Oracle® AI Database

Oracle Provider for OLE DB Developer's Guide

26ai for Microsoft Windows
G43546-01
October 2025

Oracle AI Database Oracle Provider for OLE DB Developer's Guide, 26ai for Microsoft Windows

G43546-01

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Preface

Based on an open standard, Oracle Provider for OLE DB (OraOLEDB) allows access to Oracle Databases. This documentation describes OraOLEDB's provider-specific features and properties.

This document describes the features of Oracle Database for Windows that apply to the Windows operating system.

Audience

Oracle Provider for OLE DB Developer's Guide is intended for programmers developing applications to access an Oracle Database using Oracle Provider for OLE DB. This documentation is also valuable to systems analysts, project managers, and others interested in the development of database applications.

To use this document, you must be familiar with OLE DB and have a working knowledge of application programming using Microsoft C/C++, Visual Basic, or ActiveX Data Objects (ADO). Knowledge of Component Object Model (COM) concepts are also useful.

Readers should also be familiar with the use of Structured Query Language (SQL) to access information in relational database systems.

Documentation Accessibility

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

Access to Oracle Support

Oracle customer access to and use of Oracle support services will be pursuant to the terms and conditions specified in their Oracle order for the applicable services.

Related Documents

For more information, see these Oracle resources:

- *Oracle Database Installation Guide for Microsoft Windows*
- *Oracle Database Release Notes*
- *Oracle Database Concepts*
- *Oracle Services for Microsoft Transaction Server Developer's Guide for Microsoft Windows*
- *Oracle Database Net Services Administrator's Guide*
- *Oracle Database New Features Guide*
- *Oracle Database Reference*

- *Oracle Database Globalization Support Guide*
- *Oracle Database Error Messages* for information about Oracle error message. Once you find the specific range, you can search for the specific message. When connected to the Internet, you can search for a specific error message using the error message search feature of the Oracle online documentation.

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

http://www.oracle.com/technetwork/index.html

For the latest version of the Oracle documentation, including this guide, visit

http://www.oracle.com/technetwork/indexes/documentation/index.html

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

Changes in This Release for Oracle Provider for OLE DB Developer's Guide

This preface contains:

Changes in Oracle Provider for OLE DB in 26ai

The following are changes in *Oracle Provider for OLE DB Developer's Guide* for Oracle AI Database 26ai:

New Features

The following feature is new in this release:

- `VECTOR` Data Type

  OraOLEDB supports vectors using `CLOB`, `VARCHAR2`, or equivalent data types. OLE DB data retrieval and manipulation use existing OLE DB `DBTYPE_STR` or `DBTYPE_WSTR` data types to consume the vector data.

- Increased Database Password Length

  Starting with this release, Oracle AI Database and client drivers including Oracle Provider for OLE DB support passwords up to 1024 bytes in length.

- SQL BOOLEAN Data Type

  Oracle client drivers now support fetching and binding the new `BOOLEAN` database column. Applications can use the native database `BOOLEAN` column data type with a native driver `BOOLEAN` datatype.

- Oracle Database JSON Data Type

  Oracle Provider for OLE DB supports the native JavaScript Object Notation (JSON) data type in Oracle AI Database. The JSON data type is optimized for query and DML processing, yielding database performance improvements processing JSON.

  JSON data can be bound as a parameter using the `DBTYPE_STR` or `DBTYPE_WSTR` data types.

- JSON Relational Duality

  JSON Relational Duality Views are fully updatable JSON views over relational data introduced in Oracle AI Database 26ai. Data remains stored in relational tables in a highly efficient normalized format but can be accessed by applications in the form of JSON documents.

  Duality views provide game-changing flexibility and simplicity by overcoming the historical challenges developers have faced when building applications using relational or document models.

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Introduction to Oracle Provider for OLE DB

These topics introduce Oracle Provider for OLE DB (OraOLEDB).

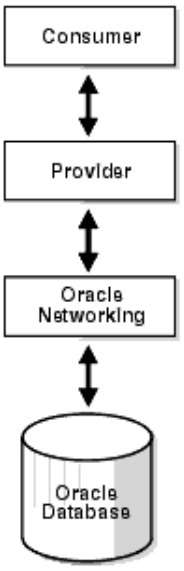
Overview of OLE DB

OLE DB is an open standard data access methodology which utilizes a set of Component Object Model (COM) interfaces for accessing and manipulating different types of data. These interfaces are available from various database providers.

OLE DB Design

The design of OLE DB centers around the concept of a consumer and a provider. Figure 1-1 is an illustration of the OLE DB system. The consumer represents the traditional client. The provider places data into a tabular format and returns it to the consumer.

Figure 1-1 OLE DB Flow



OLE DB Data Providers

OLE DB data providers are a set of **COM** components that transfer data from a data source to a **consumer**. An OLE DB Provider places that data in a tabular format in response to calls

from a consumer. Providers can be simple or complex. A **provider** may return a table, it may allow the consumer to determine the format of that table, and it may perform operations on the data.

Each provider implements a standard set of COM interfaces to handle requests from the consumer. A provider may implement optional COM interfaces to provide additional functionality.

With the standard interfaces, any OLE DB consumer can access data from any provider. Because of COM components, consumers can access them in any programming language that supports COM, such as C++, Visual Basic, and Java.

OLE DB Data Consumers

The OLE DB data consumer is any application or tool that utilizes OLE DB interfaces of a provider to access a broad range of data.

Overview of OraOLEDB

Oracle Provider for OLE DB (OraOLEDB) is an OLE DB data provider that offers high performance and efficient access to Oracle data by OLE DB consumers.

In general, this developer's guide assumes that you are using OraOLEDB through OLE DB or ADO.

With the advent of the .NET framework, support has been provided for using the OLEDB.NET Data Provider with OraOLEDB. With the proper connection attribute setting, an OLEDB.NET Data Provider can utilize OraOLEDB to access Oracle Database.

> **See Also**
>
> "OLEDB.NET Data Provider Compatibility" for further information on support for OLEDB.NET Data Provider

System Requirements

The following items are required on a system to use Oracle Provider for OLE DB:

- Windows Operating System:
  - 64-bit: Windows 10 x64 (Pro, Enterprise, and Education Editions), Windows 11 x64 (Pro, Enterprise, and Education Editions), Windows Server 2016 x64 (Standard, Datacenter, and Essentials Editions), Windows Server 2019 x64 (Standard, Datacenter, and Essentials Editions), or Windows Server 2022 x64 (Standard, Datacenter, and Essentials Editions).

    Starting in version 23, only 64-bit Oracle Provider for OLE DB is supported.
- Access to an Oracle Database (Oracle 19c or later) for OLE DB version 23
- Oracle Client and Oracle Net Services (included with Oracle Provider for OLE DB installation).
- Redistributable files provided with Microsoft Data Access Components (MDAC) 2.8 or higher are required by the provider. These files are available at the Microsoft Web site:

  https://www.microsoft.com/en-us/download/

- Oracle Services for Microsoft Transaction Server. This is required for consumers using Microsoft Transaction Server (MTS) or COM+.

OraOLEDB Installation

Oracle Provider for OLE DB is included as part of your Oracle installation. It contains the features and demos that illustrate how to use this product to solve real-world problems.

During the installation process, the following files are installed on the system. Some files have *ver* in their name to indicate the release version.

Table 1-1 Oracle Provider for OLE DB Files

File	Description	Location
`OraOLEDB`*`ver`*`.dll`	Oracle Provider for OLE DB	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\bin`
`OraOLEDBrfc`*`ver`*`.dll`	Oracle rowset file cache manager	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\bin`
`OraOLEDBrmc`*`ver`*`.dll`	Oracle rowset memory cache manager	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\bin`
`OraOLEDBrst`*`ver`*`.dll`	Oracle rowset	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\bin`
`OraOLEDBgmr`*`ver`*`.dll`	Oracle ODBC SQL parser	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\bin`
`OraOLEDB`*`lang`*`ver.dll` where *`lang`* is the required language	Language-specific resource DLL	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\bin`
`OraOLEDBpus`*`ver`*`.dll`	Property descriptions	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\bin`
`OraOLEDButl`*`ver`*`.dll`	OraOLEDB utility DLL	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\bin`
`OraOLEDB`*`ver`*`.tlb`	OraOLEDB type library	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\bin`
`OraOLEDB.h`	OraOLEDB header file	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\oledb\include`
`OraOLEDB`*`ver`*`.lib`	OraOLEDB library file	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\oledb\lib`
`OraOLEDB`*`lang`*`.msb` where *`lang`* is the required language	Language-specific message file	*`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\oledb\mesg`

> **See Also**
>
> The *Oracle AI Database Installation Guide for Microsoft Windows* for installation instructions

Component Certifications

Oracle provides support information for components on various platforms, lists compatible client and database versions, and identifies patches and workaround information.

Find the latest certification information at My Oracle Support:

https://support.oracle.com/portal/

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Features of OraOLEDB

These topics describe components of Oracle Provider for OLE DB (OraOLEDB) and how to use the components to develop OLE DB consumer applications.

- OraOLEDB Provider Specific Features
- Using OraOLEDB with Visual Basic
- OraOLEDB Programming Recommendations and Tips

OraOLEDB Provider Specific Features

The following sections describe provider-specific features of OraOLEDB:

- Data Source
- OraOLEDB Sessions
- Commands
- Rowsets
- Data Types
- JSON Support
- LOB Support
- Unicode Support
- Errors
- OLEDB.NET Data Provider Compatibility

Additional provider-specific information is provided in Provider-Specific Information.

Data Source

A data source object in OraOLEDB is responsible for establishing the first connection to the Oracle Database. To establish the initial connection, the consumer must use the `CoCreateInstance` function to create an instance of the data source object. This function requires important information about the provider: class ID of the provider and executable context. The class ID of OraOLEDB is `CLSID_OraOLEDB`.

OraOLEDB is an in-process server. When calling `CoCreateInstance`, use the `CLSCTX_INPROC_SERVER` macro. For example:

```
// create an instance of OraOLEDB data source object and
// obtain the IDBInitialize interface
hr = CoCreateInstance(CLSID_OraOLEDB, NULL,
                      CLSCTX_INPROC_SERVER, IID_IDBInitialize,
                     (void**)&pIDBInitialize);
```

The code snippet above does not enable OLEDB Services when instantiating the Data Source object. To enable OLEDB services, see "Compatibility with OLE DB Services" below.

> **Note**
>
> OraOLEDB does not support persistent data source objects.

After the successful creation of an instance of a data source object, the consumer application can initialize the data source and create sessions.

OraOLEDB supports connections to Oracle Databases releases. To connect to a specific database, the consumer is required to set the following properties of the `DBPROPSET_DBINIT` property set:

- `DBPROP_AUTH_USERNAME` with the user ID, such as `scott`
- `DBPROP_AUTH_PASSWORD` with the password, such as `tiger`
- `DBPROP_INIT_DATASOURCE` with the net service name, such as `myOraDb`

The consumer could also populate `DBPROP_INIT_PROMPT` with `DBPROMPT_PROMPT` which causes the **provider** to display a logon box for the user to enter the connect information.

Using `DBPROMPT_NOPROMPT` disables display of the logon box. In this case, incomplete logon information causes the provider to return a logon error. However, if this property is set to `DBPROMPT_COMPLETE` or `DBPROMPT_COMPLETEREQUIRED`, the logon box will be displayed only if the logon information is incomplete.

Compatibility with OLE DB Services

OraOLEDB is compatible with OLE DB Services that are available in OLE DB version 2.0 and later. OLE DB Services contains useful services such as automatic transaction enlistment, Client Cursor Engine (CCE), connection and session pooling, which can enhance application performance, and others.

OLE DB Services can be used with OraOLEDB through C++/COM or ADO.

By default, the `OLEDB_SERVICES` registry entry for OraOLEDB is set, under the `CLSID` of OraOLEDB, to `0xffffffff` (that is, `-1`), which enables all services. Certain OLE DB Services can also be disabled or enabled programmatically through the `DBPROP_INIT_OLEDBSERVICES` property setting.

> **See Also**
>
> `http://msdn.microsoft.com/en-us/library/ms724518(VS.85).aspx` for more information on OLE DB Services and how to enable or disable specific services

ADO Applications with OLE DB Services

ADO automatically enables OLE DB Services. Thus, ADO applications do not need any special code to use OLEDB Services.

C++/COM Applications with OLE DB Services

For C++/COM applications, some additional steps are needed to use OLE DB Services.

The following code snippet shows one way that C++/COM applications can enable OLE DB Services. The code shows the OLE DB consumer creating an instance of the `CLSID_MSDAINITIALIZE` class through `CoCreateInstance()`, obtaining the `IDataInitialize` interface from that object, and then creating an OLE DB data source object through that interface.

```
// Instantiate the CLSID_MSDAINITIALIZE class and request for the
// IID_IDataInitialize interface from it
hr = CoCreateInstance(CLSID_MSDAINITIALIZE, NULL, CLSCTX_INPROC_SERVER,
  IID_IDataInitialize, (void**)&pIDataInitialize);

// Set properties, datasource name, userid, and password, etc.
...

// Create an OLEDB data source object using the interface obtained from the
// CLSID_MSDAINITIALIZE class.
hr = pIDataInitialize->CreateDBInstance(CLSID_OraOLEDB, NULL,
    CLSCTX_INPROC_SERVER, NULL,IID_IDBInitialize,(IUnknown**)&pIDBInitialize);
...

// If connection/session pooling was enabled, pIDBInitialize->Release()
// releases the connection/session back to the pool.
// pIDataInitialize->Release() should not be called until the application no
// longer need to use connection/session pooling and the rest of
// the OLE DB Services that were enabled for the application.
//
pIDBInitialize->Release();
```

Connecting to an Oracle Database

To connect to an Oracle Database using OraOLEDB, the OLE DB connection string must be as follows:

```
"Provider=OraOLEDB.Oracle;User ID=user;Password=pwd;Data Source=constr;"
```

When connecting to a remote database, `Data Source` must be set to the correct net service name which is the alias in the `tnsnames.ora` file.

> **See Also**
>
> *Oracle AI Database Net Services Administrator's Guide*

OraOLEDB-Specific Connection String Attributes

OraOLEDB offers provider-specific connection string attributes, which are set in the same way as the Provider and User ID are set. The provider-specific connection string attributes are:

- `CacheType` - specifies the type of cache used to store the rowset data on the client. See "OraOLEDB-Specific Connection String Attributes for Rowsets".
- `ChunkSize` - specifies the size of `LONG` or `LONG RAW` column data stored in the provider's cache. See "OraOLEDB-Specific Connection String Attributes for Rowsets".
- `DistribTX` - enables or disables distributed transaction enlistment capability. See "Distributed Transactions".
- `FetchSize` - specifies the size of the fetch array in rows. See "OraOLEDB-Specific Connection String Attributes for Rowsets".

- `InitialLOBFetchSize` - specifies the initial amount of `BLOB`, `CLOB`, or `NCLOB` data OraOLEDB immediately fetches. See "OraOLEDB-Specific Connection String Attributes for Rowsets".
- `OLEDB.NET` - enables or disables compatibility with OLEDB.NET Data Provider. See "OLEDB.NET Data Provider Compatibility".
- `OSAuthent` - specifies whether operating system authentication will be used when connecting to an Oracle Database. See "Operating System Authentication".
- `PLSQLRSet` - enables or disables the return of a rowset from PL/SQL stored procedures. See "OraOLEDB Custom Properties for Commands".
- `PwdChgDlg` - enables or disables displaying the password change dialog box when the password expires. See "Password Expiration".
- `UseSessionFormat` - specifies whether to use the default NLS session formats or let OraOLEDB override some of these formats for the duration of the session. Valid values are `0` (`FALSE`) and `1` (`TRUE`). The default is `FALSE` which lets OraOLEDB override some of the default NLS session formats. If the value is `TRUE`, OraOLEDB uses the default NLS session formats.

  Note that this connection attribute does not appear under the `\\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`*`\OLEDB` registry key.
- `VCharNull` - enables or disables the NULL termination of `VARCHAR2 OUT` parameters from stored procedures.
- `SPPrmDefVal` - specifies whether to use the default value or a NULL value if the application has not specified a stored procedure parameter value.
- `NDataType` - specifies whether any of the parameters bound to the command are of N data types, which include `NCHAR`, `NVARCHAR2`, or `NCLOB`. See "NDatatype".

  Note that this connection attribute does not appear under the `\\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`*`\OLEDB` registry key.
- `SPPrmsLOB` - specifies whether one or more parameters bound to the stored procedures are of LOB data type, which include `CLOB`, `BLOB`, or `NCLOB`. See "SPPrmsLOB".

  Note that this connection attribute does not appear under the `\\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`*`\OLEDB` registry key.
- `StmtCacheSize` – specifies the maximum number of statements that can be cached. See "Statement Caching".
- `MetaDataCacheSize` - specifies the maximum number of `SELECT` statements for which the metadata can be cached. See "Metadata Caching".
- `DeferUpdChk` - specifies whether or not to defer the updateability check to support updating read-only disconnected rowsets. See `DeferUpdChk` under "OraOLEDB-Specific Connection String Attributes for Rowsets".
- `DBNotifications` - specifies whether or not to subscribe to the high availability events. See "Enhanced Failover Capability".
- `DBNotificationPort` - specifies the port number, which is opened to listen to the Database notifications. See "Enhanced Failover Capability".

Default Attribute Values

The default values for these attributes are located under the `\\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`*`\OLEDB` registry key, where `KEY_`*`HOMENAME`* is the Oracle home.

The registry default values are read by OraOLEDB from the registry when the provider is loaded into memory. If Oracle-specific connection string attributes are not provided at connection time, then the default registry values are used. However, if the attributes are provided, then these new values override the default registry values.

These attributes can be set by setting the `DBPROP_INIT_PROVIDERSTRING` property, provided in the `DBPROPSET_DBINIT` property set. For example:

```
"FetchSize=100;CacheType=Memory;OSAuthent=0;PLSQLRSet=1;StmtCacheSize=10;"
```

Distributed Transactions

The `DistribTX` attribute specifies whether sessions are enabled to enlist in distributed transactions. Valid values are `0` (disabled) and `1` (enabled). The default is `1` which indicates that sessions are enabled for distributed transaction enlistments.

Applications using Microsoft Distributed Transaction Coordinator must have `DistribTX` set to `1`, the default.

Sessions enabled for distributed transaction enlistments cannot run statements that use the direct path load and parallel DML capabilities of the Oracle database. Such statements are executed as conventional path serial statements.

Enhanced Failover Capability

This feature enhances failover capability.

These connection string attributes support enhanced failover capability.

- `DBNotifications`

  The `DBNotifications` attribute specifies whether or not to subscribe to high availability events. Valid values are `0` (`FALSE`) and `1` (`TRUE`). The default is `FALSE`, which indicates that OraOLEDB does not subscribe to high availability events. If this attribute is not provided at the connection time, then the default registry value is used.

- `DBNotificationPort`

  The `DBNotificationPort` attribute specifies the port number, which is used to listen to the database notifications. The valid value is an unsigned integer.

  `DBNotificationPort` is effective only if the `DBNotifications` attribute is set to `TRUE`, either through the connection string attribute or by registry entry. The default for the `DBNotificationPort` attribute is `0`, which implies that OraOLEDB opens a valid port randomly. OraOLEDB does not validate the port number, so it is the responsibility of the application to specify a valid port number.

Enabling Failover Capability Through Registry Entry

- `DBNotifications`

  The `DBNotifications` registry entry specifies whether or not to subscribe to high availability events. Valid values are `0` (`FALSE`) and `1` (`TRUE`). The default value is `FALSE`,

OraOLEDB does not subscribe. This registry entry value is used when the `DBNotifications` connection string attribute is not set. It is located under the `\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`*`\OLEDB` registry key.

Operating System Authentication

The `OSAuthent` attribute specifies whether operating system authentication will be used when connecting to an Oracle Database. Valid values are `0` (disabled) and `1`(enabled). The default is `0`, which indicates that operating system authentication is not used.

Operating system authentication is the feature by which Oracle uses the security mechanisms of the operating system to authorize users.

After the Windows client has been set up properly for operating system authentication, this feature may be enabled by OraOLEDB clients by setting any of the following:

- `DBPROP_AUTH_USERNAME` to `/`
- `DBPROP_INIT_PROVIDERSTRING` to `OSAuthent=1`;
- `OSAuthent` in the registry to `1`

Password Expiration

Oracle provides a Password Expiration feature which allows database administrators to force users to change their passwords regularly. The `PwdChgDlg` attribute enables or disables the displaying of the password change dialog box, whenever a logon fails due to an expired password. When enabled, the provider displays the dialog box to change the password. When disabled, the logon fails with an error message. The valid values are `0` (disabled) and `1` (enabled). The default is `1` (enabled).

> **See Also**
>
> *Oracle Database Security Guide* for more information on the Password Expiration feature.

Example: Connecting to an Oracle Database Using ADO

The following examples illustrate how to connect to an Oracle Database using OraOLEDB and ADO.

> **Note**
>
> If `Data Source`, `User ID`, and `Password` are provided with the `Open` method, then ADO ignores those `ConnectionString` attributes.

Connect Using ConnectionString

```
Dim con As New ADODB.Connection
con.ConnectionString = "Provider=OraOLEDB.Oracle;Data Source=MyOraDb;" & _
                       "User ID=scott;Password=tiger;"
con.Open
```

Connect Without Using ConnectionString

```
Dim con As New ADODB.Connection
con.Provider = "OraOLEDB.Oracle"
con.Open "MyOraDb", "scott", "tiger"
```

Connect and Set Provider-specific Attributes

```
Dim con As New ADODB.Connection
con.Provider = "OraOLEDB.Oracle"
con.ConnectionString = "FetchSize=200;CacheType=Memory;" & _
                       "OSAuthent=0;PLSQLRSet=1;Data Source=MyOraDb;" & _
                       "User ID=scott;Password=tiger;"
con.Open
```

Operating System-Authenticated Connect Setting User ID to /

```
Dim con As New ADODB.Connection
con.Provider = "OraOLEDB.Oracle"
con.Open "MyOraDb", "/", ""
```

Operating System-Authenticated Connect Using OSAuthent

```
Dim con As New ADODB.Connection
con.Provider = "OraOLEDB.Oracle"
con.ConnectionString = "Data Source=MyOraDb;OSAuthent=1;"
con.Open
```

VCharNull

The `VCharNull` attribute enables or disables the NULL termination of `VARCHAR2 OUT` parameters from stored procedures. Valid values are `0` (disabled) and `1` (enabled). The default is `1`, which indicates that `VARCHAR2 OUT` parameters are NULL terminated. A value of `0` indicates that `VARCHAR2 OUT` parameters are padded with spaces.

The default value for this attribute is located under the `\\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`*`\OLEDB` registry key, where *`HOMENAME`* is the Oracle home. If this attribute is not provided at the connection time, then the default registry value is used.

Note that with this connection attribute enabled, applications need to pad the stored procedure `IN` and `IN OUT CHAR` parameters with spaces explicitly, if the parameter is to be used in a `WHERE` clause.

SPPrmDefVal

The `SPPrmDefVal` attribute specifies whether to use the default value or a NULL value if the application has not specified a stored procedure parameter value. Valid values are `0` (FALSE) and `1` (TRUE). The default is FALSE, which enables OraOLEDB to pass a NULL value. If the value is TRUE, then OraOLEDB uses the default value.

The default value for this attribute is located under the `\\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`*`\OLEDB` registry key. If this attribute is not provided at connection time, then the default registry value is used.

OraOLEDB Sessions

An OraOLEDB session object represents a single connection to an Oracle Database. The session object exposes the interfaces that allow data access and manipulation.

The first session created on the initialized data source inherits the initial connection established by `IDBInitialize::Initialize()`. Subsequent sessions that are created establish their own independent connections to the particular Oracle Database specified by the data source properties.

Each session object also defines a transaction space for a data source. All command and rowset objects created from a particular session object are part of the transaction of that session.

After all references to the session object are released, the session object is removed from memory and the connection is dropped.

Transactions

OraOLEDB supports local and distributed transactions, which provide explicit commit and abort transactional operations.

OraOLEDB does not support nested transactions. In addition, a local transaction cannot be started if the session is currently enlisted in a distributed transaction. This also applies to distributed transactions if the session is currently enlisted in a local transaction.

During a Local or Global Transaction, do not execute SQL commands `COMMIT`, `ROLLBACK`, or `SAVEPOINT` using the Command interface as they may affect the data consistency in the Rowsets. The same holds for executing DDLs (`CREATE TABLE`, `ALTER VIEW`, etc.) in this explicit transaction mode, as DDLs in Oracle perform an implicit Commit to the database. Execute DDLs only in the Auto-Commit mode.

To enable Autonomous Transaction support, the connection string attribute, `DistribTx`, should be disabled. Using this feature, consumers can execute Stored Procedures having `COMMIT`s and/or `ROLLBACK`s. Note that `COMMIT`/`ROLLBACK` in a stored procedure should be performed with caution. As OraOLEDB provides transactional capability on rowsets, whose data is cached locally on the client-side, performing an explicit `COMMIT`/`ROLLBACK` in a stored procedure, with an open rowset, could cause the rowset to be out of sync with the database. In these cases, all commits and rollbacks (aborts) should be performed from the client-side (`con.Commit` or `con.Abort`). The exception is if the user is making use of Autonomous Transactions in the stored procedure. By using this, the transaction in the stored procedure is isolated from the main one; thus allowing for localized commits/aborts.

See Also

- Database Development Guide
- PL/SQL Language Reference

Local Transactions

OraOLEDB supports the `ITransactionLocal` interface for explicit transactions. By default, OraOLEDB is in an autocommit mode, meaning that each unit of work done on the database is automatically or implicitly committed. With the use of the `ITransactionLocal` interface,

consumers may explicitly start a transaction for a particular session, allowing a unit of work to be explicitly committed or aborted by the consumer.

OraOLEDB supports the Read Committed (Cursor Stability) isolation level. In this level, the changes made by other transactions are not visible until those transactions are committed.

Distributed Transactions

OraOLEDB consumers must install Oracle Services for Microsoft Transaction Server (MTS) to be able to participate in Microsoft Transaction Server (or COM+) transactions or to enlist in a distributed transaction coordinated by Microsoft Distributed Transaction Coordinator (MS DTC).

OraOLEDB ignores `IsoLevel`, `IsoFlags`, and `pOtherOptions` parameters when `ITransactionJoin::JoinTransaction()` is called. These options must be provided when the consumer acquires a transaction object from MS DTC with the `ITransactionDispenser::BeginTransaction()` method call.

However, if `IsoFlags` is nonzero, then `XACT_E_NOISORETAIN` is returned.

> **See Also**
>
> *Oracle Services for Microsoft Transaction Server Developer's Guide for Microsoft Windows* for setup and configuration information on Oracle Services for MTS.

Commands

OraOLEDB supports ANSI SQL as supported by Oracle Database and the ODBC SQL syntax.

Stored Procedures

When executing an Oracle **PL/SQL** stored procedure using a command, use Oracle native syntax or the ODBC procedure call escape sequence in the command text:

- Oracle native syntax: `BEGIN credit_account(123, 40); END;`
- ODBC syntax: `{CALL credit_account(123, 40)}`

Preparing Commands

OraOLEDB validates and fetches the metadata only for SELECT SQL statements.

Command Parameters

When using Oracle ANSI SQL, parameters in the command text are preceded by a colon. In ODBC SQL, parameters are indicated by a question mark (?).

OraOLEDB supports input, output, and input and output parameters for PL/SQL stored procedures and stored functions. OraOLEDB supports input parameters for SQL statements.

> **Note**
>
> OraOLEDB supports only positional binding.

OraOLEDB Custom Properties for Commands

OraOLEDB custom properties for commands are grouped under the custom property set `ORAPROPSET_COMMANDS`. It provides these properties:

Table 2-1 Custom Properties for Commands

For Visual Basic Users	For C++ Users
`PLSQLRSet`	`ORAPROP_PLSQLRSet`
`NDatatype`	`ORAPROP_NDatatype`
`SPPrmsLOB`	`ORAPROP_SPPrmsLOB`
`AddToStmtCache`	`ORAPROP_AddToStmtCache`

PLSQLRSet

This property is similar to the `PLSQLRSet` connection string attribute.

The property specifies whether OraOLEDB must return a rowset from the PL/SQL stored procedure. If the stored procedure, provided by the consumer, returns a rowset, `PLSQLRSet` must be set to `TRUE` (enabled). This property should be set to `FALSE` after the command has been run. By default, the property is set to `FALSE` (disabled).

Consumers should use the property over the attribute, as the property can be set at the command object rather than at the session. By setting it at the command object, the consumer is able to set the property only for the command object executing stored procedures which are returning rowsets. With the attribute, the consumer needed to set it even if only one of many stored procedures being executed by the ADO application returned a rowset. The use of this property should provide a performance boost to applications making use of the attribute previously.

Example: Setting the Custom Property PLSQLRSet

```
Dim objRes As NEW ADODB.Recordset
Dim objCon As NEW ADODB.Connection
Dim objCmd As NEW ADODB.Command
....
objCmd.ActiveConnection = objCon
objCmd.CommandType = adCmdText

' Enabling the PLSQLRSet property indicates to the provider
' that the command returns one or more rowsets
objCmd.Properties("PLSQLRSet") = TRUE

' Assume Employees.GetEmpRecords() has a REF CURSOR as
' one of the arguments
objCmd.CommandText = "{ CALL Employees.GetEmpRecords(?,?) }"

' Execute the SQL
set objRes = objCmd.Execute

' It is a good idea to disable the property after execute as the
' same command object may be used for a different SQL statement
objCmd.Properties("PLSQLRSet") = FALSE
```

NDatatype

This property allows the consumers to specify whether any of the parameters bound to the command are of Oracle's N data types (`NCHAR`, `NVARCHAR2`, or `NCLOB`). This information is required by OraOLEDB to detect and bind the parameters. This property should not be set for commands executing `SELECT` statements. However, this property must be set for all other SQL statements, such as `INSERT`, `UPDATE`, and `DELETE`.

The use of this property should be limited to SQL statements containing parameters of N data type as setting it incurs a processing overhead of at least one round-trip to the database. By default, this property is set to `FALSE`.

> **Note**
>
> OraOLEDB does not support parameters of N data types in the `WHERE` clause of SQL statements.

> **Note**
>
> Consumers are required to use the ODBC procedure call escape sequence to call **stored procedure**s or functions having N data type parameters.

Example: Setting the Custom Property NDatatype

```
Dim objCon As NEW ADODB.Connection
Dim objCmd As NEW ADODB.Command
Dim prEmpno As NEW ADODB.Parameter
Dim prEname As NEW ADODB.Parameter
...
objCmd.ActiveConnection = objCon
objCmd.CommandType = adCmdText

' Create and append the parameters to the command object
Set prEmpno = objCmd.CreateParameter("prEmpno", adSmallInt, adParamInput, ,8521)
' prEname is bound to a NVARCHAR2 column in the EMP table
Set prEname = objCmd.CreateParameter("prEname", adBSTR, adParamInput, , "Joe")
objCmd.Parameters.Append prEmpno
objCmd.Parameters.Append prEname

' Enabling the NDatatype property indicates to the provider
' that one or more of the bound parameters is of N datatype
objCmd.Properties("NDatatype") = TRUE

' Assume column ENAME in table EMP is of NVARCHAR2 type
objCmd.CommandText = "INSERT INTO EMP (EMPNO, ENAME) VALUES (?, ?)"

' Execute the SQL
objCmd.Execute

' It is a good idea to disable the property after execute as the same command
' object may be used for a different SQL statement
objCmd.Properties("NDatatype") = FALSE
```

SPPrmsLOB

This property allows the consumer to specify whether one or more of the parameters bound to the stored procedures are of Oracle's LOB data type (`CLOB`, `BLOB`, or `NCLOB`). OraOLEDB requires this property to be set to `TRUE`, to fetch the parameter list of the stored procedure prior to execution. The use of this property limits the processing overhead to stored procedures having one or more LOB data type parameters. This property should be set to `FALSE` after the command has been executed. By default, the property is set to `FALSE`.

> **Note**
>
> Consumers are required to use the ODBC procedure call escape sequence to call stored procedures or functions having LOB data type parameters.

Example: Setting the Custom Property SPPrmsLOB

```
Dim objCon As NEW ADODB.Connection
Dim objCmd As NEW ADODB.Command
Dim prCLOB As NEW ADODB.Parameter
...
objCmd.ActiveConnection = objCon
objCmd.CommandType = adCmdText

' Create and append the parameters to the command object
Set prCLOB = objCmd.CreateParameter("prCLOB", adLongVarchar, adParamOutput, _
                                                    10000)
objCmd.Parameters.Append prCLOB

' Enabling the SPPrmsLOB property indicates to the provider
' that one or more of the bound parameters is of LOB data type
objCmd.Properties("SPPrmsLOB") = TRUE

' Assume the Stored Procedure requires a CLOB parameter
objCmd.CommandText = "{ call storedproc(?) }"

'Execute the SQL
objCmd.Execute

' It is a good idea to disable the property after execute as the
' same command object may be used for a different SQL statement
objCmd.Properties("SPPrmsLOB") = FALSE
```

AddToStmtCache

This property allows the consumer to cache the executed statements when the property is set to `TRUE` and statement caching is enabled. If the statement caching is disabled or if this property is set to `FALSE`, then the executed statement is not cached.

This property is ignored if statement caching is disabled. Statement caching can be enabled by setting the `StmtCacheSize` connection string attribute to a value greater than zero. This property provides a way to selectively add statements to the cache when statement caching is enabled. By default, the property is set to `TRUE`.

Example: Setting the Custom Property AddToStmtCache

```
Dim objCon As NEW ADODB.Connection
Dim objCmd As NEW ADODB.Command
```

```
...

' Statement caching is enabled by setting the 'StmtCacheSize'
' connection string attribute to a value greater than zero
objCon.ConnectionString = "StmtCacheSize=10;Data Source=MyOraDb;" &
_                         "User ID=scott;Password=tiger;"
objCon.Open
objCmd.ActiveConnection = objCon
objCmd.CommandType = adCmdText
objCmd.CommandText = "SELECT * FROM EMP"

' "SELECT * FROM EMP" statement would be added to the statement cache because
' StmtCacheSize connection string attribute value is greater than 0 and
' AddToStmtCache property value is TRUE by default.
objCmd.Execute

' Do not add "SELECT * FROM DEPT" to the statement cache
objCmd.CommandText = "SELECT * FROM DEPT"
objCmd.Properties("AddToStmtCache") = FALSE

' "SELECT * FROM DEPT" statement would not be added to the statement cache
objCmd.Execute
```

Stored Procedures and Functions Returning Rowsets

Oracle Provider for OLE DB allows consumers to execute a **PL/SQL** stored procedure with an argument of `REF CURSOR` type or a stored function returning a `REF CURSOR` value.

OraOLEDB returns a rowset for the `REF CURSOR` bind variable. Because there is no predefined data type for `REF CURSOR` in the OLE DB specification, the consumer must not bind this parameter.

If the PL/SQL stored procedure has one or more arguments of `REF CURSOR` type, OraOLEDB binds these arguments and returns a rowset for each argument of `REF CURSOR` type.

If the PL/SQL stored function returns a `REF CURSOR` or has an argument of `REF CURSOR` type, OraOLEDB binds these and returns a rowset for each `REF CURSOR` type.

To use this feature, stored procedures or functions must be called in the ODBC procedure call escape sequence.

The stored procedure or function being called could be either standalone or packaged. However, the `REF CURSOR` being returned must be explicitly defined in a package in the database.

Multiple Rowsets

OraOLEDB supports returning more than one rowset from a stored procedure. Consumers can use this feature to access all the `REF CURSOR`s being returned by a stored procedure.

Example: Stored Procedure Returning Multiple Rowsets

PL/SQL Package

```
CREATE OR REPLACE PACKAGE Employees AS
  TYPE empcur IS REF CURSOR;

  PROCEDURE GetEmpRecords(p_cursor OUT empcur,
                          q_cursor OUT empcur,
                          indeptno IN NUMBER,
```

```
                          p_errorcode OUT NUMBER);

  FUNCTION GetDept(inempno IN NUMBER,
                   p_errorcode OUT NUMBER)
    RETURN empcur;
END Employees;

CREATE OR REPLACE PACKAGE BODY Employees AS

  PROCEDURE GetEmpRecords(p_cursor OUT empcur,
                          q_cursor OUT empcur,
                          indeptno IN NUMBER,
                          p_errorcode OUT NUMBER) IS
  BEGIN
    p_errorcode := 0;
    OPEN p_cursor FOR
      SELECT *
      FROM emp
      WHERE deptno = indeptno
      ORDER BY empno;

OPEN q_cursor FOR
      SELECT empno
      FROM emp
      WHERE deptno = indeptno
      ORDER BY empno;

  EXCEPTION
    WHEN OTHERS THEN
      p_errorcode:= SQLCODE;

  END GetEmpRecords;

  FUNCTION GetDept(inempno IN NUMBER,
                   p_errorcode OUT NUMBER)
    RETURN empcur IS
      p_cursor empcur;
  BEGIN
    p_errorcode := 0;
    OPEN p_cursor FOR
      SELECT deptno
      FROM emp
      WHERE empno = inempno;
    RETURN (p_cursor);

  EXCEPTION
    WHEN OTHERS THEN
      p_errorcode:= SQLCODE;

  END GetDept;

END Employees;
```

ADO Program

```
Dim Con   As New ADODB.Connection
Dim Rst1  As New ADODB.Recordset
Dim Rst2  As New ADODB.Recordset
Dim Rst3  As New ADODB.Recordset
Dim Cmd   As New ADODB.Command
Dim Prm1  As New ADODB.Parameter
Dim Prm2  As New ADODB.Parameter
```

```
Con.Provider = "OraOLEDB.Oracle"
Con.ConnectionString = "Data Source=MyOraDb;" & _
                       "User ID=scott;Password=tiger;"
Con.Open
Cmd.ActiveConnection = Con

' Although Employees.GetEmpRecords() takes four parameters, only
' two need to be bound because Ref cursor parameters are automatically
' bound by the provider.

Set Prm1 = Cmd.CreateParameter("Prm1", adSmallInt, adParamInput, , 30)
Cmd.Parameters.Append Prm1
Set Prm2 = Cmd.CreateParameter("Prm2", adSmallInt, adParamOutput)
Cmd.Parameters.Append Prm2

' Enable PLSQLRSet property
Cmd.Properties ("PLSQLRSet") = TRUE

' Stored Procedures returning resultsets must be called using the
' ODBC escape sequence for calling stored procedures.
Cmd.CommandText = "{CALL Employees.GetEmpRecords(?, ?)}"

' Get the first recordset
Set Rst1 = Cmd.Execute

' Disable PLSQLRSet property
Cmd.Properties("PLSQLRSet") = FALSE

' Get the second recordset
Set Rst2 = Rst1.NextRecordset

' Just as in a stored procedure, the REF CURSOR return value must
' not be bound in a stored function.
Prm1.Value = 7839
Prm2.Value = 0

' Enable PLSQLRSet property
Cmd.Properties("PLSQLRSet") = TRUE

' Stored Functions returning resultsets must be called using the
' ODBC escape sequence for calling stored functions.
Cmd.CommandText = "{CALL Employees.GetDept(?, ?)}"

' Get the rowset
Set Rst3 = Cmd.Execute

' Disable PLSQLRSet
Cmd.Properties ("PLSQLRSet") = FALSE

' Clean up
Rst1.Close
Rst2.Close
Rst3.Close
```

Statement Caching

Statement caching eliminates the need to parse each SQL or PL/SQL statement before execution, by caching server cursors created during the initial statement execution. Subsequent executions of the same statement can reuse the parsed information from the cursor, and then execute the statement without reparsing, for better performance.

To see performance gains from statement caching, Oracle recommends caching only those statements that will be repeatedly executed. Furthermore, SQL or PL/SQL statements should use parameters rather than literal values. This will enable you to take full advantage of statement caching. This is because parsed information from parameterized statements can be reused, even if the parameter values change in subsequent executions. However, if the literal values in the statements are different, the parsed information cannot be reused unless the subsequent statements also have the same literal values.

StmtCacheSize Connection String Attribute

This attribute enables or disables OraOLEDB statement caching. By default, this attribute is set to `0` (disbled). If it is set to a value greater than `0`, OraOLEDB statement caching is enabled and the value specifies the maximum number of statements that can be cached for a connection.

After a connection has been cached to the specified maximum cache size, the cursor least recently used is freed to make room to cache the newly-created cursor. This value should not be greater than the value of the `OPEN_CURSORS` parameter set in the `init.ora` database configuration file.

AddToStmtCache Command Property

This property is relevant only when statement caching is enabled. If statement caching is enabled and this property is set to `true` (default), then statements are added to the cache when they are executed. If statement caching is disabled or if this property is set to `false`, then the executed statement is not cached.

Enabling Statement Caching Through the Registry

To enable statement caching by default for all OraOLEDB applications running in a system without changing the application, set the registry key of `\\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`*`\OLEDB\StmtCacheSize` to a value greater than `0`. Here, *`HOMENAME`* refers to the appropriate Oracle home. This value specifies the number of cursors that are to be cached on the server. By default, it is set to `10`.

Connections and Statement Caching

Statement caching is managed separately for each connection. Therefore, for running the same statement on different connections, you need to parse once for each connection and cache a separate cursor for each connection.

Metadata Caching

This feature minimizes the retrieval of metadata for `SELECT` statements by caching the metadata during the initial statement execution. Subsequent executions of the same statement can reuse the cached metadata information for better performance. To see performance gains from metadata caching, Oracle recommends caching only those statements that are executed repeatedly.

> **Note**
>
> Metadata caching is managed separately for each connection. Therefore, to run the same statement on different connections, the metadata must be cached once for each connection.

Enabling Metadata Caching Through the Connection String Attribute

The `MetaDataCacheSize` attribute enables or disables OraOLEDB metadata caching. If it is set to a value greater than `0`, OraOLEDB metadata caching is enabled and the value specifies the maximum number of statements for which the metadata can be cached for a connection. By default, this attribute is set to `10`.

Enabling Metadata Caching Through the Registry

To enable metadata caching by default for all OraOLEDB applications running in a system, without changing the application, set the following registry key to a value greater than `0`. By default, it is set to `10`.

`\\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`*`\ OLEDB\MetaDataCacheSize`

Command Timeout and Cancel Method

The `Cancel` method cancels the OraOLEDB command currently being executed. This method can be useful when the application needs to cancel a long running command during times of heavy network traffic or heavy server use.

Alternatively, by using the `CommandTimeout` property, developers can set a limit to the time that a command executes before OraOLEDB attempts to cancel it. OraOLEDB requires setting the `EnableCmdTimeout` registry value to `1` to enable `CommandTimeout`.

When using OLE DB, the default `DPBROP_COMMANDTIMEOUT` is `0` seconds. When using ADO, the default `CommandTimeout` property is `30` seconds.

Enabling CommandTimeout Through the Registry

The installation adds a registry value called `EnableCmdTimeout` with the default value set to `0`. Setting it to `0` disables command timeout and setting it to `1` enables it. The `CommandTimeout` property value setting takes effect only when `EnableCmdTimeout` is set to `1`.

The registry value is:

`\\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`*`\OLEDB\EnableCmdTimeout`

Rowsets

This section discusses using Rowsets with OraOLEDB.

To Create Rowsets

OraOLEDB supports `IOpenRowset::OpenRowset` and `ICommand::Execute` for creating rowsets.

To Create Rowsets with IOpenRowset::OpenRowset

When using `IOpenRowset::OpenRowset`, note the following guidelines:

- The `pTableID` parameter must contain a `DBID` structure that specifies a base table or a view.
- The `DBID` structure's `eKind` member must be set to `DBKIND_GUID_NAME`, `DBKIND_NAME`, or `DBKIND_PGUID_NAME`.

- The DBID structure's uName member must specify the base table or view name as a Unicode character string. It cannot be NULL.
- The pIndexID parameter of OpenRowset must be NULL.

To Create Rowsets with ICommand::Execute

OraOLEDB supports SQL SELECT statements that return rowsets. OraOLEDB also supports returning rowsets from PL/SQL stored procedures and functions.

By default, ADO creates a nonupdatable rowset from a command object. An updatable rowset can be created by setting the Updatability and IRowsetChange properties on the command object. The Updatability property can be set to the following values:

Table 2-2 Possible Values for Updatability Property

Value	Description
1	update
2	delete
3	update and delete
4	insert
5	insert and update
6	insert and delete
7	insert, delete, and update

The following ADO code sample sets the Updatability property on a command object to allow insert, delete, and update operations on the rowset object.

```
Dim Cmd As New ADODB.Command
Dim Rst As New ADODB.Recordset
Dim Con As New ADODB.Connection
...
Cmd.ActiveConnection = Con
Cmd.CommandText = "SELECT * FROM emp"
Cmd.CommandType = adCmdText
cmd.Properties("IRowsetChange") = TRUE
Cmd.Properties("Updatability") = 7
' creates an updatable rowset
Set Rst = cmd.Execute
```

Updatability

OraOLEDB supports both immediate and deferred update mode. However, insert and update operations cannot be deferred when the operation changes a nonscalar column, such as LONG, BLOB, or CLOB. When nonscalar column values are changed in a deferred update mode, the entire row is transmitted to the database as though the operation was in an immediate update mode. In addition, these operations cannot be undone with the Undo method (ADO) or IRowsetUpdate::Undo(). However, if they are in a transaction, they can be rolled back with RollbackTrans method (ADO) or ITransactionLocal::Abort().

Rowsets created using queries with joins are updatable by OraOLEDB only with the Client Cursor Engine enabled. C/C++ OLE DB consumers must enable this service to make these rowsets updatable. ADO consumers must specify the CursorLocation as adUseClient to make these rowsets updatable.

For example:

```
Dim objCon As New ADODB.Connection
Dim objRst As New ADODB.Recordset

objCon.Provider = "OraOLEDB.Oracle"
objCon.Open "MyOraDb", "scott", "tiger"
objRst.CursorLocation = adUseClient       'ADO Client Cursor
objRst.Open "select ename, dname " & _
       "from emp, dept " & _
       "where emp.deptno = dept.deptno", _
       objCon, adOpenStatic, adLockOptimistic, adCmdText


'Recordset created is updatable. Please note that CursorLocation
'needs to be explicitly set to adUseClient for this join recordset
'to be updatable.
```

Server Data on Insert Property

If DBPROP_SERVERDATAONINSERT (Server Data on Insert) is set to TRUE using OraOLEDB, the consumer can obtain defaults, sequences, and triggered column values from newly inserted and updated rows, if the insert and update operations are made through the rowset.

Having DBPROP_SERVERDATAONINSERT set to TRUE may degrade performance for both insert and update executions using a rowset because OraOLEDB fetches row data from the database for the newly inserted and updated row. However, if DBPROP_SERVERDATAONINSERT is set to its default value of FALSE, only the explicitly provided values for insert and update operations are returned when column values are requested for those rows.

If the base table from which the rowset was created does not contain any defaults, sequences, or triggers, then it is highly recommended that DBPROP_SERVERDATAONINSERT retain its default value of FALSE.

The DBPROP_SERVERDATAONINSERT property does not affect the performance of insert and update operations using the command object.

To Search for Rows with IRowsetFind::FindNext

OraOLEDB only supports searches performed on CHAR, DATE, FLOAT, NUMBER, RAW, and VARCHAR2 columns. Otherwise, DB_E_NOTSUPPORTED is returned.

When a search is done with a NULL value, only the DBCOMPAREOPS_EQ and DBCOMPAREOPS_NE compare operations are supported. Otherwise, DB_E_NOTSUPPORTED is returned.

OraOLEDB-Specific Connection String Attributes for Rowsets

OraOLEDB-specific connection string attributes which affect the performance of the rowset are:

- CacheType - specifies the type of caching used by the provider to store rowset data. OraOLEDB provides two caching mechanisms:
  - Memory - The provider stores all the rowset data in-memory. This caching mechanism provides better performance at the expense of higher memory utilization. The default is Memory.
  - File - The provider stores all the rowset data on disk. This caching mechanism limits memory consumption at the expense of performance.

- `ChunkSize` - This attribute specifies the size, in bytes, of the data in `LONG` and `LONG RAW` columns fetched and stored in the provider cache. Providing a high value for this attribute improves performance, but requires more memory to store the data in the rowset. Valid values are `1` to `65535`. The default value has been updated to 32768 (32 KB) in OraOLEDB 23.4.
- `DeferUpdChk` - The `DeferUpdChk` attribute specifies whether or not to defer the updateability check. This supports updating ADO read-only disconnected rowsets. Valid values are `0` (`FALSE`) and `1` (`TRUE`). The default is `FALSE`, which implies that OraOLEDB does not defer the check. If this attribute is not provided at the connection time, then the default registry value is used.
- `FetchSize` - specifies the number of rows the provider will fetch at a time (fetch array). It must be set on the basis of data size and the response time of the network. If the value is set too high, then this could result in more wait time during the execution of the query. If the value is set too low, then this could result in many more round trips to the database. Valid values are `1` to `429,496,` and `296.` The default is `100`.
- `InitialLOBFetchSize` - This attribute specifies the size, in bytes, of the initial amount of `BLOB`, `CLOB`, or `NCLOB` column data to prefetch. Valid values are 0 to 1,073,741,824 (1 GB). The default is 32678 (32 KB) starting in version 23.5. Prior to 23.4, `InitialLOBFetchSize` was not available and no LOB data was prefeteched. That behavior would be equivalent to setting `InitialLOBFetchSize` to zero.

  A high `InitialLOBFetchSize` value is generally faster performing by reducing the number of database round trips to retrieve LOB data. However, it does require more memory usage to store the prefeteched data.

  The value can be set in the `\ \HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_HOMENAME\OLEDB` registry key as well.

> **Note**
>
> The `InitialLOBFetchSize` value determines the memory amount OraOLEDB allocates to fetch data from the database regardless of the LOB data size. `InitialLOBFetchSize` dictates the memory amount allocated for each LOB column in the SELECT list, multiplied by the number of rows to be fetched per server round-trip, which is controlled by the `FetchSize`. In addition, OraOLEDB allocates additional memory for other non-LOB columns in the result set. As such, developers should be cautious while setting the `InitialLOBFetchSize` value since the process may not have enough memory available to allocate a large enough contiguous memory space to hold all the result set's column data that is obtained from each server round-trip. For example, applications might run into access violation or out of memory errors if OraOLEDB attempts to allocate more than 4 GB. It is advised that `InitialLOBFetchSize` be specified carefully as too large of a size may also result in ORA-24452 or ORA-24821.

The default attribute values are set in the registry. The following ADO code example overrides the default attribute values:

```
Dim con As ADODB.Connection
Set con = NEW ADODB.Connection
con.ConnectionString = "Provider=OraOLEDB.Oracle;User ID=scott;" & _
                       "Password=tiger;Data Source=MyOraDB;" & _
                       "FetchSize=200;CacheType=File;"
con.Open
```

> **See Also**
>
> Default Attribute Values for more information about default attribute values.

Tips for ADO Programmers

Setting the ADO Rowset property `LockType` to `adLockPessimistic` is not supported by Oracle Provider for OLE DB. If `LockType` is set to `adLockPessimistic`, then OraOLEDB behaves similar to when set as `adLockOptimistic`. This behavior occurs because OraOLEDB does not perform explicit locks on the rows being modified. However, when new data is submitted to the database, the database only performs the update if the rowset data was not already updated by another user, which means that dirty writes are not allowed. `LockType` values `adLockReadOnly`, `adLockBatchOptimistic`, and `adLockOptimistic` are supported by OraOLEDB.

Setting ADO Rowset property `CursorType` to `adOpenKeyset` or `adOpenDynamic` is not supported by Oracle Provider for OLE DB. OraOLEDB does not support either of the two as Oracle supports *Statement Level Read Consistency*, which ensures that the data returned by a query contains only committed data as of the time the query was executed. `CursorType` values `adOpenStatic` and `adOpenForwardOnly` are supported by OraOLEDB.

Schema Rowsets

The schema rowsets available through Oracle Provider for OLE DB are:

- `DBSCHEMA_COLUMNS`
- `DBSCHEMA_INDEXES`
- `DBSCHEMA_SCHEMATA`
- `DBSCHEMA_VIEWS`
- `DBSCHEMA_TABLES`
- `DBSCHEMA_PROVIDER_TYPES` (forward scroll only)
- `DBSCHEMA_FOREIGN_KEYS`
- `DBSCHEMA_PRIMARY_KEYS`
- `DBSCHEMA_PROCEDURES`
- `DBSCHEMA_PROCEDURE_PARAMETERS`

Date Formats

The date format for the Oracle session cannot be set using the `ALTER SESSION SET NLS_DATE_FORMAT` command. In Visual Basic, date formats are controlled by the Regional Settings properties in Windows Control Panel. For more information on Visual Basic date formats, refer to your Visual Basic documentation.

For Oracle Provider for OLE DB, if the `Connection` property `UseSessionFormat` is `FALSE`, which is a default value, then `NLS_DATE_FORMAT` is fixed for the session to `'YYYY-MM-DD HH24:MI:SS'` by the provider. If you pass the date to Oracle Database as a string, the date must be in the `'YYYY-MM-DD HH24:MI:SS'` format. If `UseSessionFormat` is `TRUE`, then `NLS_DATE_FORMAT` is not fixed by Oracle Provider for OLE DB and the default session `NLS_DATE_FORMAT` is used. For example:

```
SELECT * FROM EMP WHERE HIREDATE > '1981-06-15 17:32:12'
```

To use a different format, you need to use the SQL function, `TO_DATE()`, to specify the format for dates passed as strings. For example:

```
SELECT * FROM EMP WHERE HIREDATE > TO_DATE('15-JUN-81', 'DD-MON-YY')
```

However, for dates passed as parameters, the date format is controlled by ADO, which is controlled by the Regional Settings in Windows Control Panel. In this case, `TO_DATE()` should not be used. For example:

```
Private Sub Command1_Click()
  Dim objCon As New ADODB.Connection
  Dim objCmd As New ADODB.Command
  Dim objRst  As New ADODB.Recordset
  Dim pDate As New ADODB.Parameter

  objCon.Provider = "OraOLEDB.Oracle"
  objCon.Open "MyOraDb", "scott", "tiger"
  Set pDate = objCmd.CreateParameter("pDate", adDate, adParamInput)
  objCmd.Parameters.Append pDate
  objCmd.CommandText = _
         "SELECT * FROM EMP WHERE HIREDATE > ?"
  objCmd.ActiveConnection = objCon
  objCmd.CommandType = adCmdText
  pDate.Value = "06/15/1981"
  Set objRst = objCmd.Execute

    ...
End Sub
```

Case of Object Names

The names of all objects (tables, columns, views, and so forth) in Oracle Database are case-sensitive. This allows the two objects `EMP` and `emp` to exist in the same namespace in the database.

The query, `SELECT ename FROM emp`, executes correctly even though the table name is `EMP` (all uppercase) in the database. However, if you want to specify object names in mixed case, you can do so by enclosing the name in double quotes. For example:

```
SELECT ename FROM "Emp"
```

will execute successfully if the table name in the database is `Emp`. Double quotes preserve the case of the object names in Oracle Database.

Performing a Fast Load with SQL Server Integration Services

OraOLEDB implements the `IRowsetFastLoad` interface when opening a rowset. When used with SQL Server Integration Services (SSIS), this allows an application to perform a fast-load to an OLE DB Destination using Oracle Provider for OLE DB. This can dramatically speed up load times versus using a conventional load. In order to perform a fast-load, set the `AccessMode` property on the OLE DB Destination to `"OpenRowset Using FastLoad"`.

Data Types

The data types that OraOLEDB supports are listed in Table A-1 with Unicode and NonUnicode mappings.

> **See Also**
>
> For details about these and other data types, and time zones, see *Oracle Database SQL Language Reference*

Binary Data Types

`BINARY_FLOAT` is a single-precision floating point data type (4 bytes), which is mapped to OLE DB `DBTYPE_R4`.

`BINARY_DOUBLE` is a double-precision floating point data type (8 bytes), which is mapped to OLE DB `DBTYPE_R8`.

TIMESTAMP Data Types

This section discusses the Timestamp data types and then provides the following:

- Sample data illustrating insertion and retrieval operations using each of the `Timestamp` data types.
- A Visual Basic code example using the `Timestamp` data types.

Timestamp data types are mapped to the OLE DB `DBTYPE_DBTIMESTAMP`. The OLE DB `DBTYPE_DBTIMESTAMP` data type does not have `TIME ZONE` information.

The Timestamp data types include:

- `TIMESTAMP`
- `TIMESTAMP WITH TIME ZONE`
- `TIMESTAMP WITH LOCAL TIME ZONE`

Data Insertion

For data insertion into a `TIMESTAMP WITH TIME ZONE` or `TIMESTAMP WITH LOCAL TIME ZONE` column, the time zone setting of the client is used.

OLE DB Timestamp data type cannot provide the time zone information. For insert operations, the default time zone from the client session is added to the `TIMESTAMP WITH TIME ZONE` column data.

Data Retrieval

For data retrieval, `TIME ZONE` is dropped for `TIMESTAMP WITH TIME ZONE` columns, but `TIME ZONE` is used for `TIMESTAMP WITH LOCAL TIME ZONE` columns.

The OLE DB `Timestamp` data type cannot store time zone information.

Fractional Second

Fractional second is not supported for `TIMESTAMP` data types binding with `Command` objects.

Note that using `ALTER SESSION` to change time zone information does not change the time zone information in the new and existing `Recordsets`, which use the client time zone setting from the Regional options of the operating system. The maximum `fractional_seconds_precision` of `TIMESTAMP` is `9` and the default precision is `6`.

ADO Consumers

For the Timestamp data types, ADO consumers must specify the value of `CursorLocation` as `adUseServer` and use `Recordset` for DML operations.

Examples of Timestamp Insert and Retrieval

The following scenarios assume that the default precision of `6` is used.

TIMESTAMP Column

Insert Data: 4/16/2003 11:19:19 AM (No time zone)

Data in DB: 4/16/2003 11.19.19.000000 AM

Data Retrieval: 4/16/2003 11:19:19 AM

TIMESTAMP WITH TIME ZONE Column

Insert Data: 4/16/2003 11:19:19 AM (Time zone of the Client session is used)

Data in DB: 4/16/2003 11.19.19.000000 AM -07:00

Data Retrieval: 4/16/2003 11:19:19 AM (Time zone is dropped)

> **See Also**
>
> - "Data Insertion"
> - "Data Retrieval"

TIMESTAMP WITH LOCAL TIME ZONE Column

The following scenario assumes that the time zone of the client session is `-04:00`, currently on US EDT (Eastern daylight time). For an insert operation, the data in the `TIMESTAMP WITH LOCAL TIME ZONE` column does not include time zone displacement, but its `TIMESTAMP` data is *normalized* to the database time zone `-07:00`, which is the same as US PDT (Pacific daylight time).

For a query, data is returned in the time zone of the client session. The time zone displacement is the difference (in hours and minutes) between the local time and the Coordinated Universal Time (UTC).

Insert Data: 4/16/2003 4:30:23 PM (Client time zone is -04:00)

Data in DB: 4/16/2003 01.30.23.000000 PM (Database time zone -07:00)

Data Retrieval: 4/16/2003 4:30:23 PM (Client time zone is -04:00)

Data Retrieval: 4/16/2003 3:30:23 PM (Client time zone is -05:00)

Data Retrieval: 4/16/2003 2:30:23 PM (Client time zone is -06:00)

Data Retrieval: 4/16/2003 1:30:23 PM (Client time zone is -07:00)

Visual Basic Example

```
...
Dim DT As Date
```

```
 DT = Now()
con.ConnectionString = "Provider=OraOLEDB.Oracle.1;User ID=user_name;" & _
    "Password=pwd;Data Source=Oracle;"
con.Open
'Must use adUseServer
rec.CursorLocation = adUseServer
rec.ActiveConnection = con
rec.Open "select timestamp_column from test_table", con, adOpenDynamic,_
    adLockOptimistic
rec.AddNew Array("timestamp_column"), Array(DT)

update data
rec.Update Array("timestamp_column"), Array("07/07/07 07:17:17 AM")
...
```

INTERVAL Data Types

The INTERVAL data types are mapped to OLE DB `DBTYPE_STR` data type. The INTERVAL data types include:

- `INTERVAL YEAR TO MONTH`
- `INTERVAL DAY TO SECOND`

For the `INTERVAL YEAR TO MONTH` column, the maximum `year_precision` is `9` and the default is `2`. For `INTERVAL DAY TO SECOND` column, the maximum `day_precision` is `9` and the default is `2` and the maximum `fractional_seconds_precision` is `9`, the default is `6`.

> **Note**
>
> If the sign is not specified, then the default is **+**.

INTERVAL YEAR TO MONTH

Usage: (sign) `years-months`

Examples:

- `2-3`

  2 years and 3 months
- `+2-3`

  2 years and 3 months
- `-2-3`

  negative 2 years and 3 months

INTERVAL DAY TO SECOND

Usage: (sign) `days hours:minutes:seconds.second_fraction`

Examples:

- `7 10:20:30.123456`

  7 days, 10 hours, 20 minutes, and 30.123456 seconds
- `+7 10:20:30.123456`

7 days, 10 hours, 20 minutes, and 30.123456 seconds

- `-7 10:20:30.123456`

  negative 7 days, 10 hours, 20 minutes, and 30.123456 seconds

Visual Basic Example

```
...
con.ConnectionString = "Provider=OraOLEDB.Oracle.1;User ID=user_name;"& _
     "Password=pwd;Data Source=Oracle;"
con.Open
'no restriction on using adUseServer or adUseClient
rec.CursorLocation = adUseServer
rec.ActiveConnection = con
rec.Open "select * from test_table2", con, adOpenDynamic, adLockOptimistic
rec.AddNew Array("year_to_month_column", "day_to_second_column"), _
    Array("8-1", "3 20:30:10.12")

'update data
rec.Update Array("year_to_month_column", "day_to_second_column"), _
     Array("2-3", "7 10:20:30.123456")
...
```

VECTOR Data Types

Oracle AI Database 26ai introduces semantic search capabilities using Artificial Intelligence (AI) vector search. These capabilities include a new vector data type, vector indexes, and vector search SQL operators that allow the database to store semantic document content, images, and other unstructured data as vectors and then run fast performing similarity queries. The key innovation is that the database better understands user intent and the search context to find similar matches, rather than only find exact matches.

OraOLEDB supports vectors using `CLOB`, `VARCHAR2`, or equivalent data types. OLE DB data retrieval and manipulation use existing OLE DB `DBTYPE_STR` or `DBTYPE_WSTR` data types to consume the vector data.

JSON Support

Oracle Provider for OLE DB supports Oracle Database's native JSON data type and JSON Relational Duality

JSON can be consumed in Oracle Provider for OLE DB using the `DBTYPE_STR` and `DBTYPE_WSTR` data types only.

See Also

- *JSON Developer's Guide*
- *JSON-Relational Duality Developer's Guide*

LOB Support

The `ISequentialStream` interface is supported for all `LONG`, `LONG RAW`, and LOB (`BLOB`, `CLOB`, `NCLOB`, and `BFILE`) columns. The consumer can use this interface to read and write to all the

LOB columns, except `BFILE` which is read-only. To have read and write access to these columns, the `SELECT` SQL statement used to create the rowset should not contain a join.

> **Note**
>
> Although most of the LOB columns in an Oracle Database support LOBs over 2 GB of data storage, ADO limits the maximum column size to 2 GB.

Columns having the `BFILE` data type are not updatable in the `Rowset` interface. However, these columns can be updated using the command interface, if the update is limited to modifying the directory and name of the external file pointed to by the `BFILE` column. For example:

```
INSERT INTO topomaps (areanum, topomap)
VALUES (158, BFILENAME('mapdir', 'topo158.tps'))
```

As most LOB write (`INSERT` and `UPDATE`) operations involve multiple write operations within the provider, it is recommended that a transaction be enabled for such operations. Enabling transactions will allow consumers to rollback the entire write operation in the event of some failure. This is recommended when writing LOBs from the `Command` or the `Recordset` object.

For more information on LOBs, see *Oracle AI Database SecureFiles and Large Objects Developer's Guide*.

Unicode Support

OraOLEDB supports the Unicode character set. Using this feature, consumers can use OraOLEDB to access data in multiple languages on the same client computer. It can be especially useful in creating global Internet applications supporting as many languages as the Unicode standard entails. For example, you can write a single Active Server Page (ASP) application that accesses an Oracle Database to dynamically generate contents in Japanese, Arabic, English, Thai, and so on.

Types of Unicode Encoding

The Oracle Databases store the Unicode data in the UTF-8 encoding scheme, which is an ASCII compatible multibyte encoding of Unicode. Microsoft Windows uses the UTF-16 encoding, which is a 2-byte fixed-width encoding scheme. OraOLEDB transparently converts the data between the two encoding schemes allowing the consumers to deal with only UTF-16.

> **Note**
>
> The Unicode support is transparent to ADO consumers. OLE DB consumers using C or C++ need to explicitly specify `DBTYPE_WSTR` in their data type bindings when Unicode data in involved.

How Oracle Unicode Support Works

OraOLEDB works in two modes, Unicode mode and nonUnicode mode. When the client character set is not a superset of the server character set or the database character set is a multibyte character set, OraOLEDB automatically enables the Unicode mode. In this mode,

OraOLEDB stores the data in its cache in the UTF-16 encoding scheme. The user should ensure that the database's character set is AL32UTF8 to prevent any data loss.

If the client character set is a superset of the server's, then the provider operates in the nonUnicode mode. This mode provides slightly better performance as it does not have to deal with larger character buffers required by the UTF-16 encoding.

The detection of the client's and the server's character set is performed during logon.

> **Note**
>
> OraOLEDB no longer requires the client character set to be set to UTF8 to enable the Unicode mode. The provider still supports such setups but no longer requires it.

See "Data Type Mappings in Rowsets and Parameters" for further information.

Unicode Support Setup

To prevent any data loss, the database character set should be AL32UTF8. Other than this, there is no other setup required for Unicode support.

Database Setup

You must ensure that the Oracle Database is configured to store the data in the AL32UTF8 character set. The character set configuration is typically specified during database creation. To check the character set setting of your database, execute the following query in SQL*Plus:

```
SQL> SELECT parameter, value FROM nls_database_parameters
     WHERE parameter = 'NLS_CHARACTERSET';
```

If the character set of your database is not AL32UTF8, you need to create a new database with the AL32UTF8 character set and import your data into it.

> **See Also**
>
> - *Oracle AI Database Administrator's Guide*
> - *Oracle AI Database Globalization Support Guide*

Errors

OLE and COM objects report errors through the `HRESULT` return code of the object member functions. An OLE/COM `HRESULT` return code is a bit-packed structure. OLE provides macros that dereference structure members. OraOLEDB exposes `IErrorLookup` to retrieve information about an error.

All objects support extended error information. For this, the consumer must instantiate the OLE DB Extended Error object followed by calling the method `GetErrorDescription()` to get the error text.

```
// Instantiate OraOLEDBErrorLookup and obtain a pointer to its
//   IErrorLookup interface
CoCreateInstance(CLSID_OraOLEDBErrorLookup, NULL, CLSCTX_INPROC_SERVER,
                 IID_IErrorLookup, (void **)&pIErrorLookup)
```

```
//Call the method GetErrorDescription() to get the full error text
pIErrorLookup->GetErrorDescription()
```

The OraOLEDB provider returns the entire error stack in one text block.

For ADO users, the following example applies:

```
Dim oerr As ADODB.Error
For Each oerr in con.Errors
    MsgBox "Error: " & oerr.Description & vbCrLf _
        & "Source: " & oerr.Source
Next
```

OLEDB.NET Data Provider Compatibility

The OLE DB .NET Data Provider can utilize OraOLEDB as the OLE DB Provider for accessing Oracle Database in ADO.NET applications.

To make OraOLEDB compatible with OLE DB .NET Data Provider, set the connection string attribute `OLEDB.NET` to `True`.

Setting the `OLEDB.NET` attribute to `False` disables .NET compatibility.

OraOLEDB does not support `LongVarChar`, `LongVarWChar`, `LongVarBinary`, and `BSTR IN/OUT` and `OUT` parameter types with OLE DB .NET Data Provider due to a Microsoft OLE DB .NET Data Provider known limitation.

> **Note**
>
> The `OLEDB.NET` connection string attribute must not be used in ADO applications.

Using the OLEDB.NET Attribute in a Connection String

When using OraOLEDB with the OLE DB .NET Data Provider, the `OLEDB.NET` connection attribute must be set to `True` as shown in the following examples:

```
// in VB.NET
Dim con As New OleDbConnection()
con.ConnectionString = "Provider=OraOLEDB.Oracle;User Id=scott;" & _
     "Password=tiger;Data Source=Oracle;OLEDB.NET=True;"
con.Open

// in C#
...
OleDbConnection con = new OleDbConnection();
con.ConnectionString = "Provider=OraOLEDB.Oracle;User Id=scott;" +
     "Password=tiger;Data Source=Oracle;OLEDB.NET=true;"
con.Open();
...
```

Using OraOLEDB Custom Properties

ADO allows OraOLEDB provider-specific properties to be set at the object level. The OraOLEDB-specific properties `SPPrmsLOB` and `NDatatype` can be set as connection string attributes as well as at the command-object level. The `StmtCacheSize` property can be set as a

connection string attribute and the AddToStmtCache property can be set at the command object level. The following example shows the setting of properties at the command level:

```
// in VB
Dim cmd as new ADODB.Command
...
cmd.Properties("SPPrmsLOB") = True
cmd.Properties("NDatatype") = True
cmd.Properties("AddToStmtCache") = True
...
```

However, the OLEDB.NET Data Provider cannot expose OLE DB provider-specific properties at the object level. Therefore, the SPPrmsLOB and NDatatype properties can only be set as connection string attributes and AddToStmtCache property is not supported when OraOLEDB is used by OLE DB .NET Data Provider:

```
// in VB.NET
Dim con As New OleDbConnection()
con.ConnectionString = "Provider=OraOLEDB.Oracle;User Id=scott;" & _
     "Password=tiger;Data Source=Oracle;OLEDB.NET=True;" & _
     "SPPrmsLOB=False;NDatatype=False;"
con.Open()
```

Both SPPrmsLOB and NDatatype connection string attributes are set to False by default if they are not specified.

Setting either of these connection string attributes to True incurs additional processing overhead when executing commands with parameters.

> **See Also**
>
> OraOLEDB Custom Properties for Commands before setting either attribute to True

Updating Oracle with DataTable Changes

In order for the OleDbDataAdapter.Update() method to properly update Oracle Database with changes made in DataTable, which must contain a primary key of a database table. If the database table does not contain a primary key, the ROWID must be selected explicitly when populating DataTable, so that the ROWID can be used to uniquely identify a row when updating a row in the database.

Do not select the ROWID from database tables that contains a primary key. If ROWID is selected along with a primary key, ROWID will be the only column marked as the primary key.

> **See Also**
>
> For further information on using the OLE DB .NET Data Provider
>
> - Microsoft .NET Documentation
> - Microsoft .NET Framework Class Library

.NET Booleans

OLEDB.NET Data Provider supports retrieving Oracle database Booleans as .NET bools. They cannot be retrieved as any other .NET data type.

Database columns that are not Boolean cannot be retrieved a .NET bools.

Using OraOLEDB with Visual Basic

The following simple example illustrates how to use Oracle Provider for OLE DB with ADO in Visual Basic 6.0 to connect to an Oracle Database and execute PL/SQL stored procedures and functions.

Setting Up the Oracle Database

This example assumes that the Oracle Database has the demonstration table `EMP` under the user account `scott`. The `scott` account is available on GitHub here:

https://github.com/oracle/dotnet-db-samples/blob/master/schemas/scott.sql

The SQL script is now called `scott.sql`.

This example also uses *`exampledb`* as the database network alias when connecting to the Oracle Database. You must change this network alias to match your system.

Step 1: Build the Sample Tables:

1. Start SQL*Plus.
2. Connect as username `scott` with the password `tiger`.
3. Run the `demobld.sql` script:

   ```
   SQL> @ORACLE_BASE\ORACLE_HOME\sqlplus\demo\demobld.sql;
   ```

After the `emp` table has been created in the `scott` account, you need to create the PL/SQL package that contains the stored procedure and function that are run in the Visual Basic example.

Step 2: Create the PL/SQL package:

1. Connect as username `scott` with the password `tiger`.
2. Create the PL/SQL packages shown in PL/SQL Package.

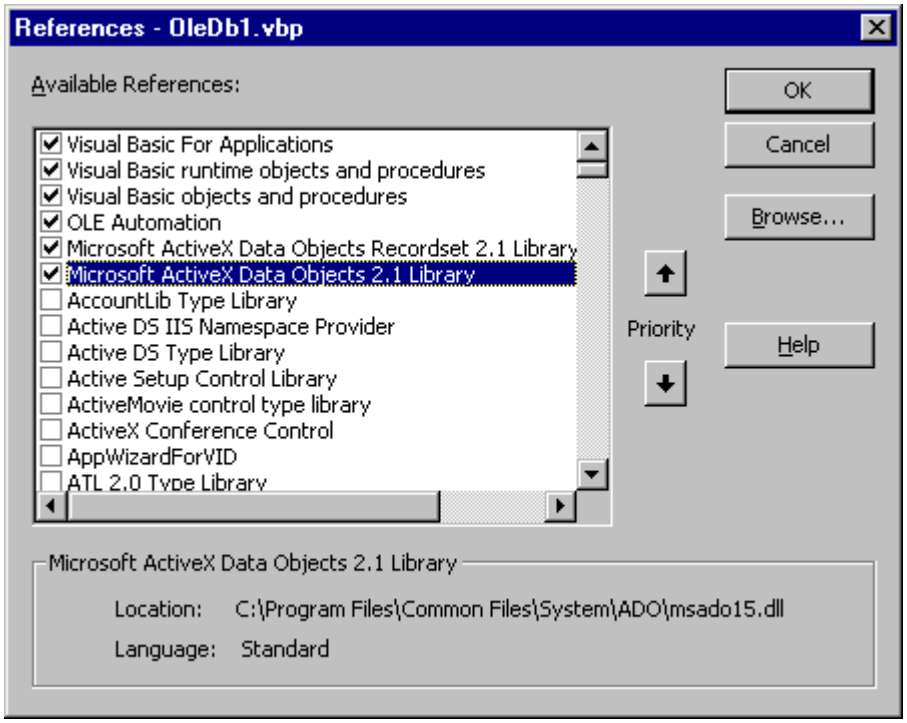
> **Note**
>
> When creating PL/SQL packages the `/` character is used as a terminator and must be added on a separate line following each `CREATE PACKAGE...END` block.

Setting Up the Visual Basic Project

After the Oracle Database setup is completed, you can create the Visual Basic 6.0 project.

1. Start Visual Basic 6.0 and create a new project.

2. Make sure that the Microsoft ActiveX Data Objects 2.1 Library and Microsoft ActiveX Data Objects Recordset 2.1 Library are included as Project References.



3. Add two command buttons to the form. One of the buttons will run the code to execute the PL/SQL procedure `GetEmpRecords`. The other will run the code to execute the PL/SQL function `GetDept`.

4. Add the following code to the `Click` subroutine of the button that will run the code to execute the PL/SQL procedure `GetEmpRecords`.

```
Dim Oracon As ADODB.Connection
Dim recset As New ADODB.Recordset
Dim cmd As New ADODB.Command
Dim param1 As New ADODB.Parameter
Dim param2 As New ADODB.Parameter
Dim objErr As ADODB.Error
Dim Message, Title, Default, EmpNoValue
```

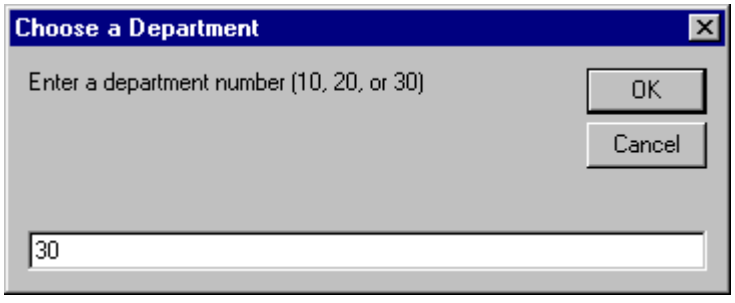
```
Message = "Enter an employee number (5000 - 9000)"
Title = "Choose an Employee"
Default = "7654"

On Error GoTo err_test

EmpNoValue = InputBox(Message, Title, Default)
If EmpNoValue = "" Then Exit Sub
If EmpNoValue < 5000 Or EmpNoValue > 9000 Then EmpNoValue = 7654

Set Oracon = CreateObject("ADODB.Connection")
Oracon.ConnectionString = "Provider=OraOLEDB.Oracle;" & _
                          "Data Source=exampledb;" & _
                          "User ID=scott;" & _
                          "Password=tiger;"

Oracon.Open
Set cmd.ActiveConnection = Oracon
Set param1 = cmd.CreateParameter("param1", adSmallInt, adParamInput, ,
                                 EmpNoValue)
cmd.Parameters.Append param1
Set param2 = cmd.CreateParameter("param2", adSmallInt, adParamOutput)
cmd.Parameters.Append param2

' Enable PLSQLRSet property
Cmd.Properties ("PLSQLRSet") = TRUE

cmd.CommandText = "{CALL Employees.GetDept(?, ?)}"
Set recset = cmd.Execute

' Disable PLSQLRSet property
Cmd.Properties ("PLSQLRSet") = FALSE

MsgBox "Number: " & EmpNoValue & "  Dept: " & recset.Fields("deptno").Value

Exit Sub

err_test:
    MsgBox Error$
    For Each objErr In Oracon.Errors
        MsgBox objErr.Description
    Next
    Oracon.Errors.Clear
    Resume Next
```

5. Add the following code to the `Click` subroutine of the button that will run the code to execute the PL/SQL function `GetDept`.

```
Dim Oracon As ADODB.Connection
Dim recset As New ADODB.Recordset
Dim cmd As New ADODB.Command
Dim param1 As New ADODB.Parameter
Dim param2 As New ADODB.Parameter
Dim objErr As ADODB.Error

Dim Message, Title, Default, DeptValue
Message = "Enter a department number (10, 20, or 30)"
Title = "Choose a Department"
Default = "30"

On Error GoTo err_test
DeptValue = InputBox(Message, Title, Default)
```

```
If DeptValue = "" Then Exit Sub
If DeptValue < 10 Or DeptValue > 30 Then DeptValue = 30

Set Oracon = CreateObject("ADODB.Connection")
Oracon.ConnectionString = "Provider=OraOLEDB.Oracle;" & _
                          "Data Source=exampledb;" & _
                          "User ID=scott;" & _
                          "Password=tiger;"
Oracon.Open
Set cmd = New ADODB.Command
Set cmd.ActiveConnection = Oracon
Set param1 = cmd.CreateParameter("param1", adSmallInt, adParamInput, ,
                                 DeptValue)
cmd.Parameters.Append param1
Set param2 = cmd.CreateParameter("param2", adSmallInt, adParamOutput)
cmd.Parameters.Append param2

' Enable PLSQLRSet property
Cmd.Properties ("PLSQLRSet") = TRUE

cmd.CommandText = "{CALL Employees.GetEmpRecords(?, ?)}"
Set recset = cmd.Execute

' Disable PLSQLRSet property
Cmd.Properties ("PLSQLRSet") = FALSE

Do While Not recset.EOF
   MsgBox "Number: " & recset.Fields("empno").Value & "  Name: " &
   recset.Fields("ename").Value & "  Dept: " & recset.Fields("deptno").Value
   recset.MoveNext
Loop

Exit Sub

err_test:
    MsgBox Error$
    For Each objErr In Oracon.Errors
        MsgBox objErr.Description
    Next
    Oracon.Errors.Clear
    Resume Next
```

6. Run the project and check the results. For example, if you choose the Get Employee Records by Dept button, then you would see a dialog box requesting that you enter a department number.



After you have entered a department number and clicked **OK**, another dialog box displays employee names and numbers from that department.

OraOLEDB Programming Recommendations and Tips

This section covers general OraOLEDB recommendations and tips to improve performance and usability.

- To improve performance, do not use ADO method `AppendChunk` on `LONG`/`LONG RAW` columns. Instead, insert or update the entire `LONG`/`LONG RAW` column using the ADO `AddNew` or `Update` method.
- Use `/*+ ... */` as the optimizer hint syntax with the OraOLEDB driver. The hint syntax, `--+ ...` is currently not supported.
- The Command object currently errors out when updating LOBs on more than one row at a time. For example, `UPDATE SomeTable SET LobCol = ? WHERE ...` will error out if the `UPDATE` statement affects more than one row in the table. This restriction is limited to LOBs (`BLOB`/`CLOB`) and not LONGs (`LONG`/`LONG RAW`).
- To enable creating rowsets using queries containing Oracle Database Links, the connection string attribute, DistribTx, should be disabled. Such rowsets are currently limited to being read-only.
- For overloaded PL/SQL stored procedures and functions, the `PROCEDURE_PARAMETERS` Schema Rowset returns the parameter information for only the first overloaded stored procedure/function. This is because the OLE DB specification currently does not have any provision for overloaded procedures/functions.
- OraOLEDB currently expects the case of the objects specified in the Schema Rowset Restriction to be exactly the same as in the database. That is, it does not support passing `emp` to access the table `EMP`. For example:

```
Dim restrictions As Variant
...
' Schemarowset contains table EMP owned by SCOTT
restrictions = Array(Empty, "SCOTT", "EMP", Empty)
Set objRst = objCon.OpenSchema(adSchemaTables, restrictions)
...
' Schemarowset created with no rows
restrictions = Array(Empty, "scott", "emp", Empty)
Set objRst = objCon.OpenSchema(adSchemaTables, restrictions)
...
```

- In VB 6, Microsoft ActiveX Data Objects and Microsoft ActiveX Data Objects Recordset libraries must be included as Project References.
- `OraOLEDB.h` must be included in the relevant `.cpp` files in the VC++ project. Also, `#define DBINITCONSTANTS` needs to be added to one of the `.cpp` files in the project.

A

Provider-Specific Information

These topics describe OLE DB information that is specific to Oracle Provider for OLE DB. For generic OLE DB information that includes a detailed listing of all OLE DB properties and interfaces, see the Microsoft *OLE DB Programmer's Reference Guide*.

Data Type Mappings in Rowsets and Parameters

This section lists the data type mapping between Oracle data types and OLE DB-defined types. Oracle Provider for OLE DB represents Oracle data types by using certain OLE DB-defined data types in the rowset as well as in parameters. OLE DB-defined types are also mapped to an Oracle data type when creating tables.

Each Oracle data type is mapped to a specific OLE DB data type, as shown in the following table. This correspondence is used when data type information is retrieved from an Oracle Database.

Table A-1 Data Type Mappings

Oracle Data Type	OLE DB Data Type - Regular (NonUnicode) Mode	OLE DB Data Type - Unicode Mode
BFILE	DBTYPE_BYTES	DBTYPE_BYTES
BINARY_FLOAT	DBTYPE_R4	DBTYPE_R4
BINARY_DOUBLE	DBTYPE_R8	DBTYPE_R8
BLOB	DBTYPE_BYTES	DBTYPE_BYTES
BOOLEN	DBTYPE_BOOL	DBTYPE_BOOL
CHAR	DBTYPE_STR	DBTYPE_WSTR
CLOB	DBTYPE_STR	DBTYPE_WSTR
DATE	DBTYPE_DBTIMESTAMP	DBTYPE_DBTIMESTAMP
FLOAT	DBTYPE_R8	DBTYPE_R8
INTERVAL DAY TO SECOND	DBTYPE_STR	DBTYPE_WSTR
INTERVAL YEAR TO MONTH	DBTYPE_STR	DBTYPE_WSTR
JSON	DBTYPE_STR	DBTYPE_WSTR
LONG	DBTYPE_STR	DBTYPE_WSTR
LONG RAW	BTYPE_BYTES	DBTYPE_BYTES
NCHAR	DBTYPE_STR	DBTYPE_WSTR

Table A-1 (Cont.) Data Type Mappings

Oracle Data Type	OLE DB Data Type - Regular (NonUnicode) Mode	OLE DB Data Type - Unicode Mode
NCLOB	DBTYPE_STR	DBTYPE_WSTR
NUMBER	DBTYPE_VARNUMERIC	DBTYPE_VARNUMERIC
NUMBER(p,s)	DBTYPE_NUMERIC	DBTYPE_NUMERIC
NVARCHAR2	DBTYPE_STR	DBTYPE_WSTR
RAW	DBTYPE_BYTES	DBTYPE_BYTES
ROWID	DBTYPE_STR	DBTYPE_STR
TIMESTAMP	DBTYPE_DBTIMESTAMP	DBTYPE_DBTIMESTAMP
TIMESTAMP WITH TIME ZONE	DBTYPE_DBTIMESTAMP	DBTYPE_DBTIMESTAMP
TIMESTAMP WITH LOCAL TIME ZONE	DBTYPE_DBTIMESTAMP	DBTYPE_DBTIMESTAMP
VECTOR	DBTYPE_STR	DBTYPE_WSTR
VARCHAR	DBTYPE_STR	DBTYPE_WSTR

> **Note**
>
> Oracle Provider for OLE DB does not support `Object` data types nor `MLSLABEL` data types.

Properties Supported

This section lists the properties supported by Oracle Provider for OLE DB. The read/write status and initial values are noted.

- Data Source Properties
- DataSourceInfo Properties
- Initialization and Authorization Properties
- Session Properties
- Rowset Properties

Data Source Properties

Table A-2 lists data source properties.

Table A-2 DBPROPSET_DATASOURCE Properties

Property	Status	Initial Value
DBPROP_CURRENTCATALOG	READ-ONLY	NULL

DataSourceInfo Properties

Table A-3 lists DataSourceInfo properties.

Table A-3 DBPROPSET_DATASOURCEINFO Properties

Property	Status	Initial Value
DBPROP_ACTIVESESSIONS	READ-ONLY	0, Unlimited sessions
DBPROP_ASYNCTXNABORT	READ-ONLY	VARIANT_FALSE
DBPROP_ASYNCTXNCOMMIT	READ-ONLY	VARIANT_FALSE
DBPROP_BYREFACCESSORS	READ-ONLY	VARIANT_TRUE
DBPROP_CATALOGLOCATION	READ-ONLY	DBPROPVAL_CL_END
DBPROP_CATALOGTERM	READ-ONLY	"Database link"
DBPROP_CATALOGUSAGE	READ-ONLY	DBPROPVAL_CU_DML_STATEMENTS
DBPROP_COLUMNDEFINITION	READ-ONLY	DBPROPVAL_CD_NOTNULL
DBPROP_CONCATNULLBEHAVIOR	READ-ONLY	DBPROPVAL_CB_NON_NULL
DBPROP_CONNECTIONSTATUS	READ-ONLY	DBPROPVAL_CS_INITIALIZED
DBPROP_DATASOURCENAME	READ-ONLY	" ", set at run time
DBPROP_DATASOURCEREADONLY	READ-ONLY	VARIANT_FALSE
DBPROP_DBMSNAME	READ-ONLY	" ", set at run time
DBPROP_DBMSVER	READ-ONLY	set at run time
DBPROP_DSOTHREADMODEL	READ/WRITE	DBPROPVAL_RT_FREETHREAD
DBPROP_GROUPBY	READ-ONLY	DBPROPVAL_GB_CONTAINS_SELECT
DBPROP_HETEROGENEOUSTABLES	READ-ONLY	DBPROPVAL_HT_DIFFERENT_CATALOGS
DBPROP_IDENTIFIERCASE	READ-ONLY	DBPROPVAL_IC_UPPER
DBPROP_MAXINDEXSIZE	READ-ONLY	0, limit unknown - depends on block size
DBPROP_MAXOPENCHAPTERS	READ-ONLY	0, not supported
DBPROP_MAXORSINFILTER	READ-ONLY	0, not supported
DBPROP_MAXROWSIZE	READ-ONLY	0, no limit
DBPROP_MAXROWSIZEINCLUDESBLOB	READ-ONLY	VARIANT_FALSE
DBPROP_MAXSORTCOLUMNS	READ-ONLY	0, not supported
DBPROP_MAXTABLESINSELECT	READ-ONLY	0, no limit
DBPROP_MULTIPLEPARAMSETS	READ-ONLY	VARIANT_TRUE
DBPROP_MULTIPLERESULTS	READ-ONLY	DBPROP_MR_SUPPORTED | DBPROPVAL__MR_CONCURRENT
DBPROP_MULTIPLESTORAGEOBJECTS	READ-ONLY	VARIANT_FALSE
DBPROP_MULTITABLEUPDATE	READ-ONLY	VARIANT_FALSE
DBPROP_NULLCOLLATION	READ-ONLY	DBPROPVAL_NC_HIGH
DBPROP_OLEOBJECTS	READ-ONLY	DBPROPVAL_OO_BLOB
DBPROP_ORDERBYCOLUMNSINSELECT	READ-ONLY	VARIANT_FALSE
DBPROP_OUTPUTPARAMETERAVAILABILITY	READ-ONLY	DBPROPVAL_OA_ATEXECUTE

Table A-3 (Cont.) DBPROPSET_DATASOURCEINFO Properties

Property	Status	Initial Value
DBPROP_PERSISTENTIDTYPE	READ-ONLY	DBPROPVAL_PT_NAME
DBPROP_PREPAREABORTBEHAVIOR	READ-ONLY	DBPROPVAL_CB_PRESERVE
DBPROP_PREPARECOMMITBEHAVIOR	READ-ONLY	DBPROPVAL_CB_PRESERVE
DBPROP_PROCEDURETERM	READ-ONLY	"PL/SQL Stored Procedure"
DBPROP_PROVIDERFRIENDLYNAME	READ-ONLY	"Oracle Provider for OLE DB"
DBPROP_PROVIDERNAME	READ-ONLY	OraOLEDB*ver*.dll
DBPROP_PROVIDEROLEDBVER	READ-ONLY	"02.01"
DBPROP_PROVIDERVER	READ-ONLY	set to current OraOLEDB version
DBPROP_QUOTEDIDENTIFIERCASE	READ-ONLY	DBPROPVAL_IC_SENSITIVE
DBPROP_ROWSETCONVERSIONSONCOMMAND	READ-ONLY	VARIANT_TRUE
DBPROP_SCHEMATERM	READ-ONLY	"Owner"
DBPROP_SCHEMAUSAGE	READ-ONLY	DBPROPVAL_SU_DML_STATEMENTS | DBPROPVAL_SU_TABLE_DEFINITION | DBPROPVAL_SU_INDEX_DEFINITION | DBPROPVAL_SU_PRIVILEGE_DEFINITION
DBPROP_SERVERNAME	READ-ONLY	" ", set at run time
DBPROP_SORTONINDEX	READ-ONLY	VARIANT_FALSE
DBPROP_SQLSUPPORT	READ-ONLY	DBPROPVAL_SQL_ODBC_MINIMUM | DBPROPVAL_SQL_ANSI92_ENTRY | DBPROPVAL_SQL_ESCAPECLAUSES
DBPROP_STRUCTUREDSTORAGE	READ-ONLY	DBPROPVAL_SS_ISEQUENTIAL_STREAM
DBPROP_SUBQUERIES	READ-ONLY	DBPROPVAL_SQ_CORRELATEDSUBQUERIES
DBPROP_SUPPORTEDTXNDDL	READ-ONLY	DBPROPVAL_TC_DDL_COMMIT
DBPROP_SUPPORTEDTXNISOLEVELS	READ-ONLY	DBPROPVAL_TI_CURSORSTABILITY | DBPROPVAL_TI_READCOMMITTED
DBPROP_SUPPORTEDTXNISORETAIN	READ-ONLY	DBPROPVAL_TR_DONTCARE
DBPROP_TABLETERM	READ-ONLY	"Table"
DBPROP_USERNAME	READ-ONLY	" ", set at run time

Initialization and Authorization Properties

Table A-4 lists initialization and authorization properties.

Table A-4 DBPROPSET_DBINIT Properties

Property	Status	Initial Value
DBPROP_AUTH_PERSIST_SENSITIVE_AUTHINFO	READ-ONLY	VARIANT_FALSE
DBPROP_AUTH_USERID	READ/WRITE	User ID
DBPROP_INIT_DATASOURCE	READ/WRITE	Connect string
DBPROP_INIT_HWND	READ/WRITE	Window handle for prompt

Table A-4 (Cont.) DBPROPSET_DBINIT Properties

Property	Status	Initial Value
DBPROP_INIT_LCID	READ/WRITE	LCID of system
DBPROP_INIT_OLEDBSERVICES	READ/WRITE	DBPROPVAL_OS_ENABLEALL
DBPROP_INIT_PROMPT	READ/WRITE	DBPROMPT_NOPROMPT

Session Properties

Table A-5 lists session properties.

Table A-5 DBPROPSET_SESSION Properties

Property	Status	Initial Value
DBPROP_SESS_AUTOCOMMITISOLEVELS	READ-ONLY	DBPROPVAL_TI_CURSORSTABILITY | DBPROPVAL_TI_READCOMMITTED

Rowset Properties

Table A-6 lists rowset properties.

Table A-6 DBPROPSET_ROWSET Properties

Property	Status	Initial Value
DBPROP_ABORTPRESERVE	READ/WRITE	VARIANT_TRUE
DBPROP_ACCESSORORDER	READ-ONLY	DBPROP_AO_RANDOM
DBPROP_APPENDONLY	READ-ONLY	VARIANT_FALSE
DBPROP_BLOCKINGSTORAGEOBJECTS	READ-ONLY	VARIANT_FALSE
DBPROP_BOOKMARKINFO	READ-ONLY	0
DBPROP_BOOKMARKS	READ/WRITE	VARIANT_FALSE
DBPROP_BOOKMARKSKIPPED	READ/WRITE	VARIANT_TRUE
DBPROP_BOOKMARKTYPE	READ-ONLY	DBPROP_BMK_NUMERIC
DBPROP_CACHEDEFERRED	READ-ONLY	VARIANT_FALSE
DBPROP_CANFETCHBACKWARDS	READ/WRITE	VARIANT_FALSE
DBPROP_CANHOLDROWS	READ/WRITE	VARIANT_FALSE
DBPROP_CANSCROLLBACKWARDS	READ/WRITE	VARIANT_FALSE
DBPROP_CHANGEINSERTEDROWS	READ-ONLY	VARIANT_TRUE
DBPROP_CLIENTCURSOR	READ/WRITE	VARIANT_TRUE
DBPROP_COLUMNRESTRICT	READ-ONLY	VARIANT_TRUE
DBPROP_COMMANDTIMEOUT	READ/WRITE	0
DBPROP_COMMITPRESERVE	READ/WRITE	VARIANT_TRUE
DBPROP_DEFERRED	READ-ONLY	VARIANT_TRUE
DBPROP_DELAYSTORAGEOBJECTS	READ-ONLY	VARIANT_TRUE, no delayed update

Table A-6 (Cont.) DBPROPSET_ROWSET Properties

Property	Status	Initial Value
DBPROP_FINDCOMPAREOPS	READ-ONLY	DBPROPVAL_CO_EQUALITY | DBPROPVAL_CO_STRING | DBPROPVAL_CO_CASESENSITIVE | DBPROPVAL_CO_CASEINSENSITIVE | DBPROPVAL_CO_CONTAINS | DBPROPVAL_CO_BEGINSWITH
DBPROP_HIDDENCOLUMNS	READ-ONLY	0
DBPROP_IACCESSOR	READ-ONLY	VARIANT_TRUE
DBPROP_ICOLUMNSINFO	READ-ONLY	VARIANT_TRUE
DBPROP_ICOLUMNSROWSET	READ/WRITE	VARIANT_TRUE
DBPROP_ICONNECTIONPOINTCONTAINER	READ-ONLY	VARIANT_TRUE
DBPROP_ICONVERTTYPE	READ-ONLY	VARIANT_TRUE
DBPROP_IMMOBILEROWS	READ-ONLY	VARIANT_TRUE
DBPROP_IMULTIPLERESULTS	READ/WRITE	VARIANT_TRUE
DBPROP_IROWSET	READ-ONLY	VARIANT_TRUE
DBPROP_IROWSETCHANGE	READ/WRITE	VARIANT_FALSE
DBPROP_IROWSETFIND	READ/WRITE	VARIANT_FALSE
DBPROP_IROWSETIDENTITY	READ-ONLY	VARIANT_TRUE
DBPROP_IROWSETINFO	READ-ONLY	VARIANT_TRUE
DBPROP_IROWSETLOCATE	READ/WRITE	VARIANT_FALSE
DBPROP_IROWSETREFRESH	READ/WRITE	VARIANT_FALSE
DBPROP_IROWSETSCROLL	READ/WRITE	VARIANT_FALSE
DBPROP_IROWSETUPDATE	READ/WRITE	VARIANT_FALSE
DBPROP_ISEQUENTIALSTREAM	READ/WRITE	VARIANT_TRUE
DBPROP_ISUPPORTERRORINFO	READ/WRITE	VARIANT_TRUE
DBPROP_LITERALBOOKMARKS	READ-ONLY	VARIANT_FALSE
DBPROP_LITERALIDENTITY	READ-ONLY	VARIANT_FALSE
DBPROP_LOCKMODE	READ-ONLY	DBPROPVAL_LM_NONE
DBPROP_MAXOPENROWS	READ/WRITE	0, No limit
DBPROP_MAXPENDINGROWS	READ-ONLY	0, No limit
DBPROP_MAXROWS	READ/WRITE	0
DBPROP_MAXROWSIZE	READ-ONLY	0
DBPROP_MAXROWSIZEINCLUDESBLOB	READ-ONLY	VARIANT_FALSE
DBPROP_NOTIFICATIONGRANULARITY	READ/WRITE	DBPROPVAL_NT_MULTIPLEROWS
DBPROP_NOTIFICATIONPHASES	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO | DBPROPVAL_NP_SYNCHAFTER | DBPROPVAL_NP_FAILEDTODO | DBPROPVAL_NP_DIDEVENT

Table A-6 (Cont.) DBPROPSET_ROWSET Properties

Property	Status	Initial Value
DBPROP_NOTIFYCOLUMNSET	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO | DBPROPVAL_NP_SYNCHAFTER | DBPROPVAL_NP_FAILEDTODO | DBPROPVAL_NP_DIDEVENT
DBPROP_NOTIFYROWDELETE	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO | DBPROPVAL_NP_SYNCHAFTER | DBPROPVAL_NP_FAILEDTODO | DBPROPVAL_NP_DIDEVENT
DBPROP_NOTIFYROWFIRSTCHANGE	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO
DBPROP_NOTIFYROWINSERT	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO | DBPROPVAL_NP_SYNCHAFTER | DBPROPVAL_NP_FAILEDTODO | DBPROPVAL_NP_DIDEVENT
DBPROP_NOTIFYROWRESYNCH	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO | DBPROPVAL_NP_SYNCHAFTER
DBPROP_NOTIFYROWSETRELEASE	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO | DBPROPVAL_NP_SYNCHAFTER
DBPROP_NOTIFYROWSETFETCHPOSITIONCHANGE	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO | DBPROPVAL_NP_SYNCHAFTER
DBPROP_NOTIFYROWUNDOCHANGE	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO | DBPROPVAL_NP_SYNCHAFTER | DBPROPVAL_NP_FAILEDTODO | DBPROPVAL_NP_DIDEVENT
DBPROP_NOTIFYROWUNDODELETE	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO | DBPROPVAL_NP_SYNCHAFTER | DBPROPVAL_NP_FAILEDTODO | DBPROPVAL_NP_DIDEVENT
DBPROP_NOTIFYROWUNDOINSERT	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO | DBPROPVAL_NP_SYNCHAFTER | DBPROPVAL_NP_FAILEDTODO | DBPROPVAL_NP_DIDEVENT
DBPROP_NOTIFYROWUNDOUPDATE	READ/WRITE	DBPROPVAL_NP_OKTODO | DBPROPVAL_NP_ABOUTTODO | DBPROPVAL_NP_SYNCHAFTER | DBPROPVAL_NP_FAILEDTODO | DBPROPVAL_NP_DIDEVENT
DBPROP_ORDEREDBOOKMARKS	READ-ONLY	VARIANT_TRUE
DBPROP_OTHERINSERT	READ-ONLY	VARIANT_FALSE

Table A-6 (Cont.) DBPROPSET_ROWSET Properties

Property	Status	Initial Value
DBPROP_OTHERUPDATEDELETE	READ-ONLY	VARIANT_FALSE
DBPROP_OWNINSERT	READ-ONLY	VARIANT_TRUE
DBPROP_OWNUPDATEDELETE	READ-ONLY	VARIANT_TRUE
DBPROP_QUICKRESTART	READ/WRITE	VARIANT_FALSE
DBPROP_REENTRANTEVENTS	READ-ONLY	VARIANT_FALSE
DBPROP_REMOVEDELETED	READ-ONLY	VARIANT_TRUE
DBPROP_REPORTMULTIPLECHANGES	READ-ONLY	VARIANT_FALSE
DBPROP_RETURNPENDINGINSERTS	READ/WRITE	VARIANT_TRUE
DBPROP_ROWRESTRICT	READ/WRITE	VARIANT_FALSE
DBPROP_ROWTHREADMODEL	READ-ONLY	DBPROPVAL_RT_FREETHREAD
DBPROP_SERVERCURSOR	READ/WRITE	VARIANT_FALSE
DBPROP_SERVERDATAONINSERT	READ/WRITE	VARIANT_TRUE
DBPROP_STRONGIDENTITY	READ/WRITE	VARIANT_TRUE
DBPROP_TRANSACTEDOBJECT	READ-ONLY	VARIANT_TRUE
DBPROP_UNIQUEROWS	READ/WRITE	VARIANT_FALSE
DBPROP_UPDATABILITY	READ/WRITE	DBPROPVAL_UP_CHANGE | DBPROPVAL_UP_DELETE | DBPROPVAL_UP_INSET

Rowset Property Implications

Oracle Provider for OLE DB sets other necessary properties if a particular property is set to VARIANT_TRUE.

- If DBPROP_IROWSETLOCATE is set to VARIANT_TRUE, then the following properties are also set to VARIANT_TRUE:
  - DBPROP_IROWSETIDENTITY
  - DBPROP_CANHOLDROWS
  - DBPROP_BOOKMARKS
  - DBPROP_CANFETCHBACKWARDS
  - DBPROP_CANSCROLLBACKWARDS
- If DBPROP_IROWSETSCROLL is set to VARIANT_TRUE, then the following properties are also set to VARIANT_TRUE:
  - DBPROP_IROWSETIDENTITY
  - DBPROP_IROWSETLOCATE
  - DBPROP_CANHOLDROWS
  - DBPROP_BOOKMARKS
  - DBPROP_CANFETCHBACKWARDS
  - DBPROP_CANSCROLLBACKWARDS

- If DBPROP_IROWSETUPDATE is set to VARIANT_TRUE, then the DBPROP_IROWSETCHANGE property is also set to VARIANT_TRUE.

Interfaces Supported

This section identifies the OLE DB interfaces that are supported by Oracle Provider for OLE DB.

Data Source

```
CoType TDataSource {
   interface IDBCreateSession;
   interface IDBInitialize;
   interface IDBProperties;
   interface IPersist;
   interface IDBInfo;
   interface ISupportErrorInfo;
}
```

Session

```
CoType TSession {
   interface IGetDataSource;
   interface IOpenRowset;
   interface ISessionProperties;
   interface IDBCreateCommand;
   interface IDBSchemaRowset;
   interface ISupportErrorInfo;
   interface ITransactionJoin;
   interface ITransactionLocal;
   interface ITransaction;
}
```

Command

```
CoType TCommand {
   interface IAccessor;
   interface IColumnsInfo;
   interface ICommand;
   interface ICommandProperties;
   interface ICommandText;
   interface IConvertType;
   interface IColumnsRowset;
```

```
   interface ICommandPrepare;
   interface ICommandWithParameters;
   interface ISupportErrorInfo;
}
```

Rowset

```
CoType TRowset {
   interface IAccessor;
   interface IColumnsInfo;
   interface IConvertType;
   interface IRowset;
   interface IRowsetInfo;
   interface IColumnsRowset;
   interface IConnectionPointContainer;
   interface IRowsetChange;
   interface IRowsetFind;
   interface IRowsetIdentity;
   interface IRowsetLocate;
   interface IRowsetRefresh;
   interface IRowsetFastLoad;
   interface IRowsetScroll;
   interface IRowsetUpdate;
   interface ISupportErrorInfo;
}
```

Multiple Results

```
CoType TMultipleResults {
   interface IMultipleResults;
   interface ISupportErrorInfo;
}
```

Transaction Options

```
CoType TTransactionOptions {
   interface ITransactionOptions;
   interface ISupportErrorInfo;
}
```

Custom Error Object

```
CoType TCustomErrorObject {
   interface IErrorLookup;
}
```

MetaData Columns Supported

`DBTYPE_BASECOLUMNNAME`, `DBTYPE_BASETABLENAME`, and `DBTYPE_BASESCHEMANAME` metadata columns are not populated for read-only recordsets. OraOLEDB creates a read-only recordset for server cursor for SQL queries with `DISTINCT` or `UNIQUE` keywords. OraOLEDB also creates a read-only recordset for server cursor for `JOIN` queries.

The following metadata columns are supported by the column rowset of OraOLEDB:

- DBCOLUMN_IDNAME
- DBCOLUMN_PROPID
- DBCOLUMN_NAME
- DBCOLUMN_NUMBER
- DBCOLUMN_TYPE
- DBCOLUMN_TYPEINFO
- DBCOLUMN_COLUMNSIZE
- DBCOLUMN_PRECISION
- DBCOLUMN_SCALE
- DBCOLUMN_FLAGS
- DBCOLUMN_BASECATALOGNAME
- DBCOLUMN_BASECOLUMNNAME
- DBCOLUMN_BASESCHEMANAME
- DBCOLUMN_BASETABLENAME
- DBCOLUMN_COMPUTEMODE
- DBCOLUMN_ISAUTOINCREMENT
- DBCOLUMN_ISCASESENSITIVE
- DBCOLUMN_ISSEARCHABLE
- DBCOLUMN_OCTETLENGTH
- DBCOLUMN_KEYCOLUMN

OraOLEDB Tracing

OraOLEDB provides the ability to trace the interface calls for debugging purposes. This feature has been provided to assist Oracle Support Services in debugging customer issues.

The provider can be configured to record the following information:

- For OLE DB Interface method entry and exit:
  - Parameter values supplied (entry)
  - Return value; HRESULT (exit)
  - Thread ID (entry and exit)
- For Distributed transaction enlistment and delistment:
  - Session object information
  - Transaction ID

> **Note**
>
> To record global transaction enlistment and delistment information, the `TraceLevel` value must be set to session object. See `TraceOption` in Registry Setting for Tracing Calls.

Registry Setting for Tracing Calls

In ODAC 12*c* Release 4, OraOLEDB now uses a new directory to write trace files to by default: `<*Windows user temporary folder*>\oledb\trace`.

The Windows user temporary folder is determined by your local Windows settings, such as your Windows TMP or TEMP environment variable. Typically, it can be `C:\temp` or `C:\Users\<*user name*>\AppData\Local\Temp`.

To change the trace file location, use the `TraceFileLocation` attribute to set a new location. `TraceFileLocation` will not be created by default in the Windows Registry. OraOLEDB will create an entry in the Windows event log where the trace was created anytime it creates a trace file.

To trace the interface calls, you must configure the following registry values for `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_*HOMENAME*\OLEDB\`:

- `TraceFileLocation`

  Valid Value: Any valid directory path

  `TraceFileLocation` specifies trace file destination directory. The default trace location is `<*Windows user temporary folder*>\oledb\trace`.

- `TraceCategory`

  Valid Values:

  - `0` = None
  - `1` = OLEDB Interface method entry
  - `2` = OLEDB Interface method exit
  - `4` = Distributed Transaction Enlistment and Delistment

  `TraceCategory` specifies the information that is to be traced. Combinations of different tracing categories can be made by adding the valid values. For example, set `TraceCategory` to `3` to trace all OLE DB interface method entries and exits.

- `TraceLevel`

  Valid Values:

  - `0` = None
  - `1` = Data Source object
  - `2` = Session object
  - `4` = Command object
  - `8` = Rowset object
  - `16` = Error object
  - `64` = Multiple Results Object

`TraceLevel` specifies the OLE DB objects to be traced. Because tracing all the entry and exit calls for all the OLE DB objects can be excessive, `TraceLevel` is provided to limit tracing to a single or multiple OLE DB objects. To obtain tracing on multiple objects, add the valid values. For example, if `TraceLevel` is set to `12` and `TraceCategory` is set to `3`, the trace file will only contain method entry and exit for Command and Rowset objects.

The `TraceLevel` value must be set to session object (2) to trace global transaction enlistment and delistment information.

- `TraceOption`

  Valid Values:

  - `0` = Single trace file
  - `1` = Multiple trace files

  `TraceOption` specifies whether to log trace information in single or multiple files for each Thread ID. If multiple trace file is requested, a Thread ID is appended to the file name provided to create a trace file for each thread.

Glossary

Component Object Model (COM)

A binary standard that enables objects to interact with other objects, regardless of the programming language that each object was written in.

consumer

A consumer is any application or tool that calls to a data source or the interfaces of provider to access data. See **provider**.

Oracle Net Services

The Oracle client/server communication software that offers transparent operation to Oracle tools or databases over any type of network protocol and operating system.

PL/SQL

Procedural language extension to SQL provided by Oracle .

provider

A provider is an interface or set of components that provides data to a consumer. As the term is used with Oracle Provider for OLE DB, a data provider is a set of COM components that transfer data from a data source to a consumer, by placing the data in a tabular format when called for. See **consumer**.

stored procedure

A stored procedure is a PL/SQL block that are stored in an Oracle Database and can be called by name from an application.

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