Oracle® Data Provider for .NET

Oracle TimesTen In-Memory Database Support User's Guide

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About This Content

This document provides usage and reference information for TimesTen support for ODP.NET.

Audience

This guide is for application developers who administer and access TimesTen through ODP.NET.

In addition to familiarity with the particular programming interface you use, you should be familiar with TimesTen, SQL (Structured Query Language), database operations, and ODBC.

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

Related Resources

Oracle Database documentation is available on the Oracle documentation website. This may be especially useful for Oracle Database features that TimesTen supports but does not attempt to fully document, such as OCI and Pro*C/C++. In particular, these Oracle Database documents may be of interest:

- *Oracle Database Globalization Support Guide*
- *Oracle Database Net Services Administrator's Guide*
- *Oracle Database SQL Language Reference*

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.

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Initial Considerations for ODP.NET in a TimesTen Environment

TimesTen supports programming interfaces such as JDBC, ODBC, OCI, ODP.NET, Pro*C/C++, and PL/SQL. This document discusses the use of ODP.NET, covering only those aspects of ODP.NET that are specific to its use in a TimesTen environment. The term *ODP.NET for TimesTen* refers to ODP.NET support for TimesTen.

This section discusses points you should be aware of before starting to use ODP.NET with TimesTen Classic, covering the following topics:

- Environments and TimesTen Releases Supported by ODP.NET
- Support for .NET-Related Features
- Requirements and Prerequisites for Using ODP.NET with TimesTen

Environments and TimesTen Releases Supported by ODP.NET

This revision of the document is for TimesTen support of the ODP.NET 19c release.

Note the following:

- See ODP.NET Namespace and Class Support with TimesTen for details of supported namespaces and APIs. ODP.NET 19c is available in corresponding Oracle Database or Oracle Data Access Components (ODAC) releases.
- As of this release, ODP.NET for TimesTen can be used in the ODP.NET for .NET Framework 4 with Microsoft .NET Framework 4.5.x, 4.6.x, 4.7.x, and 4.8.
- ODP.NET for TimesTen can be used on all Microsoft Windows platforms that support TimesTen.

Support for .NET-Related Features

ODP.NET for TimesTen supports a subset of features currently available in ODP.NET for Oracle Database.

In particular, as of this release, it supports the following features:

- ODP.NET un-managed driver
- ODP.NET connection pooling
- ODP.NET tracing

ODP.NET for TimesTen does not currently support these features:

- ADO.NET Entity Framework object relational mapper
- LINQ (Language-Integrated Query)

ODP.NET for TimesTen does not currently support interoperability with the following Oracle Database client components:

- Oracle Developer Tools for Visual Studio
- Oracle Database Extensions for .NET
- Oracle Providers for ASP.NET

Requirements and Prerequisites for Using ODP.NET with TimesTen

This section lists requirements to use ODP.NET for TimesTen.

- You must install TimesTen client on the client system. TimesTen is not provided with ODP.NET or OCI.
- PL/SQL must be installed and enabled, which is always the case in TimesTen.
- ODP.NET 19c for TimesTen depends on Oracle Call Interface (OCI) support for TimesTen and requires the version of OCI that is provided with ODP.NET 19c releases, not the version provided with TimesTen.

  Also see Post-Installation Path Considerations.

  > **Note:**
  >
  > – For reference, the OCI version provided with TimesTen is under the *tt_installation_dir*\ttoracle_home directory, where *tt_installation_dir* is the TimesTen installation root directory. Do *not* use this version for ODP.NET applications.
  >
  > – There is no issue in using the TimesTen version of OCI for OCI or Pro*C/C++ programs that do not use ODP.NET.

- Requirements for the execution environment to use ODP.NET with Oracle Database apply to using ODP.NET with TimesTen as well. Refer to *Oracle Data Provider for .NET Developer's Guide*.

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Getting Started with ODP.NET

This section discusses the following topics to help you start using ODP.NET. Note that installation steps are not TimesTen-specific.

- Pre-Installation Considerations
- Installing ODP.NET
- Post-Installation Path Considerations
- Uninstalling ODP.NET
- Building an Application for ODP.NET

Pre-Installation Considerations

The installation process for ODP.NET is independent of the TimesTen environment. Nothing is installed into the TimesTen installation directories.

Be aware of these important notes:

- To use ODP.NET for TimesTen, ODP.NET should be installed on the same system as your TimesTen client. See Installation and Management of TimesTen on Windows in *Oracle TimesTen In-Memory Database Installation, Migration, and Upgrade Guide*. In addition, a TimesTen DSN must be configured. Refer to Specifying Data Source Names to Identify TimesTen Databases in *Oracle TimesTen In-Memory Database Operations Guide*.
- It is recommended, but not required (unless otherwise noted), to remove any previous versions of ODP.NET before installing a new version.
- After you have completed the installation steps, the location of ODP.NET binaries varies depending on your type of Oracle product installation and version of .NET. Consult *Oracle Data Provider for .NET Developer's Guide* and the ODP.NET README file for information.

Refer to *Oracle Data Provider for .NET Developer's Guide* for additional information about ODP.NET installation, including associated Windows registry entries.

Installing ODP.NET

Use these instructions to install ODP.NET as part of the Oracle XCopy version of Oracle Data Access Components (ODAC) 19c releases. This is the recommended way to install ODP.NET for use with TimesTen.

> **Note:**
>
> If you have an Oracle Database installation, ODP.NET is already provided with that.

XCopy provides system administrators with an ODP.NET client that is smaller than the standard ODP.NET client and can be configured more easily, with finer-grained control than OUI offers. This makes it more convenient for production deployments to large numbers of computers, and simplifies the embedding of ODP.NET in customized deployment packages.

This installation does *not* use the Oracle Universal Installer. Instead, run the installation by executing the `install.bat` batch file, which you can access in the installation directory into which you unzip the ODAC ZIP file for XCopy installation.

This is a summary of the installation instructions. For further details, refer to `readme.htm`, which is also located in the installation directory.

> **Tip:**
>
> The `readme.htm` file emphasizes the following points.
>
> - Do not install XCopy over an existing OUI-based Oracle home installation.
> - If you do multiple ODAC product installations to the same directory, specify the same Oracle home name each time.
> - By default, ODAC products and dependencies are installed without a check to see if there are newer product versions already installed.

Execute `install.bat` to specify the desired ODAC products to install. For example, assuming `C:\oracle\odac` is your installation directory and `odachome` is your Oracle home name for ODAC, use this command to install the client with ODP.NET for .NET 4 libraries:

```
install.bat odp.net4 C:\oracle\odac odachome
```

Alternatively, use the following command to install the client with all ODAC products:

```
install.bat all C:\oracle\odac odachome
```

Post-Installation Path Considerations

In a TimesTen environment, ODP.NET finds and uses the appropriate version of OCI; namely, the Oracle Client version and not the TimesTen Instant Client version.

In addition, check the following for your path:

- Confirm that the `PATH` setting has the location of the TimesTen shared libraries at *`timesten_home`*`\bin`, where *`timesten_home`* is the TimesTen instance home directory. This should follow any other Oracle directories in the path.

  Note that on Windows, there is only one TimesTen instance per installation, and *`timesten_home`* (the instance home) refers to *`tt_installation_dir`*`\instance`.
- For an XCopy installation, add your ODAC installation directory and ODAC installation `bin` directory to the `PATH` setting, preceding any other Oracle

directories, including TimesTen directories. For example, if `C:\oracle\odac` is the installation directory:

```
set PATH=C:\oracle\odac;C:\oracle\odac\bin;%PATH%
```

> **Note:**
>
> Refer to the ODP.NET README file for any further information about setting up ODP.NET.

Uninstalling ODP.NET

To uninstall an XCopy installation (the recommended way to install ODP.NET), execute the `uninstall.bat` batch file from your ODP.NET installation directory, specifying the product to uninstall (or all products) and the Oracle home name for ODAC products. For example, to uninstall a client with ODP.NET for .NET 4 libraries, assuming the Oracle home name is `odachome`:

Refer to Installing ODP.NET.

```
uninstall.bat odp.net4 odachome
```

Or to uninstall all ODAC products:

```
uninstall.bat all odachome
```

For information about uninstalling Oracle Database products, including ODP.NET, refer to Removing Oracle Database Software in *Oracle Database Installation Guide for Microsoft Windows*.

Building an Application for ODP.NET

You can use the Visual Studio IDE to build your application, or you can use the `csc.exe` command-line compiler executed from the Visual Studio command prompt.

The following example uses `csc.exe` to build the ODP.NET sample application discussed in Testing Your ODP.NET Installation with TimesTen :

```
C:\Build\TimesTen\quickstart\sample_code\odp.net>csc /out:DemoODP.exe
/reference:C:\Build\ODAC1910\odp.net4\odp.net\bin\4\Oracle.DataAccess.dll
DemoODP.cs

Microsoft (R) Visual C# Compiler version 3.8.0-5.20604.10 (9ed4b774)
Copyright (C) Microsoft Corporation. All rights reserved.
```

The location of the `Oracle.DataAccess.dll` assembly and dependent libraries is according to your type of Oracle product installation and version of .NET. Refer to *Oracle Data Provider for .NET Developer's Guide* and the ODP.NET README file for information.

> **Note:**
>
> Visual Studio is not a runtime requirement of ODP.NET for TimesTen, but you would need a .NET compiler, such as the C# compiler that comes with Visual Studio, to develop applications.

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Configuring TimesTen Connections for an ODP.NET Application

This sections discusses how to set up connections for an ODP.NET application.

- About TimesTen Connections for ODP.NET
- Using the tnsnames Naming Method to Connect
- Using the Easy Connect Naming Method to Connect
- Configuring Whether to Use tnsnames or Easy Connect Naming Method
- Setting TimesTen Connection Attributes in ODP.NET Connection Strings

About TimesTen Connections for ODP.NET

ODP.NET for TimesTen supports multiple simultaneous connections to TimesTen and Oracle databases. Existing applications written for the ODP.NET interface can access TimesTen with a minimal set of changes to their application code.

In a TimesTen environment, ODP.NET uses OCI to interact with the TimesTen database. Therefore, an ODP.NET application can connect to TimesTen using either the `tnsnames` or the *easy connect* naming method, as with Oracle Database. See Configuring Naming Methods in *Oracle Database Net Services Administrator's Guide* for information about the `tnsnames` and easy connect naming methods beyond what is provided below.

Be aware of the following:

- TimesTen does not support distributed transactions through OCI. Therefore, an ODP.NET application cannot use distributed transactions in a TimesTen connection.
- ODP.NET for TimesTen does not support global runtime load balancing (a feature for Oracle RAC databases) and therefore does not support the connection string attribute setting "`Load Balancing=true`".
- Error messages associated with connections to TimesTen from an ODP.NET application are based on TimesTen OCI error message mapping. TimesTen OCI errors are propagated to the ODP.NET application as `OracleException` objects. (Also see OCI Error Reporting in *Oracle TimesTen In-Memory Database C Developer's Guide*.)

Using the tnsnames Naming Method to Connect

TimesTen supports `tnsnames` syntax. You can use a TimesTen `tnsnames.ora` entry in the same way you would use an Oracle `tnsnames.ora` entry.

The syntax of a TimesTen entry in the `tnsnames.ora` file is as follows:

```
tns_entry = (DESCRIPTION =
               (CONNECT_DATA =
```

```
(SERVICE_NAME = dsn)
(SERVER = timesten_client)))
```

Where *tns_entry* is an arbitrary TNS name you assign to the entry. Note the following:

- DESCRIPTION and CONNECT_DATA are required as shown.
- For SERVICE_NAME, *dsn* must be a TimesTen data source name (DSN) that is defined in the ODBC Data Source Administrator and is visible to the user running the ODP.NET application.
- For SERVER, timesten_client specifies a client/server connection. The SERVICE_NAME *dsn* value must be a TimesTen client DSN.

The following is a sample tnsnames.ora entry for a direct connection to the TimesTen database referenced by the DSN my_client_dsn:

```
my_tnsname = (DESCRIPTION =
                (CONNECT_DATA =
                   (SERVICE_NAME = my_client_dsn)
                   (SERVER = timesten_client)))
```

To connect as user scott with password tiger to the my_client_dsn TimesTen database that is referenced by the my_tnsname entry in the tnsnames.ora file, specify the following connection string in your ODP.NET application:

```
"User Id=scott;Password=tiger;Data Source=my_tnsname"
```

To connect as the current operating system user to my_client_dsn that is referenced by the my_tnsname entry in the tnsnames.ora file, specify the following connection string in your ODP.NET application. The current operating system user must be either the TimesTen instance administrator or a defined TimesTen external user.

```
"User Id=/;Data Source=my_tnsname"
```

> **Note:**
>
> For TimesTen Classic, you can use the ttInstanceCreate -tnsadmin option or the ttInstanceModify -tnsadmin option (in addition to the TNS_ADMIN environment variable) to set the tnsnames location.

Using the Easy Connect Naming Method to Connect

TimesTen supports easy connect syntax, which allows connections to be made without configuring a tnsnames.ora entry.

The syntax of a TimesTen easy connect string is as follows:

```
host/service_name:server
```

Note the following:

- A host name must be specified to satisfy easy connect syntax, but is otherwise ignored by TimesTen. The name `localhost` is typically used by convention.
- For *`service_name`*, specify a TimesTen DSN that is defined in the ODBC Data Source Administrator and is visible to the user running the ODP.NET application.
- For *`server`*, `timesten_client` specifies a client/server connection. The *`service_name`* must be a TimesTen client DSN.

To establish a client/server connection as user `scott` with password `tiger` to the TimesTen database referenced by the `my_client_dsn` DSN, specify the following connection string in your ODP.NET application:

```
"User Id=scott;Password=tiger;Data Source=localhost/
my_client_dsn:timesten_client"
```

To establish a client/server connection as the current operating system user to the TimesTen database referenced by `my_client_dsn`, specify the following connection string in your ODP.NET application. The current operating system user must be either the TimesTen instance administrator or a defined TimesTen external user.

```
"User Id=/;Data Source=localhost/my_client_dsn:timesten_client"
```

Configuring Whether to Use tnsnames or Easy Connect Naming Method

If a `sqlnet.ora` file is present, it specifies the naming methods to be tried and the order in which to try them.

ODP.NET looks for a `sqlnet.ora` file with the following precedence:

1. If the `TNS_ADMIN` environment variable has been set, ODP.NET looks in that specified location.
2. If `TNS_ADMIN` has not been set, ODP.NET looks in the Oracle Database default location, as noted in Parameters for the sqlnet.ora File in *Oracle Database Net Services Reference*.

If `sqlnet.ora` is found, you can use only naming methods that are indicated there. If `sqlnet.ora` is not found, you can use either the `tnsnames` or easy connect naming method.

In TimesTen, sample copies of the `tnsnames.ora` and `sqlnet.ora` files are in the *`tt_installation_dir`*`\network\admin\samples` directory, where *`tt_installation_dir`* is the TimesTen installation root directory. The following is the `sqlnet.ora` file that TimesTen provides, which supports both the `tnsnames` naming method and the easy connect naming method.

```
# To use ezconnect syntax or tnsnames, the following entries must be
# included in the sqlnet.ora configuration.
NAMES.DIRECTORY_PATH= (TNSNAMES, EZCONNECT)
```

With this setting, ODP.NET first looks for `tnsnames` syntax in your connection strings. If it cannot find `tnsnames` syntax, it looks for easy connect strings.

> **Note:**
>
> Oracle Database network libraries are provided with ODP.NET. In a TimesTen environment, ODP.NET does *not* use the copy of the Oracle Database network libraries provided with the Instant Client shipped with TimesTen. (That location, for reference, is *tt_installation_dir*`\ttoracle_home\instantclient` for the Oracle Database 19c Instant Client shipped with TimesTen releases.)

Setting TimesTen Connection Attributes in ODP.NET Connection Strings

You can set TimesTen connection attributes within the `Password` setting of your ODP.NET connection string.

The syntax is as follows:

- Components of the `Password` setting, including the password setting itself and any TimesTen connection attribute settings, are delimited by semi-colons.
- Whenever the `Password` setting has semi-colons, the entire setting must be quoted.
- Because the ODP.NET connection string as a whole is quoted, the begin quotation mark and end quotation mark of the `Password` setting must each be preceded by the "`\`" escape character.

The following example specifies `lion` as the password for user `scott` in TimesTen. It also sets the TimesTen `OraclePWD` connection attribute, which specifies the password `tiger` for user `scott` in Oracle Database, for cache operations.

```
"Data Source=mysource;User Id=scott;Password=\"lion;OraclePwd=tiger\"";
```

The next example again specifies `lion` as the password for `scott` in TimesTen. This time, it sets the TimesTen `OracleNetServiceName` connection attribute as well as the `OraclePWD` connection attribute. `OracleNetServiceName` specifies the Oracle ID in Oracle Database, with the `OraclePWD` setting specifying the corresponding password `tiger`. Finally, this example sets the TimesTen passthrough level to 1.

```
"Data Source=mysource;User ID=scott;Password=\"lion;OraclePwd=tiger;
OracleNetServiceName=mytest-pc.example.com;passthrough=1\"";
```

(For general information about TimesTen connection attributes, refer to Connection Attributes in *Oracle TimesTen In-Memory Database Reference*.)

> **Note:**
>
> As always, you can also set TimesTen connection attributes in your TimesTen DSN definition in ODBC Data Source Administrator, as shown in Managing TimesTen Databases in *Oracle TimesTen In-Memory Database Operations Guide*. This is not secure, however, so is not advisable for password settings such as the `OraclePWD` attribute.

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Testing Your ODP.NET Installation with TimesTen

This section refers to the TimesTen Classic Quick Start for instructions to run an ODP.NET sample application to test your installation. Quick Start is available from the TimesTen GitHub location. There is a complete set of tutorials, how-to instructions, and sample applications.

Go to ODP.NET Sample Program for the `DemoODP.cs` sample.

The instructions assume you have a TimesTen Linux/UNIX server with a database running. You must also have a copy of the TimesTen Quick Start files on that system.

On the Windows client, you must have Visual Studio and the NET 4.0 development environment. The instructions include installing the TimesTen Windows client.

The sample application should produce the following output:

```
Start Test
The employee who got the 10% pay raise was CLARK

Employees in department #50:
7944, ITMGR, MANAGER, 7839, 10/08/2010 10:34:20 AM, 2500, <NULL>, 50
7945, DVLPR1, DEVELOPER, 7944, 10/08/2010 12:00:00 AM, 2000, <NULL>, 50
7946, DVLPR2, DEVELOPER, 7944, 10/08/2010 12:00:00 AM, 2000, <NULL>, 50
7947, DVLPR3, DEVELOPER, 7944, 10/08/2010 12:00:00 AM, 2000, <NULL>, 50
7948, DVLPR4, DEVELOPER, 7944, 10/08/2010 12:00:00 AM, 2000, <NULL>, 50
7949, DVLPR5, DEVELOPER, 7944, 10/08/2010 12:00:00 AM, 2000, <NULL>, 50
7950, DVLPR6, DEVELOPER, 7944, 10/08/2010 12:00:00 AM, 2000, <NULL>, 50
7951, DVLPR7, DEVELOPER, 7944, 10/08/2010 12:00:00 AM, 2000, <NULL>, 50
7952, DVLPR8, DEVELOPER, 7944, 10/08/2010 12:00:00 AM, 2000, <NULL>, 50
7953, DVLPR9, DEVELOPER, 7944, 10/08/2010 12:00:00 AM, 2000, <NULL>, 50
7954, DVLPR10, DEVELOPER, 7944, 10/08/2010 12:00:00 AM, 2000, <NULL>, 50
Test finished
```

5

Development Considerations for ODP.NET with TimesTen

This section discusses points to be aware of when developing applications to use ODP.NET in a TimesTen environment.

- Effects of Transaction Commits on Result Sets and REF CURSORs
- Support for TimesTen Built-In Procedures
- Support for VARCHAR2, NVARCHAR2 and VARBINARY Data Types
- Support for LOBs
- Troubleshooting

Effects of Transaction Commits on Result Sets and REF CURSORs

When processing result sets generated from executing statements and creating REF CURSORs, the behavior when transactions in TimesTen connections are committed differs from that when transactions in Oracle Database connections are committed.

When a transaction is committed in TimesTen while a result set of an `OracleDataReader` object is open, the result set is closed automatically, unlike in an Oracle database. This applies to explicit commits, autocommit, and implicit commits.

In TimesTen, an implicit commit occurs after a DDL statement. In ODP.NET, an implicit commit also occurs when an `OracleCommand` object is executed without there first being an `OracleTransaction` object instantiated from the command connection. An explicit commit occurs when the `Commit` method is called on an `OracleTransaction` object. In either case, if a commit occurs in a TimesTen connection before a result set that is open in the transaction is completely processed, the `Function sequence error` exception may be thrown.

This difference in behavior is likely to occur when the execution of an `OracleCommand` object is interleaved with the processing of a result set associated with another `OracleCommand` object. To avoid the `Function sequence error` exception, the execution and processing of a result set should be contained exclusively within the context of an `OracleTransaction` object. This prevents a commit from occurring before all rows of the result set are retrieved.

The occurrence of a `Function sequence error` exception may depend on the value of the `FetchSize` property of an `OracleCommand`, `OracleRefCursor` or `OracleDataReader` object. If the `FetchSize` property is not explicitly set or if it is set to a large value, then many rows may be fetched by the application before the `Function sequence error` exception is thrown.

Support for TimesTen Built-In Procedures

You can call TimesTen built-in procedures directly from TimesTen OCI only for built-ins that do not return a result set. Therefore, this restriction also applies to ODP.NET for TimesTen.

Use an `OracleCommand` instance to call a built-in, as in the following example. This assumes an `OracleConnection` instance `conn` with a connection to TimesTen has been established. Call the `Dispose` method to free resources when you have finished using the `OracleCommand` instance.

```
// switching to passthrough 1 mode using ttOptSetFlag built-in function
string switchModeStmt = "call ttOptSetFlag('passthrough', 1)";
OracleCommand switchCmd = new OracleCommand(switchModeStmt, conn);
switchCmd.CommandType = CommandType.Text;
switchCmd.ExecuteNonQuery();
switchCmd.Dispose();
```

For built-in procedures that do return a result set, the result set would not be accessible directly through ODP.NET. However, you could access it as an `OUT` parameter if you call the built-in from PL/SQL. Here is an example:

```
int passThruValue = -1;
OracleCommand cmd = conn.CreateCommand();
cmd.CommandText = "declare v_name varchar2(255); begin execute
immediate
                  'call ttOptGetFlag(''passthrough'')' into
v_name, :rc1; end;";
cmd.Parameters.Add("rc1", OracleDbType.Int32, -1,
ParameterDirection.Output);
cmd.ExecuteNonQuery();
passThruValue = Convert.ToInt32(cmd.Parameters[0].Value.ToString());
cmd.Parameters.Clear();
cmd.Dispose();
```

Support for VARCHAR2, NVARCHAR2 and VARBINARY Data Types

TimesTen `VARCHAR2`, `NVARCHAR2` and `VARBINARY` types support a maximum of 4 MB of data. ODP.NET for TimesTen supports the transfer of the maximum amount of data for these types (and all other TimesTen SQL types).

> **Note:**
>
> ODP.NET 19c, when used outside of a TimesTen environment, has a 32 KB size limit for character data, increased from a 4 KB limit in previous releases.

Support for LOBs

TimesTen LOB support is limited to the LOB access methods associated with the default 0 (zero) setting of the `InitialLobFetchSize` property of the `OracleDataReader` object. If this property is changed to another value then TimesTen ignores such changes, assuming it retains the 0 setting.

Also refer to OracleDataReader Class Support Details.

Troubleshooting

This section discusses solutions for various exceptions you may encounter when using ODP.NET for TimesTen.

- **Exception "ORA-12154: TNS: Could not resolve the connect identifier specified"** or **"ORA-12541: TNS: No listener"**

  To connect to a TimesTen database from an ODP.NET application, the `Data Source` attribute in the ODP.NET connection string must be set either to the TNS name of a TimesTen entry in the `tnsnames.ora` file or to a TimesTen easy connect string.

  If the `tnsnames` naming method is used to connect, verify that an entry in the `tnsnames.ora` file is associated with a TimesTen DSN. Also verify that the `TNS_ADMIN` environment variable is set to the directory where the `tnsnames.ora` file is located.

  If the easy connect naming method is used to connect, verify that *`service_name`* is set to a TimesTen DSN and that *`server`* is set to either `timesten_direct` or `timesten_client`, depending on whether the DSN configures a direct connection or a client/server connection.

- **Exception "ORA-29158: Unable to open library"**

  If you are connecting to a TimesTen database, verify either that the entry in the `tnsnames.ora` file is associated with a TimesTen DSN or that *`service_name`* in the easy connect string is set to a TimesTen DSN.

  This error may also occur due to a path issue, if ODP.NET cannot find the TimesTen ODBC driver, which is located in the TimesTen *`timesten_home`*`\bin` directory. (Also see the next troubleshooting item.)

- **Exception "ORA-29159: Unable to read library"**

  In addition to the steps for `ORA-29158` above, verify that the server setting in the `tnsnames.ora` file entry or easy connect string is `timesten_direct` or `timesten_client`, as appropriate for the type of TimesTen DSN.

  See Connecting to a TimesTen Database from OCI in *Oracle TimesTen In-Memory Database C Developer's Guide* for information about `tnsnames.ora` and easy connect.

- **Exception "The application has failed to start because ttcommon*xxxx*.dll was not found. Re-installing the application may fix the problem"**

  This indicates that the location of the TimesTen shared libraries at *`timesten_home`*`\bin` is not in the `PATH` environment variable setting.

> **Note:**
>
> Instead of "*xxxx*", the TimesTen release number is indicated. In TimesTen Release 22.1 releases the file name is `ttcommon221.dll`.

6

ODP.NET Namespace and Class Support with TimesTen

The following sections, after a brief overview, document support for the ODP.NET classes, enumerations and types of the `Oracle.DataAccess.Client` and `Oracle.DataAccess.Types` namespaces in a TimesTen environment.

- About ODP.NET Namespaces
- Oracle.DataAccess.Client Namespace Support
- Oracle.DataAccess.Types Namespace Support

About ODP.NET Namespaces

ODP.NET implements the classes, enumerations, interfaces, delegates, and structures of the `Oracle.DataAccess.Client` and `Oracle.DataAccess.Types` namespaces.

The `Oracle.DataAccess.Client` namespace contains implementations of core ADO.NET classes, enumerations for ODP.NET, and ODP.NET-specific classes. The `Oracle.DataAccess.Types` namespace provides classes, structures, and exceptions for Oracle Database native types that can be used with ODP.NET. See *Oracle Data Provider for .NET Developer's Guide* for information about these namespaces beyond what is provided below. You must have access to them in your program as follows:

```
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;
```

> **Note:**
>
> When connecting to a TimesTen database from an ODP.NET application, your application can use only ODP.NET features that correspond to features that TimesTen supports. This is reflected in what is supported for the namespaces discussed here.
>
> For example, you cannot use Oracle Streams Advanced Queueing because TimesTen does not support this feature. `OracleException` objects are thrown when you attempt to use ODP.NET features that are not supported by TimesTen. These exceptions are based on corresponding TimesTen OCI error messages.

Oracle.DataAccess.Client Namespace Support

This section documents supported delegates, classes, and enumerations of the `Oracle.DataAccess.Client` namespace.

- Oracle.DataAccess.Client Delegate Support

- Oracle.DataAccess.Client Class Support
- Oracle.DataAccess.Client Enumeration Support
- OracleCommand Class Support Details
- OracleConnection Class Support Details
- OracleDataReader Class Support Details
- OracleTransaction Class Support Details

Oracle.DataAccess.Client Delegate Support

Table 6-1 lists supported delegates for the `Oracle.DataAccess.Client` namespace.

Table 6-1 Oracle.DataAccess.Client Namespace Delegate Support

Delegate Name	Notes
`OracleInfoMessageEventHandler`	No notes
`OracleRowUpdatedEventHandler`	No notes
`OracleRowUpdatingEventHandler`	No notes

Oracle.DataAccess.Client Class Support

Table 6-2 lists supported classes for the `Oracle.DataAccess.Client` namespace.

Table 6-2 Oracle.DataAccess.Client Namespace Class Support

Class Name	Notes
`OracleClientFactory`	No notes
`OracleCommand`	See "OracleCommand Class Support Details" for information about TimesTen support for properties and public methods of this class.
`OracleCommandBuilder`	No notes
`OracleConnection`	See OracleConnection Class Support Details for information about TimesTen support for properties and public methods of this class.
`OracleConnectionStringBuilder`	No notes
`OracleDataAdapter`	The `IdentityInsert` and `IdentityUpdate` properties are not supported.
`OracleDataReader`	See OracleDataReader Class Support Details for information about TimesTen support for properties and public methods of this class.
`OracleDataSourceEnumerator`	No notes
`OracleError`	No notes
`OracleErrorCollection`	No notes
`OracleException`	No notes
`OracleInfoMessageEventArgs`	No notes

Table 6-2 (Cont.) Oracle.DataAccess.Client Namespace Class Support

Class Name	Notes
OracleParameter	No notes
OracleParameterCollection	No notes
OraclePermission	No notes
OraclePermissionAttribute	No notes
OracleRowUpdatedEventArgs	No notes
OracleRowUpdatingEventArgs	No notes
OracleTransaction	See OracleTransaction Class Support Details for information about TimesTen support for properties and public methods of this class.

Oracle.DataAccess.Client Enumeration Support

Table 6-3 lists supported enumerations for the `Oracle.DataAccess.Client` namespace.

Table 6-3 Oracle.DataAccess.Client namespace Enumeration Support

Enumeration Name	Notes
OracleDbType	No notes
OracleParameterStatus	No notes

OracleCommand Class Support Details

The following tables list supported properties and methods of the OracleCommand class.

Table 6-4 OracleCommand Class Property Support

Property Name	Notes
AddToStatementCache	No notes
ArrayBindCount	No notes
CommandText	No notes
CommandType	No notes
Connection	No notes
FetchSize	No notes
ImpliedRefCursors	While TimesTen supports the `ImpliedRefCursors` property, its use is complementary to the ADO.NET Entity Framework, which TimesTen does not support.
Parameters	No notes
RowSize	No notes
Transaction	No notes

Table 6-4 (Cont.) OracleCommand Class Property Support

Property Name	Notes
`UpdatedRowSource`	No notes

> **Note:**
>
> ODP.NET for TimesTen does not support the `InitialLOBFetchSize` property. Changing its value has no effect. It is always effectively set to the default value of 0 (zero).

Table 6-5 OracleCommand Class Method Support

Method Name	Notes
`Clone`	No notes
`CreateParameter`	No notes
`ExecuteNonQuery`	No notes
`ExecuteReader`	No notes
`ExecuteScalar`	No notes

OracleConnection Class Support Details

The following tables list supported properties and methods of the OracleConnection class.

Table 6-6 OracleConnection Class Property Support

Property Name	Notes
`ConnectionString`	No notes
`ConnectionTimeout`	No notes
`DataSource`	No notes
`ServerVersion`	No notes
`State`	No notes
`StatementCacheSize`	No notes

Table 6-7 OracleConnection Class Event Support

Method Name	Notes
`StateChange`	No notes

Table 6-8 OracleConnection Class Method Support

Method Name	Notes
`BeginTransaction`	No notes
`ClearAllPools` (static method)	No notes
`ClearPool` (static method)	No notes
`Clone`	No notes
`Close`	No notes
`CreateCommand`	No notes
`GetSchema`	Returns metadata collections of tables, columns, users, and other objects that allow application developers to discover and enumerate database information. This information is specific to TimesTen and may differ from corresponding metadata collections returned from Oracle Database. For example, TimesTen does not support the `JavaClasses` and `XMLSchemas` metadata collections because these object types are not supported by TimesTen.
`GetSessionInfo`	No notes
`Open`	No notes
`PurgeStatementCache`	No notes

Note:

TimesTen does not support distributed transactions through OCI. An ODP.NET application cannot use `EnlistDistributedTransaction` or `EnlistTransaction` in a TimesTen connection.

`OracleConnectionType`, an enumeration and public `OracleConnection` class property, allows an ODP.NET application to determine whether a particular connection object is associated with a TimesTen connection, an Oracle Database connection, or no physical connection at all. The property has the following signature:

```
public OracleConnectionType ConnectionType
```

It returns one of the following values from the `OracleConnectionType` enumeration:

```
OracleConnectionType.Undefined: No connection is associated with the
OracleConnection object

OracleConnectionType.Oracle: The OracleConnection object is associated with
an Oracle database

OracleConnectionType.TimesTen: The OracleConnection object is associated
with a TimesTen database
```

OracleDataReader Class Support Details

The following tables list supported properties and methods of the OracleDataReader class.

Table 6-9 OracleDataReader Class Property Support

Property Name	Notes
`Depth`	No notes
`FetchSize`	No notes
`FieldCount`	No notes
`HasRows`	No notes
`HiddenFieldCount`	No notes
`IsClosed`	No notes
`Item`	No notes
`RowSize`	No notes
`VisibleFieldCount`	No notes

> **Note:**
>
> ODP.NET for TimesTen does not support use of the `InitialLOBFetchSize` property. Changing its value has no effect. It is always effectively set to the default value of 0 (zero).

Table 6-10 OracleDataReader Class Method Support

Method Name	Notes
`Close`	No notes
`Dispose`	No notes
`GetByte`	No notes
`GetBytes`	No notes
`GetChar`	No notes
`GetChars`	No notes
`GetDataTypeName`	No notes
`GetDateTime`	No notes
`GetDecimal`	No notes
`GetDouble`	No notes
`GetFieldType`	No notes
`GetFloat`	No notes
`GetInt16`	No notes

Table 6-10 (Cont.) OracleDataReader Class Method Support

Method Name	Notes
GetInt32	No notes
GetInt64	No notes
GetName	No notes
GetOracleBinary	No notes
GetOracleBlob	No notes
GetOracleBlobForUpdate	No notes
GetOracleClob	No notes
GetOracleClobForUpdate	No notes
GetOracleDate	No notes
GetOracleDecimal	No notes
GetOracleString	No notes
GetOracleTimeStamp	No notes
GetOracleValue	No notes
GetOracleValues	No notes
GetOrdinal	No notes
GetProviderSpecificFieldType	No notes
GetProviderSpecificValue	No notes
GetProviderSpecificValues	No notes
GetSchemaTable	No notes
GetString	No notes
GetValue	No notes
GetValues	No notes
IsDBNull	No notes
Read	No notes

OracleTransaction Class Support Details

The following tables list supported properties and methods of the `OracleTransaction` class.

Table 6-11 OracleTransaction Class Property Support

Property Name	Notes
IsolationLevel	No notes
Connection	No notes

Table 6-12 OracleTransaction Class Method Support

Class Name	Notes
`Commit`	No notes
`Dispose`	No notes
`Rollback`	No notes

> **Note:**
>
> TimesTen does not support transaction savepoints.

Oracle.DataAccess.Types Namespace Support

This section documents supported structures, exceptions, classes, interfaces, and enumerations of the `Oracle.DataAccess.Types` namespace.

- Oracle.DataAccess.Types Structure Support
- Oracle.DataAccess.Types Exception Support
- Oracle.DataAccess.Types Class Support
- Oracle.DataAccess.Types Interface Support
- Oracle.DataAccess.Types Enumeration Support

Oracle.DataAccess.Types Structure Support

Table 6-13 lists supported structures for the `Oracle.DataAccess.Types` namespace.

Table 6-13 Oracle.DataAccess.Types Namespace Structure Support

Structure Name	Notes
`OracleBinary`	No notes
`OracleDate`	No notes
`OracleDecimal`	No notes
`OracleString`	No notes
`OracleTimeStamp`	No notes

Oracle.DataAccess.Types Exception Support

Table 6-14 lists supported exceptions for the `Oracle.DataAccess.Types` namespace.

Table 6-14 Oracle.DataAccess.Types Namespace Exception Support

Class Name	Notes
`OracleTypeException`	No notes
`OracleNullValueException`	No notes
`OracleTruncateException`	No notes

Oracle.DataAccess.Types Class Support

Table 6-15 lists supported classes for the `Oracle.DataAccess.Types` namespace.

Table 6-15 Oracle.DataAccess.Types Namespace Class Support

Class Name	Notes
`OracleBlob`	No notes
`OracleClob`	No notes
`OracleRefCursor`	No notes

Oracle.DataAccess.Types Interface Support

Table 6-16 lists supported interfaces for the `Oracle.DataAccess.Types` namespace.

Table 6-16 Oracle.DataAccess.Types Namespace Interface Support

Interface Name	Notes
`INullable`	No notes

Oracle.DataAccess.Types Enumeration Support

Table 6-17 lists supported enumerations for the `Oracle.DataAccess.Types` namespace.

Table 6-17 Oracle.DataAccess.Types Namespace Enumeration Support

Enumeration Name	Notes
(No enumerations are supported.)	No notes