,
  m      IN      POSITIVEN,
  n      IN      POSITIVEN,
  k      IN      POSITIVEN,
  alpha  IN      SCALAR_FLOAT,
  a      IN      UTL_NLA_ARRAY_FLT,
  lda    IN      POSITIVEN,
  b      IN      UTL_NLA_ARRAY_FLT,
  ldb    IN      POSITIVEN,
  beta   IN      SCALAR_FLOAT,
  c      IN OUT  UTL_NLA_ARRAY_FLT,
  ldc    IN      POSITIVEN,
  pack   IN      flag DEFAULT 'C');

```

Parameters

Table 287-12 BLAS_GEMM Procedure Parameters

Parameter	Description
transa	Specifies the form of $op(A)$ to be used in the matrix multiplication as follows: <ul style="list-style-type: none"> transa = 'N' or 'n': $op(A) = 'A'$ transa = 'T' or 't': $op(A) = 'A'$ transa = 'C' or 'c': $op(A) = 'A'$
transb	Specifies the form of $op(B)$ to be used in the matrix multiplication as follows: <ul style="list-style-type: none"> transb = 'N' or 'n': $op(B) = B$ transb = 'T' or 't': $op(B) = B'$ transb = 'C' or 'c': $op(B) = B'$
m	Specifies the number of rows of the matrix $op(A)$ and of the matrix C. m must be at least zero.
n	Specifies the number of columns of the matrix $op(B)$ and of the matrix C. n must be at least zero.
k	Specifies the rows of the matrix $op(A)$ and the number of columns of the matrix $op(B)$. k must be at least zero.
alpha	SCALAR_FLOAT/DOUBLE. Specifies the scalar alpha.
a	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, ka) where ka is k when transa = 'N' or 'n', and is m otherwise. Before entry with transa = 'N' or 'n', the leading m by k part of the array A must contain the matrix A, otherwise the leading k by m part of the array A must contain the matrix A.

Table 287-12 (Cont.) BLAS_GEMM Procedure Parameters

Parameter	Description
lda	Specifies the first dimension of <i>a</i> as declared in the calling (sub) program. When <i>transa</i> = 'N' or 'n', <i>lda</i> must be at least $\max(1, k)$.
b	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (<i>lda</i> , <i>kb</i>) where <i>kb</i> is <i>n</i> when <i>transb</i> = 'N' or 'n', and is <i>k</i> otherwise. Before entry with <i>transb</i> = 'N' or 'n', the leading <i>k</i> by <i>n</i> part of the array <i>b</i> must contain the matrix <i>B</i> , otherwise the leading <i>n</i> by <i>k</i> part of the array <i>b</i> must contain the matrix <i>B</i> .
ldb	Specifies the first dimension of <i>b</i> as declared in the calling (sub) program. When <i>transb</i> = 'N' or 'n', <i>ldb</i> must be at least $\max(1, n)$.
beta	SCALAR_FLOAT/DOUBLE. Specifies the scalar <i>beta</i> . When <i>beta</i> is supplied as zero then <i>c</i> need not be set on input.
c	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (<i>ldc</i> , <i>n</i>). Before entry, the leading <i>m</i> by <i>n</i> part of the array <i>C</i> must contain the matrix <i>C</i> , except when <i>beta</i> is zero, in which case <i>C</i> need not be set on entry. On exit, the array <i>C</i> is overwritten by the <i>m</i> by <i>n</i> matrix $(\alpha * \text{op}(A) * \text{op}(B) + \beta * C)$.
ldc	Specifies the first dimension of <i>C</i> as declared in the calling (sub) program. <i>ldc</i> must be at least $\max(1, m)$.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.7 BLAS_GEMV Procedures

This procedure performs one of the matrix-vector operations: $y := \alpha * A * x + \beta * y$ or $y := \alpha * A' * x + \beta * y$ where α and β are scalars, x and y are vectors and A is an m by n matrix.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_GEMV (
    trans IN      flag,
    m     IN      POSITIVEN,
    n     IN      POSITIVEN,
    alpha IN      SCALAR_DOUBLE,
    a     IN      UTL_NLA_ARRAY_DBL,
    lda  IN      POSITIVEN,
    x     IN      UTL_NLA_ARRAY_DBL,
    incx IN      POSITIVEN,

```

```

beta  IN      SCALAR_DOUBLE,
y     IN OUT  UTL_NLA_ARRAY_DBL,
incy  IN      POSITIVEN,
pack  IN      flag DEFAULT 'C');

UTL_NLA.BLAS_GEMV (
  trans IN      flag,
  m     IN      POSITIVEN,
  n     IN      POSITIVEN,
  alpha IN      SCALAR_FLOAT,
  a     IN      UTL_NLA_ARRAY_FLT,
  lda   IN      POSITIVEN,
  x     IN      UTL_NLA_ARRAY_FLT,
  incx  IN      POSITIVEN,
  beta  IN      SCALAR_FLOAT,
  y     IN OUT  UTL_NLA_ARRAY_FLT,
  incy  IN      POSITIVEN,
  pack  IN      flag DEFAULT 'C');

```

Parameters

Table 287-13 BLAS_GEMV Procedure Parameters

Parameter	Description
trans	Specifies the operation to be performed: <ul style="list-style-type: none"> trans = 'N' or 'n', $y := \alpha * A * x + \beta * y$ trans = 'T' or 't', $y := \alpha * A^T * x + \beta * y$ trans = 'C' or 'c', $y := \alpha * A^H * x + \beta * y$
m	Specifies the number of rows of the matrix A. m must be at least zero.
n	Specifies the number of columns of the matrix A. n must be at least zero.
alpha	SCALAR_FLOAT/DOUBLE. Specifies the scalar alpha.
a	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, n). Before entry, the leading m by n part of the array a must contain the matrix of coefficients.
lda	Specifies the first dimension of a as declared in the calling (sub) program. lda must be at least $\max(1, m)$.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (n - 1) * \text{abs}(\text{incx}))$ when trans = 'N' or 'n' and at least $(1 + (m - 1) * \text{abs}(\text{incx}))$ otherwise. Before entry, the incremented array X must contain the vector x.
incx	Specifies the increment for the elements of x. Must not be zero.
beta	SCALAR_FLOAT/DOUBLE. Specifies the scalar beta. When beta is supplied as zero then y need not be set on input.

Table 287-13 (Cont.) BLAS_GEMV Procedure Parameters

Parameter	Description
y	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (m - 1) * \text{abs}(incy))$ when trans = 'N' or 'n' and at least $(1 + (n - 1) * \text{abs}(incy))$ otherwise. Before entry with beta nonzero, the incremented array Y must contain the vector y. On exit, Y is overwritten by the updated vector y.
incy	Specifies the increment for the elements of y. Must not be zero.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.8 BLAS_GER Procedures

This procedure performs the rank 1 operation: $A := \alpha * x * y' + A$ where alpha is a scalar, x is an m element vector, y is an n element vector and A is an m by n matrix.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_GER (
  m      IN      POSITIVEN,
  n      IN      POSITIVEN,
  alpha  IN      SCALAR_DBL,
  x      IN OUT  UTL_NLA_ARRAY_DBL,
  incx   IN      POSITIVEN,
  y      IN      UTL_NLA_ARRAY_DBL,
  incy   IN      POSITIVEN,
  a      IN OUT  UTL_NLA_ARRAY_DBL,
  lda    IN      POSITIVEN,
  pack   IN      flag DEFAULT 'C');

```

```

UTL_NLA.BLAS_GER (
  m      IN      POSITIVEN,
  n      IN      POSITIVEN,
  alpha  IN      SCALAR_FLT,
  x      IN OUT  UTL_NLA_ARRAY_FLT,
  incx   IN      POSITIVEN,
  y      IN      UTL_NLA_ARRAY_FLT,
  incy   IN      POSITIVEN,
  a      IN OUT  UTL_NLA_ARRAY_FLT,

```

```
lda    IN    POSITIVE,
pack   IN    flag DEFAULT 'C');
```

Parameters

Table 287-14 BLAS_GER Procedure Parameters

Parameter	Description
m	Specifies the number of rows of the matrix A. m must be at least zero.
n	Specifies the number of columns of the matrix A. n must be at least zero.
alpha	Specifies the scalar alpha.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (m - 1) * \text{abs}(\text{incx}))$ Before entry, the incremented array X must contain the m element vector x.
incx	Specifies the increment for the elements of x. incx must not be zero.
y	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (n - 1) * \text{abs}(\text{incy}))$ Before entry, the incremented array Y must contain the m element vector y.
incy	Specifies the increment for the elements of y. incy must not be zero.
a	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, n). Before entry, the leading m by n part of the array a must contain the matrix of coefficients. On exit, a is overwritten by the updated matrix.
lda	Specifies the first dimension of a as declared in the calling (sub) program. lda must be at least $\text{max}(1, m)$
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.9 BLAS_IAMAX Functions

This function computes the index of first element of a vector that has the largest absolute value.



See Also:

[BLAS Level 1 \(Vector-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_IAMAX (
  n      IN  POSITIVE_INTEGER,
  x      IN  UTL_NLA_ARRAY_DBL,
  incx   IN  POSITIVE_INTEGER,
  RETURN POSITIVE_INTEGER;
```

```
UTL_NLA.BLAS_IAMAX (
  n      IN  POSITIVE_INTEGER,
  x      IN  UTL_NLA_ARRAY_FLT,
  incx   IN  POSITIVE_INTEGER,
  RETURN POSITIVE_INTEGER;
```

Parameters

Table 287-15 BLAS_IAMAX Function Parameters

Parameter	Description
n	Specifies the number of elements of the vectors x and y. n must be at least zero.
x	UTL_NLA_ARRAY_FLT/DBL of DIMENSION at least (1 + (n - 1) * abs (incx))
incx	Specifies the increment for the elements of x. incx must not be zero.

287.5.10 BLAS_NRM2 Functions

This function computes the vector 2-norm (Euclidean norm).



See Also:

[BLAS Level 1 \(Vector-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_NRM2 (
  n      IN      POSITIVEN,
  x      IN      UTL_NLA_ARRAY_DBL,
  incx   IN      POSITIVEN)
RETURN BINARY_DOUBLE;

```

```

UTL_NLA.BLAS_NRM2 (
  n      IN      POSITIVEN,
  x      IN      UTL_NLA_ARRAY_FLT,
  incx   IN      POSITIVEN)
RETURN BINARY_FLOAT;

```

Parameters**Table 287-16 BLAS_NRM2 Function Parameters**

Parameter	Description
n	Specifies the number of elements of the vectors x and y. n must be at least zero.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (n - 1) * \text{abs}(\text{incx}))$
incx	Specifies the increment for the elements of x. incx must not be zero.

287.5.11 BLAS_ROT Procedures

This procedure returns the plane rotation of points.

**See Also:**

[BLAS Level 1 \(Vector-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_ROT (
  n      IN      POSITIVEN,
  x      IN OUT  UTL_NLA_ARRAY_DBL,
  incx   IN      POSITIVEN,
  y      IN OUT  UTL_NLA_ARRAY_DBL,
  incy   IN      POSITIVEN,
  c      IN      SCALAR_DOUBLE,
  s      IN      SCALAR_DOUBLE);

```

```

UTL_NLA.BLAS_ROT (
  n      IN      POSITIVEN,
  x      IN OUT  UTL_NLA_ARRAY_FLT,
  incx   IN      POSITIVEN,
  y      IN OUT  UTL_NLA_ARRAY_FLT,

```



```

incy  IN    POSITIVE,
c      IN    SCALAR_DOUBLE,
s      IN    SCALAR_DOUBLE);

```

Parameters

Table 287-17 BLAS_ROT Procedure Parameters

Parameter	Description
n	Specifies the number of elements of the vectors x and y. n must be at least zero.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1+(n-1) * \text{abs}(\text{incx}))$
incx	Specifies the increment for the elements of x. incx must not be zero.
y	UTL_NLA_ARRAY_FLT/DBL of DIMENSION at least $(1+(n-1) * \text{abs}(\text{incy}))$
incy	Specifies the increment for the elements of y. incy must not be zero.
c	SCALAR_FLOAT/DOUBLE.Specifies the scalar C.
s	SCALAR_FLOAT/DOUBLE.Specifies the scalar S.

287.5.12 BLAS_ROTG Procedures

This procedure returns the Givens rotation of points.



See Also:

[BLAS Level 1 \(Vector-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_ROTG (
  a  IN OUT  SCALAR_DOUBLE,
  b  IN OUT  SCALAR_DOUBLE,
  c  IN OUT  SCALAR_DOUBLE,
  s  IN OUT  SCALAR_DOUBLE);

```

```

UTL_NLA.BLAS_ROTG (
  a  IN OUT  SCALAR_FLOAT,
  b  IN OUT  SCALAR_FLOAT,
  c  IN OUT  SCALAR_FLOAT,
  s  IN OUT  SCALAR_FLOAT);

```

Parameters

Table 287-18 BLAS_ROTG Procedure Parameters

Parameter	Description
a	SCALAR_FLOAT/DOUBLE. Specifies the scalar A.
b	SCALAR_FLOAT/DOUBLE. Specifies the scalar B.
c	SCALAR_FLOAT/DOUBLE. Specifies the scalar C.
s	SCALAR_FLOAT/DOUBLE. Specifies the scalar S.

287.5.13 BLAS_SCAL Procedures

This procedure scales a vector by a constant.



See Also:

[BLAS Level 1 \(Vector-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_SCAL (
    n      IN  POSITIVEN,
    alpha  IN  SCALAR_DOUBLE,
    x      IN  OUT UTL_NLA_ARRAY_DBL,
    incx   IN  POSITIVEN);
```

```
UTL_NLA.BLAS_SCAL (
    n      IN  POSITIVEN,
    alpha  IN  SCALAR_FLOAT,
    x      IN  OUT UTL_NLA_ARRAY_FLT,
    incx   IN  POSITIVEN);
```

Parameters

Table 287-19 BLAS_SCAL Procedure Parameters

Parameter	Description
n	Specifies the number of elements of the vectors x and y. n must be at least zero.
alpha	Specifies the scalar alpha.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least (1+(n-1)*abs(incx))
incx	Specifies the increment for the elements of x. incx must not be zero.

287.5.14 BLAS_SPMV Procedures

This procedure performs the matrix-vector operation $y := \alpha A x + \beta y$, where α and β are scalars, x and y are n element vectors and A is an n by n symmetric matrix, supplied in packed form.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_SPMV (
    uplo   IN       flag,
    n      IN       POSITIVEN,
    alpha  IN       SCALAR_DOUBLE,
    ap     IN       UTL_NLA_ARRAY_DBL,
    x      IN       UTL_NLA_ARRAY_DBL,
    incx   IN       POSITIVEN,
    beta   IN       SCALAR_DOUBLE,
    y      IN OUT   UTL_NLA_ARRAY_DBL,
    incy   IN       POSITIVEN,
    pack   IN       flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_SPMV (
    uplo   IN       flag,
    n      IN       POSITIVEN,
    alpha  IN       SCALAR_FLOAT,
    ap     IN       UTL_NLA_ARRAY_FLT,
    x      IN       UTL_NLA_ARRAY_FLT,
    incx   IN       POSITIVEN,
    beta   IN       SCALAR_FLOAT,
    y      IN OUT   UTL_NLA_ARRAY_FLT,
    incy   IN       POSITIVEN,
    pack   IN       flag DEFAULT 'C');
```

Parameters

Table 287-20 BLAS_SPMV Procedure Parameters

Parameter	Description
uplo	Specifies the upper or lower triangular part of the matrix A is supplied in the packed array AP : <ul style="list-style-type: none"> uplo = 'U' or 'u'. The upper triangular part of A is supplied in AP. uplo = 'L' or 'l'. The lower triangular part of A is supplied in AP.
n	Specifies the order of the matrix A . n must be at least zero.
alpha	SCALAR_FLOAT/DOUBLE. Specifies the scalar α .

Table 287-20 (Cont.) BLAS_SPMV Procedure Parameters

Parameter	Description
ap	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least</p> $((n * (n + 1)) / 2)$ <p>Before entry with <code>uplo = 'U'</code> or <code>'u'</code>, the array <code>ap</code> must contain the upper triangular part of the symmetric matrix packed sequentially, column by column, so that <code>ap(1)</code> contains <code>a(1,1)</code>, <code>ap(2)</code> and <code>ap(3)</code> contain <code>a(1,2)</code> and <code>a(2,2)</code> respectively, and so on.</p> <p>Before entry with <code>uplo = 'L'</code> or <code>'l'</code>, the array <code>ap</code> must contain the lower triangular part of the symmetric matrix packed sequentially, column by column, so that <code>ap(1)</code> contains, <code>ap(2)</code> and <code>ap(3)</code> contain <code>a(2,1)</code> and <code>a(3,1)</code> respectively, and so on.</p>
x	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least</p> $(1 + (n - 1) * \text{abs}(\text{incx}))$ <p>Before entry, the incremented array <code>X</code> must contain the <code>n</code> element vector <code>x</code>.</p>
incx	Specifies the increment for the elements of <code>x</code> . Must not be zero.
beta	SCALAR_FLOAT/DOUBLE. Specifies the scalar <code>beta</code> . When <code>beta</code> is supplied as zero then <code>Y</code> need not be set on input.
y	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least</p> $(1 + (n - 1) * \text{abs}(\text{incy}))$ <p>Before entry, the incremented array <code>Y</code> must contain the <code>n</code> element vector <code>y</code>. On exit, <code>Y</code> is overwritten by the updated vector <code>y</code>.</p>
incy	Specifies the increment for the elements of <code>y</code> . Must not be zero.
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> • 'C': column-major (default) • 'R': row-major

287.5.15 BLAS_SPR Procedures

This procedure performs the rank 1 operation $A := \text{alpha} * x * x' + A$, where `alpha` is a real scalar, `x` is an `n` element vector, and `A` is an `n` by `n` symmetric matrix, supplied in packed form.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_SPR (
    uplo IN      flag,
```

```

n      IN      POSITIVEN,
alpha IN      SCALAR_DBL,
x      IN OUT  UTL_NLA_ARRAY_DBL,
incx  IN      POSITIVEN,
ap     IN OUT  UTL_NLA_ARRAY_DBL,
pack  IN      flag DEFAULT 'C');

UTL_NLA.BLAS_SPR (
  uplo IN      flag,
  n     IN      POSITIVEN,
  alpha IN     SCALAR_FLT,
  x     IN OUT  UTL_NLA_ARRAY_FLT,
  incx  IN     POSITIVEN,
  ap    IN OUT  UTL_NLA_ARRAY_FLT,
  pack  IN     flag DEFAULT 'C');

```

Parameters

Table 287-21 BLAS_SPR Procedure Parameters

Parameter	Description
uplo	Specifies whether the upper or lower triangular part of the matrix A is supplied in the packed array ap: <ul style="list-style-type: none"> uplo = 'U' or 'u': The upper triangular part of A is supplied in ap. uplo = 'L' or 'l': The lower triangular part of A is supplied in ap.
n	Specifies the order of the matrix A. n must be at least zero.
alpha	Specifies the scalar alpha.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1+(n-1)*abs(incx))$ Before entry, the incremented array X must contain the m element vector x.
incx	Specifies the increment for the elements of x. incx must not be zero.
ap	UTL_NLA_ARRAY_FLT/DBL of dimension at least $((n*(n+1))/2)$ Before entry with uplo = 'U' or 'u', the array ap must contain the upper triangular part of the symmetric matrix packed sequentially, column by column, so that ap(1) contains a(1,1), ap(2) and ap(3) contain a(1,2) and a(2,2) respectively, and so on. On exit, the array ap is overwritten by the upper triangular part of the updated matrix. Before entry with uplo = 'L' or 'l', the array ap must contain the lower triangular part of the symmetric matrix packed sequentially, column by column, so that ap(1) contains a(1,1), ap(2) and ap(3) contain a(2,1) and a(3,1) respectively, and so on. On exit, the array ap is overwritten by the lower triangular part of the updated matrix
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.16 BLAS_SPR2 Procedures

This procedure performs the rank 2 operation $A := \alpha * x * y' + \alpha * y * x' + A$, where α is a scalar, x and y are n element vectors, and A is an n by n symmetric matrix, supplied in packed form.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_SPR2 (
    uplo   IN        flag,
    n      IN        POSITIVEN,
    alpha  IN        SCALAR_DBL,
    x      IN        UTL_NLA_ARRAY_DBL,
    incx   IN        POSITIVEN,
    y      IN        UTL_NLA_ARRAY_DBL,
    incy   IN        POSITIVEN,
    a      IN OUT    UTL_NLA_ARRAY_DBL,
    lda    IN        POSITIVEN,
    pack   IN        flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_SPR2 (
    uplo   IN        flag,
    n      IN        POSITIVEN,
    alpha  IN        SCALAR_FLT,
    x      IN        UTL_NLA_ARRAY_FLT,
    incx   IN        POSITIVEN,
    y      IN        UTL_NLA_ARRAY_FLT,
    incy   IN        POSITIVEN,
    a      IN OUT    UTL_NLA_ARRAY_FLT,
    lda    IN        POSITIVEN,
    pack   IN        flag DEFAULT 'C');
```

Parameters

Table 287-22 BLAS_SPR2 Procedure Parameters

Parameter	Description
uplo	Specifies whether the upper or lower triangular part of the matrix A is supplied in the packed array ap : <ul style="list-style-type: none"> uplo = 'U' or 'u' : The upper triangular part of A is supplied in ap. uplo = 'L' or 'l' : The lower triangular part of A is supplied in ap.
n	Specifies the order of the matrix A . n must be at least zero.
alpha	Specifies the scalar α .

Table 287-22 (Cont.) BLAS_SPR2 Procedure Parameters

Parameter	Description
x	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (n-1) * \text{abs}(\text{incx}))$</p> <p>Before entry, the incremented array X must contain the m element vector x.</p>
incx	<p>Specifies the increment for the elements of x. incx must not be zero.</p>
y	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (n-1) * \text{abs}(\text{incy}))$</p> <p>Before entry, the incremented array X must contain the m element vector y.</p>
incy	<p>Specifies the increment for the elements of y. incy must not be zero.</p>
ap	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least $((n * (n+1)) / 2)$</p> <p>Before entry with uplo = 'U' or 'u', the array ap must contain the upper triangular part of the symmetric matrix packed sequentially, column by column, so that ap(1) contains ap(1) contains a(1,1), ap(2) and ap(3) contain a(1,2) and a(2,2) respectively, and so on. On exit, the array ap is overwritten by the upper triangular part of the updated matrix.</p> <p>Before entry with uplo = 'L' or 'l', the array ap must contain the lower triangular part of the symmetric matrix packed sequentially, column by column, so that ap(1) contains a(1,1), ap(2) and ap(3) contain a(2,1) and a(3,1) respectively, and so on. On exit, the array ap is overwritten by the lower triangular part of the updated matrix</p>
lda	<p>Specifies the first dimension of a as declared in the calling (sub) program. lda must be at least (k + 1).</p>
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> • 'C': column-major (default) • 'R': row-major

287.5.17 BLAS_SBMV Procedures

This procedure performs the matrix-vector operation $y := \alpha * A * x + \beta * y$, where α and β are scalars, x and y are n element vectors and A is an n by n symmetric band matrix, with k super-diagonals.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_SBMV (
    uplo   IN       flag,
    n      IN       POSITIVEN,
    k      IN       NATURALN,
    alpha  IN       SCALAR_DOUBLE,
    a      IN       UTL_NLA_ARRAY_DBL,
    lda    IN       POSITIVEN,
    x      IN       UTL_NLA_ARRAY_DBL,
    incx   IN       POSITIVEN,
    beta   IN       SCALAR_DOUBLE,
    y      IN OUT   UTL_NLA_ARRAY_DBL,
    incy   IN       POSITIVEN,
    pack   IN       flag DEFAULT 'C');

```

```

UTL_NLA.BLAS_SBMV (
    uplo   IN       flag,
    n      IN       POSITIVEN,
    k      IN       NATURALN,
    alpha  IN       SCALAR_FLOAT,
    a      IN       UTL_NLA_ARRAY_FLT,
    lda    IN       POSITIVEN,
    x      IN       UTL_NLA_ARRAY_FLT,
    incx   IN       POSITIVEN,
    beta   IN       SCALAR_FLOAT,
    y      IN OUT   UTL_NLA_ARRAY_FLT,
    incy   IN       POSITIVEN,
    pack   IN       flag DEFAULT 'C');

```

Parameters

Table 287-23 BLAS_SBMV Procedure Parameters

Parameter	Description
uplo	Specifies whether the upper or lower triangular part of the band matrix A is being supplied: <ul style="list-style-type: none"> uplo = 'U' or 'u'. The upper triangular part of A is supplied. uplo = 'L' or 'l'. The lower triangular part of A is supplied.
n	Specifies the order of the matrix A . n must be at least zero.

Table 287-23 (Cont.) BLAS_SBMV Procedure Parameters

Parameter	Description
k	Specifies the number of super-diagonals of the matrix A. k must satisfy $0 \leq k$.
alpha	SCALAR_FLOAT/DOUBLE. Specifies the scalar alpha.
a	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda,n).</p> <p>Before entry with uplo = 'U' or 'u', the leading (k+1) by n part of the array A must contain the upper triangular band part of the symmetric matrix, supplied column by column, with the leading diagonal of the matrix in row (k+1) of the array, the first super-diagonal starting at position 2 in row k, and so on. The top left k by k triangle of the array A is not referenced.</p> <p>Before entry with uplo = 'L' or 'l', the leading (k+1) by n part of the array A must contain the lower triangular band part of the symmetric matrix, supplied column by column, with the leading diagonal of the matrix in row 1 of the array, the first sub-diagonal starting at position 1 in row 2, and so on. The bottom right k by k triangle of the array A is not referenced.</p> <p>Unchanged on exit</p>
lda	Specifies the first dimension of a as declared in the calling (sub) program. lda must be at least (k + 1).
x	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (n-1) * \text{abs}(\text{incx}))$</p> <p>Before entry, the incremented array X must contain the n element vector x.</p>
incx	Specifies the increment for the elements of x. Must not be zero.
beta	SCALAR_FLOAT/DOUBLE. Specifies the scalar beta.
y	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (n-1) * \text{abs}(\text{incy}))$</p> <p>Before entry, the incremented array Y must contain the n element vector y. On exit, Y is overwritten by the updated vector y.</p>
incy	Specifies the increment for the elements of y. Must not be zero.
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.18 BLAS_SWAP Procedures

This procedure swaps the contents of two vectors each of size n.

Syntax

```

UTL_NLA.BLAS_SWAP (
    n      IN      POSITIVEN,
    x      IN OUT  UTL_NLA_ARRAY_DBL,
    incx   IN      POSITIVEN,

```

```

y      IN OUT UTL_NLA_ARRAY_DBL,
incy   IN      POSITIVEN);

UTL_NLA.BLAS_SWAP (
  n      IN      POSITIVEN,
  x      IN OUT UTL_NLA_ARRAY_FLT,
  incx   IN      POSITIVEN,
  y      IN OUT UTL_NLA_ARRAY_FLT,
  incy   IN      POSITIVEN);

```

Parameters

Table 287-24 BLAS_SWAP Procedure Parameters

Parameter	Description
n	Specifies the number of elements of the vectors x and y. n must be at least zero.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least (1+(n-1)*abs(incx))
incx	Specifies the increment for the elements of x. incx must not be zero.
y	UTL_NLA_ARRAY_FLT/DBL of DIMENSION at least (1+(n-1)*abs(incy))
incy	Specifies the increment for the elements of y. incy must not be zero.

287.5.19 BLAS_SYMM Procedures

This procedure performs one of the matrix-matrix operations $C := \alpha * A * B + \beta * C$ or $C := \alpha * B * A + \beta * C$, where alpha and beta are scalars, A is a symmetric matrix, and B and C are m by n matrices.



See Also:

[BLAS Level 3 \(Matrix-Matrix Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_SYMM (
  side   IN      flag,
  uplo   IN      flag,
  m      IN      POSITIVEN,
  n      IN      POSITIVEN,
  alpha  IN      SCALAR_DOUBLE,
  a      IN      UTL_NLA_ARRAY_DBL,
  lda    IN      POSITIVEN,
  b      IN      UTL_NLA_ARRAY_DBL,
  ldb    IN      POSITIVEN,

```

```

beta  IN      SCALAR_DOUBLE,
c     IN OUT  UTL_NLA_ARRAY_DBL,
ldc  IN      POSITIVEN,
pack  IN      flag DEFAULT 'C');

UTL_NLA.BLAS_SYMM (
  side  IN      flag,
  uplo  IN      flag,
  m     IN      POSITIVEN,
  n     IN      POSITIVEN,
  alpha IN      SCALAR_FLOAT,
  a     IN      UTL_NLA_ARRAY_FLT,
  lda   IN      POSITIVEN,
  b     IN      UTL_NLA_ARRAY_FLT,
  ldb   IN      POSITIVEN,
  beta  IN      SCALAR_FLOAT,
  c     IN OUT  UTL_NLA_ARRAY_FLT,
  ldc  IN      POSITIVEN,
  pack  IN      flag DEFAULT 'C');

```

Parameters

Table 287-25 BLAS_SYMM Procedure Parameters

Parameter	Description
side	Specifies whether the symmetric matrix A appears on the left or right in the operation: <ul style="list-style-type: none"> side = 'L' or 'l': $C := \alpha * A * B + \beta * C$ side = 'R' or 'r': $C := \alpha * B * A + \beta * C$
uplo	Specifies whether the upper or lower triangular part of the array A is to be referenced: <ul style="list-style-type: none"> uplo = 'U' or 'u': Only the upper triangular part of the symmetric matrix is to be referenced. uplo = 'L' or 'l': Only the lower triangular part of the symmetric matrix is to be referenced.
m	Specifies the number of rows of the matrix C. m must be at least zero.
n	Specifies the number of columns of the matrix C. n must be at least zero.
alpha	SCALAR_FLOAT/DOUBLE. Specifies the scalar alpha.

Table 287-25 (Cont.) BLAS_SYMM Procedure Parameters

Parameter	Description
a	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, ka) where ka is m when side = 'L' or 'l', and is n otherwise.</p> <p>Before entry with side = 'L' or 'l', the leading m by m part of the array A must contain the symmetric matrix, such that when uplo = 'U' or 'u', the leading m by m upper triangular part of the array A must contain the upper triangular part of the symmetric matrix and the strictly lower triangular part of A is not referenced, and when uplo = 'L' or 'l', the leading m by m lower triangular part of the array A must contain the lower triangular part of the symmetric matrix and the strictly upper triangular part of A is not referenced.</p> <p>Before entry with side = 'R' or 'r', the n by n part of the array A must contain the symmetric matrix, such that when uplo = 'U' or 'u', the leading n by n upper triangular part of the array A must contain the upper triangular part of the symmetric matrix and the strictly lower triangular part of A is not referenced, and when uplo = 'L' or 'l', the leading n by n lower triangular part of the array A must contain the lower triangular part of the symmetric matrix and the strictly upper triangular part of A is not referenced.</p>
lda	<p>Specifies the first dimension of a as declared in the calling (sub) program. When side = 'L' or 'l', lda must be at least max(1, m), otherwise lda must be at least max(1, n).</p>
b	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (ldb, n).</p> <p>Before entry, the leading m by n part of the array B must contain the matrix B.</p>
ldb	<p>Specifies the first dimension of b as declared in the calling (sub) program. ldb must be at least max(1, m).</p>
beta	<p>SCALAR_FLOAT/DOUBLE. Specifies the scalar beta. When beta is supplied as zero then c need not be set on input.</p>
c	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (ldc, n). Before entry, the leading m by n part of the array C must contain the matrix C, except when beta is zero, in which case C need not be set on entry. On exit, the array C is overwritten by the m by n updated matrix.</p>
ldc	<p>Specifies the first dimension of C as declared in the calling (sub) program. ldc must be at least max(1, m).</p>
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> • 'C': column-major (default) • 'R': row-major

287.5.20 BLAS_SYMV Procedures

This procedure performs the matrix-vector operation $y := \alpha * A * x + \beta * y$, where α and β are scalars, x and y are n element vectors and A is an n by n symmetric matrix.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_SYMV (
    uplo   IN        flag,
    n      IN        POSITIVEN,
    alpha  IN        SCALAR_DOUBLE,
    a      IN        UTL_NLA_ARRAY_DBL,
    lda    IN        POSITIVEN,
    x      IN        UTL_NLA_ARRAY_DBL,
    incx   IN        POSITIVEN,
    beta   IN        SCALAR_DOUBLE,
    y      IN OUT    UTL_NLA_ARRAY_DBL,
    incy   IN        POSITIVEN,
    pack   IN        flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_SYMV (
    uplo   IN        flag,
    n      IN        POSITIVEN,
    alpha  IN        SCALAR_FLOAT,
    a      IN        UTL_NLA_ARRAY_FLT,
    lda    IN        POSITIVEN,
    x      IN        UTL_NLA_ARRAY_FLT,
    incx   IN        POSITIVEN,
    beta   IN        SCALAR_FLOAT,
    y      IN OUT    UTL_NLA_ARRAY_FLT,
    incy   IN        POSITIVEN,
    pack   IN        flag DEFAULT 'C');
```

Parameters

Table 287-26 BLAS_SYMV Procedure Parameters

Parameter	Description
uplo	Specifies whether the upper or lower triangular part of the array A is to be referenced: <ul style="list-style-type: none"> uplo = 'U' or 'u'. Only the upper triangular part of A is to be referenced. uplo = 'L' or 'l'. Only the lower triangular part of A is to be referenced.
n	Specifies the order of the matrix A. n must be at least zero.
alpha	SCALAR_FLOAT/DOUBLE. Specifies the scalar alpha.

Table 287-26 (Cont.) BLAS_SYMV Procedure Parameters

Parameter	Description
a	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, n). Before entry with uplo = 'U' or 'u', the leading n by n upper triangular part of the array A must contain the upper triangular part of the symmetric matrix and the strictly lower triangular part of A is not referenced.</p> <p>Before entry with uplo = 'L' or 'l', the leading n by n lower triangular part of the array A must contain the lower triangular part of the symmetric matrix and the strictly upper triangular part of A is not referenced.</p>
lda	Specifies the first dimension of a as declared in the calling (sub) program. lda must be at least max(1, n).
x	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least</p> <p>(1+(n-1)*abs(incx))</p> <p>Before entry, the incremented array X must contain the n element vector x.</p>
incx	Specifies the increment for the elements of x. Must not be zero.
beta	SCALAR_FLOAT/DOUBLE. Specifies the scalar beta. When beta is supplied as zero then y need not be set on input.
y	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least</p> <p>(1+(n-1)*abs(incy))</p> <p>Before entry, the incremented array Y must contain the n element vector y. On exit, Y is overwritten by the updated vector y.</p>
incy	Specifies the increment for the elements of y. Must not be zero.
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> • 'C': column-major (default) • 'R': row-major

287.5.21 BLAS_SYR Procedures

This procedure performs the rank 1 operation $A := \alpha * x * x' + A$, where alpha is a real scalar, x is an n element vector, and A is an n by n symmetric matrix.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_SYR (
    uplo   IN      flag,
    n      IN      POSITIVE,
    alpha  IN      SCALAR_DBL,

```

```

x      IN OUT  UTL_NLA_ARRAY_DBL,
incx   IN      POSITIVEN,
a      IN OUT  UTL_NLA_ARRAY_DBL,
lda    IN      POSITIVEN,
pack   IN      flag DEFAULT 'C');

UTL_NLA.BLAS_SYR (
  uplo  IN      flag,
  n     IN      POSITIVEN,
  alpha IN      SCALAR_FLT,
  x     IN OUT  UTL_NLA_ARRAY_FLT,
  incx  IN      POSITIVEN,
  a     IN OUT  UTL_NLA_ARRAY_FLT,
  lda   IN      POSITIVEN,
  pack  IN      flag DEFAULT 'C');

```

Parameters

Table 287-27 BLAS_SYR Procedure Parameters

Parameter	Description
uplo	Specifies whether the upper or lower triangular part of the array A is to be referenced: <ul style="list-style-type: none"> uplo = 'U' or 'u' : Only the upper triangular part of A is to be referenced. uplo = 'L' or 'l' : Only the lower triangular part of A is to be referenced.
n	Specifies the order of the matrix A. n must be at least zero.
alpha	Specifies the scalar alpha.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1+(n-1)*abs(incx))$ Before entry, the incremented array X must contain the m element vector x.
incx	Specifies the increment for the elements of x. incx must not be zero.
a	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, n) Before entry with uplo = 'U' or 'u', the leading n by n upper triangular part of the array A must contain the upper triangular part of the symmetric matrix and the strictly lower triangular part of A is not referenced. On exit, the upper triangular part of the array A is overwritten by the upper triangular part of the updated matrix. Before entry with uplo = 'L' or 'l', the leading n by n lower triangular part of the array A must contain the lower triangular part of the symmetric matrix and the strictly upper triangular part of A is not referenced. On exit, the lower triangular part of the array A is overwritten by the lower triangular part of the updated matrix.
lda	Specifies the first dimension of a as declared in the calling (sub) program. lda must be at least $\max(1, n)$

Table 287-27 (Cont.) BLAS_SYR Procedure Parameters

Parameter	Description
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.22 BLAS_SYR2 Procedures

This procedure performs the rank 2 operation $A := \alpha x y' + \alpha y x' + A$, where α is a scalar, x and y are n element vectors, and A is an n by n symmetric matrix.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_SYR2 (
    uplo   IN      flag,
    n      IN      POSITIVEN,
    alpha  IN      SCALAR_DBL,
    x      IN      UTL_NLA_ARRAY_DBL,
    incx   IN      POSITIVEN,
    y      IN      UTL_NLA_ARRAY_DBL,
    incy   IN      POSITIVEN,
    a      IN OUT  UTL_NLA_ARRAY_DBL,
    lda    IN      POSITIVEN,
    pack   IN      flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_SYR2 (
    uplo   IN      flag,
    n      IN      POSITIVEN,
    alpha  IN      SCALAR_FLT,
    x      IN      UTL_NLA_ARRAY_FLT,
    incx   IN      POSITIVEN,
    y      IN      UTL_NLA_ARRAY_FLT,
    incy   IN      POSITIVEN,
    a      IN OUT  UTL_NLA_ARRAY_FLT,
    lda    IN      POSITIVEN,
    pack   IN      flag DEFAULT 'C');
```


Parameters

Table 287-28 BLAS_SYR2 Procedure Parameters

Parameter	Description
uplo	Specifies whether the upper or lower triangular part of the array A is to be referenced: <ul style="list-style-type: none"> • uplo = 'U' or 'u' : Only the upper triangular part of A is to be referenced. • uplo = 'L' or 'l' : Only the lower triangular part of A is to be referenced.
n	Specifies the order of the matrix A. n must be at least zero.
alpha	Specifies the scalar alpha.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (n - 1) * \text{abs}(\text{incx}))$ Before entry, the incremented array X must contain the m element vector x.
incx	Specifies the increment for the elements of x. incx must not be zero.
y	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (n - 1) * \text{abs}(\text{incy}))$ Before entry, the incremented array Y must contain the m element vector y.
incy	Specifies the increment for the elements of y. incy must not be zero.
a	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, n) With uplo = 'U' or 'u', the leading n by n upper triangular part of the array A must contain the upper triangular part of the symmetric matrix and the strictly lower triangular part of A is not referenced. On exit, the upper triangular part of the array A is overwritten by the upper triangular part of the updated matrix. With uplo = 'L' or 'l', the leading n by n lower triangular part of the array A must contain the lower triangular part of the symmetric matrix and the strictly upper triangular part of A is not referenced. On exit, the lower triangular part of the array A is overwritten by the lower triangular part of the updated matrix.
lda	Specifies the first dimension of a as declared in the calling (sub) program. lda must be at least $\max(1, n)$
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> • 'C': column-major (default) • 'R': row-major

287.5.23 BLAS_SYR2K Procedures

It performs one of the symmetric rank2 k operations $C := \alpha * A * B' + \alpha * B * A' + \beta * C$ or $C := \alpha * A' * B + \alpha * B' * A + \beta * C$, where alpha and beta are scalars, C is

an n by n symmetric matrix and A and B are n by k matrices in the first case and k by n matrices in the second case.



See Also:

[BLAS Level 3 \(Matrix-Matrix Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_SYR2K (
    uplo   IN      flag,
    trans  IN      flag,
    n      IN      POSITIVEN,
    k      IN      POSITIVEN,
    alpha  IN      SCALAR_DOUBLE,
    a      IN      UTL_NLA_ARRAY_DBL,
    lda    IN      POSITIVEN,
    b      IN      UTL_NLA_ARRAY_DBL,
    ldb    IN      POSITIVEN,
    beta   IN      SCALAR_DOUBLE,
    c      IN OUT  UTL_NLA_ARRAY_DBL,
    ldc    IN      POSITIVEN,
    pack   IN      flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_SYR2K (
    uplo   IN      flag,
    trans  IN      flag,
    n      IN      POSITIVEN,
    k      IN      POSITIVEN,
    alpha  IN      SCALAR_FLOAT,
    a      IN      UTL_NLA_ARRAY_FLT,
    lda    IN      POSITIVEN,
    b      IN OUT  UTL_NLA_ARRAY_FLT,
    ldb    IN      POSITIVEN,
    beta   IN      SCALAR_FLOAT,
    c      IN OUT  UTL_NLA_ARRAY_FLT,
    ldc    IN      POSITIVEN,
    pack   IN      flag DEFAULT 'C');
```

Parameters

Table 287-29 BLAS_SYR2K Procedure Parameters

Parameter	Description
uplo	Specifies whether the upper or lower triangular part of the array C is to be referenced: <ul style="list-style-type: none"> uplo = 'U' or 'u' : Only the upper triangular part of C is to be referenced. uplo = 'L' or 'l' : Only the lower triangular part of C is to be referenced.

Table 287-29 (Cont.) BLAS_SYR2K Procedure Parameters

Parameter	Description
trans	<p>Specifies the operations to be performed:</p> <ul style="list-style-type: none"> trans = 'N' or 'n': $C := \alpha * A * B' + \alpha * B * A' + \beta * C$ trans = 'T' or 't': $C := \alpha * A' * B + \alpha * B' * A + \beta * C$ trans = 'C' or 'c': $C := \alpha * A' * B + \alpha * B' * A + \beta * C$
n	Specifies the order of matrix C. n must be at least zero.
k	On entry with trans = 'N' or 'n', k specifies the number of columns of the matrices A and B. On entry with trans = 'T' or 't' or trans = 'C' or 'c', k specifies the number of rows of the matrices A and B. k must be at least zero.
alpha	SCALAR_FLOAT/DOUBLE. Specifies the scalar alpha.
a	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, ka) where kb is k when trans = 'N' or 'n', and is n otherwise.</p> <p>Before entry with trans = 'N' or 'n', the leading n by k part of the array A must contain the matrix A, otherwise the leading k by n part of the array A must contain the matrix A.</p>
lda	Specifies the first dimension of a as declared in the calling (sub) program. When trans = 'N' or 'n', lda must be at least $\max(1, n)$, otherwise lda must be at least $\max(1, k)$.
b	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, kb) where kb is k when trans = 'N' or 'n', and is n otherwise.</p> <p>Before entry with trans = 'N' or 'n', the leading n by k part of the array B must contain the matrix B, otherwise the leading k by n part of the array B must contain the matrix B.</p>
ldb	Specifies the first dimension of b as declared in the calling (sub) program. When trans = 'N' or 'n', ldb must be at least $\max(1, n)$, otherwise ldb must be at least $\max(1, k)$.
beta	SCALAR_FLOAT/DOUBLE. Specifies the scalar beta.
c	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (ldc, n).</p> <p>Before entry with uplo = 'U' or 'u', the leading n by n upper triangular part of the array C must contain the upper triangular part of the symmetric matrix and the strictly lower triangular part of C is not referenced. On exit, the upper triangular part of the array C is overwritten by the upper triangular part of the updated matrix.</p> <p>Before entry with uplo = 'L' or 'l', the leading n by n lower triangular part of the array C must contain the lower triangular part of the symmetric matrix and the strictly upper triangular part of C is not referenced. On exit, the lower triangular part of the array C is overwritten by the lower triangular part of the updated matrix.</p>
ldc	Specifies the first dimension of C as declared in the calling (sub) program. ldc must be at least $\max(1, n)$.

Table 287-29 (Cont.) BLAS_SYR2K Procedure Parameters

Parameter	Description
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.24 BLAS_SYRK Procedures

This procedure performs one of the symmetric rank k operations $C := \alpha * A * A' + \beta * C$ or $C := \alpha * A' * A + \beta * C$, where α and β are scalars, C is an n by n symmetric matrix and A is an n by k matrix in the first case and a k by n matrix in the second case.



See Also:

[BLAS Level 3 \(Matrix-Matrix Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_SYRK (
  uplo   IN      flag,
  trans  IN      flag,
  n      IN      POSITIVEN,
  k      IN      POSITIVEN,
  alpha  IN      SCALAR_DOUBLE,
  a      IN      UTL_NLA_ARRAY_DBL,
  lda   IN      POSITIVEN,
  beta   IN      SCALAR_DOUBLE,
  c      IN OUT  UTL_NLA_ARRAY_DBL,
  ldc   IN      POSITIVEN,
  pack   IN      flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_SYRK (
  uplo   IN      flag,
  trans  IN      flag,
  n      IN      POSITIVEN,
  k      IN      POSITIVEN,
  alpha  IN      SCALAR_FLOAT,
  a      IN      UTL_NLA_ARRAY_FLT,
  lda   IN      POSITIVEN,
  beta   IN      SCALAR_FLOAT,
  c      IN OUT  UTL_NLA_ARRAY_DBL,
  ldc   IN      POSITIVEN,
  pack   IN      flag DEFAULT 'C');
```

Parameters

Table 287-30 BLAS_SYRK Procedure Parameters

Parameter	Description
uplo	Specifies whether the upper or lower triangular part of the array C is to be referenced: <ul style="list-style-type: none"> uplo = 'U' or 'u' : Only the upper triangular part of C is to be referenced. uplo = 'L' or 'l' : Only the lower triangular part of C is to be referenced.
trans	Specifies the operations to be performed: <ul style="list-style-type: none"> trans = 'N' or 'n' : $C := \alpha * A * A' + \beta * C$ trans = 'T' or 't' : $C := \alpha * A' * A + \beta * C$ trans = 'C' or 'c' : $C := \alpha * A * A + \beta * C$
n	Specifies the order of matrix C. n must be at least zero.
k	On entry with trans = 'N' or 'n', k specifies the number of columns of the matrix A. On entry with trans = 'T' or 't' or trans = 'C' or 'c', k specifies the number of rows of the matrix A. k must be at least zero.
alpha	SCALAR_FLOAT/DOUBLE. Specifies the scalar alpha.
a	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, ka) where ka is k when trans = 'N' or 'n', and is n otherwise. Before entry with trans = 'N' or 'n', the leading n by k part of the array A must contain the matrix A, otherwise the leading k by n part of the array A must contain the matrix A.
lda	Specifies the first dimension of a as declared in the calling (sub) program. When trans = 'N' or 'n', lda must be at least $\max(1, n)$, otherwise lda must be at least $\max(1, k)$.
beta	SCALAR_FLOAT/DOUBLE. Specifies the scalar beta.
c	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (ldc, n). Before entry with uplo = 'U' or 'u', the leading n by n upper triangular part of the array C must contain the upper triangular part of the symmetric matrix and the strictly lower triangular part of C is not referenced. On exit, the upper triangular part of the array C is overwritten by the upper triangular part of the updated matrix. Before entry with uplo = 'L' or 'l', the leading n by n lower triangular part of the array C must contain the lower triangular part of the symmetric matrix and the strictly upper triangular part of C is not referenced. On exit, the lower triangular part of the array C is overwritten by the lower triangular part of the updated matrix.
ldc	Specifies the first dimension of C as declared in the calling (sub) program. ldc must be at least $\max(1, n)$.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.25 BLAS_TBMV Procedures

This procedure performs the matrix-vector operations $x := A*x$ or $x := A'*x$, where x is an n element vector and A is an n by n unit, or non-unit, upper or lower triangular band matrix, with $(k+1)$ diagonals.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_TBMV (
  uplo   IN      flag,
  trans  IN      flag,
  diag   IN      flag,
  n       IN      POSITIVE,
  k       IN      NATURAL,
  a       IN      UTL_NLA_ARRAY_DBL,
  lda    IN      POSITIVE,
  x       IN OUT  UTL_NLA_ARRAY_DBL,
  incx   IN      POSITIVE,
  pack   IN      flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_TBMV (
  uplo   IN      flag,
  trans  IN      flag,
  diag   IN      flag,
  n       IN      POSITIVE,
  k       IN      NATURAL,
  a       IN      UTL_NLA_ARRAY_FLT,
  lda    IN      POSITIVE,
  x       IN OUT  UTL_NLA_ARRAY_FLT,
  incx   IN      POSITIVE,
  pack   IN      flag DEFAULT 'C');
```

Parameters

Table 287-31 BLAS_TBMV Procedure Parameters

Parameter	Description
uplo	Specifies whether the matrix is an upper or lower triangular matrix: <ul style="list-style-type: none"> uplo = 'U' or 'u'. A is an upper triangular matrix. uplo = 'L' or 'l'. A is a lower triangular matrix.
trans	Specifies the operation to be performed: <ul style="list-style-type: none"> trans = 'N' or 'n' $x := A*x$ trans = 'T' or 't' $x := A'*x$ trans = 'C' or 'c' $x := A'*x$

Table 287-31 (Cont.) BLAS_TBMV Procedure Parameters

Parameter	Description
diag	<p>Specifies whether or not A is unit triangular:</p> <ul style="list-style-type: none"> diag = 'U' or 'u'. A is assumed to be unit triangular. diag = 'N' or 'n'. A is not assumed to be unit triangular.
n	Specifies the order of the matrix A. n must be at least zero.
k	<p>Specifies whether or not A is unit triangular:</p> <ul style="list-style-type: none"> with uplo = 'U' or 'u', K specifies the number of super-diagonals of the matrix A. with uplo = 'L' or 'l', K specifies the number of sub-diagonals of the matrix A. <p>K must satisfy 0 ≤ k.</p>
a	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, n).</p> <p>Before entry with uplo = 'U' or 'u', the leading (k+1) by n part of the array A must contain the upper triangular band part of the matrix of coefficients, supplied column by column, with the leading diagonal of the matrix in row (k+1) of the array, the first super-diagonal starting at position 2 in row k, and so on. The top left k by k triangle of the array A is not referenced.</p> <p>Before entry with uplo = 'L' or 'l', the leading (k+1) by n part of the array A must contain the lower triangular band part of the matrix of coefficients, supplied column by column, with the leading diagonal of the matrix in row 1 of the array, the first sub-diagonal starting at position 1 in row 2, and so on. The bottom right k by k triangle of the array A is not referenced.</p> <p>Note that when diag = 'U' or 'u', the elements of the array A corresponding to the diagonal elements of the matrix are not referenced, but are assumed to be unity.</p>
lda	Specifies the first dimension of a as declared in the calling (sub) program. lda must be at least (k+1).
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least (1+(n-1)*abs(incx)). Before entry, the incremented array X must contain the n element vector x. On exit, X is overwritten with the transformed vector x.
incx	Specifies the increment for the elements of x. Must not be zero.
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.26 BLAS_TBSV Procedures

This procedure solves one of the systems of equations $A*x = b$ or $A'*x = b$, where b and x are n element vectors and A is an n by n unit, or non-unit, upper or lower triangular band matrix, with $(k+1)$ diagonals.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_TBSV (
    uplo   IN      flag,
    trans  IN      flag,
    diag   IN      flag,
    n      IN      POSITIVEN,
    k      IN      NATURALN,
    a      IN      UTL_NLA_ARRAY_DBL,
    lda    IN      POSITIVEN,
    x      IN OUT  UTL_NLA_ARRAY_DBL,
    incx   IN      POSITIVEN,
    pack   IN      flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_STBSV (
    uplo   IN      flag,
    trans  IN      flag,
    diag   IN      flag,
    n      IN      POSITIVEN,
    k      IN      NATURALN,
    a      IN      UTL_NLA_ARRAY_FLT,
    lda    IN      POSITIVEN,
    x      IN OUT  UTL_NLA_ARRAY_FLT,
    incx   IN      POSITIVEN,
    pack   IN      flag DEFAULT 'C');
```

Parameters

Table 287-32 BLAS_TBSV Procedure Parameters

Parameter	Description
uplo	Specifies whether the matrix is an upper or lower triangular matrix: <ul style="list-style-type: none"> uplo = 'U' or 'u'. A is an upper triangular matrix. uplo = 'L' or 'l'. A is a lower triangular matrix.
trans	Specifies the equations to be solved: <ul style="list-style-type: none"> trans = 'N' or 'n': $A*x = b$ trans = 'T' or 't': $A'*x = b$ trans = 'C' or 'c': $A'*x = b$

Table 287-32 (Cont.) BLAS_TBSV Procedure Parameters

Parameter	Description
diag	<p>Specifies whether or not A is unit triangular:</p> <ul style="list-style-type: none"> diag = 'U' or 'u' : A is assumed to be unit triangular. diag = 'N' or 'n' : A is not assumed to be unit triangular.
n	Specifies the order of the matrix A. n must be at least zero.
k	<p>Specifies whether or not A is unit triangular:</p> <ul style="list-style-type: none"> with uplo = 'U' or 'u', K specifies the number of super-diagonals of the matrix A. with uplo = 'L' or 'l', K specifies the number of sub-diagonals of the matrix A. <p>K must satisfy 0 ≤ k.</p>
a	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda,n).</p> <p>Before entry with uplo = 'U' or 'u', the leading (k+1) by n part of the array A must contain the upper triangular band part of the matrix of coefficients, supplied column by column, with the leading diagonal of the matrix in row (k+1) of the array, the first super-diagonal starting at position 2 in row k, and so on. The top left k by k triangle of the array A is not referenced.</p> <p>Before entry with uplo = 'L' or 'l', the leading (k+1) by n part of the array A must contain the lower triangular band part of the matrix of coefficients, supplied column by column, with the leading diagonal of the matrix in row 1 of the array, the first sub-diagonal starting at position 1 in row 2, and so on. The bottom right k by k triangle of the array A is not referenced.</p> <p>Note that when diag = 'U' or 'u', the elements of the array A corresponding to the diagonal elements of the matrix are not referenced, but are assumed to be unity.</p>
lda	On entry, lda specifies the first dimension of A as declared in the calling (sub) program. lda must be at least (k+1).
x	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least</p> $(1 + (n - 1) * \text{abs}(\text{incx}))$ <p>Before entry, the incremented array X must contain the n element right-hand side vector b.</p> <p>On exit, X is overwritten with the solution vector x.</p>
incx	Specifies the increment for the elements of x. incx must not be zero.
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

Usage Notes

No test for singularity or near-singularity is included in this routine. Such tests must be performed before calling this routine.

287.5.27 BLAS_TPMV Procedures

This procedure performs the matrix-vector operations $x := A*x$ or $x := A'*x$, where x is an n element vector and A is an n by n unit, or non-unit, upper or lower triangular matrix, supplied in packed form.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_TPMV (
    uplo   IN      flag,
    trans  IN      flag,
    diag   IN      flag,
    n      IN      POSITIVEN,
    ap     IN      UTL_NLA_ARRAY_DBL,
    x      IN OUT  UTL_NLA_ARRAY_DBL,
    incx   IN      POSITIVEN,
    pack   IN      flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_TBMV (
    uplo   IN      flag,
    trans  IN      flag,
    diag   IN      flag,
    n      IN      POSITIVEN,
    ap     IN      UTL_NLA_ARRAY_FLT,
    x      IN OUT  UTL_NLA_ARRAY_FLT,
    incx   IN      POSITIVEN,
    pack   IN      flag DEFAULT 'C');
```

Parameters

Table 287-33 BLAS_TPMV Procedure Parameters

Parameter	Description
uplo	Specifies whether the matrix is an upper or lower triangular matrix: <ul style="list-style-type: none"> uplo = 'U' or 'u'. A is an upper triangular matrix. uplo = 'L' or 'l'. A is a lower triangular matrix.
trans	Specifies the operation to be performed: <ul style="list-style-type: none"> trans = 'N' or 'n' $x := A*x$ trans = 'T' or 't' $x := A'*x$ trans = 'C' or 'c' $x := A'*x$
diag	Specifies whether or not A is unit triangular: <ul style="list-style-type: none"> diag = 'U' or 'u'. A is assumed to be unit triangular. diag = 'N' or 'n'. A is not assumed to be unit triangular.
n	Specifies the order of the matrix A. n must be at least zero.

Table 287-33 (Cont.) BLAS_TPMV Procedure Parameters

Parameter	Description
ap	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda,n).</p> <p>Before entry with uplo = 'U' or 'u', the leading (k+1) by n part of the array A must contain the upper triangular band part of the matrix of coefficients, supplied column by column, with the leading diagonal of the matrix in row (k+1) of the array, the first super-diagonal starting at position 2 in row k, and so on. The top left k by k triangle of the array A is not referenced.</p> <p>Before entry with uplo = 'L' or 'l', the leading (k+1) by n part of the array A must contain the lower triangular band part of the matrix of coefficients, supplied column by column, with the leading diagonal of the matrix in row 1 of the array, the first sub-diagonal starting at position 1 in row 2, and so on. The bottom right k by k triangle of the array A is not referenced.</p> <p>Note that when diag = 'U' or 'u', the elements of the array A corresponding to the diagonal elements of the matrix are not referenced, but are assumed to be unity.</p>
x	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least (1+(n-1)*abs(incx)). Before entry, the incremented array X must contain the n element vector x. On exit, X is overwritten with the transformed vector x.</p>
incx	Specifies the increment for the elements of x. Must not be zero.
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.28 BLAS_TPSV Procedures

This procedure solves one of the systems of equations $A*x = b$ or $A'*x = b$, where b and x are n element vectors and A is an n by n unit, or non-unit, upper or lower triangular matrix, supplied in packed form.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.BLAS_TPSV (
  uplo   IN      flag,
  trans  IN      flag,
  diag   IN      flag,
  n      IN      POSITIVEN,
  ap     IN      UTL_NLA_ARRAY_DBL,
  x      IN OUT  UTL_NLA_ARRAY_DBL,
  incx   IN      POSITIVEN,
  pack   IN      flag DEFAULT 'C');

```

```

UTL_NLA.BLAS_TPSV (
  uplo  IN      flag,
  trans IN      flag,
  diag  IN      flag,
  n     IN      POSITIVEN,
  ap    IN      UTL_NLA_ARRAY_FLT,
  x     IN OUT  UTL_NLA_ARRAY_FLT,
  incx  IN      POSITIVEN,
  pack  IN      flag DEFAULT 'C');

```

Parameters

Table 287-34 BLAS_TPSV Procedure Parameters

Parameter	Description
uplo	Specifies whether the matrix is an upper or lower triangular matrix: <ul style="list-style-type: none"> uplo = 'U' or 'u' : A is an upper triangular matrix. uplo = 'L' or 'l' : A is a lower triangular matrix.
trans	Specifies the operation to be performed: <ul style="list-style-type: none"> trans = 'N' or 'n' : $A*x = b$ trans = 'T' or 't' : $A'*x = b$ trans = 'C' or 'c' : $A'*x = b$
diag	Specifies whether or not A is unit triangular: <ul style="list-style-type: none"> diag = 'U' or 'u' : A is assumed to be unit triangular. diag = 'N' or 'n' : A is not assumed to be unit triangular.
n	Specifies the order of the matrix A. n must be at least zero.
ap	UTL_NLA_ARRAY_FLT/DBL of dimension at least $((n*(n+1))/2)$ Before entry with uplo = 'U' or 'u', the array ap must contain the upper triangular matrix packed sequentially, column by column, so that ap(1) contains a(1,1), ap(2) and ap(3) contain a(1,2) and a(2,2) respectively, and so on. Before entry with uplo = 'L' or 'l', the array ap must contain the lower triangular matrix packed sequentially, column by column, so that ap(1) contains a(1,1), ap(2) and ap(3) contain a(2,1) and a(3,1) respectively, and so on. Note that when diag = 'U' or 'u', the diagonal elements of A are not referenced, but are assumed to be unity.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1 + (n - 1) * \text{abs}(incx))$ Before entry, the incremented array X must contain the n element right-hand side vector b. On exit, X is overwritten with the solution vector x.
incx	Specifies the increment for the elements of x. incx must not be zero.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

Usage Notes

No test for singularity or near-singularity is included in this routine. Such tests must be performed before calling this routine.

287.5.29 BLAS_TRMM Procedures

This procedure performs a matrix-matrix operation.

It performs one of the following matrix-matrix operations:

```
B := alpha*op( A )*B
```

or

```
B := alpha*B*op( A )
```

where `alpha` is a scalar, `B` is an `m` by `n` matrix, `A` is a unit, or non-unit, upper or lower triangular matrix and `op(A)` is one of

```
op( A ) = A
```

or

```
op( A ) = A'
```



See Also:

[BLAS Level 3 \(Matrix-Matrix Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_TRMM (
    side   IN      flag,
    uplo   IN      flag,
    transa IN      flag,
    diag   IN      flag,
    m      IN      POSITIVEN,
    n      IN      POSITIVEN,
    alpha  IN      SCALAR_DOUBLE,
    a      IN      UTL_NLA_ARRAY_DBL,
    lda    IN      POSITIVEN,
    b      IN OUT  UTL_NLA_ARRAY_DBL,
    ldb    IN      POSITIVEN,
    pack   IN      flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_TRMM (
    side   IN      flag,
    uplo   IN      flag,
    transa IN      flag,
    diag   IN      flag,
    m      IN      POSITIVEN,
    n      IN      POSITIVEN,
    alpha  IN      SCALAR_FLOAT,
    a      IN      UTL_NLA_ARRAY_FLT,
```

```

lda   IN      POSITIVEN,
b     IN OUT  UTL_NLA_ARRAY_FLT,
ldb   IN      POSITIVEN,
pack  IN      flag DEFAULT 'C');

```

Parameters

Table 287-35 BLAS_TRMM Procedure Parameters

Parameter	Description
side	Specifies whether the symmetric matrix A appears on the left or right in the operation: <ul style="list-style-type: none"> side = 'L' or 'l' : B := alpha*op(A)*B side = 'R' or 'r' : B := alpha*B*op(A)
uplo	Specifies whether the upper or lower triangular part of the array A is to be referenced: <ul style="list-style-type: none"> uplo = 'U' or 'u' : A is an upper triangular matrix. uplo = 'L' or 'l' : A is a lower triangular matrix.
transa	Specifies the form of op(A) to be used in the matrix multiplication as follows: <ul style="list-style-type: none"> transa = 'N' or 'n' : op(A) = A transa = 'T' or 't' : op(A) = A' transa = 'C' or 'c' : op(A) = A'
diag	Specifies whether or not A is unit triangular: <ul style="list-style-type: none"> diag = 'U' or 'u' . A is assumed to be unit triangular. diag = 'N' or 'n' . A is not assumed to be unit triangular.
m	Specifies the number of rows of the B. m must be at least zero.
n	Specifies the number of columns of B. n must be at least zero.
alpha	SCALAR_FLOAT/DOUBLE. Specifies the scalar alpha. When alpha is zero then A is not referenced and B need not be set before entry.
a	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda,k) where k is m when side = 'L' or 'l', and is n when side = 'R' or 'r'. Before entry with uplo = 'U' or 'u', the leading k by k upper triangular part of the array A must contain the upper triangular matrix, and the strictly lower triangular part of A is not referenced. Before entry with uplo = 'L' or 'l', the leading k by k lower triangular part of the array A must contain the lower triangular matrix and the strictly upper triangular part of A is not referenced. Note that when diag = 'U' or 'u', the diagonal elements of A are not referenced either, but are assumed to be unity.
lda	Specifies the first dimension of a as declared in the calling (sub) program. When side = 'L' or 'l', lda must be at least max(1,m), otherwise lda must be at least max(1,n).
b	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (ldb,n). Before entry, the leading m by n part of the array B must contain the matrix B, and on exit is overwritten by the transformed matrix.
ldb	Specifies the first dimension of b as declared in the calling (sub) program. ldb must be at least max(1,m).

Table 287-35 (Cont.) BLAS_TRMM Procedure Parameters

Parameter	Description
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.30 BLAS_TRMV Procedures

This procedure performs the matrix-vector operations $x := A*x$ or $x := A'*x$, where x is an n element vector and A is an n by n unit, or non-unit, upper or lower triangular matrix.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_TRMV (
  uplo  IN      flag,
  trans IN      flag,
  diag  IN      flag,
  n     IN      POSITIVEN,
  a     IN      UTL_NLA_ARRAY_DBL,
  lda   IN      POSITIVEN,
  x     IN OUT  UTL_NLA_ARRAY_DBL,
  incx  IN      POSITIVEN,
  pack  IN      flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_TRMV (
  uplo  IN      flag,
  trans IN      flag,
  diag  IN      flag,
  n     IN      POSITIVEN,
  a     IN      UTL_NLA_ARRAY_FLT,
  lda   IN      POSITIVEN,
  x     IN OUT  UTL_NLA_ARRAY_FLT,
  incx  IN      POSITIVEN,
  pack  IN      flag DEFAULT 'C');
```

Parameters

Table 287-36 BLAS_TRMV Procedure Parameters

Parameter	Description
uplo	Specifies whether the matrix is an upper or lower triangular matrix: <ul style="list-style-type: none"> uplo = 'U' or 'u'. A is an upper triangular matrix. uplo = 'L' or 'l'. A is a lower triangular matrix.

Table 287-36 (Cont.) BLAS_TRMV Procedure Parameters

Parameter	Description
trans	Specifies the operation to be performed: <ul style="list-style-type: none"> trans = 'N' or 'n': $x := A*x$ trans = 'T' or 't': $x := A^T*x$ trans = 'C' or 'c': $x := A^H*x$
diag	Specifies whether or not A is unit triangular: <ul style="list-style-type: none"> diag = 'U' or 'u': A is assumed to be unit triangular. diag = 'N' or 'n': A is not assumed to be unit triangular.
n	Specifies the order of the matrix A. n must be at least zero.
a	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, n). Before entry with uplo = 'U' or 'u', the leading n by n upper triangular part of the array A must contain the upper triangular matrix and the strictly lower triangular part of A is not referenced. Before entry with uplo = 'L' or 'l', the leading n by n lower triangular part of the array A must contain the lower triangular matrix and the strictly upper triangular part of A is not referenced. Note that when diag = 'U' or 'u', the diagonal elements of A are not referenced either, but are assumed to be unity
lda	Specifies the first dimension of a as declared in the calling (sub) program. lda must be at least $\max(1, n)$.
x	UTL_NLA_ARRAY_FLT/DBL of dimension at least $(1+(n-1)*as(incx))$. Before entry, the incremented array X must contain the n element vector x.
incx	Specifies the increment for the elements of x. Must not be zero.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.31 BLAS_TRSM Procedures

This procedure performs a matrix-matrix operation.

It performs one of the matrix-matrix operations:

$$\text{op}(A) * X = \alpha * B$$

or

$$X * \text{op}(A) = \alpha * B$$

where alpha is a scalar, X and B are m by n matrices, A is a unit, or non-unit, upper or lower triangular matrix and op(A) is one of

$$\text{op}(A) = A$$

or

$$\text{op}(A) = A^T$$

The matrix X is overwritten on B.



See Also:

[BLAS Level 3 \(Matrix-Matrix Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_TRSM (
    side   IN      flag,
    uplo   IN      flag,
    transa IN      flag,
    diag   IN      flag,
    m      IN      POSITIVEN,
    n      IN      POSITIVEN,
    alpha  IN      SCALAR_DOUBLE,
    a      IN      UTL_NLA_ARRAY_DBL,
    lda    IN      POSITIVEN,
    b      IN OUT  UTL_NLA_ARRAY_DBL,
    ldb    IN      POSITIVEN,
    pack   IN      flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_TRSM (
    side   IN      flag,
    uplo   IN      flag,
    transa IN      flag,
    diag   IN      flag,
    m      IN      POSITIVEN,
    n      IN      POSITIVEN,
    alpha  IN      SCALAR_FLOAT,
    a      IN      UTL_NLA_ARRAY_FLT,
    lda    IN      POSITIVEN,
    b      IN OUT  UTL_NLA_ARRAY_FLT,
    ldb    IN      POSITIVEN,
    pack   IN      flag DEFAULT 'C');
```

Parameters

Table 287-37 BLAS_TRSM Procedure Parameters

Parameter	Description
side	Specifies whether the symmetric matrix A appears on the left or right in the operation: <ul style="list-style-type: none"> side = 'L' or 'l': $op(A) * X = alpha * B$ side = 'R' or 'r': $X * op(A) = alpha * B$
uplo	Specifies whether the upper or lower triangular part of the array A is to be referenced: <ul style="list-style-type: none"> uplo = 'U' or 'u': A is an upper triangular matrix. uplo = 'L' or 'l': A is a lower triangular matrix.

Table 287-37 (Cont.) BLAS_TRSM Procedure Parameters

Parameter	Description
transa	Specifies the form of $op(A)$ to be used in the matrix multiplication as follows: <ul style="list-style-type: none"> transa = 'N' or 'n': $op(A) = A$ transa = 'T' or 't': $op(A) = A'$ transa = 'C' or 'c': $op(A) = A^{-1}$
diag	Specifies whether or not A is unit triangular: <ul style="list-style-type: none"> diag = 'U' or 'u'. A is assumed to be unit triangular. diag = 'N' or 'n'. A is not assumed to be unit triangular.
m	Specifies the number of rows of the B. m must be at least zero.
n	Specifies the number of columns of B. n must be at least zero.
alpha	SCALAR_FLOAT/DOUBLE. Specifies the scalar alpha. When alpha is zero then A is not referenced and B need not be set before entry.
a	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, k) where k is m when side = 'L' or 'l', and is n when side = 'R' or 'r'. Before entry with uplo = 'U' or 'u', the leading k by k upper triangular part of the array A must contain the upper triangular matrix, and the strictly lower triangular part of A is not referenced. Before entry with uplo = 'L' or 'l', the leading k by k lower triangular part of the array A must contain the lower triangular matrix and the strictly upper triangular part of A is not referenced. Note that when diag = 'U' or 'u', the diagonal elements of A are not referenced either, but are assumed to be unity.
lda	Specifies the first dimension of a as declared in the calling (sub) program. When side = 'L' or 'l', lda must be at least $\max(1, m)$, otherwise lda must be at least $\max(1, n)$.
b	UTL_NLA_ARRAY_FLT/DBL of DIMENSION (ldb, n). Before entry, the leading m by n part of the array B must contain the matrix B, and on exit is overwritten by the solution matrix X.
ldb	Specifies the first dimension of b as declared in the calling (sub) program. ldb must be at least $\max(1, m)$.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.32 BLAS_TRSV Procedures

This procedure solves one of the systems of equations $A*x = b$ or $A'*x = b$, where b and x are n element vectors and A is an n by n unit, or non-unit, upper or lower triangular matrix.



See Also:

[BLAS Level 2 \(Matrix-Vector Operations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.BLAS_TRSV (
  uplo   IN      flag,
  trans  IN      flag,
  diag   IN      flag,
  n      IN      POSITIVE,
  a      IN      UTL_NLA_ARRAY_DBL,
  lda    IN      POSITIVE,
  x      IN OUT  UTL_NLA_ARRAY_DBL,
  incx   IN      POSITIVE,
  pack   IN      flag DEFAULT 'C');
```

```
UTL_NLA.BLAS_TRSV (
  uplo   IN      flag,
  trans  IN      flag,
  diag   IN      flag,
  n      IN      POSITIVE,
  a      IN      UTL_NLA_ARRAY_FLT,
  lda    IN      POSITIVE,
  x      IN OUT  UTL_NLA_ARRAY_FLT,
  incx   IN      POSITIVE,
  pack   IN      flag DEFAULT 'C');
```

Parameters

Table 287-38 BLAS_TRSV Procedure Parameters

Parameter	Description
uplo	Specifies whether the matrix is an upper or lower triangular matrix: <ul style="list-style-type: none"> uplo = 'U' or 'u'. A is an upper triangular matrix. uplo = 'L' or 'l'. A is a lower triangular matrix.
trans	Specifies the operation to be performed: <ul style="list-style-type: none"> trans = 'N' or 'n'. $A*x = b$ trans = 'T' or 't'. $A'*x = b$ trans = 'C' or 'c'. $A'*x = b$
diag	Specifies whether or not A is unit triangular: <ul style="list-style-type: none"> diag = 'U' or 'u'. A is assumed to be unit triangular. diag = 'N' or 'n'. A is not assumed to be unit triangular.
n	Specifies the order of the matrix A. n must be at least zero.

Table 287-38 (Cont.) BLAS_TRSV Procedure Parameters

Parameter	Description
a	<p>UTL_NLA_ARRAY_FLT/DBL of DIMENSION (lda, n).</p> <p>Before entry with <code>uplo = 'U'</code> or <code>'u'</code>, the leading <code>n</code> by <code>n</code> upper triangular part of the array <code>A</code> must contain the upper triangular matrix and the strictly lower triangular part of <code>A</code> is not referenced.</p> <p>Before entry with <code>uplo = 'L'</code> or <code>'l'</code>, the leading <code>n</code> by <code>n</code> lower triangular part of the array <code>A</code> must contain the lower triangular matrix and the strictly upper triangular part of <code>A</code> is not referenced.</p> <p>Note that when <code>diag = 'U'</code> or <code>'u'</code>, the diagonal elements of <code>A</code> are not referenced either, but are assumed to be unity.</p>
lda	<p>Specifies the first dimension of <code>A</code> as declared in the calling (sub) program. <code>lda</code> must be at least <code>max(1, n)</code>.</p>
x	<p>UTL_NLA_ARRAY_FLT/DBL of dimension at least</p> $(1 + (n - 1) * \text{abs}(\text{incx}))$ <p>Before entry, the incremented array <code>X</code> must contain the <code>n</code> element right-hand side vector <code>b</code>. On exit, <code>X</code> is overwritten with the solution vector <code>x</code>.</p>
incx	<p>Specifies the increment for the elements of <code>x</code>. Must not be zero.</p>
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> • 'C': column-major (default) • 'R': row-major

Usage Notes

No test for singularity or near-singularity is included in this routine. Such tests must be performed before calling this routine.

287.5.33 LAPACK_GBSV Procedures

This procedure computes the solution to a real system of linear equations $a * x = b$, where `a` is a band matrix of order `n` with `kl` sub diagonals and `ku` superdiagonals, and `x` and `b` are `n` by `nrhs` matrices.

The LU decomposition with partial pivoting and row interchanges is used to factor `A` as

$$a = L * U$$

where `L` is a product of permutation and unit lower triangular matrices with `kl` sub diagonals, and `U` is upper triangular with `kl+ku` superdiagonals. The factored form of `a` is then used to solve the system of equations

$$a * x = b$$



See Also:

[LAPACK Driver Routines \(Linear Equations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_GBSV (
  n      IN      POSITIVEN,
  kl     IN      NATURALN,
  ku     IN      NATURALN,
  nrhs   IN      POSITIVEN,
  ab     IN OUT  UTL_NLA_ARRAY_DBL,
  ldab   IN      POSITIVEN,
  ipiv   IN OUT  UTL_NLA_ARRAY_INT,
  b      IN OUT  UTL_NLA_ARRAY_DBL,
  ldb    IN      POSITIVEN,
  info   OUT    INTEGER,
  pack   IN      flag DEFAULT 'C');

```

```

UTL_NLA.LAPACK_GBSV (
  n      IN      POSITIVEN,
  kl     IN      NATURALN,
  ku     IN      NATURALN,
  nrhs   IN      POSITIVEN,
  ab     IN OUT  UTL_NLA_ARRAY_FLT,
  ldab   IN      POSITIVEN,
  ipiv   IN OUT  UTL_NLA_ARRAY_INT,
  b      IN OUT  UTL_NLA_ARRAY_FLT,
  ldb    IN      POSITIVEN,
  info   OUT    INTEGER,
  pack   IN      flag DEFAULT 'C');

```

Parameters

Table 287-39 LAPACK_GBSV Procedure Parameters

Parameter	Description
n	The number of linear equations, equivalent to the order of the matrix <i>a</i> . <i>n</i> >= 0
kl	The number of sub diagonals within the band of <i>a</i> . <i>kl</i> >= 0.
ku	The number of superdiagonals within the band of <i>a</i> . <i>ku</i> >= 0.
nrhs	The number of right-hand sides, which is the number of columns of the matrix <i>b</i> . <i>nrhs</i> >= 0.
ab	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldab, n). On entry, the matrix <i>a</i> in band storage, in rows <i>kl</i> +1 to 2* <i>kl</i> + <i>ku</i> +1; rows 1 to <i>kl</i> of the array need not be set. The <i>j</i> -th column of <i>A</i> is stored in the <i>j</i> -th column of the array <i>ab</i> : $ab(kl+ku+1+i-j, j) = a(i, j)$ for $\max(1, j-ku) \leq i \leq \min(n, j+kl)$ On exit, details of the factorization: <i>U</i> is stored as an upper triangular band matrix with <i>kl</i> + <i>ku</i> superdiagonals in rows 1 to <i>kl</i> + <i>ku</i> +1, and the multipliers used during the factorization are stored in rows: <i>kl</i> + <i>ku</i> +2 to 2* <i>kl</i> + <i>ku</i> +1
ldab	The leading dimension of the array <i>ab</i> . <i>ldab</i> >= 2* <i>kl</i> + <i>ku</i> +1

Table 287-39 (Cont.) LAPACK_GBSV Procedure Parameters

Parameter	Description
ipiv	INTEGER array, DIMENSION (n). The pivot indices that define the permutation matrix P; row i of the matrix was interchanged with row ipiv(i).
b	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldb, nrhs). On entry, the n by nrhs matrix of right hand side matrix b. On exit, if info = 0, the n by nrhs solution matrix X.
ldb	The leading dimension of the array b. ldb >= max(1, n)
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, U(i,i) is exactly zero. The factorization has been completed, but the factor U is exactly singular, and the solution has not been computed
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.34 LAPACK_GEES Procedures

This procedure computes for an n by n real nonsymmetric matrix A, the eigenvalues, the real Schur form T, and, optionally, the matrix of Schur vectors Z.

This gives the Schur factorization $A = Z^*T^*(Z^{**T})$.

A matrix is in real Schur form if it is upper quasi-triangular with 1 by 1 and 2 by 2 blocks. 2 by 2 blocks will be standardized in the form

$$\begin{bmatrix} a & b \\ c & a \end{bmatrix}$$

where $b^*c < 0$. The eigenvalues of such a block are $a \pm \sqrt{bc}$.



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_GEES (
  jobvs   IN      flag,
  n       IN      POSITIVEN,
  a       IN OUT  UTL_NLA_ARRAY_DBL,
  lda    IN      POSITIVEN,
  wr     IN OUT  UTL_NLA_ARRAY_DBL,

```

```

wi      IN OUT  UTL_NLA_ARRAY_DBL,
vs      IN OUT  UTL_NLA_ARRAY_DBL,
ldvs   IN      POSITIVEN,
info    OUT     INTEGER,
pack    IN      flag DEFAULT 'C');

UTL_NLA.LAPACK_GEES (
  jobvs  IN      flag,
  n       IN      POSITIVEN,
  a       IN OUT  UTL_NLA_ARRAY_FLT,
  lda    IN      POSITIVEN,
  wr      IN      OUT UTL_NLA_ARRAY_FLT,
  wi      IN      OUT UTL_NLA_ARRAY_FLT,
  vs      IN OUT  UTL_NLA_ARRAY_FLT,
  ldvs   IN      POSITIVEN,
  info    OUT     integer,
  pack    IN      flag DEFAULT 'C');

```

Parameters

Table 287-40 LAPACK_GEES Procedure Parameters

Parameter	Description
jobz	<ul style="list-style-type: none"> 'N': Schur vectors are not computed. 'V': Schur vectors are computed.
n	The order of the matrix a. $N \geq 0$.
a	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (lda, n). <ul style="list-style-type: none"> On entry, the n by n matrix A. On exit, A has been overwritten by its real Schur form T.
lda	The leading dimension of the array a. $lda \geq \max(1, n)$.
wr	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). wr and wi contain the real and imaginary parts respectively of the computed eigenvalues in the same order that they appear on the diagonal of the output Schur form T. Complex conjugate pairs of eigenvalues will appear consecutively with the eigenvalue having the positive imaginary part first.
wi	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldz, n). wr and wi contain the real and imaginary parts respectively of the computed eigenvalues in the same order that they appear on the diagonal of the output Schur form T. Complex conjugate pairs of eigenvalues will appear consecutively with the eigenvalue having the positive imaginary part first.
vs	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). <ul style="list-style-type: none"> If jobvs = 'V', vs contains the orthogonal matrix Z of Schur vectors. If jobvs = 'N', vs is not referenced.
ldvs	The leading dimension of the array vs. $ldvs \geq 1$. If jobvs = 'V', $ldvs \geq N$.

Table 287-40 (Cont.) LAPACK_GEES Procedure Parameters

Parameter	Description
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, and i is ≤ N: the QR algorithm failed to compute all the eigenvalues. Elements 1:ILO-1 and i+1:N of wr and wi contain those eigenvalues which have converged. If jobvs = 'V', vs contains the matrix which reduces A to its partially converged Schur form.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.35 LAPACK_GELS Procedures

This procedure solves overdetermined or underdetermined real linear systems involving an m by n matrix A , or its transpose, using a QR or LQ factorization of A . It is assumed that A has full rank.

The following options are provided:

- If TRANS = 'N' and $m \geq n$: find the least squares solution of an overdetermined system, that is, solve the least squares problem

$$\text{minimize } || B - A * X ||$$
- If TRANS = 'N' and $m < n$: find the minimum norm solution of an underdetermined system $A * X = B$.
- If TRANS = 'T' and $m \geq n$: find the minimum norm solution of an undetermined system $A^{**T} * X = B$.
- If TRANS = 'T' and $m < n$: find the least squares solution of an overdetermined system, that is, solve the least squares problem $\text{minimize } || B - A^{**T} * X ||$.



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_GELS (
    trans    IN        flag,
    m        IN        POSITIVEN,
    n        IN        POSITIVEN,
    nrhs     IN        POSITIVEN,
    a        IN OUT    UTL_NLA_ARRAY_DBL,
    lda      IN        POSITIVEN,
    b        IN OUT    UTL_NLA_ARRAY_DBL,
    ldb      IN        POSITIVEN,

```



```

info    OUT    INTEGER,
pack    IN     flag DEFAULT 'C');

UTL_NLA.LAPACK_GELS (
  trans  IN     flag,
  m      IN     POSITIVEN,
  n      IN     POSITIVEN,
  nrhs   IN     POSITIVEN,
  a      IN OUT UTL_NLA_ARRAY_FLT,
  lda    IN     POSITIVEN,
  b      IN OUT UTL_NLA_ARRAY_FLT,
  ldb    IN     POSITIVEN,
  info   OUT    INTEGER,
  pack   IN     flag DEFAULT 'C');

```

Parameters

Table 287-41 LAPACK_GELS Procedure Parameters

Parameter	Description
trans	<ul style="list-style-type: none"> CHARACTER = 'N': The linear system involves A. CHARACTER = 'T': The linear system involves A**T.
m	The number of rows of the matrix a. $M \geq 0$.
n	The number of columns of the matrix a. $N \geq 0$.
nrhs	The number of right-hand sides, which is the number of columns of the matrix band $x.nrhs \geq 0$.
a	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (lda, n). On entry, the matrix b of right hand side vectors, stored columnwise; b is m by nrhs if TRANS = 'N', or n by nrhs if trans = 'T'. On exit, if $m \geq n$, a is overwritten by details of its QR factorization as returned by SGEQRF. If $m < n$, A is overwritten by details of its LQ factorization as returned by SGELQF.
lda	The leading dimension of the array A. $lda \geq \max(1, m)$.
b	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldb, nrhs). On entry, the matrix b of right hand side vectors, stored columnwise. b is m by nrhs if trans = 'n', or n by nrhs if trans = 'T'. On exit, b is overwritten by the solution vectors, stored columnwise: <ul style="list-style-type: none"> If trans = 'n' and $m \geq n$, rows 1 to n of b contain the least squares solution vectors; the residual sum of squares for the solution in each column is given by the sum of squares of elements n+1 to m in that column. If trans = 'n' and $m < n$, rows 1 to n of b contain the minimum norm solution vectors. If trans = 'T' and $m \geq n$, rows 1 to m of b contain the minimum norm solution vectors. If trans = 'T' and $m < n$, rows 1 to m of b contain the least squares solution vectors; the residual sum of squares for the solution in each column is given by the sum of squares of elements m+1 to n in that column.
ldb	The leading dimension of the array b. $ldb \geq \max(1, m, n)$

Table 287-41 (Cont.) LAPACK_GELS Procedure Parameters

Parameter	Description
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.36 LAPACK_GESDD Procedures

This procedure computes the singular value decomposition (SVD) of a real m by n matrix A , optionally computing the left and right singular vectors. If singular vectors are desired, it uses a divide-and-conquer algorithm that makes mild assumptions about floating point arithmetic.

The SVD is written

$$A = U * \text{SIGMA} * \text{transpose}(V)$$

where SIGMA is an m by n matrix which is zero except for its $\min(m, n)$ diagonal elements, U is an m by m orthogonal matrix, and V is an n by n orthogonal matrix. The diagonal elements of SIGMA are the singular values of A , they are real and non-negative, and are returned in descending order. The first $\min(m, n)$ columns of U and V are the left and right singular vectors of A .

Note that the routine returns V^{*T} , not V .



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_GESDD (
    jobz    IN          flag,
    m       IN          POSITIVEN,
    n       IN          POSITIVEN,
    a       IN OUT     UTL_NLA_ARRAY_DBL,
    lda     IN          POSITIVEN,
    s       IN OUT     UTL_NLA_ARRAY_DBL,
    u       IN OUT     UTL_NLA_ARRAY_DBL,
    ldu     IN          POSITIVEN,
    vt      IN OUT     UTL_NLA_ARRAY_DBL,
    ldvt    IN          POSITIVEN,
    info    OUT         INTEGER,
    pack    IN          flag DEFAULT 'C');

```

```

UTL_NLA.LAPACK_GESDD (
    jobz    IN          flag,
    m       IN          POSITIVEN,

```

```

n      IN      POSITIVEN,
a      IN OUT  UTL_NLA_ARRAY_FLT,
lda    IN      POSITIVEN,
s      IN OUT  UTL_NLA_ARRAY_FLT,
u      IN OUT  UTL_NLA_ARRAY_FLT,
ldu    IN      POSITIVEN,
vt     IN OUT  UTL_NLA_ARRAY_FLT,
ldvt   IN      POSITIVEN,
info   OUT     INTEGER,
pack   IN      flag DEFAULT 'C');

```

Parameters

Table 287-42 LAPACK_GESDD Procedure Parameters

Parameter	Description
jobz	<p>Specifies options for computing all or part of the matrix U:</p> <ul style="list-style-type: none"> 'A': All m columns of u and all n rows of V**T are returned in arrays u and vt. 'S': The first min(m,n) columns of u and the first min(m,n) rows of V**T are returned in the arrays u and vt. 'O': The first min(m,n) columns of u (the left singular vectors) are overwritten on the array a. jobz and jobvt cannot both be 'O' 'N': No columns of u (no left singular vectors) are computed.
m	The order of the matrix a. m >= 0.
n	The order of the matrix a. n >= 0.
a	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (lda, n).</p> <p>On entry, the n by n matrix A.</p> <p>On exit:</p> <ul style="list-style-type: none"> If jobz = 'O', a is overwritten with the first min(m,n) columns of u (the left singular vectors, stored columnwise). If m >= n, a is overwritten with the first m rows of V**T (the right singular vectors, stored rowwise). If jobz .ne. 'O', the contents of a are destroyed.
lda	The leading dimension of the array a. lda >= max(1,m).
s	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (min(m,n)).</p> <p>The singular values of a, sorted so that S(i) >= S(i+1).</p>
u	<p>UTL_NLA_ARRAY_FLT/DBL. ucol = m if jobz = 'A' or jobz = 'O' and m < n; ucol = min(m,n) if jobz = 'S'.</p> <ul style="list-style-type: none"> If jobz = 'A' or jobz = 'O' and m < n, u contains the m by m orthogonal matrix u. If jobz = 'S', u contains the first min(m,n) columns of u (the left singular vectors, stored columnwise). If jobz = 'O' and m >= n, or jobz = 'N', u is not referenced.
ldu	The leading dimension of the array U. ldu >= 1. If jobz = 'S' or 'A', or jobz = 'O' and m < n, ldu >= m.

Table 287-42 (Cont.) LAPACK_GESDD Procedure Parameters

Parameter	Description
vt	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldvt, n). <ul style="list-style-type: none"> • If jobz = 'A' or jobz = 'O' and $m \geq n$, vt contains the n by n orthogonal matrix $V^{*}T$. • If jobz = 'S', vt contains the first $\min(m,n)$ rows of $V^{*}T$ (the right singular vectors, stored rowwise). • If jobz = 'O' and $m < n$, or jobz = 'N', vt is not referenced.
ldvt	The leading dimension of the array vt. $ldvt \geq 1$. <ul style="list-style-type: none"> • If jobz = 'A', or jobz = 'O' and $m \geq n$, $ldvt \geq n$. • If jobz = 'S', $ldvt \geq \min(m,n)$.
info	<ul style="list-style-type: none"> • = 0 : successful exit • < 0 : If info = $-i$, the i-th argument had an illegal value • > 0 : SBDSDC did not converge, updating process failed.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> • 'C': column-major (default) • 'R': row-major

287.5.37 LAPACK_GESV Procedure

This procedure computes the solution to a real system of linear equations $a * x = b$, where a is an n by n matrix and x and b are n by $nrhs$ matrices.

The LU decomposition with partial pivoting and row interchanges is used to factor A as

$$a = P * L * U$$

where P is a permutation matrix, L is unit lower triangular, and U is upper triangular. The factored form of a is then used to solve the system of equations

$$a * x = b$$



See Also:

[LAPACK Driver Routines \(Linear Equations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_GESV (
  n          IN          POSITIVEN,
  nrhs       IN          POSITIVEN,
  a          IN OUT     UTL_NLA_ARRAY_DBL,
  lda        IN          POSITIVEN,
  ipiv       IN OUT     UTL_NLA_ARRAY_INT,
  b          IN OUT     UTL_NLA_ARRAY_DBL,
  ldb        IN          POSITIVEN,
  info       OUT        INTEGER,
  pack       IN          flag DEFAULT 'C');

```

```

UTL_NLA.LAPACK_GESV (
  n      IN      POSITIVEN,
  nrhs   IN      POSITIVEN,
  a      IN OUT  UTL_NLA_ARRAY_FLT,
  lda    IN      POSITIVEN,
  ipiv   IN OUT  UTL_NLA_ARRAY_INT,
  b      IN OUT  UTL_NLA_ARRAY_FLT,
  ldb    IN      POSITIVEN,
  info   OUT    INTEGER,
  pack   IN      flag DEFAULT 'C');

```

Parameters

Table 287-43 LAPACK_GESV Procedure Parameters

Parameter	Description
n	The number of linear equations, equivalent to the order of the matrix a. n >= 0
nrhs	The number of right-hand sides, which is the number of columns of the matrix b. nrhs >= 0.
a	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (lda, n). On entry, the n by n coefficient matrix a. On exit, the factors L and U from the factorization a = P*L*U; the unit diagonal elements of L are not stored.
lda	The leading dimension of the array a. lda >= max(1, n)
ipiv	INTEGER array, DIMENSION (n). The pivot indices that define the permutation matrix P; row i of the matrix was interchanged with row ipiv(i).
b	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldb, nrhs). On entry, the n by nrhs matrix of right hand side matrix b. On exit, if info = 0, the n by nrhs solution matrix X.
ldb	The leading dimension of the array b. ldb >= max(1, n)
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, U(i, i) is exactly zero. The factorization has been completed, but the factor U is exactly singular, so the solution could not be computed.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.38 LAPACK_GESVD Procedures

This procedure computes the singular value decomposition (SVD) of a real m by n matrix A, optionally computing the left and/or right singular vectors.

The SVD is written

$$A = U * \text{SIGMA} * \text{transpose}(V)$$

where SIGMA is an m by n matrix which is zero except for its $\min(m, n)$ diagonal elements, U is an m by m orthogonal matrix, and V is an n by n orthogonal matrix. The diagonal elements of SIGMA are the singular values of A , they are real and non-negative, and are returned in descending order. The first $\min(m, n)$ columns of U and V are the left and right singular vectors of A .

Note that the routine returns V^{*T} , not V .



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.LAPACK_GESVD (
  jobu  IN      flag,
  jobvt IN      flag,
  m     IN      POSITIVEN,
  n     IN      POSITIVEN,
  a     IN OUT  UTL_NLA_ARRAY_DBL,
  lda   IN      POSITIVEN,
  s     IN OUT  UTL_NLA_ARRAY_DBL,
  u     IN OUT  UTL_NLA_ARRAY_DBL,
  ldu   IN      POSITIVEN,
  vt    IN OUT  UTL_NLA_ARRAY_DBL,
  ldvt  IN      POSITIVEN,
  info  OUT     INTEGER,
  pack  IN      flag DEFAULT 'C');
```

```
UTL_NLA.LAPACK_GESVD (
  jobu  IN      flag,
  jobvt IN      flag,
  m     IN      POSITIVEN,
  n     IN      POSITIVEN,
  a     IN OUT  UTL_NLA_ARRAY_FLT,
  lda   IN      POSITIVEN,
  s     IN OUT  UTL_NLA_ARRAY_FLT,
  u     IN OUT  UTL_NLA_ARRAY_FLT,
  ldu   IN      POSITIVEN,
  vt    IN OUT  UTL_NLA_ARRAY_FLT,
  ldvt  IN      POSITIVEN,
  info  OUT     INTEGER,
  pack  IN      flag DEFAULT 'C');
```

Parameters

Table 287-44 LAPACK_GESVD Procedure Parameters

Parameter	Description
jobu	<p>Specifies options for computing all or part of the matrix U:</p> <ul style="list-style-type: none"> 'A': All m columns of U are returned in array U. 'S': The first $\min(m,n)$ columns of U (the left singular vectors) are returned in the array U. 'O': The first $\min(m,n)$ columns of U (the left singular vectors) are overwritten on the array a. jobu and jobvt cannot both be 'O' 'N': No columns of U (no left singular vectors) are computed.
jobvt	<p>Specifies options for computing all or part of the matrix $V^{*}T$:</p> <ul style="list-style-type: none"> 'A': All n rows of $V^{*}T$ are returned in the array vt. 'S': The first $\min(m,n)$ rows of $V^{*}T$ (the right singular vectors) are returned in the array vt. 'O': The first $\min(m,n)$ rows of $V^{*}T$ (the right singular vectors) are overwritten on the array a. jobvt and jobu cannot both be 'O'. 'N': No rows of $V^{*}T$ (no right singular vectors) are computed.
m	The order of the matrix a. $M \geq 0$.
n	The order of the matrix a. $N \geq 0$.
a	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (lda, n).</p> <p>On entry, the n by n matrix A.</p> <p>On exit:</p> <ul style="list-style-type: none"> If jobu = 'O', A is overwritten with the first $\min(m,n)$ columns of U (the left singular vectors, stored columnwise); If jobvt = 'O', A is overwritten with the first $\min(m,n)$ rows of $V^{*}T$ (the right singular vectors, stored rowwise); If jobu.ne.'O' and jobvt.ne.'O', the contents of A are destroyed.
lda	The leading dimension of the array a. $lda \geq \max(1,n)$.
s	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION ($\min(m,n)$).</p> <p>The singular values of A, sorted so that $S(i) \geq S(i+1)$.</p>
u	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldu, ucol). (ldu, m) if jobu = 'A' or (ldu, $\min(m,n)$) if jobu = 'S'.</p> <ul style="list-style-type: none"> If jobu = 'A', U contains the m by m orthogonal matrix U. If jobu = 'S', U contains the first $\min(m,n)$ columns of U (the left singular vectors, stored columnwise). If jobu = 'N' or 'O', U is not referenced.
ldu	The leading dimension of the array U. $ldu \geq 1$. If jobu = 'S' or 'a', $ldu \geq m$.
vt	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldvt, n).</p> <ul style="list-style-type: none"> If jobvt = 'A', vt contains the n by n orthogonal matrix $V^{*}T$. If jobvt = 'S', vt contains the first $\min(m,n)$ rows of $V^{*}T$ (the right singular vectors, stored rowwise). If jobvt = 'N' or 'O', vt is not referenced.

Table 287-44 (Cont.) LAPACK_GESVD Procedure Parameters

Parameter	Description
ldvt	The leading dimension of the array vt. $ldvt \geq 1$. <ul style="list-style-type: none"> If $jobvt = 'A'$, $ldvt \geq n$. If $jobvt = 'S'$, $ldvt \geq \min(m,n)$.
info	<ul style="list-style-type: none"> $= 0$: successful exit < 0 : If $info = -i$, the i-th argument had an illegal value > 0 : If SBDSQR did not converge, info specifies how many superdiagonals of an intermediate bidiagonal form B did not converge to zero.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.39 LAPACK_GEEV Procedures

This procedure computes for an n by n real nonsymmetric matrix A , the eigenvalues and, optionally, the left and/or right eigenvectors.

- The right eigenvector $v(j)$ of A satisfies $A * v(j) = \text{lambda}(j) * v(j)$ where $\text{lambda}(j)$ is its eigenvalue.
- The left eigenvector $u(j)$ of A satisfies $u(j)**H * A = \text{lambda}(j) * u(j)**H$ where $u(j)**H$ denotes the conjugate transpose of $u(j)$.

The computed eigenvectors are normalized to have Euclidean norm equal to 1 and largest component real.



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_GEEV (
    jobvl  IN      flag,
    jobvr  IN      flag,
    n      IN      POSITIVEN,
    a      IN OUT  UTL_NLA_ARRAY_DBL,
    lda    IN      POSITIVEN,
    wr     IN OUT  UTL_NLA_ARRAY_DBL,
    wi     IN OUT  UTL_NLA_ARRAY_DBL,
    vl     IN OUT  UTL_NLA_ARRAY_DBL,
    ldvl   IN      POSITIVEN,
    vr     IN OUT  UTL_NLA_ARRAY_DBL,
    ldvr   IN      POSITIVEN,
    info   OUT     INTEGER,
    pack   IN      flag DEFAULT 'C');

```



```

UTL_NLA.LAPACK_GEEV (
  jobvl  IN    flag,
  jobvr  IN    flag,
  n      IN    POSITIVEN,
  a      IN OUT UTL_NLA_ARRAY_FLT,
  lda   IN    POSITIVEN,
  wr    IN OUT UTL_NLA_ARRAY_FLT,
  wi    IN OUT UTL_NLA_ARRAY_FLT,
  vl    IN OUT UTL_NLA_ARRAY_FLT,
  ldvl  IN    POSITIVEN,
  vr    IN OUT UTL_NLA_ARRAY_FLT,
  ldvr  IN    POSITIVEN,
  info  OUT    INTEGER,
  pack  IN    flag DEFAULT 'C');

```

Parameters

Table 287-45 LAPACK_GEEV Procedure Parameters

Parameter	Description
jobvl	<ul style="list-style-type: none"> 'N': Left eigenvectors of A are not computed. 'V': Left eigenvectors of A are computed.
jobvr	<ul style="list-style-type: none"> 'N': Right eigenvectors of A are not computed. 'V': Right eigenvectors of A are computed.
n	The order of the matrix a. $N \geq 0$.
a	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (lda, n). <ul style="list-style-type: none"> On entry, the n by n matrix A. On exit, A has been overwritten.
lda	The leading dimension of the array a. $lda \geq \max(1, n)$.
wr	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). wr and wi contain the real and imaginary parts respectively of the computed eigenvalues. Complex conjugate pairs of eigenvalues will appear consecutively with the eigenvalue having the positive imaginary part first.
wi	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldz, n). wr and wi contain the real and imaginary parts respectively of the computed eigenvalues. Complex conjugate pairs of eigenvalues will appear consecutively with the eigenvalue having the positive imaginary part first.
vl	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). <ul style="list-style-type: none"> If jobvl = 'V', the left eigenvectors u(j) are stored one after another in the columns of vl, in the same order as their eigenvalues. If jobvs = 'N', vl is not referenced. If the j-th eigenvalue is real, then $u(j) = VL(:, j)$, the j-th column of vl. If the j-th and (j+1)-st eigenvalues form a complex conjugate pair, then $u(j) = VL(:, j) + i*VL(:, j+1)$ and $u(j+1) = VL(:, j) - i*VL(:, j+1)$.
ldvl	The leading dimension of the array vl. $ldvl \geq 1$. If jobvl = 'V', $ldvl \geq n$.

Table 287-45 (Cont.) LAPACK_GEEV Procedure Parameters

Parameter	Description
vr	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldvr, n). <ul style="list-style-type: none"> • If jobvr = 'V', the right eigenvectors $v(j)$ are stored one after another in the columns of vr, in the same order as their eigenvalues.. • If jobvr = 'N', vr is not referenced. • If the j-th eigenvalue is real, then $v(j) = VR(:,j)$, the j-th column of vr. • If the j-th and (j+1)-st eigenvalues form a complex conjugate pair, then $v(j) = VR(:,j) + i*VR(:,j+1)$ and $v(j+1) = VR(:,j) - i*VR(:,j+1)$.
ldvr	The leading dimension of the array vr. vr.ldvr >= 1. If jobvr = 'V', ldvr >= N
info	<ul style="list-style-type: none"> • = 0 : successful exit • < 0 : if info = -i, the i-th argument had an illegal value • > 0 : if info = i, and i is <= N: the QR algorithm failed to compute all the eigenvalues, and no eigenvectors have been computed. Elements i+1:N of wr and wi contain eigenvalues which have converged..
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> • 'C': column-major (default) • 'R': row-major

287.5.40 LAPACK_GTSV Procedure

This procedure solves the equation $a * x = b$, where a is an n by n tridiagonal matrix, by Gaussian elimination with partial pivoting.

Note that the equation $a'*x = b$ may be solved by interchanging the order of the arguments du and dl.



See Also:

[LAPACK Driver Routines \(Linear Equations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_GTSV (
    n          IN          POSITIVEN,
    nrhs      IN          POSITIVEN,
    dl        IN OUT     UTL_NLA_ARRAY_DBL,
    d         IN OUT     UTL_NLA_ARRAY_DBL,
    du        IN OUT     UTL_NLA_ARRAY_DBL,
    b         IN OUT     UTL_NLA_ARRAY_DBL,
    ldb       IN          POSITIVEN,
    info      OUT        INTEGER,
    pack      IN          flag DEFAULT 'C');

```

```

UTL_NLA.LAPACK_GTSV (
  n      IN      POSITIVEN,
  nrhs   IN      POSITIVEN,
  dl     IN OUT  UTL_NLA_ARRAY_FLT,
  d      IN OUT  UTL_NLA_ARRAY_FLT,
  du     IN OUT  UTL_NLA_ARRAY_FLT,
  b      IN OUT  UTL_NLA_ARRAY_FLT,
  ldb    IN      POSITIVEN,
  info   OUT     INTEGER,
  pack   IN      flag DEFAULT 'C');

```

Parameters

Table 287-46 LAPACK_GTSV Procedure Parameters

Parameter	Description
n	The order of the matrix a .n >= 0
nrhs	The number of right-hand sides, which is the number of columns of the matrix b. nrhs >= 0.
dl	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n-1). On entry, dl must contain the (n-1) sub-diagonal elements of a. On exit, dl is overwritten by the (n-2) elements of the second super-diagonal of the upper triangular matrix U from the LU factorization of a, in dl(1), ..., dl(n-2).
d	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). On entry, d must contain the diagonal elements of a. On exit, d is overwritten by the n diagonal elements of U.
du	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n-1). On entry, du must contain the (n-1) super-diagonal elements of a. On exit, du is overwritten by the (n-1) elements of the first super-diagonal of U.
b	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (LDB, nrhs). On entry, the n by nrhs matrix of right hand side matrix b. On exit, if info = 0, the n by nrhs solution matrix X.
ldb	The leading dimension of the array b. ldb >= max (1, n)
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i , the i-th argument had an illegal value > 0 : if info = i, U(i,i) is exactly zero, and the solution has not been computed. The factorization has not been completed unless i = n.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.41 LAPACK_PBSV Procedures

This procedure computes the solution to a real system of linear equations $a * x = b$, where a is an n by n symmetric positive definite band matrix and x and b are n by $nrhs$ matrices.

The Cholesky decomposition is used to factor A as

$A = U^{*T}U$ if $UPLO = 'U'$

or

$A = L * L^{*T}$ if $UPLO = 'L'$

where U is an upper triangular matrix and L is a lower triangular matrix. The factored form of A is then used to solve the system of equations $A * X = B$.



See Also:

[LAPACK Driver Routines \(Linear Equations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.LAPACK_PBSV (
  uplo      IN      flag,
  n         IN      POSITIVEN,
  kd        IN      NATURALN,
  nrhs      IN      POSITIVEN,
  ab        IN OUT  UTL_NLA_ARRAY_DBL,
  ldab      IN      POSITIVEN,
  b         IN OUT  UTL_NLA_ARRAY_DBL,
  ldb       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');
```

```
UTL_NLA.LAPACK_PBSV (
  uplo      IN      flag,
  n         IN      POSITIVEN,
  kd        IN      NATURALN,
  nrhs      IN      POSITIVEN,
  ab        IN OUT  UTL_NLA_ARRAY_FLT,
  ldab      IN      POSITIVEN,
  b         IN OUT  UTL_NLA_ARRAY_FLT,
  ldb       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');
```

Parameters

Table 287-47 LAPACK_PBSV Procedure Parameters

Parameter	Description
uplo	<ul style="list-style-type: none"> uplo = 'U'. Upper triangular of A is stored. uplo = 'L'. Lower triangular of A is stored.
n	The number of linear equations, that is, the order of the matrix a .n >= 0
kd	The number of superdiagonals of the matrix A if uplo = 'U', or the number of subdiagonals if UPLO = 'L'. KD >= 0.
nrhs	The number of right-hand sides, which is the number of columns of the matrix b. nrhs >= 0.
ab	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldab, n). On entry, the upper or lower triangle of the symmetric band matrix a, stored in the first kd+1 rows of the array. The j-th column of a is stored in the j-th column of the array ab is as follows: <ul style="list-style-type: none"> if uplo = 'U', AB(KD+1+i-j, j) = A(i, j) for max(1, j-KD) <= i <= j; if uplo = 'L', AB(1+i-j, j) = A(i, j) for j <= i <= min(N, j+KD) .See below for further details. On exit, if info = 0, the triangular factor U or L from the Cholesky factorization $A = U^{**T}U$ or $A = L^*L^{**T}$ of the bandmatrix A, in the same storage format as a.
ldab	The leading dimension of the array ab. ldb >= kd+1
b	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldb, nrhs). On entry, the n by nrhs matrix of right hand side matrix b. On exit, if info = 0, the n by nrhs solution matrix X.
ldb	The leading dimension of the array b. ldb >= max(1, n)
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, the leading minor of order i of a is not positive definite, so the factorization could not be completed, and the solution has not been computed.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.42 LAPACK_POSV Procedures

This procedure computes the solution to a real system of linear equations $a * x = b$, where a is an n by n symmetric positive definite matrix and x and b are n by nrhs matrices.

The Cholesky decomposition is used to factor A as

$$A = U^{**T} * U \text{ if uplo} = 'U'$$

or

$A = L * L^{**T}$ if `UPLO = 'L'`

where `U` is an upper triangular matrix and `L` is a lower triangular matrix. The factored form of `A` is then used to solve the system of equations $A * X = B$.



See Also:

[LAPACK Driver Routines \(Linear Equations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.LAPACK_POSV (
  uplo      IN      flag,
  n         IN      POSITIVEN,
  nrhs      IN      POSITIVEN,
  a         IN OUT  UTL_NLA_ARRAY_DBL,
  lda       IN      POSITIVEN,
  b         IN OUT  UTL_NLA_ARRAY_DBL,
  ldb       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');
```

```
UTL_NLA.LAPACK_POSV (
  uplo      IN      flag,
  n         IN      POSITIVEN,
  nrhs      IN      POSITIVEN,
  a         IN OUT  UTL_NLA_ARRAY_FLT,
  lda       IN      POSITIVEN,
  b         IN OUT  UTL_NLA_ARRAY_FLT,
  ldb       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');
```

Parameters

Table 287-48 LAPACK_POSV Procedure Parameters

Parameter	Description
<code>uplo</code>	<ul style="list-style-type: none"> <code>uplo = 'U'</code>. Upper triangular of <code>A</code> is stored. <code>uplo = 'L'</code>. Lower triangular of <code>A</code> is stored.
<code>n</code>	The number of linear equations, that is, the order of the matrix <code>a</code> . <code>n >= 0</code>
<code>nrhs</code>	The number of right-hand sides, which is the number of columns of the matrix <code>b</code> . <code>nrhs >= 0</code> .

Table 287-48 (Cont.) LAPACK_POSV Procedure Parameters

Parameter	Description
a	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (lda, n).</p> <p>If uplo = 'U', the leading NRHS n by n upper triangular part of a contains the upper NRHS triangular part of the matrix A, and the strictly lower NRHS triangular part of A is not referenced.</p> <p>If uplo = 'L', then rhs leading n by n lower triangular part of a contains the lower nrhs triangular part of the matrix a, and the strictly upper nrhs triangular part of a is not referenced.</p> <p>On exit, if info = 0, the factor U or L from the Cholesky factorization $A = U^{**T}U$ or $A = L^{**T}L$.</p>
lda	<p>The leading dimension of the array a.</p> <p>lda >= max (1, n)</p>
b	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldb, nrhs).</p> <p>On entry, the n by nrhs matrix of right hand side matrix b.</p> <p>On exit, if info = 0, the n by nrhs solution matrix X.</p>
ldb	<p>The leading dimension of the array b.</p> <p>ldb >= max(1,n)</p>
info	<ul style="list-style-type: none"> • = 0 : successful exit • < 0 : if info = -i, the i-th argument had an illegal value • > 0 : if info = i, the leading minor of order i of a is not positive definite, so the factorization could not be completed, and the solution has not been computed.
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> • 'C': column-major (default) • 'R': row-major

287.5.43 LAPACK_PPSV Procedures

This procedure computes the solution to a real system of linear equations $a * x = b$ where a is an n by n symmetric positive definite matrix stored in packed format and x and b are n by nrhs matrices.

The Cholesky decomposition is used to factor A as

$$A = U^{**T} * U \text{ if UPLO} = 'U'$$

or

$$A = L * L^{**T} \text{ if UPLO} = 'L'$$

where **U** is an upper triangular matrix and **L** is a lower triangular matrix. The factored form of A is then used to solve the system of equations $A * X = B$.



See Also:

[LAPACK Driver Routines \(Linear Equations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.LAPACK_PPSV (
  uplo      IN      flag,
  n         IN      POSITIVEN,
  nrhs      IN      POSITIVEN,
  ap        IN OUT  UTL_NLA_ARRAY_DBL,
  b         IN OUT  UTL_NLA_ARRAY_DBL,
  ldb       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');
```

```
UTL_NLA.LAPACK_PPSV (
  uplo      IN      flag,
  n         IN      POSITIVEN,
  nrhs      IN      POSITIVEN,
  ap        IN OUT  UTL_NLA_ARRAY_FLT,
  b         IN OUT  UTL_NLA_ARRAY_FLT,
  ldb       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');
```

Parameters

Table 287-49 LAPACK_PPSV Procedure Parameters

Parameter	Description
uplo	<ul style="list-style-type: none"> uplo = 'U' . Upper triangular of A is stored. uplo = 'L' . Lower triangular of A is stored.
n	The number of linear equations, that is, the order of the matrix a .n >= 0
nrhs	The number of right-hand sides, which is the number of columns of the matrix b.nrhs >= 0.
ap	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n*(n+1)/2). On entry, the upper or lower triangle of the symmetric matrix a, packed columnwise in a linear array. The j-th column of a is stored in the array ap as follows: If uplo = 'U', AP(i + (j-1)*j/2) = A(i,j) for 1<=i<=j; If uplo = 'L', AP(i + (j-1)*(2n-j)/2) = A(i,j) for j<=i<=n; On exit, if info = 0, the factor U or 'L' from the Cholesky factorization A = U**T*U or A = L*L**T in the same storage format as A.

Table 287-49 (Cont.) LAPACK_PPSV Procedure Parameters

Parameter	Description
b	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldb, nrhs). On entry, the n by nrhs matrix of right hand side matrix b. On exit, if info = 0, the n by nrhs solution matrix X.
ldb	The leading dimension of the array b. ldb >= max(1, n)
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, the leading minor of order i of a is not positive definite, so the factorization could not be completed, and the solution has not been computed.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.44 LAPACK_PTSV Procedures

This procedure computes the solution to a real system of linear equations $a * x = b$, where a is an n by n symmetric positive definite tridiagonal matrix, and x and b are n by nrhs matrices.

a is factored as $A = L * D * L^{**T}$, and the factored form of a is then used to solve the system of equations.



See Also:

[LAPACK Driver Routines \(Linear Equations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.LAPACK_PTSV (
    n          IN          POSITIVEN,
    nrhs       IN          POSITIVEN,
    d          IN OUT     UTL_NLA_ARRAY_DBL,
    e          IN OUT     UTL_NLA_ARRAY_DBL,
    b          IN OUT     UTL_NLA_ARRAY_DBL,
    ldb        IN          POSITIVEN,
    info       OUT         INTEGER,
    pack       IN          flag DEFAULT 'C');
```

```
UTL_NLA.LAPACK_PTSV (
    n          IN          POSITIVEN,
    nrhs       IN          POSITIVEN,
    d          IN OUT     UTL_NLA_ARRAY_FLT,
    e          IN OUT     UTL_NLA_ARRAY_FLT,
    b          IN OUT     UTL_NLA_ARRAY_FLT,
```

```
ldb    IN      POSITIVEN,
info   OUT     INTEGER,
pack   IN      flag DEFAULT 'C');
```

Parameters

Table 287-50 LAPACK_PTSV Procedure Parameters

Parameter	Description
n	The order of the matrix a. $N \geq 0$.
nrhs	The number of right-hand sides, which is the number of columns of the matrix b. $nrhs \geq 0$.
d	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). On entry, the n diagonal elements of the tridiagonal matrix a. On exit, the n diagonal elements of the diagonal matrix d from the factorization $A = L*D*L^{*T}$.
e	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n-1). On entry, the (n-1) subdiagonal elements of the tridiagonal matrix a. On exit, the (n-1) diagonal elements of the unit bidiagonal factor L from the factorization $A = L*D*L^{*T}$ of a. (e can also be regarded as the superdiagonal of the unit bidiagonal factor U from the $U^{*T}*D*U$ factorization of a)
b	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldb, nrhs). On entry, the n by nrhs matrix of right hand side matrix b. On exit, if info = 0, the n by nrhs solution matrix X.
ldb	The leading dimension of the array b. $ldb \geq \max(1, n)$
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, the leading minor of order i of a is not positive definite, so the factorization could not be completed, and the solution has not been computed.
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.45 LAPACK_SBEV Procedures

This procedure computes all the eigenvalues and, optionally, eigenvectors of a real symmetric band matrix A.



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_SBEV (
  jobz      IN      flag,
  uplo      IN      flag,
  n         IN      POSITIVEN,
  kd        IN      NATURALN,
  ab        IN OUT  UTL_NLA_ARRAY_DBL,
  ldab      IN      POSITIVEN,
  w         IN OUT  UTL_NLA_ARRAY_DBL,
  z         IN OUT  UTL_NLA_ARRAY_DBL,
  ldz       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');

```

```

UTL_NLA.LAPACK_SBEV (
  jobz      IN      flag,
  uplo      IN      flag,
  n         IN      POSITIVEN,
  kd        IN      NATURALN,
  ab        IN OUT  UTL_NLA_ARRAY_FLT,
  ldab      IN      POSITIVEN,
  w         IN OUT  UTL_NLA_ARRAY_FLT,
  z         IN OUT  UTL_NLA_ARRAY_FLT,
  ldz       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');

```

Parameters

Table 287-51 LAPACK_SBEV Procedure Parameters

Parameter	Description
jobz	<ul style="list-style-type: none"> 'N': Compute eigenvalues only. 'V': Compute eigenvalues and eigenvectors.
uplo	<ul style="list-style-type: none"> 'U': Upper triangle of A is stored. 'L': Lower triangle of A is stored.
n	The order of the matrix a. $N \geq 0$.
kd	The number of superdiagonals of the matrix A if uplo = 'U', or the number of subdiagonals if uplo = 'L'. $kd \geq 0$.
ab	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldab, n). On entry, the upper or lower triangle of the symmetric band matrix A stored in the first kd+1 rows of the array. The j-th column of A is stored in the j-th column of the array ab: <ul style="list-style-type: none"> If uplo = 'U', $ab(kd+1+i-j, j) = a(i, j)$ for $\max(1, j-kd) \leq i \leq j$. If uplo = 'L', $ab(1+i-j, j) = A(i, j)$ for $j \leq i \leq \min(n, j+kd)$. On exit, ab is overwritten by values generated during the reduction to tridiagonal form: <ul style="list-style-type: none"> If uplo = 'U', the diagonal and first superdiagonal of the tridiagonal matrix T are returned in rows kd and kd+1 of ab. If uplo = 'L', the diagonal and first subdiagonal of T are returned in the first two rows of ab.

Table 287-51 (Cont.) LAPACK_SBEV Procedure Parameters

Parameter	Description
ldab	The leading dimension of the array ab. $ldab \geq kd + 1$.
w	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). If <code>info = 0</code> , the eigenvalues in ascending order.
z	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). <ul style="list-style-type: none"> If <code>jobz = 'V'</code>, then if <code>info = 0</code>, z contains the orthonormal eigenvectors of the matrix A, with the <i>i</i>-th column of z holding the eigenvector associated with <code>w(i)</code>. If <code>jobz = 'N'</code>, then z is not referenced.
ldz	The leading dimension of the array z. $ldz \geq 1$, and if <code>jobz = 'V'</code> , $ldz \geq \max(1, n)$.
info	<ul style="list-style-type: none"> <code>= 0</code> : successful exit <code>< 0</code> : if <code>info = -i</code>, the <i>i</i>-th argument had an illegal value <code>> 0</code> : if <code>info = i</code>, the algorithm failed to converge; <i>i</i> off-diagonal elements of an intermediate tridiagonal form did not converge to zero
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.46 LAPACK_SBEVD Procedures

This procedure computes all the eigenvalues and, optionally, eigenvectors of a real symmetric matrix A. If eigenvectors are desired, it uses a divide and conquer algorithm that makes mild assumptions about floating point arithmetic.



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_SBEVD (
    jobz      IN      flag,
    uplo      IN      flag,
    n         IN      POSITIVEN,
    kd        IN      NATURALN,
    ab        IN OUT  UTL_NLA_ARRAY_DBL,
    ldab      IN      POSITIVEN,
    w         IN OUT  UTL_NLA_ARRAY_DBL,
    z         IN OUT  UTL_NLA_ARRAY_DBL,
    ldz       IN      POSITIVEN,
    info      OUT     INTEGER,
    pack      IN      flag DEFAULT 'C');

```

```

UTL_NLA.LAPACK_SBEVD (
  jobz      IN      flag,
  uplo      IN      flag,
  n         IN      POSITIVEN,
  kd        IN      NATURALN,
  ab        IN OUT  UTL_NLA_ARRAY_FLT,
  ldab      IN      POSITIVEN,
  w         IN OUT  UTL_NLA_ARRAY_FLT,
  z         IN OUT  UTL_NLA_ARRAY_FLT,
  ldz       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');

```

Parameters

Table 287-52 LAPACK_SBEVD Procedure Parameters

Parameter	Description
jobz	<ul style="list-style-type: none"> 'N': Compute eigenvalues only. 'V': Compute eigenvalues and eigenvectors.
uplo	<ul style="list-style-type: none"> 'U': Upper triangle of A is stored. 'L': Lower triangle of A is stored.
n	The order of the matrix a. $N \geq 0$.
kd	The number of superdiagonals of the matrix A if uplo = 'U', or the number of subdiagonals if uplo = 'L'. $kd \geq 0$.
ab	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldab, n).</p> <p>On entry, the upper or lower triangle of the symmetric band matrix A stored in the first kd+1 rows of the array. The j-th column of A is stored in the j-th column of the array ab:</p> <ul style="list-style-type: none"> If uplo = 'U', $ab(kd+1+i-j, j) = a(i, j)$ for $\max(1, j-kd) \leq i \leq j$. If uplo = 'L', $ab(1+i-j, j) = A(i, j)$ for $j \leq i \leq \min(n, j+kd)$. <p>On exit, ab is overwritten by values generated during the reduction to tridiagonal form:</p> <ul style="list-style-type: none"> If uplo = 'U', the diagonal and first superdiagonal of the tridiagonal matrix T are returned in rows kd and kd+1 of ab. If uplo = 'L', the diagonal and first subdiagonal of T are returned in the first two rows of ab.
ldab	The leading dimension of the array ab. $ldab \geq kd + 1$.
w	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldz, n).</p> <p>If info = 0, the eigenvalues in ascending order.</p>
z	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n).</p> <ul style="list-style-type: none"> If jobz = 'V', then if info = 0, z contains the orthonormal eigenvectors of the matrix A, with the i-th column of z holding the eigenvector associated with w(i). If jobz = 'N', then z is not referenced.
ldz	The leading dimension of the array z. $ldz \geq 1$, and if jobz = 'v', $ldz \geq \max(1, n)$.

Table 287-52 (Cont.) LAPACK_SBEVD Procedure Parameters

Parameter	Description
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, the algorithm failed to converge; i off-diagonal elements of an intermediate tridiagonal form did not converge to zero
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.47 LAPACK_SPEV Procedures

This procedure computes all the eigenvalues and, optionally, eigenvectors of a real symmetric matrix **A** in packed storage.



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_SPEV (
  jobz      IN      flag,
  uplo      IN      flag,
  n         IN      POSITIVEN,
  ap        IN OUT  UTL_NLA_ARRAY_DBL,
  w         IN OUT  UTL_NLA_ARRAY_DBL,
  z         IN OUT  UTL_NLA_ARRAY_DBL,
  ldz       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');

```

```

UTL_NLA.LAPACK_SPEV (
  jobz      IN      flag,
  uplo      IN      flag,
  n         IN      POSITIVEN,
  ap        IN OUT  UTL_NLA_ARRAY_FLT,
  w         IN OUT  UTL_NLA_ARRAY_FLT,
  z         IN OUT  UTL_NLA_ARRAY_FLT,
  ldz       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');

```

Parameters

Table 287-53 LAPACK_SPEV Procedure Parameters

Parameter	Description
jobz	<ul style="list-style-type: none"> 'N': Compute eigenvalues only. 'V': Compute eigenvalues and eigenvectors.
uplo	<ul style="list-style-type: none"> 'U': Upper triangle of A is stored. 'L': Lower triangle of A is stored.
n	The order of the matrix a. $N \geq 0$.
ap	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n*(n+1)/2).</p> <p>On entry, the upper or lower triangle of the symmetric matrix a packed columnwise in a linear array. The j-th column of a is stored in the array ap:</p> <ul style="list-style-type: none"> If uplo = 'U', $ap(i + (j-1)*j/2) = a(i, j)$ for $1 \leq i \leq j$. If uplo = 'L', $ap(i + (j-1)*(2*n-j)/2) = a(i, j)$ for $j \leq i \leq n$. <p>On exit, ap is overwritten by values generated during the reduction to tridiagonal form:</p> <ul style="list-style-type: none"> If uplo = 'U', the diagonal and first superdiagonal of the tridiagonal matrix T overwrite the corresponding elements of A. If uplo = 'L', the diagonal and first subdiagonal of T overwrite the corresponding elements of A.
w	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n).</p> <p>If info = 0, the eigenvalues in ascending order.</p>
z	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldz, n).</p> <ul style="list-style-type: none"> If jobz = 'V', then if info = 0, z contains the orthonormal eigenvectors of the matrix A, with the i-th column of z holding the eigenvector associated with w(i). If jobz = 'N', then z is not referenced.
ldz	The leading dimension of the array z. $ldz \geq 1$, and if jobz = 'v', $ldz \geq \max(1, n)$.
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, the algorithm failed to converge; i off-diagonal elements of an intermediate tridiagonal form did not converge to zero
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.48 LAPACK_SPEVD Procedures

This procedure computes all the eigenvalues and, optionally, eigenvectors of a real symmetric matrix A in packed storage. If eigenvectors are desired, it uses a divide and

conquer algorithm. The divide and conquer algorithm makes very mild assumptions about floating point arithmetic.



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.LAPACK_SPEVD (
  jobz      IN      flag,
  uplo      IN      flag,
  n         IN      POSITIVEN,
  ap        IN OUT  UTL_NLA_ARRAY_DBL,
  w         IN OUT  UTL_NLA_ARRAY_DBL,
  z         IN OUT  UTL_NLA_ARRAY_DBL,
  ldz       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');
```

```
UTL_NLA.LAPACK_SPEVD (
  jobz      IN      flag,
  uplo      IN      flag,
  n         IN      POSITIVEN,
  ap        IN OUT  UTL_NLA_ARRAY_FLT,
  w         IN OUT  UTL_NLA_ARRAY_FLT,
  z         IN OUT  UTL_NLA_ARRAY_FLT,
  ldz       IN      POSITIVEN,
  info      OUT     INTEGER,
  pack      IN      flag DEFAULT 'C');
```

Parameters

Table 287-54 LAPACK_SPEVD Procedure Parameters

Parameter	Description
jobz	<ul style="list-style-type: none"> 'N': Compute eigenvalues only. 'V': Compute eigenvalues and eigenvectors.
uplo	<ul style="list-style-type: none"> 'U': Upper triangle of A is stored. 'L': Lower triangle of A is stored.
n	The order of the matrix a. N >= 0.

Table 287-54 (Cont.) LAPACK_SPEVD Procedure Parameters

Parameter	Description
ap	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n*(n+1)/2).</p> <p>On entry, the upper or lower triangle of the symmetric matrix a packed columnwise in a linear array. The j-th column of a is stored in the array ap:</p> <ul style="list-style-type: none"> If uplo = 'U', ap(i + (j-1)*j/2) = a(i,j) for 1<=i<=j. If uplo = 'L', ap(i + (j-1)*(2*n-j)/2) = a(i,j) for j<=i<=n. <p>On exit, ap is overwritten by values generated during the reduction to tridiagonal form:</p> <ul style="list-style-type: none"> If uplo = 'U', the diagonal and first superdiagonal of the tridiagonal matrix T overwrite the corresponding elements of A. If uplo = 'L', the diagonal and first subdiagonal of T overwrite the corresponding elements of A.
w	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n).</p> <p>If info = 0, the eigenvalues in ascending order.</p>
z	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldz,n).</p> <ul style="list-style-type: none"> If jobz = 'V', then if info = 0, z contains the orthonormal eigenvectors of the matrix A, with the i-th column of z holding the eigenvector associated with w(i). If jobz = 'N', then z is not referenced.
ldz	The leading dimension of the array z. ldz >= 1, and if jobz = 'v', ldz >= max(1,n).
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, the algorithm failed to converge; i off-diagonal elements of an intermediate tridiagonal form did not converge to zero
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.49 LAPACK_SPSV Procedures

This procedure computes the solution to a real system of linear equations $a * x = b$, where a is an n by n symmetric matrix stored in packed format, and x and b are n by nrhs matrices.

The diagonal pivoting method is used to factor A as

$$A = U * D * U^{**T}, \text{ if UPLO} = 'U'$$

or

$$A = L * D * L^{**T}, \text{ if UPLO} = 'L'$$

where U (or L) is a product of permutation and unit upper (lower) triangular matrices, and D is symmetric and block diagonal with 1 by 1 and 2 by 2 diagonal blocks. The factored form of A is then used to solve the system of equations $A * X = B$.



See Also:

[LAPACK Driver Routines \(Linear Equations\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.LAPACK_SPSV (
    uplo    IN        flag,
    n       IN        POSITIVEN,
    nrhs    IN        POSITIVEN,
    ap      IN OUT    UTL_NLA_ARRAY_DBL,
    ipiv    IN OUT    UTL_NLA_ARRAY_INT,
    b       IN OUT    UTL_NLA_ARRAY_DBL,
    ldb     IN        POSITIVEN,
    info    OUT       INTEGER,
    pack    IN        flag DEFAULT 'C');
```

```
UTL_NLA.LAPACK_SPSV (
    uplo    IN        flag,
    n       IN        POSITIVEN,
    nrhs    IN        POSITIVEN,
    ap      IN OUT    UTL_NLA_ARRAY_FLT,
    ipiv    IN OUT    UTL_NLA_ARRAY_INT,
    b       IN OUT    UTL_NLA_ARRAY_FLT,
    ldb     IN        POSITIVEN,
    info    OUT       INTEGER,
    pack    IN        flag DEFAULT 'C');
```

Parameters

Table 287-55 LAPACK_SPSV Procedure Parameters

Parameter	Description
uplo	<ul style="list-style-type: none"> uplo = 'U'. Upper triangular of A is stored. uplo = 'L'. Lower triangular of A is stored.
n	The number of linear equations, which is the order of the matrix a. $N \geq 0$.
nrhs	The number of right-hand sides, which is the number of columns of the matrix b. $nrhs \geq 0$.

Table 287-55 (Cont.) LAPACK_SPSV Procedure Parameters

Parameter	Description
ap	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n*(n+1)/2).</p> <p>On entry, the upper or lower triangle of the symmetric matrix A, packed columnwise in a linear array. The j-th column of A is stored in the array ap as follows:</p> <ul style="list-style-type: none"> • uplo = 'U': $AP(i + (j-1)*j/2) = A(i, j)$ for $1 \leq i \leq j$ • uplo = 'L': $AP(i + (j-1)*(2n-j)/2) = A(i, j)$ for $j \leq i \leq n$ <p>See below for further details.</p> <p>On exit, the block diagonal matrix D and the multipliers used to obtain the factor U or L from the factorization $A = U*D*U^*T$ or $A = L*D*L^*T$ as computed by SSPTRF, stored as a packed triangular matrix in the same storage format as A.</p>
ipiv	<p>INTEGER array, DIMENSION (n).</p> <p>Details of the interchanges and the block structure of d, as determined by SSPTRF.</p> <ul style="list-style-type: none"> • If $ipiv(k) > 0$, then rows and columns k and $ipiv(k)$ were interchanged, and $d(k, k)$ is a 1 by 1 diagonal block. • If uplo = 'U' and $ipiv(k) = ipiv(k-1) < 0$, then rows and columns k-1 and $-ipiv(k)$ were interchanged and $d(k-1:k, k-1:k)$ is a 2 by 2 diagonal block. • If uplo = 'L' and $ipiv(k) = ipiv(k+1) < 0$, then rows and columns k+1 and $-ipiv(k)$ were interchanged and $d(k:k+1, k:k+1)$ is a 2 by 2 diagonal block.
b	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldb, nrhs).</p> <p>On entry, the n by nrhs right hand side matrix b.</p> <p>On exit, if info = 0, the n by nrhs solution matrix X.</p>
ldb	<p>The leading dimension of the array b.</p> <p>$ldb \geq \max(1, n)$</p>
info	<ul style="list-style-type: none"> • = 0 : successful exit • < 0 : if info = -i, the i-th argument had an illegal value • > 0 : if info = i, $d(i, i)$ is exactly zero. The factorization has been completed, but the block diagonal matrix d is exactly singular, so the solution could not be computed.
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> • 'C': column-major (default) • 'R': row-major

287.5.50 LAPACK_STEV Procedures

This procedure computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix A.



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.LAPACK_STEV (
    jobz      IN      flag,
    n         IN      POSITIVEN,
    d         IN OUT  UTL_NLA_ARRAY_DBL,
    e         IN OUT  UTL_NLA_ARRAY_DBL,
    z         IN OUT  UTL_NLA_ARRAY_DBL,
    ldz      IN      POSITIVEN,
    info      OUT     INTEGER,
    pack      IN      flag DEFAULT 'C');
```

```
UTL_NLA.LAPACK_STEV (
    jobz      IN      flag,
    n         IN      POSITIVEN,
    d         IN OUT  UTL_NLA_ARRAY_FLT,
    e         IN OUT  UTL_NLA_ARRAY_FLT,
    z         IN OUT  UTL_NLA_ARRAY_FLT,
    ldz      IN      POSITIVEN,
    info      OUT     INTEGER,
    pack      IN      flag DEFAULT 'C');
```

Parameters

Table 287-56 LAPACK_STEV Procedure Parameters

Parameter	Description
jobz	<ul style="list-style-type: none"> 'N': Compute eigenvalues only. 'V': Compute eigenvalues and eigenvectors.
n	The order of the matrix a. N >= 0.
d	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). <ul style="list-style-type: none"> On entry, the n diagonal elements of the tridiagonal matrix A. On exit, if info = 0, the eigenvalues in ascending order.
e	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). <ul style="list-style-type: none"> On entry, the (n-1) subdiagonal elements of the tridiagonal matrix A, stored in elements 1 to n-1 of e. e(n) need not be set, but is used by the subprogram. On exit, the contents of e are destroyed.

Table 287-56 (Cont.) LAPACK_STEV Procedure Parameters

Parameter	Description
z	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldz, n). <ul style="list-style-type: none"> If jobz = 'V', then if info = 0, z contains the orthonormal eigenvectors of the matrix A, with the i-th column of z holding the eigenvector associated with d(i). If jobz = 'N', then z is not referenced.
ldz	The leading dimension of the array z. ldz >= 1, and if jobz = 'v', ldz >= max(1,n).
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, the algorithm failed to converge; i off-diagonal elements of an intermediate tridiagonal form did not converge to zero
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.51 LAPACK_STEVD Procedures

This procedure computes all eigenvalues and, optionally, eigenvectors of a real symmetric tridiagonal matrix. If eigenvectors are desired, it uses a divide and conquer algorithm that makes mild assumptions about floating point arithmetic.



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_STEVD (
  jobz      IN      flag,
  n         IN      POSITIVEN,
  d         IN OUT  UTL_NLA_ARRAY_DBL,
  e         IN OUT  UTL_NLA_ARRAY_DBL,
  z         IN OUT  UTL_NLA_ARRAY_DBL,
  ldz      IN      POSITIVEN,
  info      OUT     INTEGER,
  pack     IN      flag DEFAULT 'C');

```

```

UTL_NLA.LAPACK_STEVD (
  jobz      IN      flag,
  n         IN      POSITIVEN,
  d         IN OUT  UTL_NLA_ARRAY_FLT,
  e         IN OUT  UTL_NLA_ARRAY_FLT,
  z         IN OUT  UTL_NLA_ARRAY_FLT,
  ldz      IN      POSITIVEN,
  info      OUT     INTEGER,
  pack     IN      flag DEFAULT 'C');

```

Parameters

Table 287-57 LAPACK_STEVD Procedure Parameters

Parameter	Description
jobz	<ul style="list-style-type: none"> 'N': Compute eigenvalues only. 'V': Compute eigenvalues and eigenvectors.
n	The order of the matrix <i>a</i> . $N \geq 0$.
d	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). <ul style="list-style-type: none"> On entry, the <i>n</i> diagonal elements of the tridiagonal matrix <i>A</i>. On exit, if <i>info</i> = 0, the eigenvalues in ascending order.
e	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). <ul style="list-style-type: none"> On entry, the (<i>n</i>-1) subdiagonal elements of the tridiagonal matrix <i>A</i>, stored in elements 1 to <i>n</i>-1 of <i>e</i>. <i>e</i>(<i>n</i>) need not be set, but is used by the subprogram. On exit, the contents of <i>e</i> are destroyed.
z	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldz, n). <ul style="list-style-type: none"> If <i>jobz</i> = 'V', then if <i>info</i> = 0, <i>z</i> contains the orthonormal eigenvectors of the matrix <i>A</i>, with the <i>i</i>-th column of <i>z</i> holding the eigenvector associated with <i>d</i>(<i>i</i>). If <i>jobz</i> = 'N', then <i>z</i> is not referenced.
ldz	The leading dimension of the array <i>z</i> . $ldz \geq 1$, and if <i>jobz</i> = 'v', $ldz \geq \max(1, n)$.
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if <i>info</i> = -<i>i</i>, the <i>i</i>-th argument had an illegal value > 0 : if <i>info</i> = <i>i</i>, the algorithm failed to converge; <i>i</i> off-diagonal elements of an intermediate tridiagonal form did not converge to zero
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.52 LAPACK_SYEV Procedures

This procedure computes all eigenvalues and, optionally, eigenvectors of a real symmetric matrix *A*.



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.LAPACK_SYEV (
    jobz      IN      flag,
    uplo      IN      flag,
```

```

n          IN          POSITIVEN,
a          IN OUT     UTL_NLA_ARRAY_DBL,
lda       IN          POSITIVEN,
w          IN OUT     UTL_NLA_ARRAY_DBL,
info      OUT         INTEGER,
pack      IN          flag DEFAULT 'C');

UTL_NLA.LAPACK_SYEV (
  jobz     IN          flag,
  uplo     IN          flag,
  n        IN          POSITIVEN,
  a        IN OUT     UTL_NLA_ARRAY_FLT,
  lda      IN          POSITIVEN,
  w        IN OUT     UTL_NLA_ARRAY_FLT,
  info     OUT         INTEGER,
  pack     IN          flag DEFAULT 'C');

```

Parameters

Table 287-58 LAPACK_SYEV Procedure Parameters

Parameter	Description
jobz	<ul style="list-style-type: none"> 'N': Compute eigenvalues only. 'V': Compute eigenvalues and eigenvectors.
uplo	<ul style="list-style-type: none"> 'U': Upper triangle of A is stored. 'L': Lower triangle of A is stored.
n	The order of the matrix a. $N \geq 0$.
a	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (lda, n). On entry, the symmetric matrix a: <ul style="list-style-type: none"> If uplo = 'U', the leading n by n upper triangular part of a contains the upper triangular part of the matrix a. If uplo = 'L', the leading n by n lower triangular part of a contains the lower triangular part of the matrix a. On exit: <ul style="list-style-type: none"> If jobz = 'V', then if info = 0, a contains the orthonormal eigenvectors of the matrix a. If jobz = 'N', then on exit the lower triangle (if uplo = 'L') or the upper triangle (if uplo='U') of a, including the diagonal, is destroyed.
lda	The leading dimension of the array a. $lda \geq \max(1, n)$.
w	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). If info = 0, the eigenvalues in ascending order.
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, the algorithm failed to converge; i off-diagonal elements of an intermediate tridiagonal form did not converge to zero
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.53 LAPACK_SYEVD Procedures

This procedure computes all eigenvalues and, optionally, eigenvectors of a real symmetric matrix *A*. If eigenvectors are desired, it uses a divide and conquer algorithm that makes mild assumptions about floating point arithmetic.



See Also:

[LAPACK Driver Routines \(LLS and Eigenvalue Problems\) Subprograms](#) for other subprograms in this group

Syntax

```
UTL_NLA.LAPACK_SYEVD (
    jobz      IN      flag,
    uplo      IN      flag,
    n         IN      POSITIVEN,
    a         IN OUT  UTL_NLA_ARRAY_DBL,
    lda       IN      POSITIVEN,
    w         IN OUT  UTL_NLA_ARRAY_DBL,
    info      OUT     INTEGER,
    pack      IN      flag DEFAULT 'C');
```

```
UTL_NLA.LAPACK_SYEVD (
    jobz      IN      flag,
    uplo      IN      flag,
    n         IN      POSITIVEN,
    a         IN OUT  UTL_NLA_ARRAY_FLT,
    lda       IN      POSITIVEN,
    w         IN OUT  UTL_NLA_ARRAY_FLT,
    info      OUT     INTEGER,
    pack      IN      flag DEFAULT 'C');
```

Parameters

Table 287-59 LAPACK_SYEVD Procedure Parameters

Parameter	Description
jobz	<ul style="list-style-type: none"> 'N': Compute eigenvalues only. 'V': Compute eigenvalues and eigenvectors.
uplo	<ul style="list-style-type: none"> 'U': Upper triangle of <i>A</i> is stored. 'L': Lower triangle of <i>A</i> is stored.
n	The order of the matrix <i>a</i> . $N \geq 0$.

Table 287-59 (Cont.) LAPACK_SYEVD Procedure Parameters

Parameter	Description
a	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (lda, n). On entry, the symmetric matrix a: <ul style="list-style-type: none"> If uplo = 'U', the leading n by n upper triangular part of a contains the upper triangular part of the matrix a. If uplo = 'L', the leading n by n lower triangular part of a contains the lower triangular part of the matrix a. On exit: <ul style="list-style-type: none"> If jobz = 'V', then if info = 0, a contains the orthonormal eigenvectors of the matrix a. If jobz = 'N', then on exit the lower triangle (if uplo = 'L') or the upper triangle (if uplo = 'U') of a, including the diagonal, is destroyed.
lda	The leading dimension of the array a. lda >= max(1, n).
w	UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n). If info = 0, the eigenvalues in ascending order.
info	<ul style="list-style-type: none"> = 0 : successful exit < 0 : if info = -i, the i-th argument had an illegal value > 0 : if info = i, the algorithm failed to converge; i off-diagonal elements of an intermediate tridiagonal form did not converge to zero
pack	(Optional) Flags the packing of the matrices: <ul style="list-style-type: none"> 'C': column-major (default) 'R': row-major

287.5.54 LAPACK_SYSV Procedures

This procedure computes the solution to a real system of linear equations $A * X = B$, where A is an n by n symmetric matrix, and X and B are n by $nrhs$ matrices.

The diagonal pivoting method is used to factor A as

$$A = U * D * U^{**T}, \text{ if UPLO} = 'U'$$

or

$$A = L * D * L^{**T}, \text{ if UPLO} = 'L'$$

where U (or L) is a product of permutation and unit upper (lower) triangular matrices, and D is symmetric and block diagonal with 1 by 1 and 2 by 2 diagonal blocks. The factored form of A is then used to solve the system of equations $A * X = B$.



See Also:

[LAPACK Driver Routines \(Linear Equations\) Subprograms](#) for other subprograms in this group

Syntax

```

UTL_NLA.LAPACK_SYSV (
  uplo    IN      flag,
  n        IN      POSITIVEN,
  nrhs     IN      POSITIVEN,
  a        IN OUT  UTL_NLA_ARRAY_DBL,
  lda      IN      POSITIVEN,
  ipiv     IN OUT  UTL_NLA_ARRAY_INT,
  b        IN OUT  UTL_NLA_ARRAY_DBL,
  ldb      IN      POSITIVEN,
  info     OUT     INTEGER,
  pack     IN      flag DEFAULT 'C');

```

```

UTL_NLA.LAPACK_SYSV (
  uplo    IN      flag,
  n        IN      POSITIVEN,
  nrhs     IN      POSITIVEN,
  a        IN OUT  UTL_NLA_ARRAY_FLT,
  lda      IN      POSITIVEN,
  ipiv     IN OUT  UTL_NLA_ARRAY_INT,
  b        IN OUT  UTL_NLA_ARRAY_FLT,
  ldb      IN      POSITIVEN,
  info     OUT     INTEGER,
  pack     IN      flag DEFAULT 'C');

```

Parameters

Table 287-60 LAPACK_SYSV Procedure Parameters

Parameter	Description
uplo	<ul style="list-style-type: none"> uplo = 'U'. Upper triangular of A is stored. uplo = 'L'. Lower triangular of A is stored.
n	The number of linear equations, which is the order of the matrix a. $N \geq 0$.
nrhs	The number of right-hand sides, which is the number of columns of the matrix b. $nrhs \geq 0$.
a	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (n-1).</p> <p>On entry, the symmetric matrix a. If UPLO = 'U', the leading n by n upper triangular part of a contains the upper triangular part of the matrix a, and the strictly lower triangular part of a is not referenced. If uplo = 'L', the leading n by n lower triangular part of a contains the lower triangular part of the matrix a, and the strictly upper triangular part of a is not referenced.</p> <p>On exit, if info = 0, the block diagonal matrix d and the multipliers used to obtain the factor U or L from the factorization $A = U*D*U^{*T}$ or $A = L*D*L^{*T}$ as computed by SSYTRF.</p>
lda	<p>The leading dimension of the array a.</p> <p>$lda \geq \max(1, n)$</p>

Table 287-60 (Cont.) LAPACK_SYSV Procedure Parameters

Parameter	Description
ipiv	<p>INTEGER array, DIMENSION (ldb, nrhs).</p> <p>Details of the interchanges and the block structure of d, as determined by SSYTRF.</p> <ul style="list-style-type: none"> • If $\text{ipiv}(k) > 0$, then rows and columns k and $\text{ipiv}(k)$ were interchanged, and $d(k,k)$ is a 1 by1 diagonal block. • If $\text{uplo} = 'U'$ and $\text{ipiv}(k) = \text{ipiv}(k-1) < 0$, then rows and columns k-1 and $-\text{ipiv}(k)$ were interchanged and $d(k-1:k, k-1:k)$ is a 2 by 2 diagonal block. • If $\text{uplo} = 'L'$ and $\text{ipiv}(k) = \text{ipiv}(k+1) < 0$, then rows and columns k+1 and $-\text{ipiv}(k)$ were interchanged and $d(k:k+1, k:k+1)$ is a 2 by 2 diagonal block.
b	<p>UTL_NLA_ARRAY_FLT/DBL, DIMENSION (ldb, nrhs).</p> <p>On entry, the n by nrhs matrix of right hand side matrix b.</p> <p>On exit, if $\text{info} = 0$, the n by nrhs solution matrix X.</p>
ldb	<p>The leading dimension of the array b.</p> <p>$\text{ldb} \geq \max(1, n)$</p>
info	<ul style="list-style-type: none"> • = 0 : successful exit • < 0 : if $\text{info} = -i$, the i-th argument had an illegal value • > 0 : if $\text{info} = i$, $d(i,i)$ is exactly zero. The factorization has been completed, but the block diagonal matrix d is exactly singular, so the solution could not be computed.
pack	<p>(Optional) Flags the packing of the matrices:</p> <ul style="list-style-type: none"> • 'C': column-major (default) • 'R': row-major

UTL_RAW

The `UTL_RAW` package provides SQL functions for manipulating `RAW` datatypes.

This chapter contains the following topics:

- [Overview](#)
- [Operational Notes](#)
- [Summary of UTL_RAW Subprograms](#)

288.1 UTL_RAW Overview

This package is necessary because normal SQL functions do not operate on `RAW`s, and PL/SQL does not allow overloading between a `RAW` and a `CHAR` datatype. `UTL_RAW` also includes subprograms that convert various COBOL number formats to, and from, `RAW`s.

`UTL_RAW` is not specific to the database environment, and it may actually be used in other environments. For this reason, the prefix `UTL` has been given to the package, instead of `DBMS`.

288.2 UTL_RAW Operational Notes

`UTL_RAW` allows a `RAW` "record" to be composed of many elements. By using the `RAW` datatype, character set conversion will not be performed, keeping the `RAW` in its original format when being transferred through remote procedure calls.

With the `RAW` functions, you can manipulate binary data that was previously limited to the `hexoraw` and `rawtohex` functions.

Note:

Notes on datatypes:

- The `PLS_INTEGER` and `BINARY_INTEGER` datatypes are identical. This document uses `BINARY_INTEGER` to indicate datatypes in reference information (such as for table types, record types, subprogram parameters, or subprogram return values), but may use either in discussion and examples.
- The `INTEGER` and `NUMBER(38)` datatypes are also identical. This document uses `INTEGER` throughout.

288.3 Summary of UTL_RAW Subprograms

This table lists the `UTL_RAW` subprograms and briefly describes them.

Table 288-1 UTL_RAW Package Subprograms

Subprogram	Description
BIT_AND Function	Performs bitwise logical "and" of the values in RAW r1 with RAW r2 and returns the "anded" result RAW
BIT_COMPLEMENT Function	Performs bitwise logical "complement" of the values in RAW r and returns the "complement'ed" result RAW
BIT_OR Function	Performs bitwise logical "or" of the values in RAW r1 with RAW r2 and returns the "or'd" result RAW
BIT_XOR Function	Performs bitwise logical "exclusive or" of the values in RAW r1 with RAW r2 and returns the "xor'd" result RAW
CAST_FROM_BINARY_DOUBLE Function	Returns the RAW binary representation of a BINARY_DOUBLE value
CAST_FROM_BINARY_FLOAT Function	Returns the RAW binary representation of a BINARY_FLOAT value
CAST_FROM_BINARY_INTEGER Function	Returns the RAW binary representation of a BINARY_INTEGER value
CAST_FROM_NUMBER Function	Returns the RAW binary representation of a NUMBER value
CAST_TO_BINARY_DOUBLE Function	Casts the RAW binary representation of a BINARY_DOUBLE into a BINARY_DOUBLE
CAST_TO_BINARY_FLOAT Function	Casts the RAW binary representation of a BINARY_FLOAT into a BINARY_FLOAT
CAST_TO_BINARY_INTEGER Function	Casts the RAW binary representation of a BINARY_INTEGER into a BINARY_INTEGER
CAST_TO_NUMBER Function	Casts the RAW binary representation of a NUMBER into a NUMBER
CAST_TO_NVARCHAR2 Function	Converts a RAW value into a VARCHAR2 value
CAST_TO_RAW Function	Converts a VARCHAR2 value into a RAW value
CAST_TO_VARCHAR2 Function	Converts a RAW value into a VARCHAR2 value
COMPARE Function	Compares RAW r1 against RAW r2
CONCAT Function	Concatenates up to 12 RAWs into a single RAW
CONVERT Function	Converts RAW r from character set from_charset to character set to_charset and returns the resulting RAW
COPIES Function	Returns n copies of r concatenated together
LENGTH Function	Returns the length in bytes of a RAW r
OVERLAY Function	Overlays the specified portion of target RAW with overlay RAW, starting from byte position pos of target and proceeding for len bytes
REVERSE Function	Reverses a byte sequence in RAW r from end to end
SUBSTR Function	Returns len bytes, starting at pos from RAW r
TRANSLATE Function	Translates the bytes in the input RAW r according to the bytes in the translation RAWs from_set and to_set

Table 288-1 (Cont.) UTL_RAW Package Subprograms

Subprogram	Description
TRANSLITERATE Function	Converts the bytes in the input RAW <i>r</i> according to the bytes in the transliteration RAWs <i>from_set</i> and <i>to_set</i>
XRANGE Function	Returns a RAW containing all valid 1-byte encodings in succession, beginning with the value <i>start_byte</i> and ending with the value <i>end_byte</i>

288.3.1 BIT_AND Function

This function performs bitwise logical "and" of the values in RAW *r1* with RAW *r2* and returns the "anded" result RAW.

Syntax

```
UTL_RAW.BIT_AND (
    r1 IN RAW,
    r2 IN RAW)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(bit_and, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-2 BIT_AND Function Parameters

Parameter	Description
<i>r1</i>	RAW to "and" with <i>r2</i>
<i>r2</i>	RAW to "and" with <i>r1</i>

Return Values

Table 288-3 BIT_AND Function Return Values

Return	Description
RAW	Containing the "and" of <i>r1</i> and <i>r2</i>
NULL	Either <i>r1</i> or <i>r2</i> input parameter was NULL

Usage Notes

If *r1* and *r2* differ in length, the and operation is terminated after the last byte of the shorter of the two RAWs, and the unprocessed portion of the longer RAW is appended to the partial result. The result length equals the longer of the two input RAWs.

288.3.2 BIT_COMPLEMENT Function

This function performs bitwise logical "complement" of the values in RAW *r* and returns the complemented result RAW. The result length equals the input RAW *r* length.

Syntax

```
UTL_RAW.BIT_COMPLEMENT (  
    r IN RAW)  
    RETURN RAW;
```

Pragmas

```
pragma restrict_references(bit_complement, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-4 BIT_COMPLEMENT Function Parameters

Parameter	Description
<i>r</i>	RAW to perform "complement" operation

Return Values

Table 288-5 BIT_COMPLEMENT Function Return Values

Return	Description
RAW	The "complement" of <i>r1</i>
NULL	If <i>r</i> input parameter was NULL

288.3.3 BIT_OR Function

This function performs bitwise logical "or" of the values in RAW *r1* with RAW *r2* and returns the or'd result RAW.

Syntax

```
UTL_RAW.BIT_OR (  
    r1 IN RAW,  
    r2 IN RAW)  
    RETURN RAW;
```

Pragmas

```
pragma restrict_references(bit_or, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-6 BIT_OR Function Parameters

Parameters	Description
r1	RAW to "or" with r2
r2	RAW to "or" with r1

Return Values

Table 288-7 BIT_OR Function Return Values

Return	Description
RAW	Containing the "or" of r1 and r2
NULL	Either r1 or r2 input parameter was NULL

Usage Notes

If r1 and r2 differ in length, then the "or" operation is terminated after the last byte of the shorter of the two RAWs, and the unprocessed portion of the longer RAW is appended to the partial result. The result length equals the longer of the two input RAWs.

288.3.4 BIT_XOR Function

This function performs bitwise logical "exclusive or" of the values in RAW r1 with RAW r2 and returns the xor'd result RAW.

Syntax

```
UTL_RAW.BIT_XOR (
    r1 IN RAW,
    r2 IN RAW)
RETURN RAW;
```

Pragmas

```
pragma restrict_references (bit_xor, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-8 BIT_XOR Function Parameters

Parameter	Description
r1	RAW to "xor" with r2
r2	RAW to "xor" with r1

Return Values

Table 288-9 BIT_XOR Function Return Values

Return	Description
RAW	Containing the "xor" of r1 and r2
NULL	If either r1 or r2 input parameter was NULL

Usage Notes

If r1 and r2 differ in length, then the "xor" operation is terminated after the last byte of the shorter of the two RAWs, and the unprocessed portion of the longer RAW is appended to the partial result. The result length equals the longer of the two input RAWs.

288.3.5 CAST_FROM_BINARY_DOUBLE Function

This function returns the RAW binary representation of a BINARY_DOUBLE value.

Syntax

```
UTL_RAW.CAST_FROM_BINARY_DOUBLE (
    n          IN BINARY_DOUBLE,
    endianness IN PLS_INTEGER DEFAULT 1)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(cast_from_binary_double, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-10 CAST_FROM_BINARY_DOUBLE Function Parameters

Parameter	Description
n	BINARY_DOUBLE value
endianness	A BINARY_INTEGER value indicating the endianness. The function recognizes the defined constants big_endian (1), little_endian (2), and machine_endian (3). The default is big_endian. A setting of machine_endian has the same effect as big_endian on a big endian machine, or the same effect as little_endian on a little endian machine.

Return Values

The binary representation of the BINARY_DOUBLE value, or NULL if the input is NULL.

Usage Notes

- An 8-byte binary_double value maps to the IEEE 754 double-precision format as follows:

```
byte 0: bit 63 ~ bit 56
byte 1: bit 55 ~ bit 48
```

```
byte 2: bit 47 ~ bit 40
byte 3: bit 39 ~ bit 32
byte 4: bit 31 ~ bit 24
byte 5: bit 23 ~ bit 16
byte 6: bit 15 ~ bit 8
byte 7: bit 7 ~ bit 0
```

- The parameter `endianess` describes how the bytes of `BINARY_DOUBLE` are mapped to the bytes of `RAW`. In the following matrix, `rb0 ~ rb7` refer to the bytes in `raw` and `db0 ~ db7` refer to the bytes in `BINARY_DOUBLE`.

endianess	rb0	rb1	rb2	rb3	rb4	rb5	rb6	rb7
<code>big_endian</code>	db0	db1	db2	db3	db4	db5	db6	db7
<code>little_endian</code>	db7	db6	db5	db4	db3	db2	db1	db0

- In case of machine-endian, the 8 bytes of the `BINARY_DOUBLE` argument are copied straight across into the `RAW` return value. The effect is the same if the user has passed `big_endian` on a big-endian machine, or `little_endian` on a little-endian machine.

288.3.6 CAST_FROM_BINARY_FLOAT Function

This function returns the `RAW` binary representation of a `BINARY_FLOAT` value.

Syntax

```
UTL_RAW.CAST_FROM_BINARY_FLOAT(
    n          IN BINARY_FLOAT,
    endianess  IN PLS_INTEGER DEFAULT 1)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(cast_from_binary_float, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-11 CAST_FROM_BINARY_FLOAT Function Parameters

Parameter	Description
<code>n</code>	<code>BINARY_FLOAT</code> value
<code>endianess</code>	A <code>BINARY_INTEGER</code> value indicating the endianess. The function recognizes the defined constants <code>big_endian</code> (1), <code>little_endian</code> (2), and <code>machine_endian</code> (3). The default is <code>big_endian</code> . A setting of <code>machine_endian</code> has the same effect as <code>big_endian</code> on a big endian machine, or the same effect as <code>little_endian</code> on a little endian machine.

Return Values

The binary representation (`RAW`) of the `BINARY_FLOAT` value, or `NULL` if the input is `NULL`.

Usage Notes

- A 4-byte `binary_float` value maps to the IEEE 754 single-precision format as follows:

```
byte 0: bit 31 ~ bit 24
byte 1: bit 23 ~ bit 16
byte 2: bit 15 ~ bit 8
byte 3: bit 7 ~ bit 0
```

- The parameter `endianess` describes how the bytes of `BINARY_FLOAT` are mapped to the bytes of `RAW`. In the following matrix, `rb0 ~ rb3` refer to the bytes in `RAW` and `fb0 ~ fb3` refer to the bytes in `BINARY_FLOAT`.

Endianess	rb0	rb1	rb2	rb3
<code>big_endian</code>	fb0	fb1	fb2	fb3
<code>little_endian</code>	fb3	fb2	fb1	fb0

- In case of machine-endian, the 4 bytes of the `BINARY_FLOAT` argument are copied straight across into the `RAW` return value. The effect is the same if the user has passed `big_endian` on a big-endian machine, or `little_endian` on a little-endian machine.

288.3.7 CAST_FROM_BINARY_INTEGER Function

This function returns the `RAW` binary representation of a `BINARY_INTEGER` value.

Syntax

```
UTL_RAW.CAST_FROM_BINARY_INTEGER (
    n          IN BINARY_INTEGER
    endianess  IN PLS_INTEGER DEFAULT BIG_ENDIAN)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(cast_from_binary_integer, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-12 CAST_FROM_BINARY_INTEGER Function Parameters

Parameter	Description
<code>n</code>	<code>BINARY_INTEGER</code> value.
<code>endianess</code>	A <code>BINARY_INTEGER</code> value indicating the endianess. The function recognizes the defined constants <code>big_endian</code> (1), <code>little_endian</code> (2), and <code>machine_endian</code> (3). The default is <code>big_endian</code> . A setting of <code>machine_endian</code> has the same effect as <code>big_endian</code> on a big endian machine, or the same effect as <code>little_endian</code> on a little endian machine.

Return Values

The binary representation of the `BINARY_INTEGER` value.

288.3.8 CAST_FROM_NUMBER Function

This function returns the RAW binary representation of a NUMBER value.

Syntax

```
UTL_RAW.CAST_FROM_NUMBER (  
    n IN NUMBER)  
RETURN RAW;
```

Pragmas

```
pragma restrict_references(cast_from_number, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-13 CAST_FROM_NUMBER Function Parameters

Parameter	Description
n	NUMBER value

Return Values

The binary representation of the NUMBER value.

288.3.9 CAST_TO_BINARY_DOUBLE Function

This function casts the RAW binary representation of a BINARY_DOUBLE into a BINARY_DOUBLE.

Syntax

```
UTL_RAW.CAST_TO_BINARY_DOUBLE (  
    r IN RAW  
    endianness IN PLS_INTEGER DEFAULT 1)  
RETURN BINARY_DOUBLE;
```

Pragmas

```
pragma restrict_references(cast_to_binary_double, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-14 CAST_TO_BINARY_DOUBLE Function Parameters

Parameter	Description
r	Binary representation of a BINARY_DOUBLE
endianness	A PLS_INTEGER representing big-endian or little-endian architecture. The default is big-endian.

Return Values

The BINARY_DOUBLE value.

Usage Notes

- If the `RAW` argument is more than 8 bytes, only the first 8 bytes are used and the rest of the bytes are ignored. If the result is `-0`, `+0` is returned. If the result is `NaN`, the value `BINARY_DOUBLE_NAN` is returned.
- If the `RAW` argument is less than 8 bytes, a `VALUE_ERROR` exception is raised.
- An 8-byte `binary_double` value maps to the IEEE 754 double-precision format as follows:


```
byte 0: bit 63 ~ bit 56
byte 1: bit 55 ~ bit 48
byte 2: bit 47 ~ bit 40
byte 3: bit 39 ~ bit 32
byte 4: bit 31 ~ bit 24
byte 5: bit 23 ~ bit 16
byte 6: bit 15 ~ bit 8
byte 7: bit 7 ~ bit 0
```
- The parameter `endianess` describes how the bytes of `BINARY_DOUBLE` are mapped to the bytes of `RAW`. In the following matrix, `rb0 ~ rb7` refer to the bytes in `raw` and `db0 ~ db7` refer to the bytes in `BINARY_DOUBLE`.

Architecture	rb0	rb1	rb2	rb3	rb4	rb5	rb6	rb7
<code>big_endian</code>	db0	db1	db2	db3	db4	db5	db6	db7
<code>little_endian</code>	db7	db6	db5	db4	db3	db2	db1	db0

- In case of machine-endian, the 8 bytes of the `RAW` argument are copied straight across into the `BINARY_DOUBLE` return value. The effect is the same if the user has passed `big_endian` on a big-endian machine, or `little_endian` on a little-endian machine.

288.3.10 CAST_TO_BINARY_FLOAT Function

This function casts the `RAW` binary representation of a `BINARY_FLOAT` into a `BINARY_FLOAT`.

Syntax

```
UTL_RAW.CAST_TO_BINARY_FLOAT (
    r          IN RAW
    endianess  IN PLS_INTEGER DEFAULT 1)
RETURN BINARY_FLOAT;
```

Pragmas

```
pragma restrict_references(cast_to_binary_float, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-15 CAST_TO_BINARY_FLOAT Function Parameters

Parameter	Description
<code>r</code>	Binary representation of a <code>BINARY_FLOAT</code>

Table 288-15 (Cont.) CAST_TO_BINARY_FLOAT Function Parameters

Parameter	Description
endianess	A PLS_INTEGER representing big-endian or little-endian architecture. The default is big-endian.

Return Values

The BINARY_FLOAT value.

Usage Notes

- If the RAW argument is more than 4 bytes, only the first 4 bytes are used and the rest of the bytes are ignored. If the result is -0, +0 is returned. If the result is NaN, the value BINARY_FLOAT_NAN is returned.
- If the RAW argument is less than 4 bytes, a VALUE_ERROR exception is raised.
- A 4-byte binary_float value maps to the IEEE 754 single-precision format as follows:
 - byte 0: bit 31 ~ bit 24
 - byte 1: bit 23 ~ bit 16
 - byte 2: bit 15 ~ bit 8
 - byte 3: bit 7 ~ bit 0
- The parameter endianess describes how the bytes of BINARY_FLOAT are mapped to the bytes of RAW. In the following matrix, rb0 ~ rb3 refer to the bytes in RAW and fb0 ~ fb3 refer to the bytes in BINARY_FLOAT.

Endianness	rb0	rb1	rb2	rb3
big_endian	fb0	fb1	fb2	fb3
little_endian	fb3	fb2	fb1	fb0

- In case of machine-endian, the 4 bytes of the RAW argument are copied straight across into the BINARY_FLOAT return value. The effect is the same if the user has passed big_endian on a big-endian machine, or little_endian on a little-endian machine.

288.3.11 CAST_TO_BINARY_INTEGER Function

This function casts the RAW binary representation of a BINARY_INTEGER into a BINARY_INTEGER.

Syntax

```
UTL_RAW.CAST_TO_BINARY_INTEGER (
  r          IN RAW
  endianess IN PLS_INTEGER DEFAULT BIG_ENDIAN)
RETURN BINARY_INTEGER;
```

Pragmas

```
pragma restrict_references(cast_to_binary_integer, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-16 CAST_TO_BINARY_INTEGER Function Parameters

Parameter	Description
<code>r</code>	Binary representation of a <code>BINARY_INTEGER</code>
<code>endianess</code>	A <code>PLS_INTEGER</code> representing big-endian or little-endian architecture. The default is big-endian.

Return Values

The `BINARY_INTEGER` value

288.3.12 CAST_TO_NUMBER Function

This function casts the `RAW` binary representation of a `NUMBER` into a `NUMBER`.

Syntax

```
UTL_RAW.CAST_TO_NUMBER (
    r IN RAW)
RETURN NUMBER;
```

Pragmas

```
pragma restrict_references(cast_to_number, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-17 CAST_TO_NUMBER function Parameters

Parameter	Description
<code>r</code>	Binary representation of a <code>NUMBER</code>

Return Values

The `NUMBER` value.

288.3.13 CAST_TO_NVARCHAR2 Function

This function converts a `RAW` value represented using some number of data bytes into an `NVARCHAR2` value with that number of data bytes.

Note:

When casting to a `NVARCHAR2`, the current Globalization Support character set is used for the characters within that `NVARCHAR2` value.

Syntax

```
UTL_RAW.CAST_TO_NVARCHAR2 (
    r IN RAW)
RETURN NVARCHAR2;
```

Pragmas

```
pragma restrict_references(cast_to_NVARCHAR2, WNDS, RNDS, WNPS, RNPS);
```

Parameters**Table 288-18 CAST_TO_NVARCHAR2 Function Parameters**

Parameter	Description
r	RAW (without leading length field) to be changed to a NVARCHAR2)

Return Values**Table 288-19 CAST_TO_NVARCHAR2 Function Return Values**

Return	Description
NVARCHAR2	Containing having the same data as the input RAW
NULL	If r input parameter was NULL

288.3.14 CAST_TO_RAW Function

This function converts a VARCHAR2 value represented using some number of data bytes into a RAW value with that number of data bytes. The data itself is not modified in any way, but its datatype is recast to a RAW datatype.

Syntax

```
UTL_RAW.CAST_TO_RAW (
    c IN VARCHAR2)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(cast_to_raw, WNDS, RNDS, WNPS, RNPS);
```

Parameters**Table 288-20 CAST_TO_RAW Function Parameters**

Parameter	Description
c	VARCHAR2 to be changed to a RAW

Return Values

Table 288-21 CAST_TO_RAW Function Return Values

Return	Description
RAW	Containing the same data as the input VARCHAR2 and equal byte length as the input VARCHAR2 and without a leading length field
NULL	If <i>c</i> input parameter was NULL

288.3.15 CAST_TO_VARCHAR2 Function

This function converts a RAW value represented using some number of data bytes into a VARCHAR2 value with that number of data bytes.

Note:

When casting to a VARCHAR2, the current Globalization Support character set is used for the characters within that VARCHAR2.

Syntax

```
UTL_RAW.CAST_TO_VARCHAR2 (
  r IN RAW)
RETURN VARCHAR2;
```

Pragmas

```
pragma restrict_references(cast_to_VARCHAR2, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-22 CAST_TO_VARCHAR2 Function Parameters

Parameter	Description
<i>r</i>	RAW (without leading length field) to be changed to a VARCHAR2

Return Values

Table 288-23 CAST_TO_VARCHAR2 Function Return Values

Return	Description
VARCHAR2	Containing having the same data as the input RAW
NULL	If <i>r</i> input parameter was NULL

288.3.16 COMPARE Function

This function compares two RAW values. If they differ in length, then the shorter is extended on the right according to the optional `pad` parameter.

Syntax

```
UTL_RAW.COMPARE (
  r1 IN RAW,
  r2 IN RAW,
  pad IN RAW DEFAULT NULL)
RETURN NUMBER;
```

Pragmas

```
pragma restrict_references(compare, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-24 COMPARE Function Parameters

Parameter	Description
<code>r1</code>	1st RAW to be compared, may be NULL or 0 length
<code>r2</code>	2nd RAW to be compared, may be NULL or 0 length
<code>pad</code>	This is an optional parameter. Byte to extend whichever of <code>r1</code> or <code>r2</code> is shorter. The default: <code>x'00'</code>

Return Values

Table 288-25 COMPARE Function Return Values

Return	Description
NUMBER	Equals 0 if RAW byte strings are both NULL or identical; or, Equals position (numbered from 1) of the first mismatched byte

288.3.17 CONCAT Function

This function concatenates up to 12 RAWs into a single RAW. If the concatenated size exceeds 32K, then an error is returned

Syntax

```
UTL_RAW.CONCAT (
  r1 IN RAW DEFAULT NULL,
  r2 IN RAW DEFAULT NULL,
  r3 IN RAW DEFAULT NULL,
  r4 IN RAW DEFAULT NULL,
  r5 IN RAW DEFAULT NULL,
  r6 IN RAW DEFAULT NULL,
  r7 IN RAW DEFAULT NULL,
  r8 IN RAW DEFAULT NULL,
  r9 IN RAW DEFAULT NULL,
```

```
r10 IN RAW DEFAULT NULL,
r11 IN RAW DEFAULT NULL,
r12 IN RAW DEFAULT NULL)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(concat, WNDS, RNDS, WNPS, RNPS);
```

Parameters

r1....r12 are the RAW items to concatenate.

Return Values

Table 288-26 CONCAT Function Return Values

Return	Description
RAW	Containing the items concatenated

Exceptions

There is an error if the sum of the lengths of the inputs exceeds the maximum allowable length for a RAW, which is 32767 bytes.

288.3.18 CONVERT Function

This function converts RAW *r* from character set *from_charset* to character set *to_charset* and returns the resulting RAW.

Both *from_charset* and *to_charset* must be supported character sets defined to the Oracle server.

Syntax

```
UTL_RAW.CONVERT (
  r          IN RAW,
  to_charset IN VARCHAR2,
  from_charset IN VARCHAR2)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(convert, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-27 CONVERT Function Parameters

Parameter	Description
<i>r</i>	RAW byte-string to be converted
<i>to_charset</i>	Name of the character set to which <i>r</i> is converted
<i>from_charset</i>	Name of the character set in which <i>r</i> is supplied

Return Values

Table 288-28 CONVERT Function Return Values

Return	Description
RAW	Byte string <i>r</i> converted according to the specified character sets.

Exceptions

Table 288-29 CONVERT Function Exceptions

Error	Description
ORA-06502	PL/SQL: numeric or value error
ORA-12703	This character set conversion is not supported
ORA-12705	Cannot access NLS data files or invalid environment specified

Usage Notes

- The NLS_LANG parameter form *language_territory.character set* is also accepted for *to_charset* and *from_charset*. However, this form is deprecated and should be avoided. Note that *language* and *territory* are ignored by this subprogram.
- The converted value is silently truncated if it exceeds the maximum length of a RAW value, which is 32767 bytes. Do not convert values longer than $\text{floor}(32767/4) = 8191$ bytes if you want to avoid this truncation for all possible combinations of *to_charset* and *from_charset*. You can use the maximum character width of the target character set *to_charset*, if known, to expand the limit to a less pessimistic value. For example, if the target character set is ZHS16GBK, the maximum safe source string length is $\text{floor}(32767/2) = 16383$ bytes. For single-byte target character sets, no truncation is ever necessary.

288.3.19 COPIES Function

This function returns *n* copies of *r* concatenated together.

Syntax

```
UTL_RAW.COPIES (
  r IN RAW,
  n IN NUMBER)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(copies, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-30 COPIES Function Parameters

Parameters	Description
r	RAW to be copied
n	Number of times to copy the RAW (must be positive)

Return Values

This returns the RAW copied n times.

Exceptions

Table 288-31 COPIES Function Exceptions

Error	Description
VALUE_ERROR	Either: - r is missing, NULL or 0 length - n < 1 - Length of result exceeds maximum length of a RAW

288.3.20 LENGTH Function

This function returns the length in bytes of a RAW r.

Syntax

```
UTL_RAW.LENGTH (
    r IN RAW)
RETURN NUMBER;
```

Pragmas

```
pragma restrict_references(length, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-32 LENGTH Function Parameters

Parameter	Description
r	RAW byte stream to be measured

Return Values

Table 288-33 LENGTH Function Return Values

Return	Description
NUMBER	Current length of the RAW

288.3.21 OVERLAY Function

This function overlays the specified portion of `target RAW` with `overlay_str RAW`, starting from byte position `pos` of `target` and proceeding for `len` bytes.

Syntax

```
UTL_RAW.OVERLAY (
  overlay_str IN RAW,
  target      IN RAW,
  pos        IN BINARY_INTEGER DEFAULT 1,
  len        IN BINARY_INTEGER DEFAULT NULL,
  pad        IN RAW              DEFAULT NULL)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(overlay, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-34 OVERLAY Function Parameters

Parameters	Description
<code>overlay_str</code>	Byte-string used to overlay target
<code>target</code>	Byte-string which is to be overlaid
<code>pos</code>	Position in target (numbered from 1) to start overlay
<code>len</code>	The number of target bytes to overlay
<code>pad</code>	Pad byte used when <code>overlay len</code> exceeds <code>overlay_str length</code> or <code>pos</code> exceeds <code>target length</code>

Defaults and Optional Parameters

Table 288-35 OVERLAY Function Optional Parameters

Optional Parameter	Description
<code>pos</code>	1
<code>len</code>	To the length of <code>overlay_str</code>
<code>pad</code>	<code>x'00'</code>

Return Values

Table 288-36 OVERLAY Function Return Values

Return	Description
<code>RAW</code>	The target <code>byte_string</code> overlaid as specified.

Usage Notes

If `overlay_str` has less than `len` bytes, then it is extended to `len` bytes using the `pad` byte. If `overlay_str` exceeds `len` bytes, then the extra bytes in `overlay_str` are ignored. If `len` bytes beginning at position `pos` of `target` exceeds the length of `target`, then `target` is extended to contain the entire length of `overlay_str`.

If `len` is specified, it must be greater than or equal to 0. If `pos` is specified, it must be greater than or equal to 1. If `pos` exceeds the length of `target`, then `target` is padded with `pad` bytes to position `pos`, and `target` is further extended with `overlay_str` bytes.

Exceptions

Table 288-37 OVERLAY Function Exceptions

Error	Description
VALUE_ERROR	Either: <ul style="list-style-type: none"> - <code>Overlay_str</code> is NULL or has 0 length - <code>Target</code> is missing or undefined - Length of <code>target</code> exceeds maximum length of a RAW - <code>len < 0</code> - <code>pos < 1</code>

288.3.22 REVERSE Function

This function reverses a byte sequence in RAW `r` from end to end.

For example, `x'0102F3'` would be reversed to `x'F30201'`, and `'xyz'` would be reversed to `'zyx'`. The result length is the same as the input RAW length.

Syntax

```
UTL_RAW.REVERSE (
    r IN RAW)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(reverse, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-38 REVERSE Function Parameters

Parameter	Description
<code>r</code>	RAW to reverse

Return Values

Table 288-39 REVERSE Function Return Values

Return	Description
RAW	Containing the "reverse" of <i>r</i>

Exceptions

Table 288-40 REVERSE Function Exceptions

Error	Description
VALUE_ERROR	<i>R</i> is NULL or has 0 length

288.3.23 SUBSTR Function

This function returns *len* bytes, starting at *pos* from RAW *r*.

Syntax

```
UTL_RAW.SUBSTR (
  r    IN RAW,
  pos  IN BINARY_INTEGER,
  len  IN BINARY_INTEGER DEFAULT NULL)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(substr, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-41 SUBSTR Function Parameters

Parameter	Description
<i>r</i>	RAW byte-string from which a portion is extracted
<i>pos</i>	Byte position in <i>r</i> at which to begin extraction
<i>len</i>	Number of bytes from <i>pos</i> to extract from <i>r</i> (optional)

Defaults and Optional Parameters

Table 288-42 SUBSTR Function Optional Parameter

Optional Parameter	Description
<i>len</i>	Position <i>pos</i> through to the end of <i>r</i>

Return Values

Table 288-43 SUBSTR Function Return Values

Return	Description
portion of <i>r</i>	Beginning at <i>pos</i> for <i>len</i> bytes long
NULL	<i>r</i> input parameter was NULL

Usage Notes

- If *pos* is positive, then `SUBSTR` counts from the beginning of *r* to find the first byte. If *pos* is negative, then `SUBSTR` counts backward from the end of the *r*. The value *pos* cannot be 0.
- If *len* is omitted, then `SUBSTR` returns all bytes to the end of *r*. The value *len* cannot be less than 1.

Exceptions

Table 288-44 SUBSTR Function Exceptions

Error	Description
VALUE_ERROR	VALUE_ERROR is returned if: <ul style="list-style-type: none"> • <i>pos</i> = 0 or > length of <i>r</i> • <i>len</i> < 1 or > length of <i>r</i> - (<i>pos</i>-1)

288.3.24 TRANSLATE Function

This function translates the bytes in the input RAW *r* according to the bytes in the translation RAWs *from_set* and *to_set*.

If a byte in *r* has a matching byte in *from_set*, then it is replaced by the byte in the corresponding position in *to_set*, or deleted.

Bytes in *r*, but undefined in *from_set*, are copied to the result. Only the first (leftmost) occurrence of a byte in *from_set* is used. Subsequent duplicates are not scanned and are ignored.

Syntax

```
UTL_RAW.TRANSLATE (
    r          IN RAW,
    from_set  IN RAW,
    to_set    IN RAW)
RETURN RAW;
```



Note:

Be aware that *to_set* and *from_set* are reversed in the calling sequence compared to `TRANSLITERATE`.

Pragmas

```
pragma restrict_references(translate, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-45 TRANSLATE Function Parameters

Parameter	Description
<code>r</code>	RAW source byte-string to be translated
<code>from_set</code>	RAW byte-codes to be translated, if present in <code>r</code>
<code>to_set</code>	RAW byte-codes to which corresponding <code>from_str</code> bytes are translated

Return Values

Table 288-46 TRANSLATE Function Return Values

Return	Description
RAW	Translated byte-string

Usage Notes

- If `to_set` is shorter than `from_set`, the extra `from_set` bytes have no corresponding translation bytes. Bytes from the input RAW that match any such `from_set` bytes are not translated or included in the result. They are effectively translated to NULL.
- If `to_set` is longer than `from_set`, the extra `to_set` bytes are ignored.
- If a byte value is repeated in `from_set`, the repeated occurrence is ignored.

Note:

Differences from the [TRANSLITERATE Function](#):

- The `from_set` parameter comes before the `to_set` parameter in the calling sequence.
- Bytes from `r` that appear in `from_set` but have no corresponding values in `to_set` are not translated or included in the result.
- The resulting RAW value may be shorter than the input RAW value.

Note that `TRANSLATE` and `TRANSLITERATE` only differ in functionality when `to_set` has fewer bytes than `from_set`.

Exceptions

Table 288-47 TRANSLATE Function Exceptions

Error	Description
VALUE_ERROR	Either: - <i>r</i> is NULL or has 0 length - <i>from_set</i> is NULL or has 0 length - <i>to_set</i> is NULL or has 0 length

288.3.25 TRANSLITERATE Function

This function converts the bytes in the input RAW *r* according to the bytes in the transliteration RAWs *from_set* and *to_set*.

Successive bytes in *r* are looked up in the *from_set*, and, if not found, copied unaltered to the result RAW. If found, then they are replaced in the result RAW by either corresponding bytes in the *to_set*, or the *pad* byte when no correspondence exists.

Bytes in *r*, but undefined in *from_set*, are copied to the result. Only the first (leftmost) occurrence of a byte in *from_set* is used. Subsequent duplicates are not scanned and are ignored. The result RAW is always the same length as *r*.

Syntax

```
UTL_RAW.TRANSLITERATE (
    r          IN RAW,
    to_set     IN RAW DEFAULT NULL,
    from_set   IN RAW DEFAULT NULL,
    pad       IN RAW DEFAULT NULL)
RETURN RAW;
```



Note:

Be aware that *to_set* and *from_set* are reversed in the calling sequence compared to TRANSLATE.

Pragmas

```
pragma restrict_references(transliterate, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-48 TRANSLITERATE Function Parameters

Parameter	Description
<i>r</i>	RAW input byte-string to be converted
<i>to_set</i>	RAW byte-codes to which corresponding <i>from_set</i> bytes are converted (any length)

Table 288-48 (Cont.) TRANSLITERATE Function Parameters

Parameter	Description
<code>from_set</code>	RAW byte-codes to be converted, if presenting <code>r</code> (any length)
<code>pad</code>	1 byte used when <code>to_set</code> is shorter than the <code>from_set</code>

Defaults and Optional Parameters

Table 288-49 TRANSLITERATE Function Optional Parameters

Optional Parameter	Description
<code>to_set</code>	To the NULL string and effectively extended with <code>pad</code> to the length of <code>from_set</code> as necessary
<code>from_set</code>	x'00' through x'fff'
<code>pad</code>	x'00'

Return Values

Table 288-50 TRANSLITERATE Function Return Values

Return	Description
RAW	Converted byte-string.

Usage Notes

- If `to_set` is shorter than `from_set`, the extra `from_set` bytes have no corresponding conversion bytes. Bytes from the input RAW that match any such `from_set` bytes are converted in the result to the `pad` byte instead.
- If `to_set` is longer than `from_set`, the extra `to_set` bytes are ignored.
- If a byte value is repeated in `from_set`, the repeated occurrence is ignored.



Note:

Differences from the [TRANSLATE Function](#):

- The `to_set` parameter comes before the `from_set` parameter in the calling sequence.
- Bytes from `r` that appear in `from_set` but have no corresponding values in `to_set` are replaced by `pad` in the result.
- The resulting RAW value always has the same length as the input RAW value.

Note that TRANSLATE and TRANSLITERATE only differ in functionality when `to_set` has fewer bytes than `from_set`.

Exceptions

Table 288-51 TRANSLITERATE Function Exceptions

Error	Description
VALUE_ERROR	R is NULL or has 0 length

288.3.26 XRANGE Function

This function returns a RAW value containing the succession of one-byte encodings beginning and ending with the specified byte-codes. The specified byte-codes must be single-byte RAW values. If the `start_byte` value is greater than the `end_byte` value, then the succession of resulting bytes begins with `start_byte`, wraps through `x'FF'` back to `x'00'`, then ends at `end_byte`.

Syntax

```
UTL_RAW.XRANGE (
    start_byte IN RAW DEFAULT NULL,
    end_byte   IN RAW DEFAULT NULL)
RETURN RAW;
```

Pragmas

```
pragma restrict_references(xrange, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 288-52 XRANGE Function Parameters

Parameters	Description
<code>start_byte</code>	Beginning byte-code value of resulting sequence. The default is <code>x'00'</code> .
<code>end_byte</code>	Ending byte-code value of resulting sequence. The default is <code>x'FF'</code> .

Return Values

Table 288-53 XRANGE Function Return Values

Return	Description
RAW	Containing succession of 1-byte hexadecimal encodings

UTL_RECOMP

The UTL_RECOMP package recompiles invalid PL/SQL modules, invalid views, Java classes, indextypes and operators in a database, either sequentially or in parallel.

This chapter contains the following topics:

- [Overview](#)
- [Operational Notes](#)
- [Examples](#)
- [Summary of UTL_RECOMP Subprograms](#)

289.1 UTL_RECOMP Overview

This script is particularly useful after a major-version upgrade that typically invalidates all PL/SQL and Java objects. Although invalid objects are recompiled automatically on use, it is useful to run this script prior to operation because this will either eliminate or minimize subsequent latencies due to on-demand automatic recompilation at runtime.

Parallel recompilation can exploit multiple CPUs to reduce the time taken to recompile invalid objects. The degree of parallelism is specified by the first argument to [RECOMP_PARALLEL Procedure](#).

In general, a parallelism setting of one thread for each available CPU provides a good initial setting. However, please note that the process of recompiling an invalid object writes a significant amount of data to system tables and is fairly I/O intensive. A slow disk system may be a significant bottleneck and limit speedups available from a higher degree of parallelism.

289.2 UTL_RECOMP Operational Notes

UTL_RECOMP has several operational notes.

- This package uses the job queue for parallel recompilation.
- This package must be run using `SQL*PLUS`.
- You must be connected `AS SYSDBA` to run this script.
- This package expects the following packages to have been created with `VALID` status:
 - `STANDARD` (`standard.sql`)
 - `DBMS_STANDARD` (`dbmsstdx.sql`)
 - `DBMS_JOB` (`dbmsjob.sql`)
 - `DBMS_RANDOM` (`dbmsrand.sql`)
- There should be no other DDL on the database while running entries in this package. Not following this recommendation may lead to deadlocks.

289.3 UTL_RECOMP Examples

These examples show various ways that UTL_RECOMP can recompile objects.

- Recompile all objects sequentially:

```
EXECUTE UTL_RECOMP.RECOMP_SERIAL();
```

- Recompile objects in schema SCOTT sequentially:

```
EXECUTE UTL_RECOMP.RECOMP_SERIAL('SCOTT');
```

- Recompile all objects using 4 parallel threads:

```
EXECUTE UTL_RECOMP.RECOMP_PARALLEL(4);
```

- Recompile objects in schema JOE using the number of threads specified in the parameter JOB_QUEUE_PROCESSES:

```
EXECUTE UTL_RECOMP.RECOMP_PARALLEL(NULL, 'JOE');
```

289.4 Summary of UTL_RECOMP Subprograms

This table lists the UTL_RECOMP subprograms and briefly describes them.

Table 289-1 UTL_RECOMP Package Subprograms

Subprogram	Description
RECOMP_PARALLEL Procedure	Recompiles invalid objects in a given schema, or all invalid objects in the database, in parallel
RECOMP_SERIAL Procedure	Recompiles invalid objects in a given schema or all invalid objects in the database

289.4.1 RECOMP_PARALLEL Procedure

This procedure uses the information exposed in the DBA_Dependencies view to recompile invalid objects in the database, or in a given schema, in parallel.

Syntax

```
UTL_RECOMP.RECOMP_PARALLEL(
  threads IN PLS_INTEGER DEFAULT NULL,
  schema  IN VARCHAR2     DEFAULT NULL,
  flags   IN PLS_INTEGER DEFAULT 0);
```

Parameters

Table 289-2 RECOMP_PARALLEL Procedure Parameters

Parameter	Description
threads	The number of recompile threads to run in parallel. If NULL, use the value of 'job_queue_processes'.

Table 289-2 (Cont.) RECOMP_PARALLEL Procedure Parameters

Parameter	Description
schema	The schema in which to recompile invalid objects. If NULL, all invalid objects in the database are recompiled.
flags	Flag values are intended for internal testing and diagnosability only.

Usage Notes

The `UTL_RECOMP_COMPILED` table is updated with objects that `RECOMP_PARALLEL` has attempted to compile, or that it has compiled so far. If you monitor the progress of the recompilation, then the number of objects should increase with time. These tables are used internally by `RECOMP_PARALLEL` to prevent an object from being compiled more than once.

Table 289-3 Tables Generated by UTL_RECOMP.RECOMP_PARALLEL

Table	Purpose
<code>UTL_RECOMP_ERRORS</code>	A table of objects that are sorted into groups, based on dependencies. It is used internally by <code>RECOMP_PARALLEL</code> to guide parallel recompilation.
<code>UTL_RECOMP_COMPILED</code>	A table of objects that <code>RECOMP_PARALLEL</code> has attempted to compile. It is used internally by <code>recomp_parallel</code> to prevent an object from being compiled more than once.
<code>UTL_RECOMP_COMP_IDX1</code>	An index created on <code>UTL_RECOMP_COMPILED</code> , which uses object number as the primary key.
<code>UTL_RECOMP_SKIP_LIST</code>	A table of objects that <code>RECOMP_PARALLEL</code> will not attempt to compile. Typical usage is for <code>RECOMP_PARALLEL</code> to call <code>UTL_RECOMP.POPULATE_UTL_RECOMP_SKIP_LIST</code> before the update starts so that this table is filled with previously identified invalid objects. Afterward, when <code>RECOMP_PARALLEL</code> is run after upgrade, it will not attempt to compile those previously identified invalid objects.

Table 289-4 Views Generated by UTL_RECOMP.RECOMP_PARALLEL

View	Purpose
<code>UTL_RECOMP_ALL_OBJECTS</code>	A view that includes all objects that can be compiled.
<code>UTL_RECOMP_INVALID_ALL</code>	A view that selects invalid objects from <code>UTL_RECOMP_ALL_OBJECTS</code> that have not been compiled and are not on the skip list.
<code>UTL_RECOMP_INVALID_SEQ</code>	A view that selects objects from <code>UTL_RECOMP_INVALID_ALL</code> that must be compiled sequentially.
<code>UTL_RECOMP_INVALID_PARALLEL</code>	A view that selects objects from <code>UTL_RECOMP_INVALID_ALL</code> that can be compiled in parallel.
<code>UTL_RECOMP_INVALID_JAVA_SYN</code>	A view that selects from <code>UTL_RECOMP_ALL_OBJECTS</code> objects that are invalid JAVA synonyms.

Table 289-4 (Cont.) Views Generated by UTL_RECOMP.RECOMP_PARALLEL

View	Purpose
UTL_RECOMP_CIRCULAR_MV	A view that selects from UTL_RECOMP_ALL_OBJECTS materialized view objects that have a circular dependency chain.
UTL_RECOMP_INVALID_MV	A view that selects from UTL_RECOMP_ALL_OBJECTS materialized view objects that are invalid but don't have a circular dependency chain.
UTL_RECOMP_ALL_STUBS	A view that includes all stub objects that have not been compiled, and are not on the skip list. When this view is used in RECOMP_PARALLEL, it is restricted to show only stubs in the current edition.

289.4.2 RECOMP_SERIAL Procedure

This procedure recompiles invalid objects in a given schema or all invalid objects in the database.

Syntax

```
UTL_RECOMP.RECOMP_SERIAL(
    schema IN VARCHAR2 DEFAULT NULL,
    flags  IN PLS_INTEGER DEFAULT 0);
```

Parameters

Table 289-5 RECOMP_SERIAL Procedure Parameters

Parameter	Description
schema	The schema in which to recompile invalid objects. If NULL, all invalid objects in the database are recompiled.
flags	Flag values are intended for internal testing and diagnosability only.

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UTL_REF

The `UTL_REF` package provides PL/SQL procedures to support reference-based operations. Unlike SQL, `UTL_REF` procedures enable you to write generic type methods without knowing the object table name.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Types](#)
- [Exceptions](#)
- [Summary of UTL_REF Subprograms](#)

290.1 UTL_REF Overview

`UTL_REF` procedures enable you to write generic type methods without knowing the object table name.

Oracle supports user-defined composite type or object type. Any instance of an object type is called an object. An object type can be used as the type of a column or as the type of a table.

In an object table, each row of the table stores an object. You can uniquely identify an object in an object table with an object identifier.

A reference is a persistent pointer to an object, and each reference can contain an object identifier. The reference can be an attribute of an object type, or it can be stored in a column of a table. Given a reference, an object can be retrieved.

290.2 UTL_REF Security Model

The procedural option is needed to use this package. This package must be created under `SYS` (`CONNECT /AS SYSDBA`). Operations provided by this package are performed under the current calling user, not under the package owner `SYS`.

You can use the `UTL_REF` package from stored PL/SQL procedures/packages on the server, as well as from client/side PL/SQL code.

When invoked from PL/SQL procedures/packages on the server, `UTL_REF` verifies that the invoker has the appropriate privileges to access the object pointed to by the `REF`.

 **Note:**

This is in contrast to PL/SQL packages/procedures on the server which operate with definer's privileges, where the package owner must have the appropriate privileges to perform the desired operations.

Thus, if `UTL_REF` is defined under user `SYS`, and user `A` invokes `UTL_REF.SELECT` to select an object from a reference, then user `A` (the invoker) requires the privileges to check.

When invoked from client-side PL/SQL code, `UTL_REF` operates with the privileges of the client session under which the PL/SQL execution is being done.

290.3 UTL_REF Types

An object type is a composite datatype defined by the user or supplied as a library type.

You can create the object type `employee_type` using the following syntax:

```
CREATE TYPE employee_type AS OBJECT (  
    name    VARCHAR2(20),  
    id      NUMBER,  
  
    member function GET_ID  
        (name VARCHAR2)  
        RETURN MEMBER);
```

The object type `employee_type` is a user-defined type that contains two attributes, `name` and `id`, and a member function, `GET_ID()`.

You can create an object table using the following SQL syntax:

```
CREATE TABLE employee_table OF employee_type;
```

290.4 UTL_REF Exceptions

Exceptions can be returned during execution of `UTL_REF` functions for various reasons.

For example, the following scenarios would result in exceptions:

- The object selected does not exist. This could be because either:
 1. The object has been deleted, or the given reference is dangling (invalid).
 2. The object table was dropped or does not exist.
- The object cannot be modified or locked in a serializable transaction. The object was modified by another transaction after the serializable transaction started.
- You do not have the privilege to select or modify the object. The caller of the `UTL_REF` subprogram must have the proper privilege on the object that is being selected or modified.

Table 290-1 UTL_REF Exceptions

Exceptions	Description
errnum == 942	Insufficient privileges.
errnum == 1031	Insufficient privileges.
errnum == 8177	Unable to serialize, if in a serializable transaction.
errnum == 60	Deadlock detected.
errnum == 1403	No data found (if the REF is NULL, and so on.).

The UTL_REF package does not define any named exceptions. You may define exception handling blocks to catch specific exceptions and to handle them appropriately.

290.5 Summary of UTL_REF Subprograms

This table lists the UTL_REF subprograms and briefly describes them.

Table 290-2 UTL_REF Package Subprograms

Subprogram	Description
DELETE_OBJECT Procedure	Deletes an object given a reference
LOCK_OBJECT Procedure	Locks an object given a reference
SELECT_OBJECT Procedure	Selects an object given a reference
UPDATE_OBJECT Procedure	Updates an object given a reference

290.5.1 DELETE_OBJECT Procedure

This procedure deletes an object given a reference.

The semantic of this subprogram is similar to the following SQL statement:

```
DELETE FROM object_table
WHERE REF(t) = reference;
```

Unlike the preceding SQL statement, this subprogram does not require you to specify the object table name where the object resides.

Syntax

```
UTL_REF.DELETE_OBJECT (
    reference IN REF "<typename>");
```

Parameters

Table 290-3 DELETE_OBJECT Procedure Parameters

Parameter	Description
reference	Reference of the object to delete.

Exceptions

May be raised.

Examples

The following example illustrates usage of the `UTL_REF` package to implement this scenario: if an employee of a company changes their address, their manager should be notified.

... declarations of `Address_t` and others...

```
CREATE OR REPLACE TYPE Person_t (
    name    VARCHAR2(64),
    gender  CHAR(1),
    address Address_t,
    MEMBER PROCEDURE setAddress(addr IN Address_t)
);

CREATE OR REPLACE TYPE BODY Person_t (
    MEMBER PROCEDURE setAddress(addr IN Address_t) IS
    BEGIN
        address := addr;
    END;
);

CREATE OR REPLACE TYPE Employee_t (
```

Under `Person_t`: Simulate implementation of inheritance using a `REF` to `Person_t` and delegation of `setAddress` to it.

```
    thePerson REF Person_t,
    empno     NUMBER(5),
    deptREF   Department_t,
    mgrREF    Employee_t,
    reminders StringArray_t,
    MEMBER PROCEDURE setAddress(addr IN Address_t),
    MEMBER procedure addReminder(reminder VARCHAR2);
);

CREATE TYPE BODY Employee_t (
    MEMBER PROCEDURE setAddress(addr IN Address_t) IS
        myMgr Employee_t;
        meAsPerson Person_t;
    BEGIN
```

Update the address by delegating the responsibility to `thePerson`. Lock the `Person` object from the reference, and also select it:

```
    UTL_REF.LOCK_OBJECT(thePerson, meAsPerson);
    meAsPerson.setAddress(addr);
```

Delegate to `thePerson`:

```
    UTL_REF.UPDATE_OBJECT(thePerson, meAsPerson);
    if mgr is NOT NULL THEN
```

Give the manager a reminder:

```

        UTL_REF.LOCK_OBJECT(mgr);
        UTL_REF.SELECT_OBJECT(mgr, myMgr);
        myMgr.addReminder
        ('Update address in the employee directory for' ||
         thePerson.name || ', new address: ' || addr.asString);
        UTL_REF.UPDATE_OBJECT(mgr, myMgr);
    END IF;
EXCEPTION
    WHEN OTHERS THEN
        errnum := SQLCODE;
        errmsg := SUBSTR(SQLERRM, 1, 200);

```

290.5.2 LOCK_OBJECT Procedure

This procedure locks an object given a reference. In addition, this procedure lets the program select the locked object.

The semantic of this subprogram is similar to the following SQL statement:

```

SELECT VALUE(t)
  INTO object
  FROM object_table t
 WHERE REF(t) = reference
 FOR UPDATE;

```

Unlike the preceding SQL statement, this subprogram does not require you to specify the object table name where the object resides. It is not necessary to lock an object before updating/deleting it.

Syntax

```

UTL_REF.LOCK_OBJECT (
    reference IN REF "<typename>");

UTL_REF.LOCK_OBJECT (
    reference IN REF "<typename>",
    object    IN OUT "<typename>");

```

Parameters

Table 290-4 LOCK_OBJECT Procedure Parameters

Parameter	Description
reference	Reference of the object to lock.
object	The PL/SQL variable that stores the locked object. This variable should be of the same object type as the locked object.

Exceptions

May be raised.

290.5.3 SELECT_OBJECT Procedure

This procedure selects an object given its reference. The selected object is retrieved from the database and its value is put into the PL/SQL variable 'object'.

The semantic of this subprogram is similar to the following SQL statement:

```
SELECT VALUE(t)
INTO object
FROM object_table t
WHERE REF(t) = reference;
```

Unlike the preceding SQL statement, this subprogram does not require you to specify the object table name where the object resides.

Syntax

```
UTL_REF.SELECT_OBJECT (
    reference IN REF "<typename>",
    object    IN OUT "<typename>");
```

Parameters

Table 290-5 SELECT_OBJECT Procedure Parameters

Parameter	Description
reference	Reference to the object to select or retrieve.
object	The PL/SQL variable that stores the selected object; this variable should be of the same object type as the referenced object.

Exceptions

May be raised.

290.5.4 UPDATE_OBJECT Procedure

This procedure updates an object given a reference. The referenced object is updated with the value contained in the PL/SQL variable 'object'.

The semantic of this subprogram is similar to the following SQL statement:

```
UPDATE object_table t
SET VALUE(t) = object
WHERE REF(t) = reference;
```

Unlike the preceding SQL statement, this subprogram does not require you to specify the object table name where the object resides.

Syntax

```
UTL_REF.UPDATE_OBJECT (
    reference IN REF "<typename>",
    object    IN    "<typename>");
```

Parameters

Table 290-6 UPDATE_OBJECT Procedure Parameters

Parameter	Description
reference	Reference of the object to update.
object	The PL/SQL variable that contains the new value of the object. This variable should be of the same object type as the object to update.

Exceptions

May be raised.

UTL_RPADV

The `UTL_RPADV` package provides subprograms to collect and analyze statistics for the Oracle Replication components in a distributed database environment. This package uses the Oracle Replication Performance Advisor to gather statistics.

This chapter contains the following topic:

- [UTL_RPADV Overview](#)
- [DBMS_COMPARISON Security Model](#)
- [UTL_RPADV Operational Notes](#)
- [Summary of UTL_RPADV Subprograms](#)

291.1 UTL_RPADV Overview

This package enables you to collect and analyze statistics about the performance of Oracle Replication components. You can either collect statistics on demand or you can create a monitoring job that continually monitors Oracle Replication performance.

When this package is used on an Oracle Database 11g Release 2 (11.2) database, it can monitor Oracle Database 10g Release 2 (10.2) and later databases. It cannot monitor databases before release 10.2.

291.2 DBMS_COMPARISON Security Model

Security on this package can be controlled by either granting `EXECUTE` on this package to selected users or roles, or by granting `EXECUTE_CATALOG_ROLE` to selected users or roles.

If subprograms in the package are run from within a stored procedure, then the user who runs the subprograms must be granted `EXECUTE` privilege on the package directly. It cannot be granted through a role.

To ensure that the user who runs the subprograms in this package has the necessary privileges, configure an Oracle Replication administrator and connect as the Oracle Replication administrator when using this package.

291.3 UTL_RPADV Operational Notes

To use this package, you must connect to an Oracle database as an Oracle Replication administrator and run the `utlrpadv.sql` script in the `rdbms/admin` directory in `ORACLE_HOME`.

The `utlrpadv.sql` script creates the following tables:

- [STREAMS\\$_PA_COMPONENT Table](#)
- [STREAMS\\$_PA_COMPONENT_LINK Table](#)
- [STREAMS\\$_PA_COMPONENT_PROP Table](#)

- STREAMS\$_PA_COMPONENT_STAT Table
- STREAMS\$_PA_CONTROL Table
- STREAMS\$_PA_DATABASE Table
- STREAMS\$_PA_DATABASE_PROP Table
- STREAMS\$_PA_MONITORING Table
- STREAMS\$_PA_PATH_BOTTLENECK Table
- STREAMS\$_PA_PATH_STAT Table
- STREAMS\$_PA_SHOW_COMP_STAT Table
- STREAMS\$_PA_SHOW_PATH_STAT Table

The Oracle Replication Performance Advisor populates these tables when it is run.

STREAMS\$_PA_COMPONENT Table

The STREAMS\$_PA_COMPONENT table displays information about the Oracle Replication components at each database.

Table 291-1 STREAMS\$_PA_COMPONENT Table

Column	Datatype	NULL	Description
COMPONENT_ID	NUMBER	NOT NULL	Identification number assigned to the component by the Oracle Replication Performance Advisor
COMPONENT_NAME	VARCHAR2 (194)		Name of the component
COMPONENT_DB	VARCHAR2 (128)		Name of the database that contains the component
COMPONENT_TYPE	VARCHAR2 (20)		Type of the component The following types are possible: <ul style="list-style-type: none"> • CAPTURE for a capture process • PROPAGATION SENDER for a propagation sender • PROPAGATION RECEIVER for a propagation receiver • APPLY for an apply process • QUEUE for a queue
COMPONENT_CHANGED_TIME	DATE		Time when the component was last changed

STREAMS\$_PA_COMPONENT_LINK Table

The STREAMS\$_PA_COMPONENT_LINK table displays information about how information flows between Oracle Replication components.

Table 291-2 STREAMS\$_PA_COMPONENT_LINK Table

Column	Datatype	NULL	Description
PATH_ID	NUMBER	NOT NULL	Identification number assigned to the path by the Oracle Replication Performance Advisor
PATH_KEY	VARCHAR2 (4000)		Unique key assigned to the path by the Oracle Replication Performance Advisor
SOURCE_COMPONENT_ID	NUMBER	NOT NULL	Source component ID for the path The path starts with this component.
DESTINATION_COMPONENT_ID	NUMBER	NOT NULL	Destination component ID for the path The path ends with this component.
POSITION	NUMBER		Position of the component in the path

STREAMS\$_PA_COMPONENT_PROP Table

The `STREAMS$_PA_COMPONENT_PROP` table displays information about capture processes and apply processes necessary for analysis by the Replication Performance Advisor.

Table 291-3 STREAMS\$_PA_COMPONENT_PROP Table

Column	Datatype	NULL	Description
COMPONENT_ID	NUMBER	NOT NULL	Identification number assigned to the component by the Oracle Replication Performance Advisor

Table 291-3 (Cont.) STREAMS\$_PA_COMPONENT_PROP Table

Column	Datatype	NULL	Description
PROP_NAME	VARCHAR2 (30)		Property name For a capture process, the component properties include the following: <ul style="list-style-type: none"> • SOURCE_DATABASE - The source database for the changes captured by the capture process • PARALLELISM - The setting for the parallelism capture process parameter • OPTIMIZATION_MODE - Indicates whether the capture process uses combined capture and apply (greater than zero) or does not use combined capture and apply (0) For an apply process, the component properties include the following: <ul style="list-style-type: none"> • SOURCE_DATABASE - The source database for the messages applied by the apply process • PARALLELISM - The setting for the parallelism apply process parameter • APPLY_CAPTURED - Indicates whether the apply process applies captured messages (YES) persistent messages (NO) • MESSAGE_DELIVERY_MODE - Either buffered or persistent
PROP_VALUE	VARCHAR2 (30)		Property value

STREAMS\$_PA_COMPONENT_STAT Table

The STREAMS\$_PA_COMPONENT_STAT table displays performance statistics and session statistics about each Oracle Replication component.

Table 291-4 STREAMS\$_PA_COMPONENT_STAT Table

Column	Datatype	NULL	Description
ADVISOR_RUN_ID	NUMBER		Identification number of the Oracle Replication Performance Advisor run

Table 291-4 (Cont.) STREAMS\$_PA_COMPONENT_STAT Table

Column	Datatype	NULL	Description
ADVISOR_RUN_TIME	DATE		Time when the Oracle Replication Performance Advisor was run for the advisor run ID
COMPONENT_ID	NUMBER		Identification number assigned to the component by the Oracle Replication Performance Advisor
STATISTIC_TIME	DATE		Time when the statistic was recorded
STATISTIC_NAME	VARCHAR2 (64)		Name of the statistic
STATISTIC_VALUE	NUMBER		Value recorded for the statistic
STATISTIC_UNIT	VARCHAR2 (64)		Unit of measurement for the statistic
SUB_COMPONENT_TYP E	VARCHAR2 (64)		Type of the subcomponent Only capture processes and apply processes have subcomponents. The following capture process subcomponent types are possible: <ul style="list-style-type: none"> LOGMINER READER for a builder server of a capture process LOGMINER PREPARER for a preparer server of a capture process LOGMINER BUILDER for a reader server of a capture process CAPTURE SESSION for a capture process session The following apply process subcomponent types are possible: <ul style="list-style-type: none"> PROPAGATION SENDER+RECEIVER for sending LCRs from a capture process directly to an apply process in a combined capture and apply configuration in which both the capture process and apply process run on a single database APPLY READER for a reader server of an apply process APPLY COORDINATOR for a coordinator process of an apply process APPLY SERVER for a reader server of an apply process
SESSION_ID	NUMBER		Identification number of the session for the component. Query the V\$SESSION view for information about the session.

Table 291-4 (Cont.) STREAMS\$_PA_COMPONENT_STAT Table

Column	Datatype	NULL	Description
SESSION_SERIAL#	NUMBER		Session serial number of the session for the component. Query the V\$SESSION view for information about the session.

STREAMS\$_PA_CONTROL Table

The STREAMS\$_PA_CONTROL table displays the parameters set for the COLLECT_STATS procedure in this package. The parameters control the monitoring behavior.

Table 291-5 STREAMS\$_PA_CONTROL Table

Column	Datatype	NULL	Description
ADVISOR_RUN_ID	NUMBER		Identification number of the Oracle Replication Performance Advisor run
ADVISOR_RUN_TIME	DATE		Time when the Oracle Replication Performance Advisor was last run
PARAM_NAME	VARCHAR2 (30)		The name of the parameter
PARAM_VALUE	VARCHAR2 (4000)		The value set for the parameter
PARAM_UNIT	VARCHAR2 (30)		The unit of the parameter

STREAMS\$_PA_DATABASE Table

The STREAMS\$_PA_DATABASE table displays information about each database that contains Oracle Replication components.

Table 291-6 STREAMS\$_PA_DATABASE Table

Column	Datatype	NULL	Description
GLOBAL_NAME	VARCHAR2 (128)	NOT NULL	Global name of the database analyzed by the Oracle Replication Performance Advisor
LAST_QUERIED	DATE		The time when the Performance Advisor successfully collected information from a database in its last run
ERROR_NUMBER	NUMBER		The error number of the error encountered when the database was last queried
ERROR_MESSAGE	VARCHAR2 (4000)		The error message of the error encountered when the database was last queried

STREAMS\$_PA_DATABASE_PROP Table

The STREAMS\$_PA_DATABASE_PROP table displays Oracle Replication database property information necessary for analysis by the Replication Performance Advisor.

Table 291-7 STREAMS\$_PA_DATABASE_PROP Table

Column	Datatype	NULL	Description
GLOBAL_NAME	VARCHAR2 (128)	NOT NULL	Global name of the database analyzed by the Oracle Replication Performance Advisor
PROP_NAME	VARCHAR2 (30)		Property name The database properties include the following: <ul style="list-style-type: none"> • VERSION • COMPATIBILITY • MANAGEMENT_PACK_ACCESS • DB_UNIQUE_NAME
PROP_VALUE	VARCHAR2 (30)		Property value

STREAMS\$_PA_MONITORING Table

The `STREAMS$_PA_MONITORING` table displays information about each monitoring job running in a database.

Table 291-8 STREAMS\$_PA_MONITORING Table

Column	Datatype	NULL	Description
JOB_NAME	VARCHAR2 (30)	NOT NULL	Name of the monitoring job
CLIENT_NAME	VARCHAR2 (30)		Name of the client that submitted the job See Also: "Full Monitoring Job Names"
QUERY_USER_NAME	VARCHAR2 (30)		User granted privileges to view the monitoring results
SHOW_STATS_TABLE	VARCHAR2 (30)		Name of the table used by the <code>SHOW_STATS</code> procedure to display statistics
STARTED_TIME	TIMESTAMP		Time the monitoring job started
STOPPED_TIME	TIMESTAMP		Time the monitoring job last stopped
ALTERED_TIME	TIMESTAMP		Time the monitoring job was last altered
STATE	VARCHAR2 (30)		State of the monitoring job, either <code>ENABLED</code> or <code>STOPPED</code>

STREAMS\$_PA_PATH_BOTTLENECK Table

The `STREAMS$_PA_PATH_BOTTLENECK` table displays information about Oracle Replication components that might be slowing down the flow of messages.

Table 291-9 STREAMS\$_PA_PATH_BOTTLENECK Table

Column	Datatype	NULL	Description
ADVISOR_RUN_ID	NUMBER		Identification number of the Oracle Replication Performance Advisor run
ADVISOR_RUN_TIME	DATE		Time when the Oracle Replication Performance Advisor was last run

Table 291-9 (Cont.) STREAMS\$_PA_PATH_BOTTLENECK Table

Column	Datatype	NULL	Description
ADVISOR_RUN_REASON	VARCHAR2 (4000)		Reason for the bottleneck
PATH_ID	NUMBER		Identification number assigned to the path by the Oracle Replication Performance Advisor
PATH_KEY	VARCHAR2 (4000)		Unique key assigned to the path by the Oracle Replication Performance Advisor
COMPONENT_ID	NUMBER		Identification number assigned to the component by the Oracle Replication Performance Advisor
TOP_SESSION_ID	NUMBER		Session ID of the top component. Query the V\$SESSION view for information about the session.
TOP_SESSION_SERIAL#	NUMBER		Session serial number of the top component. Query the V\$SESSION view for information about the session.
ACTION_NAME	VARCHAR2 (32)		Action name for the top session
BOTTLENECK_IDENTIFIED	VARCHAR2 (30)		Whether a bottleneck was identified

STREAMS\$_PA_PATH_STAT Table

The STREAMS\$_PA_PATH_STAT table displays performance statistics about each stream path.

Table 291-10 STREAMS\$_PA_PATH_STAT Table

Column	Datatype	NULL	Description
ADVISOR_RUN_ID	NUMBER		Identification number of the Oracle Replication Performance Advisor run
ADVISOR_RUN_TIME	DATE		Time when the Oracle Replication Performance Advisor was run for the advisor run ID
PATH_ID	NUMBER		Identification number assigned to the path by the Oracle Replication Performance Advisor
PATH_KEY	VARCHAR2 (4000)		Unique key assigned to the path by the Oracle Replication Performance Advisor
STATISTIC_TIME	DATE		Time when the statistic was recorded
STATISTIC_NAME	VARCHAR2 (64)		Name of the statistic
STATISTIC_VALUE	NUMBER		Value recorded for the statistic
STATISTIC_UNIT	VARCHAR2 (64)		Unit of measurement for the statistic

STREAMS\$_PA_SHOW_COMP_STAT Table

The `STREAMS$_PA_SHOW_COMP_STAT` table displays statistics for Oracle Replication components.

Table 291-11 STREAMS\$_PA_SHOW_COMP_STAT Table

Column	Datatype	NULL	Description
ADVISOR_RUN_ID	NUMBER		Identification number of the Oracle Replication Performance Advisor run
ADVISOR_RUN_TIME	DATE		Time when the Oracle Replication Performance Advisor was last run
PATH_ID	NUMBER		Identification number assigned to the path by the Oracle Replication Performance Advisor
POSITION	NUMBER		Position of the component in the path
COMPONENT_ID	NUMBER		Identification number assigned to the component by the Oracle Replication Performance Advisor
COMPONENT_NAME	VARCHAR2 (194)		Name of the component
COMPONENT_TYPE	VARCHAR2 (30)		Type of the component The following types are possible: <ul style="list-style-type: none">• CAPTURE for a capture process• PROPAGATION SENDER for a propagation sender• PROPAGATION RECEIVER for a propagation receiver• APPLY for an apply process• QUEUE for a queue

Table 291-11 (Cont.) STREAMS\$_PA_SHOW_COMP_STAT Table

Column	Datatype	NULL	Description
SUB_COMPONENT_TYPE	VARCHAR2 (30)		Type of the subcomponent Only capture processes and apply processes have subcomponents. The following capture process subcomponent types are possible: <ul style="list-style-type: none"> LOGMINER READER for a builder server of a capture process LOGMINER PREPARER for a preparer server of a capture process LOGMINER BUILDER for a reader server of a capture process CAPTURE SESSION for a capture process session The following apply process subcomponent types are possible: <ul style="list-style-type: none"> PROPAGATION_SENDER+RECEIVER for sending LCRs from a capture process directly to an apply process in a combined capture and apply configuration in which both the capture process and apply process run on a single database APPLY READER for a reader server of an apply process APPLY COORDINATOR for a coordinator process of an apply process APPLY SERVER for a reader server of an apply process
SESSION_ID	NUMBER		Identification number of the session for the component. Query the V\$SESSION view for information about the session.
SESSION_SERIAL#	NUMBER		Session serial number of the session for the component. Query the V\$SESSION view for information about the session.
STATISTIC_ALIAS	VARCHAR2 (30)		Name of the statistic
STATISTIC_NAME	VARCHAR2 (128)		Name of the statistic
STATISTIC_VALUE	NUMBER		Value recorded for the statistic
STATISTIC_UNIT	VARCHAR2 (128)		Unit of measurement for the statistic

STREAMS\$_PA_SHOW_PATH_STAT Table

The STREAMS\$_PA_SHOW_PATH_STAT table displays statistics for the stream paths in an Oracle Replication configuration. A monitoring job uses this table as the default table for the statistics collected for stream paths.

Table 291-12 STREAMS\$_PA_SHOW_PATH_STAT Table

Column	Datatype	NULL	Description
PATH_ID	NUMBER		Identification number assigned to the path by the Oracle Replication Performance Advisor
ADVISOR_RUN_ID	NUMBER		Identification number of the Oracle Replication Performance Advisor run
ADVISOR_RUN_TIME	DATE		Time when the Oracle Replication Performance Advisor was last run
SETTING	VARCHAR2 (2000)		Setting for the Oracle Replication Performance Advisor Run
STATISTICS	VARCHAR2 (4000)		Component-level statistics
SESSION_STATISTICS	VARCHAR2 (4000)		Session-level statistics
OPTIMIZATION	NUMBER		Whether the path uses the combined capture and apply optimization 0 (zero) means that the path does not use the combined capture and apply optimization. 1 means that the path uses the combined capture and apply optimization.

291.4 Summary of UTL_RPADV Subprograms

This table lists the UTL_RPADV subprograms and briefly describes them.

Table 291-13 UTL_RPADV Package Subprograms

Subprogram	Description
ALTER_MONITORING Procedure	Alters the monitoring job submitted by the current user.
COLLECT_STATS Procedure	Uses the Oracle Replication Performance Advisor to gather statistics about the Oracle Replication components and subcomponents in a distributed database environment.
IS_MONITORING Function	Checks whether a monitoring job is currently running.
SHOW_STATS Procedure	Generates output that includes the statistics gathered by the COLLECT_STATS procedure.
SHOW_STATS_HTML Procedure	Generates HTML output that includes the statistics gathered by the COLLECT_STATS procedure.
START_MONITORING Procedure	Starts a monitoring job.
STOP_MONITORING Procedure	Stops a monitoring job.

291.4.1 ALTER_MONITORING Procedure

This procedure alters the monitoring job submitted by the current user.

Syntax

```
UTL_RPADV.ALTER_MONITORING(
    interval                IN NUMBER  DEFAULT NULL,
    top_event_threshold     IN NUMBER  DEFAULT NULL,
    bottleneck_idle_threshold IN NUMBER  DEFAULT NULL,
    bottleneck_flowctrl_threshold IN NUMBER  DEFAULT NULL,
    retention_time         IN NUMBER  DEFAULT NULL);
```

Parameters

Table 291-14 ALTER_MONITORING Procedure Parameters

Parameter	Description
interval	The amount of time, in seconds, between each Performance Advisor run. The maximum is 3600 seconds. If NULL, then the current value is not changed.
top_event_threshold	A percentage that determines whether a top wait event statistic is collected. The percentage for a wait event must be greater than the value specified in this parameter for the procedure to collect the wait event statistic. For example, if 15 is specified, then only wait events with a value larger than 15% are collected. If NULL, then the current value is not changed.
bottleneck_idle_threshold	A percentage that determines whether an Oracle Replication component session is eligible for bottleneck analysis based on its IDLE percentage. The IDLE percentage must be less than or equal to the value specified in this parameter for the Oracle Replication component session to be eligible for bottleneck analysis. For example, if 50 is specified, then only components that are idle 50% of the time or less are eligible for bottleneck analysis. If NULL, then the current value is not changed.
bottleneck_flowctrl_threshold	A percentage that determines whether an Oracle Replication component session is eligible for bottleneck analysis based on its FLOW CONTROL percentage. The FLOW CONTROL percentage must be less than or equal to the value specified in this parameter for the Oracle Replication component session to be eligible for bottleneck analysis. For example, if 50 is specified, then only components that are paused for flow control 50% of the time or less are eligible for bottleneck analysis. If NULL, then the current value is not changed.

Table 291-14 (Cont.) ALTER_MONITORING Procedure Parameters

Parameter	Description
<code>retention_time</code>	The number of hours to retain monitoring results. If NULL, then the current value is not changed.

Exceptions**Table 291-15 ALTER_MONITORING Procedure Exceptions**

Exception	Description
ORA-20113	no active monitoring job found

291.4.2 COLLECT_STATS Procedure

This procedure uses the Oracle Replication Performance Advisor to gather statistics about the Oracle Replication components and subcomponents in a distributed database environment.

**Note:**

This procedure commits.

Syntax

```
UTL_RPADV.COLLECT_STATS (
    interval                IN NUMBER    DEFAULT 60,
    num_runs                IN NUMBER    DEFAULT 10,
    comp_stat_table         IN VARCHAR2  DEFAULT 'STREAMS$$_ADVISOR_COMP_STAT',
    path_stat_table         IN VARCHAR2  DEFAULT 'STREAMS$$_ADVISOR_PATH_STAT',
    top_event_threshold     IN NUMBER    DEFAULT 15,
    bottleneck_idle_threshold IN NUMBER  DEFAULT 50,
    bottleneck_flowctrl_threshold IN NUMBER DEFAULT 50);
```

Parameters**Table 291-16 COLLECT_STATS Procedure Parameters**

Parameter	Description
<code>interval</code>	The amount of time, in seconds, between each Performance Advisor run. The maximum is 3600 seconds.
<code>num_runs</code>	The number of times that the Oracle Replication Performance Advisor is run by the procedure.

Table 291-16 (Cont.) COLLECT_STATS Procedure Parameters

Parameter	Description
comp_stat_table	<p>The name of the table that stores the statistics collected for Oracle Replication components and subcomponents. Specify the table name as <i>[schema_name.]object_name</i>. If the schema is not specified, then the current user is the default.</p> <p>The procedure creates the specified table if it does not exist.</p> <p>Oracle recommends that you use the default table <code>STREAMS\$_ADVISOR_COMP_STAT</code>.</p> <p>See "Usage Notes" for more information about this parameter.</p>
path_stat_table	<p>The name of the table that stores the statistics collected for stream paths. Specify the table name as <i>[schema_name.]object_name</i>. If the schema is not specified, then the current user is the default.</p> <p>The procedure creates the specified table if it does not exist.</p> <p>Oracle recommends that you use the default table <code>STREAMS\$_ADVISOR_PATH_STAT</code>.</p> <p>See "Usage Notes" for more information about this parameter.</p>
top_event_threshold	<p>A percentage that determines whether a top wait event statistic is collected.</p> <p>The percentage for a wait event must be greater than the value specified in this parameter for the procedure to collect the wait event statistic. For example, if 15 is specified, then only wait events with a value larger than 15% are collected.</p>
bottleneck_idle_threshold	<p>A percentage that determines whether an Oracle Replication component session is eligible for bottleneck analysis based on its <code>IDLE</code> percentage.</p> <p>The <code>IDLE</code> percentage must be less than or equal to the value specified in this parameter for the Oracle Replication component session to be eligible for bottleneck analysis. For example, if 50 is specified, then only components that are idle 50% of the time or less are eligible for bottleneck analysis.</p>
bottleneck_flowctrl_threshold	<p>A percentage that determines whether an Oracle Replication component session is eligible for bottleneck analysis based on its <code>FLOW CONTROL</code> percentage.</p> <p>The <code>FLOW CONTROL</code> percentage must be less than or equal to the value specified in this parameter for the Oracle Replication component session to be eligible for bottleneck analysis. For example, if 50 is specified, then only components that are paused for flow control 50% of the time or less are eligible for bottleneck analysis.</p>

Usage Notes

The table specified in the `path_stat_table` parameter stores stream path statistics. This table also concatenates the component and subcomponent statistics stored in the table specified in the `comp_stat_table` parameter. The `SHOW_STATS` procedure in this package shows only the statistics stored in the table specified in the `path_stat_table` parameter.

291.4.3 IS_MONITORING Function

This function checks whether a monitoring job is currently running. This function either returns `TRUE` if a monitoring job is currently running or `FALSE` if a monitoring job is not currently running.

A monitoring job is submitted using the `START_MONITORING` procedure.



See Also:

["START_MONITORING Procedure"](#)

Syntax

```
UTL_RPADV.IS_MONITORING(  
    job_name      IN VARCHAR2  DEFAULT 'STREAMS$_MONITORING_JOB',  
    client_name   IN VARCHAR2  DEFAULT NULL)  
RETURN BOOLEAN;
```

Parameters

Table 291-17 IS_MONITORING Function Parameters

Parameter	Description
<code>job_name</code>	The name of the job for which to check.
<code>client_name</code>	The name of the client that submitted the job.

291.4.4 SHOW_STATS Procedure

This procedure generates output that includes the statistics gathered by the `COLLECT_STATS` and `START_MONITORING` procedures.

The output is formatted so that it can be imported into a spreadsheet for analysis.



Note:

This procedure does not commit.

 **See Also:**

- ["COLLECT_STATS Procedure"](#)
- ["START_MONITORING Procedure"](#)

Syntax

```
UTL_RPADV.SHOW_STATS(
  path_stat_table IN VARCHAR2 DEFAULT 'STREAMS$_ADVISOR_PATH_STAT',
  path_id         IN NUMBER   DEFAULT NULL,
  bgn_run_id     IN NUMBER   DEFAULT -1,
  end_run_id     IN NUMBER   DEFAULT -10,
  show_path_id   IN BOOLEAN  DEFAULT TRUE,
  show_run_id    IN BOOLEAN  DEFAULT TRUE,
  show_run_time  IN BOOLEAN  DEFAULT TRUE,
  show_optimization IN BOOLEAN DEFAULT TRUE,
  show_setting   IN BOOLEAN  DEFAULT FALSE,
  show_stat      IN BOOLEAN  DEFAULT TRUE,
  show_sess     IN BOOLEAN  DEFAULT FALSE,
  show_legend    IN BOOLEAN  DEFAULT TRUE);
```

Parameters

Table 291-18 *SHOW_STATS Procedure Parameters*

Parameter	Description
path_stat_table	<p>The name of the table that contains the stream path statistics. Specify the table name as <i>[schema_name.]object_name</i>. If the schema is not specified, then the current user is the default.</p> <p>When you gather statistics using the COLLECT_STATS procedure, this table is specified in the path_stat_table parameter in the COLLECT_STATS procedure. The default table is STREAMS\$_ADVISOR_PATH_STAT.</p> <p>When you gather statistics using the START_MONITORING procedure, you can determine the name for this table by querying the SHOW_STATS_TABLE column in the STREAMS\$_PA_MONITORING view. The default table for a monitoring job is STREAMS\$_PA_SHOW_PATH_STAT.</p>
path_id	<p>A stream path ID.</p> <p>If non-NULL, then the procedure shows output for the specified stream path only.</p> <p>If NULL, then the procedure shows output for all active stream paths.</p>
bgn_run_id	<p>The first Oracle Replication Performance Advisor run ID to show in the range of runs.</p> <p>See "Usage Notes" for more information about this parameter.</p>
end_run_id	<p>The last Oracle Replication Performance Advisor run ID to show in the range of runs.</p> <p>See "Usage Notes" for more information about this parameter.</p>

Table 291-18 (Cont.) SHOW_STATS Procedure Parameters

Parameter	Description
show_path_id	If TRUE, then the path ID for each stream path is included in the output. If FALSE, then the path ID for each stream path is not included in the output.
show_run_id	If TRUE, then the Oracle Replication Performance Advisor run ID is included in the output. If FALSE, then the Oracle Replication Performance Advisor run ID is not included in the output.
show_run_time	If TRUE, then the Oracle Replication Performance Advisor run time is included in the output. If FALSE, then the Oracle Replication Performance Advisor run time is not included in the output.
show_optimization	If TRUE, then path output includes information pertaining to the combined capture and apply optimization. If FALSE, then path output does not include information pertaining to the combined capture and apply optimization.
show_setting	If TRUE, then the settings for the threshold parameters are included in the output. The threshold parameters are the <code>top_event_threshold</code> , <code>bottleneck_idle_threshold</code> , and <code>bottleneck_flowctrl_threshold</code> parameters in the <code>COLLECT_STATS</code> procedure. If FALSE, then the settings for the threshold parameters are not included in the output.
show_stat	If TRUE, then the component-level and subcomponent-level statistics are included in the output. These components include capture processes, queues, propagation senders, propagation receivers, and apply processes. The subcomponents are the subcomponents for capture processes and apply processes. If FALSE, then the component-level and subcomponent-level statistics are not included in the output.
show_sess	If TRUE, then the session-level statistics are included in the output. Session-level statistics include <code>IDLE</code> , <code>FLOW CONTROL</code> , and <code>EVENT</code> statistics. If FALSE, then the session-level statistics are not included in the output.
show_legend	If TRUE, then the legend is included in the output. The legend describes the abbreviations used in the output. If FALSE, then the legend is not included in the output.

Usage Notes

Use the `bgn_run_id` and `end_run_id` together to specify the range of Oracle Replication Performance Advisor runs to display. Positive numbers show statistics from an earlier run forward. Negative numbers show statistics from a later run backward.

For example, if `bgn_run_id` is set to 1 and `end_run_id` is set to 10, then the procedure shows statistics for the first ten Oracle Replication Performance Advisor runs.

However, if `bgn_run_id` is set to -1 and `end_run_id` is set to -10, then the procedure shows statistics for the last ten Oracle Replication Performance Advisor runs.

291.4.5 SHOW_STATS_HTML Procedure

This procedure generates HTML output that includes the statistics gathered by the `COLLECT_STATS` and `START_MONITORING` procedures.



Note:

This procedure does not commit.



See Also:

- ["COLLECT_STATS Procedure"](#)
- ["START_MONITORING Procedure"](#)

Syntax

```
UTL_RPADV.SHOW_STATS_HTML (
  directory          IN VARCHAR2,
  reportname        IN VARCHAR2  DEFAULT 'RPADVREPORT.HTML',
  comp_stat_table   IN VARCHAR2  DEFAULT 'STREAMS$_ADVISOR_COMP_STAT',
  path_id           IN NUMBER     DEFAULT NULL,
  bgn_run_id        IN NUMBER     DEFAULT -1,
  end_run_id        IN NUMBER     DEFAULT -10,
  detailed          IN BOOLEAN    DEFAULT TRUE);
```

Parameters

Table 291-19 SHOW_STATS_HTML Procedure Parameters

Parameter	Description
<code>directory</code>	The directory object for the directory on the local computer system into which the generated HTML report is placed The specified directory object must be created using the SQL statement <code>CREATE DIRECTORY</code> , and the user who invokes the procedure must have <code>READ</code> and <code>WRITE</code> privilege on each one.
<code>reportname</code>	The name of the HTML report

Table 291-19 (Cont.) SHOW_STATS_HTML Procedure Parameters

Parameter	Description
comp_stat_table	<p>The name of the table that stores the statistics collected for Oracle Replication components and subcomponents. Specify the table name as <i>[schema_name.]object_name</i>. If the schema is not specified, then the current user is the default.</p> <p>When you gather statistics using the <code>COLLECT_STATS</code> procedure, this table is specified in the <code>comp_stat_table</code> parameter in the <code>COLLECT_STATS</code> procedure. The default table is <code>STREAMS\$_ADVISOR_COMP_STAT</code>.</p> <p>When you gather statistics using the <code>START_MONITORING</code> procedure, you can determine the name for this table by querying the <code>SHOW_STATS_TABLE</code> column in the <code>STREAMS\$_PA_MONITORING</code> view. The default table for a monitoring job is <code>STREAMS\$_PA_SHOW_PATH_STAT</code>.</p> <p>Oracle recommends that you start a monitoring job with the <code>START_MONITORING</code> procedure in this package and use the appropriate the <code>STREAMS\$_PA_SHOW_PATH_STAT</code> table.</p>
path_id	<p>A stream path ID.</p> <p>If non-NULL, then the procedure shows output for the specified stream path only.</p> <p>If NULL, then the procedure shows output for all active stream paths.</p>
bgn_run_id	<p>The first Oracle Replication Performance Advisor run ID to show in the range of runs.</p> <p>See "Usage Notes" for more information about this parameter.</p>
end_run_id	<p>The last Oracle Replication Performance Advisor run ID to show in the range of runs.</p> <p>See "Usage Notes" for more information about this parameter.</p>
detailed	<p>If TRUE, then the procedure generates component-level statistics.</p> <p>If FALSE, then the procedure does not generate component-level statistics.</p>

Usage Notes

Use the `bgn_run_id` and `end_run_id` together to specify the range of Oracle Replication Performance Advisor runs to display. Positive numbers show statistics from an earlier run forward. Negative numbers show statistics from a later run backward.

For example, if `bgn_run_id` is set to 1 and `end_run_id` is set to 10, then the procedure shows statistics for the first ten Oracle Replication Performance Advisor runs.

However, if `bgn_run_id` is set to -1 and `end_run_id` is set to -10, then the procedure shows statistics for the last ten Oracle Replication Performance Advisor runs.

291.4.6 START_MONITORING Procedure

This procedure starts a monitoring job.

This procedure runs the `COLLECT_STATS` procedure to gather statistics about the Oracle Replication components and subcomponents in a distributed database environment.

**Note:**

This procedure commits.

**See Also:**

- ["COLLECT_STATS Procedure"](#)

Syntax

```
UTL_RPADV.START_MONITORING(
    job_name           IN VARCHAR2  DEFAULT 'STREAMS$_MONITORING_JOB',
    client_name        IN VARCHAR2  DEFAULT NULL,
    query_user_name    IN VARCHAR2  DEFAULT NULL,
    interval           IN NUMBER     DEFAULT 60,
    top_event_threshold IN NUMBER     DEFAULT 15,
    bottleneck_idle_threshold IN NUMBER DEFAULT 50,
    bottleneck_flowctrl_threshold IN NUMBER DEFAULT 50,
    retention_time     IN NUMBER     DEFAULT 24);
```

Parameters**Table 291-20 START_MONITORING Procedure Parameters**

Parameter	Description
job_name	The name of the monitoring job to create.
client_name	The name of the client.
query_user_name	The user who will query the result tables. This procedure grants privileges to the specified user to enable the user to query the result tables.
interval	The amount of time, in seconds, between each Performance Advisor run. The maximum is 3600 seconds. The specified interval is used for the interval parameter in the COLLECT_STATS procedure.
top_event_threshold	A percentage that determines whether a top wait event statistic is collected. The percentage for a wait event must be greater than the value specified in this parameter for the procedure to collect the wait event statistic. For example, if 15 is specified, then only wait events with a value larger than 15% are collected.

Table 291-20 (Cont.) START_MONITORING Procedure Parameters

Parameter	Description
bottleneck_idle_threshold	A percentage that determines whether an Oracle Replication component session is eligible for bottleneck analysis based on its IDLE percentage. The IDLE percentage must be less than or equal to the value specified in this parameter for the Oracle Replication component session to be eligible for bottleneck analysis. For example, if 50 is specified, then only components that are idle 50% of the time or less are eligible for bottleneck analysis.
bottleneck_flowctrl_threshold	A percentage that determines whether an Oracle Replication component session is eligible for bottleneck analysis based on its FLOW CONTROL percentage. The FLOW CONTROL percentage must be less than or equal to the value specified in this parameter for the Oracle Replication component session to be eligible for bottleneck analysis. For example, if 50 is specified, then only components that are paused for flow control 50% of the time or less are eligible for bottleneck analysis.
retention_time	The number of hours to retain monitoring results.

Exceptions

Table 291-21 START_MONITORING Procedure Exceptions

Exception	Description
ORA-20111	cannot start monitoring due to active EM monitoring job Stop the Oracle Enterprise Manager (EM) monitoring job, and run the START_MONITORING procedure again.
ORA-20112	cannot start monitoring due to active Replication monitoring job Stop the Replication monitoring job, and run the START_MONITORING procedure again.

Usage Notes

The following are usage notes for the START_MONITORING procedure:

- [Requirements for the User Running the Procedure](#)
- [Full Monitoring Job Names](#)
- [Restrictions on Monitoring Jobs](#)

Requirements for the User Running the Procedure

The user who runs the START_MONITORING procedure must meet the following requirements:

- The user must have access to a database link to each database that contains Oracle Replication components.

- The user must have been granted privileges using the `DBMS_XSTREAM_AUTH.GRANT_ADMIN_PRIVILEGE` procedure, and each database link must connect to a user at the remote database that has been granted privileges using the `DBMS_XSTREAM_AUTH.GRANT_ADMIN_PRIVILEGE` procedure.

Full Monitoring Job Names

When you submit a monitoring job, the client name and job name are concatenated to form the full monitoring job name. You specify the client name using the `client_name` parameter and the job name using the `job_name` parameter when you run the `START_MONITORING` procedure. The client name for a monitoring job submitted by Oracle Enterprise Manager is always `EM`.

The following table show examples of full monitoring job names:

Setting for <code>client_name</code> Parameter	Setting for <code>job_name</code> parameter	Full Monitoring Job Name
<code>NULL</code>	<code>STREAMS\$_MONITORING_JOB</code>	<code>STREAMS\$_MONITORING_JOB</code>
<code>EM</code>	<code>STREAMS\$_MONITORING_JOB</code>	<code>EMSTREAMS\$_MONITORING_JOB</code>
<code>strm</code>	<code>STREAMS\$_MONITORING_JOB</code>	<code>strmSTREAMS\$_MONITORING_JOB</code>
<code>strm</code>	<code>mjob1</code>	<code>strmmjob1</code>

Restrictions on Monitoring Jobs

The following restrictions apply to monitoring jobs:

- The limit for the length of the full monitoring job name is 30 bytes.
- Two monitoring jobs cannot have the same full monitoring job name, even if the monitoring jobs were submitted by different schemas. The name check is not case-sensitive. For example, `strmSTREAMS$_MONITORING_JOB` and `STRMSTREAMS$_MONITORING_JOB` are considered to be the same name.
- Oracle Enterprise Manager can have at most one monitoring job for each database.
- Each schema can have at most one monitoring job.

291.4.7 STOP_MONITORING Procedure

This procedure stops a monitoring job that was submitted by the current user.

Syntax

```
UTL_RPADV.STOP_MONITORING(
    purge IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 291-22 STOP_MONITORING Procedure Parameters

Parameter	Description
purge	If <code>TRUE</code> , then the procedure purges information about the monitoring job from the result tables. If <code>FALSE</code> , then the procedure retains information about the monitoring job in the result tables.

UTL_SMTP

The `UTL_SMTP` package is designed for sending electronic mails (e-mails) over Simple Mail Transfer Protocol (SMTP) as specified by RFC821.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Constants](#)
- [Types](#)
- [Reply Codes](#)
- [UTL_SMTP Operational Notes](#)
- [Exceptions](#)
- [Rules and Limits](#)
- [Examples](#)
- [Summary of UTL_SMTP Subprograms](#)



See Also:

Oracle Database Development Guide

292.1 UTL_SMTP Overview

The `UTL_SMTP` protocol consists of a set of commands for an e-mail client to dispatch e-mails to an SMTP server. The `UTL_SMTP` package provides interfaces to the SMTP commands.

For many of the commands, the package provides both a procedural and a functional interface. The functional form returns the reply from the server for processing by the client. The procedural form checks the reply and raises an exception if the reply indicates a transient (400-range reply code) or permanent error (500-range reply code). Otherwise, it discards the reply.

Note that the original SMTP protocol communicates using 7-bit ASCII. Using `UTL_SMTP`, all text data (in other words, those in `VARCHAR2`) is converted to US7ASCII before it is sent to the server. Some implementations of SMTP servers that support SMTP extension 8BITMIME [RFC1652] support full 8-bit communication between client and server. The body of the `DATA` command can be transferred in full 8 bits, but the rest of the SMTP command and response must be in 7 bits. When the target SMTP server supports 8BITMIME extension, users of multibyte databases may convert their non-US7ASCII, multibyte `VARCHAR2` data to `RAW` and use the `WRITE_RAW_DATA` subprogram to send multibyte data using 8-bit MIME encoding.

UTL_SMTP provides for SMTP communication as specified in RFC821, but does not provide an API to format the content of the message according to RFC 822 (for example, setting the subject of an electronic mail). You must format the message appropriately. In addition, UTL_SMTP does not have the functionality to implement an SMTP server for an e-mail clients to send e-mails using SMTP.

292.2 UTL_SMTP Security Model

This package is an invoker's rights package. The invoking user must have the `connect` privilege granted in the access control list assigned to the remote network host to which the user must connect.



Note:

For more information on managing fine-grained access, see *Oracle Database Security Guide*

292.3 UTL_SMTP Constants

UTL_SMTP defines several constants to use when specifying parameter values.

These are shown in the following table.

Table 292-1 UTL_SMTP Constants

Name	Type	Value	Description
ALL_SCHEMES	VARCHAR2 (256)	'CRAM-MD5 PLAIN LOGIN'	List of all authentication schemes UTL_SMTP supports, in order of their relative security strength. The subset of the schemes in ALL_SCHEMES (namely, PLAIN and LOGIN) in which cleartext passwords are sent over SMTP must be used only in SMTP connections that are secured by Secure Socket Layer / Transport Layer Security (SSL/TLS).
NON_CLEARTEXT_PASSWORD_SCHEMES	VARCHAR2 (256)	'CRAM-MD5'	List of authentication schemes that UTL_SMTP supports and in which no cleartext passwords are sent over SMTP. They can be used in SMTP connections that are not secured by SSL/TLS. Note that these schemes may still be weak when used in an insecure SMTP connection.

292.4 UTL_SMTP Types

UTL_SMTP uses a CONNECTION record type and REPLY_REPLIES record types.

CONNECTION Record Type

This is a PL/SQL record type used to represent an SMTP connection.

Syntax

```
TYPE connection IS RECORD (
    host          VARCHAR2(255),
    port          PLS_INTEGER,
    tx_timeout    PLS_INTEGER,
    private_tcp_con utl_tcp.connection,
    private_state PLS_INTEGER);
```

Fields

Table 292-2 CONNECTION Record Type Fields

Field	Description
host	Name of the remote host when connection is established. NULL when no connection is established.
port	Port number of the remote SMTP server connected. NULL when no connection is established.
tx_timeout	Time in seconds that the UTL_SMTP package waits before timing out in a read or write operation in this connection. In read operations, this package times out if no data is available for reading immediately. In write operations, this package times out if the output buffer is full and no data is to be sent into the network without being blocked. 0 indicates not to wait at all. NULL indicates to wait forever.
private_tcp_con	Private, for implementation use only. You should not modify this field.
private_state	Private, for implementation use only. You should not modify this field.

Usage Notes

The read-only fields in a connection record are used to return information about the SMTP connection after the connection is successfully made with the [OPEN_CONNECTION Functions](#). Changing the values of these fields has no effect on the connection. The fields `private_tcp_con` and `private_state` for implementation use only. You should not modify these fields.

REPLY_REPLIES Record Types

These are PL/SQL record types used to represent an SMTP reply line. Each SMTP reply line consists of a reply code followed by a text message. While a single reply line is expected for most SMTP commands, some SMTP commands expect multiple reply lines. For those situations, a PL/SQL table of reply records is used to represent multiple reply lines.

Syntax

```
TYPE reply IS RECORD (
  code    PLS_INTEGER,
  text    VARCHAR2(508));
```

```
TYPE replies IS TABLE OF reply INDEX BY BINARY_INTEGER;
```

Fields**Table 292-3 REPLY, REPLIES Record Type Fields**

Field	Description
code	3-digit reply code
text	Text message of the reply

292.5 UTL_SMTP Reply Codes

SMTP servers send reply codes that indicate message or server status.

The following is a list of the SMTP reply codes.

Table 292-4 SMTP Reply Codes

Reply Code	Meaning
211	System status, or system help reply
214	Help message [Information on how to use the receiver or the meaning of a particular non-standard command; this reply is useful only to the human user]
220	<domain> Service ready
221	<domain> Service closing transmission channel
250	Requested mail action okay, completed
251	User not local; forwards to <forward-path>
252	OK, pending messages for node <node> started. Cannot VRFY user (for example, info is not local), but takes message for this user and attempts delivery.
253	OK, <messages> pending messages for node <node> started
354	Start mail input; end with <CRLF.CRLF>
355	Octet-offset is the transaction offset
421	<domain> Service not available, closing transmission channel (This can be a reply to any command if the service knows it must shut down.)
450	Requested mail action not taken: mailbox unavailable [for example, mailbox busy]
451	Requested action terminated: local error in processing
452	Requested action not taken: insufficient system storage
453	You have no mail.

Table 292-4 (Cont.) SMTP Reply Codes

Reply Code	Meaning
454	TLS not available due to temporary reason. Encryption required for requested authentication mechanism.
458	Unable to queue messages for node <node>
459	Node <node> not allowed: reason
500	Syntax error, command unrecognized (This may include errors such as command line too long.)
501	Syntax error in parameters or arguments
502	Command not implemented
503	Bad sequence of commands
504	Command parameter not implemented
521	<Machine> does not accept mail.
530	Must issue a STARTTLS command first. Encryption required for requested authentication mechanism.
534	Authentication mechanism is too weak.
538	Encryption required for requested authentication mechanism.
550	Requested action not taken: mailbox unavailable [for, mailbox not found, no access]
551	User not local; please try <forward-path>
552	Requested mail action terminated: exceeded storage allocation
553	Requested action not taken: mailbox name not allowed [for example, mailbox syntax incorrect]
554	Transaction failed

292.6 UTL_SMTP Operational Notes

An SMTP connection is initiated by a call to `OPEN_CONNECTION` Functions which returns a SMTP connection.

After a connection is established, the following calls are required to send a mail:

[HELO Function and Procedure](#) - identify the domain of the sender

[MAIL Function and Procedure](#)- start a mail, specify the sender

[RCPT Function](#) - specify the recipient

[OPEN_DATA Function and Procedure](#)- start the mail body

[WRITE_RAW_DATA Procedure](#) - write the mail body (multiple calls allowed)

[CLOSE_DATA Function and Procedure](#) - close the mail body and send the mail

The SMTP connection is closed by calling the `QUIT` Function and Procedure.

Related Topics

- [OPEN_CONNECTION Functions](#)
These functions open a connection to an SMTP server.
- [QUIT Function and Procedure](#)
This subprogram terminates an SMTP session and disconnects from the server.

292.7 UTL_SMTP Exceptions

This table lists the exceptions that can be raised by the interface of the UTL_SMTP package.

The network error is transferred to a reply code of 421- service not available.

Table 292-5 UTL_SMTP Exceptions

Exception	Description
INVALID_OPERATION	Raised when an invalid operation is made. In other words, calling API other than the WRITE_DATA Procedure , the WRITE_RAW_DATA Procedure or the CLOSE_DATA Function and Procedure after the OPEN_DATA Function and Procedure is called, or calling <code>WRITE_DATA</code> , <code>WRITE_RAW_DATA</code> or <code>CLOSE_DATA</code> without first calling <code>OPEN_DATA</code> .
TRANSIENT_ERROR	Raised when receiving a reply code in 400 range
PERMANENT_ERROR	Raised when receiving a reply code in 500 range

292.8 UTL_SMTP Rules and Limits

The API imposes no imitation or range-checking. However, you must be aware of the limitations on various elements of SMTP. Sending data that exceed these limits may result in errors returned by the server.

The following table describes the size limitations encountered by the UTL_SMTP subprograms.

Table 292-6 SMTP Size Limitation

Element	Size Limitation
user	Maximum total length of a user name is 64 characters
domain	Maximum total length of a domain name or number is 64 characters
path	Maximum total length of a reverse-path or forward-path is 256 characters (including the punctuation and element separators)
command line	Maximum total length of a command line including the command word and the <CRLF> is 512 characters
reply line	Maximum total length of a reply line including the reply code and the <CRLF> is 512 characters
text line	Maximum total length of a text line including the <CRLF> is 1000 characters (but not counting the leading dot duplicated for transparency)

Table 292-6 (Cont.) SMTP Size Limitation

Element	Size Limitation
recipients buffer	Maximum total number of recipients that must be buffered is 100 recipients

292.9 UTL SMTP Examples

This example illustrates how UTL SMTP is used by an application to send e-mail. The application connects to an SMTP server at port 25 and sends a simple text message.

```

DECLARE
  c UTL SMTP.CONNECTION;

  PROCEDURE send_header(name IN VARCHAR2, header IN VARCHAR2) AS
  BEGIN
    UTL SMTP.WRITE_DATA(c, name || ': ' || header || UTL_TCP.CRLF);
  END;

BEGIN
  c := UTL SMTP.OPEN_CONNECTION('smtp-server.acme.com');
  UTL SMTP.HELO(c, 'foo.com');
  UTL SMTP.MAIL(c, 'sender@foo.com');
  UTL SMTP.RCPT(c, 'recipient@foo.com');
  UTL SMTP.OPEN_DATA(c);
  send_header('From',      '"Sender" <sender@foo.com>');
  send_header('To',       '"Recipient" <recipient@foo.com>');
  send_header('Subject', 'Hello');
  UTL SMTP.WRITE_DATA(c, UTL_TCP.CRLF || 'Hello, world!');
  UTL SMTP.CLOSE_DATA(c);
  UTL SMTP.QUIT(c);
EXCEPTION
  WHEN utl_smtp.transient_error OR utl_smtp.permanent_error THEN
  BEGIN
    UTL SMTP.QUIT(c);
  EXCEPTION
    WHEN UTL SMTP.TRANSIENT_ERROR OR UTL SMTP.Permanent_Error THEN
    NULL; -- When the SMTP server is down or unavailable, we don't have
    -- a connection to the server. The QUIT call raises an
    -- exception that we can ignore.
  END;
  raise_application_error(-20000,
    'Failed to send mail due to the following error: ' || sqlerrm);
END;

```

292.10 Summary of UTL SMTP Subprograms

This table lists the UTL SMTP subprograms and briefly describes them.

Table 292-7 UTL SMTP Package Subprograms

Subprogram	Description
AUTH Function and Procedure	Sends the AUTH command to authenticate to the SMTP server

Table 292-7 (Cont.) UTL_SMTP Package Subprograms

Subprogram	Description
CLOSE_CONNECTION Procedure	Closes the SMTP connection, causing the current SMTP operation to terminate
CLOSE_DATA Function and Procedure	Closes the data session
COMMAND Function and Procedure	Performs a generic SMTP command
COMMAND_REPLIES Function	Performs a generic SMTP command and retrieves multiple reply lines
DATA Function and Procedure	Sends the e-mail body
EHLO Function and Procedure	Performs the initial handshake with SMTP server using the <code>EHLO</code> command
HELO Function and Procedure	Performs the initial handshake with SMTP server using the <code>HELO</code> command
HELP Function	Sends <code>HELP</code> command
MAIL Function and Procedure	Initiates an e-mail transaction with the server, the destination is a mailbox
NOOP Function and Procedure	<code>NULL</code> command
OPEN_CONNECTION Functions	Opens a connection to an SMTP server
OPEN_DATA Function and Procedure	Sends the <code>DATA</code> command
QUIT Function and Procedure	Terminates an SMTP session and disconnects from the server
RCPT Function	Specifies the recipient of an e-mail message
RSET Function and Procedure	Terminates the current e-mail transaction
STARTTLS Function and Procedure	Sends <code>STARTTLS</code> command to secure the SMTP connection using SSL/TLS
VRFY Function	Verifies the validity of a destination e-mail address
WRITE_DATA Procedure	Writes a portion of the e-mail message
WRITE_RAW_DATA Procedure	Writes a portion of the e-mail message with <code>RAW</code> data

292.10.1 AUTH Function and Procedure

This subprogram sends the `AUTH` command to authenticate to the SMTP server. The `UTL_SMTP` package goes through the user's choices of authentication schemes, skips any that is not supported by the SMTP server and uses the first supported.

To determine the schemes the SMTP server supports from its `EHLO` reply, the user must call the [EHLO Function and Procedure](#). Otherwise, `UTL_SMTP` uses the first scheme in the list.

Syntax

```

UTL_SMTP.AUTH (
  c          IN OUT NOCOPY connection,
  username   IN          VARCHAR2,
  password   IN          VARCHAR2,
  schemes    IN          VARCHAR2 DEFAULT NON_CLEARTEXT_PASSWORD_SCHEMES)
RETURN reply;

```

```

UTL_SMTP.AUTH (
  c          IN OUT NOCOPY connection,
  username   IN          VARCHAR2,
  password   IN          VARCHAR2,
  schemes    IN          VARCHAR2 DEFAULT NON_CLEARTEXT_PASSWORD_SCHEMES);

```

Parameters

Table 292-8 AUTH Function and Procedure Parameters

Parameter	Description
c	SMTP connection
username	Username
password	Password
schemes	Space-separated list of authentication schemes UTL_SMTP is allowed to use in the preferred order. See the ALL_SCHEMES and NON_CLEARTEXT_PASSWORD_SCHEMES constants for suggestions.

Return Values

Table 292-9 AUTH Function and Procedure Function Return Values

Return Value	Description
reply	Reply of the command (see REPLY_REPLIES Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

- Currently only PLAIN, LOGIN and CRAM-MD5 authentication schemes are supported by UTL_SMTP.
- Since the SMTP server may change the authentication schemes it supports after the SMTP connection is secured by SSL/TLS after the STARTTLS command (for example, adding PLAIN and LOGIN), the caller must call the [EHLO Function and Procedure](#) again for UTL_SMTP to update the list after the [STARTTLS Function and Procedure](#) is called.

Examples

```

DECLARE
  c utl_smtp.connection;
BEGIN
  c := utl_smtp.open_connection(
    host => 'smtp.example.com',
    port => 25,

```



```

        wallet_path => 'file:/oracle/wallets/smtp_wallet',
        wallet_password => 'password',
        secure_connection_before_smtp => FALSE);
UTL_SMTP.STARTTLS(c);
UTL_SMTP.AUTH(
    c => c,
    username => 'scott',
    password => 'password'
    schemes => utl_smtp.all_schemes);
END;
```

292.10.2 CLOSE_CONNECTION Procedure

This procedure closes the SMTP connection, causing the current SMTP operation to terminate. Use this procedure only to cancel an e-mail in the middle of the data session.

To end the SMTP connection properly, use the [QUIT Function and Procedure](#).

Syntax

```
UTL_SMTP.CLOSE_CONNECTION (
    c      IN OUT NOCOPY connection);
```

Parameters

Table 292-10 CLOSE_CONNECTION Procedure Parameters

Parameter	Description
c	SMTP connection

292.10.3 CLOSE_DATA Function and Procedure

This subprogram ends the e-mail message by sending the sequence <CR><LF>.<CR><LF> (a single period at the beginning of a line).

Syntax

```
UTL_SMTP.CLOSE_DATA (
    c      IN OUT NOCOPY connection)
RETURN reply;

UTL_SMTP.CLOSE_DATA (
    c      IN OUT NOCOPY connection);
```

Parameters

Table 292-11 CLOSE_DATA Function and Procedure Parameters

Parameter	Description
c	SMTP connection

Return Values

Table 292-12 CLOSE_DATA Function and Procedure Return Values

Return Value	Description
reply	Reply of the command (see REPLY_ REPLIES Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

The calls to OPEN_DATA, WRITE_DATA, WRITE_RAW_DATA and CLOSE_DATA must be made in the right order. A program calls OPEN_DATA to send the DATA command to the SMTP server. After that, it can call WRITE_DATA or WRITE_RAW_DATA repeatedly to send the actual data. The data is terminated by calling CLOSE_DATA. After OPEN_DATA is called, the only subprograms that can be called are WRITE_DATA, WRITE_RAW_DATA, or CLOSE_DATA. A call to other subprograms results in an INVALID_OPERATION exception being raised.

CLOSE_DATA must be called only after OPEN_CONNECTION, HELO or EHLO, MAIL, and RCPT have been called. The connection to the SMTP server must be open and a mail transaction must be active when this routine is called.

Note that there is no function form of WRITE_DATA because the SMTP server does not respond until the data-terminator is sent during the call to CLOSE_DATA.

292.10.4 COMMAND Function and Procedure

This subprogram performs a generic SMTP command.

Syntax

```
UTL_SMTP.COMMAND (
  c      IN OUT NOCOPY   connection,
  cmd    IN              VARCHAR2,
  arg    IN              VARCHAR2 DEFAULT NULL)
RETURN reply;
```

```
UTL_SMTP.COMMAND (
  c      IN OUT NOCOPY   connection,
  cmd    IN              VARCHAR2,
  arg    IN              VARCHAR2 DEFAULT NULL);
```

Parameters

Table 292-13 COMMAND Function and Procedure Parameters

Parameter	Description
c	SMTP connection
cmd	SMTP command to send to the server
arg	Optional argument to the SMTP argument. A space is inserted between cmd and arg.

Return Values

Table 292-14 COMMAND Function and Procedure Return Values

Return Value	Description
reply	Reply of the command (see REPLY_ REPLIES Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

This function is used to invoke generic SMTP commands. Use `COMMAND` if only a single reply line is expected. Use `COMMAND_REPLIES` if multiple reply lines are expected.

For `COMMAND`, if multiple reply lines are returned from the SMTP server, it returns the last reply line only.

292.10.5 COMMAND_REPLIES Function

This function performs a generic SMTP command and retrieves multiple reply lines.

Syntax

```
UTL_SMTP.COMMAND_REPLIES (
  c      IN OUT NOCOPY  connection,
  cmd    IN              VARCHAR2,
  arg    IN              VARCHAR2 DEFAULT NULL)
RETURN replies;
```

Parameters

Table 292-15 COMMAND_REPLIES Function Parameters

Parameter	Description
c	SMTP connection
cmd	SMTP command to send to the server
arg	Optional argument to the SMTP argument. A space is inserted between <code>cmd</code> and <code>arg</code> .

Return Values

Table 292-16 COMMAND_REPLIES Function Return Values

Return Value	Description
replies	Reply of the command (see REPLY_ REPLIES Record Types in UTL_SMTP Types)

Usage Notes

This function is used to invoke generic SMTP commands. Use `COMMAND` if only a single reply line is expected. Use `COMMAND_REPLIES` if multiple reply lines are expected.

For `COMMAND`, if multiple reply lines are returned from the SMTP server, it returns the last reply line only.

292.10.6 DATA Function and Procedure

This subprogram specifies the body of an e-mail message.

Syntax

```
UTL_SMTP.DATA (
    c      IN OUT NOCOPY connection
    body  IN  VARCHAR2 CHARACTER SET ANY_CS)
RETURN reply;
```

```
UTL_SMTP.DATA (
    c      IN OUT NOCOPY connection
    body  IN  VARCHAR2 CHARACTER SET ANY_CS);
```

Parameters

Table 292-17 DATA Function and Procedure Parameters

Parameter	Description
c	SMTP Connection
body	Text of the message to be sent, including headers, in [RFC822] format

Return Values

Table 292-18 DATA Function and Procedure Return Values

Return Value	Description
reply	Reply of the command (see <code>REPLY_ REPLIES</code> Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

The application must ensure that the contents of the body parameter conform to the MIME(RFC822) specification. The `DATA` routine terminates the message with a `<CR><LF>.<CR><LF>` sequence (a single period at the beginning of a line), as required by RFC821. It also translates any sequence of `<CR><LF>.<CR><LF>` (single period) in body to `<CR><LF>..<CR><LF>` (double period). This conversion provides the transparency as described in Section 4.5.2 of RFC821.

The `DATA` subprogram must be called only after `OPEN_CONNECTION`, `HELO` or `EHLO`, `MAIL` and `RCPT` have been called. The connection to the SMTP server must be open, and a mail transaction must be active when this routine is called.

The expected response from the server is a message beginning with status code 250. The 354 response received from the initial `DATA` command is not returned to the caller.

292.10.7 EHLO Function and Procedure

This subprogram performs the initial handshake with SMTP server using the `EHLO` command.

Syntax

```
UTL_SMTP.EHLO (
    c          IN OUT NOCOPY connection,
    domain IN)
RETURN replies;

UTL_SMTP.EHLO (
    c          IN OUT NOCOPY connection,
    domain IN);
```

Parameters

Table 292-19 EHLO Function and Procedure Parameters

Parameter	Description
<code>c</code>	SMTP connection
<code>domain</code>	Domain name of the local (sending) host. Used for identification purposes.

Return Values

Table 292-20 EHLO Function and Procedure Return Values

Return Value	Description
<code>replies</code>	Reply of the command (see REPLY_ REPLIES Record Types in UTL_SMTP Types).

Usage Notes

The `EHLO` interface is identical to `HELO` except that it allows the server to return more descriptive information about its configuration. [RFC1869] specifies the format of the information returned, which the PL/SQL application can retrieve using the functional form of this call. For compatibility with `HELO`, each line of text returned by the server begins with status code 250.

Related Functions

[HELO Function and Procedure](#)

292.10.8 HELO Function and Procedure

This subprogram performs the initial handshake with SMTP server using the `HELO` command.

Syntax

```
UTL_SMTP.HELO (
    c          IN OUT NOCOPY  connection,
    domain    IN              VARCHAR2)
RETURN reply;
```

```
UTL_SMTP.HELO (
    c          IN OUT NOCOPY  connection,
    domain    IN              VARCHAR2);
```

Parameters

Table 292-21 HELO Function and Procedure Parameters

Parameter	Description
<code>c</code>	SMTP connection
<code>domain</code>	Domain name of the local (sending) host. Used for identification purposes.

Return Values

Table 292-22 HELO Function and Procedure Return Values

Return Value	Description
<code>reply</code>	Reply of the command (see <code>REPLY_ REPLIES</code> Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

RFC 821 specifies that the client must identify itself to the server after connecting. This routine performs that identification. The connection must have been opened through a call to [OPEN_CONNECTION Functions](#) before calling this routine.

The expected response from the server is a message beginning with status code 250.

Related Functions

[EHLO Function and Procedure](#)

292.10.9 HELP Function

This function sends the `HELP` command.

Syntax

```
UTL_SMTP.HELP (
    c          IN OUT NOCOPY  connection,
```

```

    command IN          VARCHAR2 DEFAULT NULL)
RETURN replies;

```

Parameters

Table 292-23 HELP Function Parameters

Parameter	Description
c	SMTP connection
command	Command to get the help message

Return Values

Table 292-24 HELP Function Return Values

Return Value	Description
replies	Reply of the command (see REPLY_ REPLIES Record Types in UTL_SMTP Types)

292.10.10 MAIL Function and Procedure

This subprogram initiate a mail transaction with the server. The destination is a mailbox.

Syntax

```

UTL_SMTP.MAIL (
    c          IN OUT NOCOPY  connection,
    sender     IN             VARCHAR2,
    parameters IN             VARCHAR2 DEFAULT NULL)
RETURN reply;

```

```

UTL_SMTP.MAIL (
    c          IN OUT NOCOPY  connection,
    sender     IN             VARCHAR2,
    parameters IN             VARCHAR2 DEFAULT NULL);

```

Parameters

Table 292-25 MAIL Function and Procedure Parameters

Parameter	Description
c	SMTP connection
sender	E-mail address of the user sending the message.
parameters	Additional parameters to mail command as defined in Section 6 of [RFC1869]. It must follow the format of "XXX=XXX (XXX=XXX ...)".

Return Values

Table 292-26 MAIL Function and Procedure Return Values

Return Value	Description
reply	Reply of the command (see <code>REPLY_ REPLIES</code> Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

This command does not send the message; it simply begins its preparation. It must be followed by calls to `RCPT` and `DATA` to complete the transaction. The connection to the SMTP server must be open and a `HELO` or `EHLO` command must have already been sent.

The expected response from the server is a message beginning with status code 250.

292.10.11 NOOP Function and Procedure

This subprogram issues the `NULL` command.

Syntax

```
UTL_SMTP.NOOP (
    c IN OUT NOCOPY connection)
RETURN reply;

UTL_SMTP.NOOP (
    c IN OUT NOCOPY connection);
```

Parameter

Table 292-27 NOOP Function and Procedure Parameters

Parameter	Description
c	SMTP connection

Return Values

Table 292-28 NOOP Function and Procedure Return Values

Return Value	Description
reply	Reply of the command (see <code>REPLY_ REPLIES</code> Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

- This command has no effect except to elicit a successful reply from the server. It can be issued at any time after the connection to the server has been established with `OPEN_CONNECTION`. The `NOOP` command can be used to verify that the server is still connected and is listening properly.

- This command replies with a single line beginning with status code 250.

292.10.12 OPEN_CONNECTION Functions

These functions open a connection to an SMTP server.

Syntax

```
UTL_SMTP.OPEN_CONNECTION (
    host                IN VARCHAR2,
    port                IN PLS_INTEGER DEFAULT 25,
    c                   OUT connection,
    tx_timeout          IN PLS_INTEGER DEFAULT NULL,
    wallet_path         IN VARCHAR2 DEFAULT NULL,
    wallet_password     IN VARCHAR2 DEFAULT NULL,
    secure_connection_before_smtp IN BOOLEAN DEFAULT FALSE,
    secure_host         IN VARCHAR2 DEFAULT NULL)
RETURN reply;
```

```
UTL_SMTP.OPEN_CONNECTION (
    host                IN VARCHAR2,
    port                IN PLS_INTEGER DEFAULT 25,
    tx_timeout          IN PLS_INTEGER DEFAULT NULL,
    wallet_path         IN VARCHAR2 DEFAULT NULL,
    wallet_password     IN VARCHAR2 DEFAULT NULL,
    secure_connection_before_smtp IN BOOLEAN DEFAULT FALSE,
    secure_host         IN VARCHAR2 DEFAULT NULL)
RETURN connection;
```

Parameters

Table 292-29 OPEN_CONNECTION Functions Parameters

Parameter	Description
host	Name of the SMTP server host
port	Port number on which SMTP server is listening (usually 25)
c	SMTP connection
tx_timeout	Time in seconds that the UTL_SMTP package waits before timing out in a read or write operation for this connection. In read operations, this package times out if no data is available for reading immediately. In write operations, this package times out if the output buffer is full and no data is to be sent into the network without being blocked. 0 indicates not to wait at all. NULL indicates to wait forever.
wallet_path	Directory path that contains the Oracle wallet for SSL/TLS. The format is file: <directory-path> If you want to use the operating system certificate store to act in place of the Oracle wallet, then set the path parameter to system: (include the colon). Doing so greatly improves performance in the database.
wallet_password	Password to open the wallet. When the wallet is auto-login enabled, the password can be set to NULL. If you set path to system:, then omit the password by setting it to NULL.

Table 292-29 (Cont.) OPEN_CONNECTION Functions Parameters

Parameter	Description
<code>secure_connection_before_smtp</code>	If TRUE, a secure connection with SSL/TLS is made before SMTP communication. If FALSE, no connection is made.
<code>secure_host</code>	The host name to be matched against the common name (CN) of the SMTP server's certificate when a secure connection is used. It can also be a domain name like <code>"*.example.com"</code> . If NULL, the SMTP host name to connect to will be used.

Return Values**Table 292-30 OPEN_CONNECTION Functions Return Values**

Return Value	Description
<code>reply</code>	Reply of the command (see REPLY_REPLIES Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

- The expected response from the server is a message beginning with status code 220.
- The version of `OPEN_CONNECTION` that returns `UTL_SMTP.CONNECTION` record checks the reply code returned by an SMTP server when the connection is first established. It raises an exception when the reply indicates an error. Otherwise, it discards the reply. If you want to examine the reply, invoke the version of `OPEN_CONNECTION` that returns `REPLY`.
- `tx_timeout` is intended to govern both the read operations and the write operations. However, an implementation restriction prevents `tx_timeout` from governing write operations in the current release.

Examples

```
DECLARE
  c utl_smtp.connection;
BEGIN
  c := UTL_SMTP.OPEN_CONNECTION(
    host => 'smtp.example.com',
    port => 465,
    wallet_path => 'file:/oracle/wallets/smtp_wallet',
    wallet_password => 'password',
    secure_connection_before_smtp => TRUE);
END;
```

292.10.13 OPEN_DATA Function and Procedure

This subprogram sends the `DATA` command after which you can use `WRITE_DATA` and `WRITE_RAW_DATA` to write a portion of the e-mail message.

Syntax

```
UTL_SMTP.OPEN_DATA (
  c      IN OUT NOCOPY connection)
```

```

RETURN reply;

UTL_SMTP.OPEN_DATA (
    c      IN OUT NOCOPY connection);

```

Parameters

Table 292-31 OPEN_DATA Function and Procedure Parameters

Parameter	Description
c	SMTP connection
data	Portion of the text of the message to be sent, including headers, in RFC822 format.

Return Values

Table 292-32 OPEN_DATA Function and Procedure Function Return Values

Return Value	Description
reply	Reply of the command (see REPLY_ REPLIES Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

- The calls to OPEN_DATA, WRITE_DATA, WRITE_RAW_DATA and CLOSE_DATA must be made in the right order. A program calls OPEN_DATA to send the DATA command to the SMTP server. After that, it can call WRITE_DATA or WRITE_RAW_DATA repeatedly to send the actual data. The data is terminated by calling CLOSE_DATA. After OPEN_DATA is called, the only subprograms that can be called are WRITE_DATA, WRITE_RAW_DATA, or CLOSE_DATA. A call to other subprograms results in an INVALID_OPERATION exception being raised.
- OPEN_DATA must be called only after OPEN_CONNECTION, HELO or EHLO, MAIL, and RCPT have been called. The connection to the SMTP server must be open and a mail transaction must be active when this routine is called.

292.10.14 QUIT Function and Procedure

This subprogram terminates an SMTP session and disconnects from the server.

Syntax

```

UTL_SMTP.QUIT (
    c IN OUT NOCOPY connection)
RETURN reply;

UTL_SMTP.QUIT (
    c IN OUT NOCOPY connection);

```

Parameter

Table 292-33 QUIT Function and Procedure Parameters

Parameter	Description
c	SMTP connection

Return Values

Table 292-34 QUIT Function and Procedure Function Return Values

Return Value	Description
reply	Reply of the command (see REPLY_ REPLIES Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

The `QUIT` command informs the SMTP server of the client's intent to terminate the session. It then closes the connection established by `OPEN_CONNECTION` which must have been called before executing this command. If a mail transaction is in progress when `QUIT` is issued, it is canceled in the same manner as `RSET`.

The function form of this command returns a single line beginning with the status code 221 on successful termination. In all cases, the connection to the SMTP server is closed. The fields `REMOTE_HOST` and `REMOTE_PORT` of `c` are reset.

Related Functions

[RSET Function and Procedure](#)

292.10.15 RCPT Function

This subprogram specifies the recipient of an e-mail message.

Syntax

```
UTL_SMTP.RCPT (
    c          IN OUT NOCOPY    connection,
    recipient  IN              VARCHAR2,
    parameters IN              VARCHAR2 DEFAULT NULL)
RETURN reply;

UTL_SMTP.RCPT (
    c          IN OUT NOCOPY    connection,
    recipient  IN              VARCHAR2,
    parameters IN              VARCHAR2 DEFAULT NULL);
```

Table 292-35 RCPT Function and Procedure Parameters

Parameter	Description
c	SMTP connection

Table 292-35 (Cont.) RCPT Function and Procedure Parameters

Parameter	Description
recipient	E-mail address of the user to which the message is being sent
parameters	Additional parameters to RCPT command as defined in Section 6 of [RFC1869]. It must follow the format of "XXX=XXX (XXX=XXX)".

Return Values

Table 292-36 RCPT Function and Procedure Function Return Values

Return Value	Description
reply	Reply of the command (see REPLY_ REPLIES Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

To send a message to multiple recipients, call this routine multiple times. Each invocation schedules delivery to a single e-mail address. The message transaction must have been begun by a prior call to `MAIL`, and the connection to the mail server must have been opened and initialized by prior calls to `OPEN_CONNECTION` and `HELO` or `EHLO` respectively.

The expected response from the server is a message beginning with status code 250 or 251.

292.10.16 RSET Function and Procedure

This subprogram terminates the current mail transaction.

Syntax

```
UTL_SMTP.RSET (
    c IN OUT NOCOPY connection)
RETURN reply;

UTL_SMTP.RSET (
    c IN OUT NOCOPY connection);
```

Parameters

Table 292-37 RSET Function and Procedure Parameters

Parameter	Description
c	SMTP connection

Return Values

Table 292-38 RSET Function and Procedure Return Values

Return Value	Description
reply	Reply of the command (see REPLY_ REPLIES Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

- This command allows the client to cancel an e-mail message it was in the process of composing. No mail is sent. The client can call `RSET` at any time after the connection to the SMTP server has been opened by means of `OPEN_CONNECTION` until `DATA` or `OPEN_DATA` is called. Once the e-mail data has been sent, it is too late to prevent the e-mail from being sent.
- The server responds to `RSET` with a message beginning with status code 250.

Related Functions

[QUIT Function and Procedure](#)

292.10.17 STARTTLS Function and Procedure

This subprogram sends the `STARTTLS` command to secure the SMTP connection using SSL/TLS.

SSL/TLS requires an Oracle wallet which must be specified when the connection was opened by the [OPEN_CONNECTION Functions](#).

Syntax

```
UTL_SMTP.STARTTLS (
    c          IN OUT NOCOPY connection,
    secure_host IN    VARCHAR2 DEFAULT NULL)
RETURN reply;
```

```
UTL_SMTP.STARTTLS (
    c          IN OUT NOCOPY connection,
    secure_host IN    VARCHAR2 DEFAULT NULL);
```

Parameters

Table 292-39 STARTTLS Function and Procedure Parameters

Parameter	Description
c	SMTP connection
secure_host	The host name to be matched against the common name (CN) of the SMTP server's certificate. It can also be a domain name like <code>"*.example.com"</code> . If NULL, the SMTP host name to connect to will be used.

Return Values

Table 292-40 STARTTLS Function and Procedure Return Values

Return Value	Description
reply	SMTP reply

Usage Notes

The `STARTTLS` command must only be issued on an unencrypted connection and when the SMTP server indicates the support of the command in the reply of the `EHLO` command. The wallet to be used for encryption must have been specified when the initial SMTP connection was opened by the `OPEN_CONNECTION` function.

Examples

```
DECLARE
  c utl_smtp.connection;
BEGIN
  c := utl_smtp.open_connection(
    host => 'smtp.example.com',
    port => 25,
    wallet_path => 'file:/oracle/wallets/smtp_wallet',
    wallet_password => 'password',
    secure_connection_before_smtp => FALSE);
  utl_smtp.starttls(c);
END
```

292.10.18 VRFY Function

This function verifies the validity of a destination e-mail address.

Syntax

```
UTL_SMTP.VRFY (
  c          IN OUT NOCOPY connection
  recipient IN VARCHAR2)
RETURN reply;
```

Parameters

Table 292-41 VRFY Function Parameters

Parameter	Description
c	SMTP connection
recipient	E-mail address to be verified

Return Values

Table 292-42 VRFY Function Return Values

Return Value	Description
reply	Reply of the command (see REPLY_ REPLIES Record Types in UTL_SMTP Types). In cases where there are multiple replies, the last reply is returned.

Usage Notes

The server attempts to resolve the destination address `recipient`. If successful, it returns the recipient's full name and fully qualified mailbox path. The connection to the server must have already been established by means of `OPEN_CONNECTION` and `HELO` or `EHLO` before making this request.

Successful verification returns one or more lines beginning with status code 250 or 251.

292.10.19 WRITE_DATA Procedure

This procedure writes a portion of the e-mail message. A repeat call to `WRITE_DATA` appends data to the e-mail message.

Syntax

```
UTL_SMTP.WRITE_DATA (
    c      IN OUT NOCOPY connection,
    data   IN VARCHAR2 CHARACTER SET ANY_CS);
```

Parameters

Table 292-43 WRITE_DATA Procedure Parameters

Parameter	Description
c	SMTP connection
data	Portion of the text of the message to be sent, including headers, in [RFC822] format

Usage Notes

- The calls to the [OPEN_DATA Function and Procedure](#), [WRITE_DATA Procedure](#), [WRITE_RAW_DATA Procedure](#) and [CLOSE_DATA Function and Procedure](#) must be made in the correct order. A program calls `OPEN_DATA` to send the `DATA` command to the SMTP server. After that, it can call `WRITE_DATA` or `WRITE_RAW_DATA` repeatedly to send the actual data. The data is terminated by calling `CLOSE_DATA`. After `OPEN_DATA` is called, the only subprograms that can be called are `WRITE_DATA`, `WRITE_RAW_DATA`, or `CLOSE_DATA`. A call to other subprograms results in an `INVALID_OPERATION` exception being raised.
- The application must ensure that the contents of the body parameter conform to the MIME(RFC822) specification. The `DATA` routine terminates the message with a `<CR><LF>.<CR><LF>` sequence (a single period at the beginning of a line), as required by RFC821. It also translates any sequence of `<CR><LF>.<CR><LF>` (single period) in the

body to <CR><LF>..<CR><LF> (double period). This conversion provides the transparency as described in Section 4.5.2 of RFC821.

- The [OPEN_DATA Function and Procedure](#), [WRITE_DATA Procedure](#), [WRITE_RAW_DATA Procedure](#) and [CLOSE_DATA Function and Procedure](#) must be called only after [OPEN_CONNECTION Functions](#), [HELO Function and Procedure](#), or [EHLO Function and Procedure](#), [MAIL Function and Procedure](#), and [RCPT Function](#) have been called. The connection to the SMTP server must be open and a mail transaction must be active when this routine is called.
- Note that there is no function form of the [WRITE_DATA Procedure](#) because the SMTP server does not respond until the data-terminator is sent during the call to [CLOSE_DATA Function and Procedure](#).
- Text (VARCHAR2) data sent using [WRITE_DATA](#) is converted to US7ASCII before it is sent. If the text contains multibyte characters, each multibyte character in the text that cannot be converted to US7ASCII is replaced by a '?' character. If 8BITMIME extension is negotiated with the SMTP server using the [EHLO](#) subprogram, multibyte VARCHAR2 data can be sent by first converting the text to RAW using the [UTL_RAW](#) package, and then sending the RAW data using [WRITE_RAW_DATA](#).

292.10.20 WRITE_RAW_DATA Procedure

This procedure writes a portion of the e-mail message. A repeat call to [WRITE_RAW_DATA](#) appends data to the e-mail message.

Syntax

```
UTL_SMTP.WRITE_RAW_DATA (
    c      IN OUT NOCOPY connection
    data  IN RAW);
```

Parameters

Table 292-44 WRITE_RAW_DATA Procedure Parameters

Parameter	Description
c	SMTP connection
data	Portion of the text of the message to be sent, including headers, in [RFC822] format

Usage Notes

- The calls to the [OPEN_DATA Function and Procedure](#), [WRITE_DATA Procedure](#), [WRITE_RAW_DATA Procedure](#) and [CLOSE_DATA Function and Procedure](#) must be made in the correct order. A program calls [OPEN_DATA](#) to send the DATA command to the SMTP server. After that, it can call [WRITE_DATA](#) or [WRITE_RAW_DATA](#) repeatedly to send the actual data. The data is terminated by calling [CLOSE_DATA](#). After [OPEN_DATA](#) is called, the only subprograms that can be called are [WRITE_DATA](#), [WRITE_RAW_DATA](#), or [CLOSE_DATA](#). A call to other subprograms results in an [INVALID_OPERATION](#) exception being raised.
- The application must ensure that the contents of the body parameter conform to the MIME(RFC822) specification. The [DATA](#) routine terminates the message with a <CR><LF>.<CR><LF> sequence (a single period at the beginning of a line), as

required by RFC821. It also translates any sequence of <CR><LF>.<CR><LF> (single period) in the body to <CR><LF>..<CR><LF> (double period). This conversion provides the transparency as described in Section 4.5.2 of RFC821.

- The [OPEN_DATA Function and Procedure](#), [WRITE_DATA Procedure](#), [WRITE_RAW_DATA Procedure](#) and [CLOSE_DATA Function and Procedure](#) must be called only after [OPEN_CONNECTION Functions](#), [HELO Function and Procedure](#), or [EHLO Function and Procedure](#), [MAIL Function and Procedure](#), and [RCPT Function](#) have been called. The connection to the SMTP server must be open and a mail transaction must be active when this routine is called.
- Note that there is no function form of the [WRITE_DATA Procedure](#) because the SMTP server does not respond until the data-terminator is sent during the call to [CLOSE_DATA Function and Procedure](#).

UTL_TCP

With the `UTL_TCP` package and its procedures and functions, PL/SQL applications can communicate with external TCP/IP-based servers using TCP/IP. Because many Internet application protocols are based on TCP/IP, this package is useful to PL/SQL applications that use Internet protocols and e-mail.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Types](#)
- [Exceptions](#)
- [Rules and Limits](#)
- [Examples](#)
- [Summary of UTL_TCP Subprograms](#)

293.1 UTL_TCP Overview

The `UTL_TCP` package provides TCP/IP client-side access functionality in PL/SQL.

293.2 UTL_TCP Security Model

This package is an invoker's rights package and the invoking user needs the connect privilege granted in the access control list assigned to the remote network host to which he wants to connect.

**Note:**

For more information about managing fine-grained access, see *Oracle Database Security Guide*

293.3 UTL_TCP Types

The `UTL_TCP` package includes a `CONNECTION` type and a carriage-return line-feed (CRLF) type.

CONNECTION Type

This is a PL/SQL record type used to represent a TCP/IP connection.

Syntax

```

TYPE connection IS RECORD (
    remote_host    VARCHAR2(255),
    remote_port    PLS_INTEGER,
    local_host     VARCHAR2(255),
    local_port     PLS_INTEGER,
    charset        VARCHAR2(30),
    newline        VARCHAR2(2),
    tx_timeout     PLS_INTEGER,
    private_sd     PLS_INTEGER);

```

Fields

Table 293-1 Connection Record Type Fields

Field	Description
remote_host	Name of the remote host when connection is established. NULL when no connection is established.
remote_port	Port number of the remote host connected. NULL when no connection is established.
local_host	Name of the local host used to establish the connection. NULL when no connection is established.
local_port	Port number of the local host used to establish the connection. NULL when no connection is established.
charset	The on-the-wire character set. Since text messages in the database may be encoded in a character set that is different from the one expected on the wire (that is, the character set specified by the communication protocol, or the one stipulated by the other end of the communication), text messages in the database are converted to and from the on-the-wire character set as they are sent and received on the network.
newline	Newline character sequence. This newline character sequence is appended to the text line sent by <code>WRITE_LINE</code> API.
tx_timeout	Time in seconds that the UTL_TCP package waits before giving up in a read or write operation in this connection. In read operations, this package gives up if no data is available for reading immediately. In write operations, this package gives up if the output buffer is full and no data is to be sent in the network without being blocked. Zero (0) indicates not to wait at all. NULL indicates to wait forever.

Usage Notes

The fields in a connection record are used to return information about the connection, which is often made using `OPEN_CONNECTION`. Changing the values of those fields has no effect on the connection. The fields `private_XXXX` are for implementation use only. You should not modify the values.

In the current release of the UTL_TCP package, the parameters `local_host` and `local_port` are ignored when `open_connection` makes a TCP/IP connection. It does not attempt to use the specified local host and port number when the connection is made. The `local_host` and `local_port` fields are not set in the connection record returned by the function.

Time out on write operations is not supported in the current release of the UTL_TCP package.

CRLF

The character sequence carriage-return line-feed. It is the newline sequence commonly used by many communication standards.

Syntax

```
CRLF CONSTANT VARCHAR2(2 CHAR);
```

Usage Notes

This package variable defines the newline character sequence commonly used in many Internet protocols. This is the default value of the newline character sequence for `WRITE_LINE`, specified when a connection is opened. While such protocols use `<CR><LF>` to denote a new line, some implementations may choose to use just line-feed to denote a new line. In such cases, users can specify a different newline character sequence when a connection is opened.

293.4 UTL_TCP Exceptions

UTL_TCP will raise an exception when it encounters a processing issue.

The exceptions raised by the TCP/IP package are listed in the following table.

Table 293-2 TCP/IP Exceptions

Exception	Description
BUFFER_TOO_SMALL	Buffer is too small for input that requires look-ahead
END_OF_INPUT	Raised when no more data is available to read from the connection
NETWORK_ERROR	Generic network error
BAD_ARGUMENT	Bad argument passed in an API call (for example, a negative buffer size)
TRANSFER_TIMEOUT	No data is read and a read time out occurred
PARTIAL_MULTIBYTE_CHAR	No complete character is read and a partial multibyte character is found at the end of the input

293.5 UTL_TCP Rules and Limits

The interface provided in the package only allows connections to be initiated by the PL/SQL program. It does not allow the PL/SQL program to accept connections initiated outside the program.

293.6 UTL_TCP Examples

Some possible uses for `UTL_TCP` include retrieving a Web page over HTTP or sending an e-mail.

The following code example illustrates how the TCP/IP package can be used to retrieve a Web page over HTTP. It connects to a Web server listening at port 80 (standard port for HTTP) and requests the root document.

```
DECLARE
  c      utl_tcp.connection;  -- TCP/IP connection to the Web server
  ret_val pls_integer;
BEGIN
  c := utl_tcp.open_connection(remote_host => 'www.acme.com',
                              remote_port => 80,
                              charset    => 'US7ASCII');  -- open connection
  ret_val := utl_tcp.write_line(c, 'GET / HTTP/1.0');  -- send HTTP request
  ret_val := utl_tcp.write_line(c);
  BEGIN
    LOOP
      dbms_output.put_line(utl_tcp.get_line(c, TRUE));  -- read result
    END LOOP;
  EXCEPTION
    WHEN utl_tcp.end_of_input THEN
      NULL;  -- end of input
  END;
  utl_tcp.close_connection(c);
END;
```

The following code example illustrates how the TCP/IP package can be used by an application to send e-mail (also known as email from PL/SQL). The application connects to an SMTP server at port 25 and sends a simple text message.

```
PROCEDURE send_mail (sender      IN VARCHAR2,
                    recipient IN VARCHAR2,
                    message   IN VARCHAR2) IS
  mailhost  VARCHAR2(30) := 'mailhost.mydomain.com';
  smtp_error EXCEPTION;
  mail_conn utl_tcp.connection;
  PROCEDURE smtp_command(command IN VARCHAR2,
                          ok      IN VARCHAR2 DEFAULT '250')
  IS
    response varchar2(3);
    len pls_integer;
  BEGIN
    len := utl_tcp.write_line(mail_conn, command);
    response := substr(utl_tcp.get_line(mail_conn), 1, 3);
    IF (response <> ok) THEN
      RAISE smtp_error;
    END IF;
  END;
END;

BEGIN
  mail_conn := utl_tcp.open_connection(remote_host => mailhost,
                                      remote_port => 25,
                                      charset    => 'US7ASCII');
  smtp_command('HELO ' || mailhost);
  smtp_command('MAIL FROM: ' || sender);
  smtp_command('RCPT TO: ' || recipient);
```

```

smtp_command('DATA', '354');
smtp_command(message);
smtp_command('QUIT', '221');
utl_tcp.close_connection(mail_conn);
EXCEPTION
  WHEN OTHERS THEN
    -- Handle the error
END;
```

293.7 Summary of UTL_TCP Subprograms

This table lists the UTL_TCP subprograms and briefly describes them.

Table 293-3 UTL_TCP Package Subprograms

Subprogram	Description
AVAILABLE Function	Determines the number of bytes available for reading from a TCP/IP connection
CLOSE_ALL_CONNECTIONS Procedure	Closes all open TCP/IP connections
CLOSE_CONNECTION Procedure	Closes an open TCP/IP connection
FLUSH Procedure	Transmits immediately to the server all data in the output buffer, if a buffer is used
GET_LINE Function	Returns the line of data read
GET_LINE_NCHAR Function	Returns the line of data read in NCHAR form
GET_RAW Function	Return the data read instead of the amount of data read
GET_TEXT Function	Returns the text data read
GET_TEXT_NCHAR Function	Returns the text data read in NCHAR form
OPEN_CONNECTION Function	Opens a TCP/IP connection to a specified service
READ_LINE Function	Receives a text line from a service on an open connection
READ_RAW Function	Receives binary data from a service on an open connection
READ_TEXT Function	Receives text data from a service on an open connection
SECURE_CONNECTION Procedure	Secures a TCP/IP connection using SSL/TLS
WRITE_LINE Function	Transmits a text line to a service on an open connection
WRITE_RAW Function	Transmits a binary message to a service on an open connection
WRITE_TEXT Function	Transmits a text message to a service on an open connection

293.7.1 AVAILABLE Function

This function determines the number of bytes available for reading from a TCP/IP connection. It is the number of bytes that can be read immediately without blocking. Determines if data is ready to be read from the connection.

Syntax

```

UTL_TCP.AVAILABLE (
  c          IN OUT NOCOPY connection,
```

```

    timeout IN PLS_INTEGER DEFAULT 0)
RETURN PLS_INTEGER;

```

Parameters

Table 293-4 AVAILABLE Function Parameters

Parameter	Description
c	TCP connection to determine the amount of data that is available to be read
timeout	Time in seconds to wait before giving up and reporting that no data is available. Zero (0) indicates not to wait at all. NULL indicates to wait forever.

Return Values

The number of bytes available for reading without blocking

Usage Notes

The connection must have already been opened through a call to `OPEN_CONNECTION`. Users may use this API to determine if data is available to be read before calling the read API so that the program are not blocked because data is not ready to be read from the input.

The number of bytes available for reading returned by this function may be less than what is actually available. On some platforms, this function may only return 1, to indicate that some data is available. If you are concerned about the portability of your application, then assume that this function returns a positive value when data is available for reading, and 0 when no data is available. This function returns a positive value when all the data at a particular connection has been read and the next read result in the `END_OF_INPUT` exception.

The following example illustrates using this function in a portable manner:

```

DECLARE
    c    utl_tcp.connection
    data VARCHAR2(256);
    len  PLS_INTEGER;
BEGIN
    c := utl_tcp.open_connection(...);
    LOOP
        IF (utl_tcp.available(c) > 0) THEN
            len := utl_tcp.read_text(c, data, 256);
        ELSE
            ---do some other things
            . . . .
        END IF
    END LOOP;
END;

```


293.7.2 CLOSE_ALL_CONNECTIONS Procedure

This procedure closes all open TCP/IP connections.

Syntax

```
UTL_TCP.CLOSE_ALL_CONNECTIONS;
```

Usage Notes

This call is provided to close all connections before a PL/SQL program ends to avoid dangling connections.

293.7.3 CLOSE_CONNECTION Procedure

This procedure closes an open TCP/IP connection.

Syntax

```
UTL_TCP.CLOSE_CONNECTION (  
    c IN OUT NOCOPY connection);
```

Parameters

Table 293-5 CLOSE_CONNECTION Procedure Parameters

Parameter	Description
c	TCP connection to close

Usage Notes

Connection must have been opened by a previous call to `OPEN_CONNECTION`. The fields `remote_host`, `remote_port`, `local_host`, `local_port` and `charset` of `c` are reset after the connection is closed.

An open connection must be closed explicitly. An open connection remains open when the PL/SQL record variable that stores the connection goes out-of-scope in the PL/SQL program. Failing to close unwanted connections may result in unnecessary tying up of local and remote system resources.

293.7.4 FLUSH Procedure

This procedure transfers immediately to the server all data in the output buffer, if a buffer is used.

Syntax

```
UTL_TCP.FLUSH (  
    c IN OUT NOCOPY connection);
```

Parameters

Table 293-6 FLUSH Procedure Parameters

Parameter	Description
c	TCP connection to which to send data

Usage Notes

The connection must have already been opened through a call to `OPEN_CONNECTION`.

293.7.5 GET_LINE Function

This function returns the line of data read.

Syntax

```
UTL_TCP.GET_LINE (
  c          IN OUT NOCOPY connection,
  remove_crlf IN          BOOLEAN DEFAULT FALSE,
  peek      IN          BOOLEAN DEFAULT FALSE)
RETURN VARCHAR2;
```

Parameters

Table 293-7 GET_LINE Function Parameters

Parameter	Description
c	TCP connection from which to receive data
remove_crlf	If <code>TRUE</code> , then one or more trailing CRLF characters are removed from the received message.
peek	Normally, you want to read the data and remove it from the input queue, that is, consume it. In some situations, you may just want to look ahead at the data, that is, peek at it, without removing it from the input queue, so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to <code>TRUE</code> and set up an input buffer before the connection is opened. The amount of data you can peek at (that is, read but keep in the input queue) must be less than the size of input buffer.

Return Values

The text line read

Usage Notes

- The connection must have already been opened through a call to `OPEN_CONNECTION`.
- See `READ_LINE` for the read time out, character set conversion, buffer size, and multibyte character issues.

293.7.6 GET_LINE_NCHAR Function

This function returns the line of data read in NCHAR form.

Syntax

```
UTL_TCP.GET_LINE_NCHAR (
  c          IN OUT NOCOPY connection,
  remove_crlf IN          BOOLEAN DEFAULT FALSE,
  peek       IN          BOOLEAN DEFAULT FALSE)
RETURN NVARCHAR2;
```

Parameters

Table 293-8 GET_LINE_NCHAR Function Parameters

Parameter	Description
c	TCP connection from which to receive data
remove_crlf	If TRUE, then one or more trailing CRLF characters are removed from the received message.
peek	Normally, you want to read the data and remove it from the input queue, that is, consume it. In some situations, you may just want to look ahead at the data, that is, peek at it, without removing it from the input queue, so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to TRUE and set up an input buffer before the connection is opened. The amount of data you can peek at (that is, read but keep in the input queue) must be less than the size of input buffer.

Return Values

The text line read

Usage Notes

- The connection must have already been opened through a call to `OPEN_CONNECTION`.
- See `READ_LINE` for the read time out, character set conversion, buffer size, and multibyte character issues.

293.7.7 GET_RAW Function

This function returns the data read instead of the amount of data read.

Syntax

```
UTL_TCP.GET_RAW (
  c          IN OUT NOCOPY connection,
  len       IN          PLS_INTEGER DEFAULT 1,
  peek      IN          BOOLEAN     DEFAULT FALSE)
RETURN RAW;
```

Parameters

Table 293-9 GET_RAW Function Parameters

Parameter	Description
c	TCP connection from which to receive data
len	The number of bytes (or characters for VARCHAR2) of data to receive. Default is 1.
peek	Normally, you want to read the data and remove it from the input queue, that is, consume it. In some situations, you may just want to look ahead at the data, that is, peek at it, without removing it from the input queue, so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to TRUE and set up an input buffer before the connection is opened. The amount of data you can peek at (that is, read but keep in the input queue) must be less than the size of input buffer.
remove_crlf	If TRUE, then one or more trailing CRLF characters are removed from the received message.

Return Values

The binary data read

Usage Notes

The connection must have already been opened through a call to OPEN_CONNECTION.

For all the get_* APIs described in this section, see the corresponding READ_* API for the read time out issue. For GET_TEXT and GET_LINE, see the corresponding READ_* API for character set conversion, buffer size, and multibyte character issues.

293.7.8 GET_TEXT Function

This function returns the text data read.

Syntax

```
UTL_TCP.GET_TEXT (
  c      IN OUT NOCOPY connection,
  len   IN          PLS_INTEGER DEFAULT 1,
  peek  IN          BOOLEAN     DEFAULT FALSE)
RETURN VARCHAR2;
```

Parameters

Table 293-10 GET_TEXT Function Parameters

Parameter	Description
c	TCP connection from which to receive data
len	Number of bytes (or characters for VARCHAR2) of data to receive. Default is 1.

Table 293-10 (Cont.) GET_TEXT Function Parameters

Parameter	Description
peek	Normally, you want to read the data and remove it from the input queue, that is, consume it. In some situations, you may just want to look ahead at the data, that is, peek at it, without removing it from the input queue, so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to <code>TRUE</code> and set up an input buffer before the connection is opened. The amount of data you can peek at (that is, read but keep in the input queue) must be less than the size of input buffer.
remove_crlf	If <code>TRUE</code> , then one ore more trailing CRLF characters are removed from the received message.

Return Values

The text data read

Usage Notes

The connection must have already been opened through a call to `OPEN_CONNECTION`.

For all the `get_*` APIs described in this section, see the corresponding `read_*` API for the read time out issue. For `GET_TEXT` and `GET_LINE`, see the corresponding `READ_*` API for character set conversion, buffer size, and multibyte character issues.

293.7.9 GET_TEXT_NCHAR Function

This function returns the text data read in NCHAR form.

Syntax

```
UTL_TCP.GET_TEXT_NCHAR (
    c    IN OUT NOCOPY connection,
    len  IN          PLS_INTEGER DEFAULT 1,
    peek IN          BOOLEAN      DEFAULT FALSE)
RETURN NVARCHAR2;
```

Parameters

Table 293-11 GET_TEXT_NCHAR Function Parameters

Parameter	Description
c	TCP connection from which to receive data
len	The number of bytes (or characters for <code>VARCHAR2</code>) of data to receive. Default is 1.

Table 293-11 (Cont.) GET_TEXT_NCHAR Function Parameters

Parameter	Description
peek	Normally, you want to read the data and remove it from the input queue, that is, consume it. In some situations, you may just want to look ahead at the data, that is, peek at it, without removing it from the input queue, so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to <code>TRUE</code> and set up an input buffer before the connection is opened. The amount of data you can peek at (that is, read but keep in the input queue) must be less than the size of input buffer.
remove_crlf	If <code>TRUE</code> , then one or more trailing CRLF characters are removed from the received message.

Return Values

The text data read

Usage Notes

The connection must have already been opened through a call to `OPEN_CONNECTION`.

For all the `get_*` APIs described in this section, see the corresponding `read_*` API for the read time out issue. For `GET_TEXT` and `GET_LINE`, see the corresponding `READ_*` API for character set conversion, buffer size, and multibyte character issues.

293.7.10 OPEN_CONNECTION Function

This function opens a TCP/IP connection to a specified service.

Syntax

```
UTL_TCP.OPEN_CONNECTION (
    remote_host      IN VARCHAR2,
    remote_port      IN PLS_INTEGER,
    local_host       IN VARCHAR2 DEFAULT NULL,
    local_port       IN PLS_INTEGER DEFAULT NULL,
    in_buffer_size   IN PLS_INTEGER DEFAULT NULL,
    out_buffer_size  IN PLS_INTEGER DEFAULT NULL,
    charset          IN VARCHAR2 DEFAULT NULL,
    newline          IN VARCHAR2 DEFAULT CRLF,
    tx_timeout       IN PLS_INTEGER DEFAULT NULL,
    wallet_path      IN VARCHAR2 DEFAULT NULL,
    wallet_password  IN VARCHAR2 DEFAULT NULL,
    RETURN connection;
```

Parameters

Table 293-12 OPEN_CONNECTION Function Parameters

Parameter	Description
remote_host	Name of the host providing the service. When <code>remote_host</code> is <code>NULL</code> , it connects to the local host.

Table 293-12 (Cont.) OPEN_CONNECTION Function Parameters

Parameter	Description
<code>remote_port</code>	Port number on which the service is listening for connections
<code>local_host</code>	Name of the host providing the service. <code>NULL</code> means does not care.
<code>local_port</code>	Port number on which the service is listening for connections. <code>NULL</code> means don't care.
<code>in_buffer_size</code>	The size of input buffer. The use of an input buffer can speed up execution performance in receiving data from the server. The appropriate size of the buffer depends on the flow of data between the client and the server, and the traffic/latency on the network. A zero value means no buffer should be used. A <code>NULL</code> value means the caller does not care if a buffer is used or not. The maximum size of the input buffer is 32767 bytes.
<code>out_buffer_size</code>	The size of output buffer. The use of an output buffer can speed up execution performance in sending data to the server. The appropriate size of buffer depends on the flow of data between the client and the server, and the network condition. A zero value means no buffer should be used. A <code>NULL</code> value means the caller does not care if a buffer is used or not. The maximum size of the output buffer is 32767 bytes.
<code>charset</code>	The on-the-wire character set. Since text messages in the database may be encoded in a character set that is different from the one expected on the wire (that is, the character set specified by the communication protocol, or the one stipulated by the other end of the communication), text messages in the database are converted to and from the on-the-wire character set as they are sent and received on the network using <code>READ_TEXT</code> , <code>READ_LINE</code> , <code>WRITE_TEXT</code> and <code>WRITE_LINE</code> . Set this parameter to <code>NULL</code> when no conversion is needed.
<code>newline</code>	Newline character sequence. This newline character sequence is appended to the text line sent by <code>WRITE_LINE</code> API.
<code>tx_timeout</code>	Time in seconds that the <code>UTL_TCP</code> package should wait before giving up in a read or write operations in this connection. In read operations, this package gives up if no data is available for reading immediately. In write operations, this package gives up if the output buffer is full and no data is to be sent in the network without being blocked. Zero (0) indicates not to wait at all. <code>NULL</code> indicates to wait forever.
<code>wallet_path</code>	Directory path that contains the Oracle wallet for SSL/TLS. The format is <code>file:directory-path</code> . If you want to use the operating system certificate store to act in place of the Oracle wallet, then set the <code>path</code> parameter to <code>system:</code> (include the colon). Doing so greatly improves performance in the database.
<code>wallet_password</code>	Password to open the wallet. When the wallet is auto-login enabled, the password may be set to <code>NULL</code> . If you set <code>path</code> to <code>system:</code> , then omit the password by setting it to <code>NULL</code> .

Return Values

A connection to the targeted TCP/IP service

Usage Notes

- Note that connections opened by this UTL_TCP package can remain open and be passed from one database call to another in a shared server configuration. However, the connection must be closed explicitly. The connection remains open when the PL/SQL record variable that stores the connection goes out-of-scope in the PL/SQL program. Failing to close unwanted connections may result in unnecessary tying up of local and remote system resources.
- In the current release of the UTL_TCP package, the parameters `local_host` and `local_port` are ignored when `open_connection` makes a TCP/IP connection. It does not attempt to use the specified local host and port number when the connection is made. The `local_host` and `local_port` fields is not set in the connection record returned by the function.
- `tx_timeout` is intended to govern both the read operations and the write operations. However, an implementation restriction prevents `tx_timeout` from governing write operations in the current release.

Examples

```
DECLARE
  c UTL_TCP.CONNECTION;
BEGIN
  c := UTL_TCP.OPEN_CONNECTION (
    host      => 'www.example.com',
    port      => 443,
    wallet_path => 'file:/oracle/wallets/smtp_wallet',
    wallet_password => '****');
  UTL_TCP.SECURE_CONNECTION (c => c);
END;
```

293.7.11 READ_LINE Function

This function receives a text line from a service on an open connection.

A line is terminated by a line-feed, a carriage-return or a carriage-return followed by a line-feed.

Syntax

```
UTL_TCP.READ_LINE (
  c          IN OUT NOCOPY connection,
  data      IN OUT NOCOPY VARCHAR2 CHARACTER SET ANY_CS,
  peek      IN          BOOLEAN DEFAULT FALSE)
RETURN PLS_INTEGER;
```


Parameters

Table 293-13 READ_LINE Function Parameters

Parameter	Description
c	TCP connection from which to receive data
data	Data received.
remove_crlf	If TRUE, then one or more trailing CRLF characters are removed from the received message.
peek	Normally, you want to read the data and remove it from the input queue, that is, consume it. In some situations, you may just want to look ahead at the data, that is, peek at it, without removing it from the input queue, so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to TRUE and set up an input buffer before the connection is opened. The amount of data you can peek at (that is, read but keep in the input queue) must be less than the size of input buffer.

Return Values

The number of characters of data received

Usage Notes

The connection must have already been opened through a call to `OPEN_CONNECTION`. This function does not return until the end-of-line have been reached, or the end of input has been reached. Text messages is converted from the on-the-wire character set, specified when the connection was opened, to the database character set before they are returned to the caller.

If transfer time out is set when the connection is opened, then this function waits for each data packet to be ready to read until time out occurs. If it occurs, then this function stops reading and returns all the data read successfully. If no data is read successfully, then the `transfer_timeout` exception is raised. The exception can be handled and the read operation can be retried later.

If a partial multibyte character is found at the end of input, then this function stops reading and returns all the complete multibyte characters read successfully. If no complete character is read successfully, then the `partial_multibyte_char` exception is raised. The exception can be handled and the bytes of that partial multibyte character can be read as binary by the `READ_RAW` function. If a partial multibyte character is seen in the middle of the input because the remaining bytes of the character have not arrived and read time out occurs, then the `transfer_timeout` exception is raised instead. The exception can be handled and the read operation can be retried later.

293.7.12 READ_RAW Function

This function receives binary data from a service on an open connection.

Syntax

```
UTL_TCP.READ_RAW (
  c      IN OUT NOCOPY connection,
  data   IN OUT NOCOPY RAW,
  len    IN          PLS_INTEGER DEFAULT 1,
```

```

    peek IN          BOOLEAN          DEFAULT FALSE)
RETURN PLS_INTEGER;

```

Parameters

Table 293-14 READ_RAW Function Parameters

Parameter	Description
c	TCP connection from which to receive data
data (IN OUT COPY)	Data received
len	Number of bytes of data to receive
peek	Normally, you want to read the data and remove it from the input queue, that is, consume it. In some situations, you may just want to look ahead at the data, that is, peek at it, without removing it from the input queue, so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to <code>TRUE</code> and set up an input buffer before the connection is opened. The amount of data you can peek at (that is, read but keep in the input queue) must be less than the size of input buffer.

Return Values

The number of bytes of data received

Usage Notes

The connection must have already been opened through a call to `OPEN_CONNECTION`. This function does not return until the specified number of bytes have been read, or the end of input has been reached.

If transfer time out is set when the connection is opened, then this function waits for each data packet to be ready to read until time out occurs. If it occurs, then this function stops reading and returns all the data read successfully. If no data is read successfully, then the `transfer_timeout` exception is raised. The exception can be handled and the read operation can be retried later.

293.7.13 READ_TEXT Function

This function receives text data from a service on an open connection.

Syntax

```

UTL_TCP.READ_TEXT (
    c      IN OUT NOCOPY connection,
    data  IN OUT NOCOPY VARCHAR2 CHARACTER SET ANY_CS,
    len   IN          PLS_INTEGER DEFAULT 1,
    peek  IN          BOOLEAN      DEFAULT FALSE)
RETURN PLS_INTEGER;

```

Parameters

Table 293-15 READ_TEXT Function Parameters

Parameter	Description
<code>c</code>	TCP connection from which to receive data
<code>data</code>	Data received
<code>len</code>	Number of characters of data to receive
<code>peek</code>	Normally, users want to read the data and remove it from the input queue, that is, consume it. In some situations, users may just want to look ahead at the data without removing it from the input queue so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to <code>TRUE</code> and an input buffer must be set up when the connection is opened. The amount of data that you can peek at (that is, read but keep in the input queue) must be less than the size of input buffer.

Return Values

The number of characters of data received

Usage Notes

The connection must have already been opened through a call to `OPEN_CONNECTION`. This function does not return until the specified number of characters has been read, or the end of input has been reached. Text messages is converted from the on-the-wire character set, specified when the connection was opened, to the database character set before they are returned to the caller.

Unless explicitly overridden, the size of a `VARCHAR2` buffer is specified in terms of bytes, while the parameter `len` refers to the maximum number of characters to be read. When the database character set is multibyte, where a single character may consist of more than 1 byte, you should ensure that the buffer can hold the maximum of characters. In general, the size of the `VARCHAR2` buffer should equal the number of characters to be read, multiplied by the maximum number of bytes of a character of the database character set.

If transfer time out is set when the connection is opened, then this function waits for each data packet to be ready to read until time out occurs. If it occurs, then this function stops reading and returns all the data read successfully. If no data is read successfully, then the `transfer_timeout` exception is raised. The exception can be handled and the read operation can be retried later.

If a partial multibyte character is found at the end of input, then this function stops reading and returns all the complete multibyte characters read successfully. If no complete character is read successfully, then the `partial_multibyte_char` exception is raised. The exception can be handled and the bytes of that partial multibyte character can be read as binary by the `READ_RAW` function. If a partial multibyte character is seen in the middle of the input because the remaining bytes of the character have not arrived and read time out occurs, then the `transfer_timeout` exception is raised instead. The exception can be handled and the read operation can be retried later.

293.7.14 SECURE_CONNECTION Procedure

This procedure secures a TCP/IP connection using SSL/TLS.

SSL/TLS requires an Oracle wallet which must be specified when the connection was opened by the [OPEN_CONNECTION Function](#).

Syntax

```
UTL_TCP.SECURE_CONNECTION (  
    c    IN OUT NOCOPY connection);
```

Parameters

Table 293-16 SECURE_CONNECTION Procedure Parameters

Parameter	Description
c	TCP connection from which to receive data

293.7.15 WRITE_LINE Function

This function transmits a text line to a service on an open connection. The `newline` character sequence is appended to the message before it is transmitted.

Syntax

```
UTL_TCP.WRITE_LINE (  
    c    IN OUT NOCOPY connection,  
    data IN          VARCHAR2 DEFAULT NULL CHARACTER SET ANY_CS)  
RETURN PLS_INTEGER;
```

Parameters

Table 293-17 WRITE_LINE Function Parameters

Parameter	Description
c	TCP connection to which to send data
data	Buffer containing the data to be sent

Return Values

The actual number of characters of data transmitted

Usage Notes

The connection must have already been opened through a call to `OPEN_CONNECTION`. Text messages are converted to the on-the-wire character set, specified when the connection was opened, before they are transmitted on the wire.

293.7.16 WRITE_RAW Function

This function transmits a binary message to a service on an open connection. The function does not return until the specified number of bytes have been written.

Syntax

```
UTL_TCP.WRITE_RAW (  
    c      IN OUT NOCOPY connection,  
    data  IN          RAW,  
    len   IN          PLS_INTEGER DEFAULT NULL)  
RETURN PLS_INTEGER;
```

Parameters

Table 293-18 WRITE_RAW Function Parameters

Parameter	Description
c	TCP connection to which to send data
data	Buffer containing the data to be sent
len	The number of bytes of data to transmit. When len is NULL, the whole length of data is written.

Return Values

The number of bytes of data transmitted

Usage Notes

The connection must have already been opened through a call to `OPEN_CONNECTION`.

293.7.17 WRITE_TEXT Function

This function transmits a text message to a service on an open connection.

Syntax

```
UTL_TCP.WRITE_TEXT (  
    c      IN OUT NOCOPY connection,  
    data  IN          VARCHAR2 CHARACTER SET ANY_CS,  
    len   IN          PLS_INTEGER DEFAULT NULL)  
RETURN num_chars PLS_INTEGER;
```

Parameters

Table 293-19 WRITE_TEXT Function Parameters

Parameter	Description
c	TCP connection to which to send data
data	Buffer containing the data to be sent

Table 293-19 (Cont.) WRITE_TEXT Function Parameters

Parameter	Description
<code>len</code>	The number of characters of data to transmit. When <code>len</code> is <code>NULL</code> , the whole length of data is written. The actual amount of data written may be less because of network condition.

Return Values

The actual number of characters of data transmitted

Usage Notes

The connection must have already been opened through a call to `OPEN_CONNECTION`. Text messages are converted to the on-the-wire character set, specified when the connection was opened, before they are transmitted on the wire.

UTL_URL

The `UTL_URL` package has two functions: `ESCAPE` and `UNESCAPE`.

This chapter contains the following topics:

- [Overview](#)
- [Exceptions](#)
- [Examples](#)
- [Summary of UTL_URL Subprograms](#)



See Also:

[UTL_HTTP](#)

294.1 UTL_URL Overview

A Uniform Resource Locator (URL) is a string that identifies a Web resource, such as a page or a picture. Use a URL to access such resources by way of the HyperText Transfer Protocol (HTTP).

For example, the URL for Oracle's Web site is:

```
http://www.oracle.com
```

Normally, a URL contains English alphabetic characters, digits, and punctuation symbols. These characters are known as the *unreserved characters*. Any other characters in URLs, including multibyte characters or binary octet codes, must be escaped to be accurately processed by Web browsers or Web servers. Some punctuation characters, such as dollar sign (\$), question mark (?), colon (:), and equals sign (=), are reserved as delimiters in a URL. They are known as the *reserved characters*. To literally process these characters, instead of treating them as delimiters, they must be escaped.

The unreserved characters are:

- A through Z, a through z, and 0 through 9
- Hyphen (-), underscore (_), period (.), exclamation point (!), tilde (~), asterisk (*), accent ('), left parenthesis ((), right parenthesis ())

The reserved characters are:

- Semi-colon (;) slash (/), question mark (?), colon (:), at sign (@), ampersand (&), equals sign (=), plus sign (+), dollar sign (\$), percentage sign (%), and comma (,)

The `UTL_URL` package has two functions that provide escape and unescape mechanisms for URL characters. Use the escape function to escape a URL before the URL is used fetch a

Web page by way of the UTL_HTTP package. Use the unescape function to unescape an escaped URL before information is extracted from the URL.

For more information, refer to the Request For Comments (RFC) document RFC2396. Note that this URL escape and unescape mechanism is different from the x-www-form-urlencoded encoding mechanism described in the HTML specification:

`http://www.w3.org/TR/html`

294.2 UTL_URL Exceptions

UTL_URL raises an exception when it encounter a processing issue.

The following table lists the exceptions that can be raised when the UTL_URL package API is invoked.

Table 294-1 UTL_URL Exceptions

Exception	Error Code	Reason
BAD_URL	29262	The URL contains badly formed escape code sequences
BAD_FIXED_WIDT H_CHARSET	29274	Fixed-width multibyte character set is not allowed as a URL character set.

294.3 UTL_URL Examples

UTL_URL can be used for encoding and decoding.

You can implement the x-www-form-urlencoded encoding using the UTL_URL.ESCAPE function as follows:

```
CREATE OR REPLACE FUNCTION form_url_encode (
    data    IN VARCHAR2,
    charset IN VARCHAR2) RETURN VARCHAR2 AS
BEGIN
    RETURN utl_url.escape(data, TRUE, charset); -- note use of TRUE
END;
```

For decoding data encoded with the form-URL-encode scheme, the following function implements the decoding scheme:

```
CREATE OR REPLACE FUNCTION form_url_decode (
    data    IN VARCHAR2,
    charset IN VARCHAR2) RETURN VARCHAR2 AS
BEGIN
    RETURN utl_url.unescape(
        replace(data, '+', ' '),
        charset);
END;
```

294.4 Summary of UTL_URL Subprograms

This table lists and briefly describes the UTL_URL subprograms.

Table 294-2 UTL_URL Package Subprograms

Subprogram	Description
ESCAPE Function	Returns a URL with illegal characters (and optionally reserved characters) escaped using the %2-digit-hex-code format
UNESCAPE Function	Unescapes the escape character sequences to their original forms in a URL. Convert the %XX escape character sequences to the original characters

294.4.1 ESCAPE Function

This function returns a URL with illegal characters (and optionally reserved characters) escaped using the %2-digit-hex-code format.

Syntax

```
UTL_URL.ESCAPE (
    url                IN VARCHAR2 CHARACTER SET ANY_CS,
    escape_reserved_chars IN BOOLEAN DEFAULT FALSE,
    url_charset        IN VARCHAR2 DEFAULT utl_http.body_charset)
RETURN VARCHAR2;
```

Parameters

Table 294-3 ESCAPE Function Parameters

Parameter	Description
<code>url</code>	The original URL
<code>escape_reserved_chars</code>	Indicates whether the URL reserved characters should be escaped. If set to <code>TRUE</code> , both the reserved and illegal URL characters are escaped. Otherwise, only the illegal URL characters are escaped. The default value is <code>FALSE</code> .
<code>url_charset</code>	When escaping a character (single-byte or multibyte), determine the target character set that character should be converted to before the character is escaped in %hex-code format. If <code>url_charset</code> is <code>NULL</code> , the database charset is assumed and no character set conversion will occur. The default value is the current default body character set of the <code>UTL_HTTP</code> package, whose default value is <code>ISO-8859-1</code> . The character set can be named in Internet Assigned Numbers Authority (IANA) or in the Oracle naming convention.

Usage Notes

Use this function to escape URLs that contain illegal characters as defined in the URL specification RFC 2396. The legal characters in URLs are:

- A through Z, a through z, and 0 through 9
- Hyphen (-), underscore (_), period (.), exclamation point (!), tilde (~), asterisk (*), accent ('), left parenthesis ((), right parenthesis ())

The reserved characters consist of:

- Semi-colon (;) slash (/), question mark (?), colon (:), at sign (@), ampersand (&), equals sign (=), plus sign (+), dollar sign (\$), and comma (,)

Many of the reserved characters are used as delimiters in the URL. You should escape characters beyond those listed here by using `escape_url`. Also, to use the reserved characters in the name-value pairs of the query string of a URL, those characters must be escaped separately. An `escape_url` cannot recognize the need to escape those characters because once inside a URL, those characters become indistinguishable from the actual delimiters. For example, to pass a name-value pair `$logon=HR/<password>` into the query string of a URL, escape the `$` and `/` separately as `%24logon=HR%2F<password>` and use it in the URL.

Normally, you will escape the entire URL, which contains the reserved characters (delimiters) that should not be escaped. For example:

```
utl_url.escape('http://www.acme.com/a url with space.html')
```

Returns:

```
http://www.acme.com/a%20url%20with%20space.html
```

In other situations, you may want to send a query string with a value that contains reserved characters. In that case, escape only the value fully (with `escape_reserved_chars` set to `TRUE`) and then concatenate it with the rest of the URL. For example:

```
url := 'http://www.acme.com/search?check=' || utl_url.escape
('Is the use of the "$" sign okay?', TRUE);
```

This expression escapes the question mark (?), dollar sign (\$), and space characters in 'Is the use of the "\$" sign okay?' but not the ? after search in the URL that denotes the use of a query string.

The Web server that you intend to fetch Web pages from may use a character set that is different from that of your database. In that case, specify the `url_charset` as the Web server character set so that the characters that need to be escaped are escaped in the target character set. For example, a user of an EBCDIC database who wants to access an ASCII Web server should escape the URL using `US7ASCII` so that a space is escaped as `%20` (hex code of a space in ASCII) instead of `%40` (hex code of a space in EBCDIC).

This function does not validate a URL for the proper URL format.

294.4.2 UNESCAPE Function

This function unescapes the escape character sequences to its original form in a URL, to convert the `%XX` escape character sequences to the original characters.

Syntax

```
UTL_URL.UNESCAPE (
    url          IN VARCHAR2 CHARACTER SET ANY_CS,
    url_charset  IN VARCHAR2 DEFAULT utl_http.body_charset)
RETURN VARCHAR2;
```

Parameters

Table 294-4 UNESCAPE Function Parameters

Parameter	Description
<code>url</code>	The URL to unescape
<code>url_charset</code>	After a character is unescaped, the character is assumed to be in the <code>source_charset</code> character set and it will be converted from the <code>source_charset</code> to the database character set before the URL is returned. If <code>source_charset</code> is NULL, the database charset is assumed and no character set conversion occurred. The default value is the current default body character set of the <code>UTL_HTTP</code> package, whose default value is "ISO-8859-1". The character set can be named in Internet Assigned Numbers Authority (IANA) or Oracle naming convention.

Usage Notes

The Web server that you receive the URL from may use a character set that is different from that of your database. In that case, specify the `url_charset` as the Web server character set so that the characters that need to be unescaped are unescaped in the source character set. For example, a user of an EBCDIC database who receives a URL from an ASCII Web server should unescape the URL using `US7ASCII` so that `%20` is unescaped as a space (0x20 is the hex code of a space in ASCII) instead of a `?` (because 0x20 is not a valid character in EBCDIC).

This function does not validate a URL for the proper URL format.

WPG_DOCLOAD

The `WPG_DOCLOAD` package provides an interface to download files, BLOBs and BFILES.

See Also:

For more information about implementation of this package:

- [Oracle Fusion Middleware Administrator's Guide for Oracle HTTP Server](#)
- [Oracle Fusion Middleware User's Guide for mod_plsql](#)

The chapter contains the following topics:

- [Constants](#)
- [Summary of WPG_DOCLOAD Subprograms](#)

295.1 WPG_DOCLOAD Constants

`WPG_DOCLOAD` defines several constants to use when specifying parameter values.

The `WPG_DOCLOAD` constants are listed below:

- `NAME_COL_LEN`
- `MIMET_COL_LEN`
- `MAX_DOCTABLE_NAME_LEN`

NAME_COL_LEN

The `NAME` column in your document table must be the same as the value of `name_col_len`.

```
name_col_len CONSTANT pls_integer := 64;
```

MIMET_COL_LEN

The `MIME_TYPE` column in your document table must be the same as the value of `mimet_col_len`.

```
mimet_col_len CONSTANT pls_integer := 48;
```

MAX_DOCTABLE_NAME_LEN

The name length of your document table must be less than `max_doctable_name_len`.

```
max_doctable_name_len CONSTANT pls_integer := 256;
```

295.2 Summary of WPG_DOCLOAD Subprograms

The WPG_DOCLOAD package uses one subprogram, the `DOWNLOAD_FILE` procedure.

Table 295-1 WPG_DOCLOAD Package Subprograms

Subprogram	Description
DOWNLOAD_FILE Procedures	Downloads files, BLOBS and BFILES

295.2.1 DOWNLOAD_FILE Procedures

There are three versions of this download file procedure.

- The first version downloads files and is invoked from within a document download procedure to signal the PL/SQL Gateway that `p_filename` is to be downloaded from the document table to the client's browser.
- The second version can be called from within any procedure to signal the PL/SQL Gateway that `p_blob` is to be downloaded to the client's browser.
- The third version can be called from within any procedure to signal the PL/SQL Gateway that `p_bfile` is to be downloaded to the client's browser.

Syntax

```
WPG_DOCLOAD.DOWNLOAD_FILE (
    p_filename      IN          VARCHAR2,
    p_bcaching      IN          BOOLEAN DEFAULT TRUE);
```

```
WPG_DOCLOAD.DOWNLOAD_FILE (
    p_blob          IN OUT NOCOPY BLOB);
```

```
WPG_DOCLOAD.DOWNLOAD_FILE (
    p_bfile         IN OUT      BFILE);
```

Parameters

Table 295-2 DOWNLOAD_FILE Procedure Parameters

Parameter	Description
<code>p_filename</code>	The file to download from the document table.
<code>p_blob</code>	The BLOB to download.
<code>p_bfile</code>	The BFILE to download (see Usage Notes).
<code>p_bcaching</code>	Whether browser caching is enabled (see Usage Notes).

Usage Notes

- Normally, a document will be downloaded to the browser unless the browser sends an 'If-Modified-Since' header to the gateway indicating that it has the requested document in its cache. In that case, the gateway will determine if the browser's cached copy is up to date, and if it is, it will send an HTTP 304 status

message to the browser indicating that the browser should display the cached copy. However, because a document URL and a document do not necessarily have a one-to-one relationship in the PL/SQL Web Gateway, in some cases it may be undesirable to have the cached copy of a document displayed. In those cases, the `p_bcaching` parameter should be set to `FALSE` to indicate to the gateway to ignore the 'If-Modified-Since' header, and download the document.

- `p_bfile` and `p_blob` are declared as `IN OUT` because the locator is initially opened to check for file accessibility and existence. The open operation can only be performed if the locator is writable and readable.

ANYDATA TYPE

An `ANYDATA` TYPE contains an instance of a given type, plus a description of the type. In this sense, an `ANYDATA` is self-describing. An `ANYDATA` can be persistently stored in the database.

This chapter contains the following topics:

- [Restrictions](#)
- [Operational Notes](#)
- [Summary of ANYDATA Subprograms](#)

296.1 ANYDATA TYPE Restrictions

Persistent storage of `ANYDATA` instances whose type contains embedded LOBs other than `BFILES` is not currently supported.

296.2 ANYDATA TYPE Operational Notes

This section contains notes related to `ANYDATA` TYPE construction and access.

Construction

There are 2 ways to construct an `ANYDATA`. The `CONVERT*` calls enable construction of the `ANYDATA` in its entirety with a single call. They serve as explicit `CAST` functions from any type in the Oracle ORDBMS to `ANYDATA`.

```

STATIC FUNCTION ConvertBDouble(dbl IN BINARY_DOUBLE) return ANYDATA,
STATIC FUNCTION ConvertBfile(b IN BFILE) RETURN ANYDATA,
STATIC FUNCTION ConvertBFloat(fl IN BINARY_FLOAT) return ANYDATA,
STATIC FUNCTION ConvertBlob(b IN BLOB) RETURN ANYDATA,
STATIC FUNCTION ConvertChar(c IN CHAR) RETURN ANYDATA,
STATIC FUNCTION ConvertClob(c IN CLOB) RETURN ANYDATA,
STATIC FUNCTION ConvertCollection(col IN "collection_type") RETURN ANYDATA,
STATIC FUNCTION ConvertDate(dat IN DATE) RETURN ANYDATA,
STATIC FUNCTION ConvertIntervalDS(inv IN INTERVAL DAY TO SECOND) return ANYDATA,
STATIC FUNCTION ConvertIntervalYM(inv IN INTERVAL YEAR TO MONTH) return ANYDATA,
STATIC FUNCTION ConvertNchar(nc IN NCHAR) return ANYDATA,
STATIC FUNCTION ConvertNClob(nc IN NCLOB) return ANYDATA,
STATIC FUNCTION ConvertNumber(num IN NUMBER) RETURN ANYDATA,
STATIC FUNCTION ConvertNVarchar2(nc IN NVARCHAR2) return ANYDATA,
STATIC FUNCTION ConvertObject(obj IN "<object_type>") RETURN ANYDATA,
STATIC FUNCTION ConvertRaw(r IN RAW) RETURN ANYDATA,
STATIC FUNCTION ConvertRef(rf IN REF "<object_type>") RETURN ANYDATA,
STATIC FUNCTION ConvertTimestamp(ts IN TIMESTAMP) return ANYDATA,
STATIC FUNCTION ConvertTimestampTZ(ts IN TIMESTAMP WITH TIMEZONE) return ANYDATA,
STATIC FUNCTION ConvertTimestampLTZ(ts IN TIMESTAMP WITH LOCAL TIMEZONE) return
ANYDATA,
STATIC FUNCTION ConvertURowid(rid IN UROWID) return ANYDATA,
STATIC FUNCTION ConvertVarchar(c IN VARCHAR) RETURN ANYDATA,
STATIC FUNCTION ConvertVarchar2(c IN VARCHAR2) RETURN ANYDATA,

```

The second way to construct an ANYDATA is a piece by piece approach. The [BEGINCREATE Static Procedure](#) call begins the construction process and [ENDCREATE Member Procedure](#) call finishes the construction process. In between these two calls, the individual attributes of an object type or the elements of a collection can be set using SET* calls. For piece by piece access of the attributes of objects and elements of collections, the [PIECEWISE Member Procedure](#) should be invoked prior to GET* calls.

Note: The ANYDATA has to be constructed or accessed sequentially starting from its first attribute (or collection element). The BEGINCREATE call automatically begins the construction in a piece-wise mode. There is no need to call PIECEWISE immediately after BEGINCREATE. ENDCREATE should be called to finish the construction process (before which any access calls can be made).

Access

Access functions are available based on SQL. These functions do not throw exceptions on type-mismatch. Instead, they return NULL if the type of the ANYDATA does not correspond to the type of access. If you wish to use only ANYDATA functions of the appropriate types returned in a query, you should use a WHERE clause which uses GETTYPENAME and choose the type you are interested in (say "SYS.NUMBER"). Each of these functions returns the value of a specified datatype inside a SYS.ANYDATA wrapper.

```
MEMBER FUNCTION AccessBDouble(self IN ANYDATA) return BINARY_DOUBLE
    DETERMINISTIC,
MEMBER FUNCTION AccessBfile(self IN ANYDATA) return BFILE,
MEMBER FUNCTION AccessBFloat(self IN ANYDATA) return BINARY_FLOAT
    DETERMINISTIC,
MEMBER FUNCTION AccessBlob(self IN ANYDATA) return BLOB,
MEMBER FUNCTION AccessChar(self IN ANYDATA) return CHAR,
MEMBER FUNCTION AccessClob(self IN ANYDATA) return CLOB,
MEMBER FUNCTION AccessDate(self IN ANYDATA) return DATE,
MEMBER FUNCTION AccessIntervalYM(self IN ANYDATA) return INTERVAL YEAR TO MONTH,
MEMBER FUNCTION AccessIntervalDS(self IN ANYDATA) return INTERVAL DAY TO SECOND,
MEMBER FUNCTION AccessNchar(self IN ANYDATA) return NCHAR,
MEMBER FUNCTION AccessNClob(self IN ANYDATA) return NCLOB
MEMBER FUNCTION AccessNumber(self IN ANYDATA) return NUMBER,
MEMBER FUNCTION AccessNvarchar2(self IN ANYDATA) return NVARCHAR2,
MEMBER FUNCTION AccessRaw(self IN ANYDATA) return RAW,
MEMBER FUNCTION AccessTimestamp(self IN ANYDATA) return TIMESTAMP,
MEMBER FUNCTION AccessTimestampLTZ(self IN ANYDATA) return TIMESTAMP WITH LOCAL
    TIMEZONE,
MEMBER FUNCTION AccessTimestampTZ(self IN ANYDATA) return TIMESTAMP WITH
    TIMEZONE,
MEMBER FUNCTION AccessUrowid(self IN ANYDATA) return UROWID DETERMINISTIC
MEMBER FUNCTION AccessVarchar(self IN ANYDATA) return VARCHAR,
MEMBER FUNCTION AccessVarchar2(self IN ANYDATA) return VARCHAR2,
```

296.3 Summary of ANYDATA Subprograms

This table lists the ANYDATA subprograms in alphabetical order and briefly describes them.

Table 296-1 ANYDATA Type Subprograms

Subprogram	Description
BEGINCREATE Static Procedure	Begins creation process on a new ANYDATA
ENDCREATE Member Procedure	Ends creation of an ANYDATA
GET* Member Functions	Gets the current data value (which should be of appropriate type)
GETTYPE Member Function	Gets the Type of the ANYDATA
GETTYPENAME Member Function	Get the fully qualified type name for the ANYDATA
PIECEWISE Member Procedure	Sets the <code>MODE</code> of access of the current data value to be an attribute at a time (if the data value is of <code>TYPECODE_OBJECT</code>)
SET* Member Procedures	Sets the current data value.

296.3.1 BEGINCREATE Static Procedure

This procedure begins the creation process on a new ANYDATA.

Syntax

```
STATIC PROCEDURE BeginCreate(
    dtype          IN OUT NOCOPY AnyType,
    adata         OUT NOCOPY ANYDATA);
```

Parameters

Table 296-2 BEGINCREATE Procedure Parameters

Parameter	Description
<code>dtype</code>	The type of the ANYDATA. (Should correspond to <code>OCI_TYPECODE_OBJECT</code> or a Collection typecode.)
<code>adata</code>	ANYDATA being constructed.

Exception

`DBMS_TYPES.INVALID_PARAMETERS`: `dtype` is invalid (not fully constructed, and similar deficits.)

Usage Notes

There is no need to call `PIECEWISE` immediately after this call. The construction process begins in a piece-wise manner automatically.

296.3.2 ENDCREATE Member Procedure

This procedure ends creation of an ANYDATA. Other creation functions cannot be called after this call.

Syntax

```
MEMBER PROCEDURE EndCreate(
    self          IN OUT NOCOPY ANYDATA);
```

Parameters

Table 296-3 ENDCREATE Procedure Parameter

Parameter	Description
self	An ANYDATA.

296.3.3 GET* Member Functions

These functions get the current data value (which should be of appropriate type).

The type of the current data value depends on the MODE by which it is accessed (depending on whether the PIECEWISE call is invoked).

If PIECEWISE has NOT been called, the ANYDATA is accessed in its entirety and the type of the data value should match the type of the ANYDATA.

If PIECEWISE has been called, the ANYDATA is accessed piece-wise. The type of the data value should match the type of the attribute (or collection element) at the current position.

Syntax

```
MEMBER FUNCTION GetBDouble(
    self          IN ANYDATA,
    dbl           OUT NOCOPY BINARY_DOUBLE)
RETURN PLS_INTEGER;
```

```
MEMBER FUNCTION GetBfile(
    self          IN ANYDATA,
    b             OUT NOCOPY BFILE)
RETURN          PLS_INTEGER;
```

```
MEMBER FUNCTION GetBFloat(
    self          IN ANYDATA,
    fl           OUT NOCOPY BINARY_FLOAT)
RETURN PLS_INTEGER;
```

```
MEMBER FUNCTION GetBlob(
    self          IN ANYDATA,
    b             OUT NOCOPY BLOB)
RETURN          PLS_INTEGER;
```

```
MEMBER FUNCTION GetChar(
    self          IN ANYDATA,
    c             OUT NOCOPY CHAR)
```

```
        RETURN          PLS_INTEGER;

MEMBER FUNCTION GetClob(
    self          IN ANYDATA,
    c             OUT NOCOPY CLOB)
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetCollection(
    self          IN ANYDATA,
    col          OUT NOCOPY "<collection_type>")
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetDate(
    self          IN ANYDATA,
    dat          OUT NOCOPY DATE)
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetIntervalDS(
    self          IN ANYDATA,
    inv          OUT NOCOPY INTERVAL DAY TO SECOND)
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetIntervalYM(
    self          IN ANYDATA,
    inv          OUT NOCOPY INTERVAL YEAR TO MONTH)
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetNchar(
    self          IN ANYDATA,
    nc           OUT NOCOPY NCHAR)
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetNClob(
    self          IN ANYDATA,
    nc           OUT NOCOPY NCLOB)
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetNumber(
    self          IN ANYDATA,
    num          OUT NOCOPY NUMBER)
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetNVarchar2(
    self          IN ANYDATA,
    nc           OUT NOCOPY NVARCHAR2)
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetObject(
    self          IN ANYDATA,
    obj          OUT NOCOPY "<object_type>")
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetRaw(
    self          IN ANYDATA,
    r            OUT NOCOPY RAW)
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetRef(
    self          IN ANYDATA,
    rf           OUT NOCOPY REF "<object_type>")
RETURN          PLS_INTEGER;
```

```

MEMBER FUNCTION GetTimestamp(
    self          IN ANYDATA,
    ts            OUT NOCOPY TIMESTAMP)
RETURN PLS_INTEGER;

MEMBER FUNCTION GetTimestampTZ(
    self          IN ANYDATA,
    ts            OUT NOCOPY TIMESTAMP WITH TIME ZONE)
RETURN PLS_INTEGER;

MEMBER FUNCTION GetTimestampLTZ(
    self          IN ANYDATA,
    ts            OUT NOCOPY TIMESTAMP WITH LOCAL TIME ZONE)
RETURN PLS_INTEGER;

MEMBER FUNCTION GetVarchar(
    self          IN ANYDATA,
    c             OUT NOCOPY VARCHAR)
RETURN          PLS_INTEGER;

MEMBER FUNCTION GetVarchar2(
    self          IN ANYDATA,
    c             OUT NOCOPY VARCHAR2)
RETURN          PLS_INTEGER;

```

Parameters

Table 296-4 GET* Function Parameter

Parameter	Description
self	An ANYDATA.
num	The number to be obtained.

Return Values

DBMS_TYPES.SUCCESS or DBMS_TYPES.NO_DATA

The return value is relevant only if `PIECEWISE` has been already called (for a collection). In such a case, `DBMS_TYPES.NO_DATA` signifies the end of the collection when all elements have been accessed.

Exceptions

DBMS_TYPES.TYPE_MISMATCH: When the expected type is different from the passed in type.

DBMS_TYPES.INVALID_PARAMETERS: Invalid Parameters (if it is not appropriate to add a number at this point in the creation process).

DBMS_TYPES.INCORRECT_USAGE: Incorrect usage.

296.3.4 GETTYPE Member Function

This function gets the typecode of the ANYDATA.

Syntax

```
MEMBER FUNCTION GETTYPE (  
    self          IN ANYDATA,  
    typ           OUT NOCOPY AnyType)  
    RETURN        PLS_INTEGER;
```

Parameters

Table 296-5 GETTYPE Function Parameter

Parameter	Description
self	An ANYDATA.
typ	The AnyType corresponding to the ANYDATA. May be NULL if it does not represent a user-defined type.

Return Values

The typecode corresponding to the type of the ANYDATA.

296.3.5 GETTYPENAME Member Function

This function gets the fully qualified type name for the ANYDATA.

If the ANYDATA is based on a built-in type, this function will return NUMBER and other relevant information.

If it is based on a user defined type, this function will return *schema_name.type_name*, for example, SCOTT.FOO.

If it is based on a transient anonymous type, this function will return NULL.

Syntax

```
MEMBER FUNCTION GETTYPENAME (  
    self          IN ANYDATA)  
    RETURN        VARCHAR2;
```

Parameters

Table 296-6 GETTYPENAME Function Parameter

Parameter	Description
self	An ANYDATA.

Return Values

Type name of the ANYDATA.

296.3.6 PIECEWISE Member Procedure

This procedure sets the **MODE** of access of the current data value to be an attribute at a time (if the data value is of `TYPECODE_OBJECT`).

It sets the **MODE** of access of the data value to be a collection element at a time (if the data value is of collection type). Once this call has been made, subsequent calls to `SET*` and `GET*` will sequentially obtain individual attributes or collection elements.

Syntax

```
MEMBER PROCEDURE PIECEWISE (
    self          IN OUT NOCOPY ANYDATA);
```

Parameters

Table 296-7 PIECEWISE Procedure Parameters

Parameter	Description
self	The current data value.

Exceptions

- `DBMS_TYPES.INVALID_PARAMETERS`
- `DBMS_TYPES.INCORRECT_USAGE`: On incorrect usage.

Usage Notes

The current data value must be of an `OBJECT` or `COLLECTION` type before this call can be made.

Piece-wise construction and access of nested attributes that are of object or collection types is not supported.

296.3.7 SET* Member Procedures

This procedure sets the current data value.

This is a list of procedures that should be called depending on the type of the current data value. The type of the data value should be the type of the attribute at the current position during the piece-wise construction process.

Syntax

```
MEMBER PROCEDURE SETBDOUBLE (
    self          IN OUT NOCOPY ANYDATA,
    dbl           IN BINARY_DOUBLE,
    last_elem     IN boolean DEFAULT FALSE);
```

```
MEMBER PROCEDURE SETBFILE (
    self          IN OUT NOCOPY ANYDATA,
    b             IN BFILE,
    last_elem     IN boolean DEFAULT FALSE);
```

```
MEMBER PROCEDURE SETBFLOAT (
```

```
self          IN OUT NOCOPY ANYDATA,  
fl            IN              BINARY_FLOAT,  
last_elem    IN              boolean DEFAULT FALSE);  
  
MEMBER PROCEDURE SETBLOB(  
self          IN OUT NOCOPY ANYDATA,  
b             IN BLOB,  
last_elem    IN boolean DEFAULT FALSE);  
  
MEMBER PROCEDURE SETCHAR(  
self          IN OUT NOCOPY ANYDATA,  
c             IN CHAR,  
last_elem    IN boolean DEFAULT FALSE);  
  
MEMBER PROCEDURE SETCLOB(  
self          IN OUT NOCOPY ANYDATA,  
c             IN CLOB,  
last_elem    IN boolean DEFAULT FALSE);  
  
MEMBER PROCEDURE SETCOLLECTION(  
self          IN OUT NOCOPY ANYDATA,  
col           IN "<collection_type>",  
last_elem    IN boolean DEFAULT FALSE);  
  
MEMBER PROCEDURE SETDATE(  
self          IN OUT NOCOPY ANYDATA,  
dat           IN DATE,  
last_elem    IN boolean DEFAULT FALSE);  
  
MEMBER PROCEDURE SETINTERVALS(  
self          IN OUT NOCOPY ANYDATA,  
inv           IN INTERVAL DAY TO SECOND,  
last_elem    IN boolean DEFAULT FALSE);  
  
MEMBER PROCEDURE SETINTERVALYM(  
self          IN OUT NOCOPY ANYDATA,  
inv           IN INTERVAL YEAR TO MONTH,  
last_elem    IN boolean DEFAULT FALSE);  
  
MEMBER PROCEDURE SETNCHAR(  
self          IN OUT NOCOPY ANYDATA,  
nc            IN NCHAR,  
last_elem    IN boolean DEFAULT FALSE);  
  
MEMBER PROCEDURE SETNCLOB(  
self          IN OUT NOCOPY ANYDATA,  
nc            IN NClob,  
last_elem    IN boolean DEFAULT FALSE);  
  
MEMBER PROCEDURE SETNUMBER(  
self          IN OUT NOCOPY ANYDATA,  
num           IN NUMBER,  
last_elem    IN boolean DEFAULT FALSE);  
  
MEMBER PROCEDURE SETNVARCHAR2(  
self          IN OUT NOCOPY ANYDATA,  
nc            IN NVarchar2,  
last_elem    IN boolean DEFAULT FALSE),  
  
MEMBER PROCEDURE SETOBJECT(  
self          IN OUT NOCOPY ANYDATA,
```

```

obj          IN "<object_type>",
last_elem   IN boolean DEFAULT FALSE);

MEMBER PROCEDURE SETRAW(
  self       IN OUT NOCOPY ANYDATA,
  r          IN RAW,
  last_elem  IN boolean DEFAULT FALSE);

MEMBER PROCEDURE SETREF(
  self       IN OUT NOCOPY ANYDATA,
  rf         IN REF "<object_type>",
  last_elem  IN boolean DEFAULT FALSE);

MEMBER PROCEDURE SETTIMESTAMP(
  self       IN OUT NOCOPY ANYDATA,
  ts         IN TIMESTAMP,
  last_elem  IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETTIMESTAMPtz(self IN OUT NOCOPY ANYDATA,
  ts         IN TIMESTAMP WITH TIME ZONE,
  last_elem  IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETTIMESTAMPtz(
  self IN OUT NOCOPY ANYDATA,
  ts IN TIMESTAMP WITH LOCAL TIME ZONE,
  last_elem IN boolean DEFAULT FALSE),

MEMBER PROCEDURE SETVARCHAR(
  self       IN OUT NOCOPY ANYDATA,
  c          IN VARCHAR,
  last_elem  IN boolean DEFAULT FALSE);

MEMBER PROCEDURE SETVARCHAR2(
  self       IN OUT NOCOPY ANYDATA,
  c          IN VARCHAR2,
  last_elem  IN boolean DEFAULT FALSE);

```

Parameters

Table 296-8 SET* Procedure Parameters

Parameter	Description
self	An ANYDATA.
num	The number, and associated information, that is to be set.
last_elem	Relevant only if ANYDATA represents a collection. Set to TRUE if it is the last element of the collection, FALSE otherwise.

Exceptions

- DBMS_TYPES.INVALID_PARAMETERS: Invalid Parameters (if it is not appropriate to add a number at this point in the creation process).
- DBMS_TYPES.INCORRECT_USAGE: Incorrect usage.
- DBMS_TYPES.TYPE_MISMATCH: When the expected type is different from the passed in type.

Usage Notes

When `BEGINCREATE` is called, construction has already begun in a piece-wise fashion. Subsequent calls to `SET*` will set the successive attribute values.

If the `ANYDATA` is a standalone collection, the `SET*` call will set the successive collection elements.

ANYDATASET TYPE

An `ANYDATASET TYPE` contains a description of a given type plus a set of data instances of that type. An `ANYDATASET` can be persistently stored in the database if desired, or it can be used as interface parameters to communicate self-descriptive sets of data, all of which belong to a certain type.

This chapter contains the following topics:

- [Construction](#)
- [Summary of ANYDATASET TYPE Subprograms](#)

297.1 ANYDATASET TYPE Construction

The `ANYDATASET` needs to be constructed value by value, sequentially.

For each data instance (of the type of the `ANYDATASET`), the `ADDINSTANCE` function must be invoked. This adds a new data instance to the `ANYDATASET`. Subsequently, `SET*` can be called to set each value in its entirety.

The `MODE` of construction/access can be changed to attribute/collection element wise by making calls to `PIECEWISE`.

- If the type of the `ANYDATASET` is `TYPECODE_OBJECT`, individual attributes will be set with subsequent `SET*` calls. Likewise on access.
- If the type of the current data value is a collection type individual collection elements will be set with subsequent `SET*` calls. Likewise on access. This call is very similar to `ANYDATA.PIECEWISE` call defined for the type `ANYDATA`.

Note that there is no support for piece-wise construction and access of nested (not top level) attributes that are of object types or collection types.

`ENDCREATE` should be called to finish the construction process (before which no access calls can be made).

297.2 Summary of ANYDATASET TYPE Subprograms

This table lists the `ANYDATASET` Type subprograms and briefly describes them.

Table 297-1 *ANYDATASET Type Subprograms*

Subprogram	Description
ADDINSTANCE Member Procedure	Adds a new data instance to an <code>ANYDATASET</code> .
BEGINCREATE Static Procedure	Creates a new <code>ANYDATASET</code> which can be used to create a set of data values of the given <code>ANYTYPE</code> .

Table 297-1 (Cont.) ANYDATASET Type Subprograms

Subprogram	Description
ENDCREATE Member Procedure	Ends Creation of a ANYDATASET. Other creation functions cannot be called after this call.
GET* Member Functions	Gets the current data value (which should be of appropriate type).
GETCOUNT Member Function	Gets the number of data instances in an ANYDATASET.
GETINSTANCE Member Function	Gets the next instance in an ANYDATASET.
GETTYPE Member Function	Gets the ANYTYPE describing the type of the data instances in an ANYDATASET. current data value (which should be of appropriate type).
GETTYPENAME Member Function	Gets the AnyType describing the type of the data instances in an ANYDATASET.
PIECEWISE Member Procedure	Sets the MODE of construction, access of the data value to be an attribute at a time (if the data value is of TYPECODE_OBJECT).
SET* Member Procedures	Sets the current data value.

297.2.1 ADDINSTANCE Member Procedure

This procedure adds a new data instance to an ANYDATASET.

Syntax

```
MEMBER PROCEDURE AddInstance(  
    self          IN OUT NOCOPY ANYDATASET);
```

Parameters

Table 297-2 ADDINSTANCE Procedure Parameter

Parameter	Description
self	The ANYDATASET being constructed.

Exceptions

DBMS_TYPES.invalid_parameters: Invalid parameters.
DBMS_TYPES.incorrect_usage: On incorrect usage.

Usage Notes

The data instances have to be added sequentially. The previous data instance must be fully constructed (or set to NULL) before a new one can be added.

This call DOES NOT automatically set the mode of construction to be piece-wise. The user has to explicitly call `PIECEWISE` if a piece-wise construction of the instance is intended.

297.2.2 BEGINCREATE Static Procedure

This procedure creates a new ANYDATASET which can be used to create a set of data values of the given ANYTYPE.

Syntax

```
STATIC PROCEDURE BeginCreate(
    typecode    IN PLS_INTEGER,
    rtype       IN OUT NOCOPY AnyType,
    aset        OUT NOCOPY ANYDATASET);
```

Parameters

Table 297-3 BEGINCREATE Procedure Parameter

Parameter	Description
typecode	The typecode for the type of the ANYDATASET.
dtype	The type of the data values. This parameter is a must for user-defined types like TYPECODE_OBJECT, Collection typecodes, and similar others.
aset	The ANYDATASET being constructed.

Exceptions

DBMS_TYPES.invalid_parameters: dtype is invalid (not fully constructed, and like errors.)

297.2.3 ENDCREATE Member Procedure

This procedure ends creation of a ANYDATASET. Other creation functions cannot be called after this call.

Syntax

```
MEMBER PROCEDURE ENDCREATE(
    self        IN OUT NOCOPY ANYDATASET);
```

Parameters

Table 297-4 ENDCREATE Procedure Parameter

Parameter	Description
self	The ANYDATASET being constructed.

297.2.4 GET* Member Functions

These functions get the current data value (which should be of the appropriate type).

The type of the current data value depends on the MODE used for accessing it (depending on how the PIECEWISE call is invoked). If PIECEWISE has not been called, the instance is

accessed in its entirety, and the type of the data value should match the type of the ANYDATASET.

If `PIECEWISE` has been called, the instance is accessed piece-wise. The type of the data value should match the type of the attribute (or collection element) at the current position.

Syntax

```
MEMBER FUNCTION GETBDOUBLE(  
    self          IN ANYDATASET,  
    dbl          OUT NOCOPY BINARY_DOUBLE)  
    RETURN PLS_INTEGER;
```

```
MEMBER FUNCTION GETBFLOAT(  
    self          IN ANYDATASET,  
    fl           OUT NOCOPY BINARY_FLOAT)  
    RETURN PLS_INTEGER;
```

```
MEMBER FUNCTION GETBFILE(  
    self          IN ANYDATASET,  
    b            OUT NOCOPY BFILE)  
    RETURN       PLS_INTEGER;
```

```
MEMBER FUNCTION GETBLOB(  
    self          IN ANYDATASET,  
    b            OUT NOCOPY BLOB)  
    RETURN       PLS_INTEGER;
```

```
MEMBER FUNCTION GETCHAR(  
    self          IN ANYDATASET,  
    c            OUT NOCOPY CHAR)  
    RETURN       PLS_INTEGER;
```

```
MEMBER FUNCTION GETCLOB(  
    self          IN ANYDATASET,  
    c            OUT NOCOPY CLOB)  
    RETURN       PLS_INTEGER;
```

```
MEMBER FUNCTION GETCOLLECTION(  
    self          IN ANYDATASET,  
    col          OUT NOCOPY "<collection_type>")  
    RETURN       PLS_INTEGER;
```

```
MEMBER FUNCTION GETDATE(  
    self          IN ANYDATASET,  
    dat          OUT NOCOPY DATE)  
    RETURN       PLS_INTEGER;
```

```
MEMBER FUNCTION GETINTERVALDS(  
    self          IN ANYDATASET,  
    inv          IN OUT NOCOPY INTERVAL DAY TO SECOND)  
    RETURN PLS_INTEGER;
```

```
MEMBER FUNCTION GETINTERVALYM(  
    self          IN ANYDATASET,  
    inv IN OUT NOCOPY INTERVAL YEAR TO MONTH)  
    RETURN PLS_INTEGER;
```

```
MEMBER FUNCTION GETNCHAR(  
    self          IN ANYDATASET,
```

```
nc          OUT NOCOPY NCHAR)
RETURN PLS_INTEGER;

MEMBER FUNCTION GETNCLOB(
  self      IN ANYDATASET,
  nc        OUT NOCOPY NCLOB)
RETURN PLS_INTEGER;

MEMBER FUNCTION GETNUMBER(
  self      IN ANYDATASET,
  num       OUT NOCOPY NUMBER)
RETURN     PLS_INTEGER;

MEMBER FUNCTION GETNVARCHAR2(
  self      IN ANYDATASET,
  nc        OUT NOCOPY NVARCHAR2)
RETURN PLS_INTEGER;

MEMBER FUNCTION GETOBJECT(
  self      IN ANYDATASET,
  obj       OUT NOCOPY "<object_type>")
RETURN     PLS_INTEGER;

MEMBER FUNCTION GETRAW(
  self      IN ANYDATASET,
  r         OUT NOCOPY RAW)
RETURN     PLS_INTEGER;

MEMBER FUNCTION GETREF(
  self      IN ANYDATASET,
  rf        OUT NOCOPY REF "<object_type>")
RETURN     PLS_INTEGER;

MEMBER FUNCTION GETTIMESTAMP(
  self      IN ANYDATASET,
  RETURN PLS_INTEGER;

MEMBER FUNCTION GETTIMESTAMPPLTZ(
  self      IN ANYDATASET,
  ts        OUT NOCOPY TIMESTAMP WITH LOCAL TIME ZONE)
RETURN PLS_INTEGER;

MEMBER FUNCTION GETTIMESTAMPPTZ(
  self      IN ANYDATASET,
  ts        OUT NOCOPY TIMESTAMP WITH TIME ZONE)
RETURN PLS_INTEGER;

MEMBER FUNCTION GETUROWID(
  self      IN ANYDATASET,
  rid       OUT NOCOPY UROWID)
RETURN PLS_INTEGER;

MEMBER FUNCTION GETVARIABLE(
  self      IN ANYDATASET,
  c         OUT NOCOPY VARCHAR)
RETURN     PLS_INTEGER;

MEMBER FUNCTION GETVARIABLE2(
  self      IN ANYDATASET,
  c         OUT NOCOPY VARCHAR2)
RETURN     PLS_INTEGER;
```

Parameters

Table 297-5 GET* Function Parameters

Parameter	Description
self	The ANYDATASET being accessed.
num	The number, and associated information., that is to be obtained.

Return Values

DBMS_TYPES.SUCCESS or DBMS_TYPES.NO_DATA

The return value is relevant only if `PIECEWISE` has been already called (for a collection). In such a case, `DBMS_TYPES.NO_DATA` signifies the end of the collection when all elements have been accessed.

Exceptions

DBMS_TYPES.INVALID_PARAMETERS: Invalid Parameters (if it is not appropriate to add a number at this point in the creation process).

DBMS_TYPES.INCORRECT_USAGE: Incorrect usage

DBMS_TYPES.TYPE_MISMATCH: When the expected type is different from the passed in type.

297.2.5 GETCOUNT Member Function

This function gets the number of data instances in an ANYDATASET.

Syntax

```
MEMBER FUNCTION GetCount(
    self          IN ANYDATASET)
RETURN          PLS_INTEGER;
```

Parameter

Table 297-6 GETCOUNT Function Parameter

Parameter	Description
self	The ANYDATASET being accessed.

Return Values

The number of data instances.

297.2.6 GETINSTANCE Member Function

This function gets the next instance in an `ANYDATASET`. Only sequential access to the instances in an `ANYDATASET` is allowed.

After this function has been called, the `GET*` functions can be invoked on the `ANYDATASET` to access the current instance. If `PIECEWISE` is called before doing the `GET*` calls, the individual attributes (or collection elements) can be accessed.

It is an error to invoke this function before the `ANYDATASET` is fully created.

Syntax

```
MEMBER FUNCTION GETINSTANCE (
    self          IN OUT NOCOPY ANYDATASET)
RETURN          PLS_INTEGER;
```

Parameters

Table 297-7 GETINSTANCE Function Parameter

Parameter	Description
<code>self</code>	The <code>ANYDATASET</code> being accessed.

Return Values

`DBMS_TYPES.SUCCESS` or `DBMS_TYPES.NO_DATA`

`DBMS_TYPES.NO_DATA` signifies the end of the `ANYDATASET` (all instances have been accessed).

Usage Notes

This function should be called even before accessing the first instance.

297.2.7 GETTYPE Member Function

This function gets the `AnyType` describing the type of the data instances in an `ANYDATASET`.

Syntax

```
MEMBER FUNCTION GETTYPE (
    self          IN ANYDATASET,
    typ           OUT NOCOPY AnyType)
RETURN          PLS_INTEGER;
```

Parameters

Table 297-8 GETTYPE Function Parameter

Parameter	Description
<code>self</code>	The <code>ANYDATASET</code> .
<code>typ</code>	The <code>ANYTYPE</code> corresponding to the <code>AnyData</code> . May be <code>NULL</code> if it does not represent a user-defined function.

Return Values

The typecode corresponding to the type of the `ANYDATA`.

297.2.8 GETTYPENAME Member Function

This procedure gets the fully qualified type name for the `ANYDATASET`.

If the `ANYDATASET` is based on a built-in, this function will return `NUMBER` and associated information.

If it is based on a user defined type, this function will return `schema_name.type_name`. for example, `SCOTT.FOO`.

If it is based on a transient anonymous type, this function will return `NULL`.

Syntax

```
MEMBER FUNCTION GETTYPENAME (
    self          IN ANYDATASET)
RETURN          VARCHAR2;
```

Parameter

Table 297-9 GETTYPENAME Function Parameter

Parameter	Description
<code>self</code>	The <code>ANYDATASET</code> being constructed.

Return Values

Type name of the `ANYDATASET`.

297.2.9 PIECEWISE Member Procedure

This procedure sets the `MODE` of construction, access of the data value to be an attribute at a time (if the data value is of `TYPECODE_OBJECT`).

It sets the `MODE` of construction, access of the data value to be a collection element at a time (if the data value is of a collection `TYPE`). Once this call has been made, subsequent `SET*` and `GET*` calls will sequentially obtain individual attributes or collection elements.

Syntax

```
MEMBER PROCEDURE PIECEWISE (
    self          IN OUT NOCOPY ANYDATASET);
```

Parameters

Table 297-10 PIECEWISE Procedure Parameter

Parameter	Description
self	The ANYDATASET being constructed.

Exceptions

DBMS_TYPES.INVALID_PARAMETERS: Invalid parameters.

DBMS_TYPES.INCORRECT_USAGE: On incorrect usage.

Usage Notes

The current data value must be of an object or collection type before this call can be made. There is no support for piece-wise construction or access of embedded object type attributes or nested collections.

297.2.10 SET* Member Procedures

This procedure sets the current data value.

The type of the current data value depends on the `MODE` with which we are constructing (depending on how we have invoked the `PIECEWISE` call). The type of the current data should be the type of the `ANYDATASET` if `PIECEWISE` has NOT been called. The type should be the type of the attribute at the current position if `PIECEWISE` has been called.

Syntax

```
MEMBER PROCEDURE SETBDOUBLE(
    self          IN OUT NOCOPY ANYDATASET,
    dbl           IN BINARY_DOUBLE,
    last_elem     IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETBFLOAT(
    self          IN OUT NOCOPY ANYDATASET,
    fl            IN BINARY_FLOAT,
    last_elem     IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETBFILE(
    self          IN OUT NOCOPY ANYDATASET,
    b             IN BFILE,
    last_elem     IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETBLOB(
    self          IN OUT NOCOPY ANYDATASET,
    b             IN BLOB,
    last_elem     IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETCHAR(
    self          IN OUT NOCOPY ANYDATASET,
    c             IN CHAR,
    last_elem     IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETCLOB(
```

```

self          IN OUT NOCOPY ANYDATASET,
c             IN CLOB,
last_elem    BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETCOLLECTION(
self          IN OUT NOCOPY ANYDATASET,
col           IN "<collection_type>",
last_elem    BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETDATE(
self          IN OUT NOCOPY ANYDATASET,
dat           IN DATE,
last_elem    BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETINTERVALDS(
self          IN OUT NOCOPY ANYDATASET,
inv           IN INTERVAL DAY TO SECOND,
last_elem    IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETINTERVALYM(
self          IN OUT NOCOPY ANYDATASET,
inv           IN INTERVAL YEAR TO MONTH,
last_elem    IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETNCHAR(
self          IN OUT NOCOPY ANYDATASET,
nc           IN NCHAR,
last_elem    IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETNCLOB(
self          IN OUT NOCOPY ANYDATASET,
nc           IN NCLOB,
last_elem    IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETNUMBER(
self          IN OUT NOCOPY ANYDATASET,
num          IN NUMBER,
last_elem    BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETNVARCHAR2(
self          IN OUT NOCOPY ANYDATASET,
nc           IN NVARCHAR2,
last_elem    IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETOBJECT(
self          IN OUT NOCOPY ANYDATASET,
obj          IN "<object_type>",
last_elem    BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETRAW(
self          IN OUT NOCOPY ANYDATASET,
r            IN RAW,
last_elem    BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETREF(
self          IN OUT NOCOPY ANYDATASET,
rf           IN REF "<object_type>",
last_elem    BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETTIMESTAMP(
self          IN OUT NOCOPY ANYDATASET,

```

```

        ts                IN TIMESTAMP,
        last_elem IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETTIMESTAMPPLTZ (
    self                IN OUT NOCOPY ANYDATASET,
    ts                IN TIMESTAMP WITH LOCAL TIME ZONE,
    last_elem          IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETTIMESTAMPPTZ (
    self                IN OUT NOCOPY ANYDATASET,
    ts                IN TIMESTAMP WITH TIME ZONE,
    last_elem          IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETUROWID (
    self                IN OUT NOCOPY ANYDATASET,
    rid                IN UROWID,
    last_elem IN BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETVARIABLE (
    self                IN OUT NOCOPY ANYDATASET,
    c                IN VARCHAR,
    last_elem BOOLEAN DEFAULT FALSE);

MEMBER PROCEDURE SETVARIABLE2 (
    self                IN OUT NOCOPY ANYDATASET,
    c                IN VARCHAR2,
    last_elem BOOLEAN DEFAULT FALSE);

```

Parameters

Table 297-11 SET* Procedure Parameters

Parameter	Description
self	The ANYDATASET being accessed.
num	The number, and associated information, that is to be set.
last_elem	Relevant only if <code>PIECEWISE</code> has been already called (for a collection). Set to <code>TRUE</code> if it is the last element of the collection, <code>FALSE</code> otherwise.

Exceptions

- `DBMS_TYPES.INVALID_PARAMETERS`: Invalid parameters (if it is not appropriate to add a number at this point in the creation process).
- `DBMS_TYPES.INCORRECT_USAGE`: Incorrect usage.
- `DBMS_TYPES.TYPE_MISMATCH`: When the expected type is different from the passed in type.

ANYTYPE TYPE

An `ANYTYPE TYPE` can contain a type description of any persistent SQL type, named or unnamed, including object types and collection types. It can also be used to construct new transient type descriptions.

New persistent types can only be created using the `CREATE TYPE` statement. Only new transient types can be constructed using the `ANYTYPE` interfaces.

Starting with Oracle Database 19c, the `GETANYTYPEFROMPERSISTENT` function replaces the `GETPERSISTENT` static function.

This chapter discusses the following:

- [Summary of ANYTYPE Subprograms](#)

298.1 Summary of ANYTYPE Subprograms

This table lists the `ANYTYPE` subprograms in alphabetical order and briefly describes them.

Table 298-1 *ANYTYPE Subprograms*

Subprogram	Description
BEGINCREATE Static Procedure	Creates a new instance of <code>ANYTYPE</code> which can be used to create a transient type description.
SETINFO Member Procedure	Sets any additional information required for constructing a <code>COLLECTION</code> or builtin type.
ADDATTR Member Procedure	Adds an attribute to an <code>ANYTYPE</code> (of typecode <code>DBMS_TYPES.TYPECODE_OBJECT</code>).
ENDCREATE Member Procedure	Ends creation of a transient <code>ANYTYPE</code> . Other creation functions cannot be called after this call.
GETINFO Member Function	Gets the type information for the <code>ANYTYPE</code> .
GETATTRELEMINFO Member Function	Gets the type information for an attribute of the type (if it is of <code>TYPECODE_OBJECT</code>). Gets the type information for a collection's element type if the <i>self</i> parameter is of a collection type.
GETANYTYPEFROMPERSISTENT Function	This standalone function replaces the old static function <code>GETPERSISTENT</code> . This returns an <code>ANYTYPE</code> corresponding to a persistent type created earlier using the <code>CREATE TYPE SQL</code> statement.

298.1.1 BEGINCREATE Static Procedure

This procedure creates a new instance of ANYTYPE which can be used to create a transient type description.

Syntax

```
STATIC PROCEDURE BEGINCREATE (
    typecode      IN          PLS_INTEGER,
    atype         OUT NOCOPY ANYTYPE);
```

Parameters

Table 298-2 BEGINCREATE Procedure Parameters

Parameter	Description
typecode	Use a constant from DBMS_TYPES package. Typecodes for user-defined type: <ul style="list-style-type: none"> DBMS_TYPES.TYPECODE_OBJECT DBMS_TYPES.TYPECODE_VARRAY or DBMS_TYPES.TYPECODE_TABLE Typecodes for builtin types: <ul style="list-style-type: none"> DBMS_TYPES.TYPECODE_NUMBER, and similar types.
atype	ANYTYPE for a transient type

298.1.2 SETINFO Member Procedure

This procedure sets any additional information required for constructing a COLLECTION or builtin type.

Syntax

```
MEMBER PROCEDURE SETINFO (
    self         IN OUT NOCOPY ANYTYPE,
    prec         IN PLS_INTEGER,
    scale        IN PLS_INTEGER,
    len          IN PLS_INTEGER,
    csid         IN PLS_INTEGER,
    csfrm        IN PLS_INTEGER,
    atype        IN ANYTYPE DEFAULT NULL,
    elem_tc      IN PLS_INTEGER DEFAULT NULL,
    elem_count   IN PLS_INTEGER DEFAULT 0);
```

Parameters

Table 298-3 SETINFO Procedure Parameters

Parameter	Description
self	The transient ANYTYPE that is being constructed.
prec	Optional. Required if typecode represents a NUMBER. Give precision and scale. Ignored otherwise.

Table 298-3 (Cont.) SETINFO Procedure Parameters

Parameter	Description
scale	Optional. Required if typecode represents a NUMBER. Give precision and scale. Ignored otherwise.
len	Optional. Required if typecode represents a RAW, CHAR, VARCHAR, or VARCHAR2 type. Gives length.
csid	Required if typecode represents types requiring character information such as CHAR, VARCHAR, or VARCHAR2.
csfrm	Required if typecode represents types requiring character information such as CHAR, VARCHAR, or VARCHAR2.
atype	Optional. Required if collection element typecode is a user-defined type such as TYPECODE_OBJECT, and similar others. It is also required for a built-in type that needs user-defined type information such as TYPECODE_REF. This parameter is not needed otherwise.

The Following Parameters Are Required For Collection Types

Table 298-4 SETINFO Procedure Parameters - Collection Types

Parameter	Description
elem_tc	Must be of the collection element's typecode (from DBMS_TYPES package).
elem_count	Pass 0 for elem_count if the self represents a nested table (TYPECODE_TABLE). Otherwise pass the collection count if self represents a VARRAY.

Exceptions

- DBMS_TYPES.INVALID_PARAMETER: Invalid Parameters (typecode, typeinfo)
- DBMS_TYPES.INCORRECT_USAGE: Incorrect usage (cannot call after calling ENDCREATE, and similar actions.)

Usage Notes

It is an error to call this function on an ANYTYPE that represents a persistent user defined type.

298.1.3 ADDATTR Member Procedure

This procedure adds an attribute to an ANYTYPE (of typecode DBMS_TYPES.TYPECODE_OBJECT).

Syntax

```
MEMBER PROCEDURE ADDATTR(
  self      IN OUT NOCOPY ANYTYPE,
  aname     IN VARCHAR2,
  typecode  IN PLS_INTEGER,
  prec      IN PLS_INTEGER,
  scale     IN PLS_INTEGER,
  len       IN PLS_INTEGER,
```

```

csid          IN PLS_INTEGER,
csfrm         IN PLS_INTEGER,
attr_type     IN ANYTYPE DEFAULT NULL);

```

Parameters

Table 298-5 ADDATTR Procedure Parameters

Parameter	Description
self	The transient ANYTYPE that is being constructed. Must be of type DBMS_TYPES.TYPECODE_OBJECT.
aname	Optional. Attribute's name. Could be NULL.
typecode	Attribute's typecode. Can be built-in or user-defined typecode (from DBMS_TYPES package).
prec	Optional. Required if typecode represents a NUMBER. Give precision and scale. Ignored otherwise.
scale	Optional. Required if typecode represents a NUMBER. Give precision and scale. Ignored otherwise.
len	Optional. Required if typecode represents a RAW, CHAR, VARCHAR, or VARCHAR2 type. Give length.
csid	Optional. Required if typecode represents a type requiring character information, such as CHAR, VARCHAR, or VARCHAR2.
csfrm	Optional. Required if typecode represents a type requiring character information, such as CHAR, VARCHAR, or VARCHAR2.
attr_type	Optional. ANYTYPE corresponding to a user-defined type. This parameter is required if the attribute is a user defined type.

Exceptions

- DBMS_TYPES.INVALID_PARAMETERS: Invalid Parameters (typecode, typeinfo)
- DBMS_TYPES.INCORRECT_USAGE: Incorrect usage (cannot call after calling EndCreate, and similar actions.)

298.1.4 ENDCREATE Member Procedure

This procedure ends creation of a transient ANYTYPE. Other creation functions cannot be called after this call.

Syntax

```

MEMBER PROCEDURE ENDCREATE(
    self          IN OUT NOCOPY ANYTYPE);

```

Parameter

Table 298-6 ENDCREATE Procedure Parameter

Parameter	Description
self	The transient ANYTYPE that is being constructed.

298.1.5 GETINFO Member Function

This function gets the type information for the ANYTYPE.

Syntax

```
MEMBER FUNCTION GETINFO (
    self          IN ANYTYPE,
    prec          OUT PLS_INTEGER,
    scale        OUT PLS_INTEGER,
    len          OUT PLS_INTEGER,
    csid         OUT PLS_INTEGER,
    csfrm        OUT PLS_INTEGER,
    schema_name  OUT VARCHAR2,
    type_name    OUT VARCHAR2,
    version      OUT varchar2,
    numelems    OUT PLS_INTEGER)
RETURN         PLS_INTEGER;
```

Parameters

Table 298-7 GETINFO Function Parameters

Parameter	Description
self	The ANYTYPE.
prec	If typecode represents a number. Gives precision and scale. Ignored otherwise.
scale	If typecode represents a number. Gives precision and scale. Ignored otherwise.
len	If typecode represents a RAW, CHAR, VARCHAR, or VARCHAR2 type. Gives length.
csid	If typecode represents a type requiring character information such as: CHAR, VARCHAR, or VARCHAR2.
csid	If typecode represents a type requiring character information such as: CHAR, VARCHAR, or VARCHAR2.
schema_name	Type's schema (if persistent).
type_name	Type's typename.
version	Type's version.
numelems	If <i>self</i> is a TYPECODE_VARRAY, this gives the VARRAY count. If <i>self</i> is of TYPECODE_OBJECT, this gives the number of attributes.

Return Values

The typecode of *self*.

Exceptions

- DBMS_TYPES.INVALID_PARAMETERS: Invalid Parameters (position is beyond bounds or the ANYTYPE is not properly Constructed).

298.1.6 GETATTRELEMINFO Member Function

This function gets the type information for an attribute of the type (if it is of `TYPECODE_OBJECT`). Gets the type information for a collection's element type if the *self* parameter is of a collection type.

Syntax

```
MEMBER FUNCTION GETATTRELEMINFO (
    self          IN ANYTYPE,
    pos           IN PLS_INTEGER,
    prec         OUT PLS_INTEGER,
    scale        OUT PLS_INTEGER,
    len          OUT PLS_INTEGER,
    csid         OUT PLS_INTEGER,
    csfrm        OUT PLS_INTEGER,
    attr_elt_type OUT ANYTYPE
    aname        OUT VARCHAR2)
RETURN         PLS_INTEGER;
```

Parameters

Table 298-8 GETATTRELEMINFO Function Parameters

Parameter	Description
<code>self</code>	The ANYTYPE.
<code>pos</code>	If <code>self</code> is of <code>TYPECODE_OBJECT</code> , this gives the attribute position (starting at 1). It is ignored otherwise.
<code>prec</code>	If attribute/collection element typecode represents a NUMBER. Gives precision and scale. Ignored otherwise.
<code>scale</code>	If attribute/collection element typecode represents a NUMBER. Gives precision and scale. Ignored otherwise.
<code>len</code>	If typecode represents a RAW, CHAR, VARCHAR, or VARCHAR2 type. Gives length.
<code>csid, csfrm</code>	If typecode represents a type requiring character information such as: CHAR, VARCHAR, or VARCHAR2. Gives character set ID, character set form.
<code>attr_elt_type</code>	If attribute/collection element typecode represents a user-defined type, this returns the ANYTYPE corresponding to it. User can subsequently describe the <i>attr_elt_type</i> .
<code>aname</code>	Attribute name (if it is an attribute of an object type, NULL otherwise).

Return Values

The typecode of the attribute or collection element.

Exceptions

`DBMS_TYPES.INVALID_PARAMETERS`: Invalid Parameters (position is beyond bounds or the ANYTYPE is not properly constructed).

298.1.7 GETANYTYPEFROMPERSISTENT Function

This standalone function returns an `ANYTYPE` corresponding to a persistent type created earlier using the `CREATE TYPE SQL` statement. Starting with Oracle Database 19c, the `GETANYTYPEFROMPERSISTENT` function replaces the `GETPERSISTENT` static function.

Syntax

```
GETANYTYPEFROMPERSISTENT (  
    schema_name      IN VARCHAR2,  
    type_name        IN VARCHAR2)  
RETURN               ANYTYPE;
```

Parameters

Table 298-9 GETANYTYPEFROMPERSISTENT Function Parameters

Parameter	Description
<code>schema_name</code>	Schema name of the type.
<code>type_name</code>	Type name.

Return Values

An `ANYTYPE` corresponding to a persistent type created earlier using the `CREATE TYPE SQL` statement.

Oracle Database Advanced Queuing (AQ) Types

This chapter describes the types used with Oracle Database Advanced Queuing (AQ) packages for PL/SQL, `DBMS_AQ`, and `DBMS_AQADM`.

This chapter contains the following topics:

- [Security Model](#)
- [Summary of Types](#)



See Also:

Oracle Database Advanced Queuing User's Guide for information about using Oracle Database Advanced Queuing.

299.1 Advanced Queuing (AQ) Types Security Model

`PUBLIC` is granted `EXECUTE` privilege on the types described in this chapter.

299.2 Oracle Database Advanced Queuing (AQ) Types — Summary of Types

Oracle Database Advanced Queuing (AQ) uses types to specify certain types of information.

- [AQ\\$_AGENT](#) Type
- [AQ\\$_AGENT_LIST_T](#) Type
- [AQ\\$_DESCRIPTOR](#) Type
- [AQ\\$_NTFN_DESCRIPTOR](#) Type
- [AQ\\$_NTFN_MSGID_ARRAY](#) Type
- [AQ\\$_POST_INFO](#) Type
- [AQ\\$_POST_INFO_LIST](#) Type
- [AQ\\$_PURGE_OPTIONS_T](#) Type
- [AQ\\$_RECIPIENT_LIST_T](#) Type
- [AQ\\$_REG_INFO](#) Type
- [AQ\\$_REG_INFO_LIST](#) Type
- [AQ\\$_SUBSCRIBER_LIST_T](#) Type
- [DEQUEUE_OPTIONS_T](#) Type

- ENQUEUE_OPTIONS_T Type
- QUEUE_PROPS_T Type
- SEEK_INPUT_T Type
- SEEK_OUTPUT_T Type
- SYS.MSG_PROP_T Type
- MESSAGE_PROPERTIES_T Type
- MESSAGE_PROPERTIES_ARRAY_T Type
- MSGID_ARRAY_T Type

299.2.1 AQ\$_AGENT Type

This type identifies a producer or a consumer of a message.

Syntax

```
TYPE SYS.AQ$_AGENT IS OBJECT (
  name      VARCHAR2(512),
  address   VARCHAR2(1024),
  protocol  NUMBER);
```

Attributes

Table 299-1 AQ\$_AGENT Attributes

Attribute	Description
name	Name of a producer or consumer of a message. The name must follow object name guidelines in the <i>Oracle Database SQL Language Reference</i> with regard to reserved characters.
address	Protocol-specific address of the recipient. If the protocol is 0, then the address is of the form <code>[schema.] queue[@dblink]</code> . For example, a queue named <code>emp_messages</code> in the HR queue at the site <code>dbs1.net</code> has the address: <code>hr.emp_messages@dbs1.net</code>
protocol	Protocol to interpret the address and propagate the message. Protocols 1-127 are reserved for internal use. If the protocol number is in the range 128 - 255, the address of the recipient is not interpreted by Oracle Database Advanced Queuing.

299.2.2 AQ\$_AGENT_LIST_T Type

This type identifies the list of agents for which `DBMS_AQ.LISTEN` listens.



See Also:

"AQ\$_AGENT Type"

Syntax

```
TYPE SYS.AQ$_AGENT_LIST_T IS TABLE OF SYS.AQ$_AGENT
INDEX BY BINARY_INTEGER;
```

299.2.3 AQ\$_DESCRIPTOR Type

This type specifies the Oracle Database Advanced Queuing descriptor received by the AQ PL/SQL callbacks upon notification.

**See Also:**

"MESSAGE_PROPERTIES_T Type"

Syntax

```
TYPE SYS.AQ$_DESCRIPTOR IS OBJECT (
  queue_name      VARCHAR2(261),
  consumer_name   VARCHAR2(512),
  msg_id          RAW(16),
  msg_prop        MSG_PROP_T,
  gen_desc        AQ$_NTFN_DESCRIPTOR,
  msgid_array     SYS.AQ$_NTFN_MSGID_ARRAY,
  ntfnsRecdInGrp NUMBER);
```

Attributes**Table 299-2 AQ\$_DESCRIPTOR Attributes**

Attribute	Description
queue_name	Name of the queue in which the message was enqueued which resulted in the notification
consumer_name	Name of the consumer for the multiconsumer queue
msg_id	Identification number of the message
msg_prop	Message properties specified by the MSG_PROP_T type
gen_desc	Indicates the timeout specifications
msgid_array	Group notification message ID list
ntfnsRecdInGrp	Notifications received in group

299.2.4 AQ\$_NTFN_DESCRIPTOR Type

This type is for storing a generic notification descriptor regarding PL/SQL notification flags.

Syntax

```
TYPE SYS.AQ$_NTFN_DESCRIPTOR IS OBJECT( ntfn_flags NUMBER)
```

Attributes

Table 299-3 AQ\$_NTFN_DESCRIPTOR Attributes

Attribute	Description
ntfn_flags	Set to 1 if the notifications are already removed after a stipulated timeout. Set 2 to denote grouping. Default is 0.

299.2.5 AQ\$_NTFN_MSGID_ARRAY Type

This type is for storing grouping notification data for AQ namespace, value 2³⁰ which is the max varray size.

Syntax

```
TYPE SYS.AQ$_NTFN_MSGID_ARRAY AS VARRAY(1073741824) OF RAW(16);
```

299.2.6 AQ\$_POST_INFO Type

This type specifies anonymous subscriptions to which you want to post messages.

Syntax

```
TYPE SYS.AQ$_POST_INFO IS OBJECT (
    name          VARCHAR2(512),
    namespace     NUMBER,
    payload       RAW(32767));
```


Attributes

Table 299-4 AQ\$_POST_INFO Attributes

Attribute	Description
name	Name of the anonymous subscription to which you want to post
namespace	To receive notifications from other applications through DBMS_AQ.POST or OCISubscriptionPost(), the namespace must be DBMS_AQ.NAMESPACE_ANONYMOUS
payload	The payload to be posted to the anonymous subscription

299.2.7 AQ\$_POST_INFO_LIST Type

This type identifies the list of anonymous subscriptions to which you want to post messages.

 **See Also:**
[AQ\\$_POST_INFO Type](#)

Syntax

```
TYPE SYS.AQ$_POST_INFO_LIST AS VARRAY(1024) OF SYS.AQ$_POST_INFO;
```

299.2.8 AQ\$_PURGE_OPTIONS_T Type

This type specifies the options available for purging a queue table.

 **See Also:**
[PURGE_QUEUE_TABLE Procedure.](#)

Syntax


```
TYPE AQ$_PURGE_OPTIONS_T is RECORD (
    block          BOOLEAN          DEFAULT FALSE
    delivery_mode  PLS_INTEGER      DEFAULT PERSISTENT);
```

Table 299-5 AQ\$_PURGE_OPTIONS_T Type Attributes

Attribute	Description
block	TRUE/FALSE. <ul style="list-style-type: none"> If block is TRUE, then an exclusive lock on all the queues in the queue table is held while purging the queue table. This will cause concurrent enqueueers and dequeuers to block while the queue table is purged. The purge call always succeeds if block is TRUE. The default for block is FALSE. This will not block enqueueers and dequeuers, but it can cause the purge to fail with an error during high concurrency times.
delivery_mode	Kind of messages to purge, either DBMS_AQ.BUFFERED or DBMS_AQ.PERSISTENT

299.2.9 AQ\$_RECIPIENT_LIST_T Type

Identifies the list of agents that receive the message. This type can be used only when the queue is enabled for multiple dequeues.

 **See Also:**
"AQ\$_AGENT Type"

Syntax

```
TYPE SYS.AQ$_RECIPIENT_LIST_T IS TABLE OF SYS.AQ$_AGENT
INDEX BY BINARY_INTEGER;
```

299.2.10 AQ\$_REG_INFO Type

This type identifies a producer or a consumer of a message.

Syntax

```
TYPE SYS.AQ$_REG_INFO IS OBJECT (
    name                VARCHAR2(512),
    namespace           NUMBER,
    callback            VARCHAR2(4000),
    context            RAW(2000) DEFAULT NULL,
    anyctx             ANYDATA,
    ctxtype            NUMBER,
    payloadcbk        VARCHAR2(4000),
    timeout            NUMBER,
    ntfn_grouping_class NUMBER,
    ntfn_grouping_value NUMBER DEFAULT 600,
    ntfn_grouping_type NUMBER,
    ntfn_grouping_start_time TIMESTAMP(6) WITH TIME ZONE,
    ntfn_grouping_repeat_count NUMBER);
```

Attributes

Table 299-6 AQ\$_REG_INFO Type Attributes

Attribute	Description
name	Specifies the name of the subscription. The subscription name is of the form <i>schema.queue</i> if the registration is for a single consumer queue or <i>schema.queue:consumer_name</i> if the registration is for a multiconsumer queues.

Table 299-6 (Cont.) AQ\$_REG_INFO Type Attributes

Attribute	Description
namespace	Specifies the namespace of the subscription. To receive notification from Oracle Database Advanced Queuing queues, the namespace must be <code>DBMS_AQ.NAMESPACE_AQ</code> . To receive notifications from other applications through <code>DBMS_AQ.POST</code> or <code>OCISubscriptionPost()</code> , the namespace must be <code>DBMS_AQ.NAMESPACE_ANONYMOUS</code> .
callback	Specifies the action to be performed on message notification. For HTTP notifications, use <code>http://www.company.com:8080</code> . For e-mail notifications, use <code>mailto://xyz@company.com</code> . For raw message payload for the <code>PLSQLCALLBACK</code> procedure, use <code>plsql://schema.procedure?PR=0</code> . For user-defined type message payload converted to XML for the <code>PLSQLCALLBACK</code> procedure, use <code>plsql://schema.procedure?PR=1</code> .
context	Specifies the context that is to be passed to the callback function
anyctx	Specifies the <code>ANYDATA</code> type context that is passed to the callback function
ctxtype	Specifies the context type. Valid values are 0 (<code>RAW</code>) or 1 (<code>ANYDATA</code>)
payloadcbk	Specifies payload for the callback function
timeout	Specifies the time in seconds
ntfn_grouping_class	Currently, only the following flag can be set to specify criterion for grouping. The default value will be 0. If <code>ntfn_grouping_class</code> is 0, all other notification grouping attributes must be 0. <ul style="list-style-type: none"> <code>NTFN_GROUPING_CLASS_TIME</code> - Notifications grouped by time, that is, the user specifies a time value and a single notification gets published at the end of that time.
ntfn_grouping_value	Time-period of grouping notifications specified in seconds, meaning the time after which grouping notification would be sent periodically until <code>ntfn_grouping_repeat_count</code> is exhausted.
ntfn_grouping_type	<ul style="list-style-type: none"> <code>NTFN_GROUPING_TYPE_SUMMARY</code> - Summary of all notifications that occurred in the time interval. (Default) <code>NTFN_GROUPING_TYPE_LAST</code> - Last notification that occurred in the interval.

Table 299-6 (Cont.) AQ\$_REG_INFO Type Attributes

Attribute	Description
<code>ntfn_grouping_start_time</code>	Notification grouping start time. Notification grouping can start from a user-specified time that should be a valid timestamp with time zone. If <code>ntfn_grouping_start_time</code> is not specified when using grouping, the default is to current timestamp with time zone
<code>ntfn_grouping_repeat_count</code>	Grouping notifications will be sent as many times as specified by the notification grouping repeat count and after that revert to regular notifications. The <code>ntfn_grouping_repeat_count</code> , if not specified, will default to <ul style="list-style-type: none"> • <code>NTFN_GROUPING_FOREVER</code> - Keep sending grouping notifications forever.

Usage Notes

You can use the following notification mechanisms:

- OCI callback
- e-mail callback
- PL/SQL callback

[Table 299-7](#) shows the actions performed for nonpersistent queues for different notification mechanisms when RAW presentation is specified. [Table 299-8](#) shows the actions performed when XML presentation is specified.

Table 299-7 Actions Performed for Nonpersistent Queues When RAW Presentation Specified


Queue Payload Type	OCI Callback	E-mail	PL/SQL Callback
RAW	OCI callback receives the RAW data in the payload.	Not supported	PL/SQL callback receives the RAW data in the payload.
Oracle object type	Not supported	Not supported	Not supported

Table 299-8 Actions Performed for Nonpersistent Queues When XML Presentation Specified

Queue Payload Type	OCI Callback	E-mail	PL/SQL Callback
RAW	OCI callback receives the XML data in the payload.	XML data is formatted as a SOAP message and e-mailed to the registered e-mail address.	PL/SQL callback receives the XML data in the payload.
Oracle object type	OCI callback receives the XML data in the payload.	XML data is formatted as a SOAP message and e-mailed to the registered e-mail address.	PL/SQL callback receives the XML data in the payload.

299.2.11 AQ\$_REG_INFO_LIST Type

Identifies the list of registrations to a queue.


 **See Also:**
"AQ\$_REG_INFO Type"

Syntax

```
TYPE SYS.AQ$_REG_INFO_LIST AS VARRAY(1024) OF SYS.AQ$_REG_INFO;
```

299.2.12 AQ\$_SUBSCRIBER_LIST_T Type

This type identifies the list of subscribers that subscribe to a queue.

 **See Also:**
"AQ\$_AGENT Type"

Syntax

```
TYPE SYS.AQ$_SUBSCRIBER_LIST_T IS TABLE OF SYS.AQ$_AGENT  
INDEX BY BINARY_INTEGER;
```

299.2.13 DEQUEUE_OPTIONS_T Type

DEQUEUE_OPTIONS_T specifies the options available for the dequeue operation.

Syntax

```
TYPE DEQUEUE_OPTIONS_T IS RECORD (  
    consumer_name    VARCHAR2(30)    DEFAULT NULL,  
    dequeue_mode     BINARY_INTEGER DEFAULT REMOVE,  
    navigation       BINARY_INTEGER DEFAULT NEXT_MESSAGE,  
    visibility       BINARY_INTEGER DEFAULT ON_COMMIT,  
    wait             BINARY_INTEGER DEFAULT FOREVER,  
    msgid            RAW(16)        DEFAULT NULL,  
    correlation      VARCHAR2(128)  DEFAULT NULL,  
    deq_condition    VARCHAR2(4000) DEFAULT NULL,  
    signature        aq$_sig_prop   DEFAULT NULL,  
    transformation   VARCHAR2(61)   DEFAULT NULL,  
    delivery_mode    PLS_INTEGER    DEFAULT PERSISTENT);
```

Attributes

Table 299-9 DEQUEUE_OPTIONS_T Attributes

Attribute	Description
consumer_name	<p>Name of the consumer. Only those messages matching the consumer name are accessed. If a queue is not set up for multiple consumers, then this field should be set to NULL.</p> <p>For secure queues, consumer_name must be a valid AQ agent name, mapped to the database user performing the dequeue operation, through dbms_aqadm.enable_db_access procedure call.</p>
dequeue_mode	<p>Specifies the locking behavior associated with the dequeue. Possible settings are:</p> <p>BROWSE: Read the message without acquiring any lock on the message. This specification is equivalent to a select statement.</p> <p>LOCKED: Read and obtain a write lock on the message. The lock lasts for the duration of the transaction. This setting is equivalent to a select for update statement.</p> <p>REMOVE: Read the message and delete it. This setting is the default. The message can be retained in the queue table based on the retention properties.</p> <p>REMOVE_NODATA: Mark the message as updated or deleted. The message can be retained in the queue table based on the retention properties.</p>
navigation	<p>Specifies the position of the message that will be retrieved. First, the position is determined. Second, the search criterion is applied. Finally, the message is retrieved. Possible settings are:</p> <p>NEXT_MESSAGE: Retrieve the next message that is available and matches the search criteria. If the previous message belongs to a message group, then AQ retrieves the next available message that matches the search criteria and belongs to the message group. This setting is the default.</p> <p>NEXT_TRANSACTION: Skip the remainder of the current transaction group (if any) and retrieve the first message of the next transaction group. This setting can only be used if message grouping is enabled for the current queue.</p> <p>FIRST_MESSAGE: Retrieves the first message which is available and matches the search criteria. This setting resets the position to the beginning of the queue.</p> <p>FIRST_MESSAGE_MULTI_GROUP: indicates that a call to DBMS_AQ.DEQUEUE_ARRAY will reset the position to the beginning of the queue and dequeue messages (possibly across different transaction groups) that are available and match the search criteria, until reaching the ARRAY_SIZE limit. Refer to the TRANSACTION_GROUP attribute for the message to distinguish between transaction groups.</p> <p>NEXT_MESSAGE_MULTI_GROUP: indicates that a call to DBMS_AQ.DEQUEUE_ARRAY will dequeue the next set of messages (possibly across different transaction groups) that are available and match the search criteria, until reaching the ARRAY_SIZE limit. Refer to the TRANSACTION_GROUP attribute for the message to distinguish between transaction groups.</p>

Table 299-9 (Cont.) DEQUEUE_OPTIONS_T Attributes

Attribute	Description
visibility	<p>Specifies whether the new message is dequeued as part of the current transaction. The visibility parameter is ignored when using the <code>BROWSE</code> dequeue mode. Possible settings are:</p> <p><code>ON_COMMIT</code>: The dequeue will be part of the current transaction. This setting is the default.</p> <p><code>IMMEDIATE</code>: The dequeue operation is not part of the current transaction, but an autonomous transaction which commits at the end of the operation.</p>
wait	<p>Specifies the wait time if there is currently no message available which matches the search criteria. Possible settings are:</p> <p><code>FOREVER</code>: Wait forever. This setting is the default.</p> <p><code>NO_WAIT</code>: Do not wait.</p> <p><code>NUMBER</code>: Wait time in seconds.</p>
msgid	Specifies the message identifier of the message to be dequeued.
correlation	<p>Specifies the correlation identifier of the message to be dequeued. Special pattern matching characters, such as the percent sign (%) and the underscore (_) can be used. If more than one message satisfies the pattern, then the order of dequeuing is undetermined.</p>
deq_condition	<p>A conditional expression based on the message properties, the message data properties, and PL/SQL functions.</p> <p>A <code>deq_condition</code> is specified as a Boolean expression using syntax similar to the <code>WHERE</code> clause of a SQL query. This Boolean expression can include conditions on message properties, user data properties (object payloads only), and PL/SQL or SQL functions (as specified in the <code>WHERE</code> clause of a SQL query). Message properties include <code>priority</code>, <code>corrid</code> and other columns in the queue table</p> <p>To specify dequeue conditions on a message payload (object payload), use attributes of the object type in clauses. You must prefix each attribute with <code>tab.user_data</code> as a qualifier to indicate the specific column of the queue table that stores the payload. The <code>deq_condition</code> parameter cannot exceed 4000 characters. If more than one message satisfies the dequeue condition, then the order of dequeuing is undetermined.</p>
signature	Currently not implemented
transformation	Specifies a transformation that will be applied after dequeuing the message. The source type of the transformation must match the type of the queue.
delivery_mode	The dequeuer specifies the delivery mode of the messages it wishes to dequeue in the dequeue options. It can be <code>BUFFERED</code> or <code>PERSISTENT</code> or <code>PERSISTENT_OR_BUFFERED</code> . The message properties of the dequeued message indicate the delivery mode of the dequeued message. Array dequeue is only supported for buffered messages with an array size of '1'.

299.2.14 ENQUEUE_OPTIONS_T Type

ENQUEUE_OPTIONS_T Type specifies the options available for the enqueue operation.

Syntax

```
TYPE SYS.ENQUEUE_OPTIONS_T IS RECORD (
  visibility          BINARY_INTEGER DEFAULT ON_COMMIT,
  relative_msgid     RAW(16)         DEFAULT NULL,
  sequence_deviation BINARY_INTEGER DEFAULT NULL,
  transformation     VARCHAR2(61)   DEFAULT NULL,
  delivery_mode      PLS_INTEGER    NOT NULL DEFAULT PERSISTENT);
```

Attributes

Table 299-10 ENQUEUE_OPTIONS_T Attributes

Attribute	Description
visibility	Specifies the transactional behavior of the enqueue request. Possible settings are: ON_COMMIT: The enqueue is part of the current transaction. The operation is complete when the transaction commits. This setting is the default. IMMEDIATE: The enqueue operation is not part of the current transaction, but an autonomous transaction which commits at the end of the operation. This is the only value allowed when enqueueing to a non-persistent queue.
relative_msgid	Specifies the message identifier of the message which is referenced in the sequence deviation operation. This field is valid only if BEFORE is specified in sequence_deviation. This parameter is ignored if sequence deviation is not specified.
sequence_deviation	Specifies whether the message being enqueued should be dequeued before other messages already in the queue. Possible settings are: BEFORE: The message is enqueued ahead of the message specified by relative_msgid. TOP: The message is enqueued ahead of any other messages.
transformation	Specifies a transformation that will be applied before enqueueing the message. The return type of the transformation function must match the type of the queue.
delivery_mode	The enqueueer specifies the delivery mode of the messages it wishes to enqueue in the enqueue options. It can be BUFFERED or PERSISTENT. The message properties of the enqueued message indicate the delivery mode of the enqueued message. Array enqueue is only supported for buffered messages with an array size of '1'.

299.2.15 QUEUE_PROPS_T Type

This type specifies the Oracle Database Advanced Queuing descriptor received by the AQ PL/SQL callbacks upon notification.

Syntax

```
TYPE QUEUE_PROPS_T IS RECORD (
  retry_delay      NUMBER          DEFAULT 0,
  retention_time   NUMBER          DEFAULT 0,
  sort_list        VARCHAR2(30)    DEFAULT NULL,
  cache_hint       BINARY_INTEGER DEFAULT AUTO,
  retention_type   BINARY_INTEGER DEFAULT DBMS_AQ.DEQUEUE_TIME
);
```

Attributes

Table 299-11 QUEUE_PROPS_T Attributes

Attribute	Description
retry_delay	Specifies the number of seconds after which this message is scheduled for processing again after an application rollback
retention_time	Specifies the number of seconds a message is retained in the queue table after being dequeued from the queue
sort_list	Sharded queues can be sorted by ENQ_TIME or PRIORITY, ENQ_TIME .
cache_hint	Specifies a hint to sharded queue whether to cache messages or not. User can specify following: <ul style="list-style-type: none"> UNCACHED: Message cache will not cache messages CACHED: Message cache will cache messages and give preference to those queues with CACHED hint. AUTO: Message cache does best effort based on available memory
retention_type	Specifies the type of retention. DBMS_AQ.DEQUEUE_TIME (default): The retention time starts after a subshard is dequeued by all the subscribers. If a new subscriber seeks back before or to this subshard, then the retention clock is reset.

299.2.16 SEEK_INPUT_T Type

This type specifies the seek input per shard.

Syntax

```
TYPE SEEK_INPUT_T IS RECORD(
  shard              binary_integer DEFAULT DBMS_AQ.ALL_SHARDS,
  priority           binary_integer DEFAULT DBMS_AQ.ALL_PRIORITIES,
  seek_msgid         raw(16)        DEFAULT NULL,
  seek_time          TIMESTAMP WITH TIME ZONE DEFAULT NULL
);
```


Attributes

Table 299-12 SEEK_INPUT_T Attributes

Attribute	Description
shard	Shard identifier on which seek operation needs to be performed. Possible values are <code>DBMS_AQ.ALL_SHARDS</code> or a specific shard on which seek is to be performed If value is <code>DBMS_AQ.ALL_SHARDS</code> , then seek is performed on requested shards, otherwise it is performed on the specific shard mentioned in this field.
priority	Seek is performed on all priorities of the shard individually. If value is <code>DBMS_AQ.ALL_PRIORITIES</code> , then seek is performed on all priorities, otherwise it is performed on the specific priority mentioned in this field
seek_msgid	Input message id when <code>seek_type</code> is <code>DBMS_AQ.MESSAGE</code> .
seek_time	Specifies the input time when <code>seek_type</code> is <code>DBMS_AQ.TIME</code> .

299.2.17 SEEK_OUTPUT_T Type

This type specifies the seek output of a seek call.

Syntax

```
TYPE SEEK_OUTPUT_T IS RECORD(
    shard          binary_integer,
    priority       binary_integer,
    seeked_from    raw(16),
    seeked_to      raw(16));
```

Attributes

Table 299-13 SEEK_OUTPUT_T Attributes

Attribute	Description
shard	Specifies the shard identifier on which the seek operation is performed for the subscriber.
priority	Specifies the priority of the shard, which is applicable only for priority queues, else value is null.
seeked_from	Specifies the message id of dequeue position before seek. NULL value signifies seeking from end of shard.
seeked_to	Specifies the message id of dequeue position after seek. NULL value signifies seeking to end of shard.

299.2.18 SYS.MSG_PROP_T Type

This type is used in PL/SQL notification, as one field in `aq$_descriptor`, to pass message properties of an AQ message to the PL/SQL notification client callback.

Syntax

```
CREATE or replace TYPE sys.msg_prop_t AS OBJECT (
  priority          NUMBER,
  delay             NUMBER,
  expiration        NUMBER,
  correlation       VARCHAR2(128),
  attempts          NUMBER,
  exception_queue   VARCHAR2(51),
  enqueue_time     DATE,
  state             NUMBER,
  sender_id         aq$_agent,
  original_msgid    RAW(16),
  delivery_mode     NUMBER);
```

Parameters

Table 299-14 SYS.MSG_PROP_T Type Attributes

Parameter	Description
<code>priority</code>	Specifies the priority of the message. A smaller number indicates higher priority. The priority can be any number, including negative numbers.
<code>delay</code>	Specifies the delay of the enqueued message. The delay represents the number of seconds after which a message is available for dequeuing. Dequeuing by <code>msgid</code> overrides the delay specification. A message enqueued with <code>delay</code> set is in the <code>WAITING</code> state, and when the delay expires, the message goes to the <code>READY</code> state. <code>DELAY</code> processing requires the queue monitor to be started. However the queue monitor is started automatically by the system if needed. Delay is set by the producer who enqueues the message. The possible settings follow: <code>NO_DELAY</code> : The message is available for immediate dequeuing number: The number of seconds to delay the message
<code>expiration</code>	Specifies the expiration of the message. It determines, in seconds, the duration the message is available for dequeuing. This parameter is an offset from the time the message is ready for dequeue. Expiration processing requires the queue monitor to be running. However the queue monitor is started automatically by the system if needed. The possible settings follow: <code>NEVER</code> : The message does not expire number: The number of seconds message remains in <code>READY</code> state. If the message is not dequeued before it expires, then it is moved to the exception queue in the <code>EXPIRED</code> state.
<code>correlation</code>	Returns the identifier supplied by the producer of the message at enqueue time.
<code>attempts</code>	Returns the number of attempts that have been made to dequeue the message. This parameter cannot be set at enqueue time.

Table 299-14 (Cont.) SYS.MSG_PROP_T Type Attributes

Parameter	Description
exception_queue	<p>Specifies the name of the queue into which the message is moved if it cannot be processed successfully.</p> <p>Messages are moved automatically into the exception queue.</p> <p>Messages are moved into the exception queue in the following cases:</p> <ul style="list-style-type: none"> RETRY_COUNT, the number of unsuccessful dequeue attempts, has exceeded the specification for the MAX_RETRIES parameter in the DBMS_AQADM.CREATE_QUEUE procedure during queue creation. <p>For multiconsumer queues, the message becomes eligible to be moved to the exception queue even if failed dequeue attempts exceeds the MAX_RETRIES parameter for only one of the consumers. But the message will not be moved until either all other consumers have successfully consumed the message or failed more than MAX_RETRIES. You can view MAX_RETRIES for a queue in the ALL_QUEUES data dictionary view.</p> <p>If a dequeue transaction fails because the server process dies (including ALTER SYSTEM KILL SESSION) or SHUTDOWN ABORT on the instance, then RETRY_COUNT is not incremented.</p> <ul style="list-style-type: none"> A message was not dequeued before the expiration time elapsed. Message propagation to the specified destination queue failed with one of the following errors: <ul style="list-style-type: none"> * There were no recipients for the multiconsumer destination queue. * Recipients were specified for a single-consumer destination queue. * Destination queue was an exception queue * There was an error when applying transformation. <p>The default is the exception queue associated with the queue table. If the exception queue specified does not exist at the time of the move, then the message is moved to the default exception queue associated with the queue table, and a warning is logged in the alert log. If the default exception queue is specified, then the parameter returns a NULL value at dequeue time.</p>
enqueue_time	<p>Specifies the time the message was enqueued. This value is determined by the system and cannot be set by the user at enqueue time.</p>
state	<p>Specifies the state of the message at the time of the dequeue. This parameter cannot be set at enqueue time. The possible states follow:</p> <ul style="list-style-type: none"> DBMS_AQ.READY: The message is ready to be processed. DBMS_AQ.WAITING: The message delay has not yet been reached. DBMS_AQ.PROCESSED: The message has been processed and is retained. DBMSAQ.EXPIRED: The message has been moved to the exception queue.

Table 299-14 (Cont.) SYS.MSG_PROP_T Type Attributes

Parameter	Description
sender_id	The application-sender identification specified at enqueue time by the message producer. Sender id is of type aq\$_agent. Sender name is required for secure queues at enqueue time. This must be a valid AQ agent name, mapped to the database user performing the enqueue operation, through dbms_aqadm.enable_db_access procedure call. Sender address and protocol should not be specified. The Sender id in the message properties returned at dequeue time may have a sender address if the message was propagated from another queue. The value of the address is the source_queue, source database name if it was a remote database [format source_queue@source_database_name]
original_msgid	This parameter is used by Oracle Database Advanced Queuing for propagating messages.
delivery_mode	DBMS_AQ.BUFFERED or DBMS_AQ.PERSISTENT.

299.2.19 MESSAGE_PROPERTIES_T Type

This type is defined inside the DBMS_AQ package, and describes the information that AQ uses to convey the state of individual messages. These are set at enqueue time, and their values are returned at dequeue time.



See Also:

[AQ\\$_RECIPIENT_LIST_T Type](#)

Syntax

```
TYPE message_properties_t IS RECORD (
    priority          BINARY_INTEGER NOT NULL DEFAULT 1,
    delay             BINARY_INTEGER NOT NULL DEFAULT NO_DELAY,
    expiration        BINARY_INTEGER NOT NULL DEFAULT NEVER,
    correlation        VARCHAR2(128)  DEFAULT NULL,
    attempts          BINARY_INTEGER,
    recipient_list    AQ$_RECIPIENT_LIST_T,
    exception_queue   VARCHAR2(61)    DEFAULT NULL,
    enqueue_time      DATE,
    state             BINARY_INTEGER,
    sender_id         SYS.AQ$_AGENT   DEFAULT NULL,
    original_msgid    RAW(16)         DEFAULT NULL,
    signature         aq$_sig_prop    DEFAULT NULL,
    transaction_group VARCHAR2(30)    DEFAULT NULL,
    user_property     SYS.ANYDATA     DEFAULT NULL,
    delivery_mode     PLS_INTEGER     NOT NULL DEFAULT DBMS_AQ.PERSISTENT);
```

Attributes

Table 299-15 MESSAGE_PROPERTIES_T Attributes

Attribute	Description
priority	Specifies the priority of the message. A smaller number indicates higher priority. The priority can be any number, including negative numbers.
delay	<p>Specifies the delay of the enqueued message. The delay represents the number of seconds after which a message is available for dequeuing. Dequeuing by <code>msgid</code> overrides the delay specification. A message enqueued with <code>delay</code> set is in the <code>WAITING</code> state, and when the delay expires, the message goes to the <code>READY</code> state. <code>DELAY</code> processing requires the queue monitor to be started. However the queue monitor is started automatically by the system if needed. Delay is set by the producer who enqueues the message.</p> <p>The possible settings follow:</p> <p><code>NO_DELAY</code>: The message is available for immediate dequeuing</p> <p>number: The number of seconds to delay the message</p>
expiration	<p>Specifies the expiration of the message. It determines, in seconds, the duration the message is available for dequeuing. This parameter is an offset from the time the message is ready for dequeue. Expiration processing requires the queue monitor to be running. However the queue monitor is started automatically by the system if needed.</p> <p>The possible settings follow:</p> <p><code>NEVER</code>: The message does not expire</p> <p>number: The number of seconds message remains in <code>READY</code> state. If the message is not dequeued before it expires, then it is moved to the exception queue in the <code>EXPIRED</code> state.</p>
correlation	Returns the identifier supplied by the producer of the message at enqueue time.
attempts	Returns the number of attempts that have been made to dequeue the message. This parameter cannot be set at enqueue time.
recipient_list	<p>This parameter is only valid for queues that allow multiple consumers. The default recipients are the queue subscribers. This parameter is not returned to a consumer at dequeue time.</p> <p>For type definition, see the "AQ\$_AGENT Type".</p>

Table 299-15 (Cont.) MESSAGE_PROPERTIES_T Attributes

Attribute	Description
exception_queue	<p>Specifies the name of the queue into which the message is moved if it cannot be processed successfully.</p> <p>Messages are moved automatically into the exception queue. Messages are moved into the exception queue in the following cases:</p> <ul style="list-style-type: none"> RETRY_COUNT, the number of unsuccessful dequeue attempts, has exceeded the specification for the MAX_RETRIES parameter in the DBMS_AQADM.CREATE_QUEUE procedure during queue creation. <p>For multiconsumer queues, the message becomes eligible to be moved to the exception queue even if failed dequeue attempts exceeds the MAX_RETRIES parameter for only one of the consumers. But the message will not be moved until either all other consumers have successfully consumed the message or failed more than MAX_RETRIES. You can view MAX_RETRIES for a queue in the ALL_QUEUES data dictionary view.</p> <p>If a dequeue transaction fails because the server process dies (including ALTER SYSTEM KILL SESSION) or SHUTDOWN ABORT on the instance, then RETRY_COUNT is not incremented.</p> <ul style="list-style-type: none"> A message was not dequeued before the expiration time elapsed. Message propagation to the specified destination queue failed with one of the following errors: <ul style="list-style-type: none"> * There were no recipients for the multiconsumer destination queue. * Recipients were specified for a single-consumer destination queue. * Destination queue was an exception queue * There was an error when applying transformation. <p>The default is the exception queue associated with the queue table. If the exception queue specified does not exist at the time of the move, then the message is moved to the default exception queue associated with the queue table, and a warning is logged in the alert log. If the default exception queue is specified, then the parameter returns a NULL value at dequeue time.</p>
enqueue_time	<p>The enqueue_time attribute specifies the time the message was enqueued. This value is always in Universal Coordinated Time (UTC), and is determined by the system and cannot be set by the user at enqueue time.</p>
state	<p>Specifies the state of the message at the time of the dequeue. This parameter cannot be set at enqueue time. The possible states follow:</p> <ul style="list-style-type: none"> DBMS_AQ.READY: The message is ready to be processed. DBMS_AQ.WAITING: The message delay has not yet been reached. DBMS_AQ.PROCESSED: The message has been processed and is retained. DBMSAQ.EXPIRED: The message has been moved to the exception queue.

Table 299-15 (Cont.) MESSAGE_PROPERTIES_T Attributes

Attribute	Description
sender_id	The application-sender identification specified at enqueue time by the message producer. Sender id is of type aq\$_agent. Sender name is required for secure queues at enqueue time. This must be a valid AQ agent name, mapped to the database user performing the enqueue operation, through dbms_aqadm.enable_db_access procedure call. Sender address and protocol should not be specified. The Sender id in the message properties returned at dequeue time may have a sender address if the message was propagated from another queue. The value of the address is the source_queue, source database name if it was a remote database [format source_queue@source_database_name]
original_msgid	This parameter is used by Oracle Database Advanced Queuing for propagating messages.
signature	Currently not implemented
transaction_group	Specifies the transaction_group for the dequeued message. Messages belonging to the same transaction group will have the same value for this attribute. This attribute is only set by the DBMS_AQ.DEQUEUE_ARRAY. This attribute cannot be used to set the transaction group of a message through DBMS_AQ.ENQUEUE or DBMS_AQ.ENQUEUE_ARRAY calls.
user_property	This optional attribute is used to store additional information about the payload.
delivery_mode	The message publisher specifies the delivery mode in the message_properties. This can be DBMS_AQ.BUFFERED or DBMS_AQ.PERSISTENT. Array enqueue is only supported for buffered messages with an array size of '1'.

299.2.20 MESSAGE_PROPERTIES_ARRAY_T Type

This type is used by dbms_aq.enqueue_array and dbms_aq.dequeue_array calls to hold the set of message properties.

Each element in the payload_array should have a corresponding element in the MESSAGE_PROPERTIES_ARRAY_T VARRAY.



See Also:

"MESSAGE_PROPERTIES_T Type"

Syntax

```
TYPE MESSAGE_PROPERTIES_ARRAY_T IS VARRAY (2147483647)
OF MESSAGE_PROPERTIES_T;
```

299.2.21 MSGID_ARRAY_T Type

The `msgid_array_t` type is used in `dbms_aq.enqueue_array` and `dbms_aq.dequeue_array` calls to hold the set of message IDs that correspond to the enqueued or dequeued messages.

Syntax

```
TYPE MSGID_ARRAY_T IS TABLE OF RAW(16) INDEX BY BINARY_INTEGER
```


300

DBFS Content Interface Types

DBFS Content Interface Types are public types that support the `DBMS_DBFS_CONTENT` interface.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Data Structures](#)

Related Topics

- [DBMS_DBFS_CONTENT](#)
The `DBMS_DBFS_CONTENT` package provides an interface comprising a file system-like abstraction backed by one or more Store Providers.

300.1 DDBFS Content Interface Types Overview

The type definitions described in this chapter support the `DBMS_DBFS_CONTENT` interface in implementing metadata tables, packages, views, dependent application-side entities, and service-provider entities.

300.2 DBFS Content Interface Types Security Model

The user can access the content operational and administrative interfaces (packages, types, tables, and so on) with the `DBFS_ROLE`. This role can be granted to users as needed.

300.3 DBFS Content Interface Types —Data Structures

Types that support the `DBMS_DBFS_CONTENT` interface include both Object and Table types.

Object Types

- [DBMS_DBFS_CONTENT_CONTEXT_T](#) Object Type
- [DBMS_DBFS_CONTENT_LIST_ITEM_T](#) Object Type
- [DBMS_DBFS_CONTENT_PROPERTY_T](#) Object Type

Table Types

- [DBMS_DBFS_CONTENT_LIST_ITEMS_T](#) Table Type
- [DBMS_DBFS_CONTENT_PROPERTIES_T](#) Table Type
- [DBMS_DBFS_CONTENT_RAW_T](#) Table Type

300.3.1 DBMS_DBFS_CONTENT_CONTEXT_T Object Type

This type describes the execution context for the providers. It provides the user performing the operation with the Access Control List, the owner of the item(s), a timestamp for doing `asof` queries, and whether or not the item(s) are `read_only`. This type can be used both as input, in the case of path item creation functions, and output, in the case of path item query, or both.

Syntax

```
CREATE OR REPLACE TYPE dbms_dbfs_content_context_t
  AUTHID DEFINER
AS OBJECT (
  principal    VARCHAR2(32),
  acl          VARCHAR2(1024),
  owner        VARCHAR2(32),
  asof         TIMESTAMP,
  read_only    INTEGER);
```

Fields

Table 300-1 DBMS_DBFS_CONTENT_CONTEXT_T Fields

Field	Description
<code>principal</code>	File system user
<code>acl</code>	Access control list
<code>owner</code>	Path item owner
<code>asof</code>	Timestamp
<code>read_only</code>	Nonzero if the path item is read-only

300.3.2 DBMS_DBFS_CONTENT_LIST_ITEM_T Object Type

This type describes a type to assist in listing the contents of a directory.

Syntax

```
CREATE OR REPLACE TYPE dbms_dbfs_content_list_item_t
  AUTHID DEFINER
AS OBJECT (
  path          VARCHAR2(1024),
  item_name     VARCHAR2(256),
  item_type     INTEGER);
```

Fields

Table 300-2 DBMS_DBFS_CONTENT_LIST_ITEM_T Fields

Field	Description
<code>path</code>	Path to the path item
<code>item_name</code>	Name of the path item

Table 300-2 (Cont.) DBMS_DBFS_CONTENT_LIST_ITEM_T Fields

Field	Description
item_type	Type of path item. (See Table 58-4)

300.3.3 DBMS_DBFS_CONTENT_PROPERTY_T Object Type

This type describes a single (name, value, typecode) property tuple. All properties (standard, optional, and user-defined) are described using such tuples.

The type is used by both the client-facing interfaces and by store providers for the DBMS_DBFS_CONTENT interface.

Syntax

```
CREATE OR REPLACE TYPE dbms_dbfs_content_property_t
  AUTHID DEFINER
AS OBJECT (
  propname      VARCHAR2(32),
  propvalue     VARCHAR2(1024),
  typecode      INTEGER);
```

Fields

Table 300-3 DBMS_DBFS_CONTENT_PROPERTY_T Fields

Field	Description
prop_name	Name of property
prop_value	Value of property
typecode	Property type (See Constants in DBMS_TYPES)

300.3.4 DBMS_DBFS_CONTENT_LIST_ITEMS_T Table Type

This type is a variable-sized array of DBMS_DBFS_CONTENT_LIST_ITEM_T Object Type. It is used by both the client-facing interfaces and by store providers for the DBMS_DBFS_CONTENT interface.

Syntax

```
CREATE OR REPLACE TYPE dbms_dbfs_content_list_items_t AS
  TABLE OF dbms_dbfs_content_list_item_t;
```

Related Topics

- [DBMS_DBFS_CONTENT_LIST_ITEM_T Object Type](#)
This type describes a type to assist in listing the contents of a directory.
- [DBMS_DBFS_CONTENT](#)
The DBMS_DBFS_CONTENT package provides an interface comprising a file system-like abstraction backed by one or more Store Providers.

300.3.5 DBMS_DBFS_CONTENT_PROPERTIES_T Table Type

This type is a variable-sized array of property tuples of `DBMS_DBFS_CONTENT_PROPERTY_T` Object Type. It is used by both the client-facing interfaces and by store providers for the `DBMS_DBFS_CONTENT` interface.

Syntax

```
CREATE OR REPLACE TYPE dbms_dbfs_content_properties_t AS  
  TABLE OF dbms_dbfs_content_property_t;
```

Related Topics

- [DBMS_DBFS_CONTENT_PROPERTY_T Object Type](#)
This type describes a single (name, value, typecode) property tuple. All properties (standard, optional, and user-defined) are described using such tuples.

300.3.6 DBMS_DBFS_CONTENT_RAW_T Table Type

This type is an array of `RAW`. It is to enable `RAW` data transport for batch interfaces in the `DBMS_DBFS_CONTENT` interface.

Syntax

```
CREATE OR REPLACE TYPE dbms_dbfs_content_raw_t AS  
  TABLE OF RAW(32767);
```

Related Topics

- [DBMS_DBFS_CONTENT](#)
The `DBMS_DBFS_CONTENT` package provides an interface comprising a file system-like abstraction backed by one or more Store Providers.

Database URI TYPEs

Oracle supports the `UriType` family of types that can be used to store and query Uri-refs inside the database. The `UriType` itself is an abstract object type and the `HTTPURITYPE`, `XDBURITYPE` and `DBURITYPE` are subtypes of it.

You can create a `UriType` column and store instances of the `DBURITYPE`, `XDBURITYPE` or the `HTTPURITYPE` inside of it. You can also define your own subtypes of the `UriType` to handle different URL protocols.

Oracle also provides a `UriFactory` package that can be used as a factory method to automatically generate various instances of these `UriTypes` by scanning the prefix, such as `http://` or `/oradb`. You can also register your subtype and provide the prefix that you support. For instance, if you have written a subtype to handle the gopher protocol, you can register the prefix `gopher://` to be handled by your subtype. The `UriFactory` will then generate your subtype instance for any URL starting with that prefix.

This chapter contains the following topics:

- [Summary of URITYPE Supertype Subprograms](#)
- [Summary of HTTPURITYPE Subtype Subprograms](#)
- [Summary of DBURITYPE Subtype Subprograms](#)
- [Summary of XDBURITYPE Subtype Subprograms](#)
- [Summary of URIFACTORY Package Subprograms](#)

See Also:

- *Oracle XML DB Developer's Guide*

301.1 Summary of URITYPE Supertype Subprograms

The `UriType` is the abstract super type. It provides a standard set of functions to get the value pointed to by the URI. The actual implementation of the protocol must be defined by the subtypes of this type.

Instances of this type cannot be created directly. However, you can create columns of this type and store subtype instances in it, and also select from columns without knowing the instance of the URL stored.

Table 301-1 URITYPE Type Subprograms

Method	Description
GETBLOB	Returns the BLOB located at the address specified by the URL.

Table 301-1 (Cont.) URITYPE Type Subprograms

Method	Description
GETCLOB	Returns the CLOB located at the address specified by the URL.
GETCONTENTTYPE	Returns the URL, in escaped format, stored inside the UriType instance.
GETEXTERNALURL	Returns the URL, in escaped format, stored inside the UriType instance.
GETURL	Returns the URL, in non-escaped format, stored inside the UriType instance.
GETXML	Returns the XMLType located at the address specified by the URL.

301.1.1 UriType Supertype GETBLOB

This function returns the BLOB located at the address specified by the URL.

This function can be overridden in the subtype instances. The options are described below.

This function returns the BLOB located at the address specified by the URL.

Syntax

```
MEMBER FUNCTION getBlob()
    RETURN BLOB;
```

This function returns the BLOB located at the address specified by the URL and the content type.

Syntax

```
MEMBER FUNCTION getBlob(content OUT VARCHAR2)
    RETURN BLOB;
```

This function returns the BLOB located at the address specified by the URL in the specified character set.

Syntax

```
FUNCTION getBlob(csid IN NUMBER)
    RETURN BLOB;
```

Table 301-2 UriType Supertype GETBLOB Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.
csid	(IN)	Character set id of the document. Must be a valid Oracle id and greater than 0; otherwise returns an error

301.1.2 UriType Supertype GETCLOB

This function returns the CLOB located at the address specified by the URL.

This function can be overridden in the subtype instances. This function returns either a permanent CLOB or a temporary CLOB. If a temporary CLOB is returned, it must be freed. The options are described below.

This function returns the CLOB located at the address specified by the URL.

Syntax

```
MEMBER FUNCTION getClob()
  RETURN CLOB;
```

This function returns the CLOB located at the address specified by the URL and the content type.

Syntax

```
MEMBER FUNCTION getClob(content OUT VARCHAR2)
  RETURN CLOB;
```

Table 301-3 UriType Supertype GETCLOB Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.

301.1.3 UriType Supertype GETCONTENTTYPE

This function returns the content type of the document pointed to by the URI.

This function can be overridden in the subtype instances. This function returns the content type as VARCHAR2.

Syntax

```
MEMBER FUNCTION getContentType()
  RETURN VARCHAR2;
```

301.1.4 UriType Supertype GETEXTERNALURL

This function returns the URL, in escaped format, stored inside the UriType instance.

The subtype instances override this member function to provide additional semantics. For instance, the HTTPURITYPE function does not store the prefix `http://` in the URL itself. When generating the external URL, it appends the prefix and generates it. For this reason, use the `getExternalUrl` function or the `getUrl` function to get to the URL value instead of using the attribute present in the UriType instance.

Syntax

```
MEMBER FUNCTION getExternalUrl()
  RETURN varchar2;
```

301.1.5 UriType Supertype GETURL

This function returns the URL, in non-escaped format, stored inside the `UriType` instance.

The subtype instances override this member function to provide additional semantics. For instance, the `HTTPURITYPE` function does not store the prefix `http://` in the URL itself. When generating the external URL, it appends the prefix and generates it. For this reason, use the `getExternalUrl` function or the `getUrl` function to get to the URL value instead of using the attribute present in the `UriType` instance.

Syntax

```
MEMBER FUNCTION getUrl()  
RETURN varchar2;
```

301.1.6 UriType Supertype GETXML

This function returns the `XMLType` located at the address specified by the URL.

This function can be overridden in the subtype instances. The options are described below.

This function returns the `XMLType` located at the address specified by the URL.

Syntax

```
MEMBER FUNCTION getXML()  
RETURN XMLType;
```

This function returns the `XMLType` located at the address specified by the URL and the content type.

Syntax

```
MEMBER FUNCTION getXML(content OUT VARCHAR2)  
RETURN XMLType;
```

Table 301-4 UriType Supertype GETXML Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.

301.2 Summary of HTTPURITYPE Subtype Subprograms

The `HTTPURITYPE` is a subtype of the `UriType` that provides support for the HTTP protocol. This uses the `UTL_HTTP` package underneath to access the HTTP URLs. Proxy and secure wallets are not supported in this release.

Table 301-5 HTTPURITYPE Type Subprorgams

Method	Description
CREATEURI	Creates an instance of <code>HTTPURITYPE</code> from the given URI.
GETBLOB	Returns the <code>BLOB</code> located at the address specified by the URL.
GETCLOB	Returns the <code>CLOB</code> located at the address specified by the URL.
GETCONTENTTYPE	Returns the content type of the document pointed to by the URI.
GETEXTERNALURL	Returns the URL, in escaped format, stored inside the <code>UriType</code> instance.
GETURL	Returns the URL, in non-escaped format, stored inside the <code>UriType</code> instance.
GETXML	Returns the <code>XMLType</code> located at the address specified by the URL.
HTTPURITYPE	Creates an instance of <code>HTTPURITYPE</code> from the given URI.

301.2.1 HttpUriType Subtype CREATEURI

This static function constructs a `HTTPURITYPE` instance. The `HTTPURITYPE` instance does not contain the prefix `http://` in the stored URL.

Syntax

```
STATIC FUNCTION createUri(
    url IN varchar2)
RETURN HTTPURITYPE;
```

Table 301-6 HttpUriType Subtype CREATEURI Parameters

Parameter	IN / OUT	Description
<code>url</code>	(IN)	The URL string containing a valid HTTP URL; escaped format.

301.2.2 HttpUriType Subtype GETBLOB

This function returns the `BLOB` located at the address specified by the HTTP URL.

The subprograms of the URI Subtype `HTTPURITYPE` member subprogram `GETBLOB` are described below.

This function returns the `BLOB` located at the address specified by the HTTP URL.

Syntax

```
MEMBER FUNCTION getBlob()
RETURN BLOB;
```

This function returns the `BLOB` located at the address specified by the HTTP URL and the content type.

Syntax

```
MEMBER FUNCTION getBlob(content OUT VARCHAR2)
    RETURN BLOB;
```

This function returns the `BLOB` located at the address specified by the URL in the specified character set.

Syntax

```
FUNCTION getBlob(csid IN NUMBER)
    RETURN BLOB;
```

Table 301-7 HttpUriType Subtype GETBLOB Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.
csid	(IN)	Character set id of the document. Must be a valid Oracle id and greater than 0; otherwise returns an error.

301.2.3 HttpUriType Subtype GETCLOB

This function returns the `CLOB` located by the HTTP URL address. If a temporary `CLOB` is returned, it must be freed.

The subprograms of the URI Subtype HTTPURITYPE member subprogram GETCLOB are described below.

Returns the `CLOB` located at the address specified by the HTTP URL.

Syntax

```
MEMBER FUNCTION getClob()
    RETURN CLOB;
```

Returns the `CLOB` located at the address specified by the HTTP URL and the content type.

Syntax

```
MEMBER FUNCTION getClob(content OUT VARCHAR2)
    RETURN CLOB;
```

Table 301-8 HttpUriType Subtype GETCLOB Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.

301.2.4 HttpUriType Subtype GETCONTENTTYPE

This function returns the content type of the document pointed to by the URI.

Syntax

```
MEMBER FUNCTION getContentTypes()  
RETURN VARCHAR2;
```

301.2.5 HttpUriType Subtype GETEXTERNALURL

This function returns the URL, in escaped format, stored inside the HTTPURITYPE instance. The subtype instances override this member function.

The HTTPURITYPE function does not store the prefix `http://`, but generates it for the external URL.

Syntax

```
MEMBER FUNCTION getExternalUrl()  
RETURN varchar2;
```

301.2.6 HttpUriType Subtype GETURL

This function returns the URL, in non-escaped format, stored inside the HTTPURITYPE instance.

Syntax

```
MEMBER FUNCTION getUrl()  
RETURN varchar2;
```

301.2.7 HttpUriType Subtype GETXML

This function returns the XMLType located at the address specified by the URL. An error is thrown if the address does not point to a valid XML document.

The subprograms of the URI Subtype HttpUriType member subprogram GETXML are described below.

This function returns the XMLType located at the address specified by the URL.

Syntax

```
MEMBER FUNCTION getXML()  
RETURN XMLType;
```

This function returns the XMLType located at the address specified by the URL and the content type.

Syntax

```
MEMBER FUNCTION getXML(content OUT VARCHAR2)  
RETURN XMLType;
```

Table 301-9 HttpUriType Subtype GETXML Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.

301.2.8 HttpUriType Subtype HTTPURITYPE

This constructs a `HTTPURITYPE` instance. The `HTTPURITYPE` instance does not contain the prefix `http://` in the stored URL.

Syntax

```
CONSTRUCTOR FUNCTION HTTPURITYPE (
    url IN VARCHAR2);
```

Table 301-10 HttpUriType Subtype HTTPURITYPE Parameters

Parameter	IN / OUT	Description
url	(IN)	The URL string containing a valid HTTP URL. The URL string is expected in escaped format. For example, non-url characters are represented as the hexadecimal value for the UTF-8 encoding of those characters.

301.3 Summary of DBURITYPE Subtype Subprograms

The `DBURITYPE` is a subtype of the `UriType` that provides support for `DBUri-refs`. A `DBUri-ref` is an intra-database URL that can be used to reference any row or row-column data in the database.

The URL is specified as an XPath expression over a XML visualization of the database. The schemas become elements which contain tables and views. These tables and views further contain the rows and columns inside them.

Table 301-11 DBURITYPE Type Subprograms

Method	Description
CREATEURI	Constructs a <code>DBURITYPE</code> instance.
DBURITYPE	Creates an instance of <code>DBURITYPE</code> from the given URI.
GETBLOB	Returns the <code>BLOB</code> located at the address specified by the <code>DBURITYPE</code> instance.
GETCLOB	Returns the <code>CLOB</code> located at the address specified by the <code>DBURITYPE</code> instance.
GETCONTENTTYPE	Returns the content type of the document pointed to by the URI.
GETEXTERNALURL	Returns the URL, in escaped format, stored inside the <code>DBURITYPE</code> instance.
GETURL	Returns the URL, in non-escaped format, stored inside the <code>DBURITYPE</code> instance.

Table 301-11 (Cont.) DBURITYPE Type Subprograms

Method	Description
GETXML	Returns the <code>XMLType</code> located at the address specified by the URL

301.3.1 DBUriType Subtype CREATEURI

This static function constructs a `DBURITYPE` instance. Parses the URL given and creates a `DBURITYPE` instance.

Syntax

```
STATIC FUNCTION createUri(
    url IN varchar2)
RETURN DBURITYPE;
```

Table 301-12 DBUriType Subtype CREATEURI Parameters

Parameter	IN / OUT	Description
<code>url</code>	(IN)	The URL string, in escaped format, containing a valid <code>DBURITYPE</code> .

301.3.2 DBUriType Subtype DBURITYPE

This constructs a `DBURITYPE` instance.

Syntax

```
CONSTRUCTOR FUNCTION DBURITYPE(
    url IN varchar2);
```

Table 301-13 DBUriType Subtype DBURITYPE Parameters

Parameter	IN / OUT	Description
<code>url</code>	(IN)	The URL string containing a valid <code>DBURITYPE</code> . The URL string is expected in escaped format. For example, non-URL characters are represented as the hexadecimal value for the UTF-8 encoding of those characters.

301.3.3 DBUriType Subtype GETBLOB

This function returns the `BLOB` located at the address specified by the URL.

The subprograms of the URI Subtype `DBURITYPE` member subprogram `GETBLOB` are described below. The options are described in the following table.

This function returns the `BLOB` located at the address specified by the URL.

Syntax

```
MEMBER FUNCTION getBlob()
    RETURN BLOB;
```

This function returns the `BLOB` located at the address specified by the URL and the content type.

Syntax

```
MEMBER FUNCTION getBlob(content OUT VARCHAR2)
    RETURN BLOB;
```

This function returns the `BLOB` located at the address specified by the URL in the specified character set.

Syntax

```
FUNCTION getBlob(csid IN NUMBER)
    RETURN BLOB;
```

Table 301-14 DBUriType Subtype GETBLOB Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.
csid	(IN)	Character set id of the document. Must be a valid Oracle id and greater than 0; otherwise returns an error.

301.3.4 DBUriType Subtype GETCLOB

This function returns the `CLOB` located at the address specified by the `DBURITYPE` instance.

If a temporary `CLOB` is returned, it must be freed. The document returned may be an XML document or a text document. When the `DBUri-ref` identifies an element in the XPath, the result is a well-formed XML document. On the other hand, if it identifies a text node, then what is returned is only the text content of the column or attribute. The options are described below.

The following function returns the `CLOB` located at the address specified by the `DBURITYPE` instance.

Syntax

```
MEMBER FUNCTION getClob()
    RETURN CLOB;
```

The following function returns the `CLOB` located at the address specified by the `DBURITYPE` instance and the content type.

Syntax

```
MEMBER FUNCTION getClob(content OUT VARCHAR2)
    RETURN CLOB;
```

Table 301-15 DBUriType Subtype GETCLOB Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.

301.3.5 DBUriType Subtype GETCONTENTTYPE

This function returns the content type of the document pointed to by the URI.

Syntax

```
MEMBER FUNCTION getContentType()  
RETURN VARCHAR2;
```

301.3.6 DBUriType Subtype GETEXTERNALURL

This function returns the URL, in escaped format, stored inside the `DBURITYPE` instance. The `DBUri` servlet URL that processes the `DBURITYPE` has to be appended before using the escaped URL in Web pages.

Syntax

```
MEMBER FUNCTION getExternalUrl()  
RETURN varchar2;
```

301.3.7 DBUriType Subtype GETURL

This function returns the URL, in non-escaped format, stored inside the `DBURITYPE` instance.

Syntax

```
MEMBER FUNCTION getUrl()  
RETURN varchar2;
```

301.3.8 DBUriType Subtype GETXML

This function returns the `XMLType` located at the address specified by the URL.

The subprograms of the URI Subtype `DBPURITYPE` member subprogram `GETXML` are described below. The options are described in the following table.

This function returns the `XMLType` located at the address specified by the URL.

Syntax

```
MEMBER FUNCTION getXML()  
RETURN XMLType;
```

This function returns the `XMLType` located at the address specified by the URL and the content type.

Syntax

```
MEMBER FUNCTION getXML(content OUT VARCHAR2)
  RETURN XMLType;
```

Table 301-16 DBUriType Subtype GETXML Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.

301.4 Summary of XDBURITYPE Subtype Subprograms

XDBURITYPE is a new subtype of URITYPE. It provides a way to expose documents in the Oracle XML DB hierarchy as URIs that can be embedded in any URITYPE column in a table.

The URL part of the URI is the hierarchical name of the XML document it refers to. The optional fragment part uses the XPath syntax, and is separated from the URL part by '#'. The more general XPointer syntax for specifying a fragment is not currently supported.

Table 301-17 XDBURITYPE Type Subprograms

Method	Description
CREATEURI	Returns the <code>UriType</code> corresponding to the specified URL.
GETBLOB	Returns the <code>BLOB</code> corresponding to the contents of the document specified by the <code>XDBURITYPE</code> instance.
GETCLOB	Returns the <code>CLOB</code> corresponding to the contents of the document specified by the <code>XDBURITYPE</code> instance.
GETCONTENTTYPE	Returns the content type of the document pointed to by the URI.
GETEXTERNALURL	Returns the URL, in escaped format, stored inside the <code>XDBURITYPE</code> instance.
GETURL	Returns the URL, in non-escaped format, stored inside the <code>XDBURITYPE</code> instance.
GETXML	Returns the <code>XMLType</code> corresponding to the contents of the document specified by the URL.
XDBURITYPE	Creates an instance of <code>XDBURITYPE</code> from the given URI.

301.4.1 XDBUriType Subtype CREATEURI

This static function constructs a `XDBURITYPE` instance. It parses the given URL and creates a `XDBURITYPE` instance.

Syntax

```
STATIC FUNCTION createUri(
  url IN varchar2)
  RETURN XDBURITYPE
```


Parameter	IN / OUT	Description
url	(IN)	The URL string, in escaped format, containing a valid XDBURITYPE.

301.4.2 XDBUriType Subtype GETBLOB

This function returns the BLOB located at the address specified by the XDBURITYPE instance.

The subprograms of the URI Subtype XDBURITYPE member subprogram GETBLOB are described below. The options are described in the following table.

This function returns the BLOB located at the address specified by the URL.

Syntax

```
MEMBER FUNCTION getBlob()
  RETURN BLOB;
```

This function returns the BLOB located at the address specified by the URL and the content type.

Syntax

```
MEMBER FUNCTION getBlob(content OUT VARCHAR2)
  RETURN BLOB;
```

This function returns the BLOB located at the address specified by the URL in the specified character set.

Syntax

```
FUNCTION getBlob(csId IN NUMBER)
  RETURN BLOB;
```

Table 301-18 XDBUriType Subtype GETBLOB Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.
csid	(IN)	Character set id of the document. Must be a valid Oracle id and greater than 0; otherwise returns an error.

301.4.3 XDBUriType Subtype GETCLOB

This function returns the CLOB located at the address specified by the XDBURITYPE instance. If a temporary CLOB is returned, it must be freed.

The subprograms of the URI Subtype XDBURITYPE member subprogram GETCLOB are described below. The options are described in the following table.

Returns the CLOB located at the address specified by the XDBUriType instance.

Syntax

```
MEMBER FUNCTION getClob()
  RETURN CLOB;
```

Returns the `CLOB` located at the address specified by the `XDBUriType` instance and the content type.

Syntax

```
MEMBER FUNCTION getClob(content OUT VARCHAR2)
  RETURN CLOB;
```

Table 301-19 XDBUriType Subtype GETCLOB Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.

301.4.4 XDBUriType Subtype GETCONTENTTYPE

This function returns the content type of the document pointed to by the URI. This function returns the content type as `VARCHAR2`.

Syntax

```
MEMBER FUNCTION getContentType()
  RETURN VARCHAR2;
```

301.4.5 XDBUriType Subtype GETEXTERNALURL

This function returns the URL, in escaped format, stored inside the `XDBURITYPE` instance.

Syntax

```
MEMBER FUNCTION getExternalUrl()
  RETURN varchar2;
```

301.4.6 XDBUriType Subtype GETURL

This function returns the URL, in non-escaped format, stored inside the `XDBURITYPE` instance.

Syntax

```
MEMBER FUNCTION getUrl()
  RETURN varchar2;
```

301.4.7 XDBUriType Subtype GETXML

This function returns the `XMLType` located at the address specified by the URL.

The subprograms of the URI Subtype `XDBURITYPE` member subprogram `GETXML` are described below. The options are described in the following table.

This function returns the `XMLType` located at the address specified by the URL.

Syntax

```
MEMBER FUNCTION getXML()
  RETURN XMLType;
```

This function returns the XMLType located at the address specified by the URL and the content type.

Syntax

```
MEMBER FUNCTION getXML(content OUT VARCHAR2)
  RETURN XMLType;
```

Table 301-20 XDBUriType Subtype GETXML Parameters

Parameter	IN / OUT	Description
content	(OUT)	Content type of the document to which URI is pointing.

301.4.8 XDBUriType subtype XDBURITYPE

This constructs a XDBURITYPE instance.

Syntax

```
CONSTRUCTOR FUNCTION XDBURITYPE(
  url      IN  VARCHAR2,
  flags    IN  RAW := NULL)
  RETURN self AS RESULT;
```

Table 301-21 XDBUriType subtype XDBURITYPE Parameters

Parameter	IN / OUT	Description
url	(IN)	The URL string containing a valid XDBUriType. The URL string is expected in escaped format. For example, non-URL characters are represented as the hexadecimal value for the UTF-8 encoding of those characters.
flags	(IN)	Possible values are: <ul style="list-style-type: none"> • 1 - Expand all XInclude elements before returning the result contents. If any XInclude element cannot be successfully resolved according to the XInclude fallback semantics, then an error is raised. • 2 - Indicates that any errors during document retrieval should be suppressed • 3 - Both flag bits (1, 2) are enabled

301.5 Summary of URIFACTORY Package Subprograms

The `UriFactory` package contains factory methods that can be used to generate the appropriate instance of the URI types without having to hard code the implementation in the program.

The `UriFactory` package also provides the ability to register new subtypes of the `UriType` to handle various other protocols. For example, you can invent a new protocol `ecom://` and define a subtype of the `UriType` to handle that protocol and register it with `UriFactory`. After that any factory method would generate the new subtype instance if it sees the `ecom://` prefix.

Table 301-22 URIFACTORY Type Subprograms

Method	Description
GETURI	Returns the correct URL handler for the given URL string.
ESCAPEURI	Returns a URL in escaped format.
UNESCAPEURI	Returns a URL in unescaped format.
REGISTERURLHANDLER	Registers a particular type name for handling a particular URL.
UNREGISTERURLHANDLER	Unregisters a URL handler.

301.5.1 UriFactory Package GETURI

This factory method returns the correct URI handler for the given URI string.

It returns a subtype instance of the `UriType` that can handle the protocol. By default, it always creates an `XDBURITYPE` instance, if it cannot resolve the URL. A URL handler can be registered for a particular prefix using the [REGISTERURLHANDLER](#) function. If the prefix matches, [GETURI](#) would then use that subtype.

Syntax

```
FUNCTION getUri(
    url IN Varchar2)
RETURN UriType;
```

Table 301-23 UriFactory Package GETURI Parameters

Parameter	IN / OUT	Description
<code>uri</code>	(IN)	The URL string, in escaped format, containing a valid HTTP URL.

301.5.2 UriFactory Package ESCAPEURI

This function returns a URL in escaped format.

The subtype instances override this member function to provide additional semantics. For instance, the `HTTPURITYPE` does not store the prefix `http://` in the URL itself. When generating the external URL, it appends the prefix and generates it. For this

reason, use the [GETEXTERNALURL](#) function or the [GETURI](#) function to get to the URL value instead of using the attribute present in the `UriType`.

Syntax

```
MEMBER FUNCTION escapeUri()
RETURN varchar2;
```

Table 301-24 UriFactory Package ESCAPEURI Parameters

Parameter	IN / OUT	Description
<code>url</code>	(IN)	The URL string to be returned in escaped format.

301.5.3 UriFactory Package UNESCAPEURI

This function returns a URL in unescaped format.

This function is the reverse of the [ESCAPEURI](#) function. This function scans the string and converts any non-URL hexadecimal characters into the equivalent UTF-8 characters. Since the return type is a `VARCHAR2`, the characters would be converted into the equivalent characters as defined by the database character set.

Syntax

```
FUNCTION unescapeUri()
RETURN varchar2;
```

Table 301-25 UriFactory Package UNESCAPEURI Parameters

Parameter	IN / OUT	Description
<code>url</code>	(IN)	The URL string to be returned in unescaped format.

301.5.4 UriFactory Package REGISTERURLHANDLER

This package registers a particular type name for handling a particular URL.

The type specified must be valid and must be a subtype of the `UriType` or one of its subtypes. It must also implement the `createUri` static member function. This function is called by the [GETURI](#) function to generate an instance of the type. The `striprefix` parameter indicates that the prefix must be stripped off before calling this function.

Syntax

```
PROCEDURE registerUrlHandler(
    prefix IN varchar2,
    schemaName IN varchar2,
    typename IN varchar2,
    ignoreCase IN boolean := true,
    striprefix IN boolean := true);
```

Table 301-26 UriFactory Package REGISTERURLHANDLER Parameters

Parameter	IN / OUT	Description
prefix	(IN)	The prefix to handle; for example, <code>http://</code> .
schemaName	(IN)	Name of the schema where the type resides; case sensitive.
typename	(IN)	The name of the type to handle the URL; case sensitive.
ignoreCase	(IN)	Ignore case when matching prefixes.
stripprefix	(IN)	Strip prefix before generating the instance of the type.

301.5.5 UriFactory Package UNREGISTERURLHANDLER

This procedure unregisters a URL handler. This only unregisters user registered handler prefixes and not predefined system prefixes such as `http://`.

Syntax

```
PROCEDURE unregisterUrlHandler(
    prefix IN VARCHAR2);
```

Table 301-27 UriFactory Package UNREGISTERURLHANDLER Parameters

Parameter	IN / OUT	Description
prefix	(IN)	The prefix to be unregistered.

JMS Types

PL/SQL users can use the `DBMS_AQ` package to enqueue and dequeue messages from JMS queues.

The JMS types member and static functions and procedures in this chapter are needed to populate JMS messages for enqueueing or to interpret a dequeued JMS message.

This chapter contains these topics:

- [Overview](#)
- [Security Model](#)
- [Java Versus PL/SQL Datatypes](#)
- [More on Bytes_ Stream and Map Messages](#)
- [Upcasting and Downcasting Between General and Specific Messages](#)
- [JMS Types Error Reporting](#)
- [Oracle JMS Type Constants](#)
- [JMS Types Error Reporting](#)
- [Oracle JMS Type Constants](#)
- [CONVERT_JMS_SELECTOR](#)
- [Summary of JMS Types](#)

302.1 JMS Types Overview

Java Message Service (JMS) is a well known public standard interface for accessing messaging systems. Oracle JMS (OJMS) implements JMS based on Oracle Advanced Queuing (AQ) and a relational database system (RDBMS). Messages are stored in queues as OJMS specific ADTs. Java clients use OJMS packages to enqueue, dequeue, and manipulate these messages.

PL/SQL users, on the other hand, use the `DBMS_AQ` package to enqueue and dequeue JMS messages and the member functions in this chapter to populate and interpret them. Oracle Database Advanced Queuing offers such member functions for the following JMS ADTs:

- `aq$_jms_header`
- `aq$_jms_message`
- `aq$_jms_text_message`
- `aq$_jms_bytes_message`
- `aq$_jms_map_message`
- `aq$_jms_stream_message`

In addition to these populating and interpreting member functions, Oracle Database Advanced Queuing offers:

- Casting between `aq$_jms_message` and other message ADTs.
- PL/SQL stored procedures for converting JMS selectors to equivalent Oracle Database Advanced Queuing rules

302.2 JMS Types Security Model

`PUBLIC` is granted `EXECUTE` privilege in these JMS types.

- `SYS.AQ$_JMS_MESSAGE` Type
- `SYS.AQ$_JMS_TEXT_MESSAGE` Type
- `SYS.AQ$_JMS_BYTES_MESSAGE` Type
- `SYS.AQ$_JMS_MAP_MESSAGE` Type
- `SYS.AQ$_JMS_STREAM_MESSAGE` Type
- `SYS.AQ$_JMS_OBJECT_MESSAGE` Type
- `SYS.AQ$_JMS_NAMEARRAY` Type
- `SYS.AQ$_JMS_VALUE` Type
- `SYS.AQ$_JMS_EXCEPTION` Type

302.3 Java Versus PL/SQL Datatypes

Datatypes do not map one-to-one between PL/SQL and Java.

Some Java types, such as `BYTE` and `SHORT`, are not present in PL/SQL. PL/SQL type `INT` was chosen to represent these types. If a PL/SQL `INT` value intended to hold a Java `BYTE` or `SHORT` value exceeds the corresponding range Java enforces, an out-of-range error is thrown.

Other Java types have more than one counterpart in PL/SQL with different capabilities. A Java String can be represented by both `VARCHAR2` and `CLOB`, but `VARCHAR2` has a maximum limit of 4000 bytes. When retrieving `TEXT` data from map, stream, and bytes message types, a `CLOB` is always returned. When updating the map, stream and bytes message types, users can submit either a `VARCHAR2` or `CLOB`.

Similarly, a Java `BYTE ARRAY` can be represented by both `RAW` and `BLOB`, with `RAW` having a maximum size of 32767. When retrieving `BYTE ARRAY` data from map, stream, and bytes message types, a `BLOB` is always returned. When updating the map, stream and bytes message types, users can submit either a `RAW` or `BLOB`.



See Also:

JMS specification 3.11.3, Conversion Provided by `StreamMessage` and `MapMessage`

New JMS Support in Oracle Database 10g

In Oracle Database 10g, a new `AQ$_JMS_VALUE` ADT has been added in the `SYS` schema for OJMS PL/SQL users. It is specifically used to implement the `read_object`

procedure of `aq$_jms_stream_message` and `get_object` procedure of `aq$_jms_map_message`, to mimic the Java general object class `Object`. `AQ$_JMS_VALUE` ADT can represent any datatype that JMS `StreamMessage` and `MapMessage` can hold.

The collection ADT `AQ$_JMS_NAMEARRAY` was added for the `getNames` method of `MapMessage`. It holds an array of names.

In this release the ADT `AQ$_JMS_EXCEPTION` was added to represent a Java exception thrown in an OJMS JAVA stored procedure on the PL/SQL side. Now you can retrieve a Java exception thrown by an OJMS stored procedure and analyze it on the PL/SQL side.

302.4 More on Bytes, Stream and Map Messages

Oracle uses Java stored procedure to implement some of the procedures of `AQ$_MAP_MESSAGE`, `AQ$_JMS_STREAM_MESSAGE`, and `AQ$_JMS_BYTES_MESSAGE` types. These types have some common functionality that are different from `AQ$_JMS_TEXT_MESSAGE` type. This section discusses this common functionality.

This section contains these topics:

- Using Java Stored Procedures to Encode and Decode Oracle Database Advanced Queuing Messages
- Initialize the `Jserv` Static Variable
- Get the Payload Data Back to PL/SQL
- Garbage Collect the Static Variable
- Use a Message Store: A Static Variable Collection
- Typical Calling Sequences
- Read-Only and Write-Only Modes Enforced for Stream and Bytes Messages
- Differences Between Bytes and Stream Messages
- Getting and Setting Bytes, Map, and Stream Messages as RAW Bytes

Using Java Stored Procedures to Encode and Decode Oracle Database Advanced Queuing Messages

The major difference between map, stream, bytes, and other messages is that the message payload is encoded as a byte stream by JAVA. Retrieving and updating these payloads in PL/SQL therefore requires Oracle JAVA stored procedures.

A message payload is stored in two places during processing. On the PL/SQL side it is stored as the data members of a JMS message ADT, and on the `Jserv` side it is stored as a static variable. (`Jserv` is the JVM inside Oracle Database.) When the payload is processed, the payload data is first transformed to a static variable on the `Jserv` side. Once the static variable is initialized, all later updates on the message payload are performed on this static variable. At the end of processing, payload data is flushed back to the PL/SQL side.

Oracle provides member procedures that maintain the status of the `Jserv` static variable and enforce rules when calling these member procedures. These procedures are in the following ADTs:

- `aq$_jms_bytes_message`
- `aq$_jms_map_message`

- `aq$_jms_stream_message`

Initialize the Jserv Static Variable

Before you make any other calls to manipulate the payload data, the Jserv static variable must be properly initialized. This is done by calling the `prepare` or `clear_body` procedure. The `prepare` procedure uses the payload data in PL/SQL ADTs to initialize the static variable, while `clear_body` initializes the static variable to an empty payload (empty hashtable or stream).

Note:

It is important to call the `prepare` or `clear_body` procedure before any other calls to properly initialize the Jserv static variables. Usually these two methods are called once at the beginning. But they can be called multiple times for one message. Any call of these two methods without first calling the `flush` procedure wipes out all updates made to the messages.

Get the Payload Data Back to PL/SQL

Calling the `flush` procedure synchronizes changes made to the Jserv static variable back to the PL/SQL ADTs. The `flush` call is required when you want the changes made to be reflected in the ADT payload. It is important to synchronize the changes back to the ADT, because it is the ADT payload that matters.

Garbage Collect the Static Variable

The `clean` procedure forces garbage collection of the static variable. It is there to do cleanup and free JVM memory. You can avoid memory leaks by doing it immediately after finishing processing the message.

Use a Message Store: A Static Variable Collection

Instead of a single static variable, Oracle uses a collection of static variables to process the message payload on the Jserv side. This collection is called the message store. Each map, bytes, or stream message type has its own message store within one session.

Oracle uses the operation ID parameter to locate the correct static variable to work on within the message store. Initialization calls such as `prepare` and `clear_body` give users an operation ID, which is used in later message access.

After users complete message processing, they must call the `clean` procedure with the operation ID to clean up the message store. This avoids possible memory leaks. The `clean_all` static procedures of message ADTs `aq$_jms_bytes_message`, `aq$_jms_map_message`, and `aq$_jms_stream_message` clean up all static variables of their corresponding message stores.

Typical Calling Sequences

This section describes typical procedures for retrieving and populating messages.

Here is a typical procedure for retrieving messages

1. Call `prepare` for a message.

This call also gives you an operation ID if you do not specify one.

2. Call multiple retrieving procedures with the provided operation ID.
3. Call the `clean` procedure with the provided operation ID.

Here is a typical procedure for populating messages:

1. Call `clear_body` for a message.

For `aq$_jms_map_message`, you can also call `prepare` to update the message based on the existing payload. This call also gives you an operation ID if you do not specify one.

2. Call multiple updating procedures with the provided operation ID.
3. Call the `flush` method with the provided operation ID.
4. Call the `clean` procedure with the provided operation ID.

Read-Only and Write-Only Modes Enforced for Stream and Bytes Messages

According to the JMS specification, when a message is received, its body is read-only. Users can call the `clear_body` method to make the body writable. This method erases the current message body and sets the message body to be empty.

The OJMS JAVA API follows the rule set by JMS specification. In updating the JMS message ADTs in PL/SQL, however, Oracle enforces the rule selectively:

- Map messages

The restriction is relaxed, because adding more entries on top of a existing map payload is a convenient way for users to update the payload. Therefore there are no read-only or write-only modes for map messages.

- Stream and bytes messages

The restriction is not relaxed, because these payloads use a stream when reading and writing data. It is difficult to update the payload while in the middle of a stream. Oracle enforces read-only and write-only modes in processing stream and bytes message payloads. Calling the `prepare` procedure initializes the message payload in read-only mode. Calling the `clear_body` procedure initializes the message payload in write-only mode.

Calling the `reset` procedure resets the pointer to the beginning of the stream and switches the mode from write-only to read-only. The `reset` procedure keeps the updates made to the message payload in the `Jserv` static variable.

The `prepare` procedure, on the other hand, overwrites the message payload in the `Jserv` static variable with the payload in the PL/SQL ADT.

Oracle provides member function `get_mode` for users to query the mode.

Differences Between Bytes and Stream Messages

Member functions of bytes messages are not exactly the same as those of stream messages. Stream messages are encoded using `Java ObjectOutputStream` and bytes messages are encoded using `Java DataOutputStream`. In stream messages each primitive type is written and read as a Java Object, but in a bytes message they are written and read as raw bytes according to the encoding mechanism of `DataOutputStream`.

For stream messages, the `read_bytes` method works on a stream of bytes to the end of the byte array field written by the corresponding `write_bytes` method. The `read_bytes` method

of bytes message works on a stream of bytes to the end of the whole byte stream. This is why the `read_bytes` member procedure of `aq$_bytes_message` also requires a `length` parameter to tell how long it is to read.

You will not see a type conversion error raised by bytes message, because bytes messages do not support type conversion.

Methods `get_unsigned_byte` and `get_unsigned_short` are available for bytes messages, but not for stream messages. This is because stream messages read Java objects, and there are no Java objects as unsigned bytes or unsigned shorts.

Methods `read_string` and `write_string` methods are not available for bytes messages. The bytes message ADT must enforce some character encoding. It has methods `read_utf` and `write_utf` which support utf-8 encoding.

Note:

All data written by bytes messages use `DataOutputStream` as the basis. See JDK API documentation JavaSoft.com for details on how the data is encoded into bytes.

Getting and Setting Bytes, Map, and Stream Messages as RAW Bytes

The payloads of bytes, map, and stream message types are stored as either `RAW` or `BLOB` in the database. In this release Oracle Database Advanced Queuing provides the following member functions to set and get these payloads as raw bytes without interpreting them:

```
set_bytes(payload IN BLOB)
set_bytes(payload IN RAW)
get_bytes(payload OUT BLOB)
get_bytes(payload OUT RAW)
```

These functions were provided for bytes messages in Oracle9i Release 2 (9.2).

302.5 Upcasting and Downcasting Between General and Specific Messages

OJMS ADT `aq$_jms_message` is used to represent a general message, so that different types of messages can reside on the same Oracle Database Advanced Queuing queue. Oracle Database Advanced Queuing supports retrieving and populating of `aq$_jms_message` by supporting upcasting and downcasting between this ADT and ADTs of specific message types.

To read an `aq$_jms_message`, you must first downcast it to a specific message type according to its `message_type` field

To populate an `aq$_jms_message`, you must first populate a specific message and upcast it to `aq$_jms_message`. This avoids copying all member functions of other specific message ADTs to this ADT. It also guarantees that the manipulation of this ADT is consistent with other specific message ADTs.

302.6 JMS Types Error Reporting

This table lists Oracle JMS types related errors.

Table 302-1 Oracle JMS Types Errors

ORA error number	dbms_jms_plsql package constants	Explanation
ORA-24190	ERROR_DATA_OVERFLOW	The payload data exceeds the size that an out parameter can hold. For example, the <code>get_text</code> procedure with a <code>VARCHAR2</code> parameter of <code>aq\$_jms_text_message</code> or <code>get_bytes</code> procedure with a <code>RAW</code> parameter of <code>aq\$_jms_bytes_message</code> .
ORA-24191	ERROR_PROP_NAME_EXIST	Setting a property that is previous set
ORA-24192	ERROR_PROP_NAME_NULL	Occurs when setting a property with null property name.
ORA-24193	ERROR_EXCEED_RANGE	PL/SQL number type exceeds the valid range of the respective Java type. For example <code>set_byte_property</code> , <code>set_short_property</code> of <code>aq\$_jms_head</code> ADT; <code>set_byte</code> and <code>set_short</code> of <code>aq\$_jms_map_message</code> ADT; <code>write_byte</code> and <code>write_short</code> of <code>aq\$_jms_stream_message</code> and <code>aq\$_jms_bytes_message</code> ADT.
ORA-24194	ERROR_TYPE_MISMATCH	The type conversion between the Java type of the retrieving method and the Java type of a field of the payload is not valid.
ORA-24195	ERROR_MAP_TOO_LARGE	The size of the map exceeds the <code>aq\$_jms_namearray</code> ADT capacity. The current size limit is 1024. You can use the <code>get_names</code> function with <code>offset</code> and <code>length</code> parameters to retrieve the name array in multiple small chunks.
ORA-24196	ERROR_WRONG_MODE	The message payload is being accessed with a wrong access mode. For example, trying to read a message payload with write-only mode or trying to write a message payload with the read-only mode.
ORA-24197	ERROR_JAVA_EXCEPTION	ORA-24197 error is raised when a Java exception is raised that does not fit in any of the other error categories. You can use the <code>get_exception</code> static procedure of <code>aq\$_jms_map_message</code> , <code>aq\$_jms_bytes_message</code> , and <code>aq\$_jms_stream_message</code> to retrieve the exception information last thrown by the Java stored procedure. A single static variable is used to store the last exception and is overwritten if another exception is thrown before you retrieve it. A new ADT <code>aq\$_jms_exception</code> is created to represent the exception information on the PL/SQL side.
ORA-24198	ERROR_INVALID_ID	An invalid operation ID is being provided to access a message.
ORA-24199	ERROR_STORE_OVERFLOW	The number of messages (with the same type) that users are trying to manipulate exceeds the size of the message store on the Java stored procedure side. The current size of the store is 20. It unusual to need to manipulate more than 20 messages at the same time. A common mistake is to forget to call the <code>clean</code> procedure after using one message. The <code>clean</code> procedure frees the message slot for use by other messages attempting access.

302.7 Oracle JMS Type Constants

These constants can be useful when dealing with message type functions.

DBMS_AQ Package Constants

DBMS_AQ package constants specify different types of JMS messages. They are useful when dealing with general message types during upcasting and downcasting or constructing a general message with a specific message type:

```
JMS_TEXT_MESSAGE      CONSTANT BINARY_INTEGER;
JMS_BYTES_MESSAGE     CONSTANT BINARY_INTEGER;
JMS_STREAM_MESSAGE    CONSTANT BINARY_INTEGER;
JMS_MAP_MESSAGE       CONSTANT BINARY_INTEGER;
JMS_OBJECT_MESSAGE    CONSTANT BINARY_INTEGER;
```

SYS.DBMS_JMS_PLSQL Package Constants

SYS.DBMS_JMS_PLSQL package constants are new in Oracle Database 10g.

These constants specify the mode of message payload. They are useful when interpreting the mode of the message payload returned from the `get_mode` function:

```
MESSAGE_ACCESS_READONLY  CONSTANT PLS_INTEGER;
MESSAGE_ACCESS_WRITEONLY CONSTANT PLS_INTEGER;
```

These constants specify the ADT type of an Oracle Database Advanced Queuing queue. They are useful during the conversion of JMS selectors to Oracle Database Advanced Queuing rules:

```
DESTPLOAD_JMSTYPE  CONSTANT PLS_INTEGER;
DESTPLOAD_USERADT  CONSTANT PLS_INTEGER;
DESTPLOAD_ANYDATA  CONSTANT PLS_INTEGER;
```

These constants specify the type of data that can be held by a `aq$_jms_value` type. They are useful when interpreting the `aq$_jms_value` returned by the `get_object` method of `AQ$_JMS_MAP_MESSAGE` or `read_object` method of `AQ$_JMS_STREAM_MESSAGE`:

```
DATA_TYPE_BYTE          CONSTANT PLS_INTEGER;
DATA_TYPE_SHORT         CONSTANT PLS_INTEGER;
DATA_TYPE_INTEGER       CONSTANT PLS_INTEGER;
DATA_TYPE_LONG          CONSTANT PLS_INTEGER;
DATA_TYPE_FLOAT         CONSTANT PLS_INTEGER;
DATA_TYPE_DOUBLE        CONSTANT PLS_INTEGER;
DATA_TYPE_BOOLEAN       CONSTANT PLS_INTEGER;
DATA_TYPE_CHARACTER     CONSTANT PLS_INTEGER;
DATA_TYPE_STRING        CONSTANT PLS_INTEGER;
DATA_TYPE_BYTES         CONSTANT PLS_INTEGER;
DATA_TYPE_UNSIGNED_BYTE CONSTANT PLS_INTEGER;
DATA_TYPE_UNSIGNED_SHORT CONSTANT PLS_INTEGER;
```

These constants specify the error number of the ORA errors that can be raised by the functions of message type ADTs. They are useful in user error handlers:

```
ERROR_DATA_OVERFLOW     CONSTANT PLS_INTEGER := -24190;
ERROR_PROP_NAME_EXIST  CONSTANT PLS_INTEGER := -24191;
ERROR_PROP_NAME_NULL   CONSTANT PLS_INTEGER := -24192;
ERROR_EXCEED_RANGE     CONSTANT PLS_INTEGER := -24193;
ERROR_TYPE_MISMATCH    CONSTANT PLS_INTEGER := -24194;
```

```
ERROR_MAP_TOO_LARGE    CONSTANT PLS_INTEGER := -24195;
ERROR_WRONG_MODE       CONSTANT PLS_INTEGER := -24196;
ERROR_JAVA_EXCEPTION   CONSTANT PLS_INTEGER := -24197;
ERROR_INVALID_ID       CONSTANT PLS_INTEGER := -24198;
ERROR_STORE_OVERFLOW   CONSTANT PLS_INTEGER := -24199;
```

302.8 CONVERT_JMS_SELECTOR

Oracle Database includes three stored procedures to help users convert JMS selectors into Oracle Database Advanced Queuing rules. These rules can be used in `ADD_SUBSCRIBER` operations as subscriber rules or in `DEQUEUE` operations as dequeue conditions. These procedures are in the `SYS.dbms_jms_plsql` package.

Convert with Minimal Specification

The first procedure assumes the destination payload type is one of the JMS ADTs whose corresponding constant is `dbms_jms_plsql.DESTLOAD_JMSTYPE` and also assumes that the J2EE compliant mode is true.

Syntax

```
Function convert_jms_selector(selector IN VARCHAR2) RETURN VARCHAR2
```

Returns

The converted Oracle Database Advanced Queuing rule or null if there is any conversion error.

Exceptions

ORA-24197 if the Java stored procedure throws an exception during execution.

Convert with Destination Payload Type Specified

The second procedure takes one more parameter: `dest_pload_type`. The conversion of a JMS selector to an Oracle Database Advanced Queuing rule happens only if this parameter is `SYS.dbms_jms_plsql.DESTLOAD_JMSTYPE` or `SYS.dbms_jms_plsql.DESTLOAD_ANYDATA`. The function returns exactly the same `VARCHAR2` value as the selector parameter if the `dest_pload_type` parameter is `SYS.dbms_jms_plsql.DESTLOAD_USERADT`. The function returns null if `dest_pload_type` parameter is none of these three constants.

This function assumes that the J2EE compliant mode is true.

Syntax

```
Function convert_jms_selector(
    selector IN VARCHAR2,
    dest_pload_type IN PLS_INTEGER)
RETURN VARCHAR2
```

Returns

The converted Oracle Database Advanced Queuing rule or null if there is any conversion error.

Exceptions

ORA-24197 if the Java stored procedure throws an exception during execution.

Convert with Destination Payload Type and Compliant Mode Specified

The third procedure takes a `dest_pload_type` parameter and a `compliant` parameter. The conversion of a JMS selector to an Oracle Database Advanced Queuing rule happens only if the `dest_pload_type` parameter is

`SYS.dbms_jms_plsql.DESTPLOAD_JMSTYPE` or `SYS.dbms_jms_plsql.DESTPLOAD_ANYDATA`. The function returns exactly the same `VARCHAR2` value as the selector parameter if the `dest_pload_type` parameter is `SYS.dbms_jms_plsql.DESTPLOAD_USERADT`. The function returns null if the `dest_pload_type` parameter is none of these three constants.

The `compliant` parameter controls if the conversion is in J2EE compliant mode or not. The noncompliant conversion of a JMS selector is for backward compatibility.

Syntax

```
Function convert_jms_selector(  
    selector          IN  VARCHAR2,  
    dest_pload_type  IN  PLS_INTEGER,  
    compliant        IN  BOOLEAN )
```

Returns

The converted Oracle Database Advanced Queuing rule or null if there is any conversion error.

Exceptions

ORA-24197 if the Java stored procedure throws an exception during execution.

302.9 Summary of JMS Types

This lists shows the JMS types.

- [SYS.AQ\\$_JMS_MESSAGE](#) Type
- [SYS.AQ\\$_JMS_TEXT_MESSAGE](#) Type
- [SYS.AQ\\$_JMS_BYTES_MESSAGE](#) Type
- [SYS.AQ\\$_JMS_MAP_MESSAGE](#) Type
- [SYS.AQ\\$_JMS_STREAM_MESSAGE](#) Type
- [SYS.AQ\\$_JMS_OBJECT_MESSAGE](#) Type
- [SYS.AQ\\$_JMS_NAMEARRAY](#) Type
- [SYS.AQ\\$_JMS_VALUE](#) Type
- [SYS.AQ\\$_JMS_EXCEPTION](#) Type

302.9.1 SYS.AQ\$_JMS_MESSAGE Type

This ADT type can represent any of five different JMS message types: text message, bytes message, stream message, map message, or object message. Queues created using this ADT can therefore store all five types of JMS messages.

This section contains these topics:

- [CONSTRUCT Static Functions](#)
- [Cast Methods](#)
- [JMS Header Methods](#)
- [System Properties Methods](#)
- [User Properties Methods](#)
- [Payload Methods](#)

Syntax

```

TYPE AQ$_JMS_MESSAGE AS OBJECT(
  header          aq$_jms_header,
  senderid        varchar2(100),
  message_type    INT,
  text_len        INT,
  bytes_len       INT,
  text_vc         varchar2(4000),
  bytes_raw       raw(2000),
  text_lob        clob,
  bytes_lob       blob,
  STATIC FUNCTION construct (mtype      IN INT)
    RETURN aq$_jms_message,
  STATIC FUNCTION construct (text_msg   IN aq$_jms_text_message)
    RETURN aq$_jms_message,
  STATIC FUNCTION construct (bytes_msg  IN aq$_jms_bytes_message)
    RETURN aq$_jms_message,
  STATIC FUNCTION construct (stream_msg IN aq$_jms_stream_message)
    RETURN aq$_jms_message,
  STATIC FUNCTION construct (map_msg    IN aq$_jms_map_message)
    RETURN aq$_jms_message,
  STATIC FUNCTION construct (object_msg IN aq$_jms_object_message)
    RETURN aq$_jms_message,
  MEMBER FUNCTION cast_to_bytes_msg RETURN aq$_jms_bytes_message,
  MEMBER FUNCTION cast_to_map_msg   RETURN aq$_jms_map_message,
  MEMBER FUNCTION cast_to_object_msg RETURN aq$_jms_object_message,
  MEMBER FUNCTION cast_to_stream_msg RETURN aq$_jms_stream_message,
  MEMBER FUNCTION cast_to_text_msg   RETURN aq$_jms_text_message,
  MEMBER PROCEDURE set_replyto (replyto IN sys.aq$_agent),
  MEMBER PROCEDURE set_type     (type     IN VARCHAR),
  MEMBER PROCEDURE set_userid   (userid   IN VARCHAR),
  MEMBER PROCEDURE set_appid    (appid    IN VARCHAR),
  MEMBER PROCEDURE set_groupid  (groupid  IN VARCHAR),
  MEMBER PROCEDURE set_groupseq (groupseq IN INT),
  MEMBER FUNCTION get_replyto   RETURN sys.aq$_agent,
  MEMBER FUNCTION get_type      RETURN VARCHAR,
  MEMBER FUNCTION get_userid    RETURN VARCHAR,
  MEMBER FUNCTION get_appid     RETURN VARCHAR,
  MEMBER FUNCTION get_groupid   RETURN VARCHAR,
  MEMBER FUNCTION get_groupseq  RETURN INT,
  MEMBER PROCEDURE clear_properties,
  MEMBER PROCEDURE set_boolean_property (property_name IN VARCHAR,
    property_value IN BOOLEAN),
  MEMBER PROCEDURE set_byte_property   (property_name IN VARCHAR,
    property_value IN INT),
  MEMBER PROCEDURE set_double_property (property_name IN VARCHAR,
    property_value IN DOUBLE PRECISION),
  MEMBER PROCEDURE set_float_property  (property_name IN VARCHAR,
    property_value IN FLOAT),
  MEMBER PROCEDURE set_int_property    (property_name IN VARCHAR,

```

```

    property_value IN INT),
MEMBER PROCEDURE set_long_property    (property_name IN VARCHAR,
    property_value IN NUMBER),
MEMBER PROCEDURE set_short_property   (property_name IN VARCHAR,
    property_value IN INT),
MEMBER PROCEDURE set_string_property  (property_name IN VARCHAR,
    property_value IN VARCHAR),
MEMBER FUNCTION get_boolean_property  (property_name IN VARCHAR) RETURN BOOLEAN,
MEMBER FUNCTION get_byte_property    (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_double_property   (property_name IN VARCHAR)
    RETURN DOUBLE PRECISION,
MEMBER FUNCTION get_float_property    (property_name IN VARCHAR) RETURN FLOAT,
MEMBER FUNCTION get_int_property      (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_long_property     (property_name IN VARCHAR) RETURN NUMBER,
MEMBER FUNCTION get_short_property    (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_string_property   (property_name IN VARCHAR) RETURN VARCHAR,
MEMBER PROCEDURE set_text             (payload IN VARCHAR2),
MEMBER PROCEDURE set_text             (payload IN CLOB),
MEMBER PROCEDURE set_bytes            (payload IN RAW),
MEMBER PROCEDURE set_bytes            (payload IN BLOB),
MEMBER PROCEDURE get_text              (payload OUT VARCHAR2),
MEMBER PROCEDURE get_text              (payload OUT CLOB),
MEMBER PROCEDURE get_bytes            (payload OUT RAW),
MEMBER PROCEDURE get_bytes            (payload OUT BLOB));

```

CONSTRUCT Static Functions

There are six `CONSTRUCT` static functions in this type.

STATIC FUNCTION construct (mtype IN INT) RETURN aq\$_jms_message

Creates an instance of `aq$_jms_message`, which can hold a specific type of JMS message (`TextMessage`, `BytesMessage`, `MapMessage`, `StreamMessage` or `ObjectMessage`). The message type of the created `aq$_jms_message` instance depends on the `mtype` parameter passed to the `construct` method. Once a message has been constructed, it can be used to store JMS messages of the type it has been constructed to hold.

The `mtype` parameter must be one of the following constants described in "[Oracle JMS Type Constants](#)":

```

DBMS_AQ.JMS_TEXT_MESSAGE
DBMS_AQ.JMS_BYTES_MESSAGE
DBMS_AQ.JMS_STREAM_MESSAGE
DBMS_AQ.JMS_MAP_MESSAGE
DBMS_AQ.JMS_OBJECT_MESSAGE

```

STATIC FUNCTION construct (text_msg IN aq\$_jms_text_message) RETURN aq\$_jms_message

Creates an `aq$_jms_message` from an `aq$_jms_text_message`.

STATIC FUNCTION construct (bytes_msg IN aq\$_jms_bytes_message) RETURN aq\$_jms_message;

Creates an `aq$_jms_message` from an `aq$_jms_bytes_message`.

STATIC FUNCTION construct (stream_msg IN aq\$_jms_stream_message) RETURN aq\$_jms_message;

Creates an `aq$_jms_message` from an `aq$_jms_stream_message`.

STATIC FUNCTION construct (map_msg IN aq\$_jms_map_message) RETURN aq\$_jms_message;

Creates an aq\$_jms_message from an aq\$_jms_map_message.

STATIC FUNCTION construct (object_msg IN aq\$_jms_object_message) RETURN aq\$_jms_message;

Creates an aq\$_jms_message from an aq\$_jms_object_message.

Cast Methods

cast_to_bytes_msg RETURN aq\$_jms_bytes_message

Casts an aq\$_jms_message to an aq\$_jms_bytes_message. Returns an aq\$_jms_bytes_message or null if the message_type attribute of the aq\$_jms_message is not DBMS_AQ.JMS_BYTES_MESSAGE. This function raises ORA-24198 if the message_type field of the aq\$_jms_message is not DBMS_AQJMS.JMS_BYTES_MESSAGE.

cast_to_map_msg RETURN aq\$_jms_map_message

Casts an aq\$_jms_message to an aq\$_jms_map_message. Returns an aq\$_jms_map_message or null if the message_type attribute of the aq\$_jms_message is not DBMS_AQ.JMS_MAP_MESSAGE. This function raises ORA-24198 if the message_type field of the aq\$_jms_message is not DBMS_AQJMS.JMS_MAP_MESSAGE.

cast_to_object_msg RETURN aq\$_jms_object_message

Casts an aq\$_jms_message to an aq\$_jms_object_message. Returns an aq\$_jms_object_message or null if the message_type attribute of the aq\$_jms_message is not DBMS_AQ.JMS_OBJECT_MESSAGE. This function raises ORA-24198 if the message_type field of the aq\$_jms_message is not DBMS_AQJMS.JMS_OBJECT_MESSAGE.

cast_to_stream_msg RETURN aq\$_jms_stream_message

Casts an aq\$_jms_message to an aq\$_jms_stream_message. Returns an aq\$_jms_stream_message or null if the message_type attribute of the aq\$_jms_message is not DBMS_AQ.JMS_STREAM_MESSAGE. This function raises ORA-24198 if the message_type field of the aq\$_jms_message is not DBMS_AQJMS.JMS_STREAM_MESSAGE.

cast_to_text_msg RETURN aq\$_jms_text_message

Casts an aq\$_jms_message to an aq\$_jms_text_message. Returns an aq\$_jms_text_message or null if the message_type attribute of the aq\$_jms_message is not DBMS_AQ.JMS_TEXT_MESSAGE. This function raises ORA-24198 if the message_type field of the aq\$_jms_message is not DBMS_AQJMS.JMS_TEXT_MESSAGE.

JMS Header Methods

set_replyto (replyto IN sys.aq\$_agent)

Sets the replyto parameter, which corresponds to JMSReplyTo.

get_replyto RETURN sys.aq\$_agent

Returns replyto, which corresponds to JMSReplyTo.

set_type (type IN VARCHAR)

Sets the JMS type, which can be any text and corresponds to JMSType.

get_type RETURN VARCHAR

Returns type, which corresponds to JMSType.

System Properties Methods

set_userid (userid IN VARCHAR)

Sets `userid`, which corresponds to `JMSXUserID`.

set_appid (appid IN VARCHAR)

Sets `appid`, which corresponds to `JMSXAppID`.

set_groupid (groupid IN VARCHAR)

Sets `groupid`, which corresponds to `JMSXGroupID`.

set_groupseq (groupseq IN INT)

Sets `groupseq`, which corresponds to `JMSXGroupSeq`.

get_userid RETURN VARCHAR

Returns `userid`, which corresponds to `JMSXUserID`.

get_appid RETURN VARCHAR

Returns `appid`, which corresponds to `JMSXAppID`.

get_groupid RETURN VARCHAR

Returns `groupid`, which corresponds to `JMSXGroupID`.

get_groupseq RETURN VARCHAR

Returns `groupseq`, which corresponds to `JMSXGroupSeq`.

User Properties Methods

clear_properties

Clears all user properties. This procedure does not affect system properties.

set_boolean_property (property_name IN VARCHAR, property_value IN BOOLEAN)

Checks whether `property_name` is null or exists. If it is not null, the procedure stores `property_value` in an internal representation (a `NUMBER` type). Raises exception `ORA-24191` if the property name exists or `ORA-24192` if the property name is null.

set_byte_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If it is not null, the procedure checks whether `property_value` is within -128 to 127 (8-bits). This check is necessary because neither PL/SQL nor RDBMS defines the `byte` datatype. Raises exception `ORA-24191` if the property name exists, `ORA-24192` if the property name is null, or `ORA-24193` if the property value exceeds the valid range.

set_double_property (property_name IN VARCHAR, property_value IN DOUBLE PRECISION)

Checks whether `property_name` is null or exists. If it is not null, the procedure stores `property_value`. Raises exception `ORA-24191` if the property name exists or `ORA-24192` if the property name is null.

set_float_property (property_name IN VARCHAR, property_value IN FLOAT)

Checks whether `property_name` is null or exists. If it is not null, the procedure stores `property_value`. Raises exception `ORA-24191` if the property name exists or `ORA-24192` if the property name is null.

set_int_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If it is not null, the procedure checks whether `property_value` is within -2147483648 to 2147483647 (32-bits). This check is necessary because the `INT` datatype is 38 bits in PL/SQL and Oracle Database. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_long_property (property_name IN VARCHAR, property_value IN NUMBER)

Checks whether `property_name` is null or exists. If it is not null, the procedure stores `property_value`. In PL/SQL and Oracle Database, the `NUMBER` datatype is 38 bits. In Java, the long datatype is 64 bits. Therefore, no range check is needed. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_short_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If it is not null, the procedure checks whether `property_value` is within -32768 to 32767 (16-bits). This check is necessary because neither PL/SQL nor RDBMS defines the `short` datatype. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_string_property (property_name IN VARCHAR, property_value IN VARCHAR)

Checks whether `property_name` is null or exists. If it is not null, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

get_boolean_property (property_name IN VARCHAR) RETURN BOOLEAN

If the property with the corresponding property name passed in exists, and if it is a `BOOLEAN` property, then this function returns the value of the property. Otherwise it returns a null.

get_byte_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `BYTE` property, then this function returns the value of the property. Otherwise it returns a null.

get_double_property (property_name IN VARCHAR) RETURN DOUBLE PRECISION

If the property with the corresponding property name passed in exists, and if it is a `DOUBLE` property, then this function returns the value of the property. Otherwise it returns a null.

get_float_property (property_name IN VARCHAR) RETURN FLOAT

If the property with the corresponding property name passed in exists, and if it is a `FLOAT` property, then this function returns the value of the property. Otherwise it returns a null.

get_int_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `Integer` property, then this function returns the value of the property. Otherwise it returns a null.

get_long_property (property_name IN VARCHAR) RETURN NUMBER

If the property with the corresponding property name passed in exists, and if it is a `long` property, then this function returns the value of the property. Otherwise it returns a null.

get_short_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `short` property, then this function returns the value of the property. Otherwise it returns a null.

get_string_property (property_name IN VARCHAR) RETURN VARCHAR

If the property with the corresponding property name passed in exists, and if it is a `STRING` property, then this function returns the value of the property. Otherwise it returns a null.

Payload Methods**set_text (payload IN VARCHAR2)**

Sets the payload, a `VARCHAR2` value, to an internal representation.

set_text (payload IN CLOB),

Sets the payload, a `CLOB` value, to an internal representation.

set_bytes (payload IN RAW)

Sets the payload, a `RAW` value, to an internal representation.

set_bytes (payload IN BLOB)

Sets the payload, a `BLOB` value, to an internal representation.

get_text (payload OUT VARCHAR2)

Puts the internal representation of the payload into a `VARCHAR2` variable payload.

get_text (payload OUT CLOB)

Puts the internal representation of the payload into a `CLOB` variable payload.

get_bytes (payload OUT RAW)

Puts the internal representation of the payload into a `RAW` variable payload.

get_bytes (payload OUT BLOB)

Puts the internal representation of the payload into a `BLOB` variable payload.

302.9.2 SYS.AQ\$_JMS_TEXT_MESSAGE Type

This type is the ADT used to store a `TextMessage` in an Oracle Database Advanced Queuing queue.

This section contains these topics:

- [CONSTRUCT aq\\$_jms_text_message Function](#)
- [JMS Header Methods](#)
- [System Properties Methods](#)
- [User Properties Methods](#)
- [Payload Methods](#)

Syntax

```
TYPE AQ$_JMS_TEXT_MESSAGE AS OBJECT (  
  header    aq$_jms_header,  
  text_len  INT,  
  text_vc   varchar2(4000),  
  text_lob  clob,  
  STATIC FUNCTION construct      RETURN aq$_jms_text_message,  
  MEMBER PROCEDURE set_replyto (replyto IN sys.aq$_agent),  
  MEMBER PROCEDURE set_type    (type    IN VARCHAR),  
  MEMBER FUNCTION  get_replyto  RETURN sys.aq$_agent,
```

```

MEMBER FUNCTION get_type      RETURN VARCHAR,
MEMBER PROCEDURE set_userid   (userid   IN VARCHAR),
MEMBER PROCEDURE set_appid    (appid    IN VARCHAR),
MEMBER PROCEDURE set_groupid  (groupid  IN VARCHAR),
MEMBER PROCEDURE set_groupseq (groupseq IN INT),
MEMBER FUNCTION get_userid    RETURN VARCHAR,
MEMBER FUNCTION get_appid     RETURN VARCHAR,
MEMBER FUNCTION get_groupid   RETURN VARCHAR,
MEMBER FUNCTION get_groupseq  RETURN INT,
MEMBER PROCEDURE clear_properties,
MEMBER PROCEDURE set_boolean_property(property_name IN VARCHAR,
    property_value IN BOOLEAN),
MEMBER PROCEDURE set_byte_property  (property_name IN VARCHAR,
    property_value IN INT),
MEMBER PROCEDURE set_double_property (property_name IN VARCHAR,
    property_value IN DOUBLE PRECISION),
MEMBER PROCEDURE set_float_property (property_name IN VARCHAR,
    property_value IN FLOAT),
MEMBER PROCEDURE set_int_property   (property_name IN VARCHAR,
    property_value IN INT),
MEMBER PROCEDURE set_long_property  (property_name IN VARCHAR,
    property_value IN NUMBER),
MEMBER PROCEDURE set_short_property (property_name IN VARCHAR,
    property_value IN INT),
MEMBER PROCEDURE set_string_property (property_name IN VARCHAR,
    property_value IN VARCHAR),
MEMBER FUNCTION get_boolean_property (property_name IN VARCHAR)
    RETURN BOOLEAN,
MEMBER FUNCTION get_byte_property    (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_double_property (property_name IN VARCHAR)
    RETURN DOUBLE PRECISION,
MEMBER FUNCTION get_float_property   (property_name IN VARCHAR) RETURN FLOAT,
MEMBER FUNCTION get_int_property     (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_long_property    (property_name IN VARCHAR) RETURN NUMBER,
MEMBER FUNCTION get_short_property   (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_string_property  (property_name IN VARCHAR)
    RETURN VARCHAR,
MEMBER PROCEDURE set_text            (payload IN VARCHAR2),
MEMBER PROCEDURE set_text            (payload IN CLOB),
MEMBER PROCEDURE get_text            (payload OUT VARCHAR2),
MEMBER PROCEDURE get_text            (payload OUT CLOB);

```

CONSTRUCT aq\$_jms_text_message Function**STATIC FUNCTION construct RETURN aq\$_jms_text_message**

Creates an empty aq\$_jms_text_message.

JMS Header Methods**set_replyto (replyto IN sys.aq\$_agent)**

Sets the replyto parameter, which corresponds to JMSReplyTo in JMS.

set_type (type IN VARCHAR)

Sets the JMS type, which can be any text, and which corresponds to JMSType in JMS.

get_replyto RETURN sys.aq\$_agent

Returns replyto, which corresponds to JMSReplyTo.

get_type RETURN VARCHAR

Returns `type`, which corresponds to `JMSType`.

System Properties Methods

set_userid (userid IN VARCHAR)

Sets `userid`, which corresponds to `JMSXUserID` in JMS.

set_appid (appid IN VARCHAR)

Sets `appid`, which corresponds to `JMSXAppID` in JMS.

set_groupid (groupid IN VARCHAR)

Sets `groupid`, which corresponds to `JMSXGroupID` in JMS.

set_groupseq (groupseq IN INT)

Sets `groupseq`, which corresponds to `JMSXGroupSeq` in JMS.

get_userid RETURN VARCHAR

Returns `userid`, which corresponds to `JMSXUserID`.

get_appid RETURN VARCHAR

Returns `appid`, which corresponds to `JMSXAppID`.

get_groupid RETURN VARCHAR

Returns `groupid`, which corresponds to `JMSXGroupID`.

get_groupseq RETURN INT

Returns `groupseq`, which corresponds to `JMSXGroupSeq`.

User Properties Methods

clear_properties

Clears all user properties. This procedure does not affect system properties.

set_boolean_property (property_name IN VARCHAR, property_value IN BOOLEAN)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value` in an internal representation. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_byte_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -128 to 127 (8-bits). This check is necessary because neither PL/SQL nor RDBMS defines the `BYTE` datatype. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_double_property (property_name IN VARCHAR, property_value IN DOUBLE PRECISION)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_float_property (property_name IN VARCHAR, property_value IN FLOAT)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_int_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -2147483648 to 2147483647 (32-bits). This check is necessary because in PL/SQL and Oracle Database, the `INT` datatype is 38 bits. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_long_property (property_name IN VARCHAR, property_value IN NUMBER)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. In PL/SQL and Oracle Database, the `NUMBER` datatype is 38 bits. In Java, the `long` datatype is 64 bits. Therefore, no range check is needed. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_short_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -32768 to 32767 (16-bits). This check is necessary because neither PL/SQL nor RDBMS defines the `short` datatype. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_string_property (property_name IN VARCHAR, property_value IN VARCHAR)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

get_boolean_property (property_name IN VARCHAR) RETURN BOOLEAN

If the property with the corresponding property name passed in exists, and if it is a `BOOLEAN` property, then this function returns the value of the property. Otherwise it returns a null.

get_byte_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `BYTE` property, then this function returns the value of the property. Otherwise it returns a null.

get_double_property (property_name IN VARCHAR) RETURN DOUBLE PRECISION

If the property with the corresponding property name passed in exists, and if it is a `DOUBLE` property, then this function returns the value of the property. Otherwise it returns a null.

get_float_property (property_name IN VARCHAR) RETURN FLOAT

If the property with the corresponding property name passed in exists, and if it is a `FLOAT` property, then this function returns the value of the property. Otherwise it returns a null.

get_int_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `Integer` property, then this function returns the value of the property. Otherwise it returns a null.

get_long_property (property_name IN VARCHAR) RETURN NUMBER

If the property with the corresponding property name passed in exists, and if it is a `long` property, then this function returns the value of the property. Otherwise it returns a null.

get_short_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `short` property, then this function returns the value of the property. Otherwise it returns a null.

get_string_property (property_name IN VARCHAR) RETURN VARCHAR

If the property with the corresponding property name passed in exists, and if it is a `STRING` property, then this function returns the value of the property. Otherwise it returns a null.

Payload Methods**set_text (payload IN VARCHAR2)**

Sets the payload, a `VARCHAR2` value, to an internal representation.

set_text (payload IN CLOB)

Sets the payload, a `CLOB` value, to an internal representation.

get_text (payload OUT VARCHAR2)

Puts the internal representation of the payload into a `VARCHAR2` variable payload.

get_text (payload OUT CLOB)

Puts the internal representation of the payload into a `CLOB` variable payload.

302.9.3 SYS.AQ\$_JMS_BYTES_MESSAGE Type

The `SYS.AQ$_JMS_BYTES_MESSAGE` type is the ADT used to store a `BytesMessage` in an Oracle Database Advanced Queuing queue.

This section contains these topics:

- [CONSTRUCT aq\\$_jms_bytes_message Function](#)
- [JMS Header Methods](#)
- [System Properties Methods](#)
- [User Properties Methods](#)
- [Payload Methods](#)

Syntax

```
TYPE AQ$_JMS_BYTES_MESSAGE AS OBJECT(
  header      aq$_jms_header,
  bytes_len   INT,
  bytes_raw   raw(2000),
  bytes_lob   blob,
  STATIC FUNCTION construct RETURN aq$_jms_bytes_message,
  MEMBER PROCEDURE set_replyto (replyto IN sys.aq$_agent),
  MEMBER PROCEDURE set_type    (type    IN VARCHAR),
  MEMBER FUNCTION get_replyto  RETURN sys.aq$_agent,
  MEMBER FUNCTION get_type     RETURN VARCHAR,
  MEMBER PROCEDURE set_userid  (userid  IN VARCHAR),
  MEMBER PROCEDURE set_appid   (appid   IN VARCHAR),
  MEMBER PROCEDURE set_groupid (groupid IN VARCHAR),
  MEMBER PROCEDURE set_groupseq (groupseq IN INT),
  MEMBER FUNCTION get_userid   RETURN VARCHAR,
  MEMBER FUNCTION get_appid    RETURN VARCHAR,
  MEMBER FUNCTION get_groupid  RETURN VARCHAR,
```

```
MEMBER FUNCTION get_groupseq RETURN INT,
MEMBER PROCEDURE clear_properties,
MEMBER PROCEDURE set_boolean_property(property_name IN VARCHAR,
    property_value IN BOOLEAN),
MEMBER PROCEDURE set_byte_property (property_name IN VARCHAR,
    property_value IN INT),
MEMBER PROCEDURE set_double_property (property_name IN VARCHAR,
    property_value IN DOUBLE PRECISION),
MEMBER PROCEDURE set_float_property (property_name IN VARCHAR,
    property_value IN FLOAT),
MEMBER PROCEDURE set_int_property (property_name IN VARCHAR,
    property_value IN INT),
MEMBER PROCEDURE set_long_property (property_name IN VARCHAR,
    property_value IN NUMBER),
MEMBER PROCEDURE set_short_property (property_name IN VARCHAR,
    property_value IN INT),
MEMBER PROCEDURE set_string_property (property_name IN VARCHAR,
    property_value IN VARCHAR),
MEMBER FUNCTION get_boolean_property (property_name IN VARCHAR) RETURN BOOLEAN,
MEMBER FUNCTION get_byte_property (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_double_property (property_name IN VARCHAR)
    RETURN DOUBLE PRECISION,
MEMBER FUNCTION get_float_property (property_name IN VARCHAR) RETURN FLOAT,
MEMBER FUNCTION get_int_property (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_long_property (property_name IN VARCHAR) RETURN NUMBER,
MEMBER FUNCTION get_short_property (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_string_property (property_name IN VARCHAR) RETURN VARCHAR,
MEMBER PROCEDURE set_bytes (payload IN RAW),
MEMBER PROCEDURE set_bytes (payload IN BLOB),
MEMBER PROCEDURE get_bytes (payload OUT RAW),
MEMBER PROCEDURE get_bytes (payload OUT BLOB),
MEMBER FUNCTION prepare (id IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER PROCEDURE reset (id IN PLS_INTEGER),
MEMBER PROCEDURE flush (id IN PLS_INTEGER),
MEMBER PROCEDURE clear_body (id IN PLS_INTEGER),
MEMBER PROCEDURE clean (id IN PLS_INTEGER),
STATIC PROCEDURE clean_all,
MEMBER FUNCTION get_mode (id IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER FUNCTION read_boolean (id IN PLS_INTEGER) RETURN BOOLEAN,
MEMBER FUNCTION read_byte (id IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER FUNCTION read_bytes (id IN PLS_INTEGER,
    value OUT NOCOPY BLOB, length IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER FUNCTION read_char (id IN PLS_INTEGER) RETURN CHAR,
MEMBER FUNCTION read_double (id IN PLS_INTEGER) RETURN DOUBLE PRECISION,
MEMBER FUNCTION read_float (id IN PLS_INTEGER) RETURN FLOAT,
MEMBER FUNCTION read_int (id IN PLS_INTEGER) RETURN INT,
MEMBER FUNCTION read_long (id IN PLS_INTEGER) RETURN NUMBER,
MEMBER FUNCTION read_short (id IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER FUNCTION read_unsigned_byte (id IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER FUNCTION read_unsigned_short (id IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER PROCEDURE read_utf (id IN PLS_INTEGER, value OUT NOCOPY CLOB),
MEMBER PROCEDURE write_boolean (id IN PLS_INTEGER, value IN BOOLEAN),
MEMBER PROCEDURE write_byte (id IN PLS_INTEGER, value IN PLS_INTEGER),
MEMBER PROCEDURE write_bytes (id IN PLS_INTEGER, value IN RAW),
MEMBER PROCEDURE write_bytes (id IN PLS_INTEGER, value IN BLOB),
MEMBER PROCEDURE write_bytes (id IN PLS_INTEGER, value IN RAW,
    offset IN PLS_INTEGER, length IN PLS_INTEGER),
MEMBER PROCEDURE write_bytes (id IN PLS_INTEGER, value IN BLOB,
    offset IN INT, length IN INT),
MEMBER PROCEDURE write_char (id IN PLS_INTEGER, value IN CHAR),
MEMBER PROCEDURE write_double (id IN PLS_INTEGER,
```

```

    value IN DOUBLE PRECISION),
MEMBER PROCEDURE write_float      (id IN PLS_INTEGER, value IN FLOAT),
MEMBER PROCEDURE write_int       (id IN PLS_INTEGER, value IN PLS_INTEGER),
MEMBER PROCEDURE write_long      (id IN PLS_INTEGER, value IN NUMBER),
MEMBER PROCEDURE write_short     (id IN PLS_INTEGER, value IN PLS_INTEGER),
MEMBER PROCEDURE write_utf       (id IN PLS_INTEGER, value IN VARCHAR2),
MEMBER PROCEDURE write_utf       (id IN PLS_INTEGER, value IN CLOB));

```

CONSTRUCT aq\$_jms_bytes_message Function

STATIC FUNCTION construct RETURN aq\$_jms_bytes_message

Creates an empty aq\$_jms_bytes_message.

JMS Header Methods

set_replyto (replyto IN sys.aq\$_agent)

Sets the `replyto` parameter, which corresponds to `JMSReplyTo` in JMS.

set_type (type IN VARCHAR)

Sets the JMS type, which can be any text, and which corresponds to `JMSType` in JMS.

get_replyto RETURN sys.aq\$_agent

Returns `replyto`, which corresponds to `JMSReplyTo`.

get_type RETURN VARCHAR

Returns `type`, which corresponds to `JMSType`.

System Properties Methods

set_userid (userid IN VARCHAR)

Sets `userid`, which corresponds to `JMSXUserID` in JMS.

set_appid (appid IN VARCHAR)

Sets `appid`, which corresponds to `JMSXAppID` in JMS.

set_groupid (groupid IN VARCHAR)

Sets `groupid`, which corresponds to `JMSXGroupID` in JMS.

set_groupseq (groupseq IN INT)

Sets `groupseq`, which corresponds to `JMSXGroupSeq` in JMS.

get_userid RETURN VARCHAR

Returns `userid`, which corresponds to `JMSXUserID`.

get_appid RETURN VARCHAR

Returns `appid`, which corresponds to `JMSXAppID`.

get_groupid RETURN VARCHAR

Returns `groupid`, which corresponds to `JMSXGroupID`.

get_groupseq RETURN NUMBER

Returns `groupseq`, which corresponds to `JMSXGroupSeq`.

User Properties Methods

clear_properties

Clears all user properties. This procedure does not affect system properties.

set_boolean_property (property_name IN VARCHAR, property_value IN BOOLEAN)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value` in an internal representation. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_byte_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -128 to 127 (8-bits). This check is necessary because neither PL/SQL nor RDBMS defines the `BYTE` datatype. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_double_property (property_name IN VARCHAR, property_value IN DOUBLE PRECISION)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_float_property (property_name IN VARCHAR, property_value IN FLOAT)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_int_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -2147483648 to 2147483647 (32-bits). This check is necessary because in PL/SQL and Oracle Database, the `INT` datatype is 38 bits. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_long_property (property_name IN VARCHAR, property_value IN NUMBER)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. In PL/SQL and Oracle Database, the `NUMBER` datatype is 38 bits. In Java, the `long` datatype is 64 bits. Therefore, no range check is needed. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_short_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -32768 to 32767 (16-bits). This check is necessary because neither PL/SQL nor RDBMS defines the `short` datatype. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_string_property (property_name IN VARCHAR, property_value IN VARCHAR)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

get_boolean_property (property_name IN VARCHAR) RETURN BOOLEAN

If the property with the corresponding property name passed in exists, and if it is a `BOOLEAN` property, then this function returns the value of the property. Otherwise it returns a null.

get_byte_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `BYTE` property, then this function returns the value of the property. Otherwise it returns a null.

get_double_property (property_name IN VARCHAR) RETURN DOUBLE PRECISION

If the property with the corresponding property name passed in exists, and if it is a `DOUBLE` property, then this function returns the value of the property. Otherwise it returns a null.

get_float_property (property_name IN VARCHAR) RETURN FLOAT

If the property with the corresponding property name passed in exists, and if it is a `FLOAT` property, then this function returns the value of the property. Otherwise it returns a null.

get_int_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `Integer` property, then this function returns the value of the property. Otherwise it returns a null.

get_long_property (property_name IN VARCHAR) RETURN NUMBER

If the property with the corresponding property name passed in exists, and if it is a `long` property, then this function returns the value of the property. Otherwise it returns a null.

get_short_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `short` property, then this function returns the value of the property. Otherwise it returns a null.

get_string_property (property_name IN VARCHAR) RETURN VARCHAR

If the property with the corresponding property name passed in exists, and if it is a `STRING` property, then this function returns the value of the property. Otherwise it returns a null.

Payload Methods

set_bytes (payload in RAW)

Sets the payload, a `RAW` value, to an internal representation.

set_bytes (payload in BLOB)

Sets the payload, a `BLOB` value, to an internal representation.

get_bytes (payload out RAW)

Puts the internal representation of the payload into a `RAW` variable payload. Raises exception ORA-24190 if the length of the internal payload is more than 32767 (the maximum length of `RAW` in PL/SQL).

get_bytes (payload out BLOB)

Puts the internal representation of the payload into a BLOB variable payload.

prepare (id IN PLS_INTEGER) RETURN PLS_INTEGER

Takes the byte array stored in `aq$_jms_bytes_message` and decodes it as a Java object in the Java stored procedure. The result of the decoding is stored as a static variable in Jserv session memory. Parameter `id` is used to identify the slot where the Java object is stored in the Oracle Database JVM session memory. If `id` is null, then a new slot is created for this PL/SQL object. Subsequent JMS operations on the payload need to provide this operation ID.

This function also sets the message access mode to `MESSAGE_ACCESS_READONLY`.

Subsequent calls of `write_XXX` procedure raise an ORA-24196 error. Users can call the `clear_body` procedure to set the message access mode to `MESSAGE_ACCESS_READONLY`.

This function raises ORA-24197 if the Java stored procedure throws an exception during execution, ORA-24198 if the operation ID is invalid, or ORA-24199 if the Java stored procedure message store overflows.

reset (id IN PLS_INTEGER)

Resets the starting position of the stream to the beginning and puts the bytes message in read-only mode. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

flush (id IN PLS_INTEGER)

Takes the static variable in Jserv and synchronizes the content back to the `aq$_jms_bytes_message`. This procedure will not affect the underlying access mode. This procedure raises ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

clear_body (id IN PLS_INTEGER)

Sets the Java stored procedure static variable to empty payload. Parameter `id` is used to identify the slot where the Java object is stored in the Oracle Database JVM session memory. If `id` is null, a new slot is created for this PL/SQL object. Subsequent JMS operations on the payload need to provide this operation ID.

It also sets the message access mode to `MESSAGE_ACCESS_WRITEONLY`. Later calls of `read_XXX` procedure raise ORA-24196 error. Users can call the `reset` or `prepare` procedures to set the message access mode to `MESSAGE_ACCESS_READONLY`. Write-only and read-only modes affect only the payload functions of `AQ$_JMS_BYTES_MESSAGE`. They do not affect the header functions.

This function raises ORA-24197 if the Java stored procedure throws an exception during execution, ORA-24198 if the operation ID is invalid, or ORA-24199 if the Java stored procedure message store overflows.

clean (id IN PLS_INTEGER)

Closes and cleans up the `DataInputStream` or `DataOutputStream` at the Java stored procedure side corresponding to the operation ID. It is very important to call this procedure to avoid memory leaks. This procedure raises ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

clean_all

Closes and cleans up all the messages in the corresponding type of message store at the Java stored procedure side. This procedure raises ORA-24197 if the Java stored procedure throws an exception during execution.

get_mode (id IN PLS_INTEGER) RETURN PLS_INTEGER

Returns the current mode of this message. The return value is either `SYS.dbms_jms.plsql.MESSAGE_ACCESS_READONLY` or `SYS.dbms_jms.plsql.MESSAGE_ACCESS_WRITEONLY`. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

read_boolean (id IN PLS_INTEGER) RETURN BOOLEAN

Reads a Boolean value from the bytes message and returns the Boolean value read. Null is returned if the end of the message stream has been reached. Parameter `id` is the operation ID. Raises exception ORA-24196 if the bytes message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_byte (id IN PLS_INTEGER) RETURN PLS_INTEGER

Reads a `BYTE` value from the bytes message and returns the `BYTE` value read. Null is returned if the end of the stream has been reached. Because there is no `BYTE` type in PL/SQL, Oracle Database uses `PLS_INTEGER` to represent a `BYTE`. Although PL/SQL users get a `PLS_INTEGER`, they are guaranteed that the value is in the Java `BYTE` value range. If this value is issued with a `write_byte` function, then there will not be an out of range error. Parameter `id` is the operation ID. Raises exception ORA-24196 if the bytes message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_bytes (id IN PLS_INTEGER, value OUT NO COPY BLOB, length IN PLS_INTEGER) RETURN PLS_INTEGER

Reads length of the bytes from bytes message stream into value and returns the total number of bytes read. If there is no more data (because the end of the stream has been reached), then it returns -1. Raises exceptions ORA-24196 if the bytes message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_char (id IN PLS_INTEGER) RETURN CHAR

Reads a character value from the bytes message and returns the character value read. Null is returned if the end of the stream has been reached. Raises exception ORA-24196 if the bytes message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_double (id IN PLS_INTEGER) RETURN DOUBLE PRECISION

Reads a double from the bytes message and returns the character value read. Null is returned if the end of the stream has been reached. Raises exception ORA-24196 if the bytes message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_float (id IN PLS_INTEGER) RETURN FLOAT

Reads a float from the bytes message and returns the float read. Null is returned if the end of the stream has been reached. Raises exception ORA-24196 if the bytes message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_int (id IN PLS_INTEGER) RETURN INT

Reads an `INT` from the bytes message and returns the `INT` read. Null is returned if the end of the stream has been reached. Raises exception ORA-24196 if the bytes

message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_long (id IN PLS_INTEGER) RETURN NUMBER

Reads a long from the bytes message and returns the long read. Null is returned if the end of the stream has been reached. Raises exception ORA-24196 if the bytes message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_short (id IN PLS_INTEGER) RETURN PLS_INTEGER

Reads a short value from the bytes message and returns the short value read. Null is returned if the end of the stream has been reached. Because there is no short type in PL/SQL, `PLS_INTEGER` is used to represent a `SHORT`. Although PL/SQL users get an `PLS_INTEGER`, they are guaranteed that the value is in the Java short value range. If this value is issued with a `write_short` function, then there will not be an out of range error. Raises exception ORA-24196 if the bytes message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_unsigned_byte (id IN PLS_INTEGER) RETURN PLS_INTEGER

Reads an unsigned 8-bit number from the bytes message stream and returns the next byte from the bytes message stream, interpreted as an unsigned 8-bit number. Null is returned if the end of the stream has been reached. Raises exception ORA-24196 if the bytes message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_unsigned_short (id IN PLS_INTEGER) RETURN PLS_INTEGER

Reads an unsigned 16-bit number from the bytes message stream and returns the next two bytes from the bytes message stream, interpreted as an unsigned 16-bit integer. Null is returned if the end of the stream has been reached. Raises exception ORA-24196 if the bytes message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_utf (id IN PLS_INTEGER, value OUT NOCOPY CLOB)

Reads a string that has been encoded using a UTF-8 format from the bytes message. Null is returned if the end of the stream has been reached. Raises exception ORA-24196 if the bytes message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_boolean (id IN PLS_INTEGER, value IN BOOLEAN)

Writes a Boolean to the bytes message stream as a 1-byte value. The value `true` is written as the value (byte)1. The value `false` is written as the value (byte)0. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_byte (id IN PLS_INTEGER, value IN PLS_INTEGER)

Writes a byte to the bytes message. Because there is no `BYTE` type in PL/SQL, `PLS_INTEGER` is used to represent a `BYTE`. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_bytes (id IN PLS_INTEGER, value IN RAW)

Writes an array of bytes to the bytes message. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_bytes (id IN PLS_INTEGER, value IN BLOB)

Writes an array of bytes to the bytes message. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_bytes (id IN PLS_INTEGER, value IN RAW, offset IN PLS_INTEGER, length IN PLS_INTEGER)

Writes a portion of a byte array to the bytes message stream. Parameter *offset* is the initial offset within the byte array. If the range [*offset*, *offset+length*] exceeds the boundary of the byte array value, then a Java IndexOutOfBoundsException exception is thrown in the Java stored procedure and this procedure raises error ORA-24197. The index starts from 0. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_bytes (id IN PLS_INTEGER, value IN BLOB, offset IN INT, length IN INT)

Writes a portion of a byte array to the bytes message stream. Parameter *offset* is the initial offset within the byte array. If the range [*offset*, *offset+length*] exceeds the boundary of the byte array value, then a Java IndexOutOfBoundsException exception is thrown in the Java stored procedure and this procedure raises error ORA-24197. The index starts from 0. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_char (id IN PLS_INTEGER, value IN CHAR)

Writes a character value to the bytes message. If this value has multiple characters, it is the first character that is written. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_double (id IN PLS_INTEGER, value IN DOUBLE PRECISION)

Writes a double to the bytes message. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_float (id IN PLS_INTEGER, value IN FLOAT)

Writes a float to the bytes message. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_int (id IN PLS_INTEGER, value IN PLS_INTEGER)

Writes an `INT` to the bytes message. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_long (id IN PLS_INTEGER, value IN NUMBER)

Writes a long to the bytes message. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_short (id IN PLS_INTEGER, value IN PLS_INTEGER)

Writes a short to the bytes message as two bytes, high byte first. Because there is no short type in PL/SQL, `INT` is used to represent a short. Raises exception ORA-24193 if the parameter value exceeds the valid range, ORA-24196 if the bytes message is in

read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_utf (id IN PLS_INTEGER, value IN VARCHAR2)

Writes a string to the bytes message stream using UTF-8 encoding in a machine-independent manner. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_utf (id IN PLS_INTEGER, value IN CLOB)

Writes a string to the bytes message stream using UTF-8 encoding in a machine-independent manner. Raises exception ORA-24196 if the bytes message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

302.9.4 SYS.AQ\$_JMS_MAP_MESSAGE Type

This type is the ADT used to store a `MapMessage` in an Oracle Database Advanced Queuing queue.

This section contains these topics:

- [CONSTRUCT aq\\$_jms_map_message Function](#)
- [JMS Header Methods](#)
- [System Properties Methods](#)
- [User Properties Methods](#)
- [Payload Methods](#)

Syntax

```
TYPE aq$_jms_map_message AS object(
  header      aq$_jms_header,
  bytes_len   int,
  bytes_raw   raw(2000),
  bytes_lob   blob,
  STATIC FUNCTION construct RETURN aq$_jms_map_message,
  MEMBER PROCEDURE set_replyto (replyto IN sys.aq$_agent),
  MEMBER PROCEDURE set_type (type IN VARCHAR),
  MEMBER FUNCTION get_replyto RETURN sys.aq$_agent,
  MEMBER FUNCTION get_type RETURN VARCHAR,
  MEMBER PROCEDURE set_userid (userid IN VARCHAR),
  MEMBER PROCEDURE set_appid (appid IN VARCHAR),
  MEMBER PROCEDURE set_groupid (groupid IN VARCHAR),
  MEMBER PROCEDURE set_groupseq (groupseq IN INT),
  MEMBER FUNCTION get_userid RETURN VARCHAR,
  MEMBER FUNCTION get_appid RETURN VARCHAR,
  MEMBER FUNCTION get_groupid RETURN VARCHAR,
  MEMBER FUNCTION get_groupseq RETURN INT,
  MEMBER PROCEDURE clear_properties,
  MEMBER PROCEDURE set_boolean_property(property_name IN VARCHAR,
    property_value IN BOOLEAN),
  MEMBER PROCEDURE set_byte_property (property_name IN VARCHAR,
    property_value IN INT),
  MEMBER PROCEDURE set_double_property (property_name IN VARCHAR,
    property_value IN DOUBLE PRECISION),
  MEMBER PROCEDURE set_float_property (property_name IN VARCHAR,
    property_value IN FLOAT),
```

```
MEMBER PROCEDURE set_int_property    (property_name IN VARCHAR,  
    property_value IN INT),  
MEMBER PROCEDURE set_long_property   (property_name IN VARCHAR,  
    property_value IN NUMBER),  
MEMBER PROCEDURE set_short_property  (property_name IN VARCHAR,  
    property_value IN INT),  
MEMBER PROCEDURE set_string_property (property_name IN VARCHAR,  
    property_value IN VARCHAR),  
MEMBER FUNCTION get_boolean_property (property_name IN VARCHAR) RETURN BOOLEAN,  
MEMBER FUNCTION get_byte_property    (property_name IN VARCHAR) RETURN INT,  
MEMBER FUNCTION get_double_property  (property_name IN VARCHAR)  
    RETURN DOUBLE PRECISION,  
MEMBER FUNCTION get_float_property   (property_name IN VARCHAR) RETURN FLOAT,  
MEMBER FUNCTION get_int_property     (property_name IN VARCHAR) RETURN INT,  
MEMBER FUNCTION get_long_property    (property_name IN VARCHAR) RETURN NUMBER,  
MEMBER FUNCTION get_short_property   (property_name IN VARCHAR) RETURN INT,  
MEMBER FUNCTION get_string_property  (property_name IN VARCHAR) RETURN VARCHAR,  
MEMBER PROCEDURE set_bytes           (payload IN RAW),  
MEMBER PROCEDURE set_bytes           (payload IN BLOB),  
MEMBER PROCEDURE get_bytes           (payload OUT RAW),  
MEMBER PROCEDURE get_bytes           (payload OUT BLOB),  
MEMBER FUNCTION prepare              (id IN PLS_INTEGER) RETURN PLS_INTEGER,  
MEMBER PROCEDURE flush               (id IN PLS_INTEGER),  
MEMBER PROCEDURE clear_body          (id IN PLS_INTEGER),  
MEMBER PROCEDURE clean               (id IN PLS_INTEGER),  
STATIC PROCEDURE clean_all,  
MEMBER PROCEDURE set_boolean         (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN BOOLEAN),  
MEMBER PROCEDURE set_byte            (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN PLS_INTEGER),  
MEMBER PROCEDURE set_bytes           (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN RAW),  
MEMBER PROCEDURE set_bytes           (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN RAW, offset IN INT, length IN INT),  
MEMBER PROCEDURE set_bytes           (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN BLOB),  
MEMBER PROCEDURE set_bytes           (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN BLOB, offset IN INT, length IN INT),  
MEMBER PROCEDURE set_char            (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN CHAR),  
MEMBER PROCEDURE set_double          (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN DOUBLE PRECISION),  
MEMBER PROCEDURE set_float           (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN FLOAT),  
MEMBER PROCEDURE set_int             (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN PLS_INTEGER),  
MEMBER PROCEDURE set_long            (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN NUMBER),  
MEMBER PROCEDURE set_short           (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN PLS_INTEGER),  
MEMBER PROCEDURE set_string          (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN VARCHAR2),  
MEMBER PROCEDURE set_string          (id IN PLS_INTEGER, name IN VARCHAR2,  
    value IN CLOB),  
MEMBER FUNCTION get_boolean          (id IN PLS_INTEGER, name IN VARCHAR2)  
    RETURN BOOLEAN,  
MEMBER FUNCTION get_byte             (id IN PLS_INTEGER, name IN VARCHAR2)  
    RETURN PLS_INTEGER,  
MEMBER PROCEDURE get_bytes           (id IN PLS_INTEGER, name IN VARCHAR2,  
    value OUT NOCOPY BLOB),  
MEMBER FUNCTION get_char             (id IN PLS_INTEGER, name IN VARCHAR2) RETURN CHAR,
```

```

MEMBER FUNCTION get_double (id IN PLS_INTEGER, name IN VARCHAR2)
    RETURN DOUBLE PRECISION,
MEMBER FUNCTION get_float (id IN PLS_INTEGER, name IN VARCHAR2) RETURN FLOAT,
MEMBER FUNCTION get_int (id IN PLS_INTEGER, name IN VARCHAR2)
    RETURN PLS_INTEGER,
MEMBER FUNCTION get_long (id IN PLS_INTEGER, name IN VARCHAR2)
    RETURN NUMBER,
MEMBER FUNCTION get_short (id IN PLS_INTEGER, name IN VARCHAR2)
    RETURN PLS_INTEGER,
MEMBER PROCEDURE get_string (id IN PLS_INTEGER, name IN VARCHAR2,
    value OUT NOCOPY CLOB),
MEMBER FUNCTION get_names (id IN PLS_INTEGER) RETURN aq$_jms_namearray,
MEMBER FUNCTION get_names (id IN PLS_INTEGER, names OUT aq$_jms_namearray,
    offset IN PLS_INTEGER, length IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER PROCEDURE get_object (id IN PLS_INTEGER, name IN VARCHAR2,
    value OUT NOCOPY AQ$_JMS_VALUE),
MEMBER FUNCTION get_size (id IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER FUNCTION item_exists (id IN PLS_INTEGER, name IN VARCHAR2)
    RETURN BOOLEAN);

```

CONSTRUCT aq\$_jms_map_message Function

STATIC FUNCTION construct RETURN aq\$_jms_map_message

Creates an empty aq\$_jms_map_message object.

JMS Header Methods

set_replyto (replyto IN sys.aq\$_agent)

Sets the replyto parameter, which corresponds to JMSReplyTo in JMS.

set_type (type IN VARCHAR)

Sets the JMS type, which can be any text, and which corresponds to JMSType in JMS.

get_replyto RETURN sys.aq\$_agent

Returns replyto, which corresponds to JMSReplyTo.

get_type RETURN VARCHAR

Returns type, which corresponds to JMSType.

System Properties Methods

set_userid (userid IN VARCHAR)

Sets userid, which corresponds to JMSXUserID in JMS.

set_appid (appid IN VARCHAR)

Sets appid, which corresponds to JMSXAppID in JMS.

set_groupid (groupid IN VARCHAR)

Sets groupid, which corresponds to JMSXGroupID in JMS.

set_groupseq (groupseq IN INT)

Sets groupseq, which corresponds to JMSXGroupSeq in JMS.

get_userid RETURN VARCHAR

Returns userid, which corresponds to JMSXUserID.

get_appid RETURN VARCHAR

Returns `appid`, which corresponds to `JMSXAppID`.

get_groupid RETURN VARCHAR

Returns `groupid`, which corresponds to `JMSXGroupID`.

get_groupseq RETURN NUMBER

Returns `groupseq`, which corresponds to `JMSXGroupSeq`.

User Properties Methods

clear_properties

Clears all user properties. This procedure does not affect system properties.

set_boolean_property (property_name IN VARCHAR, property_value IN BOOLEAN)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value` in an internal representation. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_byte_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -128 to 127 (8-bits). This check is necessary because neither PL/SQL nor RDBMS defines the `BYTE` datatype. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_double_property (property_name IN VARCHAR, property_value IN DOUBLE PRECISION)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_float_property (property_name IN VARCHAR, property_value IN FLOAT)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_int_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -2147483648 to 2147483647 (32-bits). This check is necessary because in PL/SQL and Oracle Database, the `INT` datatype is 38 bits. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_long_property (property_name IN VARCHAR, property_value IN NUMBER)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. In PL/SQL and Oracle Database, the `NUMBER` datatype is 38 bits. In Java, the `long` datatype is 64 bits. Therefore, no range check is needed. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_short_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -32768 to 32767 (16-bits). This check is necessary because

neither PL/SQL nor RDBMS defines the `short` datatype. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_string_property (property_name IN VARCHAR, property_value IN VARCHAR)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

get_boolean_property (property_name IN VARCHAR) RETURN BOOLEAN

If the property with the corresponding property name passed in exists, and if it is a `BOOLEAN` property, then this function returns the value of the property. Otherwise it returns a null.

get_byte_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `BYTE` property, then this function returns the value of the property. Otherwise it returns a null.

get_double_property (property_name IN VARCHAR) RETURN DOUBLE PRECISION

If the property with the corresponding property name passed in exists, and if it is a `DOUBLE` property, then this function returns the value of the property. Otherwise it returns a null.

get_float_property (property_name IN VARCHAR) RETURN FLOAT

If the property with the corresponding property name passed in exists, and if it is a `FLOAT` property, then this function returns the value of the property. Otherwise it returns a null.

get_int_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `Integer` property, then this function returns the value of the property. Otherwise it returns a null.

get_long_property (property_name IN VARCHAR) RETURN NUMBER

If the property with the corresponding property name passed in exists, and if it is a `long` property, then this function returns the value of the property. Otherwise it returns a null.

get_short_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `short` property, then this function returns the value of the property. Otherwise it returns a null.

get_string_property (property_name IN VARCHAR) RETURN VARCHAR

If the property with the corresponding property name passed in exists, and if it is a `STRING` property, then this function returns the value of the property. Otherwise it returns a null.

Payload Methods**set_bytes (payload IN RAW)**

Sets the internal payload as a `RAW` variable without any interpretation. The payload of `aq$_jms_map_message` is stored as either `RAW` or `BLOB` in the database. This member function sets a payload as a `RAW` variable without interpreting it.

set_bytes (payload IN BLOB)

Sets the internal payload as a `BLOB` variable without any interpretation. The payload of `aq$_jms_map_message` is stored as either `RAW` or `BLOB` in the database. This member function sets a payload as a `BLOB` variable without interpreting it.

get_bytes (payload OUT RAW)

Puts the internal payload into a `RAW` variable without any interpretation. The payload of `aq$_jms_map_message` is stored as either `RAW` or `BLOB` in the database. This member function gets a payload as raw bytes without interpreting it. Raises exceptions `ORA-24190` if the length of internal payload is more than 32767.

get_bytes (payload OUT BLOB)

Puts the internal payload into a `BLOB` variable without any interpretation. The payload of `aq$_jms_map_message` is stored as either `RAW` or `BLOB` in the database. This member function gets a payload as a `BLOB` without interpreting it.

prepare (id IN PLS_INTEGER) RETURN PLS_INTEGER

Takes the byte array stored in `aq$_jms_map_message` and decodes it as a Java object in the Java stored procedure. The result of the decoding is stored as a static variable in Jserv session memory. Parameter `id` is used to identify the slot where the Java object is stored in the Oracle Database JVM session memory. If `id` is null, then a new slot is created for this PL/SQL object. Subsequent JMS operations on the payload need to provide this operation ID.

This function raises `ORA-24197` if the Java stored procedure throws an exception during execution, `ORA-24198` if the operation ID is invalid, or `ORA-24199` if the Java stored procedure message store overflows.

flush (id IN PLS_INTEGER)

Takes the static variable in Jserv and synchronizes the content back to `aq$_jms_map_message`. This procedure raises `ORA-24197` if the Java stored procedure throws an exception during execution or `ORA-24198` if the operation ID is invalid.

clear_body (id IN PLS_INTEGER)

Sets the Java stored procedure static variable to empty payload. Parameter `id` is used to identify the slot where the Java object is stored in the Oracle Database JVM session memory. If `id` is null, a new slot is created for this PL/SQL object. Subsequent JMS operations on the payload need to provide this operation ID.

This function raises `ORA-24197` if the Java stored procedure throws an exception during execution, `ORA-24198` if the operation ID is invalid, or `ORA-24199` if the Java stored procedure message store overflows.

clean (id IN PLS_INTEGER)

Closes and cleans up the `DataInputStream` or `DataOutputStream` at the Java stored procedure side corresponding to the operation ID. It is very important to call this procedure to avoid memory leaks. This procedure raises `ORA-24197` if the Java stored procedure throws an exception during execution or `ORA-24198` if the operation ID is invalid.

clean_all

Closes and cleans up all the messages in the corresponding type of message store at the Java stored procedure side. This procedure raises `ORA-24197` if the Java stored procedure throws an exception during execution.

set_boolean (id IN PLS_INTEGER, name IN VARCHAR2, value IN BOOLEAN)

Sets the Boolean value with the specified name in the map. Raises exception `ORA-24197` if the Java stored procedure throws an exception during execution or `ORA-24198` if the operation ID is invalid.

set_byte (id IN PLS_INTEGER, name IN VARCHAR2, value IN PLS_INTEGER)

Sets the `BYTE` value with the specified name in the map. Because there is no `BYTE` type in PL/SQL, `PLS_INTEGER` is used to represent a byte. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_bytes (id IN PLS_INTEGER, name IN VARCHAR2, value IN RAW)

Sets the byte array value with the specified name in the map. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_bytes (id IN PLS_INTEGER, name IN VARCHAR2, value IN RAW, offset IN INT, length IN INT)

Sets a portion of the byte array value with the specified name in the map. Parameter `offset` is the initial offset within the byte array, and parameter `length` is the number of bytes to use. If the range [`offset ... offset+length`] exceeds the boundary of the byte array value, then a Java `IndexOutOfBoundsException` exception is thrown in the Java stored procedure and this procedure raises an ORA-24197 error. The index starts from 0. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_bytes (id IN PLS_INTEGER, name IN VARCHAR2, value IN BLOB)

Sets the byte array value with the specified name in the map. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_bytes (id IN PLS_INTEGER, name IN VARCHAR2, value IN BLOB, offset IN INT, length IN INT)

Sets a portion of the byte array value with the specified name in the map. Parameter `offset` is the initial offset within the byte array, and parameter `length` is the number of bytes to use. If the range [`offset ... offset+length`] exceeds the boundary of the byte array value, then a Java `IndexOutOfBoundsException` exception is thrown in the Java stored procedure, and this procedure raises an ORA-24197 error. The index starts from 0. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_char (id IN PLS_INTEGER, name IN VARCHAR2, value IN CHAR)

Sets the character value with the specified name in the map. If this value has multiple characters, then it is the first character that is used. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_double (id IN PLS_INTEGER, name IN VARCHAR2, value IN DOUBLE PRECISION)

Sets the double value with the specified name in the map. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_float (id IN PLS_INTEGER, name IN VARCHAR2, value IN FLOAT)

This procedure is to set the float value with the specified name in the map. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_int (id IN PLS_INTEGER, name IN VARCHAR2, value IN PLS_INTEGER)

Sets the int value with the specified name in the map. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_long (id IN PLS_INTEGER, name IN VARCHAR2, value IN NUMBER)

Sets the long value with the specified name in the map. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_short (id IN PLS_INTEGER, name IN VARCHAR2, value IN PLS_INTEGER)

Sets the short value with the specified name in the map. Because there is no short type in PL/SQL, `PLS_INTEGER` is used to represent a short. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_string (id IN PLS_INTEGER, name IN VARCHAR2, value IN VARCHAR2)

Sets the string value with the specified name in the map. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

set_string (id IN PLS_INTEGER, name IN VARCHAR2, value IN CLOB)

Sets the string value with the specified name in the map. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

get_boolean (id IN PLS_INTEGER, name IN VARCHAR2) RETURN BOOLEAN

Retrieves the Boolean value with the specified name. If there is no item by this name, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

get_byte (id IN PLS_INTEGER, name IN VARCHAR2) RETURN PLS_INTEGER

Retrieves the `BYTE` value with the specified name. If there is no item by this name, then null is returned. Because there is no `BYTE` type in PL/SQL, `PLS_INTEGER` is used to represent a byte. Although the PL/SQL users get an `PLS_INTEGER`, they are guaranteed that the value is in the Java `BYTE` value range. If this value is issued with a `set_byte` function, then there will not be an out of range error. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

get_bytes (id IN PLS_INTEGER, name IN VARCHAR2, value OUT NOCOPY BLOB)

Retrieves the byte array value with the specified name. If there is no item by this name, then null is returned. Because the size of the array might be larger than the limit of PL/SQL `RAW` type, a `BLOB` is always returned here. The `BLOB` returned is a copy, which means it can be modified without affecting the message payload. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

get_char (id IN PLS_INTEGER, name IN VARCHAR2) RETURN CHAR

Retrieves and returns the character value with the specified name. If there is no item by this name, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid.

get_double (id IN PLS_INTEGER, name IN VARCHAR2) RETURN DOUBLE PRECISION

Retrieves and returns the double value with the specified name. If there is no item by this name, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid.

get_float (id IN PLS_INTEGER, name IN VARCHAR2) RETURN FLOAT

Retrieves the float value with the specified name. If there is no item by this name, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

get_int (id IN PLS_INTEGER, name IN VARCHAR2) RETURN PLS_INTEGER

Retrieves the `INT` value with the specified name. If there is no item by this name, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

get_long (id IN PLS_INTEGER, name IN VARCHAR2) RETURN NUMBER

Retrieves the long value with the specified name. If there is no item by this name, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

get_short (id IN PLS_INTEGER, name IN VARCHAR2) RETURN PLS_INTEGER

Retrieves the short value with the specified name. If there is no item by this name, then null is returned. Because there is no `short` type in PL/SQL, `INT` is used to represent a `short`. Although the PL/SQL users get an `PLS_INTEGER`, they are guaranteed that the value is in the Java short value range. If this value is issued with a `set_short` function, then there will not be an out of range error. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

get_string (id IN PLS_INTEGER, name IN VARCHAR2, value OUT NOCOPY CLOB)

Retrieves the string value with the specified name. If there is no item by this name, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

get_names (id IN PLS_INTEGER) RETURN aq\$_jms_namearray

Retrieves all the names within the map message and returns them in a varray. Because `aq$_jms_namearray` has a size as 1024 and each element is a `VARCHAR(200)`, this function will return an error if the size of the name array of the payload exceeds the limit. Raises exception ORA-24195 if the size of the name array or the size of a name exceeds the limit.

get_names (id IN PLS_INTEGER, names OUT aq\$_jms_namearray, offset IN PLS_INTEGER, length IN PLS_INTEGER) RETURN PLS_INTEGER

Retrieves a portion of the names within the map message. Because `aq$_jms_namearray` has a size as 1024 and each element is a `VARCHAR(200)`, this function will return an error if either limits are exceeded during the retrieval. (This means there is no sense to put a `length`

parameter greater than 1024.) The index of the names of a map messages begins from 0. Parameter `offset` is the offset from which to start retrieving.

The function returns the number of names that have been retrieved. The names retrieved is the intersection of the interval `[offset, offset+length-1]` and interval `[0, size-1]` where `size` is the size of this map message. If the intersection is an empty set, then names will be returned as null and the function returns 0 as the number of names retrieved. If users iterate the names by retrieving in small steps, then this can be used to test that there are no more names to read from map message.

Raises exception ORA-24195 if the size of the name array or the size of a name exceed the limit, ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

get_object (id IN PLS_INTEGER, name IN VARCHAR2, value OUT NOCOPY AQ\$_JMS_VALUE)

Returns a general value ADT `AQ$_JMS_VALUE`. If there is no item by this name, then null is returned. Users can use the `type` attribute of this ADT to interpret the data. See the map in the `AQ$_JMS_VALUE` ADT for the correspondence among `dbms_jms_plsql` package constants, Java datatype and `AQ$_JMS_VALUE` attribute. Note this member procedure might bring additional overhead compared to other `get` member procedures or functions. It is used only if the user does not know the datatype of the fields within a message before hand. Otherwise it is a good idea to use a specific `get` member procedure or function. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

get_size (id IN PLS_INTEGER) RETURN PLS_INTEGER

Retrieves the size of the map message. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

item_exists (id IN PLS_INTEGER, name IN VARCHAR2) RETURN BOOLEAN

Indicates that an item exists in this map message by returning `TRUE`. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

302.9.5 SYS.AQ\$_JMS_STREAM_MESSAGE Type

This type is the ADT used to store a `StreamMessage` in an Oracle Database Advanced Queuing queue.

This section contains these topics:

- [CONSTRUCT `aq\$_jms_stream_message` Function](#)
- [JMS Header Methods](#)
- [System Properties Methods](#)
- [User Properties Methods](#)
- [Payload Methods](#)

Syntax

```
TYPE aq$_jms_stream_message AS object(
  header      aq$_jms_header,
  bytes_len   int,
  bytes_raw   raw(2000),
```

```
bytes_lob blob,
STATIC FUNCTION construct RETURN aq$_jms_stream_message,
MEMBER PROCEDURE set_replyto (replyto IN sys.aq$_agent),
MEMBER PROCEDURE set_type (type IN VARCHAR),
MEMBER FUNCTION get_replyto RETURN sys.aq$_agent,
MEMBER FUNCTION get_type RETURN VARCHAR,
MEMBER PROCEDURE set_userid (userid IN VARCHAR),
MEMBER PROCEDURE set_appid (appid IN VARCHAR),
MEMBER PROCEDURE set_groupid (groupid IN VARCHAR),
MEMBER PROCEDURE set_groupseq (groupseq IN INT),
MEMBER FUNCTION get_userid RETURN VARCHAR,
MEMBER FUNCTION get_appid RETURN VARCHAR,
MEMBER FUNCTION get_groupid RETURN VARCHAR,
MEMBER FUNCTION get_groupseq RETURN INT,
MEMBER PROCEDURE clear_properties,
MEMBER PROCEDURE set_boolean_property(property_name IN VARCHAR,
property_value IN BOOLEAN),
MEMBER PROCEDURE set_byte_property (property_name IN VARCHAR,
property_value IN INT),
MEMBER PROCEDURE set_double_property (property_name IN VARCHAR,
property_value IN DOUBLE PRECISION),
MEMBER PROCEDURE set_float_property (property_name IN VARCHAR,
property_value IN FLOAT),
MEMBER PROCEDURE set_int_property (property_name IN VARCHAR,
property_value IN INT),
MEMBER PROCEDURE set_long_property (property_name IN VARCHAR,
property_value IN NUMBER),
MEMBER PROCEDURE set_short_property (property_name IN VARCHAR,
property_value IN INT),
MEMBER PROCEDURE set_string_property (property_name IN VARCHAR,
property_value IN VARCHAR),
MEMBER FUNCTION get_boolean_property (property_name IN VARCHAR) RETURN BOOLEAN,
MEMBER FUNCTION get_byte_property (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_double_property (property_name IN VARCHAR)
RETURN DOUBLE PRECISION,
MEMBER FUNCTION get_float_property (property_name IN VARCHAR) RETURN FLOAT,
MEMBER FUNCTION get_int_property (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_long_property (property_name IN VARCHAR) RETURN NUMBER,
MEMBER FUNCTION get_short_property (property_name IN VARCHAR) RETURN INT,
MEMBER FUNCTION get_string_property (property_name IN VARCHAR) RETURN VARCHAR,
MEMBER PROCEDURE set_bytes (payload IN RAW),
MEMBER PROCEDURE set_bytes (payload IN BLOB),
MEMBER PROCEDURE get_bytes (payload OUT RAW),
MEMBER PROCEDURE get_bytes (payload OUT BLOB),
MEMBER FUNCTION prepare (id IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER PROCEDURE reset (id IN PLS_INTEGER),
MEMBER PROCEDURE flush (id IN PLS_INTEGER),
MEMBER PROCEDURE clear_body (id IN PLS_INTEGER),
MEMBER PROCEDURE clean (id IN PLS_INTEGER),
STATIC PROCEDURE clean_all,
MEMBER FUNCTION get_mode (id IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER FUNCTION read_boolean (id IN PLS_INTEGER) RETURN BOOLEAN,
MEMBER FUNCTION read_byte (id IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER FUNCTION read_bytes (id IN PLS_INTEGER) RETURN BLOB,
MEMBER PROCEDURE read_bytes (id IN PLS_INTEGER, value OUT NOCOPY BLOB),
MEMBER FUNCTION read_char (id IN PLS_INTEGER) RETURN CHAR,
MEMBER FUNCTION read_double (id IN PLS_INTEGER) RETURN DOUBLE PRECISION,
MEMBER FUNCTION read_float (id IN PLS_INTEGER) RETURN FLOAT,
MEMBER FUNCTION read_int (id IN PLS_INTEGER) RETURN PLS_INTEGER,
MEMBER FUNCTION read_long (id IN PLS_INTEGER) RETURN NUMBER,
MEMBER FUNCTION read_short (id IN PLS_INTEGER) RETURN PLS_INTEGER,
```

```

MEMBER FUNCTION read_string RETURN CLOB,
MEMBER PROCEDURE read_string (id IN PLS_INTEGER, value OUT NOCOPY CLOB),
MEMBER PROCEDURE read_object (id IN PLS_INTEGER,
    value OUT NOCOPY AQ$_JMS_VALUE),
MEMBER PROCEDURE write_boolean (id IN PLS_INTEGER, value IN BOOLEAN),
MEMBER PROCEDURE write_byte (id IN PLS_INTEGER, value IN INT),
MEMBER PROCEDURE write_bytes (id IN PLS_INTEGER, value IN RAW),
MEMBER PROCEDURE write_bytes (id IN PLS_INTEGER, value IN RAW,
    offset IN INT, length IN INT),
MEMBER PROCEDURE write_bytes (id IN PLS_INTEGER, value IN BLOB),
MEMBER PROCEDURE write_bytes (id IN PLS_INTEGER, value IN BLOB,
    offset IN INT, length IN INT),
MEMBER PROCEDURE write_char (id IN PLS_INTEGER, value IN CHAR),
MEMBER PROCEDURE write_double (id IN PLS_INTEGER, value IN DOUBLE PRECISION),
MEMBER PROCEDURE write_float (id IN PLS_INTEGER, value IN FLOAT),
MEMBER PROCEDURE write_int (id IN PLS_INTEGER, value IN PLS_INTEGER),
MEMBER PROCEDURE write_long (id IN PLS_INTEGER, value IN NUMBER),
MEMBER PROCEDURE write_short (id IN PLS_INTEGER, value IN PLS_INTEGER),
MEMBER PROCEDURE write_string (id IN PLS_INTEGER, value IN VARCHAR2),
MEMBER PROCEDURE write_string (id IN PLS_INTEGER, value IN CLOB));

```

CONSTRUCT aq\$_jms_stream_message Function**STATIC FUNCTION construct RETURN aq\$_jms_stream_message**

Creates an empty aq\$_jms_stream_message object.

JMS Header Methods**set_replyto (replyto IN sys.aq\$_agent)**

Sets the replyto parameter, which corresponds to JMSReplyTo in JMS.

set_type (type IN VARCHAR)

Sets the JMS type, which can be any text, and which corresponds to JMSType in JMS.

get_replyto RETURN sys.aq\$_agent

Returns replyto, which corresponds to JMSReplyTo.

get_type RETURN VARCHAR

Returns type, which corresponds to JMSType.

System Properties Methods**set_userid (userid IN VARCHAR)**

Sets userid, which corresponds to JMSXUserID in JMS.

set_appid (appid IN VARCHAR)

Sets appid, which corresponds to JMSXAppID in JMS.

set_groupid (groupid IN VARCHAR)

Sets groupid, which corresponds to JMSXGroupID in JMS.

set_groupseq (groupseq IN INT)

Sets groupseq, which corresponds to JMSXGroupSeq in JMS.

get_userid RETURN VARCHAR

Returns userid, which corresponds to JMSXUserID.

get_appid RETURN VARCHAR

Returns `appid`, which corresponds to `JMSXAppID`.

get_groupid RETURN VARCHAR

Returns `groupid`, which corresponds to `JMSXGroupID`.

get_groupseq RETURN NUMBER

Returns `groupseq`, which corresponds to `JMSXGroupSeq`.

User Properties Methods**clear_properties**

Clears all user properties. This procedure does not affect system properties.

set_boolean_property (property_name IN VARCHAR, property_value IN BOOLEAN)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value` in an internal representation. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_byte_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -128 to 127 (8-bits). This check is necessary because neither PL/SQL nor RDBMS defines the `BYTE` datatype. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_double_property (property_name IN VARCHAR, property_value IN DOUBLE PRECISION)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_float_property (property_name IN VARCHAR, property_value IN FLOAT)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_int_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -2147483648 to 2147483647 (32-bits). This check is necessary because in PL/SQL and Oracle Database, the `INT` datatype is 38 bits. Raises exception ORA-24191 if the property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_long_property (property_name IN VARCHAR, property_value IN NUMBER)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. In PL/SQL and Oracle Database, the `NUMBER` datatype is 38 bits. In Java, the `long` datatype is 64 bits. Therefore, no range check is needed. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

set_short_property (property_name IN VARCHAR, property_value IN INT)

Checks whether `property_name` is null or exists. If not, the procedure checks whether `property_value` is within -32768 to 32767 (16-bits). This check is necessary because neither PL/SQL nor RDBMS defines the `short` datatype. Raises exception ORA-24191 if the

property name exists, ORA-24192 if the property name is null, or ORA-24193 if the property value exceeds the valid range.

set_string_property (property_name IN VARCHAR, property_value IN VARCHAR)

Checks whether `property_name` is null or exists. If not, the procedure stores `property_value`. Raises exception ORA-24191 if the property name exists or ORA-24192 if the property name is null.

get_boolean_property (property_name IN VARCHAR) RETURN BOOLEAN

If the property with the corresponding property name passed in exists, and if it is a `BOOLEAN` property, then this function returns the value of the property. Otherwise it returns a null.

get_byte_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `BYTE` property, then this function returns the value of the property. Otherwise it returns a null.

get_double_property (property_name IN VARCHAR) RETURN DOUBLE PRECISION

If the property with the corresponding property name passed in exists, and if it is a `DOUBLE` property, then this function returns the value of the property. Otherwise it returns a null.

get_float_property (property_name IN VARCHAR) RETURN FLOAT

If the property with the corresponding property name passed in exists, and if it is a `FLOAT` property, then this function returns the value of the property. Otherwise it returns a null.

get_int_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `Integer` property, then this function returns the value of the property. Otherwise it returns a null.

get_long_property (property_name IN VARCHAR) RETURN NUMBER

If the property with the corresponding property name passed in exists, and if it is a `long` property, then this function returns the value of the property. Otherwise it returns a null.

get_short_property (property_name IN VARCHAR) RETURN INT

If the property with the corresponding property name passed in exists, and if it is a `short` property, then this function returns the value of the property. Otherwise it returns a null.

get_string_property (property_name IN VARCHAR) RETURN VARCHAR

If the property with the corresponding property name passed in exists, and if it is a `STRING` property, then this function returns the value of the property. Otherwise it returns a null.

Payload Methods

get_bytes (payload OUT RAW)

Puts the internal payload into a `RAW` variable without any interpretation. The payload of type `aq$_jms_stream_message` is stored as either `RAW` or `BLOB` in the database. This

member function gets a payload as raw bytes without interpreting it. Raises exception ORA-24190 if the length of internal payload is more than 32767.

get_bytes (payload OUT BLOB)

Puts the internal payload into a BLOB variable without any interpretation. The payload of type `aq$_jms_stream_message` is stored as either RAW or BLOB in the database. This member function gets a payload as a BLOB variable without interpreting it.

set_bytes (payload IN RAW)

Sets the internal payload as the RAW variable without any interpretation. The payload of type `aq$_jms_stream_message` is stored as either RAW or BLOB in the database. This member function sets a payload as raw bytes without interpreting it.

set_bytes (payload IN BLOB)

Sets the internal payload as the BLOB variable without any interpretation. The payload of type `aq$_jms_stream_message` is stored as either RAW or BLOB in the database. This member function sets a payload as a BLOB variable without interpreting it.

prepare (id IN PLS_INTEGER) RETURN PLS_INTEGER

Takes the byte array stored in `aq$_jms_stream_message` and decodes it as a Java object in the Java stored procedure. The result of the decoding is stored as a static variable in Jserv session memory. Parameter `id` is used to identify the slot where the Java object is stored in the Oracle Database JVM session memory. If `id` is null, then a new slot is created for this PL/SQL object. Subsequent JMS operations on the payload need to provide this operation ID.

This function also sets the message access mode to `MESSAGE_ACCESS_READONLY`.

Subsequent calls of `write_XXX` procedure raise an ORA-24196 error. Users can call the `clear_body` procedure to set the message access mode to `MESSAGE_ACCESS_READONLY`.

This function raises ORA-24197 if the Java stored procedure throws an exception during execution, ORA-24198 if the operation ID is invalid, or ORA-24199 if the Java stored procedure message store overflows.

reset (id IN PLS_INTEGER)

Resets the starting position of the stream to the beginning and puts the stream message in `MESSAGE_ACCESS_READONLY` mode.

flush (id IN PLS_INTEGER)

Takes the static variable in Jserv and synchronizes the content back to `aq$_jms_stream_message`. This procedure will not affect the underlying access mode. This procedure raises ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

clear_body (id IN PLS_INTEGER)

Sets the Java stored procedure static variable to empty payload. Parameter `id` is used to identify the slot where the Java object is stored in the Oracle Database JVM session memory. If `id` is null, a new slot is created for this PL/SQL object. Subsequent JMS operations on the payload need to provide this operation ID.

It also sets the message access mode to `MESSAGE_ACCESS_WRITEONLY`. Later calls of `read_XXX` procedure raise ORA-24196 error. Users can call the `reset` or `prepare` procedures to set the message access mode to `MESSAGE_ACCESS_READONLY`. Write-only and read-only modes affect only the payload functions of `AQ$_JMS_BYTES_MESSAGE`. They do not affect the header functions.

This function raises ORA-24197 if the Java stored procedure throws an exception during execution, ORA-24198 if the operation ID is invalid, or ORA-24199 if the Java stored procedure message store overflows.

clean (id IN PLS_INTEGER)

Closes and cleans up the `DataInputStream` or `DataOutputStream` at the Java stored procedure side corresponding to the operation ID. It is very important to call this procedure to avoid memory leaks. This procedure raises ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

clean_all

Closes and cleans up all the messages in the corresponding type of message store at the Java stored procedure side. This procedure raises ORA-24197 if the Java stored procedure throws an exception during execution.

get_mode (id IN PLS_INTEGER) RETURN PLS_INTEGER

Returns the current mode of this message. The return value is either `SYS.dbms_aqjms.READ_ONLY` or `SYS.dbms_aqjms.WRITE_ONLY`. Raises exception ORA-24197 if the Java stored procedure throws an exception during execution or ORA-24198 if the operation ID is invalid.

read_boolean (id IN PLS_INTEGER) RETURN BOOLEAN

Reads and returns a Boolean value from the stream message. If the end of the message stream has been reached, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24196 if the stream message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_byte (id IN PLS_INTEGER) RETURN PLS_INTEGER

Reads and returns a byte value from the stream message. If the end of the message stream has been reached, then null is returned. Because there is no `BYTE` type in PL/SQL, `INT` is used to represent a byte. Although PL/SQL users get an `INT`, they are guaranteed that the value is in the Java `BYTE` value range. If this value is issued with a `write_byte` function, then there will not be an out of range error. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24196 if the stream message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_bytes (id IN PLS_INTEGER) RETURN BLOB

Reads and returns a byte array from the stream message. If the end of the message stream has been reached, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid or ORA-24196 if the stream message is in write-only mode.

read_bytes (id IN PLS_INTEGER, value OUT NOCOPY BLOB)

Reads a byte array from the stream message. If the end of the message stream has been reached, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24196 if the stream message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_char (id IN PLS_INTEGER) RETURN CHAR

Reads and returns a character value from the stream message. If the end of the message stream has been reached, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24196 if the stream message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_double (id IN PLS_INTEGER) RETURN DOUBLE PRECISION

Reads and returns a double from the stream message. If the end of the message stream has been reached, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24196 if the stream message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_float (id IN PLS_INTEGER) RETURN FLOAT

Reads and returns a float from the stream message. If the end of the message stream has been reached, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24196 if the stream message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_int (id IN PLS_INTEGER) RETURN PLS_INTEGER

Reads and returns an `INT` from the stream message. If the end of the message stream has been reached, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24196 if the stream message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_long (id IN PLS_INTEGER) RETURN NUMBER

Reads and returns a long from the stream message. If the end of the message stream has been reached, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24196 if the stream message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_short (id IN PLS_INTEGER) RETURN PLS_INTEGER

Reads and returns a short value from the stream message. If the end of the message stream has been reached, then null is returned. Because there is no short type in PL/SQL, `PLS_INTEGER` is used to represent a `SHORT`. Although PL/SQL users get an `INT`, they are guaranteed that the value is in the Java short value range. If this value is issued with a `write_short` function, then there will not be an out of range error. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24196 if the stream message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_string RETURN CLOB

Reads and returns a string from the stream message. If the end of the message stream has been reached, then null is returned. Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid or ORA-24196 if the stream message is in write-only mode.

read_string (id IN PLS_INTEGER, value OUT NOCOPY CLOB)

Reads a string from the stream message. If the end of the message stream has been reached, then null is returned. Raises exception ORA-24194 if the type conversion between

the type of real value and the expected type is invalid, ORA-24196 if the stream message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

read_object (id IN PLS_INTEGER, value OUT NOCOPY AQ\$_JMS_VALUE)

Returns a general value ADT AQ\$_JMS_VALUE. Users can use the type attribute of this ADT to interpret the data. See [Table 302-2](#) for the correspondence among `dbms_jms_plsql` package constants, Java datatype and AQ\$_JMS_VALUE attribute. This member procedure might bring additional overhead compared to other read member procedures or functions. It is used only if the user does not know the datatype of the fields within a message beforehand. Otherwise it is a good idea to use a specific read member procedure or function.

Raises exception ORA-24194 if the type conversion between the type of real value and the expected type is invalid, ORA-24196 if the stream message is in write-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_boolean (id IN PLS_INTEGER, value IN BOOLEAN)

Writes a Boolean to the stream message. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_byte (id IN PLS_INTEGER, value IN INT)

Writes a byte to the stream message. Because there is no `BYTE` type in PL/SQL, `INT` is used to represent a byte. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_bytes (id IN PLS_INTEGER, value IN RAW)

Writes a byte array field to the stream message. Consecutively written byte array fields are treated as two distinct fields when the fields are read. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_bytes (id IN PLS_INTEGER, value IN RAW, offset IN INT, length IN INT)

Writes a portion of a byte array as a byte array field to the stream message. Consecutively written byte array fields are treated as two distinct fields when the fields are read. Parameter `offset` is the initial offset within the byte array, and parameter `length` is the number of bytes to use. If the range `[offset, offset+length]` exceeds the boundary of the byte array value, then a Java `IndexOutOfBoundsException` exception is thrown in the Java stored procedure. The index starts from 0.

Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_bytes (id IN PLS_INTEGER, value IN BLOB)

Writes a byte array field to the stream message. Consecutively written byte array fields are treated as two distinct fields when the fields are read. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_bytes (id IN PLS_INTEGER, value IN BLOB, offset IN INT, length IN INT)

Writes a portion of a byte array as a byte array field to the stream message. Consecutively written byte array fields are treated as two distinct fields when the fields are read. Parameter `offset` is the initial offset within the byte array, and parameter `length` is the number of bytes to use. If the range `[offset, offset+length]` exceeds the boundary of the byte array value, then a Java `IndexOutOfBoundsException` exception is thrown in the Java stored procedure. The index starts from 0.

Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_char (id IN PLS_INTEGER, value IN CHAR)

Writes a character value to the stream message. If this value has multiple characters, then it is the first character that is written. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_double (id IN PLS_INTEGER, value IN DOUBLE PRECISION)

Writes a double to the stream message. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_float (id IN PLS_INTEGER, value IN FLOAT)

Writes a float to the stream message. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_int (id IN PLS_INTEGER, value IN PLS_INTEGER)

Writes an `INT` to the stream message. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_long (id IN PLS_INTEGER, value IN NUMBER)

Writes a long to the stream message. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_short (id IN PLS_INTEGER, value IN PLS_INTEGER)

Writes a short to the stream message. Because there is no short type in PL/SQL, `INT` is used to represent a short. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_string (id IN PLS_INTEGER, value IN VARCHAR2)

Writes a string to the stream message. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

write_string (id IN PLS_INTEGER, value IN CLOB)

Writes a string to the stream message. Raises exceptions ORA-24196 if the stream message is in read-only mode, ORA-24197 if the Java stored procedure throws an exception during execution, or ORA-24198 if the operation ID is invalid.

302.9.6 SYS.AQ\$_JMS_OBJECT_MESSAGE Type

This type is the ADT used to store an `ObjectMessage` in an Oracle Database Advanced Queuing queue.

Syntax

```
TYPE aq$_jms_object_message AS object(  
    header    aq$_jms_header,  
    bytes_len int,  
    bytes_raw raw(2000),  
    bytes_lob blob);
```

302.9.7 SYS.AQ\$_JMS_NAMEARRAY Type

This type represents the name array returned by the `get_names` procedure of `aq$_jms_map_message`.

The maximum number of names this type can hold is 1024. The maximum length of each name is 200 characters.

Syntax

```
CREATE OR REPLACE TYPE AQ$_JMS_NAMEARRAY AS VARRAY(1024) OF VARCHAR(100);
```

Usage Notes

If the names array in the message payload is greater than 1024, then use the following function to retrieve the names in multiple portions:

```
MEMBER FUNCTION get_names(id IN PLS_INTEGER, names OUT aq$_jms_namearray,  
    offset IN PLS_INTEGER, length IN PLS_INTEGER) RETURN PLS_INTEGER;
```

302.9.8 SYS.AQ\$_JMS_VALUE Type

This type represents the general data returned by the `get_object` procedure of `aq$_jms_map_message` and the `read_object` procedure of `aq$_jms_stream_message`.

The `type` field in this ADT is used to decide which type of data this object is really holding. The following table lists the mapping between the `sys.dbms_jms_plsql` type constants, the corresponding Java type, and the data field of ADT `aq$_jms_value` which effectively holds the data.

Syntax

```
CREATE OR REPLACE TYPE AQ$_JMS_VALUE AS object(  
    type        number(2),  
    num_val     number,  
    char_val    char(1),  
    text_val    clob,  
    bytes_val   blob);
```

Table 302-2 AQ\$_JMS_VALUE Type Fields and Java Fields

Type	Java Type	aq\$_jms_value Data Field
DBMS_JMS_PLSQL.DATA_TYPE_BYTE	byte	num_val
DBMS_JMS_PLSQL.DATA_TYPE_SHORT	short	num_val
DBMS_JMS_PLSQL.DATA_TYPE_INTEGER	int	num_val
DBMS_JMS_PLSQL.DATA_TYPE_LONG	long	num_val
DBMS_JMS_PLSQL.DATA_TYPE_FLOAT	float	num_val
DBMS_JMS_PLSQL.DATA_TYPE_DOUBLE	double	num_val
DBMS_JMS_PLSQL.DATA_TYPE_BOOLEAN	boolean	num_val: 0 FALSE, 1 TRUE
DBMS_JMS_PLSQL.DATA_TYPE_CHARACTER	char	char_val
DBMS_JMS_PLSQL.DATA_TYPE_STRING	java.lang.String	text_val
DBMS_JMS_PLSQL.DATA_TYPE_BYTES	byte[]	bytes_val

302.9.9 SYS.AQ\$_JMS_EXCEPTION Type

This type represents a Java exception thrown on the Java stored procedure side.

The `id` field is reserved for future use. The `exp_name` stores the Java exception name, the `err_msg` field stores the Java exception error message, and the `stack` field stores the stack trace of the Java exception.

Syntax

```
CREATE OR REPLACE TYPE AQ$_JMS_EXCEPTION AS OBJECT (
  id          number, -- Reserved and not used. Right now always return 0.
  exp_name    varchar(200),
  err_msg     varchar(500),
  stack       varchar(4000));
```

JSON Data Structures

To work with JSON data in PL/SQL, you can use these data structures.

- [JSON_ELEMENT_T Object Type](#)
- [JSON_OBJECT_T Object Type](#)
- [JSON_ARRAY_T Object Type](#)
- [JSON_SCALAR_T Object Type](#)
- [JSON_KEY_LIST Type](#)

 **Note:**

The time component in the `DATE` value of the `get_Date` function is truncated. If you want to preserve the time component, use `get_Timestamp` and then use `CAST AS DATE` to convert to a SQL date with the time component.

Related Topics

- [Oracle Database JSON Developer's Guide](#)
- [The JSON standard](#)

303.1 JSON_ELEMENT_T Object Type

`JSON_ELEMENT_T` is the supertype for the `JSON_OBJECT_T`, `JSON_SCALAR_T`, and `JSON_ARRAY_T` object types.

Description

Note the following:

- To create an instance of `JSON_ELEMENT_T`, use the `parse` or `load` function. See the “Constructors” section below for details.
- You cannot create an empty `JSON_ELEMENT_T` instance. To create an empty JSON container, create it based on one of the subtypes.
- To cast a `JSON_ELEMENT_T` into a subtype (for example, `JSON_OBJECT_T`), you need to perform an explicit cast using `TREAT AS`. For example:

```
TREAT (elem AS JSON_OBJECT_T)
```

Constructors

You create a `JSON_ELEMENT_T` instance using the `parse` or `load` function. The `parse` function takes as input `VARCHAR2`, `CLOB`, or `BLOB` data, and returns a `JSON_ELEMENT_T` instance. Similarly, the `load` function takes JSON type as an input.


```

STATIC FUNCTION parse(jsn VARCHAR2) RETURN JSON_ELEMENT_T
STATIC FUNCTION parse(jsn CLOB)      RETURN JSON_ELEMENT_T
STATIC FUNCTION parse(jsn BLOB)      RETURN JSON_ELEMENT_T
STATIC FUNCTION parse(jsn BLOB, FORMAT IN VARCHAR2) RETURN JSON_ELEMENT_T
STATIC FUNCTION load(jsn JSON)       RETURN JSON_Element_T,

```

Only UTF8-encoded JSON is passed as a BLOB.

The `parse` function takes a JSON string as input and sets up an internal representation of the JSON data. If the provided input is not valid JSON, then an error message is raised. Valid JSON has to pass the lax check of the “IS JSON” SQL condition. The input for the `load` function is a JSON type, therefore, no JSON syntax check is needed.

Serialization and Conversions

A `JSON_ELEMENT_T` instance (and all subtypes) can be serialized to a JSON string, converted to a JSON type or (if it is a scalar value) converted to a SQL value like `Date` or `Number`. Serialization is the inverse of the `parse` function: a string representation of the in-memory representation of the JSON data is being generated and returned as an appropriate SQL type.

The serialization and conversion functions are:

```

MEMBER FUNCTION to_String      RETURN VARCHAR2
MEMBER FUNCTION stringify     RETURN VARCHAR2

MEMBER FUNCTION to_Clob       RETURN CLOB
MEMBER FUNCTION to_Blob       RETURN BLOB
MEMBER PROCEDURE to_Clob(c IN OUT CLOB)
MEMBER PROCEDURE to_Blob(c IN OUT BLOB)

MEMBER FUNCTION to_Json       RETURN JSON

MEMBER FUNCTION to_Number     RETURN NUMBER
MEMBER FUNCTION to_Date       RETURN DATE
MEMBER FUNCTION to_Timestamp  RETURN TIMESTAMP
MEMBER FUNCTION to_Boolean    RETURN BOOLEAN

```

The FUNCTION `stringify` is synonym of `to_String`. It has the same functionality.

The `to_Clob` and `to_Blob` *procedures* accept a CLOB or BLOB input and enable you to provide a LOB to be used as the serialization destination. For instance, `EMPTY_LOB` can be provided. The input LOB cannot be `NULL`.

If the `to_Clob` *function* is used, then a new CLOB is created. If you do not want to create a CLOB first, then you can use the `to_Clob` or `to_Blob` *functions*, which take no parameter and generate a temp LOB.

`to_Blob` serializes to UTF8 format only.

Introspection

Introspection enables you to discover properties of JSON objects without modifying them. The introspection functions are:

```

MEMBER FUNCTION has(key VARCHAR2) RETURN BOOLEAN,

```

```

MEMBER FUNCTION is_Object          RETURN BOOLEAN
MEMBER FUNCTION is_Array          RETURN BOOLEAN
MEMBER FUNCTION is_Scalar         RETURN BOOLEAN
MEMBER FUNCTION is_String         RETURN BOOLEAN
MEMBER FUNCTION is_Number        RETURN BOOLEAN
MEMBER FUNCTION is_Boolean       RETURN BOOLEAN
MEMBER FUNCTION is_True          RETURN BOOLEAN
MEMBER FUNCTION is_False         RETURN BOOLEAN
MEMBER FUNCTION is_Null          RETURN BOOLEAN
MEMBER FUNCTION is_Date          RETURN BOOLEAN
MEMBER FUNCTION is_Timestamp     RETURN BOOLEAN
MEMBER FUNCTION get_Size         RETURN NUMBER

```

The `has` function checks if a given name exists in the `JSON_OBJECT_T` object.

The return value of the `get_size` function depends on the JSON type:

- For a scalar, it returns 1.
- For an object, it returns the number of keys.
- For an array, it returns the number of items.

Note that textual JSON does not support dates and timestamps natively. Instead they are typically modeled as strings. You can use the JSON type to preserve dates and timestamps natively. The Document Object Model (DOM) interface enables you to add dates and timestamps as scalar values and preserve them until serialization to JSON, where they are printed as string following the ISO 8601 format. If a SQL value of type date or timestamp has been added, then the `is_Date` and `is_Timestamp` functions return true. If a date has been added as a string (e.g. as ISO 8601), then the `is_Date` and `is_Timestamp` functions return false. You can use Oracle conversion function `to_Date` and `to_Timestamp` to convert a string representation of a date, and timestamp to the Oracle representation.

Error Handling

You can set the level of error handling for JSON processing. You might not want an error to be raised for every mismatch. The `on_Error` procedure enables you to specify when errors should be raised:

```
MEMBER PROCEDURE on_Error(value NUMBER)
```

The `on_Error` procedure defines what happens if an error is encountered during a PL/SQL operation, for instance, a `get` call.

The default is to not raise an error but to return NULL instead.

You invoke `On_error` on a `JSON_ELEMENT_T` instance and it sets the error behavior for all subsequent calls. To reset the behavior to the default, you can call `on_Error(0)`.

Values for the `value` parameter are:

Table 303-1 Values for the value Parameter in the ON_ERROR Procedure

Value	Description
0	Reset to the default behavior, which is to return NULL instead of raising an error.
1	Raise all errors.
2	Raise an error if no value is detected.

Table 303-1 (Cont.) Values for the value Parameter in the ON_ERROR Procedure

Value	Description
3	Raise an error if the data types do not match, for example, if you call GET_NUMBER on a string value.
4	Raise an error if the input is invalid, for example, if the array is out of bounds.

You can combine values. For example, you can specify 7 to indicate a combination of 3 and 4.

In the following example, an error is raised because the value of "a" is "xyz", which cannot be converted to a number. If the `on_error` procedure had not been called, then NULL would be returned, and no error would be raised.

```
declare
    jo JSON_OBJECT_T;
begin
    jo := JSON_OBJECT_T.parse('{a:"xyz"}');
    jo.on_error(1);
    dbms_output.put_line(jo.get_number('a'));
end;
/
```

303.2 JSON_OBJECT_T Object Type

JSON_OBJECT_T is a subtype of the JSON_ELEMENT_T object type. It corresponds to the JSON object structure.

Constructors

You can create an empty JSON_OBJECT_T instance using the following constructor.

```
CONSTRUCTOR FUNCTION JSON_OBJECT_T RETURN SELF AS RESULT
```

You can create a JSON_OBJECT_T instance using one of the following `parse` functions:

```
STATIC FUNCTION parse(jsn VARCHAR2) RETURN JSON_OBJECT_T
STATIC FUNCTION parse(jsn CLOB) RETURN JSON_OBJECT_T
STATIC FUNCTION parse(jsn BLOB) RETURN JSON_OBJECT_T
STATIC FUNCTION parse(jsn BLOB, FORMAT IN VARCHAR2) RETURN JSON_OBJECT_T
```

You can also create a JSON_OBJECT_T instance using one of the following constructors:

```
CONSTRUCTOR FUNCTION JSON_OBJECT_T(jsn VARCHAR2) RETURN SELF AS RESULT
CONSTRUCTOR FUNCTION JSON_OBJECT_T(jsn CLOB) RETURN SELF AS RESULT
CONSTRUCTOR FUNCTION JSON_OBJECT_T(jsn BLOB) RETURN SELF AS RESULT
CONSTRUCTOR FUNCTION JSON_Object_T(jsn BLOB, FORMAT IN VARCHAR2) RETURN SELF AS RESULT
CONSTRUCTOR FUNCTION JSON_OBJECT_T(jsn JSON) RETURN SELF AS RESULT
CONSTRUCTOR FUNCTION JSON_OBJECT_T(e JSON_ELEMENT_T) RETURN SELF AS RESULT
```

Only UTF8-encoded JSON is passed as a BLOB.

The `parse` function takes a JSON string as input and sets up an internal representation of the JSON data. If the provided input is not a valid JSON object, then an error message is raised. The input has to specify a JSON object, not an array.

Get Functions and Procedures

The following functions and procedures enable you to retrieve the value of the JSON object:

```
MEMBER FUNCTION get(key VARCHAR2) RETURN JSON_ELEMENT_T
MEMBER FUNCTION get_String(key VARCHAR2) RETURN VARCHAR2
MEMBER FUNCTION get_Number(key VARCHAR2) RETURN NUMBER
MEMBER FUNCTION get_Date(key VARCHAR2) RETURN DATE
MEMBER FUNCTION get_Timestamp(key VARCHAR2) RETURN TIMESTAMP
MEMBER FUNCTION get_TimestampTZ(key VARCHAR2) RETURN TIMESTAMP WITH TIME ZONE
MEMBER FUNCTION get_Boolean(key VARCHAR2) RETURN BOOLEAN
MEMBER FUNCTION get_Clob(key VARCHAR2) RETURN CLOB
MEMBER FUNCTION get_Blob(key VARCHAR2) RETURN BLOB
MEMBER FUNCTION get_Object(key VARCHAR2) RETURN JSON_OBJECT_T
MEMBER FUNCTION get_Array(key VARCHAR2) RETURN JSON_ARRAY_T
MEMBER FUNCTION get_Json(key NUMBER) RETURN JSON

MEMBER PROCEDURE get_Json(key NUMBER, j OUT NOCOPY JSON)
MEMBER PROCEDURE get_Clob(key NUMBER, c IN OUT CLOB)
MEMBER PROCEDURE get_Blob(key NUMBER, c IN OUT BLOB)
```

Note:

- The `get` function has reference semantics. This means that if the returned `JSON_ELEMENT_T` is modified, then the containing `JSON_ELEMENT_T` is also changed. See the [Reference Semantics](#) section below for details.
- The `GET_STRING` function converts the value to a string if it is not already a string. Thus, the `GET_STRING` function returns a non-null value even if `IS_STRING` returns false.
- All the “get” functions perform a conversion if possible. If no conversion is possible, then an error might be raised, depending on what `ON_ERROR` is set to.

The `GET_CLOB` and `GET_BLOB` *procedures*, which accept a CLOB or BLOB as input, enable you to provide a LOB to be used as serialization destination. For instance, `EMPTY_LOB` can be provided. If you use the `GET_CLOB` *function* instead, then a new CLOB will be created implicitly. The input LOB cannot be NULL. If you do not want to create a BLOB or CLOB first, you can use the `GET_CLOB` or `GET_BLOB` functions, which take no parameter and generates a temp LOB.

`GET_BLOB` serializes to UTF8 format only.

Set Procedures

The following procedures enable you to set the value of a JSON object. Existing values, if present, will be overwritten.

```
MEMBER PROCEDURE put(key VARCHAR2, val JSON_ELEMENT_T)
MEMBER PROCEDURE put(key VARCHAR2, val VARCHAR2)
MEMBER PROCEDURE put(key VARCHAR2, val NUMBER)
MEMBER PROCEDURE put(key VARCHAR2, val BOOLEAN)
MEMBER PROCEDURE put(key VARCHAR2, val DATE)
MEMBER PROCEDURE put(key VARCHAR2, val TIMESTAMP)
MEMBER PROCEDURE put_Null(key VARCHAR2)
MEMBER PROCEDURE put(key VARCHAR2, val JSON)
```

Introspection Functions

Introspection enables you to discover properties of JSON objects without modifying them. The introspection functions are:

MEMBER FUNCTION has(key VARCHAR2)	RETURN BOOLEAN
MEMBER FUNCTION get_Type(key VARCHAR2)	RETURN VARCHAR2
MEMBER FUNCTION get_Keys	RETURN JSON_KEY_LIST

The get_Keys function returns an object type of JSON_KEY_LIST, which is a varray of VARCHAR2(4000). The varray contains the names of keys in the JSON object. The get_Keys function returns at most 32767 field names for a given JSON object. An error is raised if it is applied to an object with more than 32767 fields.

The example below walks through the items of the varray to build a JSON_ARRAY_T object that contains all key names.

```

declare
  jo JSON_OBJECT_T;
  ja JSON_ARRAY_T;
  keys JSON_KEY_LIST;
  keys_string VARCHAR2(100);

begin
  ja := new JSON_ARRAY_T;
  jo := JSON_OBJECT_T.parse('{"name":"fred",
                            "jobTitle":"codemonkey",
                            "projects":["json", "xml"]}');

  keys := jo.get_keys;
  for i in 1..keys.count loop
    ja.append(keys(i));
  end loop;

  keys_string := ja.to_string;
  dbms_output.put_line(keys_string);
end;
/

```

The output is:

```
["name","jobTitle","projects"]
```

Modification Procedures

The following procedures enable you to remove or rename keys in a JSON object.

MEMBER PROCEDURE remove(key VARCHAR2)
MEMBER PROCEDURE rename_Key(keyOld VARCHAR2, keyNew VARCHAR2)

Duplicate key names are not supported and will raise an error.

Clone Function

This function makes a copy of the JSON object. Reference semantics is changed to value semantics.

MEMBER FUNCTION clone RETURN JSON_OBJECT_T
--

Reference Semantics

Calling the `get` function that returns a `JSON_ELEMENT_T` object always returns a reference to the complex values instead of a copy. This means that changing the returned value affects its container. See the example below.

```
declare
  data      JSON_OBJECT_T;
  address   JSON_OBJECT_T;
  zip       number;

begin

  data := new JSON_OBJECT_T('{
    "first": "John",
    "last": "Doe",
    "address": {
      "country": "USA",
      "zip": "94065"
    }
  }');

  address := data.get_object('address');
  dbms_output.put_line(address.to_string);

  -- 1) VALUE SEMANTICS for scalar values
  -- (changing the value has no effect on container)
  zip := address.get_number('zip');
  dbms_output.put_line(zip);
  zip := 12345;
  dbms_output.put_line(zip);
  -- address is still the same
  dbms_output.put_line(address.to_string);

  -- 2) REFERENCE SEMANTICS for complex values
  -- 'address' is a reference to the complex address values inside 'data'
  address.put('zip', 12345);
  address.put('street', 'Detour Road');
  dbms_output.put_line(data.to_string);
end;
/
```

In cases where you do not want the reference semantics, you can use the `clone` function to create a copy of the returned object. This decouples the value from its container. In the example above, you can create a copy of the “address” object by replacing this line:

```
address := data.get_object('address');
```

with this line:

```
address := data.get_object('address').clone;
```

After this, changing the address will have no effect on the value of the ‘data’ containing object.

Update Example

The following example updates the price of an item by 10%.

```

WITH
  FUNCTION updatePrice(jsonTxt in VARCHAR2 ) RETURN VARCHAR2 IS
    jo JSON_OBJECT_T;
    oldPrice NUMBER;

  BEGIN
    jo := new JSON_OBJECT_T(jsonTxt);
    oldPrice := jo.get_number('price');
    jo.put('price', oldPrice * 1.1);
    RETURN jo.to_string();
  END;
SELECT updatePrice(col)
FROM   t1;

```

303.3 JSON_ARRAY_T Object Type

JSON_ARRAY_T is a subtype of the JSON_ELEMENT_T object type. JSON_ARRAY_T corresponds to the JSON array structure.

Constructors

You can create an empty JSON_ARRAY_T instance using the following constructor.

```
CONSTRUCTOR FUNCTION JSON_ARRAY_T RETURN SELF AS RESULT
```

You can create a JSON_ARRAY_T instance using one the following parse functions:

```

STATIC FUNCTION parse(jsn VARCHAR2)          RETURN JSON_ARRAY_T
STATIC FUNCTION parse(jsn CLOB)             RETURN JSON_ARRAY_T
STATIC FUNCTION parse(jsn BLOB)            RETURN JSON_ARRAY_T
STATIC FUNCTION parse(jsn BLOB, FORMAT IN VARCHAR2) RETURN JSON_ARRAY_T

```

You can also create a JSON_ARRAY_T instance using one the following constructors:

```

CONSTRUCTOR FUNCTION JSON_Array_T(jsn VARCHAR2) RETURN SELF AS RESULT
CONSTRUCTOR FUNCTION JSON_Array_T(jsn CLOB) RETURN SELF AS RESULT
CONSTRUCTOR FUNCTION JSON_Array_T(jsn BLOB) RETURN SELF AS RESULT
CONSTRUCTOR FUNCTION JSON_Array_T(e JSON_ELEMENT_T) RETURN SELF AS RESULT

```

Only UTF8-encoded JSON is passed as a BLOB.

The parse function takes a JSON string as input and sets up an internal representation of the JSON data. If the provided input is not valid JSON, then an error message is raised. The input has to specify a JSON array, not an object.

Get Functions and Procedures

The following functions and procedures enable you to retrieve the value of the JSON array:

```

MEMBER FUNCTION get(pos NUMBER)          RETURN JSON_ELEMENT_T
MEMBER FUNCTION get_String(pos NUMBER)   RETURN VARCHAR2
MEMBER FUNCTION get_Number(pos NUMBER)   RETURN NUMBER
MEMBER FUNCTION get_Date(pos NUMBER)     RETURN DATE
MEMBER FUNCTION get_Timestamp(pos NUMBER) RETURN TIMESTAMP
MEMBER FUNCTION get_Boolean(pos NUMBER)  RETURN BOOLEAN
MEMBER FUNCTION get_Clob(pos NUMBER)     RETURN CLOB
MEMBER FUNCTION get_Blob(pos NUMBER)     RETURN BLOB

```

```
MEMBER FUNCTION get_Json(pos NUMBER)          RETURN JSON

MEMBER PROCEDURE get_Json(pos NUMBER, j IN OUT NOCOPY JSON)
MEMBER PROCEDURE get_Clob(pos NUMBER, c IN OUT CLOB)
MEMBER PROCEDURE get_Blob(pos NUMBER, c IN OUT BLOB)
```

Note:

- The `get` function has reference semantics. This means that if the returned `JSON_ELEMENT_T` is modified, then the containing `JSON_ELEMENT_T` is changed too.
- The `GET_STRING` function converts the value to a string if it is not already a string. The function returns a non-null value even if `IS_STRING` returns false.
- All the “get” functions perform a conversion if possible. If no conversion is possible, then an error might be raised, depending on what `ON_ERROR` is set to.

The `GET_CLOB` and `GET_BLOB` *procedures*, which accept a `CLOB` or `BLOB` as input, enable you to provide a `LOB` to be used as serialization destination. For instance, `EMPTY_LOB` can be provided. If you use the `GET_CLOB` *function* instead, then a new `CLOB` will be created implicitly. The input `LOB` cannot be `NULL`. If you do not want to create a `BLOB` or `CLOB` first, you can use the `GET_CLOB` or `GET_BLOB` functions, which take no parameter and generates a temp `LOB`.

`GET_BLOB` serializes to UTF8 format only.

Set Procedures

The following procedures enable you to set the value at the specified position in the JSON array. These procedures insert (not overwrite) at the specified position unless overwrite is requested.

```
MEMBER PROCEDURE put(pos NUMBER, val VARCHAR2, overwrite BOOLEAN DEFAULT FALSE)
MEMBER PROCEDURE put(pos NUMBER, val NUMBER, overwrite BOOLEAN DEFAULT FALSE)
MEMBER PROCEDURE put(pos NUMBER, val BOOLEAN, overwrite BOOLEAN DEFAULT FALSE)
MEMBER PROCEDURE put(pos NUMBER, val DATE, overwrite BOOLEAN DEFAULT FALSE)
MEMBER PROCEDURE put(pos NUMBER, val JSON_ELEMENT_T, overwrite BOOLEAN DEFAULT FALSE)
MEMBER PROCEDURE put(pos NUMBER, val JSON, overwrite BOOLEAN DEFAULT FALSE)
MEMBER PROCEDURE put(pos NUMBER, val TIMESTAMP, overwrite BOOLEAN DEFAULT FALSE)
MEMBER PROCEDURE put_Null(pos NUMBER, overwrite BOOLEAN DEFAULT FALSE)
```

The following procedures append the specified value to the end of the JSON array:

```
MEMBER PROCEDURE append(val JSON_ELEMENT_T)
MEMBER PROCEDURE append(val VARCHAR2)
MEMBER PROCEDURE append(val NUMBER)
MEMBER PROCEDURE append(val BOOLEAN)
MEMBER PROCEDURE append(val DATE)
MEMBER PROCEDURE append(val JSON)
MEMBER PROCEDURE append(val TIMESTAMP)
MEMBER PROCEDURE append_Null
```

Introspection Function

Introspection enables you to discover properties of the JSON array without modifying them.

```
MEMBER FUNCTION get_Type(pos NUMBER) RETURN VARCHAR2
```


Modification Procedure

The following procedure enables you to remove the value at the specified position in the JSON array.

```
MEMBER PROCEDURE remove(pos NUMBER)
```

Clone Function

This function makes a copy of the JSON array. Reference semantics is changed to value semantics.

```
MEMBER FUNCTION clone RETURN JSON_ARRAY_T
```

303.4 JSON_SCALAR_T Object Type

JSON_SCALAR_T is a subtype of the JSON_ELEMENT_T object type.

Description

A JSON_SCALAR_T instance captures one scalar values, for example, the string “fred” or the number 1. This type does not have any functions or procedures other than the ones inherited from JSON_ELEMENT_T. You cannot create an instance of this type directly.

303.5 JSON_KEY_LIST Type

JSON_KEY_LIST is a varray of VARCHAR2(4000).

Description

This type is used by the `get_Keys` function in the [JSON_OBJECT_T Object Type](#).

Logical Change Record TYPEs

This chapter describes the logical change record (LCR) types.

This chapter contains these topics:

- [Overview](#)
- [Security Model](#)
- [Summary of Logical Change Record Types](#)
- [Common Subprograms for LCR\\$_DDL_RECORD and LCR\\$_ROW_RECORD](#)

304.1 Logical Change Record TYPEs Overview

In Replication (Oracle GoldenGate and XStream), logical change records (LCRs) are message payloads that contain information about changes to a database. These changes can include changes to the data, which are data manipulation language (DML) changes, and changes to database objects, which are data definition language (DDL) changes.

When you use Replication (Oracle GoldenGate and XStream), the capture process captures changes in the form of LCRs and enqueues them into a queue. Finally, the apply process can apply LCRs at a destination database. You also have the option of creating, enqueueing, and dequeuing LCRs manually.

304.2 Logical Change Record Types Security Model

`PUBLIC` is granted `EXECUTE` privilege on the types described in this chapter.

304.3 Summary of Logical Change Record Types

This table lists the Logical Change Record TYPEs and briefly describes them.

Table 304-1 Logical Change Record (LCR) Types

Type	Description
LCR\$_DDL_RECORD Type	Represents a data definition language (DDL) change to a database object
LCR\$_ROW_RECORD Type	Represents a data manipulation language (DML) change to a database object
LCR\$_ROW_LIST Type	Identifies a list of column values for a row in a table
LCR\$_ROW_UNIT Type	Identifies the value for a column in a row

These logical change record (LCR) types can be used with the following Oracle-supplied PL/SQL packages:

- `DBMS_APPLY_ADM`

- DBMS_AQ
- DBMS_AQADM
- DBMS_CAPTURE_ADM
- DBMS_PROPAGATION_ADM
- DBMS_RULE
- DBMS_RULE_ADM
- DBMS_STREAMS
- DBMS_STREAMS_ADM
- DBMS_TRANSFORM

304.3.1 LCR\$_DDL_RECORD Type

This type represents a data definition language (DDL) change to a database object.

 **Note:**

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

If you create or modify a DDL logical change record (DDL LCR), then make sure the `ddl_text` is consistent with the `base_table_name`, `base_table_owner`, `object_type`, `object_owner`, `object_name`, and `command_type` attributes.

This topic contains information about the constructor for row LCRs and information about the member subprograms for this type.

 **Note:**

- When passing a name as a parameter to an LCR constructor, you can enclose the name in double quotes to handle names that use mixed case or lower case for database objects. For example, if a name contains any lower case characters, then you must enclose it in double quotes.
- The application does not need to specify a transaction identifier or SCN when it creates an LCR because the apply process generates these values and stores them in memory. If a transaction identifier or SCN is specified in the LCR, then the apply process ignores it and assigns a new value.

LCR\$_DDL_RECORD Constructor

Creates a SYS.LCR\$_DDL_RECORD object with the specified information.

```

STATIC FUNCTION CONSTRUCT(
    source_database_name IN VARCHAR2,
    command_type         IN VARCHAR2,
    object_owner         IN VARCHAR2,
    object_name          IN VARCHAR2,
    object_type          IN VARCHAR2,
    ddl_text              IN CLOB,
    logon_user           IN VARCHAR2,
    current_schema       IN VARCHAR2,
    base_table_owner     IN VARCHAR2,
    base_table_name      IN VARCHAR2,
    tag                  IN RAW          DEFAULT NULL,
    transaction_id       IN VARCHAR2   DEFAULT NULL,
    scn                  IN NUMBER     DEFAULT NULL,
    position             IN RAW          DEFAULT NULL,
    edition_name         IN VARCHAR2   DEFAULT NULL,
    root_name            IN VARCHAR2   DEFAULT NULL)
RETURN SYS.LCR$_DDL_RECORD;

```

LCR\$_DDL_RECORD Constructor Function Parameters

Table 304-2 Constructor Function Parameters for LCR\$_DDL_RECORD

Parameter	Description
source_database_name	<p>The database where the DDL statement occurred</p> <p>If the LCRs originated in a multitenant container database (CDB), then this field specifies the global name of the container where the DDL change occurred.</p> <p>If you do not include the domain name, then the function appends the local domain to the database name automatically. For example, if you specify DBS1 and the local domain is EXAMPLE.COM, then the function specifies DBS1.EXAMPLE.COM automatically. Set this parameter to a non-NULL value.</p>

Table 304-2 (Cont.) Constructor Function Parameters for LCR\$_DDL_RECORD

Parameter	Description
command_type	<p>The type of command executed in the DDL statement Set this parameter to a non-NULL value.</p> <p>See Also: The "SQL Command Codes" table in the <i>Oracle Call Interface Programmer's Guide</i> for a complete list of command types The following command types <i>are not supported</i> in DDL LCRs:</p> <p>ALTER MATERIALIZED VIEW ALTER MATERIALIZED VIEW LOG ALTER SUMMARY CREATE SCHEMA CREATE MATERIALIZED VIEW CREATE MATERIALIZED VIEW LOG CREATE SUMMARY DROP MATERIALIZED VIEW DROP MATERIALIZED VIEW LOG DROP SUMMARY RENAME</p> <p>The snapshot equivalents of the materialized view command types are also not supported.</p>
object_owner	The user who owns the object on which the DDL statement was executed
object_name	The database object on which the DDL statement was executed
object_type	<p>The type of object on which the DDL statement was executed The following are valid object types:</p> <p>CLUSTER FUNCTION INDEX LINK OUTLINE PACKAGE PACKAGE BODY PROCEDURE SEQUENCE SYNONYM TABLE TRIGGER TYPE USER VIEW</p> <p>LINK represents a database link. NULL is also a valid object type. Specify NULL for all object types not listed. The GET_OBJECT_TYPE member procedure returns NULL for object types not listed.</p>
ddl_text	<p>The text of the DDL statement Set this parameter to a non-NULL value.</p>
logon_user	The user whose session executed the DDL statement

Table 304-2 (Cont.) Constructor Function Parameters for LCR\$_DDL_RECORD

Parameter	Description
current_schema	The schema that is used if no schema is specified explicitly for the modified database objects in <code>ddl_text</code> If a schema is specified in <code>ddl_text</code> that differs from the one specified for <code>current_schema</code> , then the function uses the schema specified in <code>ddl_text</code> . Set this parameter to a non-NULL value.
base_table_owner	If the DDL statement is a table-related DDL (such as <code>CREATE TABLE</code> and <code>ALTER TABLE</code>), or if the DDL statement involves a table (such as creating a trigger on a table), then <code>base_table_owner</code> specifies the owner of the table involved. Otherwise, <code>base_table_owner</code> is NULL.
base_table_name	If the DDL statement is a table-related DDL (such as <code>CREATE TABLE</code> and <code>ALTER TABLE</code>), or if the DDL statement involves a table (such as creating a trigger on a table), then <code>base_table_name</code> specifies the name of the table involved. Otherwise, <code>base_table_name</code> is NULL.
tag	A binary tag that enables tracking of the LCR For example, this tag can be used to determine the original source database of the DDL statement if apply forwarding is used.
transaction_id	The identifier of the transaction
scn	The SCN at the time when the change record for a captured LCR was written to the redo log The SCN value is meaningless for a user-created LCR.
position	The position of the LCR LCR position is commonly used in XStream configurations. Using XStream requires purchasing a license for the Oracle GoldenGate product. See Also: <i>Oracle Database XStream Guide</i>
edition_name	The name of the edition in which the DDL statement was executed
root_name	If the LCRs is associated with a CDB, then this field specifies the global name of the root in the CDB. If the LCR is associated with a non-CDB, then this field is NULL.

Summary of LCR\$_DDL_RECORD Subprograms

Table 304-3 LCR\$_DDL_RECORD Type Subprograms

Subprogram	Description
EXECUTE Member Procedure	Executes the LCR under the security domain of the current user
GET_BASE_TABLE_NAME Member Function	Gets the base (dependent) table name
GET_BASE_TABLE_OWNER Member Function	Gets the base (dependent) table owner
GET_CURRENT_SCHEMA Member Function	Gets the default schema (user) name

Table 304-3 (Cont.) LCR\$_DDL_RECORD Type Subprograms

Subprogram	Description
GET_DDL_TEXT Member Procedure	Gets the DDL text in a CLOB
GET_EDITION_NAME Member Function	Gets the name of the edition in which the DDL statement was executed
GET_LOGON_USER Member Function	Gets the logon user name
GET_OBJECT_TYPE Member Function	Gets the type of the object involved for the DDL
SET_BASE_TABLE_NAME Member Procedure	Sets the base (dependent) table name
SET_BASE_TABLE_OWNER Member Procedure	Sets the base (dependent) table owner
SET_CURRENT_SCHEMA Member Procedure	Sets the default schema (user) name
SET_DDL_TEXT Member Procedure	Sets the DDL text
SET_EDITION_NAME Member Procedure	Sets the name of the edition in which the DDL statement was executed
SET_LOGON_USER Member Procedure	Sets the logon user name
SET_OBJECT_TYPE Member Procedure	Sets the object type
Common Subprograms	See " Common Subprograms for LCR\$_DDL_RECORD and LCR\$_ROW_RECORD " for a list of subprograms common to the SYS.LCR\$_ROW_RECORD and SYS.LCR\$_DDL_RECORD types

EXECUTE Member Procedure

Executes the DDL LCR under the security domain of the current user. Apply handlers are not run when the LCR is applied using this procedure.

Syntax

```
MEMBER PROCEDURE EXECUTE;
```

GET_BASE_TABLE_NAME Member Function

Gets the base (dependent) table name.

Syntax

```
MEMBER FUNCTION GET_BASE_TABLE_NAME ()  
RETURN VARCHAR2;
```

GET_BASE_TABLE_OWNER Member Function

Gets the base (dependent) table owner.

Syntax

```
MEMBER FUNCTION GET_BASE_TABLE_OWNER ()  
RETURN VARCHAR2;
```

GET_CURRENT_SCHEMA Member Function

Gets the current schema name.

Syntax

```
MEMBER FUNCTION GET_CURRENT_SCHEMA()
RETURN VARCHAR2;
```

GET_DDL_TEXT Member Procedure

Gets the DDL text in a CLOB.

For example, the following PL/SQL code uses this procedure to get the DDL text in a DDL LCR:

```
CREATE OR REPLACE PROCEDURE ddl_in_lcr (ddl_lcr in SYS.LCR$_DDL_RECORD)
IS
    ddl_text    CLOB;
BEGIN
    DBMS_OUTPUT.PUT_LINE( ' -----' );
    DBMS_OUTPUT.PUT_LINE( ' Displaying DDL text in a DDL LCR: ' );
    DBMS_OUTPUT.PUT_LINE( ' -----' );
    DBMS_LOB.CREATETEMPORARY(ddl_text, true);
    ddl_lcr.GET_DDL_TEXT(ddl_text);
    DBMS_OUTPUT.PUT_LINE('DDL text:' || ddl_text);
    DBMS_LOB.FREETEMPORARY(ddl_text);
END;
/
```



Note:

GET_DDL_TEXT is a member procedure and not a member function to make it easier for you to manage the space used by the CLOB. Notice that the previous example creates temporary space for the CLOB and then frees the temporary space when it is no longer needed.

Syntax

```
MEMBER FUNCTION GET_DDL_TEXT(
    ddl_text IN/OUT CLOB);
```

Parameter

Table 304-4 GET_DDL_TEXT Procedure Parameter

Parameter	Description
ddl_text	The DDL text in the DDL LCR

GET_EDITION_NAME Member Function

Gets the name of the edition in which the DDL statement was executed.



See Also:

Oracle Database Development Guide

Syntax

```
MEMBER FUNCTION GET_EDITION_NAME()
RETURN VARCHAR2;
```

GET_LOGON_USER Member Function

Gets the logon user name.

Syntax

```
MEMBER FUNCTION GET_LOGON_USER()
RETURN VARCHAR2;
```

GET_OBJECT_TYPE Member Function

Gets the type of the object involved for the DDL.

Syntax

```
MEMBER FUNCTION GET_OBJECT_TYPE()
RETURN VARCHAR2;
```

SET_BASE_TABLE_NAME Member Procedure

Sets the base (dependent) table name.

Syntax

```
MEMBER PROCEDURE SET_BASE_TABLE_NAME(
    base_table_name IN VARCHAR2);
```

Parameter

Table 304-5 SET_BASE_TABLE_NAME Procedure Parameter

Parameter	Description
base_table_name	The name of the base table

SET_BASE_TABLE_OWNER Member Procedure

Sets the base (dependent) table owner.

Syntax

```
MEMBER PROCEDURE SET_BASE_TABLE_OWNER(
    base_table_owner IN VARCHAR2);
```

Parameter

Table 304-6 SET_BASE_TABLE_OWNER Procedure Parameter

Parameter	Description
<code>base_table_owner</code>	The name of the base table owner

SET_CURRENT_SCHEMA Member Procedure

Sets the default schema (user) name.

Syntax

```
MEMBER PROCEDURE SET_CURRENT_SCHEMA(  
    current_schema IN VARCHAR2);
```

Parameter

Table 304-7 SET_CURRENT_SCHEMA Procedure Parameter

Parameter	Description
<code>current_schema</code>	The name of the schema to set as the current schema Set this parameter to a non-NULL value.

SET_DDL_TEXT Member Procedure

Sets the DDL text.

Syntax

```
MEMBER PROCEDURE SET_DDL_TEXT(  
    ddl_text IN CLOB);
```

Parameter

Table 304-8 SET_DDL_TEXT Procedure Parameter

Parameter	Description
<code>ddl_text</code>	The DDL text Set this parameter to a non-NULL value.

SET_EDITION_NAME Member Procedure

Sets the name of the edition in which the DDL statement was executed.



See Also:

Oracle Database Development Guide

Syntax

```
MEMBER PROCEDURE SET_EDITION_NAME(  
    edition_name IN VARCHAR2);
```

Parameter

Table 304-9 SET_EDITION_NAME Procedure Parameter

Parameter	Description
edition_name	Name of the edition

SET_LOGON_USER Member Procedure

Sets the logon user name.

Syntax

```
MEMBER PROCEDURE SET_LOGON_USER(  
    logon_user IN VARCHAR2);
```

Parameter

Table 304-10 SET_LOGON_USER Procedure Parameter

Parameter	Description
logon_user	The name of the schema to set as the logon user

SET_OBJECT_TYPE Member Procedure

Sets the object type.

Syntax

```
MEMBER PROCEDURE SET_OBJECT_TYPE(  
    object_type IN VARCHAR2);
```

Parameter**Table 304-11 SET_OBJECT_TYPE Procedure Parameter**

Parameter	Description
object_type	<p>The object type</p> <p>The following are valid object types:</p> <p>CLUSTER FUNCTION INDEX LINK OUTLINE PACKAGE PACKAGE BODY PROCEDURE SEQUENCE SYNONYM TABLE TRIGGER TYPE USER VIEW</p> <p>LINK represents a database link.</p> <p>NULL is also a valid object type. Specify NULL for all object types not listed. The GET_OBJECT_TYPE member procedure returns NULL for object types not listed.</p>

304.3.2 LCR\$_ROW_RECORD Type

This type represents a data manipulation language (DML) change to a row in a table. This type uses the LCR\$_ROW_LIST type.

Note:

A multitenant container database is the only supported architecture in Oracle Database 21c and later releases. While the documentation is being revised, legacy terminology may persist. In most cases, "database" and "non-CDB" refer to a CDB or PDB, depending on context. In some contexts, such as upgrades, "non-CDB" refers to a non-CDB from a previous release.

If you create or modify a row logical change record (row LCR), then make sure the `command_type` attribute is consistent with the presence or absence of old column values and the presence or absence of new column values.

This topic contains information about the constructor for DDL LCRs and information about the member subprograms for this type.

 **Note:**

- When passing a name as a parameter to an LCR constructor, you can enclose the name in double quotes to handle names that use mixed case or lower case for database objects. For example, if a name contains any lower case characters, then you must enclose it in double quotes.
- The application does not need to specify a transaction identifier or SCN when it creates an LCR because the apply process generates these values and stores them in memory. If a transaction identifier or SCN is specified in the LCR, then the apply process ignores it and assigns a new value.

 **See Also:**[LCR\\$_ROW_LIST Type](#)**LCR\$_ROW_RECORD Constructor**

Creates a SYS.LCR\$_ROW_RECORD object with the specified information.

```

STATIC FUNCTION CONSTRUCT(
  source_database_name IN VARCHAR2,
  command_type         IN VARCHAR2,
  object_owner         IN VARCHAR2,
  object_name          IN VARCHAR2,
  tag                  IN RAW           DEFAULT NULL,
  transaction_id       IN VARCHAR2     DEFAULT NULL,
  scn                  IN NUMBER       DEFAULT NULL,
  old_values           IN SYS.LCR$_ROW_LIST DEFAULT NULL,
  new_values           IN SYS.LCR$_ROW_LIST DEFAULT NULL,
  position             IN RAW           DEFAULT NULL,

  statement            IN VARCHAR2     DEFAULT NULL,

  bind_variables       IN SYS.LCR$_ROW_LIST DEFAULT NULL,

  bind_by_position    IN VARCHAR2     DEFAULT 'N',

  root_name            IN VARCHAR2     DEFAULT NULL)
RETURN SYS.LCR$_ROW_RECORD;

```

LCR\$_ROW_RECORD Constructor Function Parameters

Table 304-12 Constructor Function Parameters for LCR\$_ROW_RECORD

Parameter	Description
source_database_name	<p>The database where the row change occurred</p> <p>If the LCRs originated in a CDB, then this field specifies the global name of the container where the row change occurred.</p> <p>If you do not include the domain name, then the function appends the local domain to the database name automatically. For example, if you specify <code>DBS1</code> and the local domain is <code>EXAMPLE.COM</code>, then the function specifies <code>DBS1.EXAMPLE.COM</code> automatically. Set this parameter to a non-NULL value.</p>
command_type	<p>The type of command executed in the DML statement</p> <p>Set this parameter to a non-NULL value.</p> <p>Valid values are the following:</p> <pre> INSERT UPDATE DELETE LOB ERASE LOB WRITE LOB TRIM </pre> <p>If <code>INSERT</code>, then ensure that the LCR has a <code>new_values</code> collection that is not empty and an empty or <code>NULL</code> <code>old_values</code> collection.</p> <p>If <code>UPDATE</code>, then ensure that the LCR has a <code>new_values</code> collection that is not empty and an <code>old_values</code> collection that is not empty.</p> <p>If <code>DELETE</code>, then ensure that the LCR has a <code>NULL</code> or empty <code>new_values</code> collection and an <code>old_values</code> collection that is not empty.</p> <p>If <code>LOB ERASE</code>, <code>LOB WRITE</code>, or <code>LOB TRIM</code>, then ensure that the LCR has a <code>new_values</code> collection that is not empty and an empty or <code>NULL</code> <code>old_values</code> collection.</p>
object_owner	<p>The user who owns the table on which the row change occurred</p> <p>Set this parameter to a non-NULL value.</p>
object_name	<p>The table on which the DML statement was executed</p> <p>Set this parameter to a non-NULL value.</p>
tag	<p>A binary tag that enables tracking of the LCR</p> <p>For example, this tag can be used to determine the original source database of the DML change when apply forwarding is used.</p>
transaction_id	<p>The identifier of the transaction</p>
scn	<p>The SCN at the time when the change record was written to the redo log</p> <p>The SCN value is meaningless for a user-created LCR.</p>
old_values	<p>The column values for the row before the DML change</p> <p>If the DML statement is an <code>UPDATE</code> or a <code>DELETE</code> statement, then this parameter contains the values of columns in the row before the DML statement. If the DML statement is an <code>INSERT</code> statement, then there are no old values.</p>

Table 304-12 (Cont.) Constructor Function Parameters for LCR\$_ROW_RECORD

Parameter	Description
new_values	The column values for the row after the DML change If the DML statement is an UPDATE or an INSERT statement, then this parameter contains the values of columns in the row after the DML statement. If the DML statement is a DELETE statement, then there are no new values. If the LCR reflects a LOB operation, then this parameter contains the supplementally logged columns and any relevant LOB information.
position	The position of the LCR LCR position is commonly used in XStream configurations. Using XStream requires purchasing a license for the Oracle GoldenGate product. See Also: <i>Oracle Database XStream Guide</i>
statement	This parameter is reserved for internal use only.
bind_variables	This parameter is reserved for internal use only.
bind_by_position	This parameter is reserved for internal use only.
root_name	If the LCRs is associated with a CDB, then this field specifies the global name of the root in the CDB. If the LCR is associated with a non-CDB, then this field is NULL.

Summary of LCR\$_ROW_RECORD Subprograms

Table 304-13 LCR\$_ROW_RECORD Type Subprograms

Subprogram	Description
ADD_COLUMN Member Procedure	Adds the value as old or new, depending on the value type specified, for the column
CONVERT_LONG_TO_LOB_CHUNK Member Procedure	Converts LONG data in a row LCR into fixed width CLOB, or converts LONG RAW data in a row LCR into a BLOB
DELETE_COLUMN Member Procedure	Deletes the old value, the new value, or both, for the specified column, depending on the value type specified
EXECUTE Member Procedure	Executes the LCR under the security domain of the current user
GET_JSON_INFORMATION Member Function	Gets JSON information.
GET_LOB_INFORMATION Member Function	Gets the LOB information for the column
GET_LOB_OFFSET Member Function	Gets the LOB offset for the specified column
GET_LOB_OPERATION_SIZE Member Function	Gets the operation size for the LOB column
GET_LONG_INFORMATION Member Function	Gets the LONG information for the column
GET_ROW_TEXT Member Procedure	Gets the SQL statement for the change that is encapsulated in the LCR

Table 304-13 (Cont.) LCR\$_ROW_RECORD Type Subprograms

Subprogram	Description
GET_VALUE Member Function	Gets the old or new value for the specified column, depending on the value type specified
GET_VALUES Member Function	Gets a list of old or new values, depending on the value type specified
GET_WHERE_CLAUSE Member Procedure	Gets a <code>WHERE</code> clause for the change that is encapsulated in the row LCR
GET_XML_INFORMATION Member Function	Gets the XML information for the specified column
IS_STATEMENT_LCR Member Function	Reserved for internal use only
KEEP_COLUMNS Member Procedure	Keeps a list of columns a row LCR
RENAME_COLUMN Member Procedure	Renames a column in an LCR
SET_JSON_INFORMATION Member Procedure	Sets the JSON information for a column.
SET_LOB_INFORMATION Member Procedure	Sets LOB information for the column
SET_LOB_OFFSET Member Procedure	Sets the LOB offset for the specified column
SET_LOB_OPERATION_SIZE Member Procedure	Sets the operation size for the LOB column
SET_ROW_TEXT Member Procedure	Reserved for internal use only
SET_VALUE Member Procedure	Overwrites the value of the specified column
SET_VALUES Member Procedure	Replaces the existing old or new values for the LCR, depending on the value type specified
SET_XML_INFORMATION Member Procedure	Sets the XML information for the column
Common Subprograms	See Common Subprograms for LCR\$_DDL_RECORD and LCR\$_ROW_RECORD for a list of subprograms common to the <code>SYS.LCR\$_ROW_RECORD</code> and <code>SYS.LCR\$_DDL_RECORD</code> types

ADD_COLUMN Member Procedure

Adds the value as old or new, depending on the value type specified, for the column. An error is raised if a value of the same type already exists for the column.

**Note:**

To set a column value that already exists, run `SET_VALUE`.

**See Also:**

[SET_VALUE Member Procedure](#)

Considerations for LOB Columns

When processing a row LCR with LOB columns with a procedure DML handler or error handler and the handler is using LOB assembly (the `assemble_lob` parameter is set to `TRUE` for the handler), you use this member procedure in the handler procedure to add a LOB column to a row LCR. If `assemble_lob` is set to `FALSE` for the handler, then you cannot use this member procedure to add a LOB column to a row LCR.

To use a DML or error handler to add a LOB column, specify the LOB locator for the `column_value` parameter in the member procedure. The `ADD_COLUMN` member procedure verifies that an `ANYDATA` encapsulated LOB locator is processed with a DML or error handler that is using LOB assembly. An error is raised under the following conditions:

- The handler attempts to enqueue a row LCR with an `ANYDATA` encapsulated LOB locator.
- An attempt is made to add an LOB column that is set incorrectly.

If an error is raised because of one of these conditions, then the transaction that includes the row LCR is moved to the error queue, and the LOB is represented by the original (nonassembled) row LCRs.

 **Note:**

- Database compatibility must be 10.2.0 or higher to use LOB assembly.
- When you are processing a row LCR with a rule-based transformation, you cannot use this member procedure to add a LOB column.
- When you are processing a row LCR with a rule-based transformation, procedure DML handler, or error handler, you cannot use this member procedure to add a `LONG` or `LONG RAW` column.

Syntax

```
MEMBER PROCEDURE ADD_COLUMN(
    value_type    IN  VARCHAR2,
    column_name   IN  VARCHAR2,
    column_value  IN  ANYDATA);
```

Parameters

Table 304-14 `ADD_COLUMN` Procedure Parameters

Parameter	Description
<code>value_type</code>	The type of value to add for the column Specify <code>old</code> to add the old value of the column. Specify <code>new</code> to add the new value of the column.
<code>column_name</code>	The column name This name is not validated. An error can be raised during application of the LCRs if an invalid name is specified.

Table 304-14 (Cont.) ADD_COLUMN Procedure Parameters

Parameter	Description
<code>column_value</code>	<p>The value of the column</p> <p>If <code>NULL</code>, then this procedure raises an error.</p> <p>If the member procedure is used in a procedure DML handler or error handler that uses LOB assembly, then a LOB locator can be specified.</p> <p>A <code>NULL</code> column value can be specified by encapsulating the <code>NULL</code> value in an <code>ANYDATA</code> wrapper.</p>

CONVERT_LONG_TO_LOB_CHUNK Member Procedure

Converts `LONG` data in a row LCR into a `CLOB`, or converts `LONG RAW` data in a row LCR into a `BLOB`.

This procedure can change the operation code from `LONG WRITE` to `LOB WRITE` for the row LCR.

This member procedure can be used in rule-based transformations.

The following restrictions apply to this member procedure:

- This member procedure cannot be used in apply handlers.
- `LONG` data can be sent as a part of a row LCR with one of the following operation codes: `INSERT`, `UPDATE`, or `LONG_WRITE`. Because `LONG` data can be sent in multiple pieces, make sure that this method is invoked on either none or all `LONG` pieces.
- `LOB` to `LONG` conversion is not supported.
- A row LCR on which this procedure is executed must have been created by a capture process. That is, this procedure does not support persistent row LCRs.

Syntax

```
MEMBER PROCEDURE CONVERT_LONG_TO_LOB_CHUNK;
```

DELETE_COLUMN Member Procedure

Deletes the old value, the new value, or both, for the specified column, depending on the value type specified.

Syntax

```
MEMBER PROCEDURE DELETE_COLUMN(
    column_name IN VARCHAR2,
    value_type  IN VARCHAR2 DEFAULT '*');
```

Parameters

Table 304-15 DELETE_COLUMN Procedure Parameters

Parameter	Description
<code>column_name</code>	The column name An error is raised if the column does not exist in the LCR.
<code>value_type</code>	The type of value to delete for the column Specify <code>old</code> to delete the old value of the column. Specify <code>new</code> to delete the new value of the column. If <code>*</code> is specified, then the procedure deletes both the old and new values.

EXECUTE Member Procedure

Executes the row LCR under the security domain of the current user. Any apply handlers that would be run for an LCR are not run when the LCR is applied using this procedure.

This member procedure can be run on a row LCR under any of the following conditions:

- The LCR is being processed by an apply handler.
- The LCR has been constructed using the `LCR$_ROW_RECORD` constructor function but has not been enqueued.
- The LCR is in the error queue.

Note:

Do not run this member procedure in a custom rule-based transformation on a row LCR. Doing so could execute the row LCR outside of its transactional context.

Considerations for LOB Columns

When processing a row LCR with LOB columns with a procedure DML handler or error handler, and the handler is using LOB assembly (the `assemble_lobs` parameter is set to `TRUE` for the handler), this member procedure executes the assembled row LCR. An assembled row LCR represents a LOB value with a LOB locator or `NULL`.

If `assemble_lobs` is set to `FALSE` for the handler, then this member procedure executes the nonassembled row LCRs. Nonassembled row LCRs represent LOB values with `VARCHAR2` and `RAW` data types. These nonassembled row LCRs might have been modified by the handler.

An error is raised under the following conditions:

- A DML or error handler configured with `assemble_lobs` set to `FALSE` attempts to execute a row LCR that contains a LOB locator.

- A DML or error handler configured with `assemble_lob` set to `TRUE` attempts to execute a row LCR that contains one or more LOB values represented with `VARCHAR2` or `RAW` data types.

If an error is raised because of one of these conditions, then the transaction that includes the row LCR is moved to the error queue, and the LOB is represented by the original (nonassembled) row LCRs.

Syntax

```
MEMBER PROCEDURE EXECUTE(
    conflict_resolution IN BOOLEAN);
```

Parameters

Table 304-16 EXECUTE Procedure Parameters

Parameter	Description
<code>conflict_resolution</code>	<p>If <code>TRUE</code>, then any conflict resolution defined for the table using the <code>SET_UPDATE_CONFLICT_HANDLER</code> procedure in the <code>DBMS_APPLY_ADM</code> package is used to resolve conflicts resulting from the execution of the LCR.</p> <p>If <code>FALSE</code>, then conflict resolution is not used.</p> <p>An error is raised if this parameter is not specified or is set to <code>NULL</code>.</p>

GET_JSON_INFORMATION Member Function

Gets JSON information.

The return value can be one of the following:

```
DBMS_LCR.NOT_OSON CONSTANT NUMBER := 1;
DBMS_LCR.OSON_DOC CONSTANT NUMBER := 2;
```



Note:

OSON is Oracle binary format for JSON column.

They represent either a column not containing `OSON` data or full `OSON` document.

Syntax

```
MEMBER FUNCTION GET_JSON_INFORMATION(
    column_name IN VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 304-17 GET_JSON_INFORMATION Member Function Parameter

Parameter	Description
<code>column_name</code>	Name of column to obtain JSON information.

GET_LOB_INFORMATION Member Function

Gets the LOB information for the column.

The return value can be one of the following:

```
DBMS_LCR.NOT_A_LOB          CONSTANT NUMBER := 1;
DBMS_LCR.NULL_LOB         CONSTANT NUMBER := 2;
DBMS_LCR.INLINE_LOB       CONSTANT NUMBER := 3;
DBMS_LCR.EMPTY_LOB        CONSTANT NUMBER := 4;
DBMS_LCR.LOB_CHUNK        CONSTANT NUMBER := 5;
DBMS_LCR.LAST_LOB_CHUNK   CONSTANT NUMBER := 6;
```

Returns NULL if the specified column does not exist.

If the command type of the row LCR is UPDATE, then specifying 'Y' for the use_old parameter is a convenient way to get the value of the columns.

Syntax

```
MEMBER FUNCTION GET_LOB_INFORMATION(
    value_type IN VARCHAR2,
    column_name IN VARCHAR2,
    use_old IN VARCHAR2 DEFAULT 'Y')
RETURN NUMBER;
```

Parameters

Table 304-18 GET_LOB_INFORMATION Function Parameters

Parameter	Description
value_type	The type of value to return for the column, either old or new
column_name	The name of the column
use_old	If Y and value_type is new, and no new value exists, then the function returns the corresponding old value. If N and value_type is new, then the function does not return the old value if no new value exists. If value_type is old or if the command type of the row LCR is not UPDATE, then the function ignores the value of the use_old parameter. NULL is not a valid specification for the use_old parameter.

GET_LOB_OFFSET Member Function

Gets the LOB offset for the specified column in the number of characters for CLOB columns and the number of bytes for BLOB columns. Returns a non-NULL value only if all of the following conditions are met:

- The value exists for the column
- The column value is an out-of-line LOB. That is, the information is DBMS_LCR.LAST_LOB_CHUNK or DBMS_LCR.LOB_CHUNK
- The command type is LOB ERASE or LOB WRITE

Otherwise, returns NULL.

Syntax

```
GET_LOB_OFFSET(
    value_type IN VARCHAR2,
    column_name IN VARCHAR2)
RETURN NUMBER;
```

Parameters**Table 304-19 GET_LOB_OFFSET Function Parameters**

Parameter	Description
value_type	The type of value to return for the column Currently, only <code>new</code> can be specified.
column_name	The name of the LOB column

GET_LOB_OPERATION_SIZE Member Function

Gets the operation size for the LOB column in the number of characters for `CLOB` columns and the number of bytes for `BLOB` columns. Returns a non-NULL value only if all of the following conditions are met:

- The value exists for the column
- The column value is an out-of-line LOB
- The command type is `LOB ERASE` or `LOB TRIM`
- The information is `DBMS_LCR.LAST_LOB_CHUNK`

Otherwise, returns `NULL`.

Syntax

```
MEMBER FUNCTION GET_LOB_OPERATION_SIZE(
    value_type IN VARCHAR2,
    column_name IN VARCHAR2)
RETURN NUMBER,
```

Parameters**Table 304-20 GET_LOB_OPERATION_SIZE Function Parameters**

Parameter	Description
value_type	The type of value to return for the column Currently, only <code>new</code> can be specified.
column_name	The name of the LOB column

GET_LONG_INFORMATION Member Function

Gets the `LONG` information for the column.

The return value can be one of the following:

```
DBMS_LCR.NOT_A_LONG          CONSTANT NUMBER := 1;
DBMS_LCR.NULL_LONG         CONSTANT NUMBER := 2;
DBMS_LCR.INLINE_LONG       CONSTANT NUMBER := 3;
DBMS_LCR.LONG_CHUNK        CONSTANT NUMBER := 4;
DBMS_LCR.LAST_LONG_CHUNK   CONSTANT NUMBER := 5;
```

Returns NULL if the specified column does not exist.

If the command type of the row LCR is UPDATE, then specifying 'Y' for the use_old parameter is a convenient way to get the value of the columns.

Syntax

```
MEMBER FUNCTION GET_LONG_INFORMATION(
    value_type IN VARCHAR2,
    column_name IN VARCHAR2,
    use_old IN VARCHAR2 DEFAULT 'Y')
RETURN NUMBER;
```

Parameters

Table 304-21 GET_LONG_INFORMATION Function Parameters

Parameter	Description
value_type	The type of value to return for the column, either old or new
column_name	The name of the column
use_old	If Y and value_type is new, and no new value exists, then the function returns the corresponding old value. If N and value_type is new, then the function does not return the old value if no new value exists. If value_type is old or if the command_type of the row LCR is not UPDATE, then the function ignores the value of the use_old parameter. NULL is not a valid specification for the use_old parameter.

GET_ROW_TEXT Member Procedure

Gets the SQL statement for the change that is encapsulated in the row LCR. This method performs SQL generation in PL/SQL.

This method is overloaded. The different functionality of each form of syntax is presented along with the definitions.

Syntax

The following procedure returns the SQL statement in a CLOB datatype.

```
MEMBER PROCEDURE GET_ROW_TEXT(
    row_text IN/OUT CLOB);
```

The following procedure returns the SQL statement with bind variables in a CLOB datatype.

```
MEMBER PROCEDURE GET_ROW_TEXT(
    row_text IN/OUT CLOB,
    variable_list IN/OUT LCR$_ROW_LIST,
    bind_var_syntax IN VARCHAR2 DEFAULT ':');
```



See Also:

"LCR\$_ROW_LIST Type"

Parameters

Table 304-22 GET_ROW_TEXT Procedure Parameters

Parameter	Description
<code>row_text</code>	The SQL statement for the change that is encapsulated in the LCR
<code>variable_list</code>	The values for the bind variables in the order of the bind variables
<code>bind_var_syntax</code>	The syntax for the bind variables One of the following values is valid: <ul style="list-style-type: none"> Specify <code>:</code>, the default, for bind values to be in the form <code>:1</code>, <code>:2</code>, and so on. Specify <code>?</code> for bind values to be in the form <code>?.</code>

GET_VALUE Member Function

Gets the old or new value for the specified column, depending on the value type specified.

If the command type of the row LCR is `UPDATE`, then specifying `'Y'` for the `use_old` parameter is a convenient way to get the value of a column.

Syntax

```
MEMBER FUNCTION GET_VALUE (
    value_type IN VARCHAR2,
    column_name IN VARCHAR2,
    use_old IN VARCHAR2 DEFAULT 'Y')
RETURN ANYDATA;
```

Parameters

Table 304-23 GET_VALUE Function Parameters

Parameter	Description
<code>value_type</code>	The type of value to return for the column Specify <code>old</code> to get the old value for the column. Specify <code>new</code> to get the new value for the column.
<code>column_name</code>	The column name If the column is present and has a <code>NULL</code> value, then the function returns an <code>ANYDATA</code> instance containing a <code>NULL</code> value. If the column value is absent, then the function returns a <code>NULL</code> .

Table 304-23 (Cont.) GET_VALUE Function Parameters

Parameter	Description
use_old	<p>If Y and value_type is new, and no new value exists, then the function returns the corresponding old value.</p> <p>If N and value_type is new, then the function returns NULL if no new value exists.</p> <p>If value_type is old or if the command_type of the row LCR is not UPDATE, then the function ignores the value of the use_old parameter.</p> <p>NULL is not a valid specification for the use_old parameter.</p>

GET_VALUES Member Function

Gets a list of old or new values, depending on the value type specified.

If the command type of the row LCR is UPDATE, then specifying 'Y' for the use_old parameter is a convenient way to get the values of all columns.

Syntax

```
MEMBER FUNCTION GET_VALUES(
    value_type IN VARCHAR2,
    use_old    IN VARCHAR2 DEFAULT 'Y')
RETURN SYS.LCR$_ROW_LIST;
```

Parameters

Table 304-24 GET_VALUES Function Parameters

Parameter	Description
value_type	<p>The type of values to return</p> <p>Specify old to return a list of old values. Specify new to return a list of new values.</p>
use_old	<p>If Y and value_type is new, then the function returns a list of all new values in the LCR. If a new value does not exist in the list, then the function returns the corresponding old value. Therefore, the returned list contains all existing new values and the old values where there are no new values.</p> <p>If N and value_type is new, then the function returns a list of all new values in the LCR without returning any old values.</p> <p>If value_type is old or if the command_type of the row LCR is not UPDATE, then the function ignores the value of the use_old parameter.</p> <p>NULL is not a valid specification for the use_old parameter.</p>

GET_WHERE_CLAUSE Member Procedure

Gets a WHERE clause for the change that is encapsulated in the row LCR.

Use the `WHERE` clause returned by `GET_WHERE_CLAUSE` instead of using the `ROWID`, because the `ROWID` is not ANSI compatible. The generated `WHERE` clause might not match the `WHERE` clause in the original DML operation.

The `ROWID` of an `INSERT` statement is the `ROWID` of the new row created by the `INSERT`. The `WHERE` clause generated for an `INSERT` operation identifies the new row. Therefore, the generated `WHERE` clause includes all of the new values inserted.

For example, consider the following insert into the `hr.departments` table:

```
INSERT INTO hr.departments (  
    department_id, department_name, manager_id, location_id)  
VALUES (10, 'HR', 20, 40);
```

The generated `WHERE` clause represents the row with the values 10, 'HR', 20, and 40. Hence, the generated `WHERE` clause is the following:

```
WHERE "DEPARTMENT_ID" = 10 AND "DEPARTMENT_NAME" = 'HR' AND  
      "MANAGER_ID" = 20 AND "LOCATION_ID" = 40
```

The `ROWID` of an `UPDATE` statement is the `ROWID` of the row that was updated. The `WHERE` clause generated for an `UPDATE` operation identifies the row after the `UPDATE` executes. The generated `WHERE` clause is based on the old and new values of the `UPDATE`.

For example, consider the following update to the `hr.departments` table:

```
UPDATE hr.departments SET department_name='Management'  
WHERE department_name='Administration' AND location_id = 20 AND  
      manager_id = 30 AND department_id = 10;
```

The values of the row after the `UPDATE` are 10, 'Management', 30, and 20. Hence, the generated `WHERE` clause to identify the row is the following:

```
WHERE "DEPARTMENT_ID" = 10 AND "DEPARTMENT_NAME" = 'MANAGEMENT' AND  
      "MANAGER_ID" = 30 AND "LOCATION_ID" = 20
```

Notice that the new value is used for `"DEPARTMENT_NAME"`, because the new value is the value of the column after the `UPDATE`. For the rest of the columns, the old values are used.

The `ROWID` of a `DELETE` operation is the row that existed before it was deleted. The generated `WHERE` clause consists of all the old column values present in the `DELETE` operation.

LOB columns do not appear in generated `WHERE` clauses. The generated `WHERE` clause is not affected by the presence of LOB columns in the LCR.

This method is overloaded. The different functionality of each form of syntax is presented along with the definitions.

Syntax

The following procedure returns the `WHERE` clause of a SQL statement in a `CLOB` datatype.

```
MEMBER PROCEDURE GET_WHERE_CLAUSE(  
    where_clause IN/OUT CLOB);
```

The following procedure returns the `WHERE` clause of a SQL statement with bind variables in a `CLOB` datatype.

```
MEMBER PROCEDURE GET_WHERE_CLAUSE(  
    where_clause IN/OUT CLOB,
```

```
variable_list    IN/OUT  LCR$_ROW_LIST,
bind_var_syntax  IN       VARCHAR2  DEFAULT ':');
```



See Also:

[LCR\\$_ROW_LIST Type](#)

Parameters

Table 304-25 GET_WHERE_CLAUSE Procedure Parameters

Parameter	Description
where_clause	The WHERE clause of the SQL statement for the change that is encapsulated in the LCR
variable_list	The values for the bind variables in the order of the bind variables
bind_var_syntax	The syntax for the bind variables One of the following values is valid: <ul style="list-style-type: none"> Specify :, the default, for bind values to be in the form :1, :2, and so on. Specify ? for bind values to be in the form ?.

GET_XML_INFORMATION Member Function

Gets the XML information for the specified column.

The return value can be one of the following:

```
DBMS_LCR.NOT_XML    CONSTANT NUMBER := 1;
DBMS_LCR.XML_DOC    CONSTANT NUMBER := 2;
DBMS_LCR.XML_DIFF   CONSTANT NUMBER := 3;
```

```
DBMS_LCR.XML_DIFF   CONSTANT NUMBER := 3;
```

DBMS_LCR.NOT_XML indicates that the column is not an XMLType column.

DBMS_LCR.XML_DOC indicates that the column contains an XML document.

DBMS_LCR.XML_DIFF indicates that the column contains an XML document that describes a change made by an update operation. This XML document describes the differences in the column's XML document. The entire XML document is not replaced.

DBMS_LCR.XML_DIFF indicates that the column contains differences between old and new XML documents for an update operation.

Returns NULL if the specified column does not exist.

Syntax

```
MEMBER FUNCTION GET_XML_INFORMATION(
    column_name IN VARCHAR2)
RETURN NUMBER;
```

Parameter

Table 304-26 GET_XML_INFORMATION Function Parameter

Parameter	Description
column_name	The column name

IS_STATEMENT_LCR Member Function

This function is reserved for internal use only.

KEEP_COLUMNS Member Procedure

This procedure keeps a list of columns in a row LCR. The procedure deletes columns that are not in the list from the row LCR.

Syntax

```
MEMBER PROCEDURE KEEP_COLUMNS (
    column_list IN VARCHAR2,
    value_type IN VARCHAR2 DEFAULT '*');
```

Parameters

Table 304-27 KEEP_COLUMNS Procedure Parameters

Parameter	Description
column_list	The names of the columns kept for the row LCR Specify a comma-delimited list of type VARCHAR2. This procedure removes columns that are not in the list from the current row LCR.
value_type	The type of value for which to keep the columns Specify <i>old</i> to keep the old values of the columns. An error is raised if the old values do not exist in the LCR. Specify <i>new</i> to keep the new values of the columns. An error is raised if the new values do not exist in the LCR. If <i>*</i> is specified, then the procedure keeps both the old and the new columns.

RENAME_COLUMN Member Procedure

Renames a column in a row LCR.

Syntax

```
MEMBER PROCEDURE RENAME_COLUMN (
    from_column_name IN VARCHAR2,
    to_column_name IN VARCHAR2,
    value_type IN VARCHAR2 DEFAULT '*');
```

Parameters

Table 304-28 RENAME_COLUMN Procedure Parameters

Parameter	Description
<code>from_column_name</code>	The existing column name
<code>to_column_name</code>	The new column name An error is raised if a column with the specified name already exists.
<code>value_type</code>	The type of value for which to rename the column Specify <code>old</code> to rename the old value of the column. An error is raised if the old value does not exist in the LCR. Specify <code>new</code> to rename the new value of the column. An error is raised if the new value does not exist in the LCR. If <code>*</code> is specified, then the procedure renames the column names for both old and new value. The procedure raises an error if either column value does not exist in the LCR.

SET_JSON_INFORMATION Member Procedure

Sets the JSON information for a column.

Syntax

```
MEMBER PROCEDURE SET_JSON_INFORMATION(
    self          IN OUT NOCOPY LCR$_ROW_RECORD,
    value_type    IN VARCHAR2,
    column_name   IN VARCHAR2,
    json_information IN NUMBER);
```

Parameters

Table 304-29 SET_JSON_INFORMATION Procedure Parameters

Parameter	Description
<code>self</code>	
<code>value_type</code>	The type of value to set for the column. The supported values are: <ul style="list-style-type: none"> NEW OLD
<code>column_name</code>	The name of the column. An exception is raised if the column does not exist in the LCR.
<code>json_information</code>	The supported values are: <ul style="list-style-type: none"> DBMS_LCR.NOT_OSON DBMS_LCR.OSON_DOC

SET_LOB_INFORMATION Member Procedure

Sets LOB information for the column.



Note:

When you are processing a row LCR with a rule-based transformation, procedure DML handler, or error handler, you cannot use this member procedure.

Syntax

```
MEMBER PROCEDURE SET_LOB_INFORMATION(
    value_type      IN VARCHAR2,
    column_name     IN VARCHAR2,
    lob_information IN NUMBER);
```

Parameters

Table 304-30 SET_LOB_INFORMATION Procedure Parameters

Parameter	Description												
value_type	The type of value to set for the column, either old or new Specify old only if lob_information is set to DBMS_LCR.NOT_A_LOB.												
column_name	The name of the column. An exception is raised if the column value does not exist. You might need to set this parameter for non-LOB columns.												
lob_information	Specify one of the following values: <table border="0"> <tr> <td>DBMS_LCR.NOT_A_LOB</td> <td>CONSTANT NUMBER := 1;</td> </tr> <tr> <td>DBMS_LCR.NULL_LOB</td> <td>CONSTANT NUMBER := 2;</td> </tr> <tr> <td>DBMS_LCR.INLINE_LOB</td> <td>CONSTANT NUMBER := 3;</td> </tr> <tr> <td>DBMS_LCR.EMPTY_LOB</td> <td>CONSTANT NUMBER := 4;</td> </tr> <tr> <td>DBMS_LCR.LOB_CHUNK</td> <td>CONSTANT NUMBER := 5;</td> </tr> <tr> <td>DBMS_LCR.LAST_LOB_CHUNK</td> <td>CONSTANT NUMBER := 6;</td> </tr> </table>	DBMS_LCR.NOT_A_LOB	CONSTANT NUMBER := 1;	DBMS_LCR.NULL_LOB	CONSTANT NUMBER := 2;	DBMS_LCR.INLINE_LOB	CONSTANT NUMBER := 3;	DBMS_LCR.EMPTY_LOB	CONSTANT NUMBER := 4;	DBMS_LCR.LOB_CHUNK	CONSTANT NUMBER := 5;	DBMS_LCR.LAST_LOB_CHUNK	CONSTANT NUMBER := 6;
DBMS_LCR.NOT_A_LOB	CONSTANT NUMBER := 1;												
DBMS_LCR.NULL_LOB	CONSTANT NUMBER := 2;												
DBMS_LCR.INLINE_LOB	CONSTANT NUMBER := 3;												
DBMS_LCR.EMPTY_LOB	CONSTANT NUMBER := 4;												
DBMS_LCR.LOB_CHUNK	CONSTANT NUMBER := 5;												
DBMS_LCR.LAST_LOB_CHUNK	CONSTANT NUMBER := 6;												

SET_LOB_OFFSET Member Procedure

Sets the LOB offset for the specified column in the number of characters for CLOB columns and the number of bytes for BLOB columns.



Note:

When you are processing a row LCR with a rule-based transformation, procedure DML handler, or error handler, you cannot use this member procedure.

Syntax

```
MEMBER PROCEDURE SET_LOB_OFFSET(
    value_type      IN VARCHAR2,
    column_name     IN VARCHAR2,
    lob_offset      IN NUMBER);
```

Parameters

Table 304-31 SET_LOB_OFFSET Procedure Parameters

Parameter	Description
value_type	The type of value to set for the column Currently, only <code>new</code> can be specified.
column_name	The column name An error is raised if the column value does not exist in the LCR.
lob_offset	The LOB offset number Valid values are <code>NULL</code> or a positive integer less than or equal to <code>DBMS_LOB.LOBBMAXSIZE</code> .

SET_LOB_OPERATION_SIZE Member Procedure

Sets the operation size for the LOB column in the number of characters for `CLOB` columns and bytes for `BLOB` columns.



Note:

When you are processing a row LCR with a rule-based transformation, procedure DML handler, or error handler, you cannot use this member procedure.

Syntax

```
MEMBER PROCEDURE SET_LOB_OPERATION_SIZE (
  value_type      IN  VARCHAR2,
  column_name     IN  VARCHAR2,
  lob_operation_size IN NUMBER);
```

Parameters

Table 304-32 SET_LOB_OPERATION_SIZE Procedure Parameters

Parameter	Description
value_type	The type of value to set for the column Currently, only <code>new</code> can be specified.
column_name	The name of the LOB column An exception is raised if the column value does not exist in the LCR.

Table 304-32 (Cont.) SET_LOB_OPERATION_SIZE Procedure Parameters

Parameter	Description
<code>lob_operation_size</code>	If <code>lob_information</code> for the LOB is or will be <code>DBMS_LCR.LAST_LOB_CHUNK</code> , then this parameter can be set to either a valid LOB ERASE value or a valid LOB TRIM value. A LOB ERASE value must be a positive integer less than or equal to <code>DBMS_LOB.LOBMAXSIZE</code> . A LOB TRIM value must be a nonnegative integer less than or equal to <code>DBMS_LOB.LOBMAXSIZE</code> . Otherwise, set to NULL.

SET_ROW_TEXT Member Procedure

This procedure is reserved for internal use only.

SET_VALUE Member Procedure

Overwrites the old or new value of the specified column.

One reason to overwrite an old value for a column is to resolve an error that resulted from a conflict.

 **Note:**

To add a column to a row LCR, run `ADD_COLUMN`.

 **See Also:**

[ADD_COLUMN Member Procedure](#)

Considerations for LOB Columns

When processing a row LCR with LOB columns with a procedure DML handler or error handler, and the handler is using LOB assembly (the `assemble_lob` parameter is set to `TRUE` for the handler), you can use this member procedure in the handler procedure on a LOB column in a row LCR. If `assemble_lob` is set to `FALSE` for the handler, then you cannot use this member procedure on a LOB column.

To use a DML or error handler to set the value of a LOB column, specify the LOB locator for the `column_value` parameter in the member procedure. The `SET_VALUE` member procedure verifies that an `ANYDATA` encapsulated LOB locator is processed with a DML or error handler that is using LOB assembly. An error is raised under the following conditions:

- The handler attempts to enqueue a row LCR with an `ANYDATA` encapsulated LOB locator.
- An attempt is made to set a LOB column incorrectly.

If an error is raised because of one of these conditions, then the transaction that includes the row LCR is moved to the error queue, and the LOB is represented by the original (nonassembled) row LCRs.

 **Note:**

- Database compatibility must be 10.2.0 or higher to use LOB assembly.
- When you are processing a row LCR with a rule-based transformation, you cannot use this member procedure on a LOB column.
- When you are processing a row LCR with a rule-based transformation, procedure DML handler, or error handler, you cannot use this member procedure on a LONG or LONG RAW column.

Considerations for XMLType Columns

When processing a row LCR with XMLType columns with a procedure DML handler or error handler, any XMLType columns and LOB columns in the LCR are always assembled using LOB assembly. You can use this member procedure in the handler procedure on a row LCR that contains one or more XMLType columns.

To use a DML or error handler to set the value an XMLType column, specify the XMLType for the column_value parameter. The SET_VALUE member procedure verifies that an ANYDATA encapsulated XMLType is processed with a DML or error handler. An error is raised under the following conditions:

- The handler attempts to enqueue a row LCR with an ANYDATA encapsulated XMLType.
- An attempt is made to set a XMLType column incorrectly.

If an error is raised because of one of these conditions, then the transaction that includes the row LCR is moved to the error queue, and the XMLType column is represented by the original (nonassembled) row LCRs.

 **Note:**

- Database compatibility must be 11.1.0 or higher to process row LCRs with XMLType columns.
- When you are processing a row LCR with a rule-based transformation, you cannot use this member procedure on XMLType columns.

Syntax

```
MEMBER PROCEDURE SET_VALUE (  
    value_type    IN  VARCHAR2,  
    column_name   IN  VARCHAR2,  
    column_value  IN  ANYDATA);
```

Parameters

Table 304-33 SET_VALUE Procedure Parameters

Parameter	Description
<code>value_type</code>	The type of value to set Specify <code>old</code> to set the old value of the column. Specify <code>new</code> to set the new value of the column.
<code>column_name</code>	The column name An error is raised if the specified <code>column_value</code> does not exist in the LCR for the specified <code>column_type</code> .
<code>column_value</code>	The new value of the column If <code>NULL</code> is specified, then this procedure raises an error. To set the value to <code>NULL</code> , encapsulate the <code>NULL</code> in an <code>ANYDATA</code> instance. If the member procedure is used in a procedure DML handler or error handler that uses LOB assembly, then specify a LOB locator for LOB columns.

SET_VALUES Member Procedure

Replaces all old values or all new values for the LCR, depending on the value type specified.

Considerations for LOB Columns

You can use this procedure when processing a row LCR with LOB columns with a procedure DML handler or error handler. If the handler is using LOB assembly (the `assemble_lob` parameter is set to `TRUE` for the handler), then you can use this member procedure in the handler procedure. If `assemble_lob` is set to `FALSE` for the handler, then you cannot use this member procedure on a row LCR.

To use a DML or error handler to set the value of one or more LOB columns in a row LCR, specify a LOB locator for each LOB column in the `value_list` parameter. The `SET_VALUES` member procedure verifies that an `ANYDATA` encapsulated LOB locator is processed with a DML or error handler that is using LOB assembly. An error is raised under the following conditions:

- The handler attempts to enqueue a row LCR with an `ANYDATA` encapsulated LOB locator.
- An attempt is made to set a LOB column incorrectly.

If an error is raised because of one of these conditions, then the transaction that includes the row LCR is moved to the error queue, and the LOB columns are represented by the original (nonassembled) row LCRs.

 **Note:**

- Database compatibility must be 10.2.0 or higher to use LOB assembly.
- When you are processing a row LCR with a rule-based transformation, you cannot use this member procedure on LOB columns.
- When you are processing a row LCR with a rule-based transformation, procedure DML handler, or error handler, you cannot use this member procedure on `LONG` or `LONG RAW` columns.

Considerations for XMLType Columns

When processing a row LCR with `XMLType` columns with a procedure DML handler or error handler, any `XMLType` and LOB columns in the LCR are always assembled using LOB assembly. You can use this member procedure in the handler procedure on a row LCR that contains one or more `XMLType` columns.

To use a DML or error handler to set the value of one or more `XMLType` columns in a row LCR, specify an `XMLType` for each `XMLType` column in the `value_list` parameter. The `SET_VALUES` member procedure verifies that an `ANYDATA` encapsulated `XMLType` is processed with a DML or error handler. An error is raised under the following conditions:

- The handler attempts to enqueue a row LCR with an `ANYDATA` encapsulated `XMLType`.
- An attempt is made to set a `XMLType` incorrectly.

If an error is raised because of one of these conditions, then the transaction that includes the row LCR is moved to the error queue, and the `XMLType` columns are represented by the original (nonassembled) row LCRs.

 **Note:**

- Database compatibility must be 11.1.0 or higher to process row LCRs with `XMLType` columns.
- When you are processing a row LCR with a rule-based transformation, you cannot use this member procedure on `XMLType` columns.

Syntax

```
MEMBER PROCEDURE SET_VALUES(  
    value_type IN VARCHAR2,  
    value_list IN SYS.LCR$_ROW_LIST);
```

Parameters

Table 304-34 SET_VALUES Procedure Parameters

Parameter	Description
value_type	The type of values to replace Specify <code>old</code> to replace the old values. Specify <code>new</code> to replace the new values.
value_list	List of values to replace the existing list Use a <code>NULL</code> or an empty list to remove all values. If the member procedure is used in a procedure DML handler or error handler that uses LOB assembly, then specify one or more LOB locators for LOB columns.

SET_XML_INFORMATION Member Procedure

Sets the XML information for the column.

Syntax

```
MEMBER PROCEDURE SET_XML_INFORMATION(
    column_name      IN VARCHAR2,
    xml_information  IN NUMBER);
```

Parameters

Table 304-35 SET_XML_INFORMATION Procedure Parameters

Parameter	Description
column_name	The name of the column An exception is raised if the column value does not exist in the LCR.
xml_information	Specify one of the following values: DBMS_LCR.NOT_XML CONSTANT NUMBER := 1; DBMS_LCR.XML_DOC CONSTANT NUMBER := 2; DBMS_LCR.XML_DIFF CONSTANT NUMBER := 3; DBMS_LCR.XML_DIFF CONSTANT NUMBER := 3; DBMS_LCR.NOT_XML indicates that the column is not an XMLType column. DBMS_LCR.XML_DOC indicates that the column contains an XML document. DBMS_LCR.XML_DIFF indicates that the column contains differences between old and new XML documents for an update operation. DBMS_LCR.XML_DIFF indicates that the column contains an XML document that describes a change made by an update operation. This XML document describes the differences in the column's XML document. The entire XML document is not replaced.

304.3.3 Common Subprograms for LCR\$_DDL_RECORD and LCR\$_ROW_RECORD

These functions and procedures are common to both the LCR\$_DDL_RECORD and LCR\$_ROW_RECORD type.

See Also:

For descriptions of the subprograms for these types that are exclusive to each type:

- ["LCR\\$_DDL_RECORD Type"](#)
- ["LCR\\$_ROW_RECORD Type"](#)

Table 304-36 Summary of Common Subprograms for DDL and Row LCR Types

Subprogram	Description
GET_COMMAND_TYPE Member Function	Gets the command type of the logical change record (LCR)
GET_COMMIT_SCN Member Function	Gets the commit system change number (SCN) of the transaction to which the current LCR belongs
GET_COMMIT_SCN_FROM_POSITION Static Function	Gets the commit SCN of a transaction from the input position, which is generated by an XStream outbound server
GET_COMMIT_TIME	Gets the commit time of the transaction to which the current LCR belongs
GET_COMPATIBLE Member Function	Gets the minimal database compatibility required to support the LCR
GET_EXTRA_ATTRIBUTE Member Function	Gets the value for the specified extra attribute in the LCR
GET_OBJECT_NAME Member Function	Gets the name of the object that is changed by the LCR
GET_OBJECT_OWNER Member Function	Gets the owner of the object that is changed by the LCR
GET_POSITION Member Function	Gets the position of the current LCR
GET_ROOT_NAME Member Function	Gets the global name of the root for a CDB.
GET_SCN Member Function	Gets the SCN of the LCR
GET_SCN_FROM_POSITION Static Function	Gets the SCN from the input position, which is generated by an XStream outbound server
GET_SOURCE_DATABASE_NAME Member Function	Gets the source database name.
GET_SOURCE_TIME Member Function	Gets the time when the change in an LCR captured by a capture process was generated in the redo log of the source database, or the time when a persistent LCR was created
GET_TAG Member Function	Gets the tag for the LCR

Table 304-36 (Cont.) Summary of Common Subprograms for DDL and Row LCR Types

Subprogram	Description
GET_THREAD_NUMBER Member Function	Gets the thread number of the database instance that made the change that is encapsulated in the LCR
GET_TRANSACTION_ID Member Function	Gets the transaction identifier of the LCR
IS_NULL_TAG Member Function	Returns Y if the tag for the LCR is NULL, or returns N if the tag for the LCR is not NULL
SET_COMMAND_TYPE Member Procedure	Sets the command type in the LCR
SET_EXTRA_ATTRIBUTE Member Procedure	Sets the value for the specified extra attribute in the LCR
SET_OBJECT_NAME Member Procedure	Sets the name of the object that is changed by the LCR
SET_OBJECT_OWNER Member Procedure	Sets the owner of the object that is changed by the LCR
SET_ROOT_NAME Member Procedure	Sets the global name of the root in a CDB.
SET_SOURCE_DATABASE_NAME Member Procedure	Sets the source database name of the object that is changed by the LCR
SET_TAG Member Procedure	Sets the tag for the LCR

GET_COMMAND_TYPE Member Function

Gets the command type of the LCR.

 **See Also:**

The "SQL Command Codes" table in the *Oracle Call Interface Programmer's Guide* for a complete list of command types

Syntax

```
MEMBER FUNCTION GET_COMMAND_TYPE ()
RETURN VARCHAR2;
```

GET_COMMIT_SCN Member Function

Gets the commit system change number (SCN) of the transaction to which the current LCR belongs.

The commit SCN for a transaction is available only during apply or during error transaction execution. This function can be used only in a procedure DML handler, DDL handler, or error handler.

The commit SCN might not be available for an LCR that is part of an incomplete transaction. For example, persistent LCRs might not have a commit SCN. If the commit SCN is not available for an LCR, then this function returns NULL.

Syntax

```
MEMBER FUNCTION GET_COMMIT_SCN()
RETURN NUMBER;
```

GET_COMMIT_SCN_FROM_POSITION Static Function

Gets the commit system change number (SCN) of a transaction from the input position, which is generated by an XStream outbound server.

Syntax

```
STATIC FUNCTION GET_COMMIT_SCN_FROM_POSITION(
    position IN RAW)
RETURN NUMBER;
```

Parameters**Table 304-37 GET_COMMIT_SCN_FROM_POSITION Function Parameter**

Parameter	Description
position	The position You can obtain the position by using the <code>GET_POSITION</code> member function or by querying the <code>DBA_XSTREAM_OUTBOUND_PROGRESS</code> data dictionary view.

**Note:**

Using XStream requires purchasing a license for the Oracle GoldenGate product. See *Oracle Database XStream Guide*.

GET_COMMIT_TIME

Gets the commit time of the transaction to which the current LCR belongs.

The commit time for a transaction is available only during apply or during error transaction execution. This function can be used only in a procedure DML handler, DDL handler, or error handler.

The commit time might not be available for an LCR that is part of an incomplete transaction. For example, persistent LCRs might not have a commit time. If the commit time is not available for an LCR, then this function returns `NULL`.

Syntax

```
MEMBER FUNCTION GET_COMMIT_TIME()
RETURN DATE;
```

GET_COMPATIBLE Member Function

Gets the minimal database compatibility required to support the LCR. You control the compatibility of an Oracle database using the `COMPATIBLE` initialization parameter.

The return value for this function can be one of the following:

Return Value	COMPATIBLE Initialization Parameter Equivalent
DBMS_STREAMS.COMPATIBLE_9_2	9.2.0
DBMS_STREAMS.COMPATIBLE_10_1	10.1.0
DBMS_STREAMS.COMPATIBLE_10_2	10.2.0
DBMS_STREAMS.COMPATIBLE_11_1	11.1.0
DBMS_STREAMS.COMPATIBLE_11_2	11.2.0

DDL LCRs always return `DBMS_STREAMS.COMPATIBLE_9_2`.

You can use the following functions in the `DBMS_STREAMS` package for constant compatibility return values:

- The `COMPATIBLE_9_2` function returns the `DBMS_STREAMS.COMPATIBLE_9_2` constant.
- The `COMPATIBLE_10_1` function returns `DBMS_STREAMS.COMPATIBLE_10_1` constant.
- The `COMPATIBLE_10_2` function returns `DBMS_STREAMS.COMPATIBLE_10_2` constant.
- The `COMPATIBLE_11_1` function returns `DBMS_STREAMS.COMPATIBLE_11_1` constant.
- The `COMPATIBLE_11_2` function returns `DBMS_STREAMS.COMPATIBLE_11_2` constant.
- The `MAX_COMPATIBLE` function returns an integer that is greater than the highest possible compatibility constant for the current release of Oracle Database.

You can use these functions with the `GET_COMPATIBLE` member function for an LCR in rule conditions and apply handlers.

See Also:

- *Oracle Database Reference* and *Oracle Database Upgrade Guide* for more information about the `COMPATIBLE` initialization parameter

Syntax

```
MEMBER FUNCTION GET_COMPATIBLE ()
RETURN NUMBER;
```

GET_EXTRA_ATTRIBUTE Member Function

Gets the value for the specified extra attribute in the LCR. The returned extra attribute is contained within an `ANYDATA` instance. You can use the `INCLUDE_EXTRA_ATTRIBUTE` procedure in the `DBMS_CAPTURE_ADM` package to instruct a capture process to capture one or more extra attributes.

See Also:

[INCLUDE_EXTRA_ATTRIBUTE Procedure](#)

Syntax

```
MEMBER FUNCTION GET_EXTRA_ATTRIBUTE(  
    attribute_name IN VARCHAR2)  
RETURN ANYDATA;
```

Parameters

Table 304-38 GET_EXTRA_ATTRIBUTE Function Parameter

Parameter	Description
attribute_name	<p>The name of the extra attribute to return</p> <p>Valid names are:</p> <ul style="list-style-type: none"> • row_id The rowid of the row changed in a row LCR. This attribute is not included in DDL LCRs, nor in row LCRs for index-organized tables. The type is UROWID. • serial# The serial number of the session that performed the change captured in the LCR. The type is NUMBER. • session# The identifier of the session that performed the change captured in the LCR. The type is NUMBER. • thread# The thread number of the instance in which the change captured in the LCR was performed. Typically, the thread number is relevant only in an Oracle Real Application Clusters (Oracle RAC) environment. The type is NUMBER. • tx_name The name of the transaction that includes the LCR. The type is VARCHAR2. • username The name of the current user who performed the change captured in the LCR. The type is VARCHAR2. <p>An error is raised if the specified attribute_name is not valid. If no value exists for the specified extra attribute, then the function returns a NULL.</p> <p>See Also: <i>Oracle Database PL/SQL Language Reference</i> for more information about the current user</p>

GET_OBJECT_NAME Member Function

Gets the name of the object that is changed by the LCR.

Syntax

```
MEMBER FUNCTION GET_OBJECT_NAME()  
RETURN VARCHAR2;
```

GET_OBJECT_OWNER Member Function

Gets the owner of the object that is changed by the LCR.

Syntax

```
MEMBER FUNCTION GET_OBJECT_OWNER()  
RETURN VARCHAR2;
```

GET_POSITION Member Function

Gets the position of the current LCR. The position uniquely identifies each LCR. The position strictly increases within each transaction and across transactions.

LCR position is commonly used in XStream configurations.

Syntax

```
MEMBER FUNCTION GET_POSITION()  
RETURN RAW;
```



Note:

Using XStream requires purchasing a license for the Oracle GoldenGate product. See *Oracle Database XStream Guide*.

GET_ROOT_NAME Member Function

Gets the global name of the root in a CDB, which is the root name for the LCR.

Syntax

```
MEMBER FUNCTION GET_ROOT_NAME()  
RETURN VARCHAR2;
```

GET_SCN Member Function

Gets the system change number (SCN) of the LCR.

Syntax

```
MEMBER FUNCTION GET_SCN()  
RETURN NUMBER;
```

GET_SCN_FROM_POSITION Static Function

Gets the system change number (SCN) from the input position, which is generated by an XStream outbound server.

Syntax

```
STATIC FUNCTION GET_SCN_FROM_POSITION(  
    position IN RAW)  
RETURN NUMBER;
```

Parameters

Table 304-39 GET_SCN_FROM_POSITION Function Parameter

Parameter	Description
position	The position You can obtain the position by using the GET_POSITION member function or by querying the DBA_XSTREAM_OUTBOUND_PROGRESS data dictionary view.

 **Note:**

Using XStream requires purchasing a license for the Oracle GoldenGate product. See *Oracle Database XStream Guide*.

GET_SOURCE_DATABASE_NAME Member Function

Gets the global name of the source database. The source database is the database where the change occurred.

Syntax

```
MEMBER FUNCTION GET_SOURCE_DATABASE_NAME ()  
RETURN VARCHAR2;
```

GET_SOURCE_TIME Member Function

Gets the time when the change in an LCR captured by a capture process was generated in the redo log of the source database, or the time when a persistent LCR was created.

Syntax

```
MEMBER FUNCTION GET_SOURCE_TIME ()  
RETURN DATE;
```

GET_TAG Member Function

Gets the tag for the LCR. An LCR tag is a binary tag that enables tracking of the LCR. For example, this tag can be used to determine the original source database of the DML or DDL change when apply forwarding is used.

Syntax

```
MEMBER FUNCTION GET_TAG ()  
RETURN RAW;
```

GET_THREAD_NUMBER Member Function

Gets the thread number of the database instance that made the change that is encapsulated in the LCR. Typically, the thread number is relevant in an Oracle Real Application Clusters configuration.

**See Also:**

Oracle Real Application Clusters Administration and Deployment Guide

Syntax

```
MEMBER FUNCTION GET_THREAD_NUMBER()  
RETURN NUMBER;
```

GET_TRANSACTION_ID Member Function

Gets the transaction identifier of the LCR.

Syntax

```
MEMBER FUNCTION GET_TRANSACTION_ID()  
RETURN VARCHAR2;
```

IS_NULL_TAG Member Function

Returns **Y** if the tag for the LCR is **NULL**, or returns **N** if the tag for the LCR is not **NULL**.

Syntax

```
MEMBER FUNCTION IS_NULL_TAG()  
RETURN VARCHAR2;
```

SET_COMMAND_TYPE Member Procedure

Sets the command type in the LCR. If the command type specified cannot be interpreted, then this procedure raises an error. For example, changing **INSERT** to **GRANT** would raise an error.

**See Also:**

- The description of the `command_type` parameter in [LCR\\$_DDL_RECORD Constructor Function Parameters](#)
- The description of the `command_type` parameter in [LCR\\$_ROW_RECORD Type](#)
- The "SQL Command Codes" table in the *Oracle Call Interface Programmer's Guide* for a complete list of command types

Syntax

```
MEMBER PROCEDURE SET_COMMAND_TYPE(  
    command_type IN VARCHAR2);
```

Parameter

Table 304-40 SET_COMMAND_TYPE Procedure Parameter

Parameter	Description
command_type	The command type Set this parameter to a non-NULL value.

SET_EXTRA_ATTRIBUTE Member Procedure

Sets the value for the specified extra attribute in the LCR. You can use the `INCLUDE_EXTRA_ATTRIBUTE` procedure in the `DBMS_CAPTURE_ADM` package to instruct a capture process to capture one or more extra attributes.



See Also:

[INCLUDE_EXTRA_ATTRIBUTE Procedure](#)

Syntax

```
MEMBER PROCEDURE SET_EXTRA_ATTRIBUTE(  
    attribute_name IN VARCHAR2,  
    attribute_value IN ANYDATA);
```

Parameters

Table 304-41 SET_EXTRA_ATTRIBUTE Procedure Parameter

Parameter	Description
<code>attribute_name</code>	<p>The name of the extra attribute to set</p> <p>Valid names are:</p> <ul style="list-style-type: none"> <code>row_id</code> The rowid of the row changed in a row LCR. This attribute is not included in DDL LCRs, nor in row LCRs for index-organized tables. The type is <code>VARCHAR2</code>. <code>serial#</code> The serial number of the session that performed the change captured in the LCR. The type is <code>NUMBER</code>. <code>session#</code> The identifier of the session that performed the change captured in the LCR. The type is <code>NUMBER</code>. <code>thread#</code> The thread number of the instance in which the change captured in the LCR was performed. Typically, the thread number is relevant only in an Oracle Real Application Clusters (Oracle RAC) environment. The type is <code>NUMBER</code>. <code>tx_name</code> The name of the transaction that includes the LCR. The type is <code>VARCHAR2</code>. <code>username</code> The name of the current user who performed the change captured in the LCR. The type is <code>VARCHAR2</code>. <p>An error is raised if the specified <code>attribute_name</code> is not valid.</p> <p>See Also: <i>Oracle Database PL/SQL Language Reference</i> for more information about the current user</p>
<code>attribute_value</code>	<p>The value to which the specified extra attribute is set</p> <p>If set to <code>NULL</code>, then this procedure removes the specified extra attribute from the LCR. To set to <code>NULL</code>, encapsulate the <code>NULL</code> in an <code>ANYDATA</code> instance.</p>

SET_OBJECT_NAME Member Procedure

Sets the name of the object that is changed by the LCR.

Syntax

```
MEMBER PROCEDURE SET_OBJECT_NAME(
    object_name IN VARCHAR2);
```

Parameter**Table 304-42 SET_OBJECT_NAME Procedure Parameter**

Parameter	Description
object_name	The name of the object

SET_OBJECT_OWNER Member Procedure

Sets the owner of the object that is changed by the LCR.

Syntax

```
MEMBER PROCEDURE SET_OBJECT_OWNER(
    object_owner IN VARCHAR2);
```

Parameter**Table 304-43 SET_OBJECT_OWNER Procedure Parameter**

Parameter	Description
object_owner	The schema that contains the object

SET_ROOT_NAME Member Procedure

Sets the global name of the root in a CDB. The setting is the root name for the LCR.

Syntax

```
MEMBER PROCEDURE SET_ROOT_NAME(
    root_name IN VARCHAR2);
```

Parameter**Table 304-44 SET_ROOT_NAME Procedure Parameter**

Parameter	Description
root_name	The global name of the root.

SET_SOURCE_DATABASE_NAME Member Procedure

Sets the source database name of the object that is changed by the LCR.

Syntax

```
MEMBER PROCEDURE SET_SOURCE_DATABASE_NAME(
    source_database_name IN VARCHAR2);
```

Parameter

Table 304-45 SET_SOURCE_DATABASE_NAME Procedure Parameter

Parameter	Description
source_database_name	The source database of the change If you do not include the domain name, then the procedure appends the local domain to the database name automatically. For example, if you specify DBS1 and the local domain is EXAMPLE.COM, then the procedure specifies DBS1.EXAMPLE.COM automatically. Set this parameter to a non-NULL value.

SET_TAG Member Procedure

Sets the tag for the LCR. An LCR tag is a binary tag that enables tracking of the LCR. For example, this tag can be used to determine the original source database of the change when apply forwarding is used.

Syntax

```
MEMBER PROCEDURE SET_TAG(
    tag IN RAW);
```

Parameter

Table 304-46 SET_TAG Procedure Parameter

Parameter	Description
tag	The binary tag for the LCR The size limit for a tag value is two kilobytes.

304.3.4 LCR\$_ROW_LIST Type

This type identifies a list of column values for a row in a table.

It uses the LCR\$_ROW_UNIT type and is used in the LCR\$_ROW_RECORD type.



See Also:

- [LCR\\$_ROW_UNIT Type](#)
- [LCR\\$_ROW_RECORD Type](#)

Syntax

```
CREATE TYPE SYS.LCR$_ROW_LIST AS TABLE OF SYS.LCR$_ROW_UNIT
/
```


304.3.5 LCR\$_ROW_UNIT Type

This type identifies the value for a column in a row.

It is used in the LCR\$_ROW_LIST type.



See Also:

[LCR\\$_ROW_LIST Type](#)

Syntax

```
CREATE TYPE LCR$_ROW_UNIT AS OBJECT (
  column_name      VARCHAR2(4000),
  data             ANYDATA,
  lob_information  NUMBER,
  lob_offset       NUMBER,
  lob_operation_size NUMBER
  long_information NUMBER);
/
```

Attributes

Table 304-47 LCR\$_ROW_UNIT Attributes

Attribute	Description												
column_name	The name of the column												
data	The data contained in the column												
lob_information	Contains the LOB information for the column and contains one of the following values: <table border="0" style="margin-left: 20px;"> <tr> <td>DBMS_LCR.NOT_A_LOB</td> <td>CONSTANT NUMBER := 1;</td> </tr> <tr> <td>DBMS_LCR.NULL_LOB</td> <td>CONSTANT NUMBER := 2;</td> </tr> <tr> <td>DBMS_LCR.INLINE_LOB</td> <td>CONSTANT NUMBER := 3;</td> </tr> <tr> <td>DBMS_LCR.EMPTY_LOB</td> <td>CONSTANT NUMBER := 4;</td> </tr> <tr> <td>DBMS_LCR.LOB_CHUNK</td> <td>CONSTANT NUMBER := 5;</td> </tr> <tr> <td>DBMS_LCR.LAST_LOB_CHUNK</td> <td>CONSTANT NUMBER := 6;</td> </tr> </table>	DBMS_LCR.NOT_A_LOB	CONSTANT NUMBER := 1;	DBMS_LCR.NULL_LOB	CONSTANT NUMBER := 2;	DBMS_LCR.INLINE_LOB	CONSTANT NUMBER := 3;	DBMS_LCR.EMPTY_LOB	CONSTANT NUMBER := 4;	DBMS_LCR.LOB_CHUNK	CONSTANT NUMBER := 5;	DBMS_LCR.LAST_LOB_CHUNK	CONSTANT NUMBER := 6;
DBMS_LCR.NOT_A_LOB	CONSTANT NUMBER := 1;												
DBMS_LCR.NULL_LOB	CONSTANT NUMBER := 2;												
DBMS_LCR.INLINE_LOB	CONSTANT NUMBER := 3;												
DBMS_LCR.EMPTY_LOB	CONSTANT NUMBER := 4;												
DBMS_LCR.LOB_CHUNK	CONSTANT NUMBER := 5;												
DBMS_LCR.LAST_LOB_CHUNK	CONSTANT NUMBER := 6;												
lob_offset	The LOB offset specified in the number of characters for CLOB columns and the number of bytes for BLOB columns Valid values are NULL or a positive integer less than or equal to DBMS_LOB.LOBMAXSIZE.												
lob_operation_size	If lob_information for the LOB is DBMS_LCR.LAST_LOB_CHUNK, then this parameter can be set to either a valid LOB ERASE value or a valid LOB TRIM value. A LOB ERASE value must be a positive integer less than or equal to DBMS_LOB.LOBMAXSIZE. A LOB TRIM value must be a nonnegative integer less than or equal to DBMS_LOB.LOBMAXSIZE. If lob_information is not DBMS_LCR.LAST_LOB_CHUNK and for all other operations, is NULL.												

Table 304-47 (Cont.) LCR\$_ROW_UNIT Attributes

Attribute	Description
long_information	<p>Contains the LONG information for the column and contains one of the following values:</p> <pre>DBMS_LCR.not_a_long CONSTANT NUMBER := 1; DBMS_LCR.null_long CONSTANT NUMBER := 2; DBMS_LCR.inline_long CONSTANT NUMBER := 3; DBMS_LCR.long_chunk CONSTANT NUMBER := 4; DBMS_LCR.last_long_chunk CONSTANT NUMBER := 5;</pre>

MGD_ID Package Types

The `MGD_ID` package provides an extensible framework that supports current radio-frequency ID (RFID) tags with the standard family of EPC bit encodings for the supported encoding types. The `MGD_ID` Package also supports new and evolving tag encodings that are not included in the current EPC standard (EPC v1.1 specification).

The `MGD_ID` package contains several predefined types.



See Also:

Oracle Database Development Guide for more information.

This chapter contains the following topics:

- [Security Model](#)
- [Summary of Types](#)
- [Summary of MGD_ID Subprograms](#)

The method described in this reference chapter show examples based on the examples shown in the constructor functions.

The examples in this chapter assume that the you have run the following set of commands before running the contents of each script:

```
SQL> connect / as sysdba;
Connected.
SQL> create user mgduser identified by mgduser;
SQL> grant connect, resource to mgduser;
SQL> connect mgduser
Enter password: mgduserpassword
Connected.
SQL> set serveroutput on;
```

305.1 MGD_ID Package Types Security Model

You must run the `catmgd.sql` script to load the `DBMS_MGD_ID_UTL` package and create the required Identity Code Package schema objects in the `MGDSYS` schema.

`MGD_ID` is a `MGDSYS`-owned object type. Any `MGD_ID` subprogram called from an anonymous PL/SQL block is run using the privileges of the current user.

A user must be granted connect and resource roles to use the `MGD_ID` object type and its subprograms.

`EXECUTE` privilege is granted to `PUBLIC` for this ADT: `MGD_ID`.

A public synonym, by the same name, is created for this ADT: `MGD_ID`.

305.2 Summary of Types

This table lists and briefly describes the `MGD_ID` Package object types.

Table 305-1 MGD_ID Package Object Types

Object Type Name	Description
MGD_ID_COMPONENT Object Type	Datatype that specifies the name and value pair attributes that define a component
MGD_ID_COMPONENT_VARRAY Object Type	Datatype that specifies a list of up to 128 components as name-value attribute pairs used in two constructor functions for creating an identity code type object
MGD_ID Object Type	Represents an <code>MGD_ID</code> object that specifies the category identifier for the code category for this identity code and its list of components

305.2.1 MGD_ID_COMPONENT Object Type

The `MGD_ID_COMPONENT` type is a datatype that specifies the name and value pair attributes that define a component.

Syntax

```
MGD_ID_COMPONENT as object (name VARCHAR2(256),
                             value VARCHAR2(1024));
```

Attributes

Table 305-2 MGD_ID_COMPONENT Attributes

Attribute	Description
name	Name of component
value	Value of the component as a character

Examples

See the [MGD_ID Constructor Function](#) for an example.

305.2.2 MGD_ID_COMPONENT_VARRAY Object Type

The `MGD_ID_COMPONENT_VARRAY` type is a datatype that specifies a list of up to 128 components as name-value attribute pairs for use in two constructor functions for creating a product code type object with its list of components.

Syntax

```
MGD_ID_COMPONENT_VARRAY is VARRAY (128) of MGD_ID_COMPONENT;
```

Examples

See the [MGD_ID Constructor Function](#) for an example.

305.2.3 MGD_ID Object Type

The `MGD_ID` type represents an identity code in an RFID application. This type represents RFID tags with standard EPC bit encoding as well as tag encodings that are not included in the EPC standard.

Syntax

```
MGD_ID as object (category_id VARCHAR2(256),
                 components  MGD_ID_COMPONENT_VARRAY);
```

Attributes

Table 305-3 MGD_ID Object Type Attributes

Attribute	Description
<code>category_id</code>	Category identifier for the code category of this code
<code>components</code>	List of components as name-value attributes

Methods

[Table 305-5](#) describes the methods of the `MGD_ID` object type.

Table 305-4 MGD_ID Methods

Method	Description
<code>MGD_ID</code> constructor function	Creates an <code>MGD_ID</code> object based on the parameters passed in and returns self as a result
<code>FORMAT</code> function	Returns the string representation of the <code>MGD_ID</code> in the specified format
<code>GET_COMPONENT</code> function	Returns the string value of the specified <code>MGD_ID</code> component
<code>TO_STRING</code> function	Returns the string value of semicolon (;) separated component name value pairs of the <code>MGD_ID</code> object
<code>TRANSLATE</code> function	Returns the result of the conversion of the identifier from one format to the specified format

Examples

See the [Summary of MGD_ID Subprograms](#) section and the section about using the Identity Code package in Using the Identity Code Package in *Oracle Database Development Guide* for examples.

305.3 Summary of MGD_ID Subprograms

This table describes the subprograms in the `MGD_ID` object type.

All the values and names passed to the procedures defined in the `MGD_ID` object type are case insensitive unless otherwise mentioned. To preserve the case, enclose the values with double quotation marks.

Table 305-5 MGD_ID Object Type Subprograms

Subprogram	Description
MGD_ID Constructor Function	Creates an <code>MGD_ID</code> object based on the parameters passed in and returns self as a result
FORMAT Function	Returns the string representation of the <code>MGD_ID</code> object in the specified format
GET_COMPONENT Function	Returns the string value of the specified <code>MGD_ID</code> component
TO_STRING Function	Returns the string value of semicolon (;) separated component name value pairs of the <code>MGD_ID</code> object
TRANSLATE Function	Returns the result of the conversion of the identifier from one format to the specified format

305.3.1 MGD_ID Constructor Function

This constructor function constructs an identity code type object, `MGD_ID`. The constructor function is overloaded. The different functionality of each form of syntax is presented along with the definitions.

Syntax

Constructs an `MGD_ID` object type based on the category ID and a list of components.

```
MGD_ID (
    category_id      IN VARCHAR2,
    components       IN MGD_ID_COMPONENT_VARRAY)
RETURN SELF AS RESULT DETERMINISTIC;
```

Constructs an `MGD_ID` object type based on the category ID, the identifier string, and the list of additional parameters required to create it.

```
MGD_ID (
    category_id      VARCHAR2,
    identifier        VARCHAR2,
    parameter_list   VARCHAR2)
RETURN SELF AS RESULT DETERMINISTIC;
```

Constructs an `MGD_ID` object type based on the category name, category version, and a list of components.

```
MGD_ID (
    category_name    VARCHAR2,
    category_version VARCHAR2,
```

```

    components          MGD_ID_COMPONENT_VARRAY)
RETURN SELF AS RESULT DETERMINISTIC;

```

Constructs an `MGD_ID` object type based on the category name, category version, the identifier string, and the list of additional parameters required to create it.

```

MGD_ID (
    category_name      VARCHAR2,
    category_version   VARCHAR2,
    identifier          VARCHAR2,
    parameter_list     VARCHAR2)
RETURN SELF AS RESULT DETERMINISTIC;

```

Parameters

Table 305-6 MGD_ID Constructor Function Parameters

Parameter	Description
<code>category_id</code>	Category identifier
<code>components</code>	List of component name value pairs
<code>category_name</code>	Category name, such as EPC
<code>category_version</code>	Category version. If <code>NULL</code> , the latest version for the specified category name will be used.
<code>identifier</code>	<p>Identifier string in any format of an encoding scheme in the specified category. For example, for SGTIN-96 encoding, the identifier can be in the format of <code>BINARY</code>, <code>PURE_IDENTITY</code>, <code>TAG_ENCODING</code>, or <code>LEGACY</code>.</p> <p>Express this identifier as a string according to the appropriate grammar or pattern in the tag data translation (TDT) markup file. For example, a binary string consisting of characters 0 and 1, a URI (either tag-encoding or pure-identity formats), or a serialized legacy code expressed as a string format for input, such as <code>gtin=00037000302414;serial=10419703</code> for a SGTIN coding scheme.</p>
<code>parameter_list</code>	<p>List of additional parameters required to create the object in the representation. The list is expressed as a parameter string containing key-value pairs, separated by the semicolon (;) as a delimiter between key-value pairs. For example, for a GTIN code, the parameter string would look as follows:</p> <pre>filter=3;companyprefixlength=7;taglength=96</pre>

Usage Notes

- Use `MGD_ID_UTL.EPC_ENCODING_CATEGORY_ID` as `category_id`.
- If the category is not already registered, an error is raised.
- If the `bit_length` parameter is `NULL`, the `bit_length` is 8* the length of `bit_encoding`.
- If the component list does not contain all required components, an exception `MGD_ID_UTL.e_LackComponent` will be thrown.

Examples

The following examples construct identity code type objects.

Construct an MGD_ID object (SGTIN-64) passing in the category ID and a list of components.

```
--Contents of constructor11.sql
call DBMS_MGD_ID_UTL.set_proxy('www-proxy.example.com', '80');
call DBMS_MGD_ID_UTL.refresh_category('1');
select MGD_ID('1',
             MGD_ID_COMPONENT_VARRAY(
               MGD_ID_COMPONENT('companyprefix','0037000'),
               MGD_ID_COMPONENT('itemref','030241'),
               MGD_ID_COMPONENT('serial','1041970'),
               MGD_ID_COMPONENT('schemes','SGTIN-64')
             )
             ) from dual;
call DBMS_MGD_ID_UTL.remove_proxy();

SQL> @constructor11.sql
.
.
.
MGD_ID('1', MGD_ID_COMPONENT_VARRAY(MGD_ID_COMPONENT('companyprefix', '0037000'),
                                     MGD_ID_COMPONENT('itemref', '030241'),
                                     MGD_ID_COMPONENT('serial', '1041970'),
                                     MGD_ID_COMPONENT('schemes', 'SGTIN-64'))
.
.
.
```

Constructs an MGD_ID object (SGTIN-64) passing in the category ID, the tag identifier, and the list of additional parameters that may be required to create it.

```
--Contents of constructor22.sql
call DBMS_MGD_ID_UTL.set_proxy('www-proxy.example.com', '80');
call DBMS_MGD_ID_UTL.refresh_category('1');
select MGD_ID('1',
             'urn:epc:id:sgtin:0037000.030241.1041970',
             'filter=3;scheme=SGTIN-64') from dual;
call DBMS_MGD_ID_UTL.remove_proxy();

SQL> @constructor22.sql
.
.
.
MGD_ID('1', MGD_ID_COMPONENT_VARRAY(MGD_ID_COMPONENT('filter', '3'),
                                     MGD_ID_COMPONENT('schemes', 'SGTIN-64'),
                                     MGD_ID_COMPONENT('companyprefixlength', '7'),
                                     MGD_ID_COMPONENT('companyprefix', '0037000'),
                                     MGD_ID_COMPONENT('scheme', 'SGTIN-64'),
                                     MGD_ID_COMPONENT('serial', '1041970'),
                                     MGD_ID_COMPONENT('itemref', '030241'))
.
.
.
```

Construct an MGD_ID object (SGTIN-64) passing in the category name, category version (if NULL, then the latest version will be used), and a list of components.

```
--Contents of constructor33.sql
call DBMS_MGD_ID_UTL.set_proxy('www-proxy.example.com', '80');
call DBMS_MGD_ID_UTL.refresh_category(DBMS_MGD_ID_UTL.get_category_id('EPC', NULL));
select MGD_ID('EPC', NULL,
```



```

        MGD_ID_COMPONENT_VARRAY (
        MGD_ID_COMPONENT('companyprefix','0037000'),
        MGD_ID_COMPONENT('itemref','030241'),
        MGD_ID_COMPONENT('serial','1041970'),
        MGD_ID_COMPONENT('schemes','SGTIN-64')
        )
    ) from dual;
call DBMS_MGD_ID_UTL.remove_proxy();

SQL> @constructor33.sql
.
.
.
MGD_ID('1', MGD_ID_COMPONENT_VARRAY (MGD_ID_COMPONENT('companyprefix', '0037000'),
                                     MGD_ID_COMPONENT('itemref', '030241'),
                                     MGD_ID_COMPONENT('serial', '1041970'),
                                     MGD_ID_COMPONENT('schemes', 'SGTIN-64')))
.
.
.

```

Constructs an MGD_ID object (SGTIN-64) passing in the category name and category version, the tag identifier, and the list of additional parameters that may be required to create it.

```

--Contents of constructor44.sql
call DBMS_MGD_ID_UTL.set_proxy('www-proxy.example.com', '80');
call DBMS_MGD_ID_UTL.refresh_category(DBMS_MGD_ID_UTL.get_category_id('EPC', NULL));
select MGD_ID('EPC', NULL,
             'urn:epc:id:sgtin:0037000.030241.1041970',
             'filter=3;scheme=SGTIN-64') from dual;
call DBMS_MGD_ID_UTL.remove_proxy();

SQL> @constructor4.sql
.
.
.
MGD_ID('1', MGD_ID_COMPONENT_VARRAY (MGD_ID_COMPONENT('filter', '3'),
                                     MGD_ID_COMPONENT('schemes', 'SGTIN-64'),
                                     MGD_ID_COMPONENT('companyprefixlength', '7'),
                                     MGD_ID_COMPONENT('companyprefix', '0037000'),
                                     MGD_ID_COMPONENT('scheme', 'SGTIN-64'),
                                     MGD_ID_COMPONENT('serial', '1041970'),
                                     MGD_ID_COMPONENT('itemref', '030241')))
.
.
.

```

305.3.2 FORMAT Function

This function returns the string representation of the MGD_ID object in the specified format.

Syntax

```

FORMAT (parameter_list IN VARCHAR2,
       output_format   IN VARCHAR2)
RETURN VARCHAR2 DETERMINISTIC;

```

Parameters

Table 305-7 FORMAT Function Parameters

Parameter	Description
<code>parameter_list</code>	List of additional parameters required to create the object in the representation. The list is expressed as a parameter string containing key-value pairs, separated by the semicolon (;) as a delimiter between key-value pairs. For example, for a GTIN code, the parameter string would look as follows: <code>filter=3;companyprefixlength=7;taglength=96</code>
<code>output_format</code>	One of the supported output formats into which an MGD_ID component is formatted: <ul style="list-style-type: none"> • BINARY • LEGACY • TAG_ENCODING • PURE_IDENTITY • ONS_HOSTNAME

Examples

See the example for the [GET_COMPONENT Function](#).

305.3.3 GET_COMPONENT Function

This function returns the value of the specified MGD_ID component.

Syntax

```
GET_COMPONENT (
    component_name IN VARCHAR2)
RETURN VARCHAR2 DETERMINISTIC;
```

Parameters

Table 305-8 GET_COMPONENT Function Parameter

Parameter	Description
<code>component_name</code>	Name of component

Usage Notes

- If the code is an invalid code, meaning its structure is not defined in the metadata table, an error is raised.
- If the code is valid, but it does not contain the required component, NULL is returned.

Examples

The following example returns the general manager, object class, and serial number components for this GID-96 identity component:

```

--Contents of get_components.sql file
call DBMS_MGD_ID_UTL.set_proxy('www-proxy.example.com', '80');
DECLARE
id MGD_ID;
BEGIN
  DBMS_MGD_ID_UTL.set_java_logging_level(DBMS_MGD_ID_UTL.LOGGING_LEVEL_OFF);
  DBMS_MGD_ID_UTL.refresh_category(DBMS_MGD_ID_UTL.get_category_id('EPC', NULL));
  -----
  --PURE_IDENTIT
  -----
  dbms_output.put_line('..Testing constructor with pure identity');
  -----
  -- PURE_IDENTITY representation can be translated to BINARY and
  -- TAG_ENCODING ONLY when BOTH scheme and filer are provided.
  -----
  id := MGD_ID('EPC', NULL, 'urn:epc:id:sgtin:0037000.030241.1041970', 'scheme=SGTIN-64;filter=3');
  dbms_output.put_line(id.to_string);
  dbms_output.put_line('filter          = ' || id.get_component('filter'));
  dbms_output.put_line('company prefix = ' || id.get_component('companyprefix'));
  dbms_output.put_line('itemref       = ' || id.get_component('itemref'));
  dbms_output.put_line('serial        = ' || id.get_component('serial'));
  dbms_output.put_line('BINARY format = ' || id.format(NULL, 'BINARY'));
  dbms_output.put_line('PURE_IDENTITY format = ' || id.format(NULL, 'PURE_IDENTITY'));
  dbms_output.put_line('TAG_ENCODING format = ' || id.format(NULL, 'TAG_ENCODING'));
END;
/
SHOW ERRORS;
call DBMS_MGD_ID_UTL.remove_proxy();
SQL> @get_component.sql
.
.
.
..Testing constructor with pure identity
category_id =1;filter = 3;schemes = SGTIN-64;companyprefixlength =
7;companyprefix = 0037000;scheme = SGTIN-64;serial = 1041970;itemref = 030241
filter          = 3
company prefix = 0037000
itemref         = 030241
serial          = 1041970
BINARY format  =1001100000000000001000001110110001000010000011111110011000110010
PURE_IDENTITY format = urn:epc:id:sgtin:0037000.030241.1041970
TAG_ENCODING format = urn:epc:tag:sgtin-64:3.0037000.030241.1041970
PL/SQL procedure successfully completed.
.
.
.

```

305.3.4 TO_STRING Function

This function returns the semicolon (;) separated component name value pairs of the MGD_ID object.

Syntax

```

TO_STRING
RETURN VARCHAR2;

```

Examples

The following example converts the MGD_ID object into a string value:

```
-- Contents of toString3.sql file
call DBMS_MGD_ID_UTL.set_proxy('www-proxy.example.com', '80');
DECLARE
id          MGD_ID;
BEGIN
  DBMS_MGD_ID_UTL.refresh_category(DBMS_MGD_ID_UTL.get_category_id('EPC', NULL));
  dbms_output.put_line('..Testing to_string');
  id := mgd_id('EPC', NULL, 'urn:epc:id:gid:0037000.30241.1041970', 'scheme=GID-96');
  DBMS_OUTPUT.PUT_LINE('mgd_id object as a string');
  DBMS_OUTPUT.PUT_LINE(id.to_string);
END;
/
SHOW ERRORS;
call DBMS_MGD_ID_UTL.remove_proxy();
connect / as sysdba;
drop user mgduser cascade;

SQL> @toString3.sql
.
.
.
..Testing to_string
mgd_id object as a string
category_id =1;schemes = GID-96;objectclass = 30241;generalmanager =
0037000;scheme = GID-96;1 = 1;serial = 1041970
PL/SQL procedure successfully completed.
.
.
```

305.3.5 TRANSLATE Function

This static function translates between different representations directly without first constructing an `MGD_ID` object.

This method is overloaded. The different functionality of each form of syntax is presented along with the definitions.

Syntax

Converts the identifier in one format to another given the category name, the tag identifier, the parameter list, and the output format.

```
TRANSLATE (
  category_name    IN VARCHAR2,
  identifier        IN VARCHAR2,
  parameter_list   IN VARCHAR2,
  output_format    IN VARCHAR2)
RETURN VARCHAR2 DETERMINISTIC;
```

Converts the identifier in one format to another given the category name, category version, the tag identifier, the parameter list, and the output format.

```
TRANSLATE (
  category_name    IN VARCHAR2,
  category_version IN VARCHAR2,
  identifier        IN VARCHAR2,
  parameter_list   IN VARCHAR2,
  output_format    IN VARCHAR2)
RETURN VARCHAR2 DETERMINISTIC;
```

Parameters

Table 305-9 TRANSLATE Function Parameters

Parameter	Description
<code>category_name</code>	Name of category
<code>category_version</code>	Category version. If NULL, the latest version of the specified category name will be used.
<code>identifier</code>	EPC identifier, expressed as a string in accordance with one of the grammars or patterns in the TDT markup file. For example, a binary string consisting of characters 0 and 1, a URI (either tag-encoding or pure-identity formats), or a serialized legacy code expressed as a string format for input, such as <code>gtin=00037000302414;serial=10419703</code> for a SGTIN coding scheme.
<code>parameter_list</code>	List of additional parameters required to create the object in the representation. The list is expressed as a parameter string containing key-value pairs, separated by the semicolon (;) as a delimiter between key-value pairs. For example, for a GTIN code, the parameter string would look as follows: <code>filter=3;companyprefixlength=7;taglength=96</code>
<code>output_format</code>	One of the supported output formats into which an MGD_ID component shall be converted: <ul style="list-style-type: none"> • BINARY • LEGACY • TAG_ENCODING • PURE_IDENTITY • ONS_HOSTNAME

Usage Notes

When converting from a pure identity representation to a binary representation, the filter value must be supplied as a value using the `parameter_list` parameter.

Examples

The following examples translates one GID-96 representation into another:

```
-- Contents of translatel.sql file
call DBMS_MGD_ID_UTL.set_proxy('www-proxy.example.com', '80');
DECLARE
id          MGD_ID;
BEGIN
  DBMS_MGD_ID_UTL.refresh_category(DBMS_MGD_ID_UTL.get_category_id('EPC', NULL));
  dbms_output.put_line('Category ID is EPC, Identifier is BINARY, Output format is BINARY');
  dbms_output.put_line(
    mgd_id.translate('EPC',
  NULL,'001101010000000000001001000010001000000000001110110001000010000000000000011111110011000110010'
, NULL, 'BINARY'));
  dbms_output.put_line('Category ID is EPC, Identifier is BINARY, Output format is PURE_IDENTITY');
  dbms_output.put_line(
    mgd_id.translate('EPC',
  NULL,'001101010000000000001001000010001000000000001110110001000010000000000000011111110011000110010'
, NULL, 'PURE_IDENTITY'));
```

```

dbms_output.put_line('Category ID is EPC, Identifier is BINARY, Output format is TAG_ENCODING');
  dbms_output.put_line(
    mgd_id.translate('EPC',
NULL,'001101010000000000001001000010001000000000001110110001000010000000000000111111100110001
10010'
, NULL, 'TAG_ENCODING'));
  dbms_output.put_line('Category ID is EPC, Identifier is TAG_ENCODING, Output format is
BINARY');
  dbms_output.put_line(
    mgd_id.translate('EPC', NULL,
                    'urn:epc:tag:gid-96:0037000.30241.1041970',
                    NULL, 'BINARY'));
  dbms_output.put_line('Category ID is EPC, Identifier is TAG_ENCODING, Output format is
PURE_IDENTITY');
  dbms_output.put_line(
    mgd_id.translate('EPC', NULL,
                    'urn:epc:tag:gid-96:0037000.30241.1041970',
                    NULL, 'PURE_IDENTITY'));
dbms_output.put_line('Category ID is EPC, Identifier is TAG_ENCODING, Output format is
TAG_ENCODING');
  dbms_output.put_line(
    mgd_id.translate('EPC', NULL,
                    'urn:epc:tag:gid-96:0037000.30241.1041970',
                    NULL, 'TAG_ENCODING'));
  dbms_output.put_line('Category ID is EPC, Identifier is PURE_IDENTITY, Output format is
BINARY');
  dbms_output.put_line(
    mgd_id.translate('EPC', NULL,
                    'urn:epc:id:gid:0037000.30241.1041970',
                    NULL, 'BINARY'));
  dbms_output.put_line('Category ID is EPC, Identifier is PURE_IDENTITY, Output format is
PURE_IDENTITY');
  dbms_output.put_line(
    mgd_id.translate('EPC', NULL,
                    'urn:epc:id:gid:0037000.30241.1041970',
                    NULL, 'PURE_IDENTITY'));
  dbms_output.put_line('Category ID is EPC, Identifier is PURE_IDENTITY, Output format is
TAG_ENCODING');
  dbms_output.put_line(
    mgd_id.translate('EPC', NULL,
                    'urn:epc:id:gid:0037000.30241.1041970',
                    NULL, 'TAG_ENCODING'));
END;
/
SHOW ERRORS;
call DBMS_MGD_ID_UTL.remove_proxy();

```

SQL> @translatel.sql

```

.
.
.
Category ID is EPC, Identifier is BINARY, Output format is BINARY
00110101000000000000100100001000100000000000111011000100001000000000000011111110011000110010
Category ID is EPC, Identifier is BINARY, Output format is PURE_IDENTITY
urn:epc:id:gid:37000.30241.1041970
Category ID is EPC, Identifier is BINARY, Output format is TAG_ENCODING
urn:epc:tag:gid-96:37000.30241.1041970
Category ID is EPC, Identifier is TAG_ENCODING, Output format is BINARY
00110101000000000000100100001000100000000000111011000100001000000000000011111110011000110010
Category ID is EPC, Identifier is TAG_ENCODING, Output format is PURE_IDENTITY
urn:epc:id:gid:0037000.30241.1041970

```

```
Category ID is EPC, Identifier is TAG_ENCODING, Output format is TAG_ENCODING  
urn:epc:tag:gid-96:0037000.30241.1041970  
Category ID is EPC, Identifier is PURE_IDENTITY, Output format is BINARY  
0011010100000000000010010000100010000000000001110110001000010000000000000011111110011000110010  
Category ID is EPC, Identifier is PURE_IDENTITY, Output format is PURE_IDENTITY  
urn:epc:id:gid:0037000.30241.1041970  
Category ID is EPC, Identifier is PURE_IDENTITY, Output format is TAG_ENCODING  
urn:epc:tag:gid-96:0037000.30241.1041970  
PL/SQL procedure successfully completed.
```

```
.  
. .  
.
```

306

Rule TYPES

This chapter describes the types used with rules, rule sets, and evaluation contexts.

This chapter contains the following topics:

- [Overview](#)
- [Security Model](#)
- [Summary of Rule Types](#)

306.1 Rule TYPES Overview

These types are used in rules and enable clients to evaluate rules with the rules engine.

See Also:

- [DBMS_RULE](#)
- [DBMS_RULE_ADM](#)

306.2 Rule TYPES Security Model

`PUBLIC` is granted `EXECUTE` privilege on these `RULE` types.

See Also:

Oracle Database Security Guide for more information about user group `PUBLIC`

306.3 Summary of Rule Types

This table lists the `Rule Types` and briefly describes them.

Table 306-1 Rule Types

Type	Description
RE\$ATTRIBUTE_VALUE Type	Specifies the value of a variable attribute
RE\$ATTRIBUTE_VALUE_LIST Type	Identifies a list of attribute values
RE\$COLUMN_VALUE Type	Specifies the value of a table column
RE\$COLUMN_VALUE_LIST Type	Identifies a list of column values

Table 306-1 (Cont.) Rule Types

Type	Description
RE\$NAME_ARRAY Type	Identifies a list of names
RE\$NAME_ARRAY Type	Identifies a list of name-value pairs
RE\$NV_LIST Type	Identifies an object containing a list of name-value pairs and methods that operate on this list. This object type is used to represent the event context and the action context for a rule
RE\$NV_NODE Type	Identifies a name-value pair
RE\$RULE_HIT Type	Specifies a rule found because of evaluation
RE\$RULE_HIT_LIST Type	Identifies a list of rules found because of evaluation
RE\$RULE_NAME Type	Allows users to pass a list of rule as argument.
RE\$RULE_NAME_LIST Type	Identifies a list of Rule Name values
RE\$TABLE_ALIAS Type	Provides the table corresponding to an alias used in a rule evaluation context
RE\$TABLE_ALIAS_LIST Type	Identifies a list of table aliases used in a rule evaluation context
RE\$TABLE_VALUE Type	Specifies the value of a table row using a ROWID
RE\$TABLE_VALUE_LIST Type	Identifies a list of table values
RE\$VALUE Type	Represents one datapoint value element
RE\$VALUE_LIST Type	Defines a list of RE\$VALUE type
RE\$VARIABLE_TYPE Type	Provides the type of a variable used in a rule evaluation context
RE\$VARIABLE_TYPE_LIST Type	Identifies a list of variables and their types used in a rule evaluation context
RE\$VARIABLE_VALUE Type	Specifies the value of a variable
RE\$VARIABLE_VALUE_LIST Type	Identifies a list of variable values

Rule types are used with the following Oracle-supplied PL/SQL packages:

- `DBMS_RULE`
- `DBMS_RULE_ADM`

You can use the `DBMS_RULE_ADM` package to create and administer rules, rule sets, and evaluation contexts, and you can use the `DBMS_RULE` package to evaluate rules.

When you use Replication (Oracle GoldenGate and XStream), rules determine which changes are captured by a capture process, which messages are propagated by a propagation, which messages are applied by an apply process, and which messages are dequeued by a messaging client. The following Replication (Oracle GoldenGate and XStream) packages use rules:

- `DBMS_APPLY_ADM`
- `DBMS_CAPTURE_ADM`
- `DBMS_PROPAGATION_ADM`

306.3.1 RE\$ATTRIBUTE_VALUE Type

RE\$ATTRIBUTE_VALUE type specifies the value of a variable attribute.



Note:

Enclose the variable name and attribute name in double quotation marks (") if the name contains special characters.

Syntax

```
TYPE SYS.RE$ATTRIBUTE_VALUE (
  variable_name  VARCHAR2(32),
  attribute_name VARCHAR2(4000),
  attribute_value ANYDATA);
```

Attributes

Table 306-2 RE\$ATTRIBUTE_VALUE Attributes

Attribute	Description
variable_name	Specifies the variable used in a rule
attribute_name	Specifies the attribute name. The attribute name can be a multi-component name, such as a1.b2.c3.
attribute_value	Specifies the attribute value

306.3.2 RE\$ATTRIBUTE_VALUE_LIST Type

The RE\$ATTRIBUTE_VALUE_LIST type identifies a list of attribute values.

Syntax

```
TYPE SYS.RE$ATTRIBUTE_VALUE_LIST AS VARRAY(1024) OF SYS.RE$ATTRIBUTE_VALUE;
```

306.3.3 RE\$COLUMN_VALUE Type

RE\$COLUMN_VALUE type specifies the value of a table column.



Note:

Enclose the column name in double quotation marks (") if the name contains special characters.

Syntax

```
TYPE SYS.RE$COLUMN_VALUE (
  table_alias  VARCHAR2(32),
```

```
column_name  VARCHAR2(4000),
column_value ANYDATA);
```

Attributes

Table 306-3 RE\$COLUMN_VALUE Attributes

Attribute	Description
table_alias	Specifies the alias used for the table in a rule
column_name	Specifies the column name
column_value	Specifies the column value

306.3.4 RE\$COLUMN_VALUE_LIST Type

RE\$COLUMN_VALUE_LIST type identifies a list of column values.

Syntax

```
TYPE SYS.RE$COLUMN_VALUE_LIST AS VARRAY(1024) OF SYS.RE$COLUMN_VALUE;
```

306.3.5 RE\$NAME_ARRAY Type

RE\$NAME_ARRAY type identifies a list of names.

Syntax

```
TYPE SYS.RE$NAME_ARRAY AS VARRAY(1024) OF VARCHAR2(30);
```

306.3.6 RE\$NV_ARRAY Type

RE\$NV_ARRAY type identifies a list of name-value pairs.

Syntax

```
TYPE SYS.RE$NV_ARRAY AS VARRAY(1024) OF SYS.RE$NV_NODE;
```

306.3.7 RE\$NV_LIST Type

identifies an object containing a list of name-value pairs and methods that operate on this list.

This object type is used to represent the event context for rule set evaluation and the action context for a rule.

Syntax

```
TYPE SYS.RE$NV_LIST AS OBJECT(
  actx_list SYS.RE$NV_ARRAY);
```

Attributes

Table 306-4 RE\$NV_LIST Attributes

Attribute	Description
actx_list	The list of name-value pairs

RE\$NV_LIST Subprograms

This section describes the following member procedures and member functions of the SYS.RE\$NV_LIST type:

- [ADD_PAIR Member Procedure](#)
- [GET_ALL_NAMES Member Function](#)
- [GET_VALUE Member Function](#)
- [REMOVE_PAIR Member Procedure](#)

ADD_PAIR Member Procedure

Adds a name-value pair to the list of name-value pairs.

**Note:**

Enclose the name in double quotation marks (") if the name contains special characters.

Syntax

```
MEMBER PROCEDURE ADD_PAIR(
    name    IN VARCHAR2,
    value   IN ANYDATA);
```

Parameters

Table 306-5 ADD_PAIR Procedure Parameters

Parameter	Description
name	The name in the name-value pair being added to the list. If the name exists in the list, then this procedure raises an error.
value	The value in the name-value pair being added to the list

GET_ALL_NAMES Member Function

Returns a list of all the names in the name-value pair list.

Syntax

```
MEMBER FUNCTION GET_ALL_NAMES()
RETURN SYS.RE$NAME_ARRAY;
```

GET_VALUE Member Function

Returns the value for the specified name in a name-value pair list.



Note:

Enclose the name in double quotation marks (") if the name contains special characters.

Syntax

```
MEMBER FUNCTION GET_VALUE (  
    name IN VARCHAR2)  
RETURN ANYDATA;
```

Parameters

Table 306-6 GET_VALUE Function Parameters

Parameter	Description
name	The name whose value to return

REMOVE_PAIR Member Procedure

Removes the name-value pair with the specified name from the name-value pair list.



Note:

Enclose the name in double quotation marks (") if the name contains special characters.

Syntax

```
MEMBER PROCEDURE REMOVE_PAIR (  
    name IN VARCHAR2);
```

Parameters

Table 306-7 REMOVE_PAIR Procedure Parameters

Parameter	Description
name	The name of the pair to remove

306.3.8 RE\$NV_NODE Type

RE\$COLUMN_VALUE type identifies a name-value pair.



Note:

Enclose the name in double quotation marks (") if the name contains special characters.

Syntax

```
TYPE SYS.RE$NV_NODE (  
    nvn_name    VARCHAR2(30),  
    nvn_value   ANYDATA);
```

Attributes

Table 306-8 RE\$NV_NODE Attributes

Attribute	Description
nvn_name	Specifies the name in the name-value pair
nvn_value	Specifies the value in the name-value pair

306.3.9 RE\$RULE_HIT Type

The RE\$RULE_HIT type specifies a rule found because of an evaluation.



See Also:

- [CREATE_RULE Procedure](#)
- [ALTER_RULE Procedure](#)

Syntax

```
TYPE SYS.RE$RULE_HIT (  
    rule_name          VARCHAR2(65),  
    rule_action_context RE$NV_LIST);
```

Attributes**Table 306-9 RE\$RULE_HIT Attributes**

Attribute	Description
rule_name	The rule name in the form <i>schema_name.rule_name</i> . For example, a rule named <code>employee_rule</code> in the <code>hr</code> schema is returned in the form <code>"hr"."employee_rule"</code> .
rule_action_context	The rule action context as specified in the <code>CREATE_RULE</code> or <code>ALTER_RULE</code> procedure of the <code>DBMS_RULE_ADM</code> package

306.3.10 RE\$RULE_HIT_LIST Type

The `RE$RULE_HIT_LIST` type identifies a list of rules found because of an evaluation.

Syntax

```
TYPE SYS.RE$RULE_HIT_LIST AS VARRAY(1024) OF SYS.RE$RULE_HIT;
```

306.3.11 RE\$RULE_NAME Type

The `RE$RULE_HIT` type is create to allow use to pass a list of rule as argument.

Syntax

```
CREATE OR REPLACE TYPE SYS.RE$RULE_NAME AS OBJECT (
  rule_name          IN          varchar2,
  evaluation_context IN          varchar2);
```

Attributes**Table 306-10 RE\$RULE_NAME Attributes**

Attribute	Description
rule_name	The rule name in the form <i>SCHEMA_NAME.RULE_NAME</i> . For example, a rule named <code>employee_rule</code> in the <code>hr</code> schema is returned in the form <code>"hr"."employee_rule"</code> .
Evaluation_context	The evaluation context as specified in the <code>CREATE_RULE</code> or <code>ALTER_RULE</code> procedure of the <code>DBMS_RULE_ADM</code> package

306.3.12 RE\$RULE_NAME_LIST Type

`RE$RULE_HIT_LIST` type Identifies a list of Rule Name values.

Syntax

```
CREATE OR REPLACE TYPE SYS.RE$RULE_NAME_LIST AS VARRAY(1024) OF SYS.RE$RULE_NAME;
```

306.3.13 RE\$TABLE_ALIAS Type

RE\$TABLE_ALIAS type provides the table corresponding to an alias used in a rule evaluation context.

A specified table name must satisfy the schema object naming rules.

Note:

Enclose the table name in double quotation marks (") if the name contains special characters.

See Also:

Oracle Database SQL Language Reference for information about schema object naming rules

Syntax

```
TYPE SYS.RE$TABLE_ALIAS IS OBJECT(  
    table_alias VARCHAR2(32),  
    table_name  VARCHAR2(194));
```

Attributes

Table 306-11 RE\$TABLE_ALIAS Attributes

Attribute	Description
table_alias	The alias used for the table in a rule
table_name	The table name referred to by the alias. A synonym can be specified. The table name is resolved in the evaluation context schema. The format is one of the following: <i>schema_name.table_name</i> <i>table_name</i> For example, if the <i>schema_name</i> is <i>hr</i> and the <i>table_name</i> is <i>employees</i> , then enter the following: <i>hr.employees</i>

306.3.14 RE\$TABLE_ALIAS_LIST Type

The RE\$TABLE_ALIAS_LIST type identifies a list of table aliases used in a rule evaluation context.

Syntax

```
TYPE SYS.RE$TABLE_ALIAS_LIST AS VARRAY(1024) OF SYS.RE$TABLE_ALIAS;
```

306.3.15 RE\$TABLE_VALUE Type

The RE\$TABLE_VALUE type specifies the value of a table row using a ROWID.

Syntax

```
TYPE SYS.RE$TABLE_VALUE(  
    table_alias VARCHAR2(32),  
    table_rowid VARCHAR2(18));
```

Attributes

Table 306-12 RE\$TABLE_VALUE Attributes

Attribute	Description
table_alias	Specifies the alias used for the table in a rule
table_rowid	Specifies the rowid for the table row

306.3.16 RE\$TABLE_VALUE_LIST Type

The RE\$TABLE_VALUE_LIST type identifies a list of table values.



Note:

Each table alias in the list in the list must be unique.

Syntax

```
TYPE SYS.RE$TABLE_VALUE_LIST AS VARRAY(1024) OF SYS.RE$TABLE_VALUE;
```

306.3.17 RE\$VALUE Type

The RE\$VALUE type represents one datapoint value element.

Syntax

```
TYPE SYS.RE$VALUE (  
    table_values          IN      SYS.RE$TABLE_VALUE_LIST:= NULL,  
    column_values        IN      SYS.RE$COLUMN_VALUE_LIST:=NULL,  
    variable_values      IN      SYS.RE$VARIABLE_VALUE_LIST:=NULL,  
    attribute_values     IN      SYS.RE$ATTRIBUTE_VALUE_LIST:=NULL)
```

Attributes

Table 306-13 RE\$VALUE Attributes

Attribute	Description
table_values	ROWID of table row for expression evaluation
column_values	Values of columns referred in the expression
variable_values	Values of variables referred in expression
attribute_values	Values of attributes referred in expression

306.3.18 RE\$VALUE_LIST Type

RE\$TABLE_VALUE_LIST type is a varray for defining a list of RE\$VALUE type. It represents a list of datapoint element.

Syntax

```
CREATE OR REPLACE TYPE SYS.RE$VALUE_LIST AS VARRAY(1024) OF SYS.RE$VALUE;
```

306.3.19 RE\$VARIABLE_TYPE Type

The RE\$VARIABLE_TYPE type provides the type of a variable used in a rule evaluation context. A specified variable name must satisfy the schema object naming rules.

Note:

Enclose the variable name in double quotation marks (") if the name contains special characters.

See Also:

Oracle Database SQL Language Reference for information about schema object naming rules

Syntax

```
TYPE SYS.RE$VARIABLE_TYPE (
  variable_name          VARCHAR2(32),
  variable_type          VARCHAR2(4000),
  variable_value_function VARCHAR2(228),
  variable_method_function VARCHAR2(228));
```

Attributes

Table 306-14 RE\$VARIABLE_TYPE Attributes

Attribute	Description
<code>variable_name</code>	The variable name used in a rule
<code>variable_type</code>	The type that is resolved in the evaluation context schema. Any valid Oracle built-in datatype, user-defined type, or Oracle-supplied type can be specified. See the <i>Oracle Database SQL Language Reference</i> for more information about these types.
<code>variable_value_function</code>	A value function that can be specified for implicit variables. A synonym can be specified. The function name is resolved in the evaluation context schema. It is executed on behalf of the owner of a rule set using the evaluation context or containing a rule that uses the evaluation context. See the " Usage Notes " for more information.
<code>variable_method_function</code>	Specifies a value function, which can return the result of a method invocation. Specifying such a function can speed up evaluation, if there are many simple rules that invoke the method on the variable. The function can be a synonym or a remote function. The function name is resolved in the evaluation context schema. It is executed on behalf of the owner of a rule set using the evaluation context or containing a rule that uses the evaluation context. See the " Usage Notes " for more information.

Usage Notes

The functions for both the `variable_value_function` parameter and `variable_method_function` parameter have the following format:

```
schema_name.package_name.function_name@dblink
```

Any of the following parts of the format can be omitted: *schema_name*, *package_name*, and *@dblink*.

For example, if the *schema_name* is *hr*, the *package_name* is *var_pac*, the *function_name* is *func_value*, and the *dblink* is *dbs1.net*, then enter the following:

```
hr.var_pac.func_value@dbs1.net
```

The following sections describe the signature of the functions.

Signature for `variable_value_function`

The function must have the following signature:

```
FUNCTION variable_value_function_name(
  evaluation_context_schema IN VARCHAR2,
  evaluation_context_name   IN VARCHAR2,
  variable_name              IN VARCHAR2,
  event_context              IN SYS.RE$NV_LIST )
RETURN SYS.RE$VARIABLE_VALUE;
```

Signature for variable_method_function

This function must have the following signature:

```

FUNCTION variable_method_function_name(
  evaluation_context_schema IN VARCHAR2,
  evaluation_context_name  IN VARCHAR2,
  variable_value           IN SYS.RE$VARIABLE_VALUE,
  method_name              IN VARCHAR2,
  event_context            IN SYS.RE$NV_LIST)
RETURN SYS.RE$ATTRIBUTE_VALUE;

```

306.3.20 RE\$VARIABLE_TYPE_LIST Type

The RE\$VARIABLE_TYPE_LIST type identifies a list of variables and their types used in a rule evaluation context.

Syntax

```
TYPE SYS.RE$VARIABLE_TYPE_LIST AS VARRAY(1024) OF SYS.RE$VARIABLE_TYPE;
```

306.3.21 RE\$VARIABLE_VALUE Type

The RE\$VARIABLE_VALUE type specifies the value of a variable.



Note:

Enclose the variable name in double quotation marks (") if the name contains special characters.

Syntax

```

TYPE SYS.RE$VARIABLE_VALUE (
  variable_name VARCHAR2(32),
  variable_data ANYDATA);

```

Attributes

Table 306-15 RE\$VARIABLE_VALUE Attributes

Attribute	Description
variable_name	Specifies the variable name used in a rule
variable_data	Specifies the data for the variable value

306.3.22 RE\$VARIABLE_VALUE_LIST Type

The RE\$VARIABLE_VALUE_LIST type identifies a list of variable values.

Syntax

```
TYPE SYS.RE$VARIABLE_VALUE_LIST AS VARRAY(1024) OF SYS.RE$VARIABLE_VALUE;
```

307

SODA Types

There are several SODA types: `SODA_DOCUMENT_T`, `SODA_COLLECTION_T`, `SODA_OPERATION_T`, and `SODA_CURSOR_T`. `SODA_DOCUMENT_T` and `SODA_COLLECTION_T` represent two primary abstractions provided by SODA: document and collections. `SODA_OPERATION_T` is used for specifying condition of operations on the collection. `SODA_CURSOR_T` is a cursor over results of read operations on the collection.

This chapter contains the following topics:

- [SODA Types Overview](#)
- [SODA Types Security Model](#)
- [Summary of SODA Types](#)

307.1 SODA Types Overview

There are several SODA types: `SODA_DOCUMENT_T`, `SODA_COLLECTION_T`, `SODA_OPERATION_T`, and `SODA_CURSOR_T`. `SODA_DOCUMENT_T` and `SODA_COLLECTION_T` represent two primary abstractions provided by SODA: document and collections. `SODA_OPERATION_T` is used for specifying condition of operations on the collection. `SODA_CURSOR_T` is a cursor over results of read operations on the collection.



See Also:

- [Oracle Database SODA for PL/SQL Developer's Guide](#)
- [DBMS_SODA](#)

307.2 SODA Types Security Model

The SODA Types are available to users with the `SODA_APP` role.

All SODA types are `SYS` types. `PUBLIC` is granted `EXECUTE` privilege on the SODA types described in this chapter:

- `TYPE SODA_Collection_T`
- `TYPE SODA_Document_T`
- `TYPE SODA_Operation_T`
- `TYPE SODA_Cursor_T`

307.3 Summary of SODA Types

This chapter lists the SODA types and describes them.

Table 307-1 SODA Types

Type	Description
SODA_Collection_T Type	This SODA type represents a SODA collection. This type is not persistable.
SODA_Document_T Type	This SODA type represents a document with content, usually in JSON format. This type is not persistable.
SODA_OPERATION_T Type	This SODA type performs read/write operations, such as document finds with filtering and pagination, removes, and replaces on a SODA collection. This type is not persistable.
SODA_CURSOR_T Type	This SODA type represents the result set of documents. This type is not persistable.

307.3.1 SODA_Collection_T Type

This SODA type represents a SODA collection. A reference of SODA collection can only be obtained by either calling `DBMS_SODA.CREATE_COLLECTION()` or `DBMS_SODA.OPEN_COLLECTION()`.

Table 307-2 SODA_Collection_T Type Subprograms

Subprogram	Description
CREATE_INDEX Function	Creates an index using an index specification expressed in JSON. Three types of specifications are supported. Each specifying a different type of index: for B-tree, JSON search with Data Guide, and Spatial.
CREATE_VIEW_FROM_DG Function	Creates a view with relational columns, using scalar JSON fields as specified in the data guide.
DROP_INDEX Function	Drops the named index.
FIND Function	Returns the <code>SODA_OPERATION_T</code> object. This is the only way to get the reference of <code>SODA_Operation_T</code> as there is no constructor.
FIND_ONE Function	Fetches the document matching the key.
GET_DATA_GUIDE Function	Returns the JSON data guide as a CLOB.
GET_INDEX Function	This function returns the specification for the supplied index created on the collection.

Table 307-2 (Cont.) SODA_Collection_T Type Subprograms

Subprogram	Description
GET_METADATA Function	Returns the metadata of the collection in JSON format.
GET_NAME Function	Returns the name of the collection.
INSERT_ONE Function	Inserts a document into the collection.
INSERT_ONE_AND_GET Function	Inserts a document into the collection and returns a result document with all components except for content.
LIST_INDEXES Function	This function returns the specifications for all the indexes created on the collection.
REMOVE_ONE Function	Removes the document matching the key.
REPLACE_ONE Function	Replaces the content and (optionally) the media type of the document matching the key.
REPLACE_ONE_AND_GET Function	Replaces the content and (optionally) the media type of the document matching the key and returns a result document with all components (except content).
SAVE Function	Saves a document into the collection.
SAVE_AND_GET Function	Saves a document into the collection.
TRUNCATE Function	Deletes all documents in the collection.

307.3.1.1 CREATE_INDEX Function

This function creates an index using an index specification expressed in JSON. Three types of specifications are supported. Each specifying a different type of index: for B-tree, JSON search with Data Guide, and Spatial.

Syntax

```
CREATE_INDEX (
    specification VARCHAR2)
RETURN NUMBER;
```

Parameters

Table 307-3 CREATE_INDEX Function Parameters

Parameter	Description
specification	The index specification.

Example 307-1 Return Values

The function returns:

- 1—if the index was successfully created
- 0—if the index was not created

Exceptions

Error—If an error occurs creating the index.

See Also:

For more information about SODA Index specifications, see:

- Overview of SODA Indexing
- SODA Index Specifications (Reference)

307.3.1.2 CREATE_VIEW_FROM_DG Function

This function creates a view with relational columns, using scalar `JSON` fields as specified in the data guide. A data guide enabled `JSON` search index is not required for this function; the data guide is passed to the function. An error is thrown if the data guide passed to the function is invalid.

This procedure is available only for Autonomous Database starting 19c release.

Syntax

```
CREATE_VIEW_FROM_DG (
  data_guide          IN   CLOB,
  view_name           IN   VARCHAR2,
  materialize         IN   BOOLEAN DEFAULT FALSE,
  mv_refresh_mode     IN   NUMBER DEFAULT 1,
  path                IN   VARCHAR2 DEFAULT '$',
  resolve_name_conflicts IN  BOOLEAN  DEFAULT FALSE,
  col_name_prefix     IN   VARCHAR2 DEFAULT NULL,
  mixed_case_columns  IN   BOOLEAN DEFAULT FALSE)
RETURN NUMBER;
```

Parameters

Table 307-4 CREATE_VIEW_FROM_DG Function Parameters

Parameter	Description
<code>data_guide</code>	Data guide of the collection.
<code>view_name</code>	Name of the view to be created.
<code>materialize</code>	A boolean value to indicate if the view should be materialized or not. The default value is <code>FALSE</code> .
<code>mv_refresh_mode</code>	The materialized view refresh mode. Possible values are: <ul style="list-style-type: none"> • <code>DBMS_SODA.MV_REFRESH_ON_STATEMENT</code> (default) • <code>DBMS_SODA.MV_REFRESH_ON_COMMIT</code> • <code>DBMS_SODA.MV_REFRESH_ON_DEMAND</code>

Table 307-4 (Cont.) CREATE_VIEW_FROM_DG Function Parameters

Parameter	Description
<code>path</code>	<p>The path of the JSON field to be expanded. It uses JSON path expression syntax. For example:</p> <ul style="list-style-type: none"> • <code>\$</code> will create a view starting from the JSON document root • <code>\$.purchaseOrder</code> will create a view starting from <code>purchaseOrder</code>. It expands the children or descendants under <code>purchaseOrder</code>, and create view columns for every scalar value. <p>The default value is <code>\$</code>.</p>
<code>resolve_name_conflicts</code>	<p>By default, if there are conflicts among <code>o:preferred_column_name</code>, an error is raised. If you set this parameter to <code>TRUE</code>, the procedure automatically resolves the view column name conflicts by appending a sequence number.</p> <p>The default value is <code>FALSE</code>.</p>
<code>col_name_prefix</code>	<p>By default, the view column name is the same as the JSON field name. This parameter allows you to provide a prefix to prepend to the view column names.</p> <p>The default value is <code>NULL</code>.</p>
<code>mixed_case_columns</code>	<p>By default, the view column names are case sensitive. This parameter allows you to change the behavior to case insensitive. The default value is <code>FALSE</code>.</p>

Return Values

The function returns:

- 1—if the procedure is successfully completed
- 0—if the procedure could not be successfully completed

Exceptions

Error—If an error occurs if the function was unable to create a view.

**See Also:**

For more info on the JSON data guide, see [JSON Data Guide](#)

307.3.1.3 DROP_INDEX Function

This function drops the named index.

Syntax

```
DROP_INDEX (  
    index_Name IN VARCHAR2,  
    force      IN BOOLEAN DEFAULT FALSE)  
RETURN NUMBER;
```

Example 307-2 Parameters

Table 307-5 DROP_INDEX Function Parameters

Parameter	Description
index_Name	The name of the index.
force	The force parameter can be TRUE or FALSE. Should only be set to TRUE for dropping a JSON search index or spatial index (not B-tree index). For more information, see DROP INDEX

Return Values

The function returns:

- 1—If the index was successfully dropped
- 0—If the index was not dropped. For example, if there was no existing index with the specified name.

Exceptions

Error—if an error occurs while dropping the index.

307.3.1.4 FIND Function

This function returns the operation type for the collection. The operation type allows building and executing various read/write operations. This is the only way to get the reference of `SODA_Operation_T` as there is no constructor.

Syntax

```
FIND ()  
RETURN SODA_Operation_T;
```

Return Values

This function returns `SODA_OPERATION_T` object.

Exceptions

This function does not throw any exception.

307.3.1.5 FIND_ONE Function

This function fetches the document matching the given key.

Syntax

```
FIND_ONE (  
    key          IN VARCHAR2)  
RETURN SODA_Document_T;
```

Parameters

Table 307-6 FIND_ONE Function Parameters

Parameter	Description
key	The key of the document to be fetched.

Return Values

This function returns the document that matches the key. Returns `NULL` if no match is found.

Exceptions

`Error`—If an error occurs while finding the document.

307.3.1.6 GET_DATA_GUIDE Function

This function fetches the JSON data guide as a CLOB. The JSON data guide is essentially inferred schema for the JSON documents in the collection. In order to be able to return the JSON data guide, a collection must have a JSON Search Index defined on it, with the data guide enabled.

Syntax

```
GET_DATA_GUIDE (  
RETURN CLOB;
```

Return Values

The function returns the JSON data guide as a CLOB.



See Also:

For more info on the JSON data guide, see [JSON Data Guide](#)

Exceptions

`Error`—If an error occurs while fetching the data guide.

307.3.1.7 GET_INDEX Function

This function returns the specification for the supplied index created on the collection.

Syntax

```
GET_INDEX (  
    index_name          IN VARCHAR2,  
    schema_name        IN VARCHAR2 DEFAULT NULL)  
RETURN VARCHAR2;
```

Parameters

Table 307-7 GET_INDEX Function Parameters

Parameter	Description
index_name	The name of the index to be described.
schema_name	Name of the schema containing the index. This parameter is optional. If this parameter is not set, the method will look for the specified index in the schema from which this method is called.

Return Values

The function returns the index specification in JSON format.

Exceptions

Error—If an error occurs while returning the index specification.

307.3.1.8 GET_METADATA Function

This function returns the metadata of the collection in JSON format.

Syntax

```
GET_METADATA ()  
RETURN VARCHAR2;
```

Return Values

This function returns the metadata of the collection in JSON format.

307.3.1.9 GET_NAME Function

This function returns the name of the collection.

Syntax

```
GET_NAME ()  
RETURN NVARCHAR2;
```

Return Values

This function returns the name of the collection.

307.3.1.10 INSERT_ONE Function

This function inserts a document into the collection.

Syntax

```
INSERT_ONE (
    document      IN SODA_Document_T)
RETURN NUMBER;
```

Parameters**Table 307-8 INSERT_ONE Function Parameters**

Parameter	Description
document	The input document.

Return Values

The function returns a number— 1 if the doc was inserted successfully, 0 otherwise.

Exceptions

Error—If an error occurs while inserting the document into the collection.

307.3.1.11 INSERT_ONE_AND_GET Function

This function inserts a document into the collection.

Syntax

```
INSERT_ONE_AND_GET (
    document      IN SODA_Document_T,
    hint          IN VARCHAR2 DEFAULT NULL)
RETURN SODA_Document_T;
```

Parameters**Table 307-9 INSERT_ONE_AND_GET Function Parameters**

Parameter	Description
document	The input document.
hint	A hint string in Oracle SQL format, without the enclosing /*+ and */. This parameter is optional.

Return Values

The function returns the result document containing all document components supported by the given collection, with the exception of content.

Exceptions

Error—If an error occurs while inserting the document into the collection.

307.3.1.12 LIST_INDEXES Function

This function returns the specifications for all the indexes created on the collection.

Syntax

```
LIST_INDEXES ( )  
  RETURN SODA_Index_List_T;
```

Return Values

The function returns index specifications in `JSON` format as an instance of `SODA_Index_List_T`.

Exceptions

Error—If an error occurs while returning the index specification.

307.3.1.13 REMOVE_ONE Function

This function removes the document matching the given key.

Syntax

```
REMOVE_ONE (   
  key          IN VARCHAR2)   
  RETURN NUMBER;
```

Parameters

Table 307-10 REMOVE_ONE Function Parameters

Parameter	Description
key	The key of the document.

Return Values

This function returns the following values:

- 1—If the document was successfully removed.
- 0—If the document with the specified key was not found.

Exceptions

Error—If an error occurs while deleting the document from the collection.

307.3.1.14 REPLACE_ONE Function

This function updates the existing document with a new content and media type using the key. Any components set in `document` with the exception of content and media type are not used during the replace. They are ignored.

Syntax

```
REPLACE_ONE (
    key          IN VARCHAR2,
    document     IN SODA_Document_T)
RETURN NUMBER;
```

Parameters

Table 307-11 REPLACE_ONE Parameters

Parameter	Description
<code>key</code>	The key of the document.
<code>document</code>	The document with the new content and media type to replace the old one.

Return Values

This function returns a number—1 if the document was replaced, 0 otherwise.

Exceptions

Error—If an error occurs while replacing the document in the collection.

307.3.1.15 REPLACE_ONE_AND_GET Function

This function updates the existing document with a new content and media type using the key. Any components set in `document` with the exception of content and media type are not used during the replace. They are ignored.

Syntax

```
REPLACE_ONE_AND_GET (
    key          IN VARCHAR2,
    document     IN SODA_Document_T)
RETURN SODA_Document_T;
```

Parameters

Table 307-12 REPLACE_ONE_AND_GET Function Parameters

Parameter	Description
<code>key</code>	The key of the document.
<code>document</code>	The document with the new content and media type to replace the old one.

Return Values

The function returns the result document containing all document components supported by the given collection, with the exception of content. Last-modified and version components, if supported by the given collection, will be updated with new values. If no document in the collection had the supplied key, `NULL` is returned instead of the result document.

Exceptions

Error—If an error occurs while replacing the document in the collection.

307.3.1.16 SAVE Function

This function saves a document into the collection. This function is equivalent to the `INSERT_ONE(document)` function except that if client-assigned keys are used, and the document with the specified key already exists in the collection, it will be replaced with the input document. The key is automatically created, unless this collection is configured with client-assigned keys and the key is provided in the input document.

Syntax

```
SAVE (
    document IN SODA_Document_T)
RETURN NUMBER;
```

Parameters**Table 307-13 SAVE Parameters**

Parameter	Description
document	The input document. This cannot be null.

Return Values

The function returns a number- 1 if the function successfully completed, 0 otherwise.

Exceptions

Error—If an error occurs while saving the document.

307.3.1.17 SAVE_AND_GET Function

This function saves a document into the collection. This method is equivalent to `INSERT_ONE_AND_GET(document)` except that if client-assigned keys are used, and the document with the specified key already exists in the collection, it will be replaced with the input document. The key will be automatically created, unless this collection is configured with client-assigned keys and the key is provided in the input document.

Syntax

```
SAVE_AND_GET (
    document      IN SODA_Document_T,
    hint          IN VARCHAR2 DEFAULT NULL)
RETURN SODA_Document_T;
```


Parameters

Table 307-14 SAVE_AND_GET Function Parameters

Parameter	Description
document	The input document. This cannot be null.
hint	A hint string in Oracle SQL format, without the enclosing /*+ and */. This parameter is optional.

Return Values

The function returns the result document containing all document components supported by the given collection, with the exception of content.

Exceptions

Error—If an error occurs while saving or getting the document.

307.3.1.18 TRUNCATE Function

This function deletes all documents in the collection.

Syntax

```
TRUNCATE ( )  
  RETURN Number;
```

Return Values

The function returns:

- 1—if the function is successfully completed
- 0—if the function could not be successfully completed

Exceptions

Error—if an error occurs while deleting the documents in the collection.

307.3.2 SODA_Document_T Type

This SODA type represents a document with content, that is usually in JSON format.

This type is not persistable pl/sql type. However, SODA is a system that basically provides persistence — it has read and write operations. So you do not persist SODA_DOCUMENT_T directly, but you pass it to a write operation (like insert or replace), which is defined on SODA_COLLECTION_T, in order to write the document content and other components to the database.

A document has the following components:

- key
- content
- created-on timestamp

- last-modified timestamp
- version
- media type

Table 307-15 SODA_Document_T Type Subprograms

Subprogram	Description
GET_BLOB Function	Fetches the BLOB content of a BLOB-based document.
GET_CLOB Function	Fetches the CLOB content of a CLOB-based document.
GET_CREATED_ON Function	Fetches the created-on timestamp in VARCHAR2.
GET_DATA_TYPE Function	Fetches the SQL datatype of the document content with which it was created.
GET_JSON Function	Fetches the JSON content of a JSON-based document.
GET_KEY Function	Fetches the document key in VARCHAR2.
GET_LAST_MODIFIED Function	Fetches the last modified timestamp in VARCHAR2.
GET_MEDIA_TYPE Function	Fetches the media type of the document content in VARCHAR2.
GET_VARCHAR2 Function	Fetches the VARCHAR2 content of a VARCHAR2-based document.
GET_VERSION Function	Fetches the version of the document in VARCHAR2.
SODA_Document_T Function	There are three different SODA_DOCUMENT_T constructor functions. Each constructor function instantiates a document object using key, content, and media type.

307.3.2.1 GET_BLOB Function

This function fetches the BLOB content of the document. It assumes that the document was constructed with BLOB content, or was returned from a collection with BLOB content. Otherwise, an error is returned.

Syntax

```
GET_BLOB ()
RETURN BLOB;
```

Return Values

This function returns the BLOB content of a document.

Exceptions

SODA Error: If the document was initially not created with BLOB content.

307.3.2.2 GET_CLOB Function

The function fetches CLOB content of the document. It assumes that the document was constructed with CLOB content, or was returned from a collection with CLOB content. Otherwise, an error is returned.

Syntax

```
GET_CLOB ()
  RETURN CLOB;
```

Return Values

This function returns the CLOB content of a document.

Exceptions

SODA Error: If the document was initially not created with CLOB content.

307.3.2.3 GET_CREATED_ON Function

This function fetches the created-on timestamp. The timestamp string is in ISO-8601 format, in particular this form: YYYY-MM-DDThh:mm:ss.ssssssZ format. As indicated by the Z at the end, timestamps are returned in UTC (Z indicates zero UTC offset).

Syntax

```
GET_CREATED_ON ()
  RETURN VARCHAR2;
```

Return Values

This function returns the created-on timestamp.

307.3.2.4 GET_DATA_TYPE Function

This function fetches the SQL datatype of the document content with which it was created.

Syntax

```
GET_DATA_TYPE ()
  RETURN PLS_INTEGER;
```

Return Values

Table 307-16 GET_DATA_TYPE Return Values

Constant	Value	Description
DOC_VARCHAR2 CONSTANT PLS_INTEGER	1	VARCHAR2
DOC_BLOB CONSTANT PLS_INTEGER	2	BLOB

Table 307-16 (Cont.) GET_DATA_TYPE Return Values

Constant	Value	Description
DOC_CLOB CONSTANT PLS_INTEGER	3	CLOB
DOC_JSON CONSTANT PLS_INTEGER	4	JSON

307.3.2.5 GET_JSON Function

This function fetches the `JSON` content of the document. It assumes that the document was constructed with `JSON` type content, or was returned from a collection with `JSON` type content. Otherwise, an error is returned.

Syntax

```
GET_JSON ()  
RETURN JSON;
```

Return Values

This function returns the `JSON` content of a document.

Exceptions

`SODA Error`: If the document was initially not created with `JSON` content.

307.3.2.6 GET_KEY Function

This function fetches the document key.

Syntax

```
GET_KEY ()  
RETURN VARCHAR2;
```

Return Values

This function returns the document key.

307.3.2.7 GET_LAST_MODIFIED Function

This function fetches the last modified timestamp. The timestamp string is in `ISO-8601` format, in particular this form: `YYYY-MM-DDThh:mm:ss.ssssssZ` format. As indicated by the `Z` at the end, timestamps are returned in `UTC` (`Z` indicates zero `UTC` offset).

Syntax

```
GET_LAST_MODIFIED ()  
RETURN VARCHAR2;
```

Return Values

This function returns the last modified timestamp.

307.3.2.8 GET_MEDIA_TYPE Function

This function fetches the media type of the document content.

Syntax

```
GET_MEDIA_TYPE ()  
RETURN VARCHAR2;
```

Return Values

This function returns the media type of the document content. `application/JSON` is the media type for `JSON` documents (default).

307.3.2.9 GET_VARCHAR2 Function

This function fetches the `VARCHAR2` content of the document. It assumes that the document was constructed with `VARCHAR2` content, or was returned from a collection with `VARCHAR2` content. Otherwise, an error is returned.

Syntax

```
GET_VARCHAR2 ()  
RETURN VARCHAR2;
```

Return Values

This function returns the `VARCHAR2` content of a document.

Exceptions

SODA Error: If the document was initially not created with `VARCHAR2` content.

307.3.2.10 GET_VERSION Function

This function fetches the version of the document.

Syntax

```
GET_VERSION ()  
RETURN VARCHAR2;
```

Return Values

This function returns the version of the document.

307.3.2.11 SODA_Document_T Function

This function instantiates a document object using key, content, and media type. There are three different `SODA_DOCUMENT_T` constructor functions. The second parameter (`<v|b|c>_Content`) is different in each constructor. It is `VARCHAR2` in the first variant, `BLOB` in the second, and `CLOB` in the third.

Key and media type are optional parameters (will be defaulted to `NULL`). All three parameters can be set to `NULL`. If `media_Type` is set to `NULL`, it will be defaulted to `application/json`.

Use `key` and `j_Content` with the constructor to instantiate a document object using `key` and `content`. Media type parameter is not present in this constructor as the data is of `JSON` type. Therefore, media type is understood to be `application/json`.

Syntax

```
SODA_DOCUMENT_T (
    key          IN VARCHAR2 DEFAULT NULL,
    v_Content    IN VARCHAR2,
    media_Type   IN VARCHAR2 DEFAULT NULL)
RETURN SODA_Document_T;
```

```
SODA_DOCUMENT_T (
    key          IN VARCHAR2 DEFAULT NULL,
    b_Content    IN BLOB,
    media_Type   IN VARCHAR2 DEFAULT NULL)
RETURN SODA_Document_T;
```

```
SODA_DOCUMENT_T (
    key          IN VARCHAR2 DEFAULT NULL,
    c_Content    IN CLOB,
    media_Type   IN VARCHAR2 DEFAULT NULL)
RETURN SODA_Document_T;
```

```
SODA_DOCUMENT_T (
    key          IN VARCHAR2 DEFAULT NULL,
    j_Content    IN JSON)
RETURN SODA_Document_T;
```

Parameters

Table 307-17 SODA_Document_T Parameters

Parameter	Description
<code>key</code>	The key of the document.
<code>v_Content</code>	The content of the document in <code>VARCHAR2</code> format.
<code>b_Content</code>	The content of the document in <code>BLOB</code> format.
<code>c_Content</code>	The content of the document in <code>CLOB</code> format.
<code>j_Content</code>	The content of the document as <code>JSON</code> type instance.
<code>media_Type</code>	The media type of the document. The media type could be <code>application/json</code> for <code>JSON</code> documents.

Note:

`v_Content`, `b_Content`, and `c_Content` are not all parameters of a single `SODA_DOCUMENT_T` constructor function. Each one corresponds to a particular variant of the constructor function as shown in the `Syntax` section.

Return Values

This function returns a document of type `SODA_Document_T`.

307.3.3 SODA_OPERATION_T Type

This `SODA` type is used to perform read/write operations, such as document finds with filtering and pagination, removes, and replaces on a `SODA` collection.

Table 307-18 SODA_OPERATION_T Type Subprograms

Subprogram	Description
ACQUIRE_LOCK Function	This function ensures that the document(s) affected by a <code>read</code> operation are locked for update (which is equivalent to SQL <code>'select for update'</code>).
AS_OF_SCN Function	This function sets the SCN value for the operation.
AS_OF_TIMESTAMP Function	This function sets the the timestamp value for the operation.
COUNT Function	Returns a count of the number of documents in the collection that match the criteria. If <code>skip(...)</code> or <code>limit(...)</code> were chained together with this <code>count()</code> , an exception is raised.
FILTER Function	Sets the filter (also known as QBE or query-by-example) criteria on the operation. Returns the same <code>SODA_OPERATION_T</code> object so that further criteria can be chained together if required.
GET_CURSOR Function	Returns a <code>SODA_CURSOR_T</code> object that can be used to iterate over the documents that match the criteria.
GET_DATA_GUIDE Function	This function gets the data guide.
GET_ONE Function	Returns a single <code>SODA_DOCUMENT_T</code> object that matches the criteria. Note that, if multiple documents match the criteria, only the first document is returned.
HINT Function	This function sets the hint attribute of the operation.
KEY Function	Specifies that the document with the specified key should be returned. This causes any previous calls made to this function and <code>KEYS(...)</code> , when they appear in the same chain, to be ignored. Returns the same <code>SODA_OPERATION_T</code> object so that further operation criteria can be chained together, if needed.

Table 307-18 (Cont.) SODA_OPERATION_T Type Subprograms

Subprogram	Description
KEYS Function	<p>Specifies that documents that match the keys supplied to this function should be returned. This causes any previous calls made to this function and <code>KEY(...)</code>, when they appear in the same chain, to be ignored.</p> <p>Returns the same <code>SODA_OPERATION_T</code> object, so that further operation criteria can be chained together, if needed.</p>
LIMIT Function	<p>Sets a limit on the specified number of documents the operation should return. This setting is only usable for read operations such as <code>GET_CURSOR</code>. For write operations, any value set using this method is ignored.</p> <p>Returns the same <code>SODA_OPERATION_T</code> object so that further operation criteria can be chained together, if needed.</p>
REMOVE Function	<p>Removes all of the documents in the collection that match the criteria. Returns the number of documents that was removed.</p>
REPLACE_ONE Function	<p>Replaces a single document in the collection with the specified document. Returns a number that indicates if the document was replaced or not.</p> <p>Currently, before calling this function, you must call the function <code>KEY(...)</code> to uniquely identify the document being replaced. Any components set in the input document with the exception of content and media type are not used during the replace. They are ignored.</p>
REPLACE_ONE_AND_GET Function	<p>Replaces a single document in the collection with the specified document. Returns a result document if the document was replaced, <code>NULL</code> otherwise.</p> <p>Currently, before calling this function, you must call the function <code>KEY(...)</code> to uniquely identify the document being replaced.</p> <p>This function is similar to <code>REPLACE_ONE</code>. The only difference is that <code>REPLACE_ONE_AND_GET</code> also returns the result document with updated components, such as version and last-modified timestamp. The result document does not contain the content component.</p> <p>Any components set in the input document with the exception of content and media type are not used during the replace. They are ignored.</p>
SAMPLE Function	<p>Sets the sampling parameters to be used for the operation.</p>

Table 307-18 (Cont.) SODA_OPERATION_T Type Subprograms

Subprogram	Description
SKIP Function	<p>Sets the number of documents that match the operation criteria that will be skipped from the operation result. This setting is only usable for read operations such as <code>GET_CURSOR</code>. For write operations, any value set using this method is ignored.</p> <p>Returns the same <code>SODA_OPERATION_T</code> object so that further operation criteria can be chained together, if needed.</p>
VERSION Function	<p>Specifies that only documents with the supplied version should be returned. Typically, this is chained together with <code>KEY(...)</code> to implement optimistic locking for write operations such as <code>REMOVE</code> and <code>REPLACE</code>.</p> <p>Returns the same <code>SODA_OPERATION_T</code> object so that further operation criteria can be chained together, if needed.</p>

307.3.3.1 ACQUIRE_LOCK Function

This function ensures that the the document(s) affected by a read operation are locked for update (which is equivalent to SQL 'select for update'). An operation involving `LOCK()` would be followed by another operation that updates the document in the collection. For example, via `REPLACE` or `REMOVE` functions. The lock will prevent other transactions from modifying the document in the meantime.

The next commit or rollback, performed after the operation involving this `ACQUIRE_LOCK()` function, will unlock the document, i.e. commit or rollback the transaction which is holding the lock on this document.

This function should only be used in conjunction with read operations, other than `COUNT()` and `GET_DATA_GUIDE()` functions.

Specifying it in conjunction with `SKIP` and `LIMIT` functions is also not allowed (an error is thrown).

If specified in conjunction with a write operation, such as, `REPLACE` or `REMOVE`, it's simply ignored and has no effect.

Syntax

```
ACQUIRE_LOCK ( )
RETURN SODA_Operation_T;
```

Return Values

This function returns the same `SODA_OPERATION_T` object it was invoked on.

307.3.3.2 AS_OF_SCN Function

This function sets the SCN value for the operation.

Syntax

```
AS_OF_SCN (
    scn          IN NUMBER)
RETURN SODA_Operation_T;
```

Parameters**Table 307-19 AS_OF_SCN Function Parameters**

Parameter	Description
scn	The input value for SCN. This cannot be NULL.

Return Values

This function returns the same SODA_OPERATION_T object it was invoked on.

307.3.3.3 AS_OF_TIMESTAMP Function

This function sets the the timestamp value for the operation.

Syntax

```
AS_OF_TIMESTAMP (
    timestamp    IN VARCHAR2)
RETURN SODA_Operation_T;
```

Parameters**Table 307-20 AS_OF_TIMESTAMP Function Parameters**

Parameter	Description
timestamp	The input timestamp. This cannot be NULL.

Return Values

This function returns the same SODA_OPERATION_T object it was invoked on.

307.3.3.4 COUNT Function

This function returns a count of the number of documents in the collection that match the criteria. If skip(...) or limit(...) were chained together with this count(), an exception is raised.

Syntax

```
COUNT ()
RETURN NUMBER;
```

Return Values

This function returns the number of documents matching the criteria specified in the operation.

Exceptions

Error—If an error occurs while finding the count.

307.3.3.5 FILTER Function

Sets the filter (also known as QBE or query-by-example) criteria on the operation. Returns the same `SODA_OPERATION_T` object so that further criteria can be attached if needed.

Syntax

```
FILTER (
    qbe          IN VARCHAR2)
RETURN SODA_Operation_T;
```

Parameters**Table 307-21** FILTER Function Parameters

Parameter	Description
qbe	The string representing the query by example.

Return Values

This function returns the same `SODA_OPERATION_T` object it was invoked on.

 **See Also:**

- Overview of SODA Filter Specifications (QBEs)
- SODA Filter Specifications (Reference)

307.3.3.6 GET_CURSOR Function

Returns a `SODA_CURSOR_T` object that can be used to iterate over the documents that match the criteria.

Syntax

(Optional) Enter syntax information here.

```
GET_CURSOR ()
RETURN SODA_Cursor_T;
```

Return Values

This function returns a `SODA_CURSOR_T` object that can be used to iterate over the documents that match the read operation criteria.

Exceptions

SODA Error: If an error occurs while fetching the cursor.

307.3.3.7 GET_DATA_GUIDE Function

This function gets the data guide.

Syntax

```
GET_DATA_GUIDE (
  format      IN PLS_INTEGER DEFAULT 1,
  flag        IN PLS_INTEGER DEFAULT 0)
RETURN CLOB;
```

Parameters

Table 307-22 GET_DATA_GUIDE Function Parameters

Parameter	Description
format	<p>The format of the data guide. This parameter can have one of the following values:</p> <ul style="list-style-type: none"> DBMS_SODA.DATAGUIDE_FORMAT_HIERARCHICAL CONSTANT PLS_INTEGER := 1; DBMS_SODA.DATAGUIDE_FORMAT_FLAT CONSTANT PLS_INTEGER := 2; <p>The default value is 1.</p>
flag	<p>This parameter can have one of the following values:</p> <ul style="list-style-type: none"> DBMS_SODA.DATAGUIDE_PRETTY CONSTANT PLS_INTEGER := 1; DBMS_SODA.DATAGUIDE_GEOJSON CONSTANT PLS_INTEGER := 2; DBMS_SODA.DATAGUIDE_GATHER_STATS CONSTANT PLS_INTEGER := 4; <p>The default value is 0.</p>

Return Values

This function returns the same `SODA_OPERATION_T` object it was invoked on.

307.3.3.8 GET_ONE Function

Returns a single `SODA_DOCUMENT_T` object that matches the criteria. Note that, if multiple documents match the criteria, only the first document is returned.

Syntax

```
GET_ONE ()
RETURN SODA_Document_T;
```

Return Values

The first matching document.

Exceptions

`ERROR`—If an error occurs while fetching the document.

307.3.3.9 HINT Function

This function sets the hint attribute of the operation.

Syntax

```
HINT (  
    hint          IN VARCHAR2)  
RETURN SODA_Operation_T;
```

Parameters

Table 307-23 HINT Function Parameters

Parameter	Description
hint	A hint string in Oracle SQL format, with out the enclosing /*+ and */.

Return Values

This function returns the same `SODA_OPERATION_T` object it was invoked on.

307.3.3.10 KEY Function

Specifies that the document with the specified key should be returned. This causes any previous calls made to this function and `KEYS(...)`, when they appear in the same chain, to be ignored. Returns the same `SODA_OPERATION_T` object so that further operation criteria can be chained together, if needed.

Syntax

```
KEY (  
    key          IN VARCHAR2)  
RETURN SODA_Operation_T;
```

Parameters

Table 307-24 KEY Function Parameters

Parameter	Description
key	The key to be used for the operations.

Return Values

This function returns the same `SODA_OPERATION_T` object it was invoked on.

307.3.3.11 KEYS Function

Specifies that documents that match the keys supplied to this function should be returned. This causes any previous calls made to this function and `key(...)`, when they appear in the

same chain, to be ignored. Returns the same `SODA_OPERATION_T` object, so that further operation criteria can be chained together, if needed.

Syntax

```
KEYS (
    key_list IN SODA_Key_List_T)
RETURN SODA_Operation_T;
```

Parameters

Table 307-25 KEYS Function Parameters

Parameter	Description
<code>key_list</code>	The parameter is a <code>SODA_Key_List_T</code> which is a list of <code>VARCHAR2</code> values representing keys. Assuming <code>key_list</code> is a variable of type <code>SODA_Key_List_T</code> , it can be initialized as follows: <code>key_list := SODA_Key_List_T('key1', 'key2', 'key3', etc);</code>

Return Values

This function returns the same `SODA_OPERATION_T` object it was invoked on.

307.3.3.12 LIMIT Function

This function sets a limit on the specified number of documents the operation should return. This setting is only usable for read operations such as `GET_CURSOR`. For write operations, any value set using this method is ignored. Returns the same `SODA_OPERATION_T` object so that further operation criteria can be chained together, if needed.

Syntax

```
LIMIT (
    limit IN NUMBER)
RETURN SODA_Operation_T;
```

Parameters

Table 307-26 LIMIT Function Parameters

Parameter	Description
<code>limit</code>	A limit on the number of results returned by read operations.

Return Values

This function returns the same `SODA_OPERATION_T` object it was invoked on.

307.3.3.13 REMOVE Function

This function removes all of the documents in the collection that match the criteria. Returns the number of documents that was removed.

Syntax

```
REMOVE ()
RETURN NUMBER;
```

Return Values

This function returns the number of matching documents that were removed in the operation.

Exceptions

Error—If an error occurs while removing the documents.

307.3.3.14 REPLACE_ONE Function

This function replaces a single document in the collection with the specified document. Returns a number that indicates if the document was replaced or not. Currently, before calling this function, you must call the function `KEY(...)` to uniquely identify the document being replaced. Any components set in the input document with the exception of content and media type are not used during the replace. They are ignored.

Syntax

```
REPLACE_ONE (
    document IN SODA_Document_T)
RETURN NUMBER;
```

Parameters

Table 307-27 REPLACE_ONE Function Parameters

Parameter	Description
document	The document object with the new content and media type to be used for replacement.

Return Values

This function returns a number—1 if the document was replaced, 0 otherwise.

Exceptions

Error—If an error occurs while updating the collection.

307.3.3.15 REPLACE_ONE_AND_GET Function

Replaces a single document in the collection with the specified document. Returns a result document if the document was replaced, `NULL` otherwise. Currently, before calling this function, you must call the function `KEY(...)` to uniquely identify the document being replaced. This function is similar to `REPLACE_ONE`. The only difference is that `REPLACE_ONE_AND_GET` also

returns the result document with updated components, such as version and last-modified timestamp. The result document does not contain the content component. Any components set in the input document with the exception of content and media type are not used during the replace. They are ignored.

Syntax

```
REPLACE_ONE_AND_GET (
    document      IN SODA_Document_T)
RETURN SODA_Document_T;
```

Parameters

Table 307-28 REPLACE_ONE_AND_GET Function Parameters

Parameter	Description
document	The document object with the new content and media type to be used for replacement.

Return Values

The function returns the result document containing all document components supported by the given collection, with the exception of content. Last-modified and version components, if supported by the given collection, will be updated with new values. If no document in the collection had the supplied key, `NULL` is returned instead of the result document.

Exceptions

Error—If an error occurs while updating the collection

307.3.3.16 SAMPLE Function

This function sets the sampling parameters to be used for the operation.

Syntax

```
SAMPLE (
    pct      IN DOUBLE,
    seed    IN NUMBER      DEFAULT NULL,
    method  IN PLS_INTREFER DEFAULT DBMS_SODA.SAMPLE_ROW)
RETURN SODA_Operation_T;
```


Parameters

Table 307-29 SAMPLE Function Parameters

Parameter	Description
pct	The percentage of the total documents or block count to be included in the sample. The value must be in the range .000001 to, but not including, 100. This percentage indicates the probability of each row or each cluster of rows in the case of block sampling, being selected as part of the sample. It does not mean that the database will retrieve exactly the percentage of documents in the collection.
seed	Specify this attribute to instruct the database to attempt to return the same sample from one execution to the next. The seed value must be an integer between 0 and 4294967295. If you omit this attribute, then the resulting sample will change from one execution to the next.
method	The type of sampling method to be used. Valid values are: <ul style="list-style-type: none"> DBMS_SODA.SAMPLE_ROW DBMS_SODA.SAMPLE_BLOCK

Return Values

This function returns the `SELF` operation object.

307.3.3.17 SKIP Function

This function sets the number of documents that match the operation criteria that will be skipped from the operation result. This setting is only usable for read operations such as `GET_CURSOR`. For write operations, any value set using this method is ignored. Returns the same `SODA_OPERATION_T` object so that further operation criteria can be chained together, if needed.

Syntax

```
SKIP (
    offset          IN NUMBER)
RETURN SODA_Operation_T;
```

Parameters

Table 307-30 SKIP Function Parameters

Parameter	Description
offset	The number of documents to skip.

Return Values

This function returns the same `SODA_OPERATION_T` object it was invoked on

307.3.3.18 VERSION Function

This function specifies that only documents with the supplied version should be returned. Typically, this is chained together with `KEY(...)` to implement optimistic locking for write operations such as `REMOVE` and `REPLACE`. Returns the same `SODA_OPERATION_T` object so that further operation criteria can be chained together, if needed.

Syntax

```
VERSION (
    version          IN VARCHAR2)
RETURN SODA_Operation_T;
```

Parameters**Table 307-31** VERSION Function Parameters

Parameter	Description
<code>version</code>	Document version to be used for the operation.

Return Values

This function returns the same `SODA_OPERATION_T` object it was invoked on

307.3.4 SODA_CURSOR_T Type

This SODA type is used to represent a result set of documents.

Table 307-32 SODA_CURSOR_T Type Subprograms

Subprogram	Description
CLOSE Function	Closes the cursor.
HAS_NEXT Function	Returns <code>TRUE</code> , if the next document is available for the cursor. Otherwise, returns <code>FALSE</code> .
NEXT Function	Returns the next SODA documented pointed by the cursor.

307.3.4.1 CLOSE Function

This function closes the cursor.

Syntax

```
CLOSE ()
RETURN BOOLEAN;
```

Example 307-3 Return Values

This function returns a boolean value.

307.3.4.2 HAS_NEXT Function

This function returns `TRUE`, if the next document is available for the cursor. Otherwise, returns `FALSE`.

Syntax

```
HAS_NEXT ()  
  RETURN BOOLEAN;
```

Return Values

This function returns a boolean value. `TRUE`, if the next document is available for the cursor. Otherwise, returns `FALSE`.

Exceptions

`Error`—If an error occurs while checking if the next document is available.

307.3.4.3 NEXT Function

This function returns the next `SODA` documented pointed by the cursor.

Syntax

```
NEXT ()  
  RETURN SODA_Document_T;
```

Return Values

This function returns the next `SODA` documented pointed by the cursor. Returns `NULL` when the `HAS_NEXT` function returns `FALSE`.

Exceptions

`Error`—If an error occurs while getting the next document.

UTL Streams Types

UTL Streams Types describe abstract types used with Oracle XML functionality.

Four abstract PL/SQL streams are introduced and defined within the 'SYS' schema. The streams may be referenced by PUBLIC and are described in the following sections.

This chapter contains the following topics:

- [Security Model](#)
- [Summary of UTL Binary Streams Types](#)



See Also:

For more information, see Oracle XML DB Developer's Guide

308.1 UTL Streams Types Security Model

EXECUTE on UTL Streams Types is granted to PUBLIC.

308.2 Summary of UTL Binary Streams Types

This table lists the UTL Binary Streams Types and briefly describes them.

Table 308-1 UTL Streams Types

Type	Description
UTL_BINARYINPUTSTREAM Type	Reads bytes and closes a stream.
UTL_BINARYOUTPUTSTREAM Type	Writes bytes and closes a stream.
UTL_CHARACTERINPUTSTREAM Type	Reads chars and closes a stream.
UTL_CHARACTEROUTPUTSTREAM Type	Writes chars and closes a stream.

308.2.1 UTL_BINARYINPUTSTREAM Type

This type is similar to `java.io.InputStream` in that it can only read and close a stream.

Syntax

```
CREATE OR REPLACE TYPE Utl_BinaryInputStream AS OBJECT (
```

```

MEMBER FUNCTION available (
    self    IN OUT NOCOPY Utl_BinaryInputStream)
RETURN INTEGER,

MEMBER FUNCTION read (
    self    IN OUT NOCOPY Utl_BinaryInputStream,
    numBytes IN           INTEGER DEFAULT 1)
RETURN RAW,

MEMBER PROCEDURE read (
    self    IN OUT NOCOPY Utl_BinaryInputStream,
    bytes   IN OUT NOCOPY RAW,
    numBytes IN OUT      INTEGER),

MEMBER PROCEDURE read (
    self    IN OUT NOCOPY Utl_BinaryInputStream,
    bytes   IN OUT NOCOPY RAW,
    offset  IN INTEGER,
    numBytes IN OUT      INTEGER),

member function close (
    self    In Out Nocopy Utl_BinaryInputStream)

) NOT FINAL;

```

Attributes

Table 308-2 UTL_BINARYINPUTSTREAM Type Member Subprograms

Member Subprogram	Description
AVAILABLE	Returns the number of bytes available to be read
READ	<ul style="list-style-type: none"> #1 - Reads the number of bytes specified by <code>numBytes</code> (default is 1) and returns the bytes as a RAW. If there are no remaining bytes a value of NULL is returned. #2 - Reads the number of bytes specified in <code>numBytes</code> into the parameter <code>bytes</code>. Additionally, the actual number of bytes read is returned in parameter <code>numBytes</code>. If this parameter is set to 0 then there are no more bytes to be read. #3 - Reads the number of bytes specified in <code>numBytes</code> into the parameter <code>bytes</code>, beginning at the offset specified by parameter <code>offset</code>. The actual number of bytes read is returned in parameter <code>numBytes</code>. If this value is 0, then there are no additional bytes to be read.
CLOSE	Releases all resources held on the node to support the stream

308.2.2 UTL_BINARYOUTPUTSTREAM Type

This type is similar to `java.io.OutputStream` in that it can only write and close a stream.

Syntax

```

CREATE OR REPLACE TYPE Utl_BinaryOutputStream AS OBJECT (

    MEMBER FUNCTION write (
        self    IN OUT NOCOPY sys.utl_BinaryOutputStream,

```

```

        bytes      IN          RAW,
        numBytes   IN          INTEGER DEFAULT 1)
RETURN INTEGER,

MEMBER PROCEDURE write (                                -- #2
    self          IN OUT NOCOPY sys.utl_BinaryOutputStream,
    bytes         IN NOCOPY    RAW,
    numBytes      IN OUT      INTEGER),

MEMBER PROCEDURE write (                                -- #3
    self          IN OUT NOCOPY utl_BinaryOutputStream,    bytes      IN
NOCOPY          RAW,
    offset       IN          INTEGER,
    numBytes     IN OUT      INTEGER),

MEMBER PROCEDURE flush (
    self         IN OUT NOCOPY utl_BinaryOutputStream),

MEMBER PROCEDURE close (
    self         IN OUT NOCOPY utl_BinaryOutputStream)

) NOT FINAL;
```

Attributes

Table 308-3 UTL_BINARYOUTPUTSTREAM Type Member Subprograms

Member Subprogram	Description
WRITE	<ul style="list-style-type: none"> #1 - Writes the number of bytes specified by <code>numBytes</code> (default is 1) from <code>RAW</code> into the stream. The actual number of bytes written is returned. #2 - Writes the number of bytes specified in parameter <code>numBytes</code> from parameter <code>bytes</code> to the stream. The actual number of bytes written is returned in parameter <code>numBytes</code>. #3 - Writes the number of bytes specified by <code>numBytes</code> to the stream, beginning at the offset specified by parameter <code>offset</code>. The actual number of bytes written is returned in parameter <code>numBytes</code>.
FLUSH	Insures that any buffered bytes are copied to the node destination
CLOSE	Frees all resources associated with the stream

308.2.3 UTL_CHARACTERINPUTSTREAM Type

This type is similar to `java.io.Reader` in that it can only read characters (chars) and close a stream.

Syntax

```

CREATE OR REPLACE TYPE Utl_CharacterInputStream AS OBJECT (

MEMBER FUNCTION available (
    self          IN OUT NOCOPY    utl_CharacterInputStream)
RETURN INTEGER,

MEMBER FUNCTION read (                                -- #1
    self          IN OUT NOCOPY    utl_CharacterInputStream,
    numChars     IN                INTEGER DEFAULT 1,
```

```

        lineFeed IN          BOOLEAN DEFAULT FALSE)
RETURN VARCHAR2,

MEMBER PROCEDURE read (                                -- #2
    self      IN OUT NOCOPY utl_CharacterInputStream,
    chars     IN OUT NOCOPY VARCHAR2,
    numChars  IN OUT          INTEGER,
    lineFeed  IN BOOLEAN DEFAULT FALSE),

MEMBER PROCEDURE read (                                -- #3
    self      IN OUT NOCOPY utl_CharacterInputStream,
    chars     IN OUT NOCOPY VARCHAR2,
    offset    IN              INTEGER,
    numChars  IN OUT          INTEGER,
    lineFeed  IN              BOOLEAN DEFAULT FALSE),

MEMBER PROCEDURE close (
    self      IN OUT NOCOPY utl_CharacterInputStream)
) NOT FINAL;

```

Attributes

Table 308-4 UTL_CHARACTERINPUTSTREAM Type Member Subprograms

Member Subprogram	Description
AVAILABLE	Returns the number of bytes available to be read
READ	<ul style="list-style-type: none"> • #1 - Returns the number of characters remaining to be read • #2 - Reads the number of characters specified by numChars (default value is 1) and returns the characters as a VARCHAR2. If the value of lineFeed is true (default value is FALSE) then the reading stops if a linefeed character is found. If there are no remaining characters a value of NULL is returned. • #3 - Reads reads the number of characters specified by parameter numChars into the parameter chars. Additionally, the actual number of characters read is returned in parameter numChars. If this value is 0, then there are no more characters to be read. If the value of lineFeed is TRUE (default is FALSE), then reading stops if a linefeed character is encountered.
CLOSE	Releases all resources held by the stream

308.2.4 UTL_CHARACTEROUTPUTSTREAM Type

This type is similar to `java.io.Reader` in that it can only read characters (`chars`) and close a stream.

Syntax

```

CREATE OR REPLACE TYPE utl_CharacterOutputStream AS OBJECT (

MEMBER FUNCTION write (                                -- #1
    self      IN OUT NOCOPY utl_CharacterOutputStream,
    chars     IN              VARCHAR2,
    numChars  IN              INTEGER DEFAULT 1,
    lineFeed  IN              BOOLEAN DEFAULT FALSE)
RETURN INTEGER,

```

```

MEMBER PROCEDURE write (                                     -- #2
    self      IN OUT NOCOPY utl_CharacterOutputStream,
    chars     IN OUT NOCOPY VARCHAR2,
    numChars  IN OUT      INTEGER,
    lineFeed  IN          BOOLEAN DEFAULT FALSE),

member procedure write (                                     -- #3
    self      IN OUT NOCOPY utl_CharacterOutputStream,
    chars     IN NOCOPY    varchar2,
    offset    IN          integer,
    numChars  IN OUT      integer,
    lineFeed  IN          boolean default false),

MEMBER PROCEDURE flush (
    self      IN OUT NOCOPY utl_CharacterOutputStream),

MEMBER PROCEDURE close (
    self      IN OUT NOCOPY utl_CharacterOutputStream)

) NOT FINAL;

```

Attributes

Table 308-5 UTL_CHARACTEROUTPUTSTREAM Type Member Subprograms

Member Subprogram	Description
WRITE	<ul style="list-style-type: none"> #1 - Writes the number of characters specified by <code>numChars</code> (default is 1) from parameter <code>chars</code> into the stream and returns the actual number of characters written. If the value of <code>lineFeed</code> is TRUE (default is FALSE) a <code>lineFeed</code> character is inserted after the last character. #2 - writes the number of characters specified by parameter <code>numChars</code>, from parameter <code>chars</code> into the stream. The actual number of characters written is returned in parameter <code>numChars</code>. If the value of <code>lineFeed</code> is true (default is FALSE) a <code>lineFeed</code> character is inserted after the last character. #3 - Writes the number of characters specified by parameter <code>numChars</code>, from parameter <code>chars</code>, beginning at <code>offset</code> specified by parameter <code>offset</code>. The actual number of characters written is returned in parameter <code>numChars</code>. If the value of <code>lineFeed</code> is true (default is FALSE) a <code>lineFeed</code> character is inserted after the last character .
FLUSH	Copies all characters that may be contained within buffers to the node value
CLOSE	Releases all resources held by the stream

XMLTYPE

`XMLType` is a system-defined opaque type for handling XML data. It has predefined member functions on it to extract XML nodes and fragments.

You can create columns of `XMLType` and insert XML documents into it. You can also generate XML documents as `XMLType` instances dynamically using the `SYS_XMLAGG` SQL function.

This chapter contains the following topics:

- [Summary of XMLType Subprograms](#)

See Also:

- *Oracle XML DB Developer's Guide*

309.1 Summary of XMLType Subprograms

This table summarizes functions and procedures of `XMLType`.

Table 309-1 XMLTYPE Subprograms

Method	Description
CREATENONSCHMABASEDXML	Creates a non schema based XML from the input schema based instance.
CREATESCHMABASEDXML	Creates a schema based <code>XMLType</code> instance from the non-schema based instance using the input schema URL.
CREATEXML	Static function for creating and returning an <code>XMLType</code> instance.
EXISTSNODE	Takes a <code>XMLType</code> instance and a <code>XPath</code> and returns 1 or 0 indicating if applying the <code>XPath</code> returns a non-empty set of nodes.
EXTRACT	Takes a <code>XMLType</code> instance and an <code>XPath</code> , applies the <code>XPath</code> expression and returns the results as an <code>XMLType</code> .
GETBLOBVAL	Returns the value of the <code>XMLType</code> instance as a <code>BLOB</code> .
GETCLOBVAL	Returns the value of the <code>XMLType</code> instance as a <code>CLOB</code> .
GETNAMESPACE	Returns the namespace for the top level element in a schema based document.
GETNUMBERVAL	Returns the value of the <code>XMLType</code> instance as a <code>NUMBER</code> . This is only valid if the input <code>XMLType</code> instance contains a simple text node and is convertible to a number.
GETROOTELEMENT	Returns the root element of the input instance. Returns <code>NULL</code> if the instance is a fragment.

Table 309-1 (Cont.) XMLTYPE Subprograms

Method	Description
GETSCHEMAURL	Returns the XML schema URL if the input is an XML Schema based.
GETSTRINGVAL	Returns the value of the XMLType instance as a string.
ISFRAGMENT	Checks if the input XMLType instance is a fragment or not. A fragment is a XML instance, which has more than one root element.
ISSCHEMABASED	Returns 1 or 0 indicating if the input XMLType instance is a schema based one or not.
ISSCHEMAVALID	Checks if the input instance is schema valid according to the given schema URL.
ISSCHEMAVALIDATED	Checks if the instance has been validated against the schema.
SCHEMAVALIDATE	Validates the input instance according to the XML Schema. Raises error if the input instance is non-schema based.
SETSCHEMAVALIDATED	Sets the schema valid flag to avoid costly schema validation.
TOOBJECT	Converts the XMLType instance to an object type.
TRANSFORM	Takes an XMLType instance and an associated stylesheet (which is also an XMLType instance), applies the stylesheet and returns the result as XML.
XMLTYPE	Constructs an instance of the XMLType datatype. The constructor can take in the XML as a CLOB, VARCHAR2 or take in a object type.

309.1.1 CREATENONSCHEMABASEDXML

This member function creates a non-schema based XML document from a schema based instance.

Syntax

```
MEMBER FUNCTION CREATENONSCHEMABASEDXML
return XMLType deterministic;
```

309.1.2 CREATESCHEMABASEDXML

This member function creates a schema based XMLType instance from a non-schema based XMLType value.

It uses either the supplied SCHEMA URL, or the SCHEMALOCATION attribute of the instance.

Syntax

```
MEMBER FUNCTION createSchemaBasedXML(
schema IN varchar2 := NULL)
return XMLType deterministic;
```

Table 309-2 CREATESCHEMABASEDXML Subprogram Parameters

Parameter	Description
schema	Optional XMLSchema URL used to convert the value to the specified schema.

309.1.3 CREATEXML

This static function creates and returns an `XMLType` instance. The string and `CLOB` parameters used to pass in the data must contain well-formed and valid XML documents.

The options are described in the following table.

Table 309-3 CREATEXML Subprograms

Syntax	Description
<pre> STATIC FUNCTION createXML(xmlData IN varchar2) RETURN XMLType deterministic; </pre>	Creates the <code>XMLType</code> instance from a string.
<pre> STATIC FUNCTION createXML(xmlData IN clob) RETURN XMLType deterministic; </pre>	Creates the <code>XMLType</code> instance from a <code>CLOB</code> .
<pre> STATIC FUNCTION createXML (xmlData IN clob, schema IN varchar2, validated IN number := 0, wellformed IN number := 0) RETURN XMLType deterministic; </pre>	This static function creates a schema-based <code>XMLType</code> instance using the specified schema and xml data parameters.
<pre> STATIC FUNCTION createXML (xmlData IN varchar2, schema IN varchar2, validated IN number := 0, wellformed IN number := 0) RETURN XMLType deterministic; </pre>	This static function creates a schema-based <code>XMLType</code> instance using the specified schema and xml data parameters.
<pre> STATIC FUNCTION createXML (xmlData IN "<ADT_1>", schema IN varchar2 := NULL, element IN varchar2 := NULL, validated IN NUMBER := 0) RETURN XMLType deterministic; </pre>	Creates an XML instance from an instance of an user-defined type.

Table 309-3 (Cont.) CREATEXML Subprograms

Syntax	Description
<pre> STATIC FUNCTION createXML (xmlData IN SYS_REFCURSOR, schema in varchar2 := NULL, element in varchar2 := NULL, validated in number := 0) RETURN XMLType deterministic; </pre>	Creates an XML instance from a cursor reference. You can pass in any arbitrary SQL query as a CURSOR.
<pre> STATIC FUNCTION createXML (xmlData IN AnyData, schema in varchar2 := NULL, element in varchar2 := NULL, validated in number := 0) RETURN sys.XMLType deterministic parallel_enable </pre>	Creates an XML instance from ANYDATA. If the ANYDATA instance contains an ADT, the XMLType returned is the same as would be returned for a call directly on the ADT. If the ANYDATA contains a scalar, the XMLType contains a leaf node with the scalar value. The element name for this node is taken from the optional element string if present, and is "ANYDATA" if it is not.
<pre> STATIC FUNCTION createXML (xmlData IN blob, csid IN number, schema IN varchar2, validated IN number := 0, wellformed IN number := 0) return sys.XMLType deterministic </pre>	Creates an XML instance from a BLOB.
<pre> STATIC FUNCTION createXML (xmlData IN bfile, csid IN number, Schema IN varchar2, validated IN number := 0, wellformed IN number := 0) return sys.XMLType deterministic </pre>	Creates an XML instance from a BFILE.

Table 309-4 CREATEXML Parameters

Parameter	Description
xmlData	The actual data in the form of a BFILE, BLOB, CLOB, REF cursor, VARCHAR2 or object type.
schema	Optional Schema URL to be used to make the input conform to the given schema. Caution: Oracle does not support use of types generated by Schema Registration (see <i>Oracle XML DB Developer's Guide</i>).
validated	Flag to indicate that the instance is valid according to the given XML Schema. (Default is 0)

Table 309-4 (Cont.) CREATEXML Parameters

Parameter	Description
wellformed	Flag to indicate that the input is well formed. If set, then the database would not do well formed check on the input instance. (Default is 0)
element	Optional element name in the case of the ADT_1 or REF CURSOR constructors. (Default is NULL). Caution: Oracle does not support use of types generated by Schema Registration (see <i>Oracle XML DB Developer's Guide</i>).
csid	The character set id of input XML data.

309.1.4 EXISTSNODE

This member function checks if the node exists.

If the XPath string is NULL or the document is empty, then a value of 0 is returned, otherwise returns 1.

The options are described in the following table.

Syntax	Description
<pre>MEMBER FUNCTION existsNode(xpath IN varchar2) RETURN number deterministic;</pre>	Given an XPath expression, checks if the XPath applied over the document can return any valid nodes.
<pre>MEMBER FUNCTION existsNode(xpath in varchar2, nsmap in varchar2) RETURN number deterministic;</pre>	This member function uses the XPath expression with the namespace information and checks if applying the XPath returns any nodes or not.

Table 309-5 EXISTSNODE Subprogram Parameters

Parameter	Description
xpath	The XPath expression to test.
nsmap	Optional namespace mapping.

309.1.5 EXTRACT

This member function extracts an XMLType fragment and returns an XMLType instance containing the result nodes. If the XPath does not result in any nodes, it then returns NULL.

The options are described in the following table.

Syntax	Description
<pre>MEMBER FUNCTION extract(xpath IN varchar2) RETURN XMLType deterministic;</pre>	<p>Given an XPath expression, applies the XPath to the document and returns the fragment as an XMLType.</p>
<pre>MEMBER FUNCTION extract(xpath IN varchar2, nsmmap IN varchar2) RETURN XMLType deterministic;</pre>	<p>This member function applies the XPath expression and namespace mapping, over the XML data to return a XMLType instance containing the resultant fragment.</p>

Table 309-6 EXTRACT Subprogram Parameters

Parameter	Description
xpath	The XPath expression to apply.
nsmmap	Optional prefix to namespace mapping information.

309.1.6 GETBLOBVAL

This member function returns a BLOB containing the serialized XML representation. If the BLOB returned is temporary, it must be freed after use.

Syntax

```
MEMBER FUNCTION getBlobVal(
    csid IN NUMBER)
RETURN BLOB DETERMINISTIC;
```

Table 309-7 GETBLOBVAL Subprogram Parameters

Parameter	Description
csid	The desired character set ID of output BLOB

309.1.7 GETCLOBVAL

This member function returns a CLOB containing the serialized XML representation. If the CLOB returned is temporary, it must be freed after use. The CLOBs returned by this function are read-only.

Syntax

```
MEMBER FUNCTION getClobVal()
RETURN clob deterministic;
```

309.1.8 GETNAMESPACE

GETNAMESPACE is a member function. It returns the namespace of the top level element in the instance. It returns NULL if the input is a fragment or is a non-schema based instance.

Syntax

```
MEMBER FUNCTION getNamespace  
return varchar2 deterministic;
```

309.1.9 GETNUMBERVAL

This is a member function. It returns a numeric value, formatted from the text value pointed to by the XMLType instance. The XMLType must point to a valid text node that contains a numerical value.

The options are described in the following table.

Syntax

```
MEMBER FUNCTION getNumberVal()  
RETURN number deterministic;
```

309.1.10 GETROOTELEMENT

this member function gets the root element of the XMLType instance. It returns NULL if the instance is a fragment.

Syntax

```
MEMBER FUNCTION getRootElement  
return varchar2 deterministic;
```

309.1.11 GETSCHEMAURL

This member function returns the XML Schema URL corresponding to the XMLType instance, if the XMLType instance is a schema-based document. Otherwise, it returns NULL.

Syntax

```
MEMBER FUNCTION getSchemaURL  
return varchar2 deterministic;
```

309.1.12 GETSTRINGVAL

This member function returns the document as a string. It returns a string containing the serialized XML representation, or in the case of text nodes, the text itself.

If the XML document exceeds the VARCHAR2 maximum size (4000), then an error is raised at run time.

Syntax

```
MEMBER FUNCTION getStringVal()  
RETURN varchar2 deterministic;
```

309.1.13 ISFRAGMENT

ISFRAGMENT determines if the XMLType instance corresponds to a well-formed document, or a fragment. It returns 1 or 0 indicating if the XMLType instance contains a fragment or a well-formed document.

Syntax

```
MEMBER FUNCTION isFragment()  
RETURN number deterministic;
```

309.1.14 ISSCHEMABASED

This member function determines whether the XMLType instance is schema-based or not. It returns 1 or 0 depending on whether the XMLType instance is schema-based.

Syntax

```
MEMBER FUNCTION isSchemaBased  
return number deterministic;
```

309.1.15 ISSCHEMAVALID

This member function checks if the input instance conforms to a specified schema. It does not change the validation status of the XML instance.

If an XML Schema URL is not specified and the xml document is schema based, the conformance is checked against the XMLType instance's own schema.

Syntax

```
member function isSchemaValid(  
schurl IN VARCHAR2 := NULL,  
elem IN VARCHAR2 := NULL)  
return NUMBER deterministic;
```

Table 309-8 ISSCHEMAVALID Subprogram Parameters

Parameter	IN / OUT	Description
schurl	(IN)	The URL of the XML Schema against which to check conformance.
elem	(IN)	Element of a specified schema, against which to validate. This is useful when we have a XML Schema which defines more than one top level element, and we want to check conformance against a specific one of these elements.

309.1.16 ISSCHEMAVALIDATED

This member function returns the validation status of the `XMLType` instance to tell if a schema-based instance has been actually validated against its schema. It returns 1 if the instance has been validated against the schema, 0 otherwise.

Syntax

```
MEMBER FUNCTION isSchemaValidated
return NUMBER deterministic;
```

309.1.17 SCHEMAVALIDATE

This member procedure validates the XML instance against its schema, if it has not already been done.

For non-schema based documents an error is raised. If validation fails an error is raised; else, the document's status is changed to validated.

Syntax

```
MEMBER PROCEDURE schemaValidate(
    self IF OUT NOCOPY XMLType);
```

Table 309-9 SCHEMAVALIDATE Subprogram Parameters

Parameter	IN / OUT	Description
self	(OUT)	XML instance being validated against the schema.

309.1.18 SETSCHEMAVALIDATED

This member function sets the `VALIDATION` state of the input XML instance.

Syntax

```
MEMBER PROCEDURE setSchemaValidated(
    self IF OUT NOCOPY XMLType,
    flag IN BINARY_INTEGER := 1);
```

Table 309-10 SERTSSCHEMAVALIDATED Subprogram Parameters

Parameter	IN / OUT	Description
self	(OUT)	XML instance.
flag	(IN)	0 - NOT VALIDATED; 1 - VALIDATED (Default)

309.1.19 TOOBJECT

This member procedure converts the XML value to an object type using the `XMLSCHEMA` mapping, if available. If a `SCHEMA` is not supplied or the input is a non-schema based XML, the procedure uses canonical mapping between elements and object type attributes.

Syntax

```
MEMBER PROCEDURE toObject(
  SELF in XMLType,
  object OUT "<ADT_1>",
  schema in varchar2 := NULL,
  element in varchar2 := NULL);
```

Table 309-11 TOOBJECT Subprogram Parameters

Parameter	IN / OUT	Description
SELF	(IN)	Instance to be converted. Implicit if used as a member procedure.
object	(IN)	Converted object. An object instance of the required type may be passed in to this function
schema	(IN)	Schema URL. The mapping of the <code>XMLType</code> instance to the converted object instance may be specified using a schema. Caution: Oracle does not support use of types generated by Schema Registration (see <i>Oracle XML DB Developer's Guide</i>).
element	(IN)	Top-level element name. An XML Schema document does not specify the top-level element for a conforming XML instance document without this parameter. Caution: Oracle does not support use of types generated by Schema Registration (see <i>Oracle XML DB Developer's Guide</i>).

309.1.20 TRANSFORM

This member function transforms the XML data using the XSL stylesheet argument and the top-level parameters passed as a string of name=value pairs

If any of the arguments other than the parammap is `NULL`, then a `NULL` is returned.

Syntax

```
MEMBER FUNCTION transform(
  xsl IN XMLType,
  parammap in varchar2 := NULL)
RETURN XMLType deterministic;
```

Table 309-12 TRANSFORM Subprogram Parameters

Parameter	IN / OUT	Description
xsl	(IN)	The XSL stylesheet describing the transformation
parammap	(IN)	Top level parameters to the XSL - string of name=value pairs

309.1.21 XMLTYPE

This is an XMLType constructor.

The options are described in the following table.

Table 309-13 XMLTYPE Member Subprogram Parameters

Syntax	Description
<pre> constructor function XMLType(xmlData IN clob, schema IN varchar2 := NULL, validated IN number := 0, wellformed IN Number := 0) return self as result deterministic;</pre>	<p>This constructor function creates an optionally schema-based XMLType instance using the specified schema and xml data parameters.</p>
<pre> constructor function XMLType(xmlData IN varchar2, schema IN varchar2 := NULL, validated IN number := 0, wellformed IN number := 0) return self as result deterministic;</pre>	<p>This constructor function creates an optionally schema-based XMLType instance using the specified schema and xml data parameters.</p>
<pre> constructor function XMLType (xmlData IN "w<ADT_1>", schema IN varchar2 := NULL, element IN varchar2 := NULL, validated IN number := 0) return self as result deterministic;</pre>	<p>This constructor function creates an optionally schema-based XMLType instance from the specified object type parameter.</p>
<pre> constructor function XMLType(xmlData IN SYS_REFCURSOR, schema in varchar2 := NULL, element in varchar2 := NULL, validated in number := 0) return self as result deterministic;</pre>	<p>This constructor function creates an optionally schema-based XMLType instance from the specified REF CURSOR parameter.</p>
<pre> constructor function XMLType(xmlData IN AnyData, schema IN varchar2 := NULL, element IN varchar2 := NULL, validated IN number := 0) return self as result deterministic parallel_enable</pre>	<p>This constructor function creates an optionally schema-based XMLType instance from the specified ANYDATA parameter. If the ANYDATA instance contains an ADT, the XMLType returned is the same as would be returned for a call directly on the ADT. If the ANYDATA contains a scalar, the XMLType contains a leaf node with the scalar value. The element name for this node is taken from the optional element string if present, and is "ANYDATA" if it is not.</p>

Table 309-13 (Cont.) XMLTYPE Member Subprogram Parameters

Syntax	Description
<pre> constructor function XMLType(xmlData IN blob, csid IN number, schema IN varchar2 := NULL, validated IN number := 0, wellformed IN number := 0) return self as result deterministic </pre>	<p>This constructor function creates an optionally schema-based XMLType instance from the specified BLOB parameter.</p>
<pre> constructor function XMLType(xmlData IN bfile, csid IN number, schema IN varchar2 := NULL, validated IN number := 0, wellformed IN number := 0) return self as result deterministic </pre>	<p>This constructor function creates an optionally schema-based XMLType instance from the specified BFILE parameter.</p>

Table 309-14 XMLTYPE Constructor Subprogram Parameters

Parameter	Description
xmlData	The data in the form of a BFILE, BLOB, CLOB, REFS, VARCHAR2 or object type.
schema	Optional Schema URL to be used to make the input conform to the given schema. Caution: Oracle does not support use of types generated by Schema Registration (see <i>Oracle XML DB Developer's Guide</i>).
validated	Indicates that the instance is valid to the given XML Schema.
wellformed	Indicates that the input is well formed. If set, then the database would not do well formed check on the input instance.
element	Optional element name in the case of the ADT_1 or REF CURSOR constructors. (Default is NULL). Caution: Oracle does not support use of types generated by Schema Registration (see <i>Oracle XML DB Developer's Guide</i>).
csid	The character set id of input XML data.

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