

Oracle9i

Database New Features

Release 2 (9.2)

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Oracle9i Database New Features, Release 2 (9.2)

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Oracle9i Database New Features, Release 2 (9.2)

Part No. A96531-01

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Preface

This book introduces the features, options, and enhancements that are new with respect to each release of the Oracle9i Database. This book also provides readers with a list of titles and a brief description for the technical documentation that is available with this release of the Oracle9i Database.

This preface contains these topics:

- [Audience](#)
- [Organization](#)
- [Related Documentation](#)
- [Conventions](#)
- [Documentation Accessibility](#)

Audience

Oracle9i Database New Features is addressed to people familiar with previous versions of the Oracle Database who would like to become familiar with features, options, and enhancements that are new with respect to each release of the Oracle9i database.

Organization

This document contains:

Chapter 1, "Overview of Oracle9i"

This chapter introduces Oracle9i with its various components.

Chapter 2, "Oracle9i Database Release 2 (9.2) New Features"

This chapter describes the new features of the Oracle9i Database, release 2 (9.2).

Chapter 3, "Oracle9i Database Release 1 (9.0.1) New Features"

This chapter describes the new features of the Oracle9i Database, release 1 (9.0.1).

Chapter 4, "Oracle9i Documentation"

This chapter lists technical documentation available with the Oracle9i Database and briefly describes the subject matter of each document.

Chapter 5, "Oracle9i Feature and Option Availability"

This chapter describes the Oracle features and options available for the Oracle9i Database.

Related Documentation

Many of the examples in this book use the sample schemas of the seed database, which is installed by default when you install Oracle. Refer to *Oracle9i Sample Schemas* for information on how these schemas were created and how you can use them yourself.

In North America, printed documentation is available for sale in the Oracle Store at

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

Customers in Europe, the Middle East, and Africa (EMEA) can purchase documentation from

<http://www.oraclebookshop.com/>

Other customers can contact their Oracle representative to purchase printed documentation.

To download free release notes, installation documentation, white papers, or other collateral, please visit the Oracle Technology Network (OTN). You must register online before using OTN; registration is free and can be done at

<http://otn.oracle.com/admin/account/membership.html>

If you already have a username and password for OTN, then you can go directly to the documentation section of the OTN Web site at

<http://otn.oracle.com/docs/index.htm>

To access the database documentation search engine directly, please visit

<http://tahiti.oracle.com>

Conventions

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

- [Conventions in Text](#)
- [Conventions in Code Examples](#)
- [Conventions for Microsoft Windows Operating Systems](#)

Conventions in Text

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

| Convention | Meaning | Example |
|----------------|---|--|
| Bold | Bold typeface indicates terms that are defined in the text or terms that appear in a glossary, or both. | When you specify this clause, you create an index-organized table . |
| <i>Italics</i> | Italic typeface indicates book titles or emphasis. | <i>Oracle9i Database Concepts</i> Ensure that the recovery catalog and target database do <i>not</i> reside on the same disk. |

| Convention | Meaning | Example |
|--|--|---|
| UPPERCASE monospace (fixed-width) font | Uppercase monospace typeface indicates elements supplied by the system. Such elements include parameters, privileges, datatypes, RMAN keywords, SQL keywords, SQL*Plus or utility commands, packages and methods, as well as system-supplied column names, database objects and structures, usernames, and roles. | You can specify this clause only for a NUMBER column. You can back up the database by using the BACKUP command. Query the TABLE_NAME column in the USER_TABLES data dictionary view. Use the DBMS_STATS.GENERATE_STATS procedure. |
| lowercase monospace (fixed-width) font | Lowercase monospace typeface indicates executables, filenames, directory names, and sample user-supplied elements. Such elements include computer and database names, net service names, and connect identifiers, as well as user-supplied database objects and structures, column names, packages and classes, usernames and roles, program units, and parameter values. Note: Some programmatic elements use a mixture of UPPER CASE and lowercase. Enter these elements as shown. | Enter sqlplus to open SQL*Plus. The password is specified in the orapwd file. Back up the datafiles and control files in the /disk1/oracle/dbs directory. The department_id, department_name, and location_id columns are in the hr.departments table. Set the QUERY_REWRITE_ENABLED initialization parameter to true. Connect as oe user. The JRepuTil class implements these methods. |
| <i>lowercase italic monospace (fixed-width) font</i> | Lowercase italic monospace font represents placeholders or variables. | You can specify the <i>parallel_clause</i> . Run <i>Uold_release</i> .SQL where <i>old_release</i> refers to the release you installed prior to upgrading. |

Conventions in Code Examples

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

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

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

| Convention | Meaning | Example |
|----------------|--|---|
| [] | Brackets enclose one or more optional items. Do not enter the brackets. | DECIMAL (<i>digits</i> [, <i>precision</i>]) |
| { } | Braces enclose two or more items, one of which is required. Do not enter the braces. | {ENABLE DISABLE} |
| | A vertical bar represents a choice of two or more options within brackets or braces. Enter one of the options. Do not enter the vertical bar. | {ENABLE DISABLE} [COMPRESS NOCOMPRESS] |
| ... | Horizontal ellipsis points indicate either: <ul style="list-style-type: none"> That we have omitted parts of the code that are not directly related to the example That you can repeat a portion of the code | CREATE TABLE ... AS <i>subquery</i> ; SELECT <i>col1</i> , <i>col2</i> , ... , <i>coln</i> FROM <i>employees</i> ; |
| . | Vertical ellipsis points indicate that we have omitted several lines of code not directly related to the example. | SQL> SELECT NAME FROM V\$DATAFILE; NAME ----- /fsl/dbs/tbs_01.dbf /fsl/dbs/tbs_02.dbf . . . /fsl/dbs/tbs_09.dbf 9 rows selected. |
| Other notation | You must enter symbols other than brackets, braces, vertical bars, and ellipsis points as shown. | acctbal NUMBER(11,2); acct CONSTANT NUMBER(4) := 3; |
| <i>Italics</i> | Italicized text indicates placeholders or variables for which you must supply particular values. | CONNECT SYSTEM/ <i>system_password</i> DB_NAME = <i>database_name</i> |
| UPPERCASE | Uppercase typeface indicates elements supplied by the system. We show these terms in uppercase in order to distinguish them from terms you define. Unless terms appear in brackets, enter them in the order and with the spelling shown. However, because these terms are not case sensitive, you can enter them in lowercase. | SELECT last_name, employee_id FROM <i>employees</i> ; SELECT * FROM USER_TABLES; DROP TABLE hr.employees; |

| Convention | Meaning | Example |
|------------|--|---|
| lowercase | Lowercase typeface indicates programmatic elements that you supply. For example, lowercase indicates names of tables, columns, or files. Note: Some programmatic elements use a mixture of UPPERCASE and lowercase. Enter these elements as shown. | <pre>SELECT last_name, employee_id FROM employees; sqlplus hr/hr CREATE USER mjones IDENTIFIED BY ty3MU9;</pre> |

Conventions for Microsoft Windows Operating Systems

The following table describes conventions for Microsoft Windows operating systems and provides examples of their use.

| Convention | Meaning | Example |
|--------------------------|--|--|
| Choose Start > | How to start a program. | To start the Database Configuration Assistant, choose Start > Programs > Oracle - <i>HOME_NAME</i> > Configuration and Migration Tools > Database Configuration Assistant. |
| File and directory names | File and directory names are not case sensitive. The following special characters are not allowed: left angle bracket (<), right angle bracket (>), colon (:), double quotation marks ("), slash (/), pipe (), and dash (-). The special character backslash (\) is treated as an element separator, even when it appears in quotes. If the file name begins with \\, then Windows assumes it uses the Universal Naming Convention. | <pre>c:\winnt\"\"system32 is the same as C:\WINNT\SYSTEM32</pre> |
| C:\> | Represents the Windows command prompt of the current hard disk drive. The escape character in a command prompt is the caret (^). Your prompt reflects the subdirectory in which you are working. Referred to as the <i>command prompt</i> in this manual. | C:\oracle\oradata> |

| Convention | Meaning | Example |
|---|---|--|
| Special characters | The backslash (\) special character is sometimes required as an escape character for the double quotation mark (") special character at the Windows command prompt. Parentheses and the single quotation mark (') do not require an escape character. Refer to your Windows operating system documentation for more information on escape and special characters. | <pre>C:\>exp scott/tiger TABLES=emp QUERY=\"WHERE job='SALESMAN' and sal<1600\" C:\>imp SYSTEM/password FROMUSER=scott TABLES=(emp, dept)</pre> |
| <i>HOME_NAME</i> | Represents the Oracle home name. The home name can be up to 16 alphanumeric characters. The only special character allowed in the home name is the underscore. | <pre>C:\> net start OracleHOME_NAME\TNSListener</pre> |
| <i>ORACLE_HOME</i> and <i>ORACLE_</i> <i>BASE</i> | <p>In releases prior to Oracle8i release 8.1.3, when you installed Oracle components, all subdirectories were located under a top level <i>ORACLE_HOME</i> directory that by default used one of the following names:</p> <ul style="list-style-type: none"> ■ C:\orant for Windows NT ■ C:\orawin98 for Windows 98 <p>This release complies with Optimal Flexible Architecture (OFA) guidelines. All subdirectories are not under a top level <i>ORACLE_HOME</i> directory. There is a top level directory called <i>ORACLE_BASE</i> that by default is C:\oracle. If you install Oracle9i release 1 (9.0.1) on a computer with no other Oracle software installed, then the default setting for the first Oracle home directory is C:\oracle\ora90. The Oracle home directory is located directly under <i>ORACLE_BASE</i>.</p> <p>All directory path examples in this guide follow OFA conventions.</p> <p>Refer to <i>Oracle9i Database Getting Started for Windows</i> for additional information about OFA compliances and for information about installing Oracle products in non-OFA compliant directories.</p> | Go to the <i>ORACLE_BASE\ORACLE_HOME\rdms\admin</i> directory. |

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Accessibility of Code Examples in Documentation JAWS, a Windows screen reader, may not always correctly read the code examples in this document. The conventions for writing code require that closing braces should appear on an otherwise empty line; however, JAWS may not always read a line of text that consists solely of a bracket or brace.

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Overview of Oracle9i

This chapter presents an overview of the architecture and various components of Oracle9i. It contains the following sections:

- [Introduction](#)
- [Oracle9i Database](#)
- [Oracle9i Application Server](#)
- [Oracle9i Developer Suite](#)

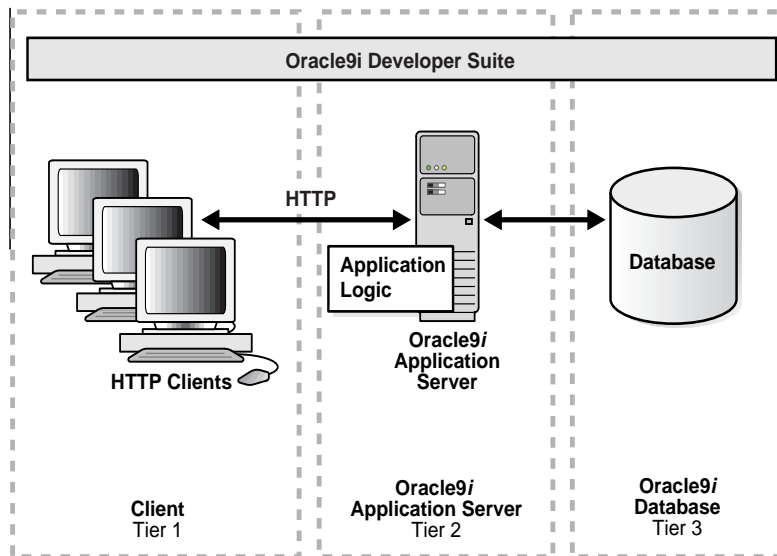
Introduction

Epitomizing high-quality service in a service-driven marketplace, Oracle9i maximizes the usefulness of traditional business and intranet applications while also providing users with the functionality needed to foster the growth of the emerging hosted applications market on the Internet.

Oracle9i builds on historic Oracle strengths to offer the first complete and simple software infrastructure for the Internet's next generation of intelligent, collaborative applications. Oracle9i new features expedite delivery of the performance, scalability, and availability that is crucial to providing hosted service software for anyone, anywhere, and anytime.

Oracle9i architecture is depicted in [Figure 1-1](#).

Figure 1-1 Oracle9i Architecture



Oracle9i is made up of the following components:

- [Oracle9i Database](#)
- [Oracle9i Application Server](#)
- [Oracle9i Developer Suite](#)

Oracle9i Database

The Oracle9i Database introduces the following advanced and automated design features to stand alone or to work in conjunction with the Oracle9i Application Server or the Oracle9i Developer Suite to optimize performance for traditional applications and for the emerging hosted applications market.

Oracle9i Real Application Clusters

Oracle9i Real Application Clusters provides the following functionality:

- Out-of-the-box linear scaling transparency
- Compatibility with all applications without redesign
- Capacity for rapidly adding nodes and disks

Systems Management

Integrated system management products in Oracle9i create a comprehensive view of all critical components that drive e-business processes. From the client and application server to the database and host, Oracle9i quickly and completely assesses the overall health of an e-business infrastructure.

High Availability

Setting a new standard for high availability, Oracle9i introduces powerful new functionalities in the areas of disaster recovery, system fault recovery, and planned downtime.

High Security

Oracle9i offers the most secure internet platform available to protect company information with multiple layers of security for data, users, and companies. Included are features for building internet-scale applications, for providing security for users, and for keeping separate the data from different hosted user communities.

Oracle9i Application Server

Recognized as the leading application server for database-driven Web sites, Oracle9i Application Server offers the industry's most innovative and comprehensive set of middle-tier services.

Comprehensive Middle-tier Services

Continued innovation within comprehensive middle-tier services—ranging from self-service enterprise portals to e-stores and supplier exchange—continues to establish that the Oracle9i Application Server is the industry's preferred application server for database-driven Web sites.

New Caching Technology

The new caching technology in Oracle9i can dramatically increase Web site performance, scalability, and availability. Oracle9i provides greater numbers of users with more personalized, dynamic Web content without adding application or Databases.

Scalability and Performance

Superb scalability and performance now is made available for all Web applications. Oracle Portal services make it easy for Web site developers to deploy enterprise portals with centralized management and unified security. Standard Java, with rich XML and content management support—as well as back-office transactional applications built using Oracle Forms Developer—can easily be deployed.

Wireless Device Access

Information in any database or internet application is easily available through Oracle9i so that support for each wireless device's specific markup language is no longer necessary.

Business Intelligence

Oracle9i Application Server has built-in reporting and ad hoc query functionality to derive business intelligence after Web site deployment.

Oracle9i Developer Suite

Oracle Internet Developer Suite combines leading Oracle applications development tools, business intelligence tools, and enterprise portal building tools into a single, integrated product. Built on internet standards such as Java, XML, CORBA, and HTML, the Oracle Internet Developer Suite provides a high-performance development environment with tools needed to respond to rapidly changing markets and user demands.

Extensive Development Alternatives

Oracle Internet Developer Suite tools are suitable for any kind of development approach including component-based development, Java coding, or visual modeling. They also offer rapid application development based on fourth generation language (4GL). Applications can be developed for all clients, including High Productive Java Client, Universal HTML Client, and Anywhere Mobile Client.

Tools

Oracle Internet Developer Suite includes the following tools:

- **Oracle Forms Developer**, which enables developers to leverage declarative capabilities and visual editors to automatically generate highly interactive Java clients without having to code in Java.
- **Oracle Designer**, which models business processes, data entities, and relationships. Models are automatically transformed into designs, which automatically generate complete applications and databases.
- **Oracle JDeveloper and Business Components for Java**, which includes a J2EE(tm) development environment with end-to-end support for developing, debugging, and deploying e-business applications.
- **Oracle Reports Developer**, which can build enterprise-level reports rapidly and productively and which is wizard-driven, includes a graphical layout editor, and delivers advanced capabilities to tackle the most challenging reports involving complex queries and programmatic logic.
- **Oracle Discoverer**, which provides users with powerful, on-demand query and reporting capabilities to gain strategic insight into their business and to formulate new ebusiness strategies.

Other Features

All applications are single, middle-tier deployable with Oracle9i Application Server. Oracle Portal is available for an integrated, personalized portal view with all applications. Integrated business intelligence for enterprise reporting and ad-hoc query is also available.

Oracle9i Database Release 2 (9.2) New Features

The new features in Oracle9i Database release 2 (9.2) deliver the performance, scalability, and availability critical to hosted service software that must be available round the clock to anyone anywhere.

This chapter discusses these features and is organized to introduce new functionality in accordance with the following themes:

- Scalability and Performance
- Availability
- Manageability
- Information Integration
- Business Intelligence
- Security and Directory
- Internet Content Management
- Application Development
- Windows Integration

Scalability and Performance

Oracle9i Real Application Clusters enables all applications to exploit cluster database availability, scalability, and performance with no application modifications, making it possible to scale the most demanding e-business applications and thus disperse transaction loads.

Key enhancements in Oracle9i include the following:

- [Partitioning of Applications No Longer Necessary](#)
- [Fast Split Partitioning](#)
- [Shared Server](#)

Partitioning of Applications No Longer Necessary

Applications can treat Oracle9i Real Application Clusters as a single system making it unnecessary to modify or partition applications to achieve near-linear cluster database scalability. The advantage of this is that you can horizontally scale the database tier as usage and demand grow without needing to modify the application itself.

See Also: For more information on Oracle Real Application Clusters, please see [Scalability and Performance](#) on page 3-38.

See Also: *Oracle9i Real Application Clusters Administration*.

Fast Split Partitioning

Fast split partitioning takes advantage of those situations in which a split partition results in all rows being moved to a single partition. If all the rows map into a single partition and if the segment attributes of the old partition and the segment attributes of the partition inheriting all the rows match, then the database simply reuses the old segment and adds an empty segment for the other partition. Another benefit of this is that global indexes do not have to be invalidated and, in certain cases, local index partitions corresponding to the new partitions are also usable.

See Also: *Oracle9i Database Administrator's Guide*.

Shared Server

The Shared Server Architecture in Oracle9i significantly improves the scalability of applications and any concurrent clients connected to the server. It also allows existing applications to scale without changes to them.

Dynamic Support for Remote and Local Listener Parameters

This feature allows LOCAL_LISTENER and REMOTE_LISTENER initialization parameters to be updated via the "alter system set" command. Any change made to the LOCAL_LISTENER and REMOTE_LISTENER parameters is recognized by PMON and takes effect immediately.

Same SHUTDOWN IMMEDIATE Behavior for Both Shared and Dedicated Servers

Both shared and dedicated servers are not terminated until all the requests that are in the queue for each kind of server either have been responded to by its server or have been committed.

See Also: *Oracle9i Net Services Administrator's Guide.*

Availability

Oracle9i extends Oracle's lead on the competition in the internet database availability critical for any e-business application.

Key enhancements in Oracle9i include the following:

- [Enhanced Disaster Recovery Environment](#)
- [Streamlined Operational Database Management](#)

Enhanced Disaster Recovery Environment

Oracle9i sets a new standard for high availability with the introduction of four powerful new features to protect against downtime, the most disruptive event an e-business can encounter.

Key enhancements to Oracle9i include the following:

- [Disaster Recovery and Data Protection](#)
- [Correcting Errors Using Flashback Query](#)

Disaster Recovery and Data Protection

Oracle9i offers many new features for disaster recovery. Key areas include the following:

Oracle9i Data Guard-Logical Standby The standby database is a logical copy of the production database. Updates to the secondary site are made using SQL statements regenerated from logged changes to the primary database. You can use the logical standby database to run reports, even when changes are being applied (using SQL) from the production site. If there is a disaster that causes the production database to fail, the logical standby database can be activated as the new primary database with minimal disruption and with no data loss. Data Guard makes the tasks of creating, monitoring, and managing standby databases significantly easier. The Data Guard broker supports up to nine standby database in a single configuration, which can be a mixture of both logical and physical standby databases, with simple role transitions.

See Also:

- *Oracle9i Real Application Clusters Real Application Clusters Guard I - Concepts and Administration*
- *Oracle9i Data Guard Concepts and Administration*

Correcting Errors Using Flashback Query Flashback Query allows users to generate flashback information within a SQL statement, instead of only within a session. Once the errors are identified, undoing the updates is a straightforward process that can be done without intervention from the database administrator and without database downtime. You can restore deleted rows, old values, or the previous version of the table, and you can select the difference in sets of data between two different times.

See Also: *Oracle9i Application Developer's Guide - Fundamentals*

Recovery Manager Enhancements and Changes

Key enhancements to Recovery Manager include the following:

- [Backup of Server Parameter Files](#)
- [Control File Autobackups After Structural Changes to the Database](#)
- [Backing Up Archived Logs That Need Backups](#)
- [Managing Space When Restoring Archived Logs](#)

- [New VS Views in Recovery Manager](#)
- [Default Autolocation for Real Application Clusters](#)
- [Diagnostics for Media Manager Function Calls](#)
- [FORCE Option for DELETE Command](#)
- [Deletion of Files Already Backed Up to a Device](#)
- [DUPLICATE Command Enhancements](#)
- [Recovery Manager Error Output Improved](#)
- [Automated Archived Log Files Space Management](#)
- [New Utility: DBNEWID](#)
- [Legato NetWorker bundled with Oracle9i](#)

Backup of Server Parameter Files

The `BACKUP` command can be used to back up the current server parameter file. Recovery Manager automatically backs up the current server parameter file whenever it includes the current control file in a backup set. If the server parameter file is lost, then you can start an instance without a parameter file, and then run `RESTORE SPFILE` to restore it.

Control File Autobackups After Structural Changes to the Database

If `CONFIGURE CONTROLFILE AUTOBACKUP` is set to `ON` (it is `OFF` by default), then Recovery Manager automatically backs up the control file and server parameter file after structural changes to the database. The target database records the autobackup in the alert log.

Backing Up Archived Logs That Need Backups

You can use `NOT BACKED UP integer TIMES` clause of the `BACKUP ARCHIVELOG` command to back up only those logs that have not been backed up at least *integer* times. When calculating the number of backups for a file, Recovery Manager only considers backups created on the same device type as the current backup. This option is a convenient way to back up archived logs on specified media—for example, you want to keep at least three copies of each log on tape.

Managing Space When Restoring Archived Logs

The `MAXSIZE` option of the `RECOVER . . . DELETE ARCHIVELOG` command limits how much disk space Recovery Manager uses when restoring logs during media recovery.

New V\$ Views in Recovery Manager

The `V$DATABASE_BLOCK_CORRUPTION` view records the corrupt blocks in a file after the most recent backup, backup validation, or copy of the file. The `CORRUPTION_TYPE` column shows the type of corruption. Run the `BLOCKRECOVER` command with the `CORRUPTION LIST` clause to recover all corrupt blocks recorded in the view. After a corrupt block is repaired, the row describing the corruption remains in the view until the next Recovery Manager backup of the affected file. The `V$DATABASE_BLOCK_CORRUPTION` view has a corresponding recovery catalog view called `RC_DATABASE_BLOCK_CORRUPTION`.

The `V$DATABASE_INCARNATION` view lists all incarnations of the database. A new incarnation is created whenever the database is opened with the `RESETLOGS` option. The `V$DATABASE_INCARNATION` view has a corresponding recovery catalog view called `RC_DATABASE_INCARNATION`.

Default Autolocation for Real Application Clusters

Recovery Manager automatically discovers which nodes of an Oracle Real Application Clusters configuration can access the files that you want to back up or restore. Recovery Manager autolocates the following files:

- Backup pieces during backup or restore
- Archived redo logs during backup
- Datafile or control file copies during backup or restore

Prior to this release of Oracle9i, you had to manually enable this option with `SET AUTOLOCATE`, and the option only applied to backup pieces.

Diagnostics for Media Manager Function Calls

You can now query dynamic performance event views to obtain diagnostic data about Recovery Manager calls to the media manager. An event name corresponds to every media management function. These event names can be used to diagnose problems during Recovery Manager backup, restore, and maintenance jobs.

FORCE Option for DELETE Command

Sometimes the status of an object in the Recovery Manager repository does not reflect the status of the object on the media. For example, someone deletes a backup piece with an operating system utility before `CROSSCHECK` is run. If the object is listed as `AVAILABLE` or `EXPIRED` but the reality on the media is otherwise, and if you run the `DELETE` command on the object, then Recovery Manager does not delete it. You can override this behavior with the `FORCE` option of the `DELETE` command.

Deletion of Files Already Backed Up to a Device

You can delete files that have already been backed up a specified number of times to a device. For example, you can delete all archived redo logs that have been backed up at least twice to tape.

DUPLICATE Command Enhancements

The `SKIP TABLESPACE` option of the `DUPLICATE` command enables you to exclude a list of tablespaces from the duplicate database. Also, you can specify the `UNTIL` clause on the `DUPLICATE` command to recover the duplicate database to a noncurrent time.

Recovery Manager Error Output Improved

The Recovery Manager error output is more compact and more informative. If an Recovery Manager command fails, then the error stack is always followed by `RMAN-03002` or `RMAN-03009` stating which command failed. If the errors are generated from the target database, then Recovery Manager does not explicitly indicate that they are from the target database; however, if the errors are from the catalog or auxiliary database, then Recovery Manager indicates this fact in a separate message.

Automated Archived Log Files Space Management

Recovery Manager can automate the space management of archived log files, thus simplifying database administration.

See Also: *Oracle9i Recovery Manager User's Guide*

New Utility: DBNEWID

Prior to the introduction of the `DBNEWID` utility, you could manually create a copy of a database and give it a new database name (`DBNAME`) by re-creating the

control file. However, you could not give the database a new identifier (DBID). Because Recovery Manager (RMAN) distinguishes databases by DBID, you could not register a seed database and a manually copied database together in the same RMAN repository. The DBNEWID utility solves this problem by allowing you to change any of the following:

- Only the DBID of a database
- Only the DBNAME of a database
- Both the DBNAME and DBID of a database

See Also: *Oracle9i Database Utilities*

Legato NetWorker bundled with Oracle9i

In this release, Oracle has bundled a new version of the Legato backup and recovery software for Oracle databases. This is a single version of Legato NetWorker and the NetWorker Module for Oracle client, which has been designed to operate on the same server as your Oracle database. After installing this version of Legato NetWorker, you will receive a license notice each time you backup your database to tape using the Oracle Recovery Manager (RMAN) interface. To eliminate this license notice, you can enter an Authorization Code, which can be obtained directly from Legato without charge. Instructions for obtaining this code are in the displayed license notice.

Legato NetWorker documentation can be obtained directly from Legato. Documentation for this version of NetWorker can be found at:

<http://www.legato.com/lssv/>.

This site will also contain any product updates for this NetWorker version.

Manageability

Oracle9i Systems management is simplified and improved by increased self-management and self-tuning capabilities. Also, Oracle9i integrated system management tools create a complete view of all database and host critical processes, making it possible to quickly and completely assess the overall health of an e-business infrastructure.

Key enhancements in Oracle9i include the following:

- [Streamlined Operational Database Management](#)
- [Simplified Oracle9i Administration With Oracle Enterprise Manager](#)

- LogMiner Enhancements
- Minimizing the Production Impact of Upgrading
- Cluster File Systems
- Domain Indexes Enhancement
- Table Function Enhancement
- Oracle Net Services Enhancements
- Segment-level statistics collection
- Real Application Clusters Guard II

Streamlined Operational Database Management

Several new features simplify administration of the Oracle9i database:

- Automatic Server Parameter File Backup and Configuration
- Performance Tuning Intelligent Advisories
- Actual Operation-Level Query Statistics
- Input/Output Topology
- Dynamic Sampling of Optimizer Statistics
- Locally Managed SYSTEM Tablespace
- Clone Database in Oracle Enterprise Manager
- Specifying FORCE LOGGING Mode

Automatic Server Parameter File Backup and Configuration

Recovery Manager can now automatically back up and restore the server parameter File (SPFILE) configuration file, simplifying the backup and restoration processes of the system.

Performance Tuning Intelligent Advisories

The current release of Oracle9i provides a number of built-in intelligent advisories for performance tuning. These advisories are set to go "out-of-the-box", and allow the administrator to simulate a variety of hypothetical scenarios. These advisories use minimal resources and are available through the standard SQL interface.

- These advisories show Shared Pool usage to improve parse time and to minimize CPU usage. They also show SQL execution memory to shorten SQL execution time and to minimize unnecessary central processing unit and input/output usage.
- An advisory for the Mean-Time-To-Recover setting makes it possible for the administrator to set time requirements to recover from a system crash without jeopardizing run-time performance.
- An advisory for the PGA Aggregate Target makes it possible for the server to control dynamically the amount of PGA memory allotted to SQL work areas according to the `PGA_AGGREGATE_TARGET` limit that is set by the DBA.

Actual Operation-Level Query Statistics

Performance tuning in the current release of Oracle9i is simplified with intelligent tuning features that provide actual operation-level query execution statistics rather than estimates. This new information helps database administrators identify what tables, partitions, and indexes are most heavily accessed.

Input/Output Topology

A complete input/output topology shows a complete mapping of a file to logical volumes and physical devices.

Dynamic Sampling of Optimizer Statistics

At compile time, this feature, if enabled, will dynamically gather statistics if the existing statistics are incomplete or known to be inaccurate. With default settings, this feature addresses missing optimizer statistics, providing for a possible source of poor optimization. With optional settings, this feature addresses additional sources of inaccurate statistics. Dynamic sampling of optimizer statistics may improve performance by improving the quality of the statistics used by the query optimizer.

Locally Managed SYSTEM Tablespace

The `SYSTEM` tablespace can be locally managed to simplify the database administrator's tasks.

Clone Database in Oracle Enterprise Manager

Included in the Oracle Enterprise Manager Change Management Pack, this feature enables you to clone a subset of a production environment (data and statistics) for development testing

Specifying FORCE LOGGING Mode

The `FORCE LOGGING` clause of the `CREATE DATABASE`, `CREATE CONTROLFILE`, and `CREATE TABLESPACE` statement enables you to force redo log records to be written even when `NOLOGGING` has been specified in a DDL statement.

See Also: *Oracle9i Database Administrator's Guide.*

Simplified Oracle9i Administration With Oracle Enterprise Manager

This release of Oracle Enterprise Manager includes a number of improvements over earlier versions:

- [New Feature Support in Oracle Enterprise Manager](#)
- [New Features in the Database Configuration Assistant](#)
- [Production Database Subset Cloning](#)
- [Workflow](#)

New Feature Support in Oracle Enterprise Manager

Oracle Enterprise Manager provides support for features new to release 2. These include XML DB, Oracle Streams, Data Guard-Logical Standby Database, and database advisories.

New Features in the Database Configuration Assistant

The Database Configuration Assistant now creates a locally managed `SYSTEM` tablespace, and resumable statements and resource management control operations are now supported in Oracle Enterprise Manager.

Production Database Subset Cloning

Oracle Enterprise Manager can be used to clone a subset of the production environment for development testing.

Workflow

Workflow Manager is available to users through the Oracle Enterprise Manager console.

See Also: *Oracle Enterprise Manager Administrator's Guide.*

LogMiner Enhancements

LogMiner release 9.2 has added support for several new features and changed some default behavior as follows:

- [LONG and LOB Datatype Support for Redo Logs](#)
- [Supplemental Logging Turned Off by Default](#)
- [Database and Table Supplemental Logging](#)
- [New Formatting Options](#)
- [New Option, DBMS_LOGMNR.CONTINUOUS_MINE, in LogMiner](#)
- [DBMS_LOGMNR.NO_DICT_RESET_ONSELECT Option Unnecessary](#)
- [New Procedure, DBMS_LOGMNR_D.SET_TABLESPACE, in LogMiner](#)

LONG and LOB Datatype Support for Redo Logs

LONG and LOB datatypes are supported for redo logs generated on a release 9.2 or later Oracle database.

Supplemental Logging Turned Off by Default

Supplemental logging is turned *off* by default. This is a change from release 9.0.1, in which minimal supplemental logging was turned on by default. In release 9.2, the level of supplemental logging desired must be specified.

Database and Table Supplemental Logging

Database supplemental logging and table supplemental logging are each available, depending on what level of supplemental logging you need. Within table supplemental logging, you have a choice of using conditional or unconditional log groups.

New Formatting Options

Two new options have been added that affect the formatting of returned data. The `DBMS_LOGMNR.NO_SQL_DELIMITER` option suppresses the semi-colon at the end of `SQL_REDO` and `SQL_UNDO` statements. The `DBMS_LOGMNR.PRINT_PRETTY_SQL` option formats the reconstructed SQL statements so that they are easier to read.

New Option, DBMS_LOGMNR.CONTINUOUS_MINE, in LogMiner

A new option, DBMS_LOGMNR.CONTINUOUS_MINE, directs LogMiner to automatically add and mine redo log files that are archived after the LogMiner session has started.

DBMS_LOGMNR.NO_DICT_RESET_ONSELECT Option Unnecessary

Use of the DBMS_LOGMNR.NO_DICT_RESET_ONSELECT option is no longer necessary. When data definition language (DDL) tracking is enabled, LogMiner stores old metadata definitions so that a second select operation has all the needed metadata versions.

New Procedure, DBMS_LOGMNR_D.SET_TABLESPACE, in LogMiner

A new procedure, DBMS_LOGMNR_D.SET_TABLESPACE, recreates all LogMiner tables in a tablespace other than the default tablespace, SYSTEM.

See Also: *Oracle9i Database Administrator's Guide*

Minimizing the Production Impact of Upgrading

The Oracle9i Database release 2 introduces new features to lessen the time spent upgrading applications and database systems. These new features include the ability to rename CONSTRAINTS and COLUMNS as well as a significant reduction in the recompilation of PL/SQL packages and procedures. The database system also provides for fast loading of wrapped source code, automatically determines to do nothing upon loading an unchanged package, view or synonym, and removes double invalidation and parallel compilation in dependency code.

See Also: *Oracle9i Database Administrator's Guide.*

Cluster File Systems

If your platform supports a cluster file system, then you can use it in Real Application Clusters to store datafiles, control files, the SRVM Configuration Repository, and so on. Using a cluster file system simplifies your administrative overhead and it improves disk manageability.

See Also:

- *Oracle9i Real Application Clusters Setup and Configuration*
- *Oracle9i Real Application Clusters Concepts*
- Your platform-specific documentation for more information about cluster file system support.

Domain Indexes Enhancement

It is now possible to create and rebuild domain indexes and local domain index partitions in parallel.

See Also: *Oracle9i Database Administrator's Guide.*

Table Function Enhancement

A table function can now return the generic collection type `SYS.AnyDataSet`.

See Also: *PL/SQL User's Guide and Reference*

Oracle Net Services Enhancements

Oracle9i includes the following new features for Oracle Net Services:

- [Net Service Alias](#)
- [Global Database Link Support in Directory Server](#)
- [Trace Assistant](#)

Net Service Alias

A net service alias is an alternative name for a directory naming object in a directory server. A directory server stores net service aliases for any defined net service name or database service. A net service alias entry does not have connect descriptor information. Instead, it only references the location of the object for which it is an alias. When a client requests a directory lookup of a net service alias, the directory determines that the entry is a net service alias and completes the lookup as if it was actually the entry it is referencing.

Global Database Link Support in Directory Server

A global database link is a database link that is centrally stored in an Oracle Names server. A global database link that is the same as the global database name is

automatically registered with an Oracle Names server. You can use a global database link to access an object in the database.

Trace Assistant

Oracle Net Services provides a tool called the Trace Assistant to help you understand the information provided in trace files by converting existing lines of trace file text into a more readable paragraph.

See Also: *Oracle9i Net Services Administrator's Guide.*

Segment-level statistics collection

With the capacity to collect of segment-level statistics in Oracle9i release 2, users can specify that relevant statistics be collected on the segment level to pinpoint hot spots and performance bottlenecks in the system. You can query these statistics by using the V\$SEGMENT_STATISTICS to do a SELECT * FROM V\$SEGMENT_STATISTICS. You can also query V\$SEGSTAT_NAME for statistics properties and V\$SETSTAT for additional efficient access to statistics.

See Also: *Oracle9i Database Performance Tuning Guide and Reference.*

Real Application Clusters Guard II

Real Application Clusters Guard II supports comprehensive workload management to maintain high availability for Real Application Clusters databases and their applications. Real Application Clusters Guard II transfers application loads based on the concept of service names. Therefore, Real Application Clusters Guard II supports workload management based on service levels as well as applications using database services.

Service names have been adopted for high availability because you do not have to make application changes to implement them. In addition, service names provide location transparency to the database instances that offer the service. Service names enable a single-system image that simplifies the configuration, operation, and recovery of workloads.

See Also: *Oracle9i Real Application Clusters Guard II Concepts, Installation, and Administration* on the Real Application Clusters Guard II software CD

Information Integration

An important feature of any database management system is the ability to share information among multiple databases and applications. Traditionally, this has meant that users and applications must pull information from the database. Today, however, new efficiencies and business models require a more comprehensive and automated approach. This approach must automatically determine what information is relevant and share that information with those who need it. It must also be a universal solution that adapts to changing business requirements and minimizes the trade-offs of single purpose solutions. This active sharing of information includes capturing and managing events in the database, including but not limited to data manipulation language (DML) and propagating those events to other databases and applications.

Information sharing is crucial for data and application integration, replication, data warehouse loading, high availability, data protection, and other applications. However, decision makers are often overwhelmed by the variety of options they face when selecting an information sharing solution. Some solutions are targeted for different purposes and appear incompatible with other solutions. As a result, users find that no single solution meets all their needs and fear becoming limited by the solution they have implemented should their needs change. They therefore want a single solution that meets all their information sharing needs.

Oracle Streams

Oracle9i has provided a variety of information sharing features, including Oracle Advanced Queuing, Advanced Replication, Change Data Capture, and Data Guard. These features provide targeted yet overlapping functionality and are based on different underlying technologies. The Oracle9i Database release 2, however, introduces a new information sharing feature, **Oracle Streams**. Oracle Streams enables entire new classes of applications and, in a single solution, satisfies the data movement, transaction propagation, and event management needs of most users. Furthermore, should needs change, Oracle Streams can be adapted to meet your requirements.

Oracle Streams enables the propagation of data, transactions and events in a data stream, either within a database or from one database to another. The stream routes published information to subscribed destinations. This provides the functionality and flexibility to capture and to manage events and then to share those events with other databases and applications in a manner that exceeds the capabilities of traditional information sharing solutions. Oracle Streams allows you to break the cycle of trading off one solution against another and provides you with the

capabilities needed to build and operate distributed enterprises and applications, data warehouses, and high availability solutions. You can utilize all the capabilities of Oracle Streams simultaneously and, if needs change, you can implement a new capability of Oracle Streams without sacrificing existing capabilities.

Oracle Streams provides a set of elements to enable you to control the following:

- How information is placed into a stream
- How the stream is routed from node to node
- What happens to events in the stream as they flow into each node
- How the stream terminates

You can also address specific requirements by specifying the configuration of the elements acting on the stream.

The architecture of Oracle Streams is very flexible. Streams contains the following three basic elements:

- [Capturing Events](#)
- [Staging and Propagating Events](#)
- [Applying Events](#)

Capturing Events

Streams supports capture of events (database changes and application generated events) into a queue in two ways. On the one hand, implicit capture enables the server to capture DML and DDL events at a source database. On the other hand, user enqueued events allow for more flexibility by allowing applications to explicitly generate events and place them in a queue.

A fundamental distinguishing feature of Oracle Streams is support for log-based change capture. Capturing changes directly from the redo log files minimizes system overhead, while log-based capture leverages the fact that changes made to tables are logged to guarantee recoverability in the event of a crash or media failure. Oracle9i can read, analyze, and interpret redo information about the history of activity on a database. Oracle9i release 2 can mine the information and deliver change data to the capture process. Users can specify supplemental logging to log additional information into the redo stream—such as primary key columns—to facilitate the delivery of this information. The capture process retrieves change data extracted from the redo log, formats it into a logical change record (LCR), and places it in a queue for further processing. The capture process can intelligently

filter LCRs based upon defined rules so that only the specified types of changes to desired objects are captured.

Staging and Propagating Events

Once captured, events are placed in a queue. The queue provides a service to store and manage captured events. Changes to database tables are formatted as logical change records (LCRs), and then stored in a queue until they are applied or propagated to another queue. LCR staging provides a holding area with security, as well as auditing and tracking of LCR data.

Applying Events

Subscribers examine the contents of the queue and determine whether or not they have an interest in an event. A subscriber can be a user application, another queue—usually on another system—or an apply process. The subscriber can optionally evaluate a set of rules to determine whether or not the event meets the criteria listed in the subscription. If so, then the event will be consumed by the subscriber.

If the subscriber is a user application, then the application will dequeue the event from the queue in order to consume the event. If the subscriber is another queue, then the event will be propagated to that queue. If the subscriber is the default apply process, then the event will be dequeued and applied by the apply process.

Oracle Streams includes a flexible apply process that enables a default or custom apply function. A custom apply sends an event to a user-created PL/SQL procedure for processing. This enables data to be transformed when necessary. Support for explicit dequeue allows application developers to use Oracle Streams to notify applications of changes to data while still leveraging the change capture and propagation features of Oracle Streams.

Open Standards Oracle Streams is an open information sharing solution. Each element supports industry standard languages and standards. Streams supports capture and apply from Oracle to non-Oracle systems. Changes can be applied to a non-Oracle system by means of an Oracle transparent gateway or by generic connectivity, both of which allow an Oracle database to communicate with and apply changes to a non-Oracle data system. Streams also includes an application programming interface to allow non-Oracle data sources to easily submit or receive change records, allowing for heterogeneous data movement in both directions. In addition, events can be sent to and received from other event queuing systems such as MQSeries and TIBCO through the Message Gateway.

Conclusion

The current release of Oracle9i provides many powerful features to share information between databases, users, and applications. In addition to established features like Advanced Queuing, Advanced Replication, and Data Guard, Streams can now be used to satisfy the most demanding information sharing requirements using a common infrastructure. Complex distributed environments will benefit from a single solution to simplify their information sharing solutions. Simple distributed environments will benefit in the knowledge they can expand their environment as their needs change without having to learn and integrate new products. The result of this is that developers and administrators can spend less time wrestling with their tools and more time providing solutions.

See Also: *Oracle9i Streams.*

Business Intelligence

Oracle9i release 2 continues to challenge the competition by providing the best platform support for business intelligence in medium to large scale enterprises. Oracle9i technology focuses especially on the challenges raised by the large volume of data and the need for near real time complex analysis in an Internet-enabled environment.

Key enhancements in Oracle9i include the following:

- [Oracle OLAP Option Enhancements](#)
- [Scalability for Business Intelligence](#)

Oracle OLAP Option Enhancements

With the Oracle OLAP (Online Analytical Processing) Option for the database, Oracle9i challenges the traditional view of analytic servers by making an integrated, relational-multidimensional database available that is fully integrated into the Oracle9i relational database system. This technology eliminates the trade-off between manageability on the one hand and performance and analytic power on the other. Furthermore, it reduces the cost of maintaining data, while it retains excellent performance and support for complex analytical queries. Oracle9i is the only database to provide access to both relational and multidimensional data through SQL or an OLAP API. Any OLAP value calculation can be queried by SQL and the Oracle OLAP functionality provides a complete set of analytic functions through a powerful OLAP API, multidimensional engine, and OLAP data manipulation language (DML). Because OLAP technology is part of a single

database process, it is characterized by the same scalability and reliability benefit as the Oracle database process, and, because of this integration, it includes support for Real Application Clusters and Data Guard

See Also: *Oracle9i OLAP User's Guide*

Scalability for Business Intelligence

As in previous database releases, the Oracle9i Database release 2 provides important new technological advances scalability for business intelligence.

Key enhancements in Oracle9i include the following:

- [Partitioning Capabilities](#)
- [Integrated Relational-Multidimensional Database Capabilities](#)
- [Extended Data Mining Capabilities](#)
- [Range-List Partitioning](#)
- [Partitioning Enhancements](#)
- [Parallel DML on Nonpartitioned Tables](#)
- [Summary Advisor Enhancements](#)
- [Materialized View Enhancements](#)
- [Data Segment Compression](#)
- [Query Rewrite Enhancements](#)

Partitioning Capabilities

Partitioning capabilities in Oracle9i release 2 have been expanded to support composite range-list partitioning. This makes it much easier to perform rolling window operations on a list of partitions by partitioning by a range of values—for example, a month—with a subpartition with a list value. It is also easy to perform data maintenance operations—for example, backups by geographic region by month. Furthermore, list partitioning now supports the concept of a **default** partition, so that, if a data row does not conform to the designated list of values, then the data row can be placed in a default partition instead of being rejected and generating an error. This means that applications no longer need to contain code to handle exception cases.

In addition, parallel data manipulation language (DML) is now supported on nonpartitioned data tables, greatly enhancing the performance of a large update operation.

Integrated Relational-Multidimensional Database Capabilities

The Oracle9i Database release 2 also provides important new functionality in Online Analytical Processing (OLAP) and Data Mining.

All Data Stored in Oracle Data Files In Oracle9i, all data—both relational and multidimensional—is stored in Oracle data files. This means that there are no separate multidimensional files to manage and administer. Additionally, a new data compression capability is leveraged by Oracle OLAP for further disk space savings.

Data Mining Since the Oracle9i Database release 2 is designed to be a full data warehouse platform, you can leverage the database as the scalable data engine for all operations on data warehousing data.

Extended Data Mining Capabilities

Oracle9i provides a data mining engine that enables customers to incorporate accurate, real-time recommendations into their online operations to integrate data mining more tightly with the relational database.

Range-List Partitioning

You can now subpartition range-partitioned tables by list.

Partitioning Enhancements

You can now simplify the syntax for list partitions by using a `DEFAULT` partition. You can implement `SPLIT` operations more easily.

Parallel DML on Nonpartitioned Tables

You can now use parallel DML on nonpartitioned tables.

Summary Advisor Enhancements

The Summary Advisor tool and its related `DBMS_OLAP` package were improved so you can restrict workloads to a specific schema.

Materialized View Enhancements

You can now nest materialized views when the materialized view contains joins and aggregates. Fast refresh is now possible on materialized views containing the `UNION ALL` operator. Various restrictions were removed, while the number of situations in which materialized views could be effectively used was expanded. In particular, using materialized views in an OLAP environment is improved.

Data Segment Compression

You can compress data segments in heap-organized tables, and a typical example of heap organized tables you should consider for data segment compression is partitioned tables. Data segment compression is also useful for highly redundant data, such as tables with many foreign keys and materialized views created with the `ROLLUP` clause. You should avoid compression on tables with many updates or DML.

Query Rewrite Enhancements

Text match processing and join equivalence recognition have been improved. Materialized views containing the `UNION ALL` operator can now use query rewrite

See Also: *Oracle9i Data Warehousing Guide*

Security and Directory

Security for Oracle9i release 2 has been enhanced by the addition of the following new features:

- [SYS Accountability](#)
- [DBA GRANT/REVOKE of Object Privileges](#)
- [Password for Users SYS and SYSTEM at Database Creation](#)
- [Enterprise User Security: Simplified User Setup and Administration](#)
- [Enterprise User Security: User Migration Utility](#)
- [Support for Advanced Encryption Standard \(AES\)](#)
- [Strong Authentication: Support for RADIUS Authorizations](#)
- [Public Key Infrastructure: SSL Hardware Acceleration](#)
- [Directory Naming Access Control in Oracle Net Services](#)
- [Oracle Label Security: Releasabilities](#)

SYS Accountability

Heightened user accountability and database security are now possible with the capability to audit all operations done by user SYS (includes all AS SYSDBA and AS SYSOPER connections).

DBA GRANT/REVOKE of Object Privileges

Improved security functionality allows the database administrator to grant or revoke object privileges on the objects of another user.

Password for Users SYS and SYSTEM at Database Creation

Passwords for the users SYS and SYSTEM can now be set using a clause in the CREATE DATABASE statement. This provides for greater database security by eliminating the use of the commonly known default Oracle passwords for these accounts.

See Also: *Oracle9i Security Overview*

Enterprise User Security: Simplified User Setup and Administration

Oracle Advanced Security has made enterprise user security easier to use and has simplified enterprise user setup and administration. Password-based enterprise user security reduces the huge overhead of managing not only the users, but also eliminates certificate administration overhead, thereby reducing the time and costs involved in user administration. This release is particularly useful for large user communities accessing multiple applications in a heterogeneous environment using password-base authentication. In addition, applications that use prior versions of Oracle Database client software can take advantage of this feature without code modification or any upgrade activities on the client. Because users and their credentials are stored in the Oracle internet Directory, they enjoy the same level of protection and security as when they were stored in the database.

Enterprise User Security: User Migration Utility

In this release, user administration is further simplified with the user migration utility. It allows administrators to migrate users defined in the database to Oracle Internet Directory. These migrated users are now referred to as "password authenticated enterprise users." The administrators and the end users enjoy the benefits of centralized user management and single password login to the database.

See Also:

- *Oracle9i Security Overview*
- *Oracle Advanced Security Administrator's Guide*

Support for Advanced Encryption Standard (AES)

Advanced Encryption Standard (AES) is a new Federal Information Processing Standard (FIPS) that all U.S. government organizations can use to protect sensitive information. With this release, all government agencies and businesses can leverage the strength of AES to protect sensitive information on the network.

Strong Authentication: Support for RADIUS Authorizations

Support for external RADIUS authorizations in addition to the database roles for a RADIUS user connecting to an Oracle database is new in this release.

Public Key Infrastructure: SSL Hardware Acceleration

In this release, the Oracle Advanced Security option allows enterprises to delegate complex public key cryptographic operations to hardware accelerator devices to speed up SSL transactions.

See Also: *Oracle Advanced Security Administrator's Guide*

Directory Naming Access Control in Oracle Net Services

Directory naming is a naming method that resolves a database service, net service name, or net service alias to a connect descriptor stored in a central directory server. With Oracle9i, a directory server provides central administration of directory naming objects, reducing the work effort associated with adding or relocating services.

See Also: *Oracle9i Net Services Administrator's Guide*

Oracle Label Security: Releasabilities

Oracle9i release 2 Label Security introduces inverse groups to indicate releasability of information. When you add an inverse group to a data label, the data becomes less classified. For example, a user with the inverse groups UK, US cannot access data which only has inverse group UK. Adding US to that data makes it accessible to all users with the inverse groups UK, US.

For data to be accessible to a user, the data releasabilities must dominate the releasabilities assigned to the user. In other words, releasabilities assigned to a data record must contain all the releasabilities assigned to a user.

See Also:

- *Oracle9i Security Overview*
- *Oracle Label Security Administrator's Guide*

Internet Content Management

Oracle9i allows customers to store, manage and aggregate all types of multimedia content into a single database. Oracle9i significantly enhances the capabilities of the database to serve as a platform to create, manage, and deliver internet content.

Key enhancements in Oracle9i include the following:

- [Storage, Management, and Aggregation of All Types of Content](#)
- [Oracle Spatial](#)

Storage, Management, and Aggregation of All Types of Content

Files Online, the upgraded Internet File System in the current release of Oracle9i, provides users with a brand new interface and general user experience for Internet File System. This new user interface, tested over two years of running very large Internet File System installations, makes it simple for literally thousands of users to store, collaborate on and publish content with a single Internet File System instance.

Key enhancements in Oracle9i include the following:

- [Internet Files System Improvements](#)
- [Database Content Management Platform Improvements](#)

Internet Files System Improvements

Improvements in Internet Files System for the current release of Oracle9i include the following new features:

Single File Restore Single File Restore enables administrators to recover individual files and folders that have been mistakenly deleted.

Workflow Workflow enables users to route and approve documents through Oracle Workflow. With Oracle9i Internet File Systems, developers can build Oracle Workflow into their applications.

Application Plug-Ins Application plug-ins allow users to access Oracle Internet File System with Microsoft Office applications.

Database Content Management Platform Improvements

Additionally, the current release of Oracle9i expands the content management platform that is part of the database. Improvements and new capabilities for content management include the following new features:

Internet File System User Interface A new look and feel for Oracle Internet File System is based on an Oracle9i Internet File System used by thousands of Oracle employees

Oracle Text Improvements Improvements to Oracle Text enhance its manageability and scalability with new features to support XML searching

Format Support by *interMedia* AVI and Improved Image Processing Performance. New formats are supported by *interMedia* AVI with improved image processing performance

Oracle Spatial Improvements Oracle Spatial performance improvements

New XML Processing Capabilities New XML processing capabilities within the database with the brand new technology of Oracle XML DB

These built-in self service capabilities reduce overall administrative costs as well as the cost of storing content on file servers. Instead of requiring many disparate servers, these capabilities consolidate all the content into one Oracle9i system. This results in a tremendous cost savings because you eliminate the necessity of having many separate servers.

See Also:

- *Oracle 9iFS* documentation
- *Oracle interMedia User's Guide and Reference*
- *Oracle Text Reference*

Oracle Spatial

Oracle Spatial allows database users to index and store spatial data and to develop spatial applications.

Key enhancements in Oracle9i include the following:

- [Validation with Context](#)
- [SDO_CS.VIEWPORT_TRANSFORM to_sname Parameter Not Supported](#)
- [Utility Functions](#)
- [Partitioned Spatial Indexes: Splitting and Merging Supported](#)
- [Partitioned Spatial Indexes: Exchanging Partitions Including Indexes](#)
- [Exchanging Partitions Including Indexes](#)
- [Parallel Index Creation and Rebuilding](#)
- [Deferred Modifications to an Index](#)

Validation with Context

You can now validate a geometry or a layer and obtain additional information about the context (the coordinate, edge, or ring) that causes any geometry to be invalid.

SDO_GEOM.VALIDATE_GEOMETRY_WITH_CONTEXT function The new `SDO_GEOM.VALIDATE_GEOMETRY_WITH_CONTEXT` function performs the same checks as the `SDO_GEOM.VALIDATE_GEOMETRY` function and includes context information if the geometry is not valid.

SDO_GEOM.VALIDATE_LAYER_WITH_CONTEXT The new `SDO_GEOM.VALIDATE_LAYER_WITH_CONTEXT` procedure performs the same checks as the `SDO_GEOM.VALIDATE_LAYER` procedure, but also includes context information about any invalid geometries.

Note: The `SDO_GEOM.VALIDATE_GEOMETRY` function and the `SDO_GEOM.VALIDATE_LAYER` procedure are deprecated and will not be supported in future releases of Oracle Spatial. Because of this, you are encouraged to switch to the new interfaces.

SDO_CS.VIEWPORT_TRANSFORM to_sname Parameter Not Supported

The `SDO_CS.VIEWPORT_TRANSFORM` function format with the `to_sname` parameter, which was supported in the previous release, is no longer supported. Because of this, you must use the format with the `to_srid` parameter.

Utility Functions

A new Spatial utility package, `SDO_UTIL`, is provided, with the following functions.

SDO_UTIL.EXTRACT The `SDO_UTIL.EXTRACT` function returns the geometry that represents a specified element (and optionally a ring) of the input geometry.

SDO_UTIL.GETVERTICES The `SDO_UTIL.GETVERTICES` function returns the coordinates of the vertices of the input geometry.

Partitioned Spatial Indexes: Splitting and Merging Supported

`ALTER TABLE` partitioning statements for splitting and merging partitions, which were not supported in the previous release, are now supported.

Partitioned Spatial Indexes: Exchanging Partitions Including Indexes

You can use the `ALTER TABLE` statement with the `EXCHANGE PARTITION . . . INCLUDING INDEXES` clause to exchange a spatial table partition and its index partition with a corresponding table and its index. In the previous release of Oracle Spatial, this operation resulted in an error.

Exchanging Partitions Including Indexes

You can use the `ALTER TABLE` statement with the `EXCHANGE PARTITION . . . INCLUDING INDEXES` clause to exchange a spatial table partition and its index partition with a corresponding table and its index. In the previous release of Oracle Spatial, this operation caused an error to be generated.

Parallel Index Creation and Rebuilding

Spatial indexes can now be created and rebuilt using parallel execution. The { `NOPARALLEL` | `PARALLEL [integer]` } option is supported for the `CREATE INDEX` and `ALTER INDEX REBUILD` statements.

Deferred Modifications to an Index

Modifications to a spatial index can be deferred until after spatial table `INSERT`, `UPDATE`, and `DELETE` operations are finished, and then the index can be synchronized with the table.

See Also: *Oracle Spatial User's Guide and Reference*

Application Development

Oracle9i continues to offer the best development platform for e-business and traditional application development.

Key enhancements in Oracle9i include the following:

- [Workspace Manager](#)
- [Multilevel Referential Integrity Support](#)
- [Oracle Spatial](#)
- [XML and XML DB](#)
- [Object Type Translator \(OTT\) Tags: Carrying Forward User Added Code](#)
- [Open Server-Side PL/SQL and Java Debugging](#)
- [Object Type Translator \(OTT\) Tags: Carrying Forward User Added Code](#)

Workspace Manager

Workspace management refers to the ability of the database to hold different versions of the same record—that is, row—in one or more workspaces. Users of the database can then change these versions independently.

Key enhancements in Oracle9i include the following:

- [DDL Support Related to Version-Enabled Tables](#)
- [Replication Support for Workspace Manager](#)
- [Migration Support Procedures](#)
- [Multilevel Referential Integrity Support](#)

DDL Support Related to Version-Enabled Tables

Some data definition language (DDL) operations are supported on version-enabled tables and on indexes and triggers that refer to version-enabled tables, subject to guidelines and restrictions. These new DDL operations include the following:

- `BeginDDL`
- `CommitDDL`
- `RollbackDDL`

Replication Support for Workspace Manager

Workspace Manager supports replication of all workspace-related entities—such as workspaces and savepoints, operations—such as `CreateWorkspace` and `MergeWorkspace`, and data manipulation language (DML) and DDL operations on version-enabled tables.

Workspace Manager includes the following new procedures for replication:

- `GenerateReplicationSupport`
- `DropReplicationSupport`
- `RelocateWriterSite`
- `SynchronizeSite`

The new `WM_REPLICATION_INFO` metadata view contains information about the Workspace Manager replication environment.

Migration Support Procedures

The following new procedures are available for recovering version-enabled tables left in an inconsistent state after a failed upgrade procedure:

- `RecoverMigratingTable`
- `RecoverAllMigratingTables`

Multilevel Referential Integrity Support

Multilevel referential integrity constraints are permitted on version-enabled tables.

See Also:

- *Oracle9i Application Developer's Guide - Workspace Manager*
- *Oracle9i SQL Reference*
- *Oracle9i Supplied PL/SQL Packages and Types Reference*
- *PL/SQL User's Guide and Reference*

XML and XML DB

XML has emerged as a key application technology in a number of areas. From its beginnings, XML's core characteristics of self description and ad-hoc extensibility have provided the flexibility needed to transport messages between various applications as well as loosely couple distributed business processes. XML is also language and platform independent, and as XML support has become standard in browsers, application servers and databases, enterprises are seeking to tie legacy applications to the Web with XML to transform various proprietary file and document exchange templates into XML.

More recently, a new generation of XML standards, such as XML Schema, have enabled an unified data model that can address both structured data and documents. XML Schema is a key innovation in managing both document content data with equal rigor by enabling documents marked up as XML to move into the database.

Because of these developments, XML use is proliferating in different applications. To include native XML support in a database for users who want to integrate the database with their applications that use XML would give them an enormous advantage over those who use other databases. Thus, for users who want to integrate their database with all their applications, the current release of the Oracle9i database includes Oracle XML DB, which is a set of built-in high-performance storage and retrieval technologies geared towards XML. Oracle XML DB fully absorbs the World-Wide-Web Consortium (W3C) XML data model into the Oracle server and provides new standard access methods for navigating and querying XML. It is important, however, to make clear that *XML DB is not separate from the Oracle9i database but is instead an evolution of the familiar Oracle database encompassing both SQL and XML data models in a highly interoperable manner that makes the XML support completely native*. The result is that with the Oracle9i database, you get the advantages of relational database technology and of XML technology both at once.

Key aspects of Oracle XML DB:

The key aspects of Oracle XML DB are listed as follows:

- Native XMLType helps you store and manipulate XML. Multiple storage options (CLOB, decomposed Object-Relational) are available with XMLType, and DBAs can choose one that meets their requirements for (i) fidelity to an original, (ii) ease of query, (iii) ease of regeneration, and so on.
- With XMLType, you can perform SQL operations (queries, OLAP functions) on XML data as well as XML operations (XPath searches, XSL transformations) on SQL data. Also, you can build regular SQL indexes or Oracle Text indexes on XMLType for high performance for a very broad spectrum of applications.
- Native XML generation provides built-in SQL operators and supplied PL/SQL packages to return the results of SQL queries formatted as XML.
- An XML Repository provides foldering, access control, FTP, and WebDAV protocol support with versioning-enabling applications to retain file abstraction when manipulating XML data.

Benefits of Oracle XML DB

Users manage structured data as tables on the one hand and unstructured data as files or BLOBs on the other. As a result, users must subject their applications to different paradigms for managing different kinds of data. Systems channel application development either down the unstructured path (making document access transparent but table access complex) or down the structured path (making document access complex and table access transparent). XML DB provides a unique ability to store and manage both structured and unstructured data, under a standard W3C XML data model (i.e. XML Schema.). XML DB provides complete transparency and interchangeability between the XML and SQL metaphors. You can perform XML operations over table data and SQL operations over XML documents. This opens up the database for a new class of XML-shaped content.

XML DB provides valuable Repository functionality—foldering, access control, FTP and WebDAV protocol support with versioning—which enables applications to retain the file abstraction when manipulating XML data brought into Oracle.

Users face a performance barrier in storing and retrieving complex XML. However, XML DB helps them to overcome this barrier by providing very high performance and scalability for XML operations. This is accomplished by a number of specific optimizations that relate to XML-specific data-caching and memory management, query optimization on XML, special hierarchical indexes on the XML Repository, and so on.

XML DB provides better management of unstructured XML data with the following features:

- Piecewise updates,
- XML indexing
- Integrated XML Text search
- Multiple views on the data, including relational views for SQL access
- Enforcing intra-document and inter document relationships in XML documents

XML DB enables data and documents from disparate systems to be accessed (e.g. through Oracle Gateways and External Tables) and combined into a standard data model. This integrative aspect reduces the complexity of developing applications that must deal with data from different stores

Oracle XML DB Features

Here are the key features of Oracle XML DB, and some of the things you can do with these features.

- [XMLType](#)
- [XML Generation](#)
- [XML Repository](#)
- [Advantages of Oracle XML DB](#)
- [XDK](#)

XMLType

XML Schema support: Create tables and types are automatically given a W3C standard XML Schema extending the normal SQL data definition language (DDL). This means you have a standard data model for all your data, both structured and unstructured, and can use the database to enforce this data model.

XML Schema storage with DOM fidelity: Use Object-Relational columns, VARRAYs, nested tables, and LOBs to store any element or Element-subtree in your XML Schema while still maintaining DOM fidelity (DOM retrieved == DOM stored). By DOM fidelity, your programs can manipulate exactly the same XML data that you

received and the process of storage does not mix up the order of elements, name spaces, and so forth.

Note: If you choose the CLOB storage that is available with XMLType, you can retain whitespaces in your data.

XML Piecewise Update: Use XPath to specify individual elements and attributes of your document during updates, without rewriting the entire document. This is more efficient than the alternatives, especially for large XML documents.

XPath Search: Specify elements to query against via XPath, and then use SQL operators on these elements to combine the best of SQL and XML.

Lazy XML Load: XMLType provides a virtual DOM; it only loads rows of data as they are requested, discarding previously-referenced sections of the document if memory usage grows too large (via a LRU cache.) You can use this for high scalability when many concurrent users are working with large XML documents.

XML Views: Create XML views to create permanent aggregations of various XML document fragments or relational tables. This means you can create your own efficient representations of XML.

Java Beans Interface: XML DB provides a Java Beans Interface for fast access to structured XML data, with extensions that save only those parts that have been modified in memory. This way, you can get static access to XML as well as dynamic (i.e. DOM) access.

Schema Caching: XML DB keeps structural information (such as element tags, datatypes, and storage location) in a special schema cache, to minimize access time and storage costs.

XML Generation

XML Operators: New operators such as XMLTABLE (to cast a list of nodes returned by XPath into a table) and XMLELEMENT (to create XML elements on the fly) make XML queries and on-the-fly XML generation easy and make the SQL and XML metaphors interoperable.

XSL Transformations for XMLType: Use an XSLT to transform XML documents with a SQL operator for database-resident, high-performance XSL transformations.

XML Repository

Access Control Lists (ACLs): Create high-performance access control lists for any XMLType object, and define your own privileges in addition to the system-defined ones for fine-grained security on XMLType.

Folding: Enable folders to map resources (XML files) into database structures and enable hierarchy traversal; also, use XMLTypes or views to map rows into URLs (with ALTER TABLE ENABLE FOLDING), providing access control, modification date tracking, and other metadata management for those rows.

WebDAV and FTP Access: Access any foldered XMLType row with WebDAV and FTP (Note that XMLType can manage arbitrary binary data as well, including any file format).

SQL Repository Search: Operators like UNDER_PATH and DEPTH, allow applications to search folders, file metadata like owner and creation date, as well as file contents via SQL, and enable the SQL optimizer to choose the best execution plan.

Hierarchical Index: XML DB provides a special hierarchical index to speed pathname resolution and folder search. Additionally, you can automatically map hierarchical data in relational tables into folders (where the hierarchy is defined by existing relational information, like the current CONNECT BY uses.)

HTTP Access: Users manipulating XML data in the Oracle server can use the servlet API to process XML by means of Java.

Advantages of Oracle XML DB

In the absence of strong database support for XML, many users have leaned towards file-storage or unstructured storage of XML. If you store XML data in files or CLOBs, you are not exploiting several key capabilities of databases.

- a. **Indexing and Search:** Real applications need to do queries like "find me all of the product definitions created between March & April 2000," a query that is typically supported by a BTREE index on a date column. This type of query is why most content management servers need to use an RDBMS, since even document metadata requires BTREE indexes. Content management servers have proprietary query APIs to handle this problem, whereas XML DB enables efficient structured search over XML data using standard SQL and XPath.

- b. Updates & Transaction Processing:** Today's commercial databases enable fast updates of subparts of a record, with minimal contention between users trying to update. As traditionally document-centric data becomes more structured (via XML), this requirement gains in importance. File- or CLOB-storage cannot provide the granular concurrency control that XML DB does.
- c. Managing Relationships:** Data with any structure will typically have some type of foreign key constraint. Currently, XML data stores lack this feature, so you must implement these in application code. XML DB enables you to constrain XML data to XML schemas and thus achieve the control over relationships that structured data has always enjoyed.
- d. Multiple Views of Data:** Most enterprise applications need to group data together in different ways for different modules. This is why relational views are necessary -- to allow for these multiple ways to combine data. By allowing views on XML, XML DB allows you to create different logical abstractions on XML.
- e. Performance and Scalability:** People expect data storage, retrieval, and query to be fast. Loading a file or CLOB and parsing is much slower than relational data access. XML DB dramatically speeds up XML storage and retrieval.
- f. Ease of Development:** Databases are primarily an application platform that provides standard, easy ways to manipulate, transform and modify individual data elements. While XML parsers give read access to XML data in a standard way, they don't provide an easy way to modify individual XML elements and store them. XML DB supports a number of standard ways to store and retrieve data, including XML Schema, XPath, DOM, and Java Beans. However, if the drawbacks of XML file storage are forcing you to break down XML into database tables and columns, there are several advantages of XML you are leaving on the table.
- g. Structure Independence:** The open content model of XML cannot be captured easily in the pure tables-and-columns world. XML Schema allows global element declarations (not just scoped to a container), so that you can find a particular data item regardless of where in the XML document it moves to as your application evolves.
- h. Storage Independence:** When you use relational design, your client programs need to know where your data is stored, and in what format, what table, and what the relationships are between those tables. XML Schema allows you to write applications without that knowledge, and

allow the DBA to map structured data to physical table and column storage.

- i. **Ease of Presentation:** XML is understood by browsers, many popular desktop authoring tools, and most internet applications, as a native capability. Relational data isn't generally accessible directly from applications, but requires programming. XML DB allows you to store data as XML and pump it out as XML, requiring negligible programming to display XML content stored in your database.
- j. **Ease of Interchange:** XML is the language business is using to talk to business. If you are forced to store XML into an arbitrary table structure, you are living with some sort of proprietary translation. Whenever you translate a language, information is lost, so interchange suffers. By natively understanding XML and providing DOM fidelity in the storage/retrieval process, XML DB enables clean interchange.

XDK

Complementing the XML Database is the Oracle XML Developer Kit, or XDK -- a set of commonly used building blocks or utilities for development and runtime support. The Oracle XML Developer's Kits (XDK) contain the basic building blocks for reading, manipulating, transforming and viewing XML documents. To provide a broad variety of deployment options, the Oracle XDKs are available for Java, JavaBeans, C, C++ and PL/SQL. Oracle XDKs consist of XML Parsers, an XSLT Processor, XML Schema Processor, XML Class Generator, XML Transviewer Java Beans, XML SQL Utility, XSQL Servlet. Release 9.2 XDK brings these components up-to-date with the latest standards

See Also: *Oracle9i XML Database Developer's Guide - Oracle XML DB*

Open Server-Side PL/SQL and Java Debugging

The Oracle9i Database provides JSWP-compliant debugging of Java and PL/SQL in the database, with debugging from any JDB-compliant tool—for example, JDeveloper (IASV2). It also provide Unicode 3.1 standard support along with NCHAR types and character semantics supported with object types. BFILEs also support Unicode character sets.

Key enhancements in Oracle9i include the following:

- [JDK 1.3 Support](#)

- [Character Length Semantics](#)
- [Type Synonyms](#)
- [User-defined Constructors](#)
- [NCHAR Datatypes](#)
- [Integrated PL/SQL and Java Debugging](#)

JDK 1.3 Support

The Oracle9i Database Java Virtual Machine has been brought to JDK 1.3.1 compliance. It now has JDBC support for the `TIMESTAMP` datatype and for statement pooling. It also provides thin JDBC support for PL/SQL index tables, `NUMBER` conversion routines, and optimized statement execution time. It has implemented all Java methods for `NUMBER` and `DATE` and has J2EE 1.3 compliance for Oracle JMS. SQLJ improvements include `TIMESTAMP`, specific data sources, and offline parsing. Java publishing improvements include the `LOADJAVA` capability.

Character Length Semantics

Lengths for character types `CHAR` and `VARCHAR2` may be specified as a number of characters, instead of bytes, in object attributes and collections, even if some of the characters consist of multiple bytes.

Like `CHAR` and `VARCHAR2`, `NCHAR` and `NVARCHAR2` may also be used as attribute types in objects and collections. These types are always implicitly measured in terms of characters, so no `char` qualifier is used.

For `CHAR` and `VARCHAR2` attributes whose length is specified without a `CHAR` qualifier, the default unit of measure is determined by whether the `NLS_LENGTH_SEMANTICS` initialization parameter is set to `CHAR` or `BYTE`.

Type Synonyms

Synonyms can be defined for user-defined types so that a type can be used without having to qualify its name with the name of the schema in which the type was defined.

User-defined Constructors

User-defined constructor functions make possible custom initialization of newly created object instances. They also make it possible to evolve a type without having to update calls to constructors in existing code to accommodate a newly added attribute.

NCHAR Datatypes

Object types now support NCHAR datatypes and character semantics.

Integrated PL/SQL and Java Debugging

Integrated PL/SQL and Java debugging has been designed for all deployment scenarios, with the initial support for JDeveloper and JDB built on top of standard JDWP protocol. This multi-language debugging functionality has the following features:

- PL/SQL Associative Arrays to replace large volumes of sort/search code significantly faster than explicitly coded hash.
- Collection/Record Performance improvements.
- Faster string operations under UTF8.
- Insert/Update using a whole record.
- Bulk operation on table of record.
- Schema independence.
- Shorter code for common cases.
- Enhancements to the UTL_FILE package.

See Also: *Oracle9i Java Developer's Guide.*

Object Type Translator (OTT) Tags: Carrying Forward User Added Code

To extend the functionality of OTT generated code, at times programmers may want to add code in the OTT generated file. The way OTT can distinguish between OTT generated code and code added by the user is by looking for some predefined markers (tags). Support for these tags has been added in the Oracle9i database release 2 (9.2) database.

See Also: *Oracle Call Interface Programmer's Guide*

Windows Integration

Oracle9i continues to lead as the platform of choice for organizations deploying on the Windows operating system.

Integration Capabilities

Oracle9i release 2 (9.2) supports the following:

- The Microsoft .Net environment with OLE DB .Net and ODBC .Net compliance
- Improvements in the OLE DB driver to provide better performance by reducing the number of round trips to the database and by caching metadata for improved query performance

These underlying improvements provide performance benefits for ADO, ADO .Net, and OLE DB .Net. With support for both OLE DB .Net and ODBC .Net, Oracle9i release 2 can participate fully in a Microsoft .Net environment while providing the highest possible scalability and availability.

Additionally, the Oracle9i Database provides support with Oracle Fail Safe for the Microsoft Cluster Server environment. Oracle9i release 2 Fail Safe provides support for Data Guard (both physical and logical standby databases) and multi-clusters management.

Oracle9i supports several versions of Microsoft Windows, including Windows XP, Windows 2000 and Windows NT.

See Also:

- *Oracle9i Security and Network Integration Guide*
- *Oracle Services for Microsoft Transaction Server Developer's Guide*
- *Oracle Provider for OLE DB Developer's Guide*
- *Oracle Objects for OLE*
- *Oracle Objects for OLE C++ Class Library*
- *Oracle COM Automation Feature Developer's Guide*

Oracle9i Database Release 1 (9.0.1) New Features

The Oracle9i Database contains important new features that make it possible for users to maximize the usefulness of traditional business applications, facilitate critical competitive advantages for Internet-based business, and foster growth in the emerging hosted application market. These new features include new transparent, rapid growth clustering capabilities along with powerful and cost-effective security measures, zero-data-loss safeguards, and real-time intelligence, all to deliver the power needed in today's dynamic marketplace.

This chapter discusses features new to the Oracle9i database release 1 (9.0.1). This chapter is organized to introduce new features listed in accordance with the following themes:

- [Development Platform](#)
- [Internet Content Management](#)
- [Availability](#)
- [Manageability](#)
- [Business Intelligence](#)
- [Scalability and Performance](#)
- [Database Security](#)
- [Windows Integration](#)
- [Information Integration](#)
- [Packaged Applications](#)

Development Platform

Oracle9i continues to offer the best development platform for e-business and traditional application development. Key focus areas include the following:

- [Enterprise Java Engine](#)
- [New Extended Markup Language \(XML\) Features in the Server](#)
- [Oracle XML Developer's Kit](#)
- [SQL and PL/SQL Improvements](#)

Enterprise Java Engine

Oracle9i JVM (previously JServer) extends its support for Java 2 Enterprise Edition application programming interfaces (APIs) and containers by means of the following new features:

- A robust base architecture including session-based, optimized process and memory management and Unicode support
- A comprehensive set of infrastructure services, including JNDI, JTA, Java 2 Security, JMS, RMI/IIOP, and Persistence
- A Servlet 2.2-compliant Oracle Servlet Engine, and a JavaServer Pages 1.1-compliant OracleJSP Engine, for assembling Web components
- A comprehensive CORBA and EJB architecture including support for Entity EJB, XML deployment descriptors and a persistence service interface for CMP-EJB for e-business processes and components development
- A comprehensive set of JDBC 2.0 drivers, including an OCI client driver, a 100% Java thin driver, a server-side driver and an ultra thin client-side proxy driver, and an ANSI ISO-compliant SQLJ translator and optimized Java stored procedures support for data access and management
- A native Java bytecode Accelerator and Memory profiler for deployment performance

Note: The Oracle9i JVM embedded in both Oracle9i and Oracle iAS allows for reliable, flexible, scalable, and secure e-business applications deployment.

See Also: *Oracle9i Java Developer's Guide.*

New Extended Markup Language (XML) Features in the Server

Extensible Markup Language (XML) is designed to improve the functionality of the Web by providing more flexible and adaptable information identification. It is called extensible because it is not a fixed format like HTML (a single, predefined markup language). Instead, XML is actually a meta-language—that is, a language for describing other languages—which lets you design your own customized markup languages for limitlessly different types of documents.

Key enhancements in Oracle9i include the following:

[XMLType](#)

[XML Generation](#)

[Arrive Data Types](#)

XMLType

XMLType natively stores XML content and allows XML operations to be run from SQL.

XMLType enables non-native XML data to be treated as XML by allowing users to create an XML view over standard database tables, documents, or web content. Thus, the same high-performance access to XML data is available whether data is natively XML or is an artifact generated from existing data.

XML Generation

To more efficiently generate XML in bulk from a database, XML generation capabilities have been moved into the database and application server kernels and have been made available as built-in SQL operators. The kernel proximity of these operators ensures massively sustainable throughputs that are large enough to meet the processing demands of the largest content repositories or the busiest exchanges.

Arrive Data Types

A universal content model for all kinds of data and documents can be created through a set of native Arrive data types, which can hold references to XML documents or fragments either inside or outside the database. Just as applications locate HTML files using a uniform resource locator (URL), a set of native Arrive data types can locate native or generated XML content inside or outside of the database. Universal resource identifier references play a major role in creating database-backed content repositories, which in turn can be used to feed portals, archives, or other content management systems.

See Also: *Oracle9i XML Database Developer's Guide - Oracle XML DB*

Oracle XML Developer's Kit

Oracle9i features several enhanced database operations to store XML using SQL and to render traditional database data as XML. These functionalities are required to support business-to-business and business-to-customer e-business, packaged applications, and internet content management. The main area of XML support in Oracle9i is built-in XML Developer Kits (XDKs).

With pre-loaded Java and the C XDK linked into Oracle9i, developers are easily able to access World-Wide-Web Consortium (W3C) functionalities that generate, manipulate, render, and store XML-formatted data in Oracle9i. Also available in PL/SQL and C++, XML developer kits provide XML/XSLT parsers, XML schema processors, XML Class Generators, XML Transviewer Beans, and the XSQL Servlet to allow developers to quickly enable their applications for XML.

See Also:

- *Oracle9i XML Developer's Kits Guide - XDK*
- *Oracle9i XML API Reference - XDK and Oracle XML DB*

SQL and PL/SQL Improvements

SQL and PL/SQL have continued to be improved in Oracle9i to meet current development requirements.

- Multi-language server side debugging has been added, allowing integrated development environments to debug both Java and PL/SQL within the same framework.
- Support for inheritance and multilevel collections completes the modeling capabilities of the object-relational subsystem in Oracle9i, making it possible to build complex models inside the database. In addition, Oracle9i supports type evolution by means of which certain changes may be made to object types even if instances of the object types already exist in the database. Both types of support make it easier to deploy complex applications in real-life environments.
- New ANSI requirements are also supported, including support for the CASE statement, ANSI-compliant joins, and reserved name versioning. To aid migration to Oracle9i from other databases, scrolling cursor support has been

added, and stored procedures can now return result sets that can be easily passed and pipelined between database and client side processes.

Key enhancements in Oracle9i include the following:

- [SQL Improvements](#)
- [User-Defined Aggregate Functions](#)
- [PL/SQL Improvements](#)
- [Generic and Transient Datatypes](#)
- [SQL Type Inheritance](#)
- [Object View Hierarchies](#)

SQL Improvements

The following datatypes are new for Oracle9i:

```
TIMESTAMP
TIMESTAMP WITH [LOCAL]TIME ZONE
INTERVAL YEAR TO MONTH
INTERVAL DAY TO SECOND
XMLType, native XML datatype
SYS.UriType, SYS.UriFactoryType
SYS.ANYType, SYS.AnyData, SYS.AnyDataSet
```

```
MDSYS.SDO_GEOMETRY, new spatial datatype
```

```
ORDSYS.ORDImage - media type
ORDSYS.ORDVideo - media type
ORDSYS.ORDAudio - media type
```

The following built-in SQL functions are new for Oracle9i:

```
ASCIISTR
BIN-TO-NUM
COALESCE
COMPOSE
CURRENT_DATE
CURRENT_TIMESTAMP
DBTIMEZONE
DECOMPOSE
EXISTSNODE
```

EXTRACT (datetime)
EXTRACT (XML)
FIRST
FROM_TZ
GROUP_ID
GROUPING_ID
LAST
LOCALTIMESTAMP
NULLIF
NUMTOYMINTERVAL
NUMTODSINTERVAL
PERCENTILE_CONT
PERCENTILE_DISC
RAWTONHEX
ROWIDTONCHAR
SESSIONTIMEZONE
SYS_CONNECT_BY_PATH
SYS_DBURIGEN
SYS_EXTRACT_UTC
SYS_XMLAGG
SYS_XMLGEN
SYSTIMESTAMP
TO_CHAR (character)
TO_CLOB
TO_DSINTERVAL
TO_TIMESTAMP
TO_TIMESTAMP_TZ
TO_YMINTERVAL
TREAT
TZ_OFFSET
UNISTR
WIDTH_BUCKET

The following built-in SQL expressions are new for Oracle9i:

datetime expressions
interval expressions
scalar subquery expressions

The following built-in SQL condition is new for Oracle9i:

IS OF type condition

The following top-level SQL statements are new for Oracle9i:

```
CREATE PFILE
CREATE SPFILE
MERGE
```

User-Defined Aggregate Functions

Custom aggregate functions can be defined for working with complex data.

See Also: *Oracle9i SQL Reference*

PL/SQL Improvements

Oracle9i includes a PL/SQL package, `DBMS_METADATA`, which provides interfaces for extracting complete definitions of database objects. The definitions can be expressed either as XML or as SQL data definition language (DDL). The following two styles of interface are provided:

- A flexible, sophisticated interface for programmatic control
- A simplified interface for ad hoc querying

Other technological advances to PL/SQL include the following new features:

- Integrated front-end for SQL compilation so that PL/SQL immediately supports all SQL syntax changes to embedded SQL.
- SQL parallel query mechanism that have been extended to stored procedures written in 3GL languages (including Java, external routines, and PL/SQL). Stored procedures can now incrementally return data to the calling SQL statement.
- Full support for ANSI-style `CASE` statements and expressions.
- Better support for computing-intensive applications with native compilation support
- More tightly integrated SQL and PL/SQL runtime engines for improved performance
- Reduced overhead for calling PL/SQL procedures from SQL
- Improved PL/SQL assistance in data conversion between `RAW` and numeric datatypes. The `UTL_RAW` package offers `CAST_TO_NUMBER`, `CAST_FROM_NUMBER`, `CAST_TO_BINARY_INTEGER`, and `CAST_FROM_BINARY_INTEGER`

See Also:

- *Oracle9i Supplied PL/SQL Packages and Types Reference*
- *PL/SQL User's Guide and Reference*

Generic and Transient Datatypes

External procedures can be given fields or parameters of a generic type that can contain values of any scalar or user-defined type, making it unnecessary to implement multiple versions of the same external procedure just to handle multiple datatypes.

See Also: *PL/SQL User's Guide and Reference*

SQL Type Inheritance

Specialized versions of user-defined types can be defined as subtypes in a SQL type hierarchy.

See Also: *Oracle9i SQL Reference.*

Object View Hierarchies

Hierarchies can be created of object views based on some or all of the types in a type hierarchy. Object view hierarchies simplify targeting a particular subtype (and perhaps its subtypes) in queries and other operations.

See Also: *Oracle9i Application Developer's Guide - Object-Relational Features*

Oracle Text

Oracle Text, formerly *interMedia* Text, includes the following new features to provide greater flexibility in building text query applications.

- Document Classification is a new index type that enables classification of an incoming stream of documents based on their content.
- Local Partitioned Index Support is used to create local partitioned indexes on partitioned text tables and rebuild partitioned indexes.
- New Korean Lexer continues to support indexing and querying of Korean text with a new Korean lexer.

- New Japanese Lexer continues to support indexing and querying of Japanese text with a new Japanese lexer.
- UTF-16 Auto-detection supports UTF-16 conversion to the database character set with charset and Inso filters.
- XML path searching can specify direct parentage in queries.
- CTX_OUTPUT PL/SQL Package has procedures that allow logging of index file with rowid information, which is useful in debugging an index operation.

See Also: *Oracle Text Reference*

Internet Content Management

Oracle9i allows customers to store, manage and aggregate all types of multimedia content into a single database by significantly enhancing the capabilities of the database to serve as a platform for creating, managing, and delivering internet content. Key focus areas include the following:

- [Storage, Management, and Aggregation of All Types of Content](#)
- [Efficient Searching and Indexing of All Types of Content](#)
- [Collaborative Projects](#)
- [Location-Enabled, Mobile-Ready Content](#)

Storage, Management, and Aggregation of All Types of Content

Oracle9i includes Internet File System (9iFS), a revolutionary extension to the Oracle Database. Providing the best of both relational database and file system functionalities, Internet File System delivers an out-of-the-box file system with built-in capabilities unavailable in other file systems. Oracle9i provides the following technological improvements over earlier versions of the Oracle Database:

- The Oracle9i Internet File System can store all content, from e-mail to Web content to word processing documents, in the same folders. End users can access this content through Windows, the Web, FTP, and an e-mail client without any special client installation.
- The Oracle9i Internet File System also provides content management features to better manage creation and publishing of file-based content such as the following:
 - Versioning

- Content-based searching using Oracle9i Text
- Multiple foldering of files
- Extensible file attributes
- ACL-based security
- Check-in and check-out capability

Oracle 9iFS exposes all of its capabilities through Java, making it an excellent platform for building applications with content management applications.

- Developers no longer need to spend time integrating disparate systems, building special protocol servers, and coding the same content management features over and over again.
- All the inner workings of the file system are available to developers for customization, including extensive XML processing capabilities.

Oracle9i includes enhancements to *interMedia* image, audio, and video support. Oracle9i greatly simplifies the ability to add multimedia formats, processing, and rendering by incorporating Java Advanced Imaging (JAI) into the database and providing support for the Java Media Framework (JMF) in *interMedia*. Also, *interMedia* now supports PNG and EXIF image formats.

A browser-based version of the clipboard supports insert, retrieve and annotate media objects in Oracle9i. Improvements to the image search capabilities and support for storage and delivery of streaming media with new streaming formats and plug-ins are also part of Oracle9i. In addition, *interMedia*'s audio, video, and image media processing services are now accessible in native form through relational PL/SQL and JAVA interfaces.

See Also:

- *Oracle 9iFS* documentation
- *Oracle interMedia User's Guide and Reference*

Efficient Searching and Indexing of All Types of Content

Oracle9i provides powerful Internet search facilities to extract and index metadata from rich content and to search XML and catalog structures. Now, all content in Oracle9i can be location-enabled and mobile-ready so that it can be searched and delivered according to from where the request is originating—such as mobile phone and internet personalization criteria—or its location association.

Key enhancements in Oracle9i include the following:

- [Oracle Ultra Search](#)
- [Oracle9i Text](#)
- [interMedia Annotator](#)

Oracle Ultra Search

Unlike other search engines, Oracle Ultra Search is able both to search the contents of a database to find documents, newspaper articles, and other information stored inside a database and to search the contents of static HTML pages. (Other search engines can merely search the content of static HTML pages.) Oracle Ultra Search enables you to search across heterogeneous corporate repositories, Web sites, and groupware content all in the same search. Oracle Ultra Search also provides a unified interface for enterprise and vertical portal search applications, which interface includes a Web interface, Web crawling, and search administration facilities.

See Also: *Oracle Ultra Search Online Documentation*

Oracle9i Text

Improved to meet the needs of e-business applications, Oracle9i Text indexing uses a new indextype to perform very fast searches across volumes of short textual descriptions. This functionality is ideal for facilitating faster catalog, metadata, auction data, and resume searches. With Oracle9i, text search of nested XML elements, search attribute values, XPath query syntax, and other advanced XML structures are also all supported.

See Also: *Oracle Text Reference*

interMedia Annotator

Media and document metadata can be extracted, indexed, and mapped to XML documents or database schema through Java application programming interfaces (APIs) available through the *interMedia Annotator*. These APIs allow for programmatic invocation of metadata services by any application or scripting language that can use Java APIs, including JAVAscript, VBscript, and Apple Script.

See Also: *Oracle interMedia Annotator User's Guide*

Collaborative Projects

Oracle9i provides organizations with the ability to create shared workspaces to support collaborative, long-duration projects. Workspaces support in-place, existing content and allow existing applications to run transparently against the workspace view of the database. Database content can be associated within a workspace and then used for a specific application while the underlying transaction database continues to run without being affected. Multiple, concurrent database-backed projects can coexist simultaneously against different versions of content.

See Also: *Oracle9i Application Developer's Guide - Workspace Manager*

Location-Enabled, Mobile-Ready Content

For e-business and mobile applications, Oracle9i and Oracle Spatial provide users with the ability to search, to index, and to deliver data based on the location attributes of content or proximity.

Support for mobile device protocols (WAP) and formats—such as WBMP—along with delivery through Oracle iAS Wireless (formerly Portal-to-Go) make Oracle9i a complete platform for the delivery of content for mobile applications. Content stored in Oracle9i can now be associated with related location criteria and services.

Interactive Voice Response (IVR) formats used in mobile applications are now supported in *interMedia*. New support for online mapping, yellow pages, driving directions, traffic, and geocoding services allow online content to be merged with database content.

See Also:

- *Oracle iAS Wireless Edition Developer's Guide*
- *Oracle Text Reference*

iSQL*Plus

iSQL*Plus, a browser-based implementation of SQL*Plus, can be used to connect to an Oracle database system over the Internet to perform the same tasks as those that are performed through the SQL*Plus command line. The iSQL*Plus implementation uses a Web browser, an Oracle HTTP Server with the iSQL*Plus Server, and an Oracle Database.

See Also: *Oracle iSQL*Plus documentation*

Availability

Oracle9i extends Oracle's lead on the competition in the area of internet database availability that is critical for any e-business application. Key focus areas in Oracle9i include the following:

- [Enhanced Disaster Recovery Environment](#)
- [Online Data Evolution](#)
- [Precision Database Repair](#)

Enhanced Disaster Recovery Environment

Oracle9i sets a new standard for high availability by the introduction of the following four powerful new features to protect against downtime.

- [Disaster Recovery](#)
- [System Fault Recovery](#)
- [User Error Safeguards](#)
- [Planned Downtime](#)

Disaster Recovery

Oracle9i offers many new features for disaster recovery. Key focus areas include the following new features:

Data Guard Monitoring and Automation The Oracle9i Data Guard Broker introduces an important advance in physical standby database management by automating monitoring and control features. Previously, switching to the standby database had been a highly complex administrative task, and switching back had been very difficult. Data Guard now presents a primary database system and its standby system as one environment, thus unifying configuration, monitoring and control. Oracle9i Data Guard continually monitors both the primary and standby databases.

See Also: *Oracle9i Data Guard Broker*

Zero Data Loss Log Transport Oracle9i Data Guard maintains a physical standby database that protects against any loss of data during log transport. Log file updates are synchronously written directly from the primary database to the physically

identical standby database, making it fully up-to-date at the point of failure in any disaster recovery situation. During log file updates, only log entries for the current transaction are stopped, instead of the entire log file. This disaster recovery solution makes third-party products that mirror online redo logs redundant.

See Also: *Oracle9i Data Guard Installation and Deployment*

Delayed Mode Delayed mode guards against database administrator mistakes by enabling a time lag that protects against the application of corrupted or erroneous data from the primary database to the standby database. Under most circumstances, the standby database automatically applies achieved redo logs by default when they arrive from the primary database. Delayed mode bypasses this default to protect data in the standby database.

See Also: *Oracle9i Data Guard Concepts and Administration*

LogMiner LogMiner provides information necessary for performing recovery operations, tuning, and capacity planning. The Oracle9i LogMiner utility makes it possible to query both online and archived redo log files through a SQL interface in real time. LogMiner provides optional tracking of data definition language (DDL) statements, the ability to limit queries to committed transactions, and the ability to perform queries based on actual data values. Log Miner also supports a multi-versioned dictionary.

LogMiner has also been enhanced in Oracle9i to provide comprehensive log analysis for additional datatypes. LogMiner now supports the following functionalities:

- Clustered tables
- Chained and migrated rows
- LOB and LONG datatypes
- Direct loads
- Scalar object types
- Data definition statements (DDL)
- Parallel data manipulation language (DML)

LogMiner also displays the primary key and supports queries on the logs based on the content of changes. (This is useful, for example, in the hypothetical situation where you want to show all changes to an employee named Smith.)

Oracle9i LogMiner Viewer A component of Oracle Enterprise Manager, the Oracle LogMiner Viewer provides users with an easy-to-use graphical user interface (GUI) to the Oracle9i LogMiner. The LogMiner GUI may be used to query online and archived redo log files to analyze the activity that has taken place in a database. Users can select redo log files, specify filters to be applied to the data, view query results and save the query and results for future use.

See Also: *Oracle9i Database Administrator's Guide*

System Fault Recovery

Oracle9i provides fast recovery with products improved by the following new features:

Real Application Clusters: Within-seconds Failover Real Application Clusters provides improved availability as compared to single-node configurations by eliminating the server as a single point of failure. For example, in a two-node cluster configuration where the primary node fails, the applications from that node automatically fail over to the surviving node—sometimes within seconds. With Real Application Clusters, failover minimizes the adverse effects of node failure on application processing and data availability.

Real Application Clusters Guard I Real Application Clusters Guard I, formerly Oracle Application Clusters Guard, is an enhanced configuration of Oracle9i Real Application Clusters. It tightly integrates enhanced recovery features with the cluster framework of the platform to provide a configuration that leverages the best high-availability technology each partner has to offer.

The Real Application Clusters Guard I architecture is designed to build on the strengths of traditional high-availability solutions and provides the following functionality:

- Automated, fast recovery and bounded recovery time from instance failures.
- Automatic capture of diagnostic data for certain types of failure.
- Enforced primary and secondary configurations. Clients connecting through Oracle Net Services are properly routed to the primary node even if connected to another node in the cluster.
- No delay when reestablishing connections after a failure.

Oracle9i Fail Safe: Four-Node Failover Oracle9i Fail Safe Configuration for Windows provides the high availability and protection from system failures that e-businesses

demand on Windows NT and Windows 2000 clustered architectures. Oracle9i Fail Safe provides failover processes for database and application servers in both 2- and 4-node Windows NT and Windows 2000 clusters.

See Also:

- *Oracle9i Database Administrator's Guide for Windows*
- *Oracle9i Real Application Clusters Concepts*

Fast-Start Fault Recovery Oracle9i introduces an enhancement to Fast-Start Fault Recovery that allows database administrators to specify the expected amount of time Oracle takes to recover a single instance, also known as the expected mean time to recover (MTTR).

Fast Instance Freeze and Resume A common dilemma that has faced database administrators is that of whether to identify the cause of a failure or to ensure that normal service is restored as quickly as possible. By invoking Flash Freeze, the database administrator can take a diagnostic snapshot of the entire system at the time of failure, quickly restart the database, and then make a diagnostic analysis offline.

See Also: *Oracle9i Database Administrator's Guide*

User Error Safeguards

Oracle9i eases the challenge of failures or downtime due to user errors, including erroneous or out-of-sequence updates.

Oracle9i Flashback Query Oracle9i Flashback Query lets users and applications query data from points in the past. Using this flashback parameter, a user can specify a date and time for the data and then issue standard queries on the data as it appeared at the specified time.

Comprehensive Log Analysis Identification of updates is also achieved by analysis of the database log files. Oracle9i LogMiner is a utility that allows log files, whether online or archived, to be read, analyzed, and interpreted with a SQL interface. By using Oracle9i LogMiner, database administrators can now examine all updates to the database, including all data manipulation, definition, and administration commands.

Resumable Space Allocation Certain large, long-running operations such as data uploads and complex update processes may run out of resources (disk space, for

example) prior to completion. Unsuccessful completion can be time-consuming to resolve. Oracle9i addresses this challenge by enabling database administrators to suspend operations that cannot be completed. Once the operation has been suspended, the database administrator can resolve the resource issue and then allow the statement to resume from the point of interruption.

See Also: *Oracle9i Database Administrator's Guide*

Planned Downtime

Oracle9i allows comprehensive planned maintenance operations, which previously required downtime, to run during normal usage.

Online Schema Changes Oracle9i provides the mechanism to redefine table structures while keeping them online and fully accessible to users and applications.

Online Table and Index Reorganization Oracle9i provides a simple mechanism to reorganize and redefine tables while keeping them online and available to application users. Oracle9i online table and index reorganization reduces planned downtime, increases application availability, reduces disk fragmentation, and improves application performance.

Complete Online Index Operations With Oracle9i, all table indexes can be created and re-created online. With this capability, users can continue to run their applications during table index creation.

Dynamic Database Parameters Oracle9i database parameter settings that affect Database memory use can now be reset online. This allows the database administrator to reset parameter settings without having to take the databases offline and then restart them.

See Also: ■ *Oracle9i Database Administrator's Guide*

Online Data Evolution

Oracle9i contains a new online reorganization and redefinition architecture that allows for powerful new reorganization capabilities. Administrators can now perform a variety of online operations to table definitions, including online reorganization of heap-organized tables, thus making it possible to reorganize a table at the same time that users have full access to it. Key focus areas include the following new features:

- [New Online Architecture](#)

- [Other New Capabilities](#)

New Online Architecture

Oracle9i now allows an online `CREATE TABLE AS SELECT` operation. In this new architecture, contents of a table are copied into a new table. While the contents are copied, updates to the original table are tracked by the database. After the copy is made, updates are applied to the new table.

After the updates are applied, indexes can be created on the new table. After indexes are created, any additional updates are applied and the resulting table replaces the original table. The table is locked in exclusive mode for a very brief period of time when the dictionary data is updated at the beginning and end of an operation.

This new online architecture provides the following functionalities:

- Any physical attribute of the table can be changed online. For example, the table can be moved to a new location, partitioned, or converted from one type of organization to another—such as a heap-organized to index-organized.
- Many logical attributes can also be changed. Column names, types, and sizes can be changed. Columns can be added, deleted, or merged. One restriction is that the primary key of a table cannot be altered.
- Online creation and rebuilding of secondary indexes on index-organized tables (IOTs) is supported. Secondary indexes support efficient use of block hints (physical guesses.) Invalid physical guesses can be repaired online.
- Indexes can be created online and analyzed simultaneously. Online Fix-up of the physical guess component of logical ROWIDs (used in Secondary Indexes and Mapping Table on Index-Organized Tables) can also be used.
- A new capability can fix the physical guess component of logical ROWIDs stored in secondary indexes (on index-organized tables). This allows online repair of invalid physical guesses

Other New Capabilities

Administrators can also rapidly quiesce the database to perform operations that require that there be no active transactions. Also, with Oracle9i, the buffer cache and the shared pool can be resized dynamically. Oracle9i can also validate the structure of an object (`ANALYZE VALIDATE`) while the object is online and accessed by users.

See Also:

- *Oracle9i Database Administrator's Guide*,
- *Oracle9i Database Concepts*

Precision Database Repair

Oracle9i includes improved prevention and handling of log file corruption, thus reducing the risk of extended downtimes. It is also able to restore the database to a consistent state when log corruption is detected during recovery. If corruption needs to be repaired through media recovery, a new block media recovery feature allows only the corrupt blocks to be recovered while the remainder of the table is online. These improvements include the following new features:

- [Rapid Crash Recovery](#)
- [Improved Failed State Diagnostics](#)
- [Faster Failure Detection](#)
- [Oracle Fail Safe Enhancements](#)

Rapid Crash Recovery

Oracle9i can recover from crashes more quickly than in previous releases with a new two-pass recovery algorithm that ensures that only the blocks that need to be processed are read from and written to the datafiles. A new time-based mean time to recover (MTTR) parameter also makes it much easier to set a limit on crash recovery time.

Improved Failed State Diagnostics

Oracle9i includes improved diagnosis of a failed instance and allows diagnostics to be read after recovery on the failed state. This helps diagnose the cause of the failure after its first occurrence, rather than requiring users to set events that capture data in future failures.

Faster Failure Detection

For multi-node systems, Oracle9i provides faster failure detection—for instance, node and network failures—and reconfiguration for Oracle9i Real Application Clusters, reducing downtime due to a system fault.

Oracle Fail Safe Enhancements

Oracle Fail Safe Configuration for Windows provides the high availability and protection from system failures that e-businesses need to take advantage of multi-node clusters with the enhanced functionality of Windows 2000. This allows for configurations where multiple databases on multiple nodes share a common backup node, reducing the cost of providing redundancy to multiple applications.

See Also:

- *Oracle9i Real Application Clusters Concepts*
- *Oracle9i Real Application Clusters Installation and Configuration*
- *Oracle9i Real Application Clusters Deployment and Performance*
- *Oracle9i Real Application Clusters Deployment and Performance*
- *Oracle9i Backup and Recovery Concepts*
- *Oracle9i Database Administrator's Guide*
- *Oracle9i Application Developer's Guide - Fundamentals*

Advanced Replication

Advanced Replication, formerly known simply as Replication, includes the following new features:

- Extended availability by reducing requirements for quiescing a replication group
- Support for user-defined types
- Multitier materialized views, which are materialized views based on other materialized views
- Fast refresh enhancements for materialized views
- Performance monitoring in replication environments
- Row-level dependency tracking for parallel propagation
- Replication support for CHAR column length semantics and Unicode
- Improvements to the Replication Management tool, including new reporting capabilities and improved wizards

See Also: *Oracle9i Replication*

Manageability

Oracle9i systems management is simplified and improved with increased self-management and self-tuning capabilities. Also, Oracle9i integrated system management tools create a complete view of all database and host critical processes, making it possible to quickly and completely assess the overall health of an e-business infrastructure.

Oracle9i management advances include the following features:

- [Database Self-Management](#)
- [Streamlined Operational Database Management](#)
- [Enhanced Recovery Manager \(RMAN\) Performance](#)
- [Simplified Oracle9i Administration With Oracle Enterprise Manager](#)
- [Support for a NULL Association of a Statistics Type](#)

Database Self-Management

Oracle9i includes several new features that make the Database more autonomous and self-managing. For example, new features such as automatic undo management, automatic SQL execution memory management, and automatic segment-space management enable database administrators to delegate many daily administrative tasks to the server itself.

Key enhancements in Oracle9i include the following:

- [Automatic Undo Management](#)
- [Memory Management](#)
- [Automatic SQL Execution Memory Management](#)
- [Automatic Segment-Space Management](#)

Automatic Undo Management

Oracle9i databases are capable of managing their own undo (rollback) segments. Administrators no longer need to carefully plan and tune the number and sizes of rollback segments or to decide strategically how to assign transactions to a particular rollback segment. Oracle9i also allows administrators to allocate their undo space in a single undo tablespace with the database taking care of issues such as undo block contention, consistent read retention, and space utilization.

See Also: *Oracle9i Database Administrator's Guide*

Memory Management

Memory management is another area which has been given significant attention in Oracle9i. Traditionally, administrators have needed to shut down the instance in order to grow or shrink System Global Area (SGA) components. Oracle9i introduces a dynamic memory management feature that allows for dynamically resizing the buffer cache and shared pool. A buffer cache size advice mechanism that predicts the performance of running with different sizes for the buffer cache is also available with Oracle Enterprise Manager.

See Also: *Oracle9i Database Administrator's Guide*

Automatic SQL Execution Memory Management

Oracle9i provides transparent management of working memory for SQL execution by self-tuning the initialization runtime parameters that control allocation of private memory. This feature allows low-end users to reduce the time and effort required to tune memory parameters for their data warehouse and their reporting applications, while high-end users are able to avoid memory tuning for individual work loads.

See Also: *Oracle9i Database Performance Tuning Guide and Reference*

Automatic Segment-Space Management

Oracle9i provides transparent management of segment space in the Oracle database. With automatic segment-space management, you use bitmaps, which describe the status of each data block within a segment with respect to the amount of space in the block available for inserting rows, to enable Oracle to automatically manage the free space in the segments.

See Also: *Oracle9i Database Performance Tuning Guide and Reference*

Streamlined Operational Database Management

Several new features simplify administration of the Oracle9i database.

Key enhancements in Oracle9i include the following:

- [Server Parameter File](#)
- [Database Configuration Assistant](#)
- [Oracle-Managed Files](#)

- [Resumable Space Allocation](#)
- [Corresponding Sub-Cache Configuration](#)
- [Mean Time to Recover \(MTTR\) Specification](#)
- [SQL Queryable Through V\\$SQL_PLAN View](#)
- [Parameter Changes Persist Across Shutdowns](#)

Server Parameter File

With the introduction of the server parameter file feature, server parameter file changes persist across database shutdowns and startups. This feature also allows the administrator to start the database from remote machines without a local copy of the server parameter file. This facilitates database performance tuning because parameter changes made by performance management tools such as Oracle Enterprise Manager and changes made by internal self-tuning now persist across shutdowns.

Database Configuration Assistant

The Database Configuration Assistant has been redesigned to include saved definitions of existing databases in the form of templates provided by Oracle that can, in turn, be used to generate new databases. Users can create their own templates by modifying existing templates, defining new ones, or by capturing the definition of an existing database.

When creating a database with the Database Configuration Assistant, users can include Oracle Sample Schemas at database creation or can add these schemas later as an option. Oracle Sample Schemas are the basis for many of the examples used in Oracle documentation.

Oracle-Managed Files

Oracle9i introduces Oracle-managed files. This simplifies database administration by removing the necessity that administrators directly manage the files that make up an Oracle database. Instead, Oracle9i uses internal standard file system interfaces to create and delete files as needed. While administrators must still be involved in space planning and administration, Oracle-managed files automates the routine tasks of creating and deleting database files. Operating system files associated with a temporary file also can be deleted.

Note: With the introduction of default temporary tablespace, the `SYSTEM` tablespace is no longer used as the default storage location for temporary data.

Resumable Space Allocation

Resumable Space Allocation, another feature introduced in Oracle9i, allows an administrator temporarily to suspend a large operation, such as a batch update or data load, if they start to encounter out-of-space errors. This allows the administrator to fix the problem and resume the operation from the point of interruption without disrupting normal database operation.

Corresponding Sub-Cache Configuration

Oracle9i supports databases created with multiple block sizes and allows administrators to configure corresponding sub-caches within each alternative block size. This capability allows administrators to locate objects in tablespaces of appropriate block size in order to maximize input/output (I/O) performance. It also allows administrators to transport tablespaces more easily between different databases (for example, from an OLTP environment to a data warehousing environment).

Mean Time to Recover (MTTR) Specification

Oracle9i also allows for better control over database downtime by enabling administrators to specify in number of seconds the mean time to recover (MTTR) from system failures. This feature, coupled with more dynamic initialization parameters, helps administrators further improve database availability.

SQL Queryable Through V\$SQL_PLAN View

The execution plan of a SQL statement in the shared pool is now queryable through the view `V$SQL_PLAN`. The data contained within this view is similar to that of `EXPLAIN PLAN`; the difference is that `EXPLAIN PLAN` shows a theoretical plan should the statement be executed, whereas `V$SQL_PLAN` shows the actual plan used to execute the statement.

Parameter Changes Persist Across Shutdowns

Database administration is simplified because parameter changes made through performance management tools—such as Oracle Enterprise Manager—and changes made by internal self-tuning parameters now persist across shutdowns.

See Also:

- *Oracle9i Database Administrator's Guide*
- *Oracle9i Database Performance Tuning Guide and Reference*

Enhanced Recovery Manager (RMAN) Performance

To ease backup and recovery operations, Recovery Manager in Oracle9i provides the following new features:

- One-time backup configuration that applies to any session
- Automatic management of backups and archived logs based on a user-specified recovery window
- Block media recovery
- Restartable backups and restores

Key enhancements in Oracle9i include the following:

- [Persistent RMAN Configuration](#)
- [Recovery Window](#)
- [Block Media Recovery](#)
- [Miscellaneous Manageability Enhancements](#)

Persistent RMAN Configuration

Oracle9i introduces many new features and enhancements that increase manageability and greatly expand functionality. Persistent RMAN settings can be created for automatic channels, channel parallelism, retention policies, backup options, and auxiliary filenames, and can be applied to any session, thus removing the need for manual allocation of channel settings.

Recovery Window

Recovery Manager implements a recovery window that controls when backups expire. Recovery Manager also automatically marks as obsolete all backups and archived logs no longer required to restore the database to a point in time during the recovery window. These features are designed to reduce administrator time and effort spent performing routine backup activities tasks by automating of the most commonly performed tasks.

Block Media Recovery

Block media recovery can perform media recovery on individual blocks in a datafile while the datafile remains online. The block media recovery feature is only available with RMAN.

Miscellaneous Manageability Enhancements

The new control file auto backup feature allows for restoring or recovering a database even when a Recovery Manager repository is not available. Recovery Manager in Oracle9i also features enhanced reporting and a more user-friendly interface.

Improvements in user-managed backup and recovery include the following new features:

- Batch termination of online backup mode
- The ability to perform a trial media recovery
- Multiple conversion pairs for the *_FILE_NAME_CONVERT parameters
- System-managed database files

See Also:

- *Oracle9i User-Managed Backup and Recovery Guide*
- *Oracle9i Recovery Manager User's Guide*

Simplified Oracle9i Administration With Oracle Enterprise Manager

In Oracle9i, Oracle Enterprise Manager continues to provide easy-to-use management tools that support the new capabilities of the database and the entire e-business platform.

Key enhancements in Oracle9i include the following:

- [Oracle Enterprise Manager GUI](#)
- [Connection Established Before Start-Up](#)
- [Diagnostics, Problem Resolution, and Reporting](#)
- [Advice-Incorporated Tools](#)
- [Browser-Managed Functions](#)
- [Oracle Stack Management in Oracle Enterprise Manager](#)

Oracle Enterprise Manager GUI

The Oracle Enterprise Manager graphical interface makes it simple to adopt and manage new components such as Oracle *9iFS*, Oracle Internet Directory, Oracle OLAP Server, and Oracle9iAS.

Connection Established Before Start-Up

In Oracle9i, Oracle Enterprise Manager has the ability to connect to multiple target databases without starting up the Oracle Management Server.

Diagnostics, Problem Resolution, and Reporting

To further simplify management tasks, Oracle Enterprise Manager has been enhanced to include guided, expert diagnostics and problem resolution, as well as greatly enhanced reporting capabilities.

Advice-Incorporated Tools

Advice and recommendations about how properly to configure an Oracle environment, how effectively to monitor its performance, and how quickly to resolve problems has been incorporated directly into the Oracle Enterprise Manager management tools. For example, administrators can instantly display a set of overview charts to show the overall health of their system, with indicators that automatically alert administrators to potential problems. Administrators can then analyze the problem by following the proper steps required to diagnose the problem's underlying cause.

Browser-Managed Functions

Because all essential management functions are also Web-based, administrators can manage their systems directly from a Web browser. Tools such as DBA*Studio are consolidated into the integrated management console. Oracle Enterprise Manager can also publish detailed reports to a Web site, allowing administrators easy access to any systems management information they wish to publish.

Oracle Stack Management in Oracle Enterprise Manager

In Oracle9i, Oracle Enterprise Manager allows administrators to monitor the performance of more than one system. With this release, administrators are able to monitor the response of their entire Oracle-based system and to ensure that they are meeting the required business service level agreements. This capability is critical to users such as application service providers, e-business sites, or any business whose

success depends on maintaining superior response time, performance, and availability of their information technology systems.

Service-Level Degradation Alerts Oracle Enterprise Manager allows administrators to monitor service levels and automatically alerts them to any degradation in performance. Extensive service level reports are also available to provide a complete picture of the performance of the system.

Reporting Capabilities Enhanced In addition to service level reports, reporting capabilities throughout all of Oracle Enterprise Manager have been significantly enhanced. A comprehensive set of predefined reports are included with Oracle Enterprise Manager that document the configuration and health of the entire Oracle environment. Reports can be generated, for example, on the configuration of databases, the performance of applications over the last week, or the current load on the system. Customized reports can also be generated using a site's own data or by mixing and matching the predefined report topics that Oracle Enterprise Manager provides. These reports can be automatically generated and posted to a Web site for convenient access across the organization.

Note: Oracle Enterprise Manager supports server parameter file (SPFILE) and automatic undo management.

See Also: *Oracle Enterprise Manager Administrator's Guide*

Oracle Net Services

Key enhancements in Oracle9i include the following enhancements to Oracle Net Services:

- [Multiple Oracle Context Creation in Oracle Net Configuration Assistant](#)
- [Oracle Names LDAP Proxy Servers](#)
- [Additional Enhancements](#)

Multiple Oracle Context Creation in Oracle Net Configuration Assistant

The Oracle Net Configuration Assistant enables you to create multiple Oracle Contexts to facilitate management of a complex naming structure in a directory server.

Oracle Names LDAP Proxy Servers

In future releases, Oracle Names will not be supported as a centralized naming method. As Oracle Names is deprecated in favor of directory naming with LDAP-compliant directory servers, Oracle Names LDAP Proxy servers provide a way for release 8.1.5 or previous clients that do not support directory naming to use the same data as is used for directory naming. Oracle Names LDAP Proxy servers are Oracle Names servers that have been configured to proxy for LDAP-compliant directory servers. Upon startup, Oracle Names LDAP Proxy servers obtain network object information from a directory server. This provides a single point of definition for all data in a directory server and does not require that both Oracle Names servers and directory servers be maintained separately and simultaneously.

Additional Enhancements

Oracle Net Services includes the following new features:

- Oracle Net Services supports the Virtual Interface (VI) protocol
- Oracle Net Configuration Assistant enables creation of multiple Oracle Contexts.
- Oracle Net Services enables connection load balancing for dedicated server configurations and shared server configurations.

See Also:

- *Oracle9i Net Services Administrator's Guide*
- *Oracle9i Net Services Reference Guide*

Data Cartridge Enhancements

Key enhancements in Oracle9i include the following enhancements to data cartridge functionalities:

- [Local Domain Indexes](#)
- [Collection of User-Defined Statistics for Partitioned Tables](#)
- [New Package DBMS_ODCI](#)
- [Support for a NULL Association of a Statistics Type](#)

Local Domain Indexes

Discrete domain indexes, called local domain indexes, can be built on the partitions of a range-partitioned table. Local domain indexes are equi-partitioned with the

underlying table: all keys refer only to rows stored in the local domain index's corresponding table partition.

Collection of User-Defined Statistics for Partitioned Tables

The extensible optimizer supports collection of user-defined statistics partition level and aggregate for partitioned tables.

New Package DBMS_ODCI

New package `DBMS_ODCI` contains a utility to help better estimate the cost of user-defined functions.

Support for a NULL Association of a Statistics Type

Instances of an indextype or object inherit an association of a statistics type. Now you can replace this with a `NULL` association for occasions when the benefit of using a better plan may not outweigh the added cost of compiling the cost or selectivity functions implemented by the statistics type.

See Also: *Oracle9i Data Cartridge Developer's Guide*

Oracle Spatial

For e-business and mobile applications, the location capabilities in Oracle9i and Oracle Spatial have been greatly enhanced. Content stored in Oracle9i can now be associated with related location criteria and services. New support for online mapping, yellow pages, driving directions, traffic, and geocoding services allow online content to be merged with database content. Support for mobile devices and formats—such as WBMP, interactive voice response, microbrowsers and delivery through Oracle *iAS* Wireless—make Oracle9i a complete platform for the delivery of content for mobile applications.

Note: Oracle Wireless was formerly known as Portal-to-Go.

Oracle Spatial includes the following new features:

- The `SDO_GTYPE` element of the `SDO_GEOMETRY` type has a new format that identifies the linear referencing dimension (if any).
- Methods are provided for the `SDO_GEOMETRY` type: `GET_GTYPE`, `GET_DIMENSIONS`, and `GET_LRS_DIMS`.

- Spatial aggregate functions are provided: SDO_AGGR_MBR, SDO_AGGR_UNION, SDO_AGGR_BUFFER, and SDO_AGGR_CONVEXHULL.
- The SDO_GEOMETRY type can be embedded in a user-defined data type.
- Partitioned indexes are supported.
- Coordinate system support has been enhanced: storage and conversion of coordinates in any datum and projection, Oracle Enterprise Manager interface to edit or create coordinate systems, user-defined transformations.
- Linear referencing support has been enhanced: 2D polygons and multiple line strings and 3D line strings (made of line segments), monotonically decreasing as well as increasing measure, Offset function for LRS geometry, aggregate concatenation.
- B-tree index statistics routines are provided.
- Columns have been added to the system metadata for spatial indexes.
- New views are provided for retrieving index metadata.
- UNITS support—for example, "UNITS=mile"—is provided for relevant Spatial functions and operators.
- A commit interval can be specified when validating a geometry.
- The 18-character limit for spatial index names is removed.

See Also: *Oracle Spatial User's Guide and Reference*

Heterogeneous Services

Heterogeneous Services, a component of the database that enables Oracle9i to access and process data from non-Oracle data systems, includes the following new features:

- Support for the SQL*Plus DESCRIBE command
- Support for DATE/TIME datatypes
- Support for PIECEWISE, INSERT, and FETCH of long columns
- Support for ref cursors only as stored procedure OUT arguments
- Shared server agents that enable multiple user sessions to share the same agent process

See Also: *Oracle9i Heterogeneous Connectivity Administrator's Guide*

Business Intelligence

Oracle9i continues to challenge the competition by providing the best platform support for business intelligence in medium to large scale enterprises. Oracle9i technology focuses especially on the challenges raised by the large volume of data and the need for near real time complex analysis in an Internet-enabled environment. Additionally, Oracle9i provides the first true business-intelligence platform, including extended database support for online analytical processing (OLAP), data mining, and major data extraction, transformation, and loading enhancements.

Oracle9i key focus areas for business intelligence include the following:

- [Performance and Scalability](#)
- [Data Warehouse Manageability](#)
- [Integrated Analysis Capabilities](#)

Performance and Scalability

Key enhancements in Oracle9i include the following:

- [Index-Organized Tables](#)
- [Enhancements to Materialized Views](#)
- [Automatic Memory Tuning](#)
- [List Partitioning](#)
- [Data Extraction, Transformation, and Loading Enhancements](#)
- [Table Functions](#)
- [Bitmap Join Index](#)

Index-Organized Tables

Index-organized tables include the following technological advances:

- [Bitmap Indexes on Index-Organized Tables](#)
- [Parallel DML on Index-Organized Tables](#)

- Partitioning by hash method
- B-tree index on UROWID columns

Enhancements to Materialized Views

Oracle's materialized views, which provide a mechanism for improving the performance of almost any type of query, have been enhanced in Oracle9i in important ways:

- Materialized views now include more sophisticated query-rewrite mechanisms that enables a single materialized view to address a broader class of queries.
- Enhanced refresh mechanisms allow fast, incremental refreshes for a wider variety of materialized views.

Automatic Memory Tuning

Oracle9i provides an automated mechanism for dynamically allocating runtime memory to each query. Up to 70% or more of the data warehouse server's physical memory is commonly allocated for runtime memory.

By automating the allocation of runtime memory, Oracle9i improves the overall throughput of the data warehouse and makes it possible to support larger numbers of users at the same levels of performance.

The automatic memory tuning feature ensures that memory-intensive queries receive sufficient memory, while memory-light queries are not given too much memory. By making more effective use of memory, Oracle9i increases overall query performance.

List Partitioning

Oracle partitioning delivers significant improvements in the manageability, availability, and query performance of large tables and indexes. Partitioning is a key technology for data warehousing, where large tables are commonplace. Oracle partitioning capabilities have been enhanced in Oracle9i with the addition of a new partitioning scheme, list partitioning.

List partitioning gives data warehouse administrators precise control over which data belongs in each partition. For each partition, the data warehouse administrator can specify a list of possible values for the partitioning key of the rows in that partition. Each partition in a list partitioning scheme corresponds to a list of discrete values.

See Also: *Oracle9i Database Administrator's Guide*

Data Extraction, Transformation, and Loading Enhancements

Oracle9i includes the following data extraction, transformation, and loading new features:

External Tables To increase efficiency and reduce the time taken to load and refresh critical data warehouses, Oracle9i provides support for external tables to allow data from external systems to be quickly loaded into the database. External tables do not reside in the database and may be in a format, for which a driver is provided. The `CREATE TABLE... ORGANIZATION EXTERNAL` statement specifies metadata describing the external table.

See Also: *Oracle9i Database Administrator's Guide*

Multitable inserts Other data load capabilities provided to increase data load scalability and reduce complexity include multitable `INSERT` and `MERGE` semantics. Both of these SQL enhancements allow more complex data loading to be processed within a SQL single statement, unlike the old way, where several process steps were required. With multitable inserts, data can be inserted into more than one table using a single SQL statement; this is more efficient than using multiple, separate SQL statements for each table.

Multitable inserts make SQL more useful for data transformations and conditional handling. An incremental refresh, also known as a `MERGE`, of a table requires two tasks: new records will be inserted and existing records will be updated. Rather than requiring two separate steps, the new `MERGE` statement allows both steps to be processing simultaneously within a single SQL statement. This new ETL functionality is also leveraged by Oracle Warehouse Builder.

See Also: *Oracle9i SQL Reference*

Table Functions

Table functions can be used in the `FROM` clause of a query to return a collection (either a nested table or a `varray`) of rows as output. A table function can use parallel execution, and result rows from can be pipelined—that is, iteratively returned.

See Also: *PL/SQL User's Guide and Reference*

Bitmap Join Index

Oracle9i introduces bitmap join indexes, which provide further improved performance for a specific class of join queries. A **join index** is an index structure which spans multiple tables and improves the performance of the joins of those tables.

See Also: *Oracle9i Database Performance Tuning Guide and Reference*

Data Warehouse Manageability

Oracle9i addresses the growing workloads of established data warehouses with enhanced capabilities for managing larger numbers of users. These capabilities ensure that an appropriate amount of resources is allocated to each query, the throughput of the entire warehouse platform is maximized, the warehouse administrator and users can view the status of ongoing jobs, and the database can automatically abort or queue queries, depending upon conditions pre-specified by the database administrator in order to maintain optimal system load.

Key enhancements in Oracle9i include the following:

- [Database Resource Manager](#)
- [Enhanced Statistics Gathering](#)
- [Summary Advisor and Materialized View Manageability](#)
- [Global Index Maintenance](#)
- [Materialized View Enhancements](#)
- [Complete Outer Joins](#)
- [WITH Clause](#)
- [List Partitioning](#)

Database Resource Manager

The Database Resource Manager provides a mechanism for allocating the resources of a data warehouse among multiple populations of end users. These groups of end users, called Resource Consumer Groups, are specified by the database administrator, who then detains how resources are allocated to each group.

In Oracle9i, the mechanism for allocating data warehouse resources among multiple populations of end-users allows the number of active sessions for each Resource Consumer Groups to be limited.

In addition, a simple query-governing capability allows the database administrator to specify the maximum estimated execution time for Resource Consumer Group.

Another significant enhancement allows the resource manager to automatically change the Resource Consumer Group of a given session based on criteria specified by the database administrator.

Enhanced Statistics Gathering

Oracle's query optimizer uses statistics about the objects in the database—such as the number of rows in each table. These statistics are gathered by database administrator with the `DBMS_STATS` facility.

In Oracle9i, the `DBMS_STATS` package has been enhanced to make it easier for database administrators to gather the appropriate sets of statistics. It is now possible to automatically determine the appropriate sampling percentage as well as the appropriate columns for histograms. These enhancements simplify the database administrator's task in gathering accurate statistics.

See Also: *Oracle9i Database Administrator's Guide*

Summary Advisor and Materialized View Manageability

The summary advisor has been enhanced in Oracle9i to enable it to make recommendations based on schema characteristics and previous workload history. It now supports a broader class of schemas so database administrators can specify workloads as input to the summary advisor. Other enhancements have been made to materialized views so that it is now easier to manage environments.

See Also: *Oracle9i Data Warehousing Guide*

Global Index Maintenance

Oracle9i permits an override of a default behavior, which permits an update of global indexes when partition maintenance is performed. Many table maintenance operations on partitioned tables invalidate (mark `UNUSABLE`) global indexes. Without the override, the entire global index must be built, or, if partitioned, all of its partitions must be built. Global indexes are now updated when partition maintenance is performed, thus minimizing normal maintenance.

Materialized View Enhancements

Various restrictions were removed in addition to expanding the situations where materialized views could be effectively used. The query rewrite feature allows many SQL statements to use materialized views, thereby significantly improving performance.

Complete Outer Joins

Oracle added full support for full outer joins so that you can more easily express certain complex queries.

WITH Clause

The `WITH` clause enables you to reuse a query block in a `SELECT` statement when it occurs more than once within a complex query.

List Partitioning

List partitioning offers you precise control over which data belongs in a particular partition.

See Also:

- *Oracle9i Database Administrator's Guide*
- *Oracle9i Database Performance Planning*
- *Oracle9i Data Warehousing Guide*

Integrated Analysis Capabilities

Oracle9i for business intelligence goes above and beyond requirements for performance, scalability, and manageability.

Key enhancements in Oracle9i include the following:

- [Full Data Warehouse Platform](#)
- [Enhanced SQL Functionality and Performance](#)

Full Data Warehouse Platform

Oracle9i is designed to be a full data warehouse platform, leveraging the Oracle database as the scalable data engine for all operations on data warehousing data.

New Data Mining Capabilities Oracle9i includes new data mining capabilities. Based on the Oracle data mining product, Oracle9i provides personalization capabilities which enable customers to implement accurate, real-time recommendations and personalization capabilities into their online operations. Oracle9i improves upon earlier versions of the database with tighter integration between data mining and the relational database, and includes in-database scoring along with the ability to manage data mining operations.

See Also: *Oracle9i Data Warehousing Guide*

Enhanced SQL Functionality and Performance

Oracle has substantially enhanced both the functionality and performance of SQL to address the requirements of typical OLAP operations. More specifically, Oracle9i provides an extensive set of SQL capabilities for new types of analytic functions, belonging to the three following new families and enhancements for aggregation:

- **Inverse percentile**, which can calculate the median and other statistics.
- **Hypothetical distribution and ranking**, which can calculate the rank of a hypothetical value as if it were to be inserted into a data set.
- **FIRST/LAST aggregate functions**, which return the first or last value of a selected column in a group which has been ordered by a different column.

Online Analytical Processing Oracle9i OLAP is a scalable, high-performance OLAP calculation engine with fully integrated management and administration. By leveraging Oracle OLAP Server technology and Oracle9i analytic SQL capabilities, Oracle9i OLAP provides a robust platform for delivering analytic applications.

Note: Enhancements to materialized views includes optimizations for OLAP.

See Also: *Oracle9i OLAP User's Guide*

Scalability and Performance

New shared memory capabilities, improvements in Java session support, and networking and Oracle shared server improvements substantially reduce the disk space or RAM—also called the **footprint**—required for each. This allows more users to be hosted on the same or larger hardware platforms.

Oracle9i includes several important advances in scalability and performance

- [Scalability](#)
- [Performance:](#)

Scalability

Key enhancements in Oracle9i include the following:

- [Application Partitioning No Longer Necessary](#)
- [Increased Transaction Throughput](#)
- [Improved and Expanded Functionality in Real Application Clusters](#)
- [Usability Enhancements to Recovery Manager in Real Application Clusters](#)
- [Fine-Grained, Automatic Resource Management](#)
- [Connection Load Balancing in Oracle Net Services](#)
- [Oracle Net TCP Protocol Rewrite for Windows](#)

Application Partitioning No Longer Necessary

Applications can treat Oracle9i Real Application Clusters as a single system so that it is no longer necessary to modify or partition clusters if you want to achieve near-linear cluster database scalability. The advantage of this for customers is that it allows them to horizontally scale the database tier as usage and demand grow without needing to modify the application itself.

Increased Transaction Throughput

Full Cache Fusion, as well as support for cluster file systems on some platforms, allows you to take advantage of the scalability provided by Oracle9i Real Application Clusters with little or no performance overhead. Because the full Cache Fusion implementation in Oracle9i eliminates the latencies associated with disk-based cache coordination, applications can scale effectively without having to be cluster-aware. By using the collective caches of all the nodes in a cluster to satisfy database requests, Oracle9i Real Application Clusters provides these unique capabilities:

- Out-of-the-box linear scaling transparency
- Compatibility with all applications, with no redeployment required
- Fast-growth clusters with the ability to rapidly add nodes and disks

Cache Fusion Architecture In the Cache Fusion architecture, read and write requests can be served by any of the memory caches in the cluster database.

Automatic Fusing of Caches If a data block request is served by a remote cache, then the block is transferred across the high speed cluster interconnect from one node's cache to another. This fusing of caches happens automatically and is transparent to the application. This process is the key technology that provides fast, efficient scaling in Real Application Clusters database environments.

Cluster Treated as Scalable Single System When a data block that is required by an instance is already in the cache of another instance, Oracle9i Cache Fusion directly transfers the block from the cache of the holding instance to the requesting instance's cache. This avoids costly disk read and write operations and nearly eliminates inter-instance contention that occurs in non-Cache Fusion-based clusters for read/read, write/read, or write/write operations. This functionality builds on the previous Oracle8i Cache Fusion implementation that managed read/write contention. This is the first time in an off-the-shelf application that a cluster can be treated as a truly scalable single system.

Improved and Expanded Functionality in Real Application Clusters

The Oracle9i release 1 (9.0.1) Real Application Clusters features and enhancements that follow greatly simplify the installation and configuration process.

Simplified Parameter Management You can use the server parameter file (SPFILE) to simplify parameter management in Real Application Clusters.

The server parameter file is easier to administer than the traditional client-side parameter files used in pre-9.0.1 releases.

See Also: *Oracle9i Real Application Clusters Setup and Configuration*

Automatic Undo Management Automatic undo management automatically controls undo space management. Using automatic undo management simplifies your administrative duties by more efficiently using disk space to manage undo information.

Server Control Utility Documentation The Server Control Utility (SRVCTL) is fully documented and includes documentation for use with Real Application Clusters databases.

Note: The Server Control Utility (SRVCTL) was formerly known as the Operating System Control Utility (OPSCCTL).

Usability Enhancements to Recovery Manager in Real Application Clusters

There are several usability enhancements to Recovery Manager in Real Application Clusters:

Simplified Procedures for Configuring Recovery Manager in Real Application Clusters The procedures for configuring Recovery Manager (RMAN) in Real Application Clusters databases are simplified. For example, you can use the `CONFIGURE` command to save channel allocation settings without manually allocating channels. You can also configure Recovery Manager to automatically back up your control file.

- **Improved Command Execution for Various Commands**

You can execute a `BACKUP ARCHIVELOG...DELETE ALL INPUT` command to delete the logs in all `LOG_ARCHIVE_DEST_n` locations. You can also execute commands such as `BACKUP`, `RESTORE`, and so on, directly from the Recovery Manager prompt without having to use a `RUN { ... }` command.

- **Template Management in Real Application Clusters**

The Database Configuration Assistant (DBCA) has Instance and Template Management features. Use Instance Management to add or delete instances in a Real Application Clusters database. You can also use Template Management to manage database templates. For example, you can copy databases, including data files, or you can create a template from a database, move the template to another system, and then use the template to create a new database.

Note: Effective with this release, all default usernames except `SYS`, `SYSTEM`, and `SCOTT`, expire upon install. To use these names, you must explicitly unlock them.

Simplified Backup and Restore Operations Oracle9i Real Application Clusters supports a cluster file system for Compaq Tru64, Windows 2000, and Windows NT. This removes the dependency on the Network File System to simplify backup and storage operations so that storage management on a cluster is the same as storage management on a single node.

See Also:

- *Oracle9i Real Application Clusters Concepts*
- *Oracle9i Real Application Clusters Installation and Configuration*
- *Oracle9i Real Application Clusters Administration*
- *Oracle9i Real Application Clusters Deployment and Performance*
- *Oracle9i Data Guard Concepts and Administration*

Fine-Grained, Automatic Resource Management

Oracle9i includes several new features that enhance resource management.

Granular Control Over Resources Enhancements to the Database Resource Manager in Oracle9i allow for more granular control over resources, adding features such as automatic consumer group switching, maximum active sessions control, query execution time estimation, and undo pool quotas for consumer groups.

Administrators are able to specify the maximum number of concurrently active sessions in each consumer group. Once this limit is reached, the Database Resource Manager queues all subsequent requests and runs them only after the existing active sessions complete.

Automatic Consumer Group Switching The automatic consumer group switching feature of Oracle9i allows the administrator to specify criteria which, when met, cause the Database Resource Manager to automatically switch the consumer group of a long-running session. For example, a database administrator could specify criteria that would switch a consumer group set up for online transaction processing (OLTP) operations to one more suited for batch reporting.

Administrators are also able to set a maximum estimated execution time for each consumer group, and the Database Resource Manager then estimates the approximate query execution time for each operation before it begins and will aborts the operation if it exceeds the specified limit.

Undo Pool Quota With the undo pool quota feature, administrators can specify a maximum on the total amount of rollback data generated per consumer group. This prevents a rogue transaction from consuming excessive rollback space to impact system operation.

See Also: *Oracle9i Database Administrator's Guide*

Connection Load Balancing in Oracle Net Services

Connection load balancing is load balancing, whereby the number of active connections among various instances and dispatchers for the same service are balanced. This enables listeners to make their routing decisions based on how many connections each dispatcher has and on how loaded the nodes that the instances run.

Oracle Net TCP Protocol Rewrite for Windows

The Windows implementation of the standard socket abstraction is not as scalable as the Windows proprietary socket abstraction. Re-implementing the Oracle Net TCP adapter for the Oracle9i using the Windows proprietary socket abstraction significantly improves the ability to support large numbers of concurrent network connections for Shared Server on Windows platforms. Here, a true asynchronous event notification mechanism is used on the Windows platforms.

See Also: *Oracle9i Net Services Administrator's Guide*

Performance

Oracle9i continues to provide users with superlative performance in all relevant areas and uses various performance measurement and tuning projects continually to measure, tune, and improve its own runtime performance.

Key enhancements in Oracle9i include the following:

- [Self-Tuning](#)
- [Native Compilation and Improved PL/SQL Optimization](#)
- [Latch Contention Improvements](#)
- [Enhanced Java Performance](#)
- [Network and Distributed Database Performance](#)
- [Shared Server Enhancements](#)

Self-Tuning

Oracle9i Real Application Clusters constantly tunes itself by continually adapting to the changing nature of the database workload. It does this by shifting database resources across cluster servers to optimize performance.

Cache Fusion Oracle9i Real Application Clusters uses the new technology of Cache Fusion to provide transparent scalability and high performance by means of an

architecture that uses the collective caches of all nodes in a cluster to satisfy database requests and to reduce the need for disk input/output.

See Also: *Oracle9i Real Application Clusters Concepts*

Native Compilation and Improved PL/SQL Optimization

A major emphasis of Oracle9i is improved performance in areas critical to e-business solutions. Native compilation support and improved optimization of PL/SQL improves the performance business applications, and the addition of memory and CPU costs to the cost-based optimizer results in better optimization plans, less resource usage, and faster overall performance.

See Also: *PL/SQL User's Guide and Reference*

Latch Contention Improvements

Latch contention in several areas has been eliminated or reduced to improve performance on highly active systems. Improvements in general input/output (I/O), including self-tuning direct I/O, prefetching, and skip/scan row source operations on indexes, have also improved performance in data warehouse and online transaction processing (OLTP) environments.

See Also: *Oracle9i Database Performance Tuning Guide and Reference*

Enhanced Java Performance

For Java, improved garbage collection, better native compilation, increased object sharing, and session pinning have all improved the performance of built-in Java executing inside the database. JDBC and SQLJ performance improvements have also improved the performance of Java in the middle tier or on the client.

See Also: *Oracle9i Java Developer's Guide*

Network and Distributed Database Performance

Network and distributed database performance has been improved by the rework of database-to-database communication using Oracle Call Interface (OCI). In addition, specific network interface optimization, new improved virtual circuit I/O, and a unified event/wait model all substantially improve client/server communication performance. Improved distributed query optimization has also been built into the optimizer.

See Also:

- *Oracle9i Net Services Administrator's Guide*
- *Oracle Call Interface Programmer's Guide*

Shared Server Enhancements

The Shared Server architecture enables the Oracle9i server to significantly improve the scalability of applications and concurrent clients connected to the server by reducing memory consumption, server processes and utilizing Oracle Net's scalability features. Shared Server Architecture allows existing applications to scale without changes to the application and provides the infrastructure that enables the Oracle9i server to support additional presentation protocols, such as, IIOP, FTP, and HTTP.

Name Changes Shared Server in Oracle9i was formerly known as multi-threaded server (MTS).

The following table maps the current MTS parameter and dynamic view names to the new names associated with Shared Server in Oracle9i. The old names are maintained for backward compatibility, but users are encouraged to migrate to the new names.

| New Shared Server Parameter/View Name | Current MTS Parameter/View Name |
|--|--|
| CIRCUITS parameter | MTS_CIRCUITS parameter |
| DISPATCHERS parameter | MTS_DISPATCHERS parameter |
| MAX_DISPATCHERS parameter | MTS_MAX_DISPATCHERS parameter |
| MAX_SHARED_SERVERS parameter | MTS_MAX_SERVERS parameter |
| SHARED_SERVERS parameter | MTS_SERVERS parameter |
| SHARED_SERVER_SESSIONS parameter | MTS_SESSIONS parameter |
| V\$SHARED_SERVER_MONITOR view | V\$MTS view |

Oracle Net Connect Establishment (Direct Handoff) With Oracle9i, if the Oracle Net protocol and operating system (OS) allow it, the Oracle Net Listener hands off a connection request directly to a local dispatcher for all presentation protocols. This process is done without redirection of the connection request from listener back to the client. The client is connected directly to the dispatcher. The listener can resume listening for other incoming network sessions. This new feature improves overall

latency by eliminating the need for a network round-trip for the "redirect." In addition, it improves connection establishment performance in Wide Area Network (WAN) environments in which the cost of redirecting the client connection could be significant.

Oracle Net Event Model Significant design changes to the Oracle Net event model in Oracle9i have significantly improved the ability to handle thousands of network sessions more efficiently, for dispatcher, listener and as well as Connection Manager.

Common Event Model The integration of the Oracle Net event model with the Oracle9i server's Virtual OS (VOS) event model has significantly reduced the number of OS system calls which were previously required, and improved system response times. Prior to release Oracle9i, the dispatcher handled network and database events separately and differently. There were no consistency or synchronization among the event notification mechanisms between these two types of models. The dispatcher would have to check both the network and the database for any newly arriving event. Time and resources were wasted on juggling and balancing between these two different event models.

With the new Common Event Model in Oracle9i, the Shared Server dispatcher can handle event notification more efficiently. Users can expect improve performance and scalability with Shared Server.

Performance Manager Support Performance Manager is part of the Diagnostic Pack under Oracle Enterprise Manager Tool. It provides real-time graphical performance monitoring for Shared Server. Users can monitor the performance behavior of dispatchers, shared servers, and listeners at their individual detailed level, as well as on an overall high level. User can also find out all the session performance information for each shared server and view the SQL statement executed for each individual session. Additional tuning recommendation will be provided for DBA to fine-tune the Shared Server related parameters. These new features will simplify the management, monitoring, and troubleshooting of Shared Server in the enterprise environment.

See Also: *Oracle9i Net Services Administrator's Guide.*

Database Security

Oracle database security has been widely expanded in Oracle9i. Advances in database security have made in the areas of user security, data security, and enterprise security. User security has to do with making sure that only users who are authorized to access a database can do so. Data security has to do with

protecting the integrity of the database from whatever or whomever might compromise it. Enterprise security has to do with protecting the integrity of the data belonging to a particular enterprise.

Key enhancements in Oracle9i include the following:

- [Security New Features Implementation](#)
- [Database Security New Features:](#)
- [Data Encryption and Label Security](#)

Security New Features Implementation

This section explains some the ways for you to use new the features in Oracle9i database security. It contains the following parts:

- [User Security](#)
- [Data Security](#)
- [Network Security](#)

User Security

Security mechanisms must be scalable to support thousands or millions of users over the Internet and yet must still be practical to administer. Oracle9i offers a number of security features tailored to provide security for users on internet-scale applications. These features include enhancements to database proxy authentication, Public Key Infrastructure (PKI) support, and the new applications server feature, Web Single Sign-On. Together, these features allow enterprises to identify users throughout all tiers of the network.

Instead of the middle tier establishing a single connection to the database on behalf of the Web user, Enterprise User Security creates multiple, scalable lightweight database sessions to carry the identity of the Web user, thus enabling fine-grained access control and fine-grained auditing of the Web user.

Web Single Sign-On is offered with the Login Server component of the application server's portal services. With Single Sign-On, users need to only maintain a single user name and password account, by means of which they can access all Web applications throughout the enterprise. System administrators are provided with a single LDAP directory, the Oracle Internet Directory, to manage all access control information. By centralizing user access information, Oracle Internet Directory not only provides better security for the enterprise, but also helps lower the total cost of ownership.

Oracle also supplies PKI integration for easier deployment and management of PKI within the enterprise. For example, digital certificates issued by Entrust can be used to authenticate to the Oracle environment.

All of these technologies allow companies to increase access management without increased administrative complexity.

Data Security

The best way to minimize security risk is to provide multiple layers of security mechanisms so that failure of a single mechanism does not compromise critical information. This concept is referred to as **deep data protection** or **security for data**.

The Oracle9i database provides deep data protection through enhancements to Virtual Private Database (VPD) and Selective Data Encryption capabilities, as well as through fine grained auditing and new technologies collectively referred to as **Oracle Label Security**.

Network Security

A critical security requirement confronting the hosting environment is the issue of how to keep data from different hosted user communities separate. One way to do this is to create physically separate systems for each hosted community which, however, is costly.

The Oracle9i Database provides a more efficient and less costly alternative for a hosting provider by offering mechanisms that allow multiple user communities to share a single hardware and software instance. With Oracle9i Virtual Private Database and Oracle Label Security technologies, hosting providers are certain that data belonging to each user community is kept separate from data belonging to any other user community.

Database Security New Features:

Key enhancements in Oracle9i include the following:

- [Virtual Private Database \(VPD\) enhancements](#)
- [Web-based Single Sign-On](#)
- [Strong Three-Tier Security](#)
- [API Enhancements](#)
- [Directory Access Utilities](#)
- [Standards-Based Public Key Infrastructure \(PKI\)](#)

- [Improved User and Security Policy Management](#)
- [Oracle Internet Directory Administration Improvements](#)
- [Directory Services Availability Improvements](#)
- [LDAP Server Scalability and Performance](#)
- [Optimization of Server-Side Caching](#)

Virtual Private Database (VPD) enhancements

Virtual Private Database offers partitioned fine-grained access control whereby each user can only access rows of data that pertain to them and whereby security enforcement depends upon which application is accessing data. In addition, Virtual Private Database also provides connection pooling through a global or shared application context.

Fine-Grained Auditing

Fine-grained auditing offers selective audit of `SELECT` statements, with bind variables, based on relevant column access, significantly enhancing per-user accountability.

Web-based Single Sign-On

Login Server (included with Oracle Portal 3.0) provides web-based Single Sign-On and integration with legacy applications. With Single Sign-On, users are able to authenticate (log in) once and gain access to multiple Web services, without having to remember credentials and authenticate again for each service.

Strong Three-Tier Security

Three-tier security is enhanced by proxy authentication, including the following new features:

- Credential proxy of X.509 certificates or Distinguished Names (DN)
- Support for thick JDBC
- Connection pooling for application users (thick and thin JDBC and OCI)
- Integration with LDAP

An extensible, secure application role can require users to access the database through a middle tier. Another feature can ascertain that user identities are

maintained securely through all tiers of an application, with centralized user and privilege management in LDAP-based directories.

See Also:

- *Oracle9i Security Overview*
- *Oracle Advanced Security Administrator's Guide*

API Enhancements

Several application programming interface (API) enhancements have been made to aid the developer in making use of LDAP server functionality. The PL/SQL API to LDAP (known as `DBMS_LDAP`) permits any PL/SQL code to perform any LDAP operation. This API is now supported through all database operation modes (Oracle Shared Server and dedicated server). In addition, a new API set has been added to the PL/SQL `UTL_HTTP` package. New API functions have also been added to provide asynchronous operations.

See Also:

- *Oracle9i Supplied PL/SQL Packages and Types Reference*
- *Oracle Internet Directory Administrator's Guide*

Other New Packages Other new packages include the `UTL_URL` package, which performs exit and return functions on URLs, and `UTL_URL` and `UTL_ENCODE`, which is used to encode email messages.

Existing `UTL_TCP` and `UTL_SMTP` packages have been enhanced to support transfer time-out in Oracle9i. The existing `UTL_INADDR` package has been enhanced to support reverse domain name resolution in Oracle9i.

See Also: *Oracle9i Supplied PL/SQL Packages and Types Reference*

Directory Access Utilities

Additional utilities to access directory structures have been added to the C language API to LDAP. JNDI standard protocol extensions can now be recognized by Oracle Internet Directory.

Proxy authentication allows users without schemas to access the database through the middle tier.

See Also:

- *Oracle9i Application Developer's Guide - Fundamentals*
- *Oracle Internet Directory Application Developer's Guide*
- *Oracle9i Supplied PL/SQL Packages and Types Reference*

Standards-Based Public Key Infrastructure (PKI)

Standards-based public key infrastructure (PKI) includes support for PKCS#12 certificates. They enable existing PKI credentials to be shared by an Oracle Wallet, thus reducing PKI deployment costs and increasing interoperability. Wallets can be downloaded from LDAP directories, supporting mobile users. The SSL libraries used in Oracle9i now also support hardware acceleration for improved performance. Oracle9i also supports enhanced wallet password management.

See Also: *Oracle Advanced Security Administrator's Guide*

Improved User and Security Policy Management

Oracle9i supports LDAP technology to centrally manage network naming, easing deployments regardless of how many databases—with all their respective users—customers have. Oracle9i supports Oracle Internet Directory, Novell Directory Services, and Microsoft Active Directory. Oracle9i *also* supports native authentication using Microsoft Active Directory.

Enterprise User Management Enhancements Improved user and security policy management, provided through Enterprise User Management enhancements, includes management of password-based users in LDAP directories and a management tool for VPD policies. Security policies can be organized into groups and then, by referring to the application context, the Oracle server can determine which group of policies should be in effect at runtime. The server enforces all the policies which belong to that policy group.

See Also: *Oracle9i Security Overview*

Password Encryption User passwords can also be encrypted using either standard or custom cryptographic schemes. Oracle Internet Directory supports an Internet Engineering Task Force (IETF) LDAP standard for representing prefixed user passwords where the prefixes identify the cryptographic scheme used for hashing the password values. A default hashing mechanism may be chosen from a variety of standard schemes, including MD5, SHA-1, and Unix cryptography. Values hashed

by external agents may also be stored. This is useful when external authentication service agents want to use custom cryptographic schemes.

See Also: *Oracle Internet Directory Administrator's Guide*

Secure Random Number Generator The `DBMS_OBFUSCATION_TOOLKIT` now includes a secure random number generator, `GetKey`. Secure random number generation is a very important aspect of cryptography; predictable cryptographic keys can easily be decrypted by a person or machine performing cryptographic analysis.

Note: `DBMS_RANDOM` is unsuitable for generating cryptographic keys, and should never be used for this purpose.

See Also:

- *Oracle9i Application Developer's Guide - Fundamentals*
- *Oracle9i Supplied PL/SQL Packages and Types Reference*
- *Oracle9i Security Overview*

Oracle Internet Directory Administration Improvements

Administration of Oracle Internet Directory replication server has also been improved with the provision of new replication queue management and reconciliation tools. The replication queue management tool allows administrators object-by-object control over the elements in the human intervention queue, for the purposes of retrying object processing at will and for deletion of objects from the queue. The replication reconciliation tool permits administrators to detect and correct inconsistencies among directory replicas.

A new web-based Oracle Internet Directory Self-Service Administration servlet enables users to administer their own personalized data over the Web. Directory administrators can restrict the set of attributes users are allowed to self-administer, including group memberships. Extended support for ACLs governing user self-administration of membership allows authenticated users to add their own Distinguished Names (DNs) to membership of a LDAP group object or any object type (including roles and proprietary subscriber lists) that holds membership information.

See Also: *Oracle Internet Directory Administrator's Guide*

Directory Services Availability Improvements

Several enhancements have also been made to increase the availability of directory services. Certification with certain limited Oracle9i Real Application Cluster configurations improves availability both for the front end, where the LDAP directory service and replication processes reside, and the back end Oracle RDBMS, where the directory data is stored. Support for logical hosts in clusters allows failover to a different physical host within the same cluster and also transparently supports continued availability of directory replication. New procedures allow for multi-node topology reconfiguration and upgrading with no directory service downtime.

See Also: *Oracle9i Real Application Clusters Administration*

LDAP Server Scalability and Performance

Several key enhancements have further increased LDAP server scalability and performance. Multi-process support for higher-concurrency LDAP access has been improved through a more scalable directory metadata cache coherency protocol. IETF-compliant support for LDAP referral objects enables partitioned LDAP directories. This allows delegated administration of physical directory segments and is critical for service providers and enterprises hosting large directories for a federation of autonomous organizations. By employing parallelism, the capacity of bulk-load, bulk-delete, and bulk-modify tools have been enhanced to handle much larger data sets.

See Also: *Oracle Internet Directory Administrator's Guide*

Optimization of Server-Side Caching

Optimization of server-side caching at startup on group objects reduces LDAP server startup latency and improves performance of access control evaluations. Finally, the ability of Oracle Internet Directory to consult access control information has been enhanced significantly such that the evaluation decisions are made efficiently even when there are very large numbers of ACL policies to be consulted.

See Also:

- *Oracle9i Application Developer's Guide - Fundamentals*
- *Oracle Internet Directory Administrator's Guide*

Data Encryption and Label Security

Encryption enhancements are according to the Advanced Encryption Standard (AES), the replacement from the National Institute of Standards and Technology for the Data Encryption Standard (DES). The Data Encryption Standard is the standard encryption algorithm currently in use.

Key enhancements in Oracle9i include the following:

- [Selective Data Encryption](#)
- [Oracle Label Security](#)
- [Oracle Policy Manager](#)

Selective Data Encryption

Selective data encryption in Oracle9i makes it possible to shield very sensitive information in a database by encrypting it. For example, if you want to store confidential information about upper management compensation in the company database but do not want your database administrators or other privileged users to be able to access this information, you can encrypt the specific information that you wanted to keep confidential while still storing it in the database.

See Also: *Oracle Data Integration Overview*

Oracle Label Security

The Oracle Label Security option in Oracle9i extends Virtual Private Database functionality by offering label-based data access. By attaching access control directly to the data, security cannot be bypassed. This technology is ideal for application service providers who host data from more than one enterprise within a single database and therefore need to keep the data securely separated.

Oracle Label Security is a fine-grained access control solution that can be used directly out of the box with little or no modification needed for use. It adds a special label to data rows, providing sophisticated and flexible row label security, and it is built on the Oracle9i Virtual Private Database technology. Oracle Label Security is based on labeling concepts used by government and defense organizations to protect sensitive information and provide data separation. Application hosting, health care and other industries can also take advantage of data labeling to help solve security requirements in the Internet Age. For example, in application hosting, a subscriber label can be used to separate data among subscribers in the same application.

Oracle Label Security is enforced within the database so that it provides security even if the application is bypassed. Label provides a dimension of access control that is not easily achieved using existing application data. Oracle Label Security also includes a sophisticated policy management tool, to manage policies, labels, and user label authorizations.

See Also: *Oracle Label Security Administrator's Guide*

Oracle Policy Manager

Oracle Policy Manager is an extension to Oracle Enterprise Manager that administers Oracle Label Security. The Oracle Policy Manager graphical user interface contains a tree structure that lists policies along with their labels, authorizations, and protected objects.

See Also:

- *Oracle Enterprise Manager Concepts Guide*
- *Oracle Advanced Security Administrator's Guide*
- *Oracle Label Security Administrator's Guide*
- *Oracle9i Application Developer's Guide - Fundamentals*

Windows Integration

Oracle9i reinforces Oracle's lead as the platform of choice for organizations deploying on the Windows operating system. Key focus areas include the following:

- [Integration Capabilities](#)
- [Development and Deployment Improvements](#)

Integration Capabilities

Oracle9i supports enhanced integration with Microsoft Transaction Services and Internet Information Services. The PKI infrastructure and Single Sign-On capabilities in Oracle9i have also been well integrated with Windows 2000, Active Directory, and Microsoft Certificate Store.

Development and Deployment Improvements

Oracle9i Development and Deployment Improvements are as follow:

- An enhanced solution to allow the Oracle database to participate as a Resource Manager in Microsoft Transaction Server/COM+ Transactions environment, providing enhanced performance and scalability.
- Oracle9i security supports Oracle wallets in the Windows registry or ActiveDirectory and allows Oracle products to use Microsoft Certificate Store.
- For Windows developers, Oracle9i offers a more reliable native OLE DB provider. Oracle Objects for OLE introduce new XML, database Events, and Oracle9i extension features. The COM Automation Feature now supports Java stored procedures.

See Also:

- *Oracle9i Security and Network Integration Guide*
- *Oracle Services for Microsoft Transaction Server Developer's Guide*
- *Oracle Provider for OLE DB Developer's Guide*
- *Oracle Objects for OLE*
- *Oracle Objects for OLE C++ Class Library*
- *Oracle COM Automation Feature Developer's Guide*

Information Integration

Oracle9i introduces new products and technologies crucial to facilitating a successful e-business environment. Key technological advances include the following:

- [Providing a Standard Infrastructure](#)
- [Supporting Industry Standard Business Messaging Formats](#)

Providing a Standard Infrastructure

Oracle9i includes a set of pre-developed, pre-tested, and pre-integrated business service objects, developed in Java and compliant with J2EE, to provide a faster time-to-market for customers to build and integrate Web-based storefronts, exchanges and hosted applications.

Key enhancements in Oracle9i include the following:

- [e-Business Service Objects](#)

- [Dynamic Services](#)

e-Business Service Objects

The e-business service objects seamlessly blend open Internet technologies and standards with reliable, scalable Oracle technologies and products. The e-business service objects allow developers to rapidly build complex multitiered Internet applications based on open standards, such as HTML, XML, JavaScript, Java Servlets, Java Beans, and Java Server Pages.

These e-business service objects also provide a flexible architecture for building multitier Internet applications. Components built using this framework can reside within the Oracle9i Java Virtual Machine (JVM) or within the Oracle Internet Application Server (iAS) that supports Java technologies, such as Java Server Pages (JSPs) and Java Servlets.

The collection of Java-based services provided includes the following new functionalities:

- Security and access control mechanisms
- Logging and tracing facilities
- Resource sharing and data protection facilities
- Session and state management functionality
- Globalization services

See Also: *Oracle9i Java Developer's Guide*

Dynamic Services

Oracle9i also provides an enhanced infrastructure through Dynamic Services for support of Internet service aggregation and syndication for portals, exchanges, and other Internet applications. Dynamic Services integrates the Oracle Internet Directory, XML services, and Advanced Queuing features with a policy and service management engine.

Queue information can be stored on an Oracle Internet Directory server to provide a single point of contact to locate the required topic or queue without the user needing to know in which database the queue is located. The Oracle Internet Directory can also be used as the repository for event registration. Clients can register for database events even when the database is down.

Dynamic Services allows developers to easily manage, compose, reuse, and deploy local and remote Internet services—such as quotes, news feeds, exchange rates, or

credit card processing—and database services—such as employee lookup, payroll, location services, or any PL/SQL procedure.

See Also: *Oracle9i Application Developer's Guide - Advanced Queuing*

Supporting Industry Standard Business Messaging Formats

Oracle9i also provides a standard infrastructure that makes it easier for customers to integrate these storefronts, exchanges, and portals with other backend and external systems.

Key enhancements in Oracle9i include the following:

- [XML-Based Messaging Over HTTP](#)
- [Built-In Message Transformation Architecture](#)
- [Business Event System](#)
- [Message Gateway](#)

XML-Based Messaging Over HTTP

XML-based messaging over HTTP is supported, allowing external, across-firewall systems to be more easily integrated. In addition, non-database, Internet based consumers are also supported, allowing for greater flexibility in homogeneous environments. To enable messaging operations such as enqueue and dequeue to be performed across the Internet, a new XML-based Internet Document Access Protocol (iDAP) is provided that allows message operations to be requested across firewalls. Message security itself has been improved with digitally signed messages, and message non-repudiation is supported both for messages and for iDAP requests.

Built-In Message Transformation Architecture

Oracle9i provides a built-in message transformation architecture, with support for PL/SQL and XSLT-based transformations, which can be executed during enqueue, dequeue, and propagation operations.

Advanced Queuing agents can now also be defined in Oracle Internet Directory, providing a centralized, easy-to-manage, secure infrastructure for global messaging. In addition, global topic information can also be externalized in Oracle Internet Directory, providing a single place for the configuration and management for Advanced Queuing operations that span one or more systems.

Business Event System

Oracle Workflow now provides the Business Event System, a new application service that leverages the Oracle Advanced Queuing infrastructure to communicate business events among systems within an enterprise as well as between enterprises. The Business Event System includes the Event Manager for registering subscriptions to significant events and event activities for modeling business events within workflow processes. This support allows Oracle Workflow users to deal with business objects and e-business integration flows powerfully and flexibly, with minimal intrusion into core applications.

Message Gateway

The Message Gateway in Oracle9i supports messaging between heterogeneous environments, and supports propagation of messages from Oracle9i to other proprietary message systems.

See Also:

- *Oracle Internet Directory Administrator's Guide*
- *Oracle9i Application Developer's Guide - Advanced Queuing*

Packaged Applications

Oracle9i packaged applications enhancements provide new capabilities and new economies.

- [Database Globalization Support](#)
- [Development Features for Independent Software Vendors](#)

Database Globalization Support

Oracle9i also significantly reduces the cost of developing and deploying applications globally on a single database instance.

Key enhancements in Oracle9i include the following:

- [Unicode Datetime Enhancements](#)
- [Unicode Support Expansion](#)
- [Linguistic Collation Capability Enhanced](#)
- [Extensive Locale Definitions Set](#)

Unicode Datetime Enhancements

Requirements for multi-geographical applications include named time zones and multi-language support through Unicode. The datetime datatypes `TIMESTAMP WITH LOCAL TIME ZONE` and `TIMESTAMP WITH TIME ZONE` are time-zone aware. Datetime values can be specified as local time in a particular region (rather than as a particular offset). Using the time zone rules tables for a given region, the time zone offset for a local time is calculated, taking into consideration Daylight Savings time adjustments to be used in further operations.

Unicode Support Expansion

Unicode support has been greatly expanded in Oracle9i so that developers can easily find the right Unicode solution for their application needs. Developers can now develop fully globalized applications by setting up or migrating their database character set to `UTF8` to support multiple languages simultaneously. National Character fields can be used to define columns that support one or more new languages for an existing monolingual database. Application developers can also use the Character Set Scanner utility to quickly identify potential issues in migrating an Oracle database to a new character set, thus easing migration of existing applications.

Oracle9i supports ISO 14651/Unicode Collation, and extended locale Unicode support including:

- New languages (all are for India)
- New territories (mostly for Latin America, plus Macedonia and Yugoslavia)
- New character sets
- New linguistic sorts

Linguistic Collation Capability Enhanced

Linguistic collation capability in Oracle9i is greatly enhanced based on the new proposed ISO 14651 standard for multilingual collation. In addition, Oracle9i adds a set of new pre-defined linguistic sorts for Asian languages including Chinese, Japanese, and Korean. If customers have special needs that go beyond the extensive set of linguistic sorts provided with Oracle9i, then they also have the flexibility of defining or customizing their own linguistic sorts by using a new easy-to-use graphical interface, Oracle Locale Builder.

Extensive Locale Definitions Set

Oracle9i provides an extensive set of locale definitions including 57 languages, 88 territories and approximately 200 character sets. If customers need to customize existing locale definitions, or create new definitions, the new Oracle Locale Builder provides an easy-to-use graphical user interface through which one can easily view, modify, and define the various locale-specific data.

See Also: *Oracle9i Database Globalization Support Guide*

Development Features for Independent Software Vendors

Oracle9i continues to be the best platform for independent software vendor development, deployment, hosting, and migration. Features such as updatable scrollable cursors, ANSI -compliant `CASE` statements, datetime data types, and join syntax facilitate migrating applications developed on other databases to Oracle9i. In addition, `LONG` data types can be easily converted to `LOB` data types by a simple `ALTER TABLE` statement.

Enhancements to stored outlines and default column values allow improved deployment and hosting for packaged applications. With stored outline editing, queries can be tuned without having to change the packaged application code. For the customer whose environment has unique characteristics that might cause an outline to yield a less-than-optimal execution plan, the ability to make adjustments to the outline enhances the ability to support specific customer needs.

In this manner, because users can make finely tuned adjustments to the saved plan, stored outlines are made more adaptive. Use of the `SYS_CONTEXT` function to generate default column values simplifies implementation of Virtual Private Database security feature, providing a more scalable infrastructure for managing hosted applications.

Packaged applications also benefit from the numerous development, availability, scalability and security features provided in Oracle9i.

Oracle9i Documentation

This chapter lists the generic books available online (that is, the books not specific to a particular operating system) that document the Oracle9i Database, release 2.

This chapter contains the following sections:

- [Online Documentation Structure](#)
- [Documentation Titles](#)

Online Documentation Structure

All books are available in electronic format. The following categories of documentation are available:

- [Oracle9i Master Index and Master Glossary](#)
- [Oracle9i Server and SQL*Plus](#)
- [Oracle9i Directory, Networking, and Security Documentation](#)
- [Oracle9i Real Application Clusters](#)
- [Oracle9i Database Application Development](#)
- [Oracle Text](#)

Documentation Titles

The following tables list the book titles in the generic documentation areas. All documentation is available in PDF only.

Note: This is the list of books and part numbers that were available at release time. This list might differ slightly from what is available online.

Oracle9i Master Index and Master Glossary

Table 4–1 *Oracle9i Master Index and Master Glossary*

| Documentation | Part Number | Description |
|--|-------------|--|
| <i>Oracle9i Database Generic Documentation Master Glossary</i> | A92001 | Defines terms used in Oracle9i database documentation. |
| <i>Oracle9i Generic Documentation Master Index</i> | A96625 | Lists and provides links to contexts for terms that appear in Oracle9i database documentation. |

Oracle9i Server and SQL*Plus

Table 4–2 Oracle9i Server and SQL*Plus Documentation

| Documentation | Part Number | Description |
|---|-------------|---|
| Administration, Concepts, and Reference | | |
| <i>Oracle9i Database New Features</i> | A96531 | Explains new features of Oracle9i. Also describes and lists documentation for this release. |
| <i>Oracle9i Database Administrator's Guide</i> | A96521 | Explains how to create and to manage an Oracle database. Includes information about distributed processing. |
| <i>Oracle9i Database Concepts</i> | A96524 | Describes how the Oracle server functions and lays a conceptual foundation for information contained in other Oracle server manuals. |
| <i>Oracle9i Database Error Messages</i> | A96526 | Lists Oracle Database error and informational messages and provides their corresponding cause and action statements. |
| <i>Oracle9i Database Migration</i> | A96530 | Explains how to plan and execute migrations, upgrades, and downgrades of an Oracle database system. Also provides information about compatibility, about upgrading applications to the current release of Oracle, and about important changes in the current release, including initialization parameter changes and data dictionary changes. |
| <i>Oracle9i Database Performance Tuning Guide and Reference</i> | A96533 | Explains in detail how to enhance Oracle performance by writing and tuning SQL properly, by using performance tools, and by optimizing instance performance. Also explains how to create an initial database for good performance and includes performance-related reference information. |
| <i>Oracle9i Database Performance Planning</i> | A96532 | Explains the high-level performance methodology recommended by Oracle for the database. Explains clear and simple activities that can dramatically improve system performance according to extensive oracle designing and performance research. |
| <i>Oracle9i Database Reference</i> | A96536 | Provides reference information about database initialization parameters, static data dictionary views, dynamic performance views, database limits, and SQL scripts. |

Table 4–2 Oracle9i Server and SQL*Plus Documentation (Cont.)

| Documentation | Part Number | Description |
|--|--------------------|---|
| <i>Oracle9i Database Utilities</i> | A96652 | The Oracle Database Utilities manual describes how to use Oracle Database utilities to load data into a database, transfer data between databases, and maintain data. Specific utilities discussed are Export, Import, SQL*Loader, External Tables, DBVERIFY, and DBNEWID. Also describes the Oracle9i external tables feature, which allows you to access data in external sources as if it were in a table in the database. |
| <i>Oracle9i Database Globalization Support Guide</i> | A96529 | Describes Oracle's globalization support and how to use its capabilities. |
| <i>Oracle9i Sample Schemas</i> | A96539 | Describes the four schemas that are included in the seed database that ships, along with the familiar SCOTT schema, with Oracle9i. These schemas are used in many examples in the documentation. |
| <i>Oracle9i SQL Reference</i> | A96540 | Contains a complete description of the Structured Query Language (SQL) used to manage information in an Oracle database. The first volume describes all of the building blocks of SQL statements. The remaining volumes describe the SQL statements alphabetically. |
| <i>Oracle9i Heterogeneous Connectivity Administrator's Guide</i> | A96544 | Describes Oracle's approach for heterogeneous connectivity and provides information for its use. |
| Backup and Recovery | | |
| <i>Oracle9i Backup and Recovery Documentation Online Roadmap</i> | A97202 | Lays out the structure of the various Oracle9i Backup and Recovery documents and the recommended order in which you should read them. |
| <i>Oracle9i Backup and Recovery Concepts</i> | A96519 | Describes the basic concepts involved in backup and recovery. |
| <i>Oracle9i Recovery Manager User's Guide</i> | A96566 | Describes how to use Recovery Manager (RMAN) to perform backup and recovery. |
| <i>Oracle9i Recovery Manager Reference</i> | A96565 | This book describes the RMAN syntax and recovery catalog views. |
| <i>Oracle9i Recovery Manager Quick Reference</i> | A96564 | This quick reference manual describes the basic RMAN tasks and syntax. |
| <i>Oracle9i User-Managed Backup and Recovery Guide</i> | A96572 | This book describes how to use operating system commands to perform backup and restore operations, and SQL*Plus to perform recovery. |

Data Warehousing

Table 4–2 Oracle9i Server and SQL*Plus Documentation (Cont.)

| Documentation | Part Number | Description |
|--|--------------------|---|
| <i>Oracle9i Data Warehousing Guide</i> | A96520 | Provides reference and implementation material for using Oracle9i in data warehouses. |
| Streams and Replication | | |
| <i>Oracle9i Streams</i> | A96571 | Contains conceptual information about Oracle Streams and information about configuring, administering, and monitoring an Oracle Streams environment. Also includes detailed examples of using Oracle Streams for various purposes. |
| <i>Oracle9i Replication</i> | A96567 | Contains conceptual information about Oracle replication. Also includes information about planning a replication environment, an introduction to the Replication Management tool in Oracle Enterprise Manager, descriptions of the new replication features in the current release, and information about troubleshooting replication problems. |
| <i>Oracle9i Replication Management API Reference</i> | A96568 | Contains reference information about and step-by-step instructions for using the replication management API, which is a set of PL/SQL packages for setting up and managing a replication environment. Also includes reference information about data dictionary views that are important for replication and security considerations for a replication environment. |
| SQL*Plus | | |
| <i>SQL*Plus User's Guide and Reference</i> | A90842 | Introduces the SQL*Plus tool. Introductory and How to sections describe the SQL*Plus Command Line and iSQL*Plus user interfaces and how to configure and use them. Reference and Error sections provide SQL*Plus command descriptions and a list of SQL*Plus error messages with associated cause and action text. |
| <i>SQL*Plus Quick Reference</i> | A90843 | Shows the syntax for SQL*Plus commands. |
| <i>SQL*Plus Getting Started for Windows</i> | A92157 | Describes features specific to the Windows operating system including the Windows user interface to SQL*Plus. |

Table 4–2 Oracle9i Server and SQL*Plus Documentation (Cont.)

| Documentation | Part Number | Description |
|--|--------------------|--|
| Data Guard | | |
| <i>Oracle9i Data Guard Broker</i> | A96629 | Describes the Oracle9i Data Guard broker, a management and monitoring interface that automates many of the tasks involved in configuring and monitoring standby databases in an Oracle9i Data Guard configuration. This guide provides comprehensive descriptions and examples for using both the command-line interface and the Oracle9i Data Guard Manager graphical user interface. |
| <i>Oracle9i Data Guard Concepts and Administration</i> | A96653 | Provides a comprehensive overview of Oracle9i Data Guard concepts and describes how to configure and implement standby databases that can take over production operations if your production database becomes unusable. This guide includes several common database scenarios such as creating, recovering, failing over, switching over, configuring, and backing up standby and primary databases. |

Oracle9i Directory, Networking, and Security Documentation

Table 4–3 Oracle9i Directory, Networking, and Security Documentation

| Documentation | Part Number | Description |
|---|--------------------|--|
| Networking and Security | | |
| <i>Oracle9i Net Services Administrator's Guide</i> | A96580 | Explains how to plan, configure, and manage enterprise-wide connectivity with Oracle Net Services. |
| <i>Oracle9i Net Services Reference Guide</i> | A96581 | Explains how to plan, configure, and manage enterprise-wide connectivity with Oracle Net Services. |
| <i>Oracle Advanced Security Administrator's Guide</i> | A96573 | Oracle Advanced Security provides a single source of integration with network encryption, single sign-on services, smartcard, token and biometric user authentication. |
| <i>Oracle Label Security Administrator's Guide</i> | A96578 | Describes how to use Oracle Label Security to protect sensitive data. It explains the basic concepts behind label-based security and provides examples to show how it is used. |
| <i>Oracle9i Security Overview</i> | A96582 | Introduces the basic concepts of system security. It outlines the data security risks which are prevalent today, and the industry-standard technologies available to address them. It then presents the suite of Oracle products you can use to implement these security technologies. |

Table 4–3 Oracle9i Directory, Networking, and Security Documentation (Cont.)

| Documentation | Part Number | Description |
|--|-------------|--|
| Oracle Internet Directory | | |
| <i>Oracle Internet Directory Administrator's Guide</i> | A96574 | Describes the features, architecture, and administration of Oracle Internet Directory. |
| <i>Oracle Internet Directory Application Developer's Guide</i> | A96577 | Provides information for enabling applications to access Oracle Internet Directory by using the C API and the PL/SQL API. |
| <i>Oracle9i Directory Service Integration and Deployment Guide</i> | A96579 | A starting point for those who want to learn how Oracle products use Oracle Internet Directory. Covers LDAP concepts and baseline directory configuration tasks. |

Oracle9i Real Application Clusters

Table 4–4 Oracle9i Real Application Clusters Documentation

| Documentation | Part Number | Description |
|---|-------------|--|
| <i>Oracle9i Real Application Clusters Documentation Online Roadmap</i> | A96599 | Lays out the structure of the various Real Application Clusters documents and the recommended order in which you should read them. |
| <i>Oracle9i Real Application Clusters Concepts</i> | A96597 | Provides a conceptual description of Real Application Clusters processing and the Real Application Clusters architecture. |
| <i>Oracle9i Real Application Clusters Setup and Configuration</i> | A96600 | Explains Real Application Clusters setup and configuration procedures as well as how to use Oracle tools for software installation and database creation. |
| <i>Oracle9i Real Application Clusters Administration</i> | A96596 | Explains how to administer Real Applications Clusters. |
| <i>Oracle9i Real Application Clusters Deployment and Performance</i> | A96598 | Provides a high-level explanation of deployment practices for various system types such as e-commerce, data warehousing, and online transaction processing. Gives an in-depth examination of Real Application Clusters performance measurement and tuning methods to maximize clustered environment performance. |
| <i>Oracle9i Real Application Clusters Real Application Clusters Guard I - Concepts and Administration</i> | A96601 | Describes configuration parameters, and explains how to set up customized features, how to use the command line interface, how to set up the network configuration, and how to troubleshoot Oracle Real Application Clusters Guard I. |

Oracle9i Database Application Development

Table 4–5 Oracle9i Database Application Development Documentation

| Documentation | Part Number | Description |
|--|-------------|--|
| Application Development | | |
| <i>Oracle9i Application Developer's Guide - Fundamentals</i> | A96590 | Introduces the features needed to develop applications for Oracle9i, particularly triggers and stored procedures. This book also gives a high-level overview of topics covered in more detail in other books, such as PL/SQL, Java, and OCI. |
| <i>Oracle9i Application Developer's Guide - Advanced Queuing</i> | A96587 | Describes features of application development and integration using Oracle's messaging system, Advanced Queuing. Includes the PL/SQL, C, Visual Basic, Java, and JMS interfaces to AQ and gateways to non-Oracle messaging systems. |
| <i>Oracle9i Application Developer's Guide - Large Objects (LOBs)</i> | A96591 | Describes the following large object (LOB) types and how to use them: <ul style="list-style-type: none"> ■ Character LOBs (CLOBs) ■ Binary LOBs (BLOBs) ■ External LOBs (BFILEs) ■ National Language Support LOBs (NCLOBs) |
| <i>Oracle9i Application Developer's Guide - Object-Relational Features</i> | A96594 | Describes how to use user-defined object datatypes to model complex real-world entities, such as customers and purchase orders, as objects in the database. |
| <i>Oracle9i Application Developer's Guide - Workspace Manager</i> | A96628 | Describes how to use Oracle Database Workspace Manager to work with long transactions. Workspace management refers to the ability of the database to hold different versions of the same record (that is, row) in one or more workspaces. Users of the database can then change these versions independently. This manual includes conceptual, usage, and reference information. |
| <i>Oracle9i Data Cartridge Developer's Guide</i> | A96595 | Describes how to implement custom indexing and query optimization services and how to package and use these as a server extension called a data cartridge. |

Table 4–5 Oracle9i Database Application Development Documentation (Cont.)

| Documentation | Part Number | Description |
|--|-------------|--|
| <i>Oracle9i XML Database Developer's Guide - Oracle XML DB</i> | A96620 | <p>Describes the following Oracle native XML support features of the Oracle XML database and explains how to use them:</p> <ul style="list-style-type: none"> ■ XMLType datatype and API to create XMLType columns or tables ■ World Wide Web Consortium (W3C) schema support ■ SQLX function and Oracle SQLX extension functions such as XMLSequence() ■ W3C Xpath support for extraction, condition checks and updates ■ ToObject method for converting an XMLType object to a PL/SQL object type ■ XMLType views ■ W3C XSLT support ■ OCI and JDBC support for XMLType ■ C-Based PL/SQL DOM, Parser and XSLT APIs <p>Oracle XML DB also features a repository, which adds advanced foldering, versioning, and security mechanisms to facilitate using FTP, HTTP, and WebDav to access XML data in the database. This book also discusses JDeveloper and OEM support.</p> |
| <i>Oracle9i XML Developer's Kits Guide - XDK</i> | A96621 | <p>Describes the XML Developer's Kits (XDK) components and how to use them. Contains installation and configuration information and includes documentation of XDK for Java, XDK for C, XDK for C++, and XDK for PL/SQL. (XDK for Java now includes TransXUtility, WebServices (SOAP), and JAX support) Also describes how to build XML based applications using JDeveloper, BC4J/J2EE XML applications and User Interface for XML (UIX) support.</p> |
| <i>Oracle9i XML Case Studies and Applications</i> | A88895 | <p>This manual provides case studies and applications that use Oracle9i's XML-enabled database technology. It describes different ways that XML data can be stored, managed, queried, and exchanged in the database using Oracle XML-enabled technology.</p> |
| Language and Interface | | |
| <i>Oracle Call Interface Programmer's Guide</i> | A96584 | <p>Presents the Oracle Call Interface (OCI), an application programming interface (API) that allows applications written in C or C++ to interact with one or more Oracle Databases.</p> |

Table 4–5 Oracle9i Database Application Development Documentation (Cont.)

| Documentation | Part Number | Description |
|--|--------------------|--|
| <i>Oracle C++ Call Interface Programmer's Guide</i> | A96583 | Presents the Oracle C++ Call Interface (OCCI), an application program interface (API) that enables applications written in C++ to interact with one or more Oracle Databases. Also, to extend the functionality of OTT generated code, programmers may want to add code in the OTT generated file. The way OTT can distinguish between OTT generated code and code added by the user is by looking for some predefined markers (tags). Support for these tags has been added in the Oracle9i release 2 (9.2) database. |
| <i>PL/SQL User's Guide and Reference</i> | A96624 | Presents PL/SQL (Oracle's procedural extension of SQL), an advanced fourth-generation programming language. Explains the concepts behind PL/SQL and illustrates every facet of the language. |
| <i>Pro*C/C++ Precompiler Programmer's Guide</i> | A96108 | A comprehensive user's guide and reference to the Oracle Pro*C/C++ precompiler, this manual shows how to develop C++ programs that use the SQL and PL/SQL database languages to access and manipulate Oracle data. |
| <i>Pro*C/C++ Precompiler Getting Started for Windows</i> | A96111 | This guide is an addendum to the <i>Pro*C/C++ Precompiler Programmer's Guide</i> and contains information specific to the Windows platform |
| <i>Pro*COBOL Precompiler Programmer's Guide</i> | A96109 | A comprehensive user's guide and reference to the Oracle Pro*COBOL Precompiler. It shows how to develop COBOL programs that use the SQL and PL/SQL database languages to access and manipulate Oracle data. |
| <i>Pro*COBOL Precompiler Getting Started for Windows</i> | A96113 | This guide is an addendum to the <i>Pro*COBOL Precompiler Programmer's Guide</i> and contains information specific to the Windows platform |
| <i>Programmer's Guide to the Oracle Precompilers</i> | A42525 | This manual is a comprehensive user's guide and on-the-job reference to the Oracle Pro*COBOL and Pro* Fortran Precompilers. It show you step-by-step how to develop applications that use the powerful database language SQL to access and manipulate Oracle data. |
| <i>Pro*Fortran Supplement to the Oracle Precompilers Guide</i> | A42523 | This companion book to the <i>Programmer's Guide to the Oracle Precompilers</i> shows you how to write FORTRAN programs that use the powerful database language SQL to access and manipulate Oracle data. |

Table 4–5 Oracle9i Database Application Development Documentation (Cont.)

| Documentation | Part Number | Description |
|---|-------------|--|
| <i>SQL*Module for Ada Programmer's Guide</i> | A58231 | This book is a comprehensive user's guide and reference for SQL*Module, an Oracle application development tool. It includes a complete description of Module Language, an ANSI/ISO SQL standard for developing applications that access data stored in a relational database. Module Language uses parameterized procedures to encapsulate SQL statements. The procedures can then be called from an Ada application. This Guide also describes how you can use SQL*Module to call PL/SQL procedures stored in an Oracle database. A number of complete examples using Module Language, Ada code, and stored database procedures are provided. |
| Application Reference | | |
| <i>Oracle9i XML API Reference - XDK and Oracle XML DB</i> | A96616 | Describes Oracle XML Developer's Kits (XDK) and Oracle XML DB application program interfaces (APIs) for developers building XML applications on the Oracle9i database and provides syntax and a brief description of functions, methods, and procedures associated with them. |
| <i>Oracle9i Supplied Java Packages Reference</i> | A96609 | Presents the Java packages supplied with Oracle8i. Interfaces, classes, and exceptions are summarized in a table. Each is listed in alphabetical order with its syntax, a member summary, and an inherited-member summary. This is followed by details about the fields, constructors, and methods. |
| <i>Oracle Call Interface Programmer's Guide</i> | A96584 | Presents the Oracle Call Interface (OCI), an application programming interface (API) that allows applications written in C or C++ to interact with one or more Oracle Databases. |
| <i>Oracle C++ Call Interface Programmer's Guide</i> | A96583 | Presents the Oracle C++ Call Interface (OCCI), an application program interface (API) that enables applications written in C++ to interact with one or more Oracle Databases. |
| <i>Oracle9i Supplied PL/SQL Packages and Types Reference</i> | A96612 | Describes the PL/SQL packages and defined types supplied with the Oracle Database. Packages are listed alphabetically with syntax, procedures and functions, and parameters described for each package. |
| interMedia and Oracle Spatial | | |
| <i>Oracle Spatial User's Guide and Reference</i> | A96630 | Provides usage and reference information for indexing and storing spatial data and for developing spatial applications. |
| <i>Oracle Dynamic Services User's and Administrator's Guide</i> | A88783 | Describes Java-based programmatic framework for incorporating, managing, and deploying Internet and intranet services. |

Table 4–5 Oracle9i Database Application Development Documentation (Cont.)

| Documentation | Part Number | Description |
|---|--------------------|--|
| <i>Oracle Syndication Server User's and Administrator's Guide</i> | A88787 | Describes a comprehensive system for the automated, controlled exchange and management of digital assets among business partners. |
| <i>Oracle interMedia User's Guide and Reference</i> | A96630 | Describes how to enable Oracle9i to store, manage, and retrieve geographic location information, images, audio, video, or other heterogeneous media data in an integrated fashion with other enterprise information. |
| <i>Oracle interMedia Java Classes User's Guide and Reference</i> | A96121 | Describes Java Classes to enable users to write Java applications using <i>interMedia</i> objects. |
| <i>Oracle interMedia Annotator User's Guide</i> | A96120 | Describes how to extract information (or metadata) from media sources of certain formats and insert the metadata along with the media source into an Oracle database. |

Oracle Text

Table 4–6 Oracle Text Documentation

| Documentation | Part Number | Description |
|--|--------------------|---|
| <i>Oracle Text Application Developer's Guide</i> | A96517 | Contains information about how to build an application with Oracle9i Text, such as a text query application or document classification system. Examples are provided for creating a text table, indexing, and querying. This book also contains information about query tuning, document presentation, and using a thesaurus in your application. |
| <i>Oracle Text Reference</i> | A96518 | Contains reference information for <i>interMedia</i> Text, including <i>interMedia</i> Text SQL statements, operators, supplied PL/SQL packages, and views. Examples are provided for using the PL/SQL packages and operators. |
| <i>Oracle Ultra Search Online Documentation</i> | A97204 | Contains information about how to use Oracle Ultra Search to search the contents of a database and the contents of static HTML pages. |

Oracle9i Feature and Option Availability

The Oracle9i database is available as Oracle9i Enterprise Edition, Oracle9i Standard Edition, and Oracle9i Personal Edition. Each database edition includes a wide set of database features.

A database **feature** is a specific area of functionality for the Oracle9i Database.

Oracle9i Enterprise Edition provides the most extensive functionality of the three editions and contains all database features as well as the capability to use additional database options if they are purchased with the product.

A database **option** is an area of functionality that actually extends the capability of the server and that must be licensed for an additional fee.

Oracle9i Standard Edition, a subset of the feature functionality of Oracle9i Enterprise Edition, does not allow for the purchase of options and is designed for smaller businesses and enterprises.

Oracle9i Personal Edition is designed to be used by the single user for development purposes. It is available on Windows NT, Windows 2000, and Windows XP and includes, at no extra cost, all the features and options available with Oracle9i Enterprise Edition, excluding Oracle9i Real Application Clusters.

Note: Unlike pre-Oracle9i releases, all features and options applicable to your configuration are included on your product CD-ROM and are shipped enabled. *Options must be licensed for use.*

This chapter contains the following sections:

- [Options](#)
- [Features](#)

-
- The V\$OPTION Table

Options

Table 5–1 lists the options available with Oracle9i. Options which are new or whose factoring status has changed are noted in *bold italic* print.

Note: Options to the Oracle9i Enterprise Edition expand Database performance and manageability. *Options are included on your product CD ROM but must be licensed for use.*

Table 5–1 Oracle9i Options

| Option | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|---|--|--|--|--|
| <i>Oracle9i Real Application Clusters</i> | N | Y | N | <i>Oracle9i Real Application Clusters is a computing environment that harnesses the processing power of multiple, interconnected computers using clustering technology. It includes Cluster Filesystem capability on the Windows environment.</i> |
| Oracle Partitioning | N | Y | Y | Oracle Partitioning allows large tables to be broken into smaller pieces that improve manageability, availability, and scalability. |
| <i>On-Line Analytical Processing (OLAP)</i> | N | Y | Y | <i>Oracle9i OLAP is a scalable, high-performance calculation engine with fulling integrated management and administration for delivering analytic applications.</i> |
| <i>Data Mining</i> | N | Y | Y | <i>Data Mining provides personalization capabilities to enable customers to implement accurate realtime recommendations and personalization capabilities into their online operations.</i> |
| <i>Oracle Label Security</i> | N | Y | Y | <i>Oracle Label Security extends Virtual Private Database functionality by offering label-based data access.</i> |
| Oracle Advanced Security | N | Y | Y | Oracle Advanced Security provides a comprehensive range of network security features to provide a single source of integration with network encryption, single sign-on services, smartcard, token, and biometric user authentication, with support for Enterprise User Management. |

Table 5–1 Oracle9i Options

| Option | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|--|---------------------------------|-----------------------------------|---------------------------------|--|
| Oracle Programmer | Y | Y | Y | Oracle Programmer is a family of products consisting of three SQL-style interfaces: precompilers, SQL*Module, and SQLJ; three call level interfaces: Oracle Call Interface (OCI), ODBC, and JDBC; Oracle Objects for OLE; and Object Type Translator and JPub. |
| Oracle Spatial | N | Y | Y | The Oracle Spatial option is an integrated set of functions and procedures that enables spatial data to be stored, accessed, and analyzed quickly and efficiently in an Oracle database. |
| <i>Oracle Tuning Pack for use with Oracle Enterprise Manager</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Oracle Tuning Pack provides database administrators with expert performance management for the Oracle environment, including SQL tuning and storage optimization.</i> |
| <i>Oracle Diagnostics Pack for use with Oracle Enterprise Manager</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Oracle Diagnostics Pack is an advanced set of tools used to monitor the state of databases and systems and pinpoint, analyze, and repair any weaknesses.</i> |
| <i>Oracle Change Management Pack for use with Oracle Enterprise Manager</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Oracle Change Management Pack eliminates errors and loss of data when upgrading databases to support new applications. The pack analyzes the impact and complex dependencies associated with application change and automatically performs database upgrades.</i> |
| <i>Oracle Management Pack for Oracle Applications for use with Oracle Enterprise Manager</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Oracle Management Pack for Oracle Applications extends Oracle Enterprise Manager to enable the monitoring, diagnosis, capacity planning, and tuning of the Oracle Applications environment.</i> |
| <i>Oracle Management Pack for SAP R/3 for use with Oracle Enterprise Manager</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Oracle Management Pack for SAP R/3 offers real time monitoring for SAP R/3 systems, capacity planning for historical analysis and future planning purposes, event integration, and a single point of administration of the host, database, and application.</i> |

Features

Table 5–2 lists the features, all of which, because they are new, are noted in *bold italic* print, available with Oracle9i release 2.

Note: Features are included in their respective editions of the Oracle9i Database or are included with their respective Option.

Table 5–2 Oracle9i Features, Release 2

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|------------------------------------|--|---------------------------------|-----------------------------------|---------------------------------|---|
| <i>Performance and Scalability</i> | <i>Cluster Filesystem</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Available only with the Real Application Clusters option for Windows, this feature improves disk manageability.</i> |
| <i>Performance and Scalability</i> | <i>Real Applications Clusters Guard</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Available only with the Real Application Clusters option, this new implementation of Real Application Clusters Guard supports active/active high availability configurations with easy-to-configure failover policies based on named services.</i> |
| <i>Availability</i> | <i>Logical and Physical Standby Database</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Provides standby databases for your production database; the production database must be in Oracle9i Enterprise Edition.</i> |
| <i>Availability</i> | <i>Data Guard enhancements</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Improves availability and includes Data Guard Broker enhancements for switchover, support for multiple standby databases, and enforceable restrictions on unlogged operations on a primary database that would impact its Standby databases.</i> |

Table 5–2 Oracle9i Features, Release 2

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|---------------------|--|--|--|--|--|
| Availability | <i>LogMiner improvements</i> | Y | Y | Y | <i>Provides support for Large Objects (LOBs), LONGs, and parallel DML, as well as a multi-versioned dictionary and real time mining of online logs.</i> |
| Availability | <i>Rename column and constraint</i> | Y | Y | Y | <i>Provides users with the ability to rename CONSTRAINTS and COLUMNS.</i> |
| Availability | <i>Fast PL/SQL recompilation</i> | Y | Y | Y | <i>Provides fast loading of wrapped source, knows to do nothing upon loading an unchanged package, view or synonym, and removes double invalidations and parallel compilation in dep, significantly reducing the time required for PL/SQL packages and procedures recompilation.</i> |
| Availability | <i>Flashback query improvements</i> | Y | Y | Y | <i>Generates flashback information within a SQL statement instead of only within a session.</i> |
| Information Sharing | <i>Oracle Streams</i> | N | Y | N | <i>Shares information between users, applications, and databases to enable data replication, message queuing, event management, and data warehouse loading.</i> |
| Manageability | <i>Locally managed System Tablespace</i> | Y | Y | Y | <i>Enables the SYSTEM tablespace to be Locally Managed to simplify the database administrator's tasks.</i> |
| Manageability | <i>Archive log space management</i> | Y | Y | Y | <i>Included in Recovery Manager, this feature automates the space management of archived log files, freeing the database administrator from managing the space allocation of the archived logs.</i> |

Table 5–2 Oracle9i Features, Release 2

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|----------------------|--|--|--|--|---|
| <i>Manageability</i> | <i>Built-in shared pool usage and SQL execution advisories</i> | Y | Y | Y | <p><i>This feature includes built-in advisories that do the following:</i></p> <ul style="list-style-type: none"> ■ <i>Show Shared Pool usage for improving parse time and minimizing CPU usage.</i> ■ <i>Show SQL execution memory for improvements in SQL execution time, and for minimizing unnecessary CPU and I/O use.</i> |
| <i>Manageability</i> | <i>Built-in Mean-Time-To-Recover advisory</i> | N | Y | Y | <i>Enables the administrator to set time requirements to recover from a system crash without jeopardizing run-time performance.</i> |
| <i>Manageability</i> | <i>Query execution statistics</i> | Y | Y | N | <i>Provides actual operation-level query execution statistics (instead of estimated ones) to help identify the most expensive SQL statements and their corresponding operations.</i> |
| <i>Manageability</i> | <i>Access statistics</i> | Y | Y | N | <i>Specifies areas of high contention in objects by identifying tables, partitions, and indexes that are heavily accessed or have contention points.</i> |
| <i>Manageability</i> | <i>I/O topology</i> | Y | Y | N | <i>Useful in all systems, this feature provides complete mapping of a file to logical volumes and physical devices.</i> |

Table 5–2 Oracle9i Features, Release 2

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|--------------------------------|-----------------------------------|--|--|--|--|
| <i>Manageability</i> | <i>Clone management in OEM</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Included in the Oracle Enterprise Manager Change Management Pack, this feature enables you to clone a subset of a production environment (data and statistics) for development testing.</i> |
| <i>Application Development</i> | <i>XML DB</i> | <i>Y</i> | <i>Y</i> | <i>N</i> | <i>XML support in both Native XML storage and retrieval technology is available to absorb fully the W3C XML data model into the Oracle9i database, to provide new standard access methods for navigating and querying XML, and to provide an XML repository.</i> |
| <i>Application Development</i> | <i>XDK Improvements</i> | <i>Y</i> | <i>Y</i> | <i>N</i> | <i>XDKs have improved performance, including conformance with the latest XML standards including XML Schema and SOAP, and new compression and diff features.</i> |
| <i>Application Development</i> | <i>Server side debugging</i> | <i>Y</i> | <i>Y</i> | <i>N</i> | <i>JSWP compliant debugging of Java and PL/SQL in the database allows debugging from any JDB compliant tool, such as JDeveloper (IASV2).</i> |
| <i>Application Development</i> | <i>Globalization enhancements</i> | <i>Y</i> | <i>Y</i> | <i>N</i> | <i>Globalization provides support to the 44,946 newly added, supplementary characters in the latest edition (3.1) of the Unicode standard to remove the NCHAR adoption obstacle for customers who are dependent on Objects.</i> |

Table 5–2 Oracle9i Features, Release 2

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|--------------------------------|--------------------------------------|----------------------------------|------------------------------------|----------------------------------|--|
| <i>Application Development</i> | <i>Java improvements⁹</i> | Y | Y | N | <i>The Oracle9i Database now has JDBC support for TIMESTAMP datatype and statement pooling. It provides thin JDBC support for PL/SQL index tables, NUMBER conversions routines, and optimized statement execution time and has implemented all Java methods.</i> |
| <i>Application Development</i> | <i>PL/SQL improvements</i> | Y | Y | N | <i>PL/SQL Associative Arrays replace a large volume of sort/search code for performance improvements. Collection/Record Performance improvements provide faster string operations under UTF8. Insert/Update can now be performed using a whole record.</i> |
| <i>Application Development</i> | <i>C, C++ improvements</i> | Y | Y | N | <i>Provides a scrollable cursor and efficient multi-threaded application connection pooling.</i> |
| <i>Application Development</i> | <i>iSQL*Plus</i> | Y | Y | N | <i>iSQL*Plus can run most existing SQL*Plus scripts and can be used to create dynamic reports from a web based browser.</i> |
| <i>Content Management</i> | <i>FilesOnline</i> | Y | Y | N | <i>These features in Oracle 9iFS include single file restore, Workflow, and application plug-ins.</i> |
| <i>Content Management</i> | <i>iFS improvements⁹</i> | Y | Y | N | <i>These features in Oracle 9iFS include single file restore, Workflow, and application plug-ins.</i> |

Table 5–2 Oracle9i Features, Release 2

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|------------------------------|--|--|--|--|--|
| <i>Content Management</i> | <i>interMedia improvements</i> | Y | Y | N | <i>Provides new formats supported by interMedia AVI as well as improved image processing performance.</i> |
| <i>Content Management</i> | <i>Build spatial indexes in parallel</i> | N | Y | N | <i>Supported in Locator and with the Oracle Spatial option, this feature builds R-tree and quadtree indexes in parallel.</i> |
| <i>Content Management</i> | <i>Text improvements</i> | Y | Y | N | <i>Improvements to Oracle Text enhance its manageability and scalability, and new features support XML searching.</i> |
| <i>Content Management</i> | <i>Improvements to Locator and Oracle Spatial Option</i> | Y | Y | N | <i>Included in the Oracle Spatial option, this feature provides spatial performance improvements for R-tree indexes and queries using secondary filters.</i> |
| <i>Content Management</i> | <i>Workspace manager improvements</i> | Y | Y | N | <i>Enhancements to Workspace help database administrators better to manage production workspaces and to allow workspaces to be used by hundreds or thousands of users to group, to isolate, and to version long duration updates to relational data.</i> |
| <i>Business Intelligence</i> | <i>Composite range-list partitioning</i> | N | Y | Y | <i>Included with the Partitioning option, RANGE-LIST partitioning is a composite partitioning technique, in which a table is partitioned using RANGE and then sub-partitioned using LIST.</i> |
| <i>Business Intelligence</i> | <i>Partitioning improvements</i> | N | Y | Y | <i>Subpartition Templates and Fast partition SPLIT are included in the Partitioning Option.</i> |

Table 5–2 Oracle9i Features, Release 2

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|------------------------------|---|----------------------------------|------------------------------------|----------------------------------|--|
| <i>Business Intelligence</i> | <i>Enhanced Optimizer Statistics</i> | Y | Y | Y | <i>Dynamic sampling of optimizer statistics and DBMS_STATS is enhanced to support user-defined statistics.</i> |
| <i>Business Intelligence</i> | <i>Parallel DML on non-partitioned tables</i> | N | Y | Y | <i>Update and delete statements against non-partitioned tables can be parallelized.</i> |
| <i>Business Intelligence</i> | <i>Materialized view improvements</i> | N | Y | Y | <i>Provides Full and Fast Refresh of Nested Materialized Views, Fast Refresh with UNION ALL in materialized views, Text Match Rewrite which ignores alphabetic case and supports set operators, and Text Match Rewrite with Named View Defining Text.</i> |
| <i>Business Intelligence</i> | <i>OLAP Option Enhancements</i> | N | Y | Y | <i>Provides OCI and JDBC interfaces to OLAP option, extended warehouse schema support, dynamic model execution, SQL INSERT DIRECT OLAP DML command, SQL IMPORT command in OLAP DML command, ALLOCATION system, OLAP Catalog Metadata API, and RDBMS storage of analytic workspace.</i> |
| <i>Business Intelligence</i> | <i>Data Compression</i> | N | Y | Y | <i>Provides the capability to create tablespaces, tables, and partitions with COMPRESS characteristics as they are loaded into segments.</i> |

Table 5–2 Oracle9i Features, Release 2

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|------------------------|---|---------------------------|-----------------------------|---------------------------|---|
| Business Intelligence | Data Mining Enhancements | N | Y | Y | Included with the Data Mining option, these features include two new algorithms, decision trees using adaptive Bayesian networks and clustering, and attribute importance and model seeker utilities. |
| Security and Directory | Inverse group support | N | Y | Y | Included with the Oracle Label Security option, inverse groups indicate releasability of information and are used to mark the dissemination of data. |
| Security and Directory | VPD Enhancements | N | Y | Y | Applies VPD policies to public or private synonyms associated with table or view base objects. Allows creation of VPD argument of object name to be a table, view, or synonym. |
| Security and Directory | DBA grant, revoke | Y | Y | Y | New system privilege, GRANT ANY OBJECT PRIVILEGE, allows users to grant and revoke privileges on objects on behalf of the object's owner to simplify the installation process. |
| Security and Directory | Username and password are set up upon database creation | Y | Y | Y | Improves Oracle relational database management system security. |
| Security and Directory | SYS, SYSDBA accountability | Y | Y | Y | Improves Oracle relational database management system security. |

Table 5–2 Oracle9i Features, Release 2

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|-------------------------------|--------------------------------------|--|--|--|--|
| <i>Security and Directory</i> | <i>ASO enhancements</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Included with the Oracle Advanced Security option, these improvements include SSL integration with hardware accelerators and a user migration utility, and use the Advanced Encryption Standard (AES) encryption algorithm.</i> |
| <i>Windows Integration</i> | <i>Oracle Fail Safe improvements</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>Allow additional support for Logical/Physical Standby and allow multi-cluster manageability.</i> |
| <i>Windows Integration</i> | <i>OLE DB and ODBC .Net support</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>The Oracle9i database release 2 client fully supports ODBC and OLE DB .Net data access to any Oracle database.</i> |
| <i>Windows Integration</i> | <i>VLM support</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Improves performance and scalability of Oracle on Windows by allowing access to large physical memory areas.</i> |

Features

[Table 5–3](#) lists the features, all of which, because they are new, are noted in *bold italic* print, available with Oracle9i release 2.

Note: Features are included in their respective editions of the Oracle9i Database or are included with their respective Option.

Table 5–3 Oracle9i Features, Release 1

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|------------------------------|--|---------------------------------|-----------------------------------|---------------------------------|---|
| Data Warehousing and VLDB | <i>Automated parallel query degree</i> | N | Y | Y | <i>Provides automated parallel query optimization based on system utilization.</i> |
| Data Warehousing and VLDB | Bitmap indexes | N | Y | Y | Provides an index type commonly used in a data warehouse for columns with small number of distinct values, such as 'Y' or 'to' to improve dramatically performance gains in a data warehouse application. |
| Data Warehousing and VLDB | <i>CUBE and ROLLUP</i> | Y | Y | Y | <i>OLAP operators CUBE and ROLLUP to produce sub-totals and crosstab reports easily and efficiently using a single SQL statement.</i> |
| Data Warehousing and VLDB | <i>Analytic functions</i> | Y | Y | Y | <i>Includes rank, moving average, and ratio-to-report.</i> |
| Data Warehousing and VLDB | <i>Descending indexes</i> | Y | Y | Y | <i>Provides better performance when indexed data needs to be sorted in descending order.</i> |
| Data Warehousing and VLDB | <i>Direct Path Load API</i> | Y | Y | Y | <i>Allows complete access to all load functionality via OCI API for creation of high performance load programs.</i> |

Table 5–3 Oracle9i Features, Release 1

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|--------------------------------------|---|--|--|--|---|
| <i>Data Warehousing and VLDB</i> | <i>Export transportable tablespaces</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Quickly moves or creates a copy of tablespace data. A transportable tablespace can be "plugged in" to all editions of the Oracle9i database, but only Enterprise Edition can create a transportable tablespace.</i> |
| <i>Data Warehousing and VLDB</i> | <i>Function-based indexes</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Allows indexes to be created on expressions or functions.</i> |
| <i>Data Warehousing and VLDB</i> | <i>Import transportable tablespaces</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>Quickly "plugs in" a transportable tablespace. Oracle9i Enterprise Edition must be used to create (export) a transportable tablespace.</i> |
| <i>Data Warehousing and VLDB</i> | <i>Long operations monitor</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>Progress of long running database and application operations can be monitored, and information can be displayed, such as percent complete.</i> |
| <i>Data Warehousing and VLDB</i> | <i>Materialized views</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Includes summary management functionality, join indexes, and summary advisor. Provides powerful functionality that automatically redirects queries to stored summary tables, improving query performance dramatically.</i> |
| <i>Data Warehousing and VLDB</i> | <i>Optimizer statistics management</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>Enables schema object statistics, used by the cost based optimizer, to be copied and moved to another database.</i> |

Table 5–3 Oracle9i Features, Release 1

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|--------------------------------------|---|---------------------------------|-----------------------------------|---------------------------------|---|
| Data Warehousing and VLDB | Parallel analyze | N | Y | Y | The <code>ANALYZE</code> statement, used to gather statistics on tables, can be run using parallel processing. This feature requires the Partitioning Option. |
| Data Warehousing and VLDB | Parallel bitmap star query optimization | N | Y | Y | This algorithm utilizes single-table bitmap indexes and an advanced star query join method, resulting in excellent performance while efficiently utilizing space. |
| Data Warehousing and VLDB | Parallel DML (insert/update/ delete) | N | Y | Y | DML operations are transparently divided across multiple processes. This feature requires the Partitioning Option. |
| Data Warehousing and VLDB | Parallel index build | N | Y | Y | Indexes can be created using parallel processes, significantly improving performance of the operation. |
| Data Warehousing and VLDB | Parallel index scans | N | Y | Y | Queries that use of an index can scan the index in parallel with multiple processes. This requires the Partitioning Option. |
| <i>Data Warehousing and VLDB</i> | <i>Parallel load</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>Fast load of data is accomplished by use of multiple, parallel processes.</i> |
| Data Warehousing and VLDB | Parallel query | N | Y | Y | Oracle9i transparently distributes query execution across multiple processes, resulting in excellent performance. |

Table 5–3 Oracle9i Features, Release 1

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|---------------------------|-----------------------------|---------------------------|-----------------------------|---------------------------|---|
| Data Warehousing and VLDB | Sample scan | N | Y | Y | The SAMPLE keyword is used to in SQL statements to select a percentage of random data easily within a table; this is useful in data mining applications. |
| Data Warehousing and VLDB | Star query optimization | Y | Y | Y | This algorithm utilizes B-tree indexes (not bitmap indexes). |
| Database Features | Advanced Queuing | N | Y | Y | This rules-based, publish and subscribe queuing system can be used to develop large-scale, message-oriented distributed applications. |
| Database Features | Database event triggers | Y | Y | Y | Database triggers, such as database startup or shutdown triggers, DDL statement triggers, and logon/logoff triggers, are fired when the event occurs. |
| Database Features | DBMS_REPAIR package | Y | Y | Y | Provides early detection and correction of software and hardware corruption. |
| Database Features | Drop column | Y | Y | Y | Provides functionality to remove an unwanted column from a table. |
| Database Features | Fine-grained access control | N | Y | Y | Includes functionality to create security policies that implement row-level security. |
| Database Features | Index coalesce | N | Y | Y | Free space in index leaf blocks can be defragmented while table is online. |
| Database Features | Index-organized tables | Y | Y | Y | Provides tables where data is stored in a B*-tree index structure for better performance and reduced storage. |

Table 5–3 Oracle9i Features, Release 1

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|-------------------|---|---------------------------------|-----------------------------------|---------------------------------|---|
| Database Features | <i>Indexes on NLS collating sequences</i> | N | Y | Y | <i>Provides efficient linguistic sorting using NLS sorts through use of function-based indexes (available in Enterprise Edition and Personal Oracle9i).</i> |
| Database Features | Instead-of triggers | Y | Y | Y | Provides triggers that execute instead of the DML transaction execution. |
| Database Features | LOB (large object) support | Y | Y | Y | Provides datatypes and functionality for storing and manipulating large objects, such as images or other unstructured data. |
| Database Features | <i>Locally managed tablespaces</i> | Y | Y | Y | <i>Provides efficient storage management functionality that improves reliability and reduces fragmentation.</i> |
| Database Features | LogMiner | Y | Y | Y | <i>Provides the functionality to analyze transaction log information online to enable auditing of transactions and the ability to "back out" individual transactions.</i> |
| Database Features | National language support (NLS) | Y | Y | Y | Provides native language support. |
| Database Features | <i>Objects and extensibility</i> | Y | Y | Y | <i>Object relational functionality includes object types and methods. Also provides database extensibility by means of APIs to database services and functionality.</i> |
| Database Features | <i>Online index build</i> | N | Y | Y | <i>Indexes can be built and re-built without locking the table during the operation.</i> |

Table 5–3 Oracle9i Features, Release 1

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|--------------------------|------------------------------------|----------------------------------|------------------------------------|----------------------------------|--|
| Database Features | Password management | Y | Y | Y | Provides password expiration, complexity, and security policy management. |
| Database Features | PL/SQL stored procedures, triggers | Y | Y | Y | Provides mechanism to deploy logic directly in the database. |
| <i>Database Features</i> | <i>PL/SQL Server Pages</i> | Y | Y | Y | <i>Provides server-side Web pages (in HTML or XML) with embedded PL/SQL scripts, enabling rapid development of dynamic Web pages.</i> |
| <i>Database Features</i> | <i>Plan Stability</i> | N | Y | Y | <i>Allows execution plans for SQL to be stored so that the plan remains consistent throughout schema changes, database reorganizations, and data volume changes.</i> |
| Database Features | Reverse key indexes | Y | Y | Y | Indexed columns can be indexed on reversed column values for better index performance. |
| <i>Database Features</i> | <i>Temporary tables</i> | Y | Y | Y | <i>Allows users to manipulate data for the duration of a transaction or session.</i> |
| Distributed | Advanced Replication | N | Y | Y | Advanced replication includes basic replication functionality plus multi-master replication, Replication Manager, and parallel propagation to maximize throughput. (Advanced Replication was formerly known as Replication.) |

Table 5–3 Oracle9i Features, Release 1

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|--------------------|--|---------------------------------|-----------------------------------|---------------------------------|---|
| <i>Distributed</i> | <i>Basic replication</i> | Y | Y | Y | <i>Oracle9i server fully supports bi-directional replication with automated conflict detection and resolution. Supported configurations include a single updatable master site with multiple updatable or read-only snapshot sites.</i> |
| Distributed | Distributed queries | Y | Y | Y | Queries can include tables from multiple databases. |
| Distributed | Distributed transactions | Y | Y | Y | Transactions can include tables from multiple databases. Includes transparent two phase commit functionality and XA support. |
| Distributed | Heterogeneous services | Y | Y | Y | Queries and transactions can involve Oracle and non-Oracle databases transparently. This functionality is used by Oracle Transparent Gateways. |
| <i>Networking</i> | <i>N-tier authentication/authorization</i> | N | Y | Y | <i>Preserves client identity throughout all tiers.</i> |
| Networking | Network access control | N | Y | Y | Provides filtering capabilities between clients and servers and acts as relay for thin JDBC connections that have no access privileges to the database host |
| Networking | Connection pooling | Y | Y | Y | Enables the server to time-out idle sessions and use that connection to service an active session, resulting in more efficient network usage. |
| Networking | Multi-protocol connectivity | N | Y | Y | Bridges Oracle Net Services communities of users that use different network protocols such as SPX/IPX, TCP/IP or LU6.2. |

Table 5–3 Oracle9i Features, Release 1

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|---------------------------|--|--|--|--|---|
| Networking | Multiplexing | N | Y | Y | Enables multiple network sessions to coexist over a single physical transport, reducing the number of physical connections a server must maintain to support a population of clients. |
| Networking | Net8 | Y | Y | Y | Oracle Net Services enables heterogeneous, distributed computing across machines regardless of vendor, operating system, or hardware architecture. |
| Networking | Oracle Connection Manager | N | Y | Y | Provides multiplexing, multi-protocol connectivity, and network access control. |
| Networking | Oracle Names | Y | Y | Y | Provides fully integrated, multi-protocol network naming service that allows administrators to centrally define service addresses, inter-database links, aliases and client configuration profiles. |
| <i>Program Interfaces</i> | <i>AppWizard for Visual Studio (NT only)</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>Eases development of Oracle based applications using Visual Studio.</i> |
| <i>Program Interfaces</i> | <i>Autonomous transactions</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>Blocks of PL/SQL can commit independently of each other to ease complex transaction programming.</i> |
| <i>Program Interfaces</i> | <i>COM cartridge (NT only)</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>Allows PL/SQL developers to programmatically manipulate COM objects through the OLE Automation interface. Entry points are exposed for access to the methods defined by the OLE Automation interface for easy application integration.</i> |

Table 5–3 Oracle9i Features, Release 1

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|---------------------------|---|---------------------------------|-----------------------------------|---------------------------------|---|
| Program Interfaces | JDBC drivers | Y | Y | Y | Provides JDBC access to Oracle9i that is a Java call-level interface to SQL that is standards compliant and supports Oracle-specific features. |
| <i>Program Interfaces</i> | <i>Microsoft Transaction Server Integration (NT only)</i> | Y | Y | Y | <i>Full, native integration with Microsoft Transaction Server (MTS) allows developers to deploy COM-based applications using MTS against Oracle.</i> |
| Program Interfaces | Objects for OLE | Y | Y | Y | Is a COM-based database connectivity tool that provides seamless and optimized access to Oracle databases. |
| Program Interfaces | ODBC driver | Y | Y | Y | Provides access to the Oracle database. |
| Program Interfaces | Oracle Call Interface (OCI) | Y | Y | Y | Is the lowest level API interface to the Oracle database. |
| Program Interfaces | Pro*C | Y | Y | Y | Easily allows C programs to use SQL to access data. Requires Oracle Programmer |
| <i>Program Interfaces</i> | <i>SQLJ</i> | Y | Y | Y | <i>Allows embedded SQL statements in Java for concise and easy access to Oracle data. Requires Oracle Programmer.</i> |
| <i>System Management</i> | <i>Automated standby database</i> | N | Y | Y | <i>Provides for multiple remote standby databases that can easily be configured and automatically managed by the server, including copying and applying the transaction log files at the standby sites.</i> |

Table 5–3 Oracle9i Features, Release 1

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|--------------------------|--|--|--|--|---|
| <i>System Management</i> | <i>Readable standby database</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Databases, including a standby database, can be opened as "read-only", where no DML operations are allowed.</i> |
| <i>System Management</i> | <i>Database resource management</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Resources, such as CPU and degree of parallelism, can be allocated to groups of users such that a prioritization of tasks can be managed easily.</i> |
| <i>System Management</i> | <i>Duplexed backup sets</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Backup sets can be written to multiple devices in parallel.</i> |
| <i>System Management</i> | <i>Oracle DBA Management Pack</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>Is a set of management tools bundled with Oracle Enterprise Manager.</i> |
| <i>System Management</i> | <i>Fast-start fault recovery</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Provides fast and predictable recovery from system failures.</i> |
| <i>System Management</i> | <i>Incremental backup and recovery</i> | <i>N</i> | <i>Y</i> | <i>Y</i> | <i>Allows a backup process to be set up such that only changed blocks are written to the backup file.</i> |
| <i>System Management</i> | <i>Legato Storage Manager</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>Provides integrated functionality from Legato to allow backups directly to tapes.</i> |
| <i>System Management</i> | <i>Online backup and recovery</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>Allows backups to be run while the database is online. Recovery operations can also be run while the database is running.</i> |
| <i>System Management</i> | <i>Oracle DBA Management Pack</i> | <i>Y</i> | <i>Y</i> | <i>Y</i> | <i>This Oracle Enterprise Manager management pack includes Schema Manager and other tools.</i> |

Table 5–3 Oracle9i Features, Release 1

| Area | Feature Name | Oracle9i Standard Edition | Oracle9i Enterprise Edition | Oracle9i Personal Edition | Notes |
|-------------------|-------------------------------------|--|--|--|--|
| System Management | Oracle Enterprise Manager | Y | Y | Y | Is a single, integrated console that allows easy management and monitoring of the Oracle and non-Oracle database environment. |
| System Management | Oracle Fail Safe for Oracle9i on NT | Y | Y | Y | Makes it easy to deploy highly available single-instance Oracle9i database solutions on Microsoft Windows NT clusters. |
| System Management | Parallel backup and recovery | N | Y | Y | Enables both backup and recovery to be run using parallel processing. |
| System Management | Point-in-time tablespace recovery | N | Y | Y | Allows a tablespace to be recovered up to a specified point-in-time after a failure or inadvertent transaction execution. |
| System Management | Recovery Manager | Y | Y | Y | Is an easy-to-use, wizards-based functionality to setup and manage the entire backup and recovery process. |
| System Management | Server managed backup and recovery | Y | Y | Y | Manages the backup process, such as scheduling of backups, as well as the recovery process, such as applying the correct backup file when recovery is needed. |
| System Management | Transparent Application Failover | N | Y | Y | Completely masks many failures from end-users by preserving the state of their application and resuming any work that had been in progress at the time of failure. |

The V\$OPTION Table

To check the values for different options on your database, query the V\$OPTION table:

```
SQL> SELECT * FROM V$OPTION;
```

The response, of course, varies depending upon the specific installation. A sample result might be:

| PARAMETER | VALUE |
|------------------------------------|-------|
| Partitioning | TRUE |
| Objects | TRUE |
| Real Application Clusters | FALSE |
| Advanced replication | TRUE |
| Bit-mapped indexes | TRUE |
| Connection multiplexing | TRUE |
| Connection pooling | TRUE |
| Database queuing | TRUE |
| Incremental backup and recovery | TRUE |
| Instead-of triggers | TRUE |
| Parallel backup and recovery | TRUE |
| Parallel execution | TRUE |
| Parallel load | TRUE |
| Point-in-time tablespace recovery | TRUE |
| Fine-grained access control | TRUE |
| Proxy authentication/authorization | TRUE |
| Change Data Capture | TRUE |
| Plan Stability | TRUE |
| Online Index Build | TRUE |
| Coalesce Index | TRUE |
| Managed Standby | TRUE |

| PARAMETER | VALUE |
|-------------------------------------|-------|
| Materialized view rewrite | TRUE |
| Materialized view warehouse refresh | TRUE |
| Database resource manager | TRUE |
| Spatial | TRUE |
| Visual Information Retrieval | TRUE |
| Export transportable tablespaces | TRUE |
| Transparent Application Failover | TRUE |
| Fast-Start Fault Recovery | TRUE |
| Sample Scan | TRUE |
| Duplexed backups | TRUE |
| Java | TRUE |
| OLAP Window Function | TRUE |
| Block Media Recovery | TRUE |
| Fine-grained Auditing | TRUE |
| Application Role | TRUE |
| Enterprise User Security | TRUE |
| Oracle Data Guard | TRUE |
| Oracle Label Security | FALSE |
| OLAP | FALSE |
| Heap segment compression | TRUE |
| Join Index | TRUE |
| Trial Recovery | TRUE |
| Oracle Data Mining | TRUE |
| Online Redefinition | TRUE |
| Streams | TRUE |
| Very Large Memory | TRUE |
| File Mapping | TRUE |

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