Oracle® Database

Database Administrator's Reference

21c for Microsoft Windows

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Preface

This guide provides platform-specific information about administering and configuring Oracle Database 21c on Microsoft Windows 32-bit and 64-bit platforms.

See Also:

- *Oracle Database Installation Guide for Microsoft Windows* for information about Oracle Database preinstallation requirements
- *Oracle Database Client Installation Guide for Microsoft Windows* for information about Oracle Database Client preinstallation requirements
- *Oracle Grid Infrastructure Installation and Upgrade Guide for Microsoft Windows x64 (64-Bit)* for information about Oracle Grid Infrastructure and Oracle RAC preinstallation requirements

This Preface contains these topics:

Audience

This guide is intended for database administrators, network administrators, security specialists, and developers who use Oracle Database for Windows.

To use this document, you need:

- Oracle-certified Windows operating system software installed and tested
- Knowledge of object-relational database management concepts

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Oracle is fully committed to diversity and inclusion. Oracle respects and values having a diverse workforce that increases thought leadership and innovation. As part of our initiative to build a more inclusive culture that positively impacts our employees, customers, and partners, we are working to remove insensitive terms from our products and documentation. We are also mindful of the necessity to maintain compatibility with our customers' existing technologies and the need to ensure continuity of service as Oracle's offerings and industry standards evolve. Because of these technical constraints, our effort to remove insensitive terms is ongoing and will take time and external cooperation.

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.

1

Oracle Database Architecture on Windows

Learn how Oracle Database architecture takes advantage of some more advanced services in Microsoft Windows operating systems.

- Overview of Oracle Database on Windows Architecture
  Oracle Database on Windows is a stable, reliable, and a high-performing system upon which you can build applications. Each release of the database provides new platform-specific features for high performance on Windows.
- Overview of Oracle Database Scalability on Windows
  Features in Oracle Database and in the Windows operating system work together to help increase scalability, throughput, and database capacity.
- Oracle Database Integration with Windows
  Oracle Database is increasingly integrated with Windows, easing maintenance and improving enterprise-level deployment in security, directory, and transaction services.

Overview of Oracle Database on Windows Architecture

Oracle Database on Windows is a stable, reliable, and a high-performing system upon which you can build applications. Each release of the database provides new platform-specific features for high performance on Windows.

Oracle Database operates the same way on Windows as it does on the other platforms.

- Oracle Automatic Storage Management
  Oracle Automatic Storage Management (Oracle ASM) is an integrated file system and volume manager expressly built for Oracle Database files.
- Oracle Automatic Storage Management File Access Control
  Oracle ASM File Access Control restricts the access of files to specific Oracle ASM clients that connect as `SYSDBA`.
- Thread-Based Architecture
  Threads allow concurrent operations within an operating system process so that a process can run different parts of its program simultaneously on different processors.
- File I/O Enhancements
  Oracle Database supports 64-bit file I/O to allow the use of files larger than 4 gigabytes (GB).

Oracle Automatic Storage Management

Oracle Automatic Storage Management (Oracle ASM) is an integrated file system and volume manager expressly built for Oracle Database files.

Oracle ASM provides the performance of raw I/O with the easy management of a file system. It simplifies database administration by eliminating the need for you to directly manage potentially thousands of Oracle Database files. It enables you to divide all available storage into disk groups. You manage a small set of disk groups, and Oracle ASM automates the placement of the database files within those disk groups.

Oracle recommends that you use Oracle ASM instead of raw files to store data files. It provides the performance benefits of raw files with much better manageability. Oracle ASM is available for both single instance and Oracle Real Application Clusters (Oracle RAC) databases.

You can store Oracle Cluster Registry and voting files in Oracle ASM disk groups and store database data files in the `data` disk group. The voting files and Oracle Cluster Registry are two important components of Oracle Clusterware.

Note:

- You must be logged on either as an Administrator or a user name that is a member of the Administrators group.
- To open Disk Management console, click **Start**, **Run**, and then enter: `diskmgmt.msc`.
- Storing data files on raw devices is no longer supported. You must use a file system or Oracle Automatic Storage Management.
- NFS or Direct NFS cannot be used for Oracle Clusterware files.

Related Topics

- Storing Tablespaces on Raw Partitions

See Also:

- *Oracle Automatic Storage Management Administrator's Guide*
- *Oracle Database Installation Guide for Microsoft Windows*

Oracle Automatic Storage Management File Access Control

Oracle ASM File Access Control restricts the access of files to specific Oracle ASM clients that connect as `SYSDBA`.

An Oracle ASM client is a database, which is identified by the name of the user that owns the database instance home. Oracle ASM File Access Control uses this user name to identify a database. Oracle ASM File Access Control restricts access based on the operating system and effective user identification number of a database owner.

- Creation of New User Groups and Users for Separation of Database Administration Duties
  Oracle Database provides access control to separate the roles on Windows.
- About Disk Group User Replacement
  The identity of an Oracle ASM user can be changed from one operating system user to another operating system user.

- About Changing File Access Control While the File is Open
  Oracle Database enables users to change the ownership, permissions, or group membership of a file even while the file is open.

Creation of New User Groups and Users for Separation of Database Administration Duties

Oracle Database provides access control to separate the roles on Windows.

With Oracle Database services running under the Oracle Home User account instead of the Local System Account, the Oracle ASM access control feature must be enabled to support role separation on Windows. In previous releases, this feature was disabled on Windows because all Oracle Database services ran under Windows Built-in Local System Account.

The new user groups added are `ORA_`*`HOMENAME`*`_DBA`, `ORA_`*`HOMENAME`*`_OPER`, `ORA_`*`HOMENAME`*`_SYSBACKUP`, and so on. For Oracle ASM administration, new groups `ORA_ASMADMIN`, `ORA_ASMDBA` and `ORA_ASMOPER` are automatically created and populated during Oracle Database installation. The Oracle ASM administrator can manage these Windows groups using Windows tools, though you must ensure that the required user names are not removed from these groups.

Related Topics

- *Oracle Database Installation Guide for Microsoft Windows*
- *Oracle Grid Infrastructure Installation and Upgrade Guide for Microsoft Windows x64 (64-Bit)*

About Disk Group User Replacement

The identity of an Oracle ASM user can be changed from one operating system user to another operating system user.

It enables end users to change the identity of an Oracle ASM user without having to delete and re-create the user, which requires dropping all the files a user owns. This feature improves the manageability of Oracle ASM users and the files they own. The SQL Statements `ALTER, DISKGROUP, REPLACE, USER`, and a new ASMCMD command (`rpusr`) have been added to support user replacement in a disk group.

> **See Also:**
>
> *Oracle Automatic Storage Management Administrator's Guide*

About Changing File Access Control While the File is Open

Oracle Database enables users to change the ownership, permissions, or group membership of a file even while the file is open.

Since this release, the ASMCMD file access control commands, such as `chgrp`, `chmod`, and `chown`, can run even while the file is open. The SQL statements, such as `ALTER, DISKGROUP, MODIFY,and USERGROUP` commands have also been modified as these SQL statements provide support for these ASMCMD commands.

> **See Also:**
>
> *Oracle Automatic Storage Management Administrator's Guide*

Thread-Based Architecture

Threads allow concurrent operations within an operating system process so that a process can run different parts of its program simultaneously on different processors.

- About Thread-Based Architecture
  Oracle Database instance or an Oracle Automatic Storage Management instance architecture is thread-based.

About Thread-Based Architecture

Oracle Database instance or an Oracle Automatic Storage Management instance architecture is thread-based.

Threads allow concurrent operations within an operating system process so that a process can run different parts of its program simultaneously on different processors. A thread-based architecture provides the following advantages:

- Faster context switching
- Shared memory segments
- Faster spawning of new connections, because threads are created more quickly than processes
- Decreased memory usage, because threads share more data structures than processes

Internally, the code to implement the thread model is compact and separate from the main body of Oracle Database code. Exception handlers are used to deallocate resources. They add robustness, with no downtime because of resource leaks or program that does not function as expected.

Oracle Database is not a typical Windows process. On Windows, an Oracle Database instance or an Oracle Automatic Storage Management instance (threads and memory structures) is a Windows service: a background process registered with the operating system. The service is started by Windows and requires no user interaction to start. This enables the database to open automatically at computer startup.

When running multiple Oracle Database or Oracle Automatic Storage Management instances on Windows, each instance runs its own Windows service with multiple component threads. The background processes read and write from various data files, depending on your configuration. Oracle Database architecture on Windows is illustrated in Figure 1-1. Examples of Oracle Database required threads on Windows are listed in Table 1-1 .

Figure 1-1 Oracle Database Architecture on Windows

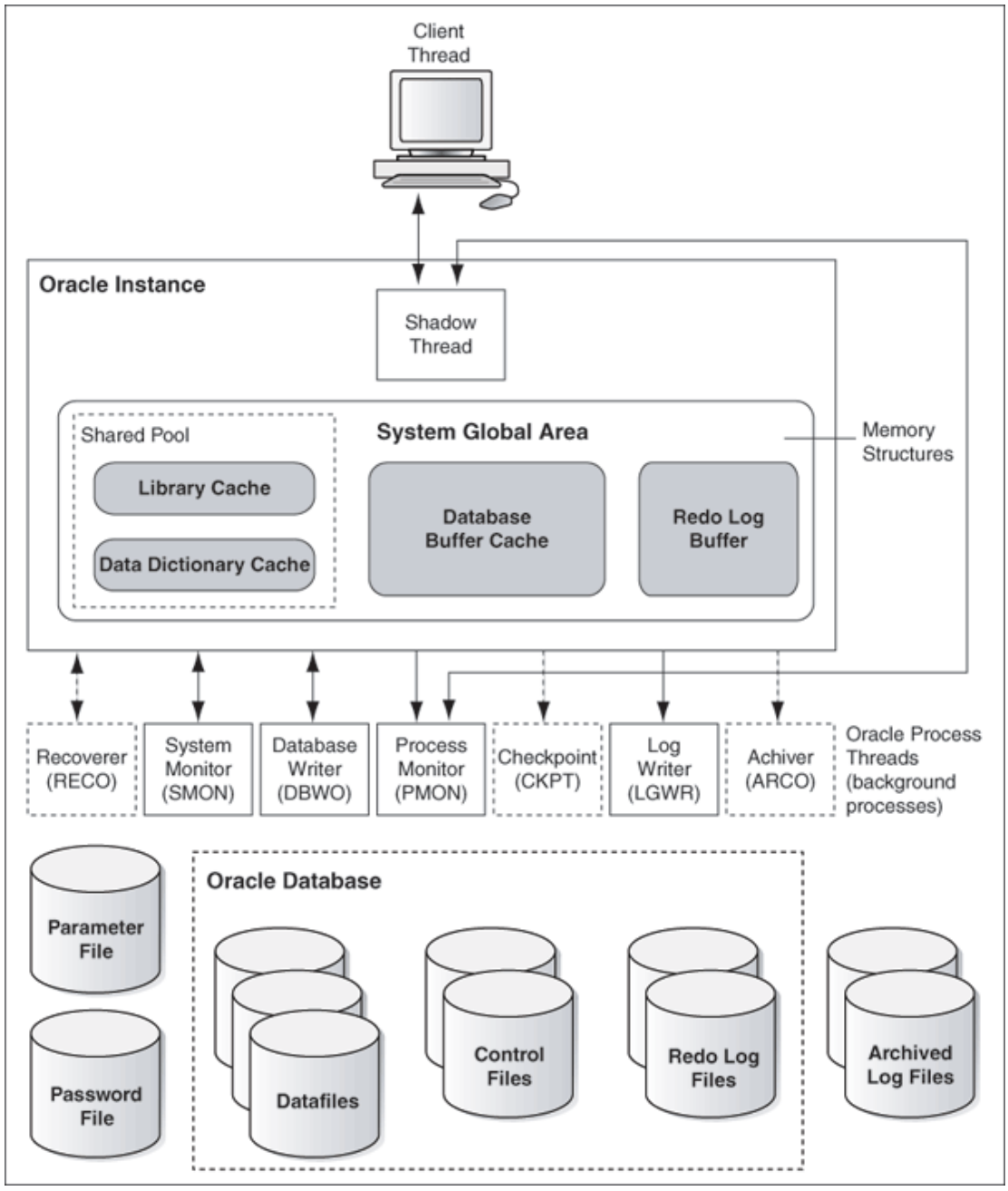


Table 1-1 Oracle Database Threads

Oracle Database Thread	Description	Required/Optional
DBWO	database writer	Required
LGWR	log writer	Required
MMAN	memory manager process	Required
PMON	process monitor	Required

Table 1-1 (Cont.) Oracle Database Threads

Oracle Database Thread	Description	Required/Optional
PSPO	process spawner process	Required
SMON	system monitor	Required
CKPT	checkpoint process (thread on Windows) that runs by default on Windows	Required
ARCO	archive process (or thread on Windows)	Required
RECO	distributed recovery background process	Required

Note:

You can view running background processes by executing the following query:

```
SQL> select * from v$bgprocess where paddr <> '00';
```

Oracle Database instance or an Oracle Automatic Storage Management instance runs as a Windows Service. On Microsoft Windows, the entire instance runs as a single operating system process. Oracle Database instance contains two types of Oracle processes: background and foreground Oracle processes. Each of these Oracle processes is spawned as an operating system thread within in the Oracle Database instance.

Oracle Database for Microsoft Windows is supplied as a set of executables and dynamic link libraries (DLLs). Executable images can be modified using `ORASTACK` to change the size of the stack used by the threads of the Oracle Database process. Oracle recommends that you use this tool only under the guidance of Oracle Support Services.

- About Enabling Support for threaded_execution Initialization Parameter
  Starting with Oracle Database 21c, Oracle Database supports the `threaded_execution` initialization parameter.

About Enabling Support for threaded_execution Initialization Parameter

Starting with Oracle Database 21c, Oracle Database supports the `threaded_execution` initialization parameter.

This parameter is set to `true` by default on the Oracle Database server instance. Like in earlier releases, even with the initialization parameter `threaded_execution = true`, the Oracle Database server instance on Microsoft Windows remains a service having a single multi-threaded operating system process.

On Microsoft Windows, `threaded_execution = false` is not supported, hence this parameter must be set to `true` only. Oracle recommends that you do not change the default value of `true` which is set automatically.

Starting with Oracle Database 21c, when you start the Oracle Database server with the default setting `threaded_execution = true` you observe the following changes:

V$PROCESS View Changes

Starting with Oracle Database 21c, the STID column in V$PROCESS is populated. The SPID is an operating system process identifier. Since Oracle Database server instance process on Windows is service-based, this is Oracle Database instance's process identifier. This is unlike the Oracle Database prior to Oracle Database 21c, where SPID had a unique operating system thread (Oracle process) identifier.

The STID is an operating system thread identifier mapped to the threads running in the operating system process, and the SPID and STID together uniquely identify an Oracle process. The STID is unique for every Oracle background and foreground except for foregrounds started by the listener. In those cases, the SPID is the operating system thread (Oracle process) identifier and STID is 0.

Snapshot of the V$PROCESS for Oracle Database 21c on Microsoft Windows is as follows:

Table 1-2 V$PROCESS for Oracle Database 21c

PID	SPID	STID	PNAME
1	5300	6312	PMON
2	5300	6148	SCMN
3	5300	4348	CLMN
4	5300	6584	PSP0
5	5300	5220	VKTM
.			
.			
.			
71	4872	0	

PID 71 in the above list having STID = 0 is spawned by the listener instead of the Connection broker process. For these PIDs, SPID indicates a unique operating system Thread (Oracle process) identifier.

A snapshot of V$PROCESS prior to Oracle Database 21c, where Oracle process is an operating system thread (Oracle process) identifier is as follows:

Table 1-3 V$PROCESS prior to Oracle Database 21c

PID	SPID	STID	PNAME
1			
2	9748	0	PMON
3	4804	0	CLMN
4	5564	0	PSP0
5	8872	0	VKTM

Dedicated Connection Broker

Starting with Oracle Database 21c, the Dedicated Connection Broker is turned on by default. Hence, you notice an additional background trace file similar to `tg_n000_3992_3100.trc`, where `tg` is the ORACLE_SID, `3992` is the SPID, and `3100` is the STID. To disable Dedication Connection Broker explicitly, set `use_dedicated_broker = FALSE` in the server initialization parameter file.

When the Dedicated Connection Broker runs on the Oracle Database server instance:

1. The bequeath client connections to the server result in spawning a new server thread (foreground) by the Dedicated Connection Broker process.
2. The Dedicated Connection Broker can spawn a server thread (foreground) in case of TNS connections from the client. For this, set `DEDICATED_THROUGH_BROKER_listener-name = on` in the `listener.ora` file and restart the listener.

Trace File Name Changes

Starting with Oracle Database 21c, trace file names can have the following formats:

1. `tg_pmon_3992_9408.trc`, where `tg` is the ORACLE_SID, 3992 is the operating system process ID, and 9408 is the operating system thread (Oracle process) identifier as described in the `V$PROCESS` view.
   Trace file names of all the background Oracle processes and foreground processes started by the connection broker in the server instance contain a sub-string of the form `pid_tid`.
2. `tg_ora_4872.trc`, where `tg` is the ORACLE_SID and 4872 is the operating system thread (Oracle process) identifier.
   This format is used in the following scenarios:
   - **a.** By default, `DEDICATED_THROUGH_BROKER_listener-name` parameter is not turned ON and hence the TNS connections result in the server foreground created by the listener. This behaviour is similar to the Oracle Database releases prior to Oracle Database 21c.
   - **b.** For a given client, when you need a listener instead of a broker spawn a foreground server process, explicitly set the environment variable `ORA_SERVER_THREAD_ENABLED = FALSE` in the client's environment.

File I/O Enhancements

Oracle Database supports 64-bit file I/O to allow the use of files larger than 4 gigabytes (GB).

In addition, physical and logical raw files are supported as data, log, and control files to support Oracle Real Application Clusters (Oracle RAC) on Windows and for those cases where performance must be maximized.

Instead of using the operating system kernel NFS client, you can configure Oracle Database to access NFS V3 servers directly using an Oracle internal Direct NFS client. Through this integration, Oracle can optimize the I/O path between Oracle and the NFS server, resulting in a significantly superior performance. In addition, Direct NFS client simplifies and optimizes the NFS client configuration for database workloads.

Now, the Direct NFS client supports all widely accepted NFS path formats, including both Windows-style and UNIX-style NFS paths.

Volumes mounted through CIFS cannot be used for storing Oracle database files without configuring the Direct NFS client. The atomic write requirements needed for database writes are not guaranteed through the CIFS protocol. Consequently, CIFS can be used only for operating system-level commands such as, copy, move, and so on.

The Direct NFS client currently supports up to four parallel network paths to provide scalability and high availability. The Direct NFS client delivers optimized performance by automatically load balancing requests across all specified paths. If one network path fails, then the Direct NFS client resends commands over any remaining paths ensuring fault tolerance and high availability.

A new parameter called `dnfs_batch_size` is now added to control the number of asynchronous I/O operations that can be queued by an Oracle process when the Direct NFS client is enabled. Set this parameter only if the Direct NFS client is overwhelming the NFS server or the network. This parameter helps the user to manage the load that the Direct NFS client can generate. In typical environments, you must not set this parameter. The default value of this parameter is 4096. To reduce the Direct NFS client load, Oracle recommends a value of 128 that can be changed based on the NFS server performance.

> **See Also:**
>
> Your vendor documentation to complete NFS configuration and mounting

Overview of Oracle Database Scalability on Windows

Features in Oracle Database and in the Windows operating system work together to help increase scalability, throughput, and database capacity.

- Large User Populations
  Several features allow Oracle Database to support an increasingly large number of database connections on Windows.

Large User Populations

Several features allow Oracle Database to support an increasingly large number of database connections on Windows.

- The Shared Server Process, limits the number of threads needed in the Oracle Database process and supports over 10,000 simultaneous connections to a single database instance.
- Oracle Net multiplexing and connection pooling features allow a large configuration to connect more users to a single database instance.
- Oracle RAC raises connection counts dramatically by allowing multiple server computers to access the same database files, increasing the number of user connections by tens of thousands while increasing throughput.

> **Note:**
>
> Oracle RAC is only supported on 64-bit Windows server operating systems.

Oracle Database Integration with Windows

Oracle Database is increasingly integrated with Windows, easing maintenance and improving enterprise-level deployment in security, directory, and transaction services.

- Oracle PKI Integration with Windows
  Oracle Advanced Security includes Oracle PKI (public key infrastructure) integration for authentication and single sign-on. You can integrate Oracle-based applications with the PKI authentication and encryption framework, using Oracle Wallet Manager.
- Oracle Services for Microsoft Transaction Server
  Microsoft Transaction Server (MTS) is used in the middle tier as an application server for COM objects and transactions in distributed environments.

Oracle PKI Integration with Windows

Oracle Advanced Security includes Oracle PKI (public key infrastructure) integration for authentication and single sign-on. You can integrate Oracle-based applications with the PKI authentication and encryption framework, using Oracle Wallet Manager.

Starting with Oracle Database 21c, Oracle Fail Safe is desupported for Oracle Database releases.

Oracle Services for Microsoft Transaction Server

Microsoft Transaction Server (MTS) is used in the middle tier as an application server for COM objects and transactions in distributed environments.

Oracle Services for Microsoft Transaction Server allows Oracle Database to be used as a resource manager in Microsoft Transaction Server-coordinated transactions, providing strong integration between Oracle solutions and Microsoft Transaction Server. Oracle Services for Microsoft Transaction Server can operate with Oracle Database running on any operating system.

Oracle Database takes advantage of a native implementation and also stores recovery information in Oracle Database itself. Oracle Services for Microsoft Transaction Server allows development in all industry wide data access interfaces, including Oracle Call Interface (OCI), ActiveX Data Objects (ADO), ADO.NET, OLE DB, and Open Database Connectivity (ODBC). The Oracle APIs, Oracle Data Provider for .NET and OCI, offer greatest efficiency.

2

Database Tools on Windows

Oracle Database for Windows includes various tools to perform database functions, describes the preferred tools to perform common database administration tasks, and explains how the tools can be started.

Unless otherwise noted, features described in this guide are common to all Oracle Database editions.

- Choosing a Database Tool
  Database tools is a collective term for tools, utilities, and assistants that you can use to perform database administration tasks.
- Starting Database Tools
  Oracle Database mandates that the administrator starting all the administration tools such as Oracle Database Configuration Assistant, Oracle Database Upgrade Assistant, Oracle Net Configuration Assistant, and Oracle ASM Configuration Assistant, must be an operating system administrator.
- Using the Oracle Home User Control Tool
  A new Windows tool, Oracle Home User Control, is a command-line tool that displays the Oracle Home User name associated with the current Oracle home and updates the password for the Windows services for the Oracle home.
- Using Windows Tools
  You can use Windows tools in the following ways to manage Oracle Database:
- Using SQL*Loader
  Describes Windows-specific information for using SQL*Loader (`SQLLDR`).

Choosing a Database Tool

Database tools is a collective term for tools, utilities, and assistants that you can use to perform database administration tasks.

Some database tools perform similar tasks, though no one database tool performs all the database administration tasks.

- Database Tools and Operating System Compatibility
  Almost all the database tools are available on all supported versions of Windows.
- Preferred Database Tools
  Lists the various database tools you can use to perform common database administration tasks.

Database Tools and Operating System Compatibility

Almost all the database tools are available on all supported versions of Windows.

The exceptions are:

- Oracle SQL Developer is available only at Oracle Technology Network (OTN). See

http://www.oracle.com/technetwork/developer-tools/sql-developer/overview/index.html

- Oracle Enterprise Manager and its optional management packs have additional integrated tools to assist in managing databases.

> **See Also:**
>
> *Oracle Enterprise Manager Concepts*

Preferred Database Tools

Lists the various database tools you can use to perform common database administration tasks.

Oracle recommends you use tools listed in the **Preferred Tool** column of the table. After choosing a tool to perform a task, go to Preferred Database Tools from the Start Menu, for instructions on how to start the tool.

> **Note:**
>
> The `VOLSIZE` parameter for the Export and Import utilities is not supported on Windows. If you attempt to use the utilities with the `VOLSIZE` parameter, then error `LRM-00101` occurs. For example:
>
> ```
> D:\> exp system full=y volsize=100m;
> Password: password
> LRM-00101: unknown parameter name 'volsize'
> EXP-00019: failed to process parameters, type 'EXP HELP=Y' for help
> EXP-00000: Export terminated unsuccessfully
> ```

Table 2-1 Preferred Database Tools

Administration Task	Preferred Tool	Other Tools
Create database services	Database Configuration Assistant	ORADIM
Delete database services	Database Configuration Assistant	ORADIM
Change passwords in the database password file	ORAPWD	ORADIM
Update the password of an Oracle Home User	Oracle Home User Control	None
Migrate database users to a directory	User Migration Utility	None
Migrate a database	Oracle Database Upgrade Assistant	Upgrade Information Tool
Export data	Data Pump Export (EXPDP)	Export (EXP)
Import data	Data Pump Import (IMPDP)	Import (IMP)
Load data	Oracle Enterprise Manager Load Wizard	SQL*Loader (SQLLDR)

Table 2-1 (Cont.) Preferred Database Tools

Administration Task	Preferred Tool	Other Tools
Back up database	Oracle Enterprise Manager Backup Wizard	Recovery Manager (RMAN) OCOPY
Recover database	Oracle Enterprise Manager Recovery Wizard	Recovery Manager (RMAN) OCOPY
Store encrypted and decrypted Oracle Wallet (Oracle Advanced Security and security PKI integration)	Oracle Wallet Manager	None
Grant database roles	Oracle Enterprise Manager Database Express	Local Users and Groups SQL*Plus
Create database objects	Oracle Enterprise Manager Cloud Control	SQL*Plus

- ORADIM can set a password only when none was previously set. If a password has been previously set, then ORADIM can change it only by deleting and re-creating Oracle Database services. Now, ORADIM creates the Oracle Database service, Oracle VSS Writer service, and Oracle Scheduler service to run under the Oracle Home User account. If this account is a Local or a Domain User Account, then ORADIM prompts for the password for that account and accepts the same through `stdin`.

  It is possible to specify both the Oracle Home User and its password using the `-RUNAS osusr[/ospass]` option to `oradim`. If the given `osusr` is different from the Oracle Home User, then the Oracle Home User is used instead of `osusr` along with the given `ospass`.
- User Migration Utility can migrate local or external users to enterprise users.

  For more information, see "Using the User Migration Utility" in *Oracle Database Enterprise User Security Administrator's Guide*.
- Oracle Database 12*c* Release 2 (12.2) and later are supported for Oracle Database Upgrade Assistant upgrades in Oracle Database 21c. Oracle Database Upgrade Assistant can also be used to apply patch sets.
- Data Pump Export and Data Pump Import are preferred for Oracle Database 10*g* Release 1 (10.1) and later data; Export and Import are preferred for earlier data.
- If you back up files while you are shutting down the database, then your backup is invalid. You cannot use an invalid backup to restore files at a later date.
- You cannot use earlier versions of Oracle Wallet Manager to manage Oracle Database 10*g* Release 1 (10.1) and later wallets that contain password-based credentials for authentication to Oracle Internet Directory. These credentials are placed in the wallet when an Oracle Database server is registered in Oracle Internet Directory.

  The database wallet that Oracle Database Configuration Assistant automatically generates during database registration can be used only with Oracle Database 10*g* Release 1 (10.1) or later. You cannot use this database wallet for earlier versions of the database, nor can you use it for Oracle Internet Directory Release 9.0.4 or earlier.

Starting Database Tools

Oracle Database mandates that the administrator starting all the administration tools such as Oracle Database Configuration Assistant, Oracle Database Upgrade Assistant, Oracle Net

Configuration Assistant, and Oracle ASM Configuration Assistant, must be an operating system administrator.

The administrator must also be a member of the `ORA_DBA` and `ORA_ASMADMIN` group for using the Oracle Database Configuration Assistant and Oracle Database Upgrade Assistant tools when accessing Oracle ASM. The administrator must be a member of the `ORA_ASMADMIN` group for using the Oracle ASM Configuration Assistant tool.

Oracle needs the password of Oracle Home User to create new Windows services for Database, Listener, and other entities. To support this, all the administration tools have been modified to prompt for the password of Oracle Home User that is required only when the Oracle Home User is a Local or a Domain Windows User Account and the password for the Oracle Home User is not stored in the Oracle Wallet.

- Starting Database Tools in Multiple Oracle Homes
  You can start database tools in multiple Oracle homes.
- Running Tools with Windows User Account Control
  You must ensure that only trusted applications run on your computer.
- Starting Database Tools from the Start Menu
  Describes how to start assistants and other tools from the **Start menu**.
- Starting Database Tools from the Command Line
  Describes how to start Oracle Database tools from the command line, and where to go for further information on using these products.
- Starting Windows Tools
  Describes how to start each Windows tool and where to go for more information on using these products.

Starting Database Tools in Multiple Oracle Homes

You can start database tools in multiple Oracle homes.

If you have multiple Oracle homes on your computer from previous releases, then see Appendix B, "Optimal Flexible Architecture" in *Oracle Database Installation Guide for Microsoft Windows* for a description of differences between Oracle homes in different releases.

- Starting Tools from Multiple Oracle Homes
  Each Oracle home, including the first Oracle home you create on your computer, has a unique *HOMENAME*.

Starting Tools from Multiple Oracle Homes

Each Oracle home, including the first Oracle home you create on your computer, has a unique *HOMENAME*.

Running Tools with Windows User Account Control

You must ensure that only trusted applications run on your computer.

To ensure that only trusted applications run on your computer, all Windows operating systems supported for Oracle Database provide User Account Control. If you have enabled this security feature, then, depending on how you have configured it, Oracle Universal Installer prompts you for either your consent or your credentials when

installing Oracle Database Client. Provide either the consent or your Windows Administrator credentials as appropriate.

You must have the Administrator privileges to run some configuration tools, or to run any tool or application that writes to any directory within the Oracle home. If User Account Control is enabled, and you are logged in as the local Administrator, then you can successfully run each of these commands in the usual way. However, if you are logged in as a member of the Administrator group, then you must explicitly run these tasks with Windows Administrator privileges.

The following tools must be run with Administrator privileges:

- Oracle Net Configuration Assistant. This tool is available as a Configuration and Migration Tool.
- Oracle OLAP Analytic Workspace Manager and Worksheet. This tool is available as an Integrated Management Tool.
- Oracle Database Configuration Assistant. This tool is available as a Configuration and Migration Tool.
- Oracle Database Wallet Manager. This tool is available as an Integrated Management Tool.
- Oracle Database Upgrade Assistant. This tool is available as a Configuration and Migration Tool.
- Oracle Net Manager. This tool is available as a Configuration and Migration Tool.
- Oracle ASM Configuration Assistant. This tool is available as a Configuration and Migration Tool.
- Oracle ASM Disk Stamping Tool (`asmtool`, `asmtoolg`). This tool is available as a Configuration and Migration Tool.

To run any **Start** menu tool with Administrator privileges:

1. Click the **Start** menu option.
2. Select **All Programs**, then select **Oracle - HOMENAME**.
3. Select the name of the tool, then right-click the name of the tool or application you want to run, and then select **Run as administrator**.

These steps describe how to start a tool as an Administrator from the command prompt:

1. Create a shortcut for the command prompt window on your desktop. An icon for that shortcut appears on the desktop.
2. Right-click the icon for the newly created shortcut, and specify **Run as administrator**.

   When you open this window, the title bar reads Administrator: Command Prompt. Commands running within this window are run with Administrator privileges.

> **See Also:**
>
> *Oracle Database Installation Guide for Microsoft Windows*

Starting Database Tools from the Start Menu

Describes how to start assistants and other tools from the **Start menu**.

It also directs you about further information on using these products.

> **Note:**
>
> When you use an assistant, you must have read and write access to the directory where database files are created or moved to. To create an Oracle Database instance, you must have the administrator privilege.

> **Note:**
>
> All Start menu paths begin with the **Start** menu where you select **All Programs**, then select **Oracle - *HOMENAME*** and so on.

Table 2-2 Starting Database Tools from the Start Menu

Tool	Start Menu Path	More Information
Microsoft ODBC Administrator	From **Configuration and Migration Tools**, select **Microsoft ODBC Administration**	Microsoft ODBC Administration online help
Oracle Automatic Storage Management Configuration Assistant	From **Configuration and Management Tools**, select **Automatic Storage Management Configuration Assistant**	*Oracle Grid Infrastructure Installation and Upgrade Guide for Microsoft Windows x64 (64-Bit)*
Oracle Database Configuration Assistant	From **Configuration and Migration Tools**, select **Database Configuration Assistant**	
Oracle Directory Manager	From **Integrated Management Tools**, select **Oracle Directory Manager**	*Oracle Internet Directory Administrator's Guide*
Oracle Locale Builder	From **Configuration and Migration Tools**, select **Locale Builder**	*Oracle Database Globalization Support Guide*
Oracle Net Configuration Assistant	From **Configuration and Migration Tools**, select **Net Configuration Assistant**	*Oracle Database Net Services Administrator's Guide*
Oracle Net Manager	From **Configuration and Migration Tools**, select **Net Manager**	*Oracle Database Net Services Administrator's Guide*
Oracle Wallet Manager	From **Integrated Management Tools**, select **Wallet Manager**	*Oracle Database Enterprise User Security Administrator's Guide*
SQL*Plus	From **Application Development**, select **SQL*Plus**	*SQL*Plus User's Guide and Reference*

Starting Database Tools from the Command Line

Describes how to start Oracle Database tools from the command line, and where to go for further information on using these products.

Table 2-3 Starting Database Tools from the Command Line

Tool	Enter at Prompt	More Information

Oracle ASM Disk Stamping Tool
Oracle ASM Disk Stamping Tool (GUI version)
	• `C:\> asmtool`
	Following are the list of options:
	`C:\> asmtool -add`
	`C:\> asmtool -addprefix`
	`C:\> asmtool -list`
	`C:\> asmtool -delete`
	• `C:\> asmtoolg`
	Note: `asmtoolg` is the GUI-based tool that performs the same actions as the command-line `asmtool` tool.
		"Marking Disk Partitions for Oracle ASM Before Installation" in *Oracle Grid Infrastructure Installation and Upgrade Guide for Microsoft Windows x64 (64-Bit)*

DBVERIFY	`C:\> dbv`
	DBVERIFY starts and prompts you for a file name parameter. To obtain a list of parameters, enter:
	`C:\> dbv help=y`
		Oracle Database Utilities

Data Pump Export	`C:\> expdp` *`user name`* EXP starts and prompts you for parameters. To obtain a list of these parameters, enter: `C:\> exp help=y`	*Oracle Database Utilities* for instructions on use of Data Pump Export *Oracle Database Error Messages Reference* for information on error messages
Data Pump Import	`C:\> impdp` *`user name`* IMP starts and prompts you for parameters. To get a list of these parameters, enter: `C:\> imp help=y`	*Oracle Database Utilities* for instructions on use of Data Pump Import *Oracle Database Error Messages* for information on error messages

Database Configuration Assistant	`C:\> dbca`
	Oracle Database Configuration Assistant tool starts in interactive mode. For silent options and other command-line options, enter:
	`C:\> dbca -help`
		"Starting DBCA" in *Oracle Database 2 Day DBA*

Database Upgrade Assistant	`C:\> dbua`
	Oracle Database Upgrade Assistant wizard starts in interactive mode. For silent options and other command line options enter:
	`C:\> dbua -help`
		Oracle Database Upgrade Guide

Export	`C:\> exp` *`user name`* EXP starts and prompts you for parameters. To obtain a list of these parameters, enter: `C:\> exp help=y`	*Oracle Database Utilities* for instructions on use of Export *Oracle Database Error Messages* for information on error messages

Table 2-3 (Cont.) Starting Database Tools from the Command Line

Tool	Enter at Prompt	More Information

Import	`C:\> imp user name`
	IMP starts and prompts you for parameters. To get a list of these parameters, enter:
	`C:\> imp help=y`
		Oracle Database Utilities for instructions on use of Import
		Oracle Database Error Messages for information on error messages

Net Services Configuration	`C:\> netca`
	Oracle Net Configuration Assistant tool starts in interactive mode. For silent options and other command-line options, enter:
	`C:\> netca -help`
		Oracle Database Upgrade Guide

ORADIM	`C:\> oradim options`
	To get a list of ORADIM options, enter either of the following:
	`C:\> oradim`
	`C:\> oradim -? | -h | -help`	

Oracle Wallet Manager	`C:\> cd ORACLE_HOME\bin` `C:\ORACLE_HOME\bin> launch.exe ORACLE_HOME\bin owm.cl`	
Password Utility (ORAPWD)	`C:\> orapwd` Password file is hidden. Use Windows Explorer to see it in a file list. From the **View** menu, select **Options**, then select **View** and then select **Show All Files**.	
Recovery Manager (RMAN)	`C:\> rman parameters`	*Oracle Database Backup and Recovery User's Guide*
SQL*Plus (SQLPLUS)	`C:\> sqlplus`	*SQL*Plus User's Guide and Reference*
SQL*Loader (SQLLDR)	`C:\> sqlldr` SQL*Loader displays a Help screen with available keywords and default values.	*Oracle Database Utilities* *Oracle Database Error Messages* "Starting Windows Tools"
TKPROF	`C:\> tkprof`	*Oracle Database SQL Tuning Guide*

User Migration Utility	`C:\> umu parameters`
	To get a list of parameters, enter:
	`C:\> umu help=yes`
		"Using the User Migration Utility" in *Oracle Database Enterprise User Security Administrator's Guide*

> **Note:**
>
> - Three special conditions apply when running Export or Import utilities on Windows. First, default values for `BUFFER` and `RECORDLENGTH` parameters are 4 KB and 2 KB respectively. This default `RECORDLENGTH` parameter does not depend on the value of `BUFSIZ` defined in the system header file. If you specify a value larger than `USHRT_MAX` (64 KB), you get a warning message. Second, the `VOLSIZE` parameter is not supported. Third, to export an entire database, you must use the `EXP_FULL_DATABASE` role.
> - Oracle Enterprise Manager Database Express is another database tool for managing the database. For information about logging in to Oracle Enterprise Manager Database Express, see "Configuring the HTTP Port for EM Express" in *Oracle Database 2 Day DBA*.

> **Note:**
>
> Oracle Enterprise Manager Database Express (EM Express) is deprecated, and will be removed in a future Oracle Database release.

- About Archiving Redo Log Files
  If you installed Oracle Database through the Typical installation, then it is created in the `NOARCHIVELOG` mode. If you created your database through the Custom option of Oracle Database Configuration Assistant, then you had the choice of either `ARCHIVELOG` or `NOARCHIVELOG`.

About Archiving Redo Log Files

If you installed Oracle Database through the Typical installation, then it is created in the `NOARCHIVELOG` mode. If you created your database through the Custom option of Oracle Database Configuration Assistant, then you had the choice of either `ARCHIVELOG` or `NOARCHIVELOG`.

In `NOARCHIVELOG` mode, redo logs are not archived. Setting your archive mode to `ARCHIVELOG` and enabling automatic archiving causes redo log files to be archived. This protects Oracle Database from both instance and disk failure.

> **See Also:**
>
> *Oracle Database Administrator's Guide* for more information about “Managing Archived Redo Logs."

Starting Windows Tools

Describes how to start each Windows tool and where to go for more information on using these products.

Table 2-4 Starting Windows Tools

Tool	Start Procedure	More Information
Event Viewer	From the **Start** menu, select **All Programs**, then select **Administrative Tools** and then select **Event Viewer**.	Your operating system documentation
Local Users and Groups	From the **Start** menu, select **Settings**, then select **Control Panel**. Double-click **Administrative Tools**. Double-click **Computer Management**. In the console tree, click **Local Users and Groups**.	Your operating system documentation
Microsoft Management Console (MMC)	From the **Start** menu, select **All Programs**, then select **Oracle - *HOMENAME***, then select **Configuration and Migration Tools** and then select **Administration Assistant for Windows**.	Your operating system documentation
Registry Editor	At the command prompt, enter: `C:\> regedit`	Your operating system documentation
Task Manager	Right-click the Task bar and select **Task Manager**.	Your operating system documentation

> **Note:**
>
> Microsoft Management Console is started whenever Oracle Administration Assistant for Windows is started.

Using the Oracle Home User Control Tool

A new Windows tool, Oracle Home User Control, is a command-line tool that displays the Oracle Home User name associated with the current Oracle home and updates the password for the Windows services for the Oracle home.

The input password must match the password for the Windows User Account used as the Oracle Home User. So, first use Windows operating system tools to change the Windows password and then use this tool. This tool updates all Windows services used by Oracle to use the new password and updates it in the Oracle Cluster Registry wallet too, if one exists.

Installer also creates a shortcut **Update Password for Oracle Home User** which starts the tool.

The Oracle Home User Control tool accepts the new password at the tool's prompt for password entry and validates the password provided against the password of the Windows User Account. The tool terminates if password validation fails. Moreover, the user starting the `orahomeuserctl` command must have Administrator privileges. The command must be in the following format:

```
orahomeuserctl list
orahomeuserctl updpwd [-user username] [-host hostname1, hostname2, …] [-log
logfilename]
```

For this command, note the following:

- `list`: This utility displays the Oracle Home User name associated with the Oracle home.
- `updpwd`: This utility prompts for a new password and updates the password for all Oracle Database services associated with the named Oracle Home User on the node. When `updpwd` is started on a node within an Oracle RAC installation, then the command first updates the Oracle Cluster Registry wallet with the new password, then updates all Oracle Database services associated with the user on all active nodes within a cluster. If there is no Oracle Cluster Registry Wallet, then the utility updates only all the Oracle Database services.
- `-user`: This option updates the passwords for all services owned by a specific user, or the password of the current Oracle Home User if no user is specified.
- `-host`: This option updates the passwords for all services belonging to the named Oracle Home User on the specified hosts. To update the password on a remote host, the user must be a Windows Domain User.
- `-log`: This option appends the time-stamped results of the password update action to the specified log file for every node and service name receiving the new password. The default log file name and location is `%ORACLE_HOME%\log\orahomeuserctl.log`.

Using Windows Tools

You can use Windows tools in the following ways to manage Oracle Database:

- Using Event Viewer to Monitor a Database
  Event Viewer lets you monitor events in your system. An event is an important occurrence in the system or application (such as Oracle Database) that requires user notification.
- Using Microsoft Management Console to Administer a Database
  Microsoft Management Console provides a central location for network administration.
- Using Registry Editor to Modify Configuration Information
  Oracle Database stores its configuration information in a structure known as the registry.
- Using Task Manager to Monitor Applications and Processes
  Task Manager monitors applications and processes.
- Using Local Users and Groups to Manage Users and Groups
  Local Users and Groups enable you to manage users and groups on Windows.

Using Event Viewer to Monitor a Database

Event Viewer lets you monitor events in your system. An event is an important occurrence in the system or application (such as Oracle Database) that requires user notification.

While messages for major events can appear on-screen as you work at your computer, events that do not require your immediate attention are recorded by Windows in the Event Viewer log file. You can then view this information at your convenience.

Use Event Viewer to monitor Oracle Database events, such as:

- Initialization of System Global Area for active instance
- Initialization of Program Global Area (PGA) for background processes of the active instance
- Connection to Oracle Database using `AS SYSDBA`

In addition, the operating system audit trail is logged in the Event Viewer log file, which can be viewed using Event Viewer.

Using Microsoft Management Console to Administer a Database

Microsoft Management Console provides a central location for network administration.

Microsoft Management Console hosts applications (called snap-ins) that administrators can use to manage their networks. Oracle snap-ins enable database administrators to:

- Configure Oracle Database administrators, operators, users, and roles so the Windows operating system can authenticate them
- Configure `OracleService`*`SID`*
- Modify registry parameters for all Oracle homes on the computer
- Modify the computer host name, user name, and password for the database
- View and terminate an Oracle Database thread

Using Registry Editor to Modify Configuration Information

Oracle Database stores its configuration information in a structure known as the registry.

You can view and modify this configuration information through Registry Editor. The registry contains configuration information for your computer and must not be accessible for editing by inexperienced users. Only experienced administrators must view and change this information.

Registry Editor displays configuration information in a format similar to Windows Explorer. In the left-hand window is a tree-like format consisting of keys (or folders). When one of these keys is highlighted, parameters and values assigned to that key are displayed in the right-hand window.

When you install products from your media, configuration parameters are automatically entered in the registry. These parameters are read each time your

Windows computer is started and whenever an Oracle Database product is started. These parameters include settings for:

- Oracle home directory
- Language
- Company name
- Oracle home subdirectories for individual products
- Individual products such as SQL*Plus
- Services

Using Task Manager to Monitor Applications and Processes

Task Manager monitors applications and processes.

Task Manager has the following tabs:

- Applications tab displays what applications run. This is useful for identifying and ending unresponsive tasks. (Oracle Database does not appear as an application because it runs as a service.)
- Processes tab displays details of the currently running processes and their resource usage. Columns are customizable.
- Performance tab graphically displays real-time CPU and memory usage, which is useful for spotting sudden changes.
- Networking tab graphically displays the network traffic taking place over the computer's network connections.

Using Local Users and Groups to Manage Users and Groups

Local Users and Groups enable you to manage users and groups on Windows.

Specifically, you can:

- Create and modify Local User Accounts
- Create and modify user profiles
- Create, add, and delete local groups

Using SQL*Loader

Describes Windows-specific information for using SQL*Loader (`SQLLDR`).

- Control File Conventions
  When preparing SQL*Loader control files (`.ctl`), you must follow certain syntax and notational conventions.

Control File Conventions

When preparing SQL*Loader control files (`.ctl`), you must follow certain syntax and notational conventions.

In the full path descriptions, backslashes do not require escape characters or other special treatment. When embedding a single or a double quotation mark inside a string delimited by double quotation marks, place a backslash escape character before the embedded quotation mark.

When specifying data types in the SQL*Loader control file, note that the default sizes of native data types shown in Default Sizes of Native Data types are specific to Windows. These data types can be loaded with correct results only between systems where they have the same length in bytes. You cannot override these defaults in the control file. If the byte order is different between the systems, you can indicate the byte order of the data with the `BYTEORDER` parameter, or you can place a byte-order mark (BOM) in the file.

Table 2-5 Default Sizes of Native Data types

Native Data Types	Default Field Length
DOUBLE	8
FLOAT	4
INTEGER	4
SMALLINT	2

Note:

The default listed is correct if `INTEGER` is specified without a size. But `INTEGER(n)` is also allowed. In that case, `n` specifies the size of the `INTEGER` field in bytes.

See Also:

Oracle Database Utilities for a complete list of options and instructions on using SQL*Loader

3

Supporting Oracle Home User on Windows

Oracle Database supports the use of Oracle Home User, specified at the time of Oracle Database installation. Oracle Home User is used to run the Windows services for the Oracle home.

Oracle Home User can be a Windows Built-in Account or a Virtual Account or a standard Windows User Account (not an Administrator account). Oracle Home User cannot be changed post installation.

If a Windows Built-in Account is used, then no user name or password is required during installation and administration. However, if a Windows User Account is used as Oracle Home User, then you must provide the user name and password during installation and some of the administration tasks.

Virtual Accounts allow you to install an Oracle Database and, create and manage Database services without passwords. A Virtual Account can be used as the Oracle Home User for Oracle Database Single Instance installations and does not require a user name or password during installation and administration.

Oracle Home User is different from Oracle Installation User. Oracle Installation User is the user, who installs a given Oracle Home and hence requires administrative privileges. Oracle Home User is used to run the Windows services. You must not log into the Windows system as Oracle Home User to perform administrative tasks.

Note that the Windows administrator privilege is still required to perform Oracle administrative functions such as installation, upgrade, patching, and other functions.

> **Note:**
>
> A Windows User Account used as Oracle Home User cannot have the administrator privileges as it causes the Oracle Universal Installer to display an error message.

- Managing Oracle Home User
  If you use a Windows User Account as the Oracle Home User, then you must ensure that this user account is present in the Windows system and its password is managed securely to ensure the proper operation and security of the database.
- Using Oracle Home User for an Oracle Database and Oracle Database Client
  For a single-instance Oracle Database and Oracle Database Client installations, you can use Built-in Account or a Windows User Account as the Oracle Home User. Single-instance Oracle Database installations may also use a Virtual Account.
- Using Oracle Home User for Multiple Oracle Homes
  Different Oracle homes on a system can use the same Oracle Home User or use different Oracle Home User names. Note that the earlier releases (11.2 and earlier) of Oracle

Database are treated equivalent to using the Windows Built-in Account as the Oracle Home User.

- Using Oracle Home User During Oracle Database Upgrade
  You can use Oracle Database Upgrade Assistant to upgrade or move databases across Oracle homes if both the Oracle homes use the same Windows User Account as Oracle Home User, or at least one of the Oracle homes is configured to use Windows built-in account as the Oracle Home User.
- Converting from Single-Instance Oracle Database to Oracle Real Application Clusters
  You can convert from Oracle Database single-instance databases to Oracle RAC using Oracle Database Configuration Assistant, `rconfig`, or Oracle Enterprise Manager.

> **See Also:**
>
> - Microsoft documentation for more information on different types of Windows user accounts
> - *Oracle Database Installation Guide for Microsoft Windows*

Managing Oracle Home User

If you use a Windows User Account as the Oracle Home User, then you must ensure that this user account is present in the Windows system and its password is managed securely to ensure the proper operation and security of the database.

You must secure the password of this Windows User Account and ensure that only database administrators have access to this password as one can log on to the database as the database administrator from this Windows User Account. You must also change the password for this Windows User Account at regular intervals for security reasons. You can change the password using Windows tools. However, when you change the password for this Windows User Account, you must also update the password for all Oracle services running under the Windows User Account.

This release has introduced a new Windows utility called the Oracle Home User Control. This is a command-line tool that displays the Oracle Home User name associated with the current Oracle home and updates the password for all Oracle services running under a specific Windows User Account (used as Oracle Home User).

Related Topics

- Using the Oracle Home User Control Tool
  A new Windows tool, Oracle Home User Control, is a command-line tool that displays the Oracle Home User name associated with the current Oracle home and updates the password for the Windows services for the Oracle home.

Using Oracle Home User for an Oracle Database and Oracle Database Client

For a single-instance Oracle Database and Oracle Database Client installations, you can use Built-in Account or a Windows User Account as the Oracle Home User. Single-instance Oracle Database installations may also use a Virtual Account.

Virtual Accounts allow you to install Oracle Database, create, and manage database services without passwords. Windows User Account can be an existing Windows Local User, Windows Domain User, Managed Services Account (MSA), or Group Managed Services Account (gMSA). For a Windows Local User Account or a Windows Domain User Account, you must provide both the user name and password during installation. For a Managed Services Account, you must provide the user name only.

The Group Managed Services Account (gMSA) enables you to install an Oracle Database and, create and manage Database services without passwords. The gMSA is a domain level account that can be used by multiple servers in a domain to run the services using this account.

For a Windows Local User, you also have the option of creating a new Windows user during installation. You must provide the user name and password for the user account and Oracle Universal Installer creates the Windows user during installation. The newly created Windows account is denied interactive logon privileges to the Windows computer. However, a Windows administrator can still manage this account like any other Windows account.

> **Note:**
>
> If a Windows Local User Account is chosen as the Oracle Home User during single-instance Oracle Database installation, Windows NT Native Authentication (NTS) cannot be used for authenticating Windows domain users or users from remote computers.

The Virtual Account option enables you to install an Oracle Database and, create and manage Database services without passwords. User names do not appear on the logon screen.

When the Windows built-in account is chosen as the Oracle Home User, Oracle services for a server home are run using the built-in privileged LocalSystem account. Hence for single-instance Oracle Database installations, Oracle recommends that you use Virtual Account or a standard Windows User Account instead of a Windows built-in account as the Oracle Home User for enhanced security. For Oracle Database Client installations, it is not necessary to use a Windows User Account as Oracle Home User for reasons of security. Even when the Windows built-in account is chosen as the Oracle Home User, Oracle services for a client home are run using the built-in low-privileged LocalService account.

See Also:

- *Oracle Grid Infrastructure Installation and Upgrade Guide for Microsoft Windows x64 (64-Bit)*
- *Oracle Real Application Clusters Administration and Deployment Guide*
- *Oracle Grid Infrastructure Installation Guide for Microsoft Windows x64 (64-Bit)*

Using Oracle Home User for Multiple Oracle Homes

Different Oracle homes on a system can use the same Oracle Home User or use different Oracle Home User names. Note that the earlier releases (11.2 and earlier) of Oracle Database are treated equivalent to using the Windows Built-in Account as the Oracle Home User.

As the Oracle Home User has complete control over the Oracle base directory for an Oracle home, multiple Oracle homes are allowed to share the same Oracle base only when they use the same Oracle Home User. This is done for security reasons.

However, as an exception, Oracle supports the sharing of an Oracle base directory between a Windows built-in account (server) and a specific Windows User Account, and Windows built-in account (server) and Virtual Account. This enables easier upgrade of Oracle home from the older releases of Oracle Database to Oracle Database 21c as the same Oracle base can be shared, and all the files under the Oracle base can be accessed by the Oracle Home User.

Note:

- When you share an Oracle base between 11*g* Release 2 (or earlier), 12*c* Release 2, and Oracle Database 21c, Windows User Account (used as Oracle Home User) is granted full control of the Oracle base and its subdirectories. This means that the Windows User Account for Oracle home can access or update any database files for the earlier release.
- After installing Oracle Database 12*c* Release 1 (or later) with a Windows User Account or Virtual Account as the Oracle Home User, do not install older versions of Oracle Database and share the same Oracle base directory. During the installation of older releases, ACLs are reset corresponding to the older releases and Oracle Database 12*c* Release 2 (or later) services may not be able to access the Oracle base directory and files.

On the contrary, if you decide to use a different Oracle base for Oracle Database 21c, there may be some issues in terms of Oracle services accessing the files from the older Oracle base.

Related Topics

- Setting File Permissions
  Oracle Universal Installer, Oracle Database Configuration Assistant, and Oracle Database Upgrade Assistant set file permissions when you install or upgrade Oracle Database software.

> **See Also:**
>
> - *Oracle Database Installation Guide for Microsoft Windows*

Using Oracle Home User During Oracle Database Upgrade

You can use Oracle Database Upgrade Assistant to upgrade or move databases across Oracle homes if both the Oracle homes use the same Windows User Account as Oracle Home User, or at least one of the Oracle homes is configured to use Windows built-in account as the Oracle Home User.

You can also use Oracle Database Upgrade Assistant to upgrade or move databases across Oracle homes if both the Oracle homes use Virtual Account.

Converting from Single-Instance Oracle Database to Oracle Real Application Clusters

You can convert from Oracle Database single-instance databases to Oracle RAC using Oracle Database Configuration Assistant, `rconfig`, or Oracle Enterprise Manager.

For an in-place conversion, you cannot change the Oracle Home User. For an out-of-place conversion, you can change the Oracle Home User only if the Oracle home for the single-instance database is not already configured with a Windows Domain User Account.

> **See Also:**
>
> *Oracle Real Application Clusters Administration and Deployment Guide*

4

Postinstallation Database Creation on Windows

Learn how to create a database after installing Oracle Database, using either Oracle Database Configuration Assistant or command-line tools.

- About Oracle Database Naming Conventions
  All the mounted Oracle Database servers in a network must have unique database names.
- About Using Oracle Database Configuration Assistant on Windows
  Oracle recommends you use Oracle Database Configuration Assistant (Oracle DBCA) to create a Database, because it is easier.
- Overview of Database Creation Tasks on Windows Using Command-Line Tools
  Learn how to create a new database manually. As part of its database software files, Oracle Database provides a sample initialization parameter file, which can you can edit to suit your needs.
- About Administering an Oracle Database Instance Using ORADIM
  ORADIM is a command-line tool that is available with Oracle Database.
- About Administering an Oracle Database Instance Using Microsoft Management Console Snapin
  You can perform the administrative activities on an Oracle Database from Microsoft Management Console Snap-In.

About Oracle Database Naming Conventions

All the mounted Oracle Database servers in a network must have unique database names.

When a database is created, a name is associated with it and stored in its control files. If you provide the database keyword, either in the `CREATE DATABASE` statement or when prompted by Database Configuration Assistant, then that value becomes the name for that database.

If you attempt to mount two Oracle Database servers with the same database name, then you receive the following error during mounting of the second server:

```
ORA-01102: cannot mount database in EXCLUSIVE mode
```

If there are two or more Oracle Database servers on the same computer, but located in different Oracle homes, then the following rules apply:

- Each database name must be unique
- Each SID must be unique

To change the name of an existing database, you must use the `CREATE CONTROLFILE` statement to re-create your control files and specify a new database name.

About Using Oracle Database Configuration Assistant on Windows

Oracle recommends you use Oracle Database Configuration Assistant (Oracle DBCA) to create a Database, because it is easier.

It offers the same interface and operates the same way on all the supported platforms, so no step-by-step procedures or screenshots are included here.

Oracle DBCA prompts for a password when the Oracle Home User is a Windows Local User Account or when a Windows Domain User Account and the password for Oracle Home User is not stored in Oracle wallet. The main purpose of Oracle Home User is to run Windows services with Windows User Account. However, this user account (Oracle Home User) has a very limited set of operating system-level privileges and must not be used for database administration. Oracle DBCA now provides an interface to create an Oracle Database service under an Oracle Home User, as specified during the process of installation. But Oracle DBCA does not provide an interface to create a new Windows user as the Oracle Home User.

The services created are not allowed to interact with the Windows desktop. ORADIM, the Windows utility tool used to create the `OracleService`*`SID`* - Oracle Database services, is used by Oracle Database Configuration Assistant to create those services on local and remote nodes. Oracle Database Configuration Assistant now accepts a user name and a password to run the service, and also changes the ownership of the files it creates (for example, the password file) so that it can be modified by the Oracle home user.

Oracle DBCA enables you to:

- Create a database
- Configure database options in a database
- Delete a database
- Manage templates

An initialization parameter file is an ASCII text file containing parameters. Use this file to create and modify a database using command-line tools. When you create a database using Oracle DBCA, a server parameter file (SPFILE) is created from the initialization parameter file, and the initialization parameter file is renamed. Oracle does not recognize the renamed file as an initialization parameter file, and it is not used after the instance is started.

If you want to modify an instance created with Oracle DBCA after it starts, you must use `ALTER SYSTEM` statements. You cannot change the server parameter file itself, because it is a binary file that cannot be browsed or edited using a text editor. The location of the newly-created server parameter file is *`ORACLE_HOME`*`\database`. The server parameter file name is `spfile`*`SID`*`.ora`.

See Also:

- *Oracle Database Administrator's Guide*
- *Oracle Database 2 Day DBA* for instructions on using Oracle DBCA

Overview of Database Creation Tasks on Windows Using Command-Line Tools

Learn how to create a new database manually. As part of its database software files, Oracle Database provides a sample initialization parameter file, which can you can edit to suit your needs.

You can choose to create database creation scripts using Oracle Database Configuration Assistant.

The following are the types of Database creation tasks:

- Copy an existing database and delete the old database.
- Copy an existing database and keep the old database.
- Create a new database when no database exists on your system.

Manual Database Creation Tasks

Use Manual Database Creation Tasks to understand the manual tasks involved in creating a new database for each of these database creation categories. Each step is explained in detail in the following subsections.

Table 4-1 Manual Database Creation Tasks

Task	Copy existing database and delete old database	Copy existing database and keep old database	Create new database when no database exists on system
About Exporting an Existing Database	Yes	Note 1	Not applicable
Deleting Database Files	Yes	No	Not applicable
Modifying the Initialization Parameter File	Yes	Yes	Yes
Starting an Oracle Database Instance	Yes	Yes	Yes
About Creating and Starting an Oracle Database Service	No	Yes	Yes
Adding the CREATE DATABASE Statement in a Script	Yes	Yes	Yes
Running the CREATE DATABASE Script	Yes	Yes	Yes
About Importing a Database	Yes	Note 2	Not applicable
Updating ORACLE_SID in the Registry	No	Only if you change the default *SID*	Yes

Table 4-1 (Cont.) Manual Database Creation Tasks

Task	Copy existing database and delete old database	Copy existing database and keep old database	Create new database when no database exists on system
Backing Up the New Database	Yes	Yes	Yes

> **Note:**
>
> If you copy data from an existing database to the new database, select Yes; otherwise, No. Also, if you import tables and other objects from the existing database, select Yes; otherwise, No.

An example in the following sections demonstrates how to create a database. In this example, the existing database is the starter database with a *SID* of `orcl` located in directory `C:\`*app*`\`*username*`\oradata\orcl`. Copy `orcl` to a new database with a database name and `SID` of `prod` located in the directory `C:\`*app*`\`*username*`\oradata\prod`. Then, delete the starter database `orcl`.

- About Exporting an Existing Database
  You are required to export an existing database only if you intend to copy its contents to a new database.
- Deleting Database Files
  Deleting database files is required only when you copy an existing database to a new database to replace the old database.
- Modifying the Initialization Parameter File
  Describes how to modify the initialization parameter file.
- About Creating and Starting an Oracle Database Service
  Learn how to create and start an Oracle Database service.
- Starting an Oracle Database Instance
  Learn how to start an instance without mounting a database.
- Adding the CREATE DATABASE Statement in a Script
  The `CREATE DATABASE` statement is a SQL statement that creates the database.
- Running the CREATE DATABASE Script
  Use this procedure to run the CREATE DATABASE script.
- About Importing a Database
  Learn how to use Data Pump Import or Import.
- Updating ORACLE_SID in the Registry
  If this is the first database on your computer or if you intend to make the new database the default database, then you must make a change in the registry.
- Creating the ORACLE_SID Parameter
  If you do not yet have the parameter `ORACLE_SID`, because this is the first database on your system, then you must create it.
- Backing Up the New Database
  Use this procedure to prevent data loss.

About Exporting an Existing Database

You are required to export an existing database only if you intend to copy its contents to a new database.

If you are working with data from an earlier Oracle release, then you can use Export for this task. If you are using Oracle Database 10*g* Release 1 (10.1) or later data, then Oracle recommends that you use Data Pump Export because it supports new Oracle Database 10*g* Release 1 (10.1) or later features, such as floating points.

Although you can start Data Pump Export or Export in either the parameter mode or an interactive mode, Oracle recommends parameter mode. Interactive mode provides less functionality than the parameter mode and exists for backward compatibility only.

The syntax for Data Pump Export parameter mode is:

```
C:\> expdp SYSTEM DUMPFILE=myexp.dmp FULL=y LOGFILE=myexp.log
Password: password
```

The syntax for Data Pump Export interactive mode is:

```
C:\> expdp SYSTEM
Password: password
```

Enter only the command `expdp SYSTEM` to begin an interactive session and let Data Pump Export prompt you for information it needs.

> **Note:**
>
> If you use the parameter mode, then Data Pump Export considers the file names and the directory names to be invalid if they contain one or more blank spaces. The workaround is to enclose the full path in the `DUMPFILE=` parameter in triple quotation marks. For example:
>
> ```
> DUMPFILE="""C:\program files\export.dmp"""
> ```
>
> If Data Pump Export is used in an interactive mode, then the file name or the directory name can contain a space without quotation marks.

The syntax for Export parameter mode is:

```
C:\> exp SYSTEM FILE=myexp.dmp FULL=y LOG=myexp.log
Password: password
```

The syntax for the Export interactive mode is:

```
C:\> exp SYSTEM
Password: password
```

Enter only the command `exp SYSTEM` to begin an interactive session and let Export prompt you for information it needs.

> **Note:**
>
> If you use the parameter mode, then Export considers the file names and the directory names to be invalid if they contain one or more blank spaces. The workaround is to enclose the full path in the `FILE=` parameter in triple quotation marks. For example:
>
> ```
> FILE="""C:\program files\export.dmp"""
> ```
>
> If Export is used in an interactive mode, then the file name or the directory name can contain a space without quotation marks.

- Exporting All Data from an Existing Database
  Describes how to export all data from an existing database to a new database.

> **See Also:**
>
> *Oracle Database Utilities* for more information about using Data Pump Export or Export

Exporting All Data from an Existing Database

Describes how to export all data from an existing database to a new database.

To export:

1. Set `ORACLE_SID` to the database service of the database whose contents you intend to export. For example, if the database you intend to export is the starter database `orcl`, then enter the following at the command prompt. Note that there are no spaces around the equal sign (=) character.

   ```
   C:\> set ORACLE_SID=orcl
   ```

2. If the existing database is Oracle Database 10*g* Release 1 (10.1) or later, then start Data Pump Export from the command prompt:

   ```
   C:\> expdp SYSTEM DUMPFILE=myexp.dmp FULL=y LOG=myexp.log
   Password: password
   ```

   You now have a full database export of the starter database `orcl` in the file `myexp.dmp`. All messages from Data Pump Export are logged in file `myexp.log`.

3. If the existing database is earlier than Oracle Database 10*g* Release 1 (10.1), then start Export from the command prompt:

   ```
   C:\> exp SYSTEM FILE=myexp.dmp FULL=y LOG=myexp.log
   Password: password
   ```

   You now have a full database export of the starter database `orcl` in the file `myexp.dmp`. All messages from Export are logged in the file `myexp.log`.

Deleting Database Files

Deleting database files is required only when you copy an existing database to a new database to replace the old database.

In the following example, you delete the database files of the starter database `orcl`.

To delete database files:

1. Shut down starter database `orcl` at the command prompt:

   ```
   C:\> oradim -SHUTDOWN -SID orcl -SHUTTYPE inst -SHUTMODE immediate
   ```

2. Delete the following files from the directory `C:\app\`*username*`\oradata\orcl`:

   ```
   control01.ctl
   control02.ctl
   control03.ctl
   index01.dbf
   drsys01.dbf
   cwmlite01.dbf
   example01.dbf
   system01.dbf
   temp01.dbf
   tools01.dbf
   undotbs01.dbf
   user01.dbf
   xdb01.dbf
   redo01.log
   redo02.log
   redo03.log
   ```

Modifying the Initialization Parameter File

Describes how to modify the initialization parameter file.

To use the starter database `orcl` as the basis for your new database:

1. Copy *`ORACLE_BASE`*`\admin\orcl\pfile\init.ora`.
2. Place the copy in *`ORACLE_BASE`*`\admin\prod\pfile\init.ora`.
3. Modify the file by performing the following tasks:

> **Note:**
>
> Starting with Oracle9*i* Release 2 (9.2), nesting of quotation marks using the backslash (\) escape character is no longer supported. This affects how Oracle Database interprets the parameter values in your initialization parameter file. For example, if you specified `CONTROL_FILES = "ctlfile\'1.ora"` in releases before release 9.2, the file name was interpreted as `ctlfile'1.ora`. Starting with release 9.2, the file name will be interpreted as `ctlfile\'1.ora`.
>
> Oracle highly recommends modifying your parameter files to remove such references and other methods of nesting quotation marks in the initialization parameter values.

a. If you do not have an existing database on your system, then you cannot copy an existing initialization parameter file to use as the basis for your new initialization parameter file. However, you can use the sample initialization parameter file `initsmpl.ora` provided in:

   ORACLE_HOME`\admin\sample\pfile`

   This is the basis for the initialization parameter file for the database `prod`.

b. If you use the `initsmpl.ora` file as the basis for the initialization parameter file, then the following parameters must be set to the indicated values, otherwise you cannot start database `prod`:

   ```
   DB_NAME=prod.domain
   ```

   The parameter `DB_NAME` indicates the database name and must match the name used in the `CREATE DATABASE` statement. Give a unique database name to each database. You can use eight characters for a database name. The name is not required to match the *SID* of the database service.

   ```
   INSTANCE_NAME=prod.domain
   ```

   ```
   SERVICE_NAMES=prod.domain
   ```

   ```
   CONTROL_FILES = ( "C:\app\username\oradata\prod\control01.ctl",
   "C:\app\username\oradata\prod\control02.ctl",
   "C:\app\username\oradata\prod\control03.ctl")
   ```

   The parameter `CONTROL_FILES` lists the database control files. You do not have to control files on your file system at this point, because control files are created when you run the `CREATE DATABASE` statement. Ensure that you specify the complete path and the file name, including the drive letter.

   ```
   DB_FILES=100
   ```

   Modifying the initialization parameter `DB_FILES` is not required, but it is recommended to optimize performance. Set this parameter to the same number as the value of the `MAXDATAFILES` option of the `CREATE DATABASE` statement. The value of `100` is used for this example.

   The `DIAGNOSTIC_DEST` initialization parameter sets the location of the Automatic Diagnostic Repository (ADR), which is a directory structure stored outside of the database. The ADR is used in problem diagnostics.

Use `DIAGNOSTIC_DEST = ORACLE_HOME\log` if the environment variable `ORACLE_BASE` is not set.

Use `DIAGNOSTIC_DEST = ORACLE_BASE` variable if the environment variable `ORACLE_BASE` is set.

> **See Also:**
>
> - *Oracle Database Installation Guide for Microsoft Windows* for information about ADR
> - *Oracle Database Reference* for information about other initialization parameters that you can add or modify

Related Topics

- Adding the CREATE DATABASE Statement in a Script
  The `CREATE DATABASE` statement is a SQL statement that creates the database.

About Creating and Starting an Oracle Database Service

Learn how to create and start an Oracle Database service.

Perform either of the following steps:

- Copy an existing database to a new database and keep the old database
- Create a new database when you have no other database to copy

Before you create the database, first create a Windows service to run the database. This service is the Oracle Database process, `oracle.exe`, installed in the form of a Windows service.

Use ORADIM to create the service.

- Creating and Starting an Oracle Database Service
  Learn how to create and start an Oracle Database service.
- Access to Oracle Wallets in a File System for Oracle Database Services
  Discusses about accessing Oracle Wallets.

Related Topics

- About Administering an Oracle Database Instance Using ORADIM
  ORADIM is a command-line tool that is available with Oracle Database.

Creating and Starting an Oracle Database Service

Learn how to create and start an Oracle Database service.

To create and start an Oracle Database service:

1. Run ORADIM from the command prompt:

```
C:\> oradim -NEW -SID prod -STARTMODE manual
-PFILE "C:\app\username\admin\prod\pfile\init.ora"
```

Note that the previously created initialization parameter file is specified, with complete path, including drive name. You can check if the service is started in the Services window of the Control Panel. ORADIM automatically creates Oracle Database services under the Oracle Home User account. If the Oracle Home User account is a Windows Local User Account or a Windows Domain User Account, then ORADIM prompts for its password.

2. Set the value of `ORACLE_SID` to `prod`. Note that there are no spaces around the equal sign (=) character:

```
C:\> set ORACLE_SID=prod
```

Access to Oracle Wallets in a File System for Oracle Database Services

Discusses about accessing Oracle Wallets.

When an Oracle wallet is created in the file system, only the user creating the wallet is granted access to that wallet by wallet creation tools. Therefore, Oracle Database services (running as the Windows User Account) might not be able to access the wallet unless you explicitly grant access to the wallet using Windows tools.

Related Topics

- About Setting File System ACLs Manually
  As Oracle Database services now run under a standard Windows User Account, a file might not be accessible by Oracle Database services unless the file system Access Control Lists (ACLs) grant access to the file.

Starting an Oracle Database Instance

Learn how to start an instance without mounting a database.

Start an instance without mounting a database.

```
SQL> STARTUP NOMOUNT
```

You must not specify the `PFILE` clause in this example, because the initialization parameter file is stored in the default location. At this point, there is no database. Only the System Global Area (SGA) is created and the background processes are started in preparation for the creation of a new database.

Adding the CREATE DATABASE Statement in a Script

The `CREATE DATABASE` statement is a SQL statement that creates the database.

A script containing this statement can be used anytime you create a database.

The `CREATE DATABASE` statement has the following parameters:

- `MAXDATAFILES` - default value: 32, maximum value: 65534
- `MAXLOGFILES` - default value: 32, maximum value: 255

The `CHARACTER SET` parameter determines the database character set of the new database. The default value is US7ASCII, however the recommended value is AL32UTF8. AL32UTF8 is the Oracle implementation of the Unicode Standard character set in UTF-8 encoding form. Unicode is suitable for storing text in practically any written language of the world.

When you run the `CREATE DATABASE` statement, Oracle Database performs several operations depending upon the clauses that you specified in the `CREATE DATABASE` statement or the initialization parameters that you have set.

> **Note:**
>
> Oracle Managed Files is a feature that works with the `CREATE DATABASE` statement to simplify administration of Oracle Database. Oracle Managed Files eliminates the requirement to directly manage operating system files comprising an Oracle Database server, because you specify operations in terms of database objects rather than file names.

To create the database `prod`, copy and save the following statement in a file named *`script_name`*`.sql`:

```
CREATE DATABASE prod
USER SYS IDENTIFIED BY sys_password
USER SYSTEM IDENTIFIED BY system_password
MAXLOGFILES 5
MAXDATAFILES 100
DATAFILE 'C:\app\username\oradata\prod\system01.dbf' SIZE 325M REUSE
AUTOEXTEND ON NEXT 10240K MAXSIZE UNLIMITED
UNDO TABLESPACE "UNDOTBS" DATAFILE 'app\username\oradata\prod\undotbs01.dbf'
SIZE 200M REUSE AUTOEXTEND ON NEXT 5120K MAXSIZE UNLIMITED
CHARACTER SET AL32UTF8
logfile 'C:\app\username\oradata\prod\redo01.log' size 100M reuse,
        'C:\app\username\oradata\prod\redo02.log' size 100M reuse,
        'C:\app\username\oradata\prod\redo03.log' size 100M reuse
Oracle Database Installation Guide for Microsoft WindowsEXTENT MANAGEMENT LOCAL;
```

> **See Also:**
>
> - *Oracle Database Administrator's Guide* for more information about using Oracle Managed Files
> - *Oracle Database Installation Guide for Microsoft Windows* for more information about recommended database character sets

Running the CREATE DATABASE Script

Use this procedure to run the CREATE DATABASE script.

To use the SQL script to create a database:

1. Verify that the service is started in the Control Panel. In this example, the service name is `OracleServicePROD`, and its status column must display `Started`. If not, then select the service name and select **Start**.

   You can also check the status of the service by entering the following at the command prompt:

   ```
   C:\> net START
   ```

A list of all the Windows services currently running on the system appears. If `OracleServicePROD` is missing from the list, then enter:

```
C:\> net START OracleServicePROD
```

2. Make `PROD` the current *`SID`*:

   ```
   C:\> set ORACLE_SID=PROD
   ```

3. Add *`ORACLE_HOME`*`\bin` to your `PATH` environment variable:

   ```
   set PATH=ORACLE_BASE\ORACLE_HOME\bin;%PATH%
   ```

4. Start SQL*Plus from the command prompt, and connect to the database as SYSDBA:

   ```
   C:\> sqlplus /NOLOG
   SQL> CONNECT / AS SYSDBA
   ```

   The message `connected` appears.

5. Turn on spooling to save messages:

   ```
   SQL> SPOOL script_name.log
   ```

6. Run the script *`script_name`*`.sql` that you created in *Adding the CREATE DATABASE Statement in a Script*.

   ```
   SQL> C:\app\username\product\21.0.0\dbhome_1\rdbms\admin\script_name.sql;
   ```

   If the database is successfully created, then the instance is started and the following message appears numerous times: `Statement processed`

Related Topics

- Adding the CREATE DATABASE Statement in a Script
  The `CREATE DATABASE` statement is a SQL statement that creates the database.

About Importing a Database

Learn how to use Data Pump Import or Import.

You can use Data Pump Import (for Oracle Database 10*g* Release 1 (10.1) or later data) or Import (for earlier data) to import the full export created into the new database. Although you can start Data Pump Import or Import using either the parameter mode or the interactive mode, Oracle recommends the parameter mode because it provides more functionality. Interactive mode exists solely for backward compatibility.

The syntax for Data Pump Import parameter mode is:

```
C:\> impdp SYSTEM DUMPFILE=myexp.dmp FULL=y LOG=myexp.log
Password: password
```

The syntax for Data Pump Import interactive mode is:

```
C:\> impdp SYSTEM
Password: password
```

Enter only `impdp SYSTEM` to begin an interactive session and let Data Pump Import prompt you for information it needs.

Note:

- If you use the parameter mode, then Data Pump Import considers the file names and the directory names to be invalid if they contain one or more blank spaces. The workaround is to enclose the full path in the `DUMPFILE=` parameter in triple quotation marks. For example:

  ```
  DUMPFILE="""C:\program files\export.dmp"""
  ```

  If you use Data Pump Import in an interactive mode, then the file name or the directory name can contain a space without the quotation marks.
- If the original database from which the export file was generated contains a tablespace that is not in the new database, then Import tries to create that tablespace with associated data files.

  The easy solution is to ensure that both the databases contain the same tablespaces. Data files are not required to be identical. Only the tablespace names are important.

Related Topics

- About Exporting an Existing Database
  You are required to export an existing database only if you intend to copy its contents to a new database.

See Also:

Oracle Database Utilities for more information about using Data Pump Import or Import

Updating ORACLE_SID in the Registry

If this is the first database on your computer or if you intend to make the new database the default database, then you must make a change in the registry.

Perform the following steps:

1. Start Registry Editor at the command prompt:

   ```
   C:\> regedit
   ```

   The Registry Editor window appears.
2. Select the subkey `\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\HOME0` for the first Oracle home on your computer. For subsequent installations to different Oracle homes on the same computer, the path is `\HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\HOME`*`ID`* where ID is the unique number identifying the Oracle home.
3. Locate the parameter `ORACLE_SID` on the right side of the Registry Editor window.
4. Double-click the parameter name and change the data to the new *`SID`*, which is `prod` in this example.

Related Topics

- Configuration Parameters and the Registry

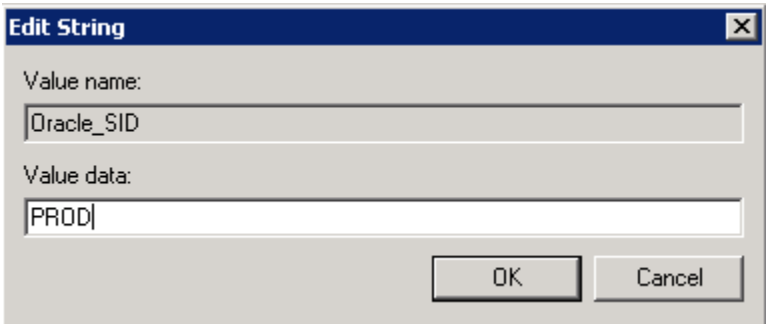
Creating the ORACLE_SID Parameter

If you do not yet have the parameter `ORACLE_SID`, because this is the first database on your system, then you must create it.

To create the parameter `ORACLE_SID`:

1. Select **New** from the **Edit** menu.
2. Select **Expandable String Value** from the menu list.
3. A **New Value #1** expandable string value name is created on the right pane of the Registry Editor window of data type `REG_EXPAND_SZ`.
4. Right-click the parameter, select **Rename** to rename it to `ORACLE_SID` and press **Enter**.
5. Double-click the `ORACLE_SID` entry to change the value data to the new *`SID`*.

   An Edit String dialog box appears:



6. Enter **PROD** in the **Value data** field.
7. Click **OK**.

   Registry Editor adds parameter `ORACLE_SID`.
8. Select **Exit** from the **File** menu.

   Registry Editor exits.

Backing Up the New Database

Use this procedure to prevent data loss.

> **Note:**
>
> If anything goes wrong while operating the new database without a backup, then you must repeat the database creation procedure. Back up your database now to prevent loss of data.

To back up the new database:

1. Shut down the database instance and stop the service:

```
C:\> oradim -SHUTDOWN -SID prod -SHUTTYPE srvc,inst -SHUTMODE immediate
```

> **Note:**
>
> Although `ORADIM` returns the prompt immediately, you must wait for the database and the service to stop completely before continuing to Step 2. Wait until the Control Panel indicates service `OracleServicePROD` has stopped. If you do not do this, then the backup is useless because it was taken while data was being written to data files.

2. Back up database files using the tool of your choice.

   Database files consist of the initialization parameter file, control files, online redo log files, and data files.

   When the backup is complete, you can start the database again, create users and objects, if necessary, make any other changes, and use the database.

   Back up the database after making any significant changes, such as switching into the archiving mode or adding a tablespace or a data file.

> **See Also:**
>
> - *Oracle Database Concepts*
> - *Oracle Database Backup and Recovery User's Guide*
> - *Oracle Database 2 Day DBA*

> **Note:**
>
> Do not store database files on a compressed drive. This can result in write errors and a decreased performance.

About Administering an Oracle Database Instance Using ORADIM

ORADIM is a command-line tool that is available with Oracle Database.

Use ORADIM only if you are manually creating, deleting, or modifying databases. Oracle Database Configuration Assistant is an easier tool to use for this purpose.

ORADIM creates Oracle Database service, Oracle VSS Writer service, and Oracle Scheduler service to run under the Oracle Home User account. If this account is a Windows Local User Account or a Windows Domain User Account, then ORADIM prompts for a password for that account and accepts the same through `stdin`.

Specify both the Oracle Home User and its password using the `-RUNAS osusr[/ospass]` option to `oradim`. If the given `osusr` is different from the Oracle Home User, then use the Oracle Home User instead of `osusr` along with the given `ospass`.

The following sections describe ORADIM commands and parameters. Note that each command is preceded by a dash (`-`). To get a list of the ORADIM parameters, enter:

```
oradim -? | -h | -help
```

> **Note:**
>
> Specifying `oradim` without any options also returns a list of ORADIM parameters and descriptions.

When you use ORADIM, a log file called `oradim.log` opens in *`ORACLE_HOME`*`\database`, or in the directory specified by registry parameter `ORA_CWD`. All operations, whether successful or failed, are logged in this file. You must check this file to verify success of an operation.

If you have installed an Oracle Database service on Windows, then when logging in as the SYSTEM user (LocalSystem), with the startup mode set to Automatic, it is possible that the Oracle Database service starts but the database does not start automatically. The following error message is written to the file `ORADIM.LOG` in the directory *`ORACLE_HOME`*`\database`:

```
ORA-12640: Authentication adapter initialization failed
```

Oracle Enterprise Management Agent, Oracle Enterprise Manager Management Server, and Oracle Internet Directory fails, because they cannot connect to the database for the same reason.

To work around this issue, perform the following tasks:

1. Modify `SQLNET.ORA`

   You can modify `SQLNET.ORA`, by doing either of the following:

   - Remove the line `sqlnet.authentication_services=(NTS)`
   - Change the line `sqlnet.authentication_services=(NONE)`

2. Start the database after the service starts.

   You can start the database manually after the Oracle Database service has started, using SQL*Plus and connecting as `SYSDBA`.

3. Start the service as a specific user.

> **See Also:**
>
> Your operating system documentation for instructions on starting the services

- Creating an Instance Using ORADIM
  Learn how to create an Oracle Database instance using ORADIM.

- Starting an Instance and Services Using ORADIM
  Learn how to start an instance and services using ORADIM.
- Stopping an Instance and Services Using ORADIM
  Learn how to stop an instance and services using ORADIM.
- Editing an Instance Using ORADIM
  Learn how to edit an instance to change such values as instance name, startup mode, shutdown mode, and shutdown type using ORADIM.
- Deleting an Instance Using ORADIM
  Learn how to delete an instance using ORADIM.
- Manipulating ACLs Using ORADIM
  Learn how to manipulate ACLs using ORADIM.
- Manipulating Family Settings to Initialization Parameters using ORADIM
  Learn how to manipulate family settings to initializing parameters.

Creating an Instance Using ORADIM

Learn how to create an Oracle Database instance using ORADIM.

To use ORADIM to create an instance, enter:

```
oradim [-NEW -SID SID] | -SRVC service_name | -ASMSID SID | -ASMSRVC service_name
[-SYSPWD password][-MAXUSERS number][-STARTMODE auto | manual] [-SRVCSTART system |
demand]
[-PFILE filename | -SPFILE] [-SHUTMODE normal | immediate | abort] [-TIMEOUT
secs] [-RUNAS osusr[/ospass]]
```

For this command, note the following:

- `-NEW` indicates that you are creating a new instance. This is a mandatory parameter.
- `-SID` *`SID`* is the name of the instance to create.
- `-SRVC` *`service_name`* is the name of the service to create (`OracleService`*`SID`*).
- `-ASMSID` *`SID`* is the name of the Oracle Automatic Storage Management instance to create.
- `-ASMSRVC` *`service_name`* is the name of the Oracle Automatic Storage Management service to create.
- `-SYSPWD` *`password`* is the system password.
- `-MAXUSERS` *`number`* is the number of users defined in the password file. The default is `5`.
- `-STARTMODE auto` | `manual` indicates whether to start the instance when the Oracle Database service is started. The default is `manual`.
- `-SRVCSTART system | demand` indicates whether to start the Oracle Database service upon computer restart. Default is `demand`. Here, `system` specifies that the service be configured to automatically start when the system boots or reboots. `Demand` specifies that the user has to explicitly start the service.
- `-PFILE` *`filename`* is the initialization parameter file to be used with this instance. Ensure that you specify the complete path name of this file, including the drive letter.
- `-SPFILE` indicates that a server parameter file (SPFILE) be used during startup instead of a PFILE.

- `-SHUTMODE` specifies how to stop an instance. It requires an argument and the default is `immediate`. If `SHUTMODE` is omitted, then there is no attempt made to shutdown the instance when the service is shut down.
- `-TIMEOUT` *`secs`* sets the maximum time to wait (in seconds) before the service for a particular *`SID`* stops. The default is 90 seconds. It cannot be used without the `SHUTDOWN` argument.
- `-RUNAS osusr[/ospass]` ("run as") makes it possible to specify both the Oracle Home User and its password. If the given `osusr` is different from the Oracle Home User, then the Oracle Home User is used instead of the `osusr` along with the given `ospass`.

  Though the `ospass` can be specified on the command line, Oracle recommends accepting `ospass` through `stdin`.

  ORADIM creates Oracle Database service, Oracle VSS Writer service, and Oracle Scheduler service to run under the Oracle Home User account. If this account is a Windows Local User Account or Windows Domain User Account, then ORADIM prompts for the password for that account and accepts the same through `stdin`.

> **Note:**
>
> For simplicity in demonstrating this feature, this example does not perform the password management techniques that a deployed system typically uses. In a production environment, follow the Oracle Database password management guidelines, and disable any sample accounts.

To create an instance called `PROD`, for example, enter:

```
C:\> oradim -NEW -SID prod -STARTMODE auto -PFILE
C:\app\username\admin\prod\pfile\init.ora
```

> **See Also:**
>
> *Oracle Database Security Guide* for password management guidelines and other security recommendations.

Starting an Instance and Services Using ORADIM

Learn how to start an instance and services using ORADIM.

To use ORADIM to start an instance and services, enter:

```
oradim -STARTUP -SID SID | -ASMSID SID [-SYSPWD password] [-STARTTYPE srvc |
inst | srvc,inst] [-PFILE filename | -SPFILE]
```

For this command, note the following:

- `-STARTUP` indicates that you are starting an instance that already exists. This is a mandatory parameter.

- `-SID SID` is the name of the instance to start.
- `-ASMSID SID` is the name of the Oracle Automatic Storage Management instance to start.
- `-STARTTYPE srvc, inst` indicates whether to start the service or the instance. One or both values can be specified. If it is not specified, then the registry is checked for the current setting.

  `-STARTTYPE srvc` is the equivalent of running `net start oracleservicesid` from the command line.

  `-STARTTYPE inst` is the equivalent of running `startup` within SQL*Plus.
- `-PFILE filename` is the initialization parameter file to be used with this instance. Ensure that you specify the complete path name of this file, including drive letter.
- `-SPFILE` indicates that a server parameter file (SPFILE) be used during startup instead of a PFILE.

To start an instance called `puma`, for example, enter:

```
C:\> oradim -STARTUP -SID puma -STARTTYPE inst -PFILE
C:\app\username\admin\prod\pfile\init.ora
```

Stopping an Instance and Services Using ORADIM

Learn how to stop an instance and services using ORADIM.

To use ORADIM to stop an instance, enter:

```
oradim -SHUTDOWN -SID SID | -ASMSID SID [-SYSPWD password]
[-SHUTTYPE srvc | inst | srvc,inst] [-SHUTMODE normal | immediate | abort]
```

For this command, note the following:

- `-SHUTDOWN` indicates that you are stopping an instance. This is a mandatory parameter.
- `-SID SID` specifies the name of the instance to stop.
- `-ASMSID SID` is the name of the Oracle Automatic Storage Management instance to stop.
- `-SHUTTYPE srvc, inst` indicates whether to stop the service or the instance. One or both values can be specified. If it is not specified, then the registry is checked for the current setting.
- `-SHUTMODE` specifies how to stop an instance. This is an optional parameter. If you do not specify how to stop an instance, then `immediate` is the default mode.

To stop an instance called `puma`, for example, enter:

```
C:\> oradim -SHUTDOWN -SID puma -SHUTTYPE srvc,inst
```

Editing an Instance Using ORADIM

Learn how to edit an instance to change such values as instance name, startup mode, shutdown mode, and shutdown type using ORADIM.

To use ORADIM to modify an instance, enter:

```
oradim -EDIT -SID SID | -ASMSID SID [-SYSPWD password] [-STARTMODE auto |
manual] [-SRVCSTART system | demand] [-PFILE filename | -SPFILE][SHUTMODE normal
| immediate | abort] [SHUTTYPE srvc | inst | srvc,inst]
```

For this command, note the following:

- `-EDIT` indicates that you are modifying an instance. This is a mandatory parameter.
- `-SID` *`SID`* specifies the name of the instance to modify. This is a mandatory parameter.
- `-ASMSID` *`SID`* is the name of the Oracle Automatic Storage Management instance to modify.
- `-STARTMODE` indicates whether to start the instance when the Oracle Database service is started. The default is `manual`.
- `-SRVCSTART system | demand` indicates whether to start the Oracle Database service on computer restart. The default is `demand`.
- `-PFILE` *`filename`* specifies the initialization parameter file to be used with this instance. Ensure that you specify the complete path name of this file, including the drive letter.
- `-SPFILE` indicates that a server parameter file (SPFILE) be used during startup instead of a PFILE.
- `-SHUTMODE` specifies how to stop an instance. This is an optional parameter. If you do not specify how to stop an instance, then `immediate` is the default mode.
- `-SHUTTYPE` indicates whether to stop the service or the instance. One or both values can be specified. If it is not specified, then the registry is checked for the current setting.

To specify a new initialization parameter file for the instance `prod`, for example, enter:

```
C:\> oradim -EDIT -SID prod -PFILE
C:\app\username\product\21.0.0\admin\lynx\pfile\init.ora
```

Deleting an Instance Using ORADIM

Learn how to delete an instance using ORADIM.

To use ORADIM to delete an instance, enter:

```
oradim -DELETE -SID SID | -ASMSID SID | -SRVC service_name | -ASMSRVC
service_name
```

For this command, note the following:

- `-DELETE` indicates that you are deleting an instance or service. This is a mandatory parameter.
- `-SID` *`SID`* specifies the name of the *`SID`* to delete.
- `-SRVC` *`service_name`* specifies the name of the service to delete (`OracleService`*`SID`*). The user must specify either *`SID`* or *`SRVC`*.
- `-ASMSID` *`SID`* is the name of the Oracle Automatic Storage Management instance to delete.
- `-ASMSRVC` *`service_name`* is the name of the Oracle Automatic Storage Management service to delete.

To delete an instance called `prod`, for example, enter:

```
C:\> oradim -DELETE -SID prod
```

Manipulating ACLs Using ORADIM

Learn how to manipulate ACLs using ORADIM.

To use ORADIM to manipulate ACL, enter:

```
oradim    -ACL -setperm|-addperm|-removeperm  dbfiles|diag|registry  -USER username  -
OBJTYPE file|dir|registry  -OBJPATH object-path  -RECURSE true|false [-HOST hostname]
```

For this command, note the following:

- `-ACL` indicates that you are manipulating ACL on an object. This is a mandatory parameter.
- `-setperm | -addperm | -removeperm dbfiles | diag | registry-` indicates that you are setting, adding, or removing ACLs on the specified object. `dbfiles` is for database files, `diag` is for database, `oracle-base & logs` and `registry` is for registry key. Set one of these based on the object on which the ACL is set. This is a mandatory parameter.
- `-USER` *`username`* indicates the user for whom the ACLs are granted. This must not be essentially the service user of the current oracle home. This is a mandatory parameter.
- `-OBJTYPE file|dir|registry` Set the object type to `file/dir/registry` based on the object on which the ACLs are set. This is a mandatory parameter.
- `-RECURSE true / false` indicates whether the ACL is applicable to all objects within the specified object. This is a mandatory parameter.
- `-HOST hostname` This can be used to remotely set ACLs on the specified host. This is limited to the scope of what windows supports remotely. Another way of doing this is to use the windows allowed conventions without using the `-HOST` option. For example , `\ \<hostame>\c$\oracle\rdbms\admin\abc.txt`. This is optional.

To set ACL on a file named abc.txt, for example, enter:

```
c:\> oradim -acl -setperm dbfiles -user winusr -objtype file -objpath c:\a.txt -
recurse true
```

To add ACL on a registry key, for example, enter:

```
c:\>oradim -acl -addperm registry -USER wingen  -OBJTYPE registry -OBJPATH
MACHINE\SOFTWARE\ORACLE\KEY_OraDB12Home1 -RECURSE true
```

Manipulating Family Settings to Initialization Parameters using ORADIM

Learn how to manipulate family settings to initializing parameters.

To use ORADIM to add family support to the initialization parameters, enter:

```
oradim     -FAMILY -set|-delete value [-SID sid | -ASMSID sid |  -MGMTDBSID sid | -
IOSSID sid | -APXSID sid ]
```

For this command, note the following:

- `-FAMILY`: Indicates that you are manipulating family settings. This is a mandatory parameter.
- `-set | -delete value`: Should be used to set/delete value `<HKLM>/Software/Oracle/<Current_ORACLE_HOME>/ORACLE_FAMILY`. Set creates the above registry key and sets its

value with the one specified. If the key exists already, then its value is updated. Delete removes the entry.

- `[-SID sid | -ASMSID sid | -MGMTDBSID sid | -IOSSID sid | -APXSID sid ]`: If one of these is specified, then the registry entry set/delete is `<HKLM>/Software/Oracle/<Current_ORACLE_HOME>/ORACLE_<sid>_FAMILY`. This is optional.

To make `inst1` as part of the family `prod` for example, enter:

```
c:\>oradim -FAMILY -set prod -SID inst1
```

This creates the registry entry `<HKLM>/Software/Oracle/<Current_ORACLE_HOME>/ORACLE_inst1_FAMILY = prod`.

About Administering an Oracle Database Instance Using Microsoft Management Console Snapin

You can perform the administrative activities on an Oracle Database from Microsoft Management Console Snap-In.

The Oracle Instance Manager Snap-In provides centralized management of instances for all Oracle Database Homes.

You can locate the Oracle Instance Manager Snap-In in the path `ORACLE_HOME\MMC Snap-Ins\oradim` or by clicking on the Oracle Instance Manager shortcut in the Oracle Home.

The Snap-In lists the Oracle Database Homes in the scope pane and clicking on them displays the Oracle Database services for the selected Oracle Database Home in the results pane. You can perform all the operations that are done in ORADIM using the Snap-In.

Right-click the Oracle Database Home in the scope pane to Create an Instance, ACL, and Family options. Right-click the service in the result pane to view the Edit, Delete, Startup, and Shutdown options.

A dialog box for the selected item appears where you choose the options and on clicking **OK**, the action is done. You can use the Snap-In only with the administrator privileges.

> **Note:**
>
> Oracle Instance Manager Snap-In for information about Snap-Ins by pressing F1 or clicking Help

5

Postinstallation Configuration Tasks on Windows

Learn about the configuration tasks that you can perform to increase security, and other configuration tasks before using Oracle Multimedia and other Oracle options.

> **Note:**
>
> Directory path examples in this chapter follow Optimal Flexible Architecture (OFA) guidelines. If you specified non-OFA compliant directories during installation, then your directory paths differ. See Appendix B, "Optimal Flexible Architecture" in *Oracle Database Installation Guide for Microsoft Windows* for more information.

- Overview of Windows Firewall
  All newer Windows operating systems, by default enable the Windows Firewall to block virtually all TCP network ports to the incoming connections.
- About the Need to Reset Passwords for Default Accounts
  Oracle Database installs with many default accounts.
- About Windows Authenticated Users
  Authenticated Users group is a Windows built-in group that cannot be modified and includes all the users whose identities were authenticated when they logged on.
- Overview of NTFS File System and Windows Registry Permissions
  Oracle recommends that you configure Oracle Database files, directories, and registry settings to provide full control to authorized database administrators (DBAs).
- Overview of ReFS File System
  The ReFS prevents corruption of the file metadata that occurs in standard NTFS volumes which makes data inaccessible.
- About Configuring External Job Support for the Scheduler on Windows
  This release includes Oracle Scheduler (the Scheduler), which provides enterprise scheduling functionality.
- About Oracle Multimedia on Windows
  Oracle Multimedia (formerly Oracle interMedia) is a feature that enables Oracle Database to store, manage, and retrieve images.
- About Oracle Text on Windows
  Oracle Text enables text queries through SQL and **PI/SQL** from most Oracle interfaces.
- About Oracle Spatial and Graph on Windows
  Oracle Spatial and Graph makes storage, retrieval, and manipulation of spatial data easier and more intuitive to users.
- About Advanced Replication on Windows
  There are many configuration and usage possibilities with Advanced Replication.

Overview of Windows Firewall

All newer Windows operating systems, by default enable the Windows Firewall to block virtually all TCP network ports to the incoming connections.

As a result, any Oracle products that listen for incoming connections on a TCP port do not receive any of those connection requests, and the clients making those connections report errors.

Depending upon which Oracle products are installed and how they are used, the products require some postinstallation configuration of the Windows Firewall to function on these operating systems.

- About Oracle Executables Requiring Windows Firewall Exceptions
  If the Oracle Database executables are in use and accepting connections from a remote client computer, then Oracle recommends that you add them to the Windows Firewall exceptions list to ensure correct operation.
- Configuring the Windows Firewall
  Oracle recommends configuring the Windows Firewall if the following conditions are true.
- Troubleshooting Windows Firewall Exceptions
  Perform the following steps to troubleshoot Windows Firewall exceptions.

About Oracle Executables Requiring Windows Firewall Exceptions

If the Oracle Database executables are in use and accepting connections from a remote client computer, then Oracle recommends that you add them to the Windows Firewall exceptions list to ensure correct operation.

Except as noted, these Oracle executables can be found in the *ORACLE_HOME*\bin directory.

> **Note:**
>
> If multiple Oracle homes are in use, then you need several firewall exceptions for the same executable: one for each home from which that executable loads.

- Configuring Windows Firewall Exceptions for Successful Connections to Oracle Software
  Learn about configuring Windows Firewall exceptions.
- Overview of Different Executables Added to the Windows Firewall Exception List
  Lists the executables that listen on TCP ports on Windows, along with a brief description of the executable.

> **See Also:**
>
> *Oracle Real Application Clusters Installation Guide*

Configuring Windows Firewall Exceptions for Successful Connections to Oracle Software

Learn about configuring Windows Firewall exceptions.

You must configure exceptions for the Windows Firewall if your system meets *all* of the following conditions:

- Oracle server-side components are installed on a Windows server operating system. The list of components includes Oracle Database, Oracle Grid infrastructure, network listeners, or any web servers or services.
- The Windows system in question accepts connections from other machines over the network. If no other machines connect to the Windows system to access the Oracle software, then no postinstallation configuration steps are required and the Oracle software functions as expected.
- The Windows system in question is configured to run the Windows Firewall. If the Windows Firewall is not enabled, then no postinstallation configuration steps are required.

If all the conditions are met, then the Windows Firewall must be configured to allow successful incoming connections to the Oracle software. To enable Oracle software to accept connection requests, Windows Firewall must be configured by either opening up the specific static TCP ports in the firewall or by creating exceptions for specific executables so they can receive the connection requests on any ports they choose. This firewall configuration can be done by one of the following methods:

- From the **Start** menu:
  1. Click **Run** and enter **firewall.cpl**. This opens the **Windows Firewall Control Panel** applet.
  2. Complete one of the following operating system-specific steps to allow a program through the Windows Firewall:
     - On Windows 8, Windows 8.1, Windows Server 2012, or Windows Server 2012 R2 x64, click **Allow an app or feature through Windows Firewall**. Click **Change Settings**.
     - On Windows 7 or Windows Server 2008 R2, click **Allow a program or feature through Windows Firewall**. Click **Change Settings**, Allow **Another Program**.
     - On Windows Server 2008, click **Allow a program through Windows Firewall**.
  3. On the **Exceptions** tab, click **Add Program** to create exceptions for the Oracle software.
- From the command prompt, use the `netsh firewall add...` command.

When Windows notifies you that a foreground application is attempting to listen on a port, and gives you the opportunity to create an exception for that executable, if you choose to create the exception in this way, then the effect is the same as creating an exception for the executable either through Control Panel or from the command line.

Overview of Different Executables Added to the Windows Firewall Exception List

Lists the executables that listen on TCP ports on Windows, along with a brief description of the executable.

Oracle recommends that these executables (if in use and accepting connections from a remote, client computer) be added to the exceptions list for the Windows Firewall to ensure correct operation. In addition, if multiple Oracle homes are in use, then create firewall exceptions for the same executable, for example, `oracle.exe`, multiple times, once for each Oracle home from which that executable loads.

- About Firewall Exceptions for Oracle Database
  For a basic database operation and connectivity from remote clients (SQL*Plus, OCI, ODBC, OLE DB applications, and so on), add the following executables to the Windows Firewall exception list:
- About Firewall Exceptions for Oracle Database Examples
  After installing Oracle Database Examples, add the following executables to the Windows Firewall exception list:
- About Firewall Exceptions for Oracle Gateways
  If your Oracle database interacts with non-Oracle software through a gateway, then you must add the gateway executable to the Windows Firewall exception list.
- About Firewall Exceptions for Oracle Clusterware and Oracle ASM
  If you installed Oracle Grid Infrastructure on the nodes in your cluster, then you can enable the Windows Firewall only after adding the following executables and ports to the Firewall exception list.
- About Firewall Exceptions for Other Oracle Products
  In addition to all the previously listed exceptions, if you use any of the Oracle software listed, then you must create an exception for Windows Firewall for the associated executable.

About Firewall Exceptions for Oracle Database

For a basic database operation and connectivity from remote clients (SQL*Plus, OCI, ODBC, OLE DB applications, and so on), add the following executables to the Windows Firewall exception list:

- *Oracle_home*`\bin\oracle.exe` - Oracle Database executable
- *Oracle_home*`\bin\tnslsnr.exe` - Oracle Listener

For remote monitoring capabilities to be available for a database running on Windows, the following executables must be added to the Windows Firewall exception list:

- *Oracle_home*`\bin\emagent.exe` - Oracle Database Control
- *Oracle_home*`\jdk\bin\java.exe-` Java Virtual Machine

About Firewall Exceptions for Oracle Database Examples

After installing Oracle Database Examples, add the following executables to the Windows Firewall exception list:

- *Oracle_home*`\opmn\bin\opmn.exe` - Oracle Process Manager

- *Oracle_home*\jdk\bin\java.exe - Java Virtual Machine

About Firewall Exceptions for Oracle Gateways

If your Oracle database interacts with non-Oracle software through a gateway, then you must add the gateway executable to the Windows Firewall exception list.

Table 5-1 Oracle Executables Requiring Windows Firewall Exceptions

File Name	Executable Name
omtsreco.exe	Oracle Services for Microsoft Transaction Server
dg4sybs.exe	Oracle Database Gateway for Sybase
dg4tera.exe	Oracle Database Gateway for Teradata
dg4msql.exe	Oracle Database Gateway for SQL Server
dg4db2.exe	Oracle Database Gateway for DRDA
pg4arv.exe	Oracle Database Gateway for APPC
pg4t4ic.exe	Oracle Database Gateway for APPC
dg4mqs.exe	Oracle Database Gateway for WebSphere MQ
dg4mqc.exe	Oracle Database Gateway for WebSphere MQ
dg4odbc.exe	Oracle Database Gateway for ODBC

About Firewall Exceptions for Oracle Clusterware and Oracle ASM

If you installed Oracle Grid Infrastructure on the nodes in your cluster, then you can enable the Windows Firewall only after adding the following executables and ports to the Firewall exception list.

The Firewall Exception list must be updated on each node.

- *Grid_home*\bin\gpnpd.exe - Grid Plug and Play daemon
- *Grid_home*\bin\oracle.exe - Oracle ASM executable (if using Oracle ASM for storage)
- *Grid_home*\bin\racgvip.exe - Virtual Internet Protocol Configuration Assistant
- *Grid_home*\bin\evmd.exe - OracleEVMService
- *Grid_home*\bin\crsd.exe - OracleCRService
- *Grid_home*\bin\ocssd.exe - OracleCSService
- *Grid_home*\bin\octssd.exe - Cluster Time Synchronization Service daemon
- *Grid_home*\bin\mDNSResponder.exe - multicast-DNS Responder Daemon
- *Grid_home*\bin\gipcd.exe - Grid IPC daemon
- *Grid_home*\bin\gnsd.exe - Grid Naming Service daemon
- *Grid_home*\bin\ohasd.exe - OracleOHService
- *Grid_home*\bin\TNSLSNR.EXE - SCAN listener and local listener for Oracle Database and Oracle ASM
- *Grid_home*\opmn\bin\ons.exe - Oracle Notification Service

- *Grid_home*\jdk\jre\bin\java.exe - Java Virtual Machine

About Firewall Exceptions for Other Oracle Products

In addition to all the previously listed exceptions, if you use any of the Oracle software listed, then you must create an exception for Windows Firewall for the associated executable.

Table 5-2 Other Oracle Software Products Requiring Windows Firewall Exceptions

Oracle Software Product	Executable Name
Data Guard Manager	dgmgrl.exe
Oracle Internet Directory LDAP Server	oidldapd.exe
External Procedural Calls	extproc.exe

Configuring the Windows Firewall

Oracle recommends configuring the Windows Firewall if the following conditions are true.

Configure the Windows Firewall if:

- Oracle server-side components are installed.

  These components include Oracle Database, network listeners, and any web servers or services.

- The computer handles connections from other computers over a network.

  If no other computers connect to the computer with the Oracle software, then no postinstallation configuration steps are required and the Oracle software functions as expected.

- The Windows Firewall is enabled.

  If the Windows Firewall is not enabled, then no postinstallation configuration steps are required.

If all of the conditions are met, then you must configure the Windows Firewall either by opening specific static TCP ports in the firewall or by creating exceptions for specific executables so that they are able to receive connection requests on any ports they choose. Postinstallation configuration for the Windows Firewall can be done by one of following methods:

- From the **Control Panel**, select **Windows Firewall** and then select **Exceptions**.
- Or enter `netsh firewall add...` at the command line.

Alternatively, Windows informs you if a foreground application is attempting to listen on a port, and it prompts you to create an exception for that executable. If you choose to do so, then the effect is the same as creating an exception for the executable either in the Control Panel or from the command line.

> **Note:**
>
> Windows Server 2008 and later operating systems do not provide any information about applications attempting to listen on a port. Instead, a security audit event is logged to signal that an application is blocked.

- About Backing Up a Database
  The technique for backing up a database depends on the archiving mode of the database and whether you are making a component-based or a volume-based backup.

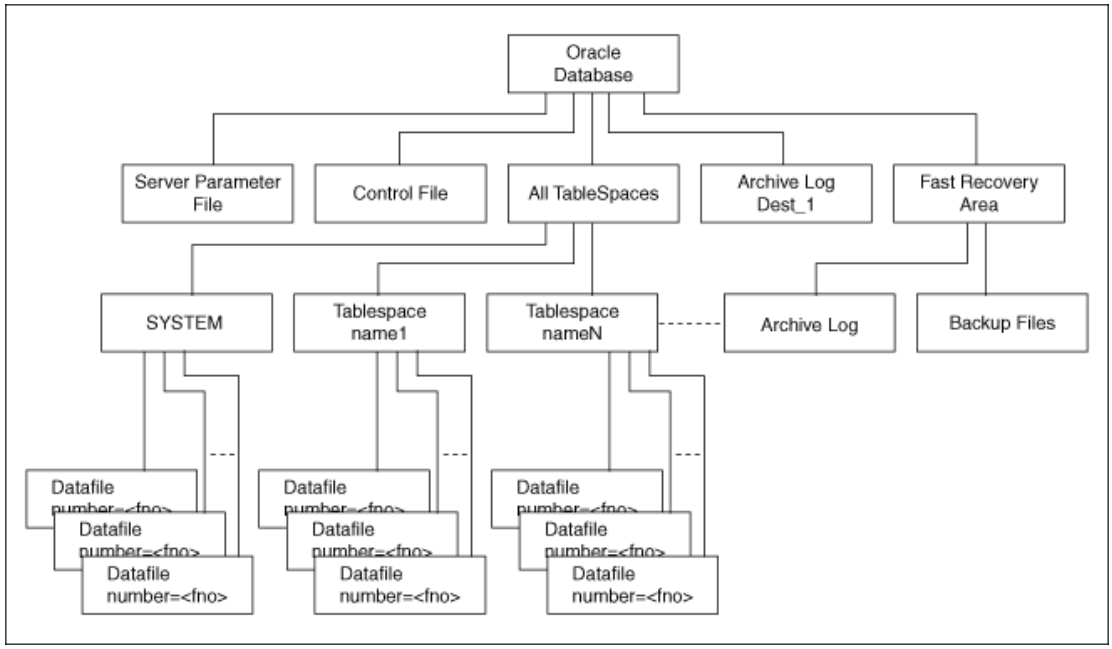
About Backing Up a Database

The technique for backing up a database depends on the archiving mode of the database and whether you are making a component-based or a volume-based backup.

Oracle recommends shadow copies taken in a component mode for backing up the Oracle Database using VSS writer. The Oracle VSS writer defines the components that include the set of database files. The Oracle VSS writer then saves the redo generated during hot backup mode when the snapshot was created in the backup writer metadata document.

The component hierarchy defined by the Oracle VSS writer is illustrated in Oracle VSS Writer Component Hierarchy.

Figure 5-1 Oracle VSS Writer Component Hierarchy



Related Topics

- About Component-Based Backups
  The components supported by the Oracle VSS writer are listed in Components Backed Up by the Oracle VSS Writer.

Troubleshooting Windows Firewall Exceptions

Perform the following steps to troubleshoot Windows Firewall exceptions.

Perform the following steps to troubleshoot Windows Firewall exceptions:

1. Examine Oracle configuration files (such as `*.conf` files), the Oracle key in the Windows registry, and network configuration files in *`ORACLE_HOME`*`\network\admin`.
2. Pay particular attention to any executable listed in *`ORACLE_HOME`*`\network\admin\listener.ora` in a `PROGRAM=` clause. Each of these must be granted an exception in the Windows Firewall, because a connection can be made through the TNS Listener to that executable.
3. Examine Oracle trace files, log files, and other sources of diagnostic information for details on failed connection attempts. Log and trace files on the database client computer might contain useful error codes or troubleshooting information for failed connection attempts. The Windows Firewall log file on the server might contain useful information as well.
4. If the preceding troubleshooting steps do not resolve a specific configuration issue, then provide the output from command `netsh firewall show state verbose=enable` to My Oracle Support for diagnosis and problem resolution at:

   `https://support.oracle.com/`

About the Need to Reset Passwords for Default Accounts

Oracle Database installs with many default accounts.

Oracle Database Configuration Assistant locks and removes most default database accounts upon successful installation. Oracle recommends changing all user passwords *immediately* after installation.

> **See Also:**
>
> *Oracle Database Administrator's Guide*

About Windows Authenticated Users

Authenticated Users group is a Windows built-in group that cannot be modified and includes all the users whose identities were authenticated when they logged on.

Membership is controlled by the operating system. The `SID` for Authenticated Users is S-1-5-11.

Overview of NTFS File System and Windows Registry Permissions

Oracle recommends that you configure Oracle Database files, directories, and registry settings to provide full control to authorized database administrators (DBAs).

If you have created a database using Oracle Database Configuration Assistant or upgraded a database using Oracle Database Upgrade Assistant, then no further action is required.

Learn about the permissions automatically set by Oracle Universal Installer, Oracle Database Configuration Assistant, and Oracle Database Upgrade Assistant and the steps to set these permissions manually.

In addition to the various groups listed in Oracle Database software installation creates the following groups for Oracle internal use and sets permissions on files and registry entries for these groups to ensure that the Oracle software functions properly. The group memberships and permissions set for the following groups must not be changed or removed:

- `ORA_INSTALL`
- `ORA_GRID_LISTENERS`
- `ORA_CLIENT_LISTENERS`
- `ORA_`*`HOMENAME`*`_SVCSIDS`

- Setting File Permissions
  Oracle Universal Installer, Oracle Database Configuration Assistant, and Oracle Database Upgrade Assistant set file permissions when you install or upgrade Oracle Database software.
- Setting Permissions for Windows Registry Entries
  Oracle Universal Installer sets the permissions for Windows registry entries pertaining to Oracle Database software.
- Setting Permissions for Windows Service Entries
  Oracle Universal Installer sets the following permissions to users and user groups for Windows service entries for Oracle Database services.
- Setting NTFS File System Security
  Use this procedure to set the NTFS file system security.
- Setting Windows Registry Security
  Oracle recommends that you remove write permissions from users who are *not* Oracle Database DBAs or system administrators in the `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE` directory of the Windows registry.

See Also:

- Your operating system documentation for more information about modifying NTFS file system and Windows registry settings
- *Oracle Database Installation Guide for Microsoft Windows*

Setting File Permissions

Oracle Universal Installer, Oracle Database Configuration Assistant, and Oracle Database Upgrade Assistant set file permissions when you install or upgrade Oracle Database software.

- About Default File Permissions Set by Oracle Universal Installer
  During Oracle Database installation, by default Oracle Universal Installer installs software in the *ORACLE_HOME* directory.
- About File Permissions Set by Oracle Database Configuration Assistant
  During Oracle Database configuration, Oracle Database Configuration Assistant installs files and directories in the following default locations, where *database_name* is the database name or *SID*.
- About File Permissions Set by Oracle Database Upgrade Assistant
  When an earlier version of the database is upgraded to Oracle Database 21c, Oracle Database Upgrade Assistant installs software in the following directories, where *database_name* is the database name or *SID*.
- About Setting Permissions for Oracle Wallets
  When an Oracle Wallet is created in the file system, the user creating the wallet is granted access to the wallet by wallet creation tools.
- About Setting File System ACLs Manually
  As Oracle Database services now run under a standard Windows User Account, a file might not be accessible by Oracle Database services unless the file system Access Control Lists (ACLs) grant access to the file.

About Default File Permissions Set by Oracle Universal Installer

During Oracle Database installation, by default Oracle Universal Installer installs software in the *ORACLE_HOME* directory.

Oracle Universal Installer sets the following permissions to this directory, and to all files and directories under this directory:

For the Oracle Grid Infrastructure home:

- Full control - `Administrators`, `SYSTEM`, `ORA_GRID_LISTENERS`, Oracle Installation User, Oracle Home User
- Read, execute, and list content - `Authenticated Users`

For the Database ORACLE_HOME:

- Full control - `Administrators`, `SYSTEM`, Oracle Installation User, Oracle Home User, or `ORA_<HomeName>_SVCACCTS` group for Virtual Account homes.
- Read, execute, and list content - `Authenticated Users`

For the Client ORACLE_HOME:

- Full control - `Administrators`, `SYSTEM`, Oracle Installation User, `ORA_`*HOMENAME*`_SVCSIDS` or the Oracle Home User
- Read, execute, and list content - `Authenticated Users`

Oracle Universal Installer sets the following permissions to the ORACLE_BASE directory, and to all the files and directories under this directory with the exception of database files, wallets, and so on:

- Full control - Administrators, SYSTEM, Oracle Installation User, Oracle Home User or ORA_<HomeName>_SVCACCTS group for Virtual Account homes.
- Full control - ORA_GRID_LISTENERS if the ORACLE_BASE is for the Oracle Grid Infrastructure ORACLE_HOME
- Full control - ORA_*HOMENAME*_SVCSIDS or Oracle Home User if the ORACLE_BASE is for a Client ORACLE_HOME

> **Note:**
>
> If these accounts already exist and have more restrictive permissions, then most restrictive permissions are retained. If accounts other than Administrators, SYSTEM, Authenticated Users, and the Oracle groups mentioned exist, then the permissions for these accounts are removed.

> **See Also:**
>
> - *Oracle Grid Infrastructure Installation Guide for Microsoft Windows x64 (64-Bit)*
> - *Oracle Database Installation Guide for Microsoft Windows*

About File Permissions Set by Oracle Database Configuration Assistant

During Oracle Database configuration, Oracle Database Configuration Assistant installs files and directories in the following default locations, where *database_name* is the database name or *SID*.

- *ORACLE_BASE*\admin*database_name* (administration file directories)
- *ORACLE_BASE*\oradata*database_name* (database file directories)
- *ORACLE_BASE*\oradata*database_name* (redo log files and control files)
- *ORACLE_HOME*\database (SPFILE*SID*.ORA)

Oracle Database Configuration Assistant sets the following permission to these directories, and to all the files and directories under these directories:

- Full control Administrators, SYSTEM, Oracle Home User or ORA_<HomeName>_SVCACCTS group for Virtual Account homes

> **Note:**
>
> If these accounts already exist and have more restrictive permissions, then the most restrictive permissions are retained. If accounts other than `Administrators`, `SYSTEM`, and Oracle Home User already exist, then the permissions for these accounts are removed.

About File Permissions Set by Oracle Database Upgrade Assistant

When an earlier version of the database is upgraded to Oracle Database 21c, Oracle Database Upgrade Assistant installs software in the following directories, where *`database_name`* is the database name or *`SID`*.

When an earlier version of the database is upgraded to Oracle Database 21c, Oracle Database Upgrade Assistant installs software in the following directories, where *`database_name`* is the database name or *`SID`*:

- *`ORACLE_BASE`*`\admin\`*`database_name`* (administration files)
- *`ORACLE_BASE`*`\oradata\`*`database_name`* (database file directories)
- *`ORACLE_BASE`*`\oradata\`*`database_name`* (redo log files and control files)
- *`ORACLE_BASE`*`\`*`ORACLE_HOME`*`\database` (`SPFILE`*`SID`*`.ORA`)

Oracle Database Upgrade Assistant sets the following permissions to these directories, and to all files and directories under these directories:

- Full control `Administrators`, `SYSTEM`, Oracle Home User or `ORA_<HomeName>_SVCACCTS` group for Virtual Account homes

> **Note:**
>
> If these accounts already exist and have more restrictive permissions, then the most restrictive permissions are retained. If accounts other than `Administrators`, `SYSTEM`, and Oracle Home User already exist, then the permissions for these accounts are removed.

Oracle Database Upgrade Assistant can also configure Oracle Enterprise Manager. If the **Enable daily backup** option is selected while configuring Oracle Enterprise Manager, then Oracle Database Upgrade Assistant shows a separate screen asking for Fast Recovery Area. Oracle Database Upgrade Assistant tries to create the directory structure (if it does not exist) in the specified file system location. Oracle Database Upgrade Assistant also puts the same set of file permissions to this location. The default location shown by Oracle Database Upgrade Assistant for Fast Recovery Area is:

- *`ORACLE_BASE`*`\recovery_area`

About Setting Permissions for Oracle Wallets

When an Oracle Wallet is created in the file system, the user creating the wallet is granted access to the wallet by wallet creation tools.

Oracle Database Windows services may run under a standard Windows User Account or Virtual Account and might not be able to access to the wallet. You may need to change the file system ACL for the wallet file manually to grant access to database and listener services.

About Setting File System ACLs Manually

As Oracle Database services now run under a standard Windows User Account, a file might not be accessible by Oracle Database services unless the file system Access Control Lists (ACLs) grant access to the file.

Though Oracle installation configures the ACLs in a way to ensure that you do not have to change ACLs manually for typical usage, it is necessary to change ACLs manually, for example, to manually upgrade databases, and database files not in Oracle base, or to grant access to wallets in the file system.

The rules to set file system ACLs manually are:

- To allow Oracle Database service access to a file: Grant access to Oracle Home User for the file when a Windows User Account is used as the Oracle Home User. If a Windows built-in account is used as the Oracle Home User, then no such permission is necessary because the Oracle Database services run under the administrative account.
- To allow Oracle Grid Listeners services access to a file: Grant access to `ORA_GRID_LISTENERS` group for the file.
- To allow Oracle services from a client `ORACLE_HOME` access to a file: Grant access to Oracle Home User for the file when a Windows User Account is used as the Oracle Home User for the client home. If a Windows built-in account is used as the Oracle Home User, then grant access to the `ORA_`*`HOMENAME`*`_SVCSIDS` group for the file.

Setting Permissions for Windows Registry Entries

Oracle Universal Installer sets the permissions for Windows registry entries pertaining to Oracle Database software.

Follow the guidelines listed below to set the permissions for Windows registry entries:

- All users have read permissions.
- Local administrators and Oracle Installation User have full control.

Setting Permissions for Windows Service Entries

Oracle Universal Installer sets the following permissions to users and user groups for Windows service entries for Oracle Database services.

The guidelines to set permissions to users and user groups for Windows service entries for Oracle Database services are:

- `ORA_DBA` and `ORA_`*`HOMENAME`*`_DBA` group users have start and stop privileges for Windows service entries.
- Local System Account and local administrators have full control of Windows service entries.

Setting NTFS File System Security

Use this procedure to set the NTFS file system security.

To ensure that only authorized users have full file system permissions:

1. Go to Windows Explorer.
2. Set the following permissions for each directory or file based on the information provided in the earlier sections.

> **See Also:**
>
> Your operating system online help for more information about how to modify NTFS file system and registry settings

Setting Windows Registry Security

Oracle recommends that you remove write permissions from users who are *not* Oracle Database DBAs or system administrators in the `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE` directory of the Windows registry.

To remove write permissions:

1. Open the registry.
2. Go to `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE`.
3. Select **Permissions** from the **Edit** menu.

   The Permissions for Oracle dialog box appears.
4. Remove write privileges from any users who are not Oracle Database DBAs or system administrators. Note that the `SYSTEM` account must have Full Control, because some Oracle Database services run as `SYSTEM`.
5. Ensure that user accounts that must run Oracle applications have read privileges.
6. Select **OK**.
7. Exit the registry.

Overview of ReFS File System

The ReFS prevents corruption of the file metadata that occurs in standard NTFS volumes which makes data inaccessible.

This release supports Oracle Database installation on Resilient File System (ReFS). ReFS uses checksums for file metadata, and an allocate-on-write method to update data which minimizes the risk of corruption.

ReFS supports volumes from 256 zettabytes to a maximum of 4 petabytes. ReFS stores and protects data from common errors that cause data loss. ReFS is resilient to power outages. ReFS also protects data based on volumes, directory, and files.

Setting File Permissions

Oracle Universal Installer, Oracle Database Configuration Assistant, and Oracle Database Upgrade Assistant set file permissions when Oracle Database software is installed or upgraded.

This section contains these topics:

About Configuring External Job Support for the Scheduler on Windows

This release includes Oracle Scheduler (the Scheduler), which provides enterprise scheduling functionality.

This release includes Oracle Scheduler (the Scheduler), which provides enterprise scheduling functionality. External jobs performed by the user are started using the `OracleJobScheduler`*`SID`* service. This service is disabled by default. To use the external jobs functionality, the administrator must set the user name and password for the user account under which this service must run and enable the service.

ORADIM creates the Oracle Database service, Oracle VSS Writer service, and Oracle Scheduler service to run under the Oracle Home User account. If this account is a Windows Local User or a Windows Domain User Account, then ORADIM prompts for the password for that account and accepts the same through `stdin`. It is possible to specify both the Oracle Home User and its password using the `-RUNAS osusr[/ospass]` option to `oradim`. If the given `osusr` is different from the Oracle Home User, then Oracle Home User is used instead of `osusr` along with the given `ospass`. Restricting execution of external jobs to a low-privileged user prevents unauthorized database users from gaining operating system-level privileges, but it also places restrictions on the kinds of jobs that can be run. Jobs requiring a higher level of operating system privileges cannot be run by this mechanism.

Enabling and starting the `OracleJobScheduler`*`SID`* service is required only for compatibility with Oracle Database 10*g* Release 1 and Release 2, for local external jobs that do not use credentials. This service is not required if all local external jobs use credentials. For improved security, Oracle recommends that all local external jobs use credentials.

See Also:

Oracle Database Administrator's Guide

About Oracle Multimedia on Windows

Oracle Multimedia (formerly Oracle interMedia) is a feature that enables Oracle Database to store, manage, and retrieve images.

Oracle Multimedia also helps DICOM format medical images and other DICOM data, audio, video, or other heterogeneous media data in an integrated fashion with other enterprise information. Oracle Multimedia extends Oracle Database reliability, availability, and data management to multimedia content in traditional, Internet, electronic commerce, medical, and media-rich applications.

If you install Standard Edition 2, or Enterprise Edition, then Oracle Database Configuration Assistant starts automatically at the end of installation. If you choose any Oracle Database Configuration Assistant installation type other than Customized, then Oracle Multimedia does not require manual configuration. All tasks described in this section are performed automatically.

If you select Customized installation, then Oracle Database Configuration Assistant guides you through configuration of Oracle Multimedia.

- Configuring Oracle Multimedia on Windows
  Use this procedure to configure Oracle Multimedia.

Configuring Oracle Multimedia on Windows

Use this procedure to configure Oracle Multimedia.

If you are creating and configuring a database manually, then you can configure Oracle Multimedia as follows:

1. Start SQL*Plus:

   ```
   C:\> sqlplus /NOLOG
   ```

2. Connect to Oracle Database with account `SYSDBA`:

   ```
   SQL> CONNECT / AS SYSDBA
   ```

3. Start the database (if necessary):

   ```
   SQL> STARTUP
   ```

4. Run the script `ordinst.sql`:

   ```
   SQL> ORACLE_HOME\ord\admin\ordinst.sql SYSAUX SYSAUX
   ```

5. Run the script `iminst.sql`:

   ```
   SQL> ORACLE_HOME\ord\im\admin\catim.sql
   ```

6. Exit SQL*Plus:

   ```
   SQL> EXIT
   ```

> **Note:**
>
> If you manually copy your Oracle8*i* `listener.ora` and `tnsnames.ora` files into your Oracle Database network directory, then you must modify network configuration files `tnsnames.ora` and `listener.ora` on your server to enable calls to work and Oracle Multimedia to function properly.

> **See Also:**
>
> *Oracle Net Services Administrator's Guide*

About Oracle Text on Windows

Oracle Text enables text queries through SQL and **PI/SQL** from most Oracle interfaces.

Oracle Text enables text queries through SQL and **PI/SQL** from most Oracle interfaces. By installing Oracle Text with an Oracle Database server, client tools such as SQL*Plus and Pro*C/C++ are able to retrieve and manipulate text in Oracle Database.

Oracle Text manages textual data in concert with traditional data types in Oracle Database. When text is inserted, updated, or deleted, Oracle Text automatically manages the change.

If you install Oracle Text from the media and do not have a previous release of Oracle Text installed, then Oracle Database is already configured for use with Oracle Text if one of the following is true:

- You created the database by using Oracle Database Configuration Assistant in standalone mode, and selected the Typical database creation type.
- The database is a **starter database** that you created by using Oracle Universal Installer (OUI) and selected the **Create and configure a database** option in "Select Installation Option" window.

> **See Also:**
>
> - *Oracle Text Application Developer's Guide*
> - *Oracle Database Upgrade Guide*
> - *Oracle Database Installation Guide for Microsoft Windows*

Configuring Oracle Text Using Database Configuration Assistant

To use Oracle Database Configuration Assistant to configure Oracle Database for use with Oracle Text at the time you create the database, select Oracle Text as the option to configure when prompted.

To configure the database at a later time:

1. Start Database Configuration Assistant.

From the **Start** menu, select **All Programs**, then select **Oracle - *HOMENAME,*** then select **Configuration and Migration Tools**, and then select **Database Configuration Assistant**.

2. Select **Configure Database Options**.
3. Select the database to modify when prompted.
4. Select **Oracle Text** as the option to configure when prompted.

About Oracle Spatial and Graph on Windows

Oracle Spatial and Graph makes storage, retrieval, and manipulation of spatial data easier and more intuitive to users.

One example of spatial data is a road map. A road map is a two-dimensional object that contains points, lines, and polygons representing cities, roads, and political boundaries such as states. A road map represents geographic information. Locations of cities, roads, and political boundaries are projected onto a two-dimensional display or piece of paper, preserving relative positions and relative distances of objects.

- Configuring Oracle Spatial and Graph on Windows Automatically
  Learn how to configure Oracle Spatial and Graph automatically on Windows.

Configuring Oracle Spatial and Graph on Windows Automatically

Learn how to configure Oracle Spatial and Graph automatically on Windows.

If you install Oracle Spatial and Graph through Enterprise Edition, then no manual configuration is required. All Oracle Spatial and Graph configuration tasks are performed automatically.

If you install both Oracle Spatial and Graph and Oracle Database together through Enterprise Edition or Standard Edition 2 installation, then Database Configuration Assistant starts automatically at the end of installation. If you select **Custom** installation and select **Create new database**, then the assistant asks if Oracle Spatial and Graph is to be configured automatically.

If you install Oracle Spatial and Graph during a separate installation from Enterprise Edition, then you must either start Oracle Database Configuration Assistant and select **Configure** database options or configure Oracle Spatial and Graph manually.

> **See Also:**
>
> *Oracle Spatial and Graph Developer's Guide*

About Advanced Replication on Windows

There are many configuration and usage possibilities with Advanced Replication.

Oracle Database installs packages and procedures automatically rather than as a separate manual process.

This section describes how to manually configure Advanced Replication in Oracle Database. Follow the instructions only if you add Advanced Replication to an installation of Oracle Database that was not previously configured with this feature.

Configuring Advanced Replication consists of the following steps:

- About Checking Tablespace and Rollback Segment Requirements
- Adding and Modifying Initialization Parameters
- Monitoring Data Dictionary Tables

About Checking Tablespace and Rollback Segment Requirements

Table 5-3 Advanced Replication Tablespace/Rollback Segment Requirements

Tablespace/Rollback Segment	Minimum Free Space
SYSTEM	20 MB
UNDOTBS	10 MB
RBS	5 MB
TEMP	10 MB
USERS	No specific requirement

Note:

Replication triggers and procedures are stored here.

See Also:

Oracle Database Administrator's Guide for more information on tablespace

Adding and Modifying Initialization Parameters

If you use Advanced Replication, then certain parameter values must be added to the initialization parameter file, and others must be set to recommended values.

Table 5-4 Advanced Replication Initialization Parameters

Parameter Name	Recommended Value	Site
JAVA_POOL_SIZE	50 MB	master
DISTRIBUTED_LOCK_TIMEOUT	300 seconds	master
GLOBAL_NAMES	TRUE	master
OPEN_LINKS	4	master
PROCESSES	Add 9 to current value	master

Table 5-4 (Cont.) Advanced Replication Initialization Parameters

Parameter Name	Recommended Value	Site
JOB_QUEUE-PROCESSES	2	master
JOB_QUEUE_PROCESSES	2	materialized view

Note

Depends on the number of n-way sites.

Monitoring Data Dictionary Tables

If you use Advanced Replication and intend to set up a large number of replicated objects, then you are required to monitor the following data dictionary tables with the `SQL SELECT` argument:

- `ARGUMENT$`
- `IDL_CHAR$`
- `IDL_UB1$`
- `IDL_UB2$`
- `IDL_SB4$`
- `I_ARGUMENT1`
- `I_SOURCE1I$`
- `SOURCE$`
- `TRIGGER`

If necessary, increase the storage parameters to accommodate storage requirements of large numbers of replicated objects.

6

Administering a Database on Windows

Learn how to administer Oracle Database for Windows.

- About Ways to Manage Oracle Database Services
  Learn how to manage the services that Oracle Database installs on your computer.
- Starting and Shutting Down a Database with SQL*Plus
  Learn how to start and shut down a database with SQL *Plus.
- Starting and Shutting Down a Database Using Services
  Learn how to start and shut down a database using services.
- Starting Multiple Instances
  Learn about how to start multiple database instances.
- Creating and Populating Password Files
  Use Password Utility to create password files. Password Utility is automatically installed with Oracle Database utilities.
- Connecting Remotely to the Database
  Learn how to connect to Oracle Database remotely.
- About Archiving Redo Log Files
  If you installed Oracle Database through the Typical installation, then it is created in the `NOARCHIVELOG` mode. If you created your database through the Custom option of Oracle Database Configuration Assistant, then you had the choice of either `ARCHIVELOG` or `NOARCHIVELOG`.

About Ways to Manage Oracle Database Services

Learn how to manage the services that Oracle Database installs on your computer.

- Overview of Oracle Database Service Naming Conventions for Multiple Oracle Homes
  Oracle Database for Windows lets you have multiple Oracle homes on a single computer.
- Starting Oracle Database Services
  Oracle Database services must be started for you to use Oracle Database and its products.
- Stopping Oracle Database Services
  On occasion (for example, when reinstalling Oracle Database), you must stop Oracle Database services.
- Auto-Starting Oracle Database Services
  Oracle Database services can be set to start automatically whenever you start the Windows computer.

Overview of Oracle Database Service Naming Conventions for Multiple Oracle Homes

Oracle Database for Windows lets you have multiple Oracle homes on a single computer.

This feature, described in Appendix B, "Optimal Flexible Architecture", in *Oracle Database Installation Guide for Microsoft Windows*, affects Oracle Services naming conventions. As you perform installations into Oracle home directories:

- You must accept the default Oracle home name provided or specify a different name for each Oracle home directory.
- You are prompted to give a system identifier and a global database name for each database installation.

> **See Also:**
>
> *Oracle Database Installation Guide for Microsoft Windows*

Starting Oracle Database Services

Oracle Database services must be started for you to use Oracle Database and its products.

You can start Oracle Database services by:

- Using the Control Panel
- Using the Command Prompt

Using the Control Panel

To start Oracle Database services from the Control Panel:

1. Access your Windows Services dialog box.

   > **See Also:**
   >
   > Your operating system documentation for instructions

2. Find the service to start in the list, select it, and click **Start**.

   If you cannot find `OracleService`*`SID`* in the list, then use ORADIM to create it.

3. Click **Close** to exit the Services dialog box.

Using the Command Prompt

To start Oracle Database services from the command prompt, enter:

```
C:\> NET START service
```

The variable *`service`* is a specific service name, such as `OracleServiceORCL`.

Related Topics

- Starting and Shutting Down a Database Using Services
  Learn how to start and shut down a database using services.

Stopping Oracle Database Services

On occasion (for example, when reinstalling Oracle Database), you must stop Oracle Database services.

You can stop Oracle Database services from three different locations:

- Using the Control Panel
- Using the Command Prompt

Using the Control Panel

To stop Oracle Database services from the Control Panel:

1. Access your Windows Services dialog box.

> **See Also:**
>
> Your operating system documentation for instructions

2. Select **`Oracle`*`HOMENAME`*`TNSListener`** and click **Stop**.

   `Oracle`*`HOMENAME`*`TNSListener` is stopped.

3. Select **`OracleService`*`SID`*** and click **Stop**.
4. Click **OK**.

   `OracleService`*`SID`* is stopped.

Using the Command Prompt

To stop Oracle Database services from the command prompt, enter:

```
C:\> net STOP service
```

The variable *`service`* is a specific service name, such as `OracleServiceORCL`.

Related Topics

- Starting and Shutting Down a Database Using Services
  Learn how to start and shut down a database using services.

Auto-Starting Oracle Database Services

Oracle Database services can be set to start automatically whenever you start the Windows computer.

You can turn auto-start on or off by using the Control Panel.

Using the Control Panel

To use the Control Panel to configure when and how Oracle Database is started:

1. Access your Windows Services dialog box.

> **See Also:**
>
> Your operating system documentation for instructions

2. Select the service **OracleServiceSID** and click **Startup**.
3. Select **Automatic** from the **Startup Type** field.
4. Click **OK**.
5. Click **Close** to exit the Services dialog box.

Starting and Shutting Down a Database with SQL*Plus

Learn how to start and shut down a database with SQL *Plus.

These instructions assume that a database instance has been created.

> **Note:**
>
> Directory path examples in this chapter follow Optimal Flexible Architecture (OFA) guidelines. If you specified directories during installation that do not comply with OFA guidelines, then your directory paths differ.

To start or shut down Oracle Database:

1. Go to your Oracle Database server.
2. Start SQL*Plus at the command prompt:

   ```
   C:\> sqlplus /NOLOG
   ```

3. Connect to Oracle Database with username SYSDBA:

   ```
   SQL> CONNECT / AS SYSDBA
   ```

4. To start a database, enter:

   ```
   SQL> STARTUP [PFILE=path\filename]
   ```

   This command uses the initialization parameter file specified in *path*`\`*filename*. To start a database using a file named `init2.ora` located in `C:\app\username\product\11.2.0\admin\orcl\pfile,` enter:

   ```
   SQL> STARTUP PFILE=C:\app\username\product\11.2.0\admin\orcl\pfile\init2.ora
   ```

   If no `PFILE` is specified, then the command looks for an `SPFILE` in *ORACLE_HOME*`\database`. If the command finds one, then the command uses it to start the database. If it does not find an `SPFILE`, then it uses the default initialization parameter file located in *ORACLE_BASE*`\ADMIN\db_name\pfile`.

5. To stop a database, enter:

   ```
   SQL> SHUTDOWN [mode]
   ```

   The mode is `normal`, `immediate`, or `abort`.

In a `normal` shutdown, Oracle Database waits for all currently connected users to disconnect and disallows any new connections before shutting down. This is the default mode.

In an `immediate` shutdown, Oracle Database terminates and rolls back active transactions, disconnects clients, and shuts down.

In an `abort` shutdown, Oracle Database terminates active transactions and disconnects users; it does not roll back transactions. The database performs automatic recovery and rollback the next time it is started. Use this mode only in emergencies.

> **See Also:**
>
> *Oracle Database Installation Guide for Microsoft Windows* for more information about "Optimal Flexible Architecture"

Starting and Shutting Down a Database Using Services

Learn how to start and shut down a database using services.

You can start or shut down Oracle Database by starting or stopping the service `OracleService`*`SID`* in the Control Panel. Starting `OracleService`*`SID`* is equivalent to using the `STARTUP` command or manually entering:

```
C:\> oradim -STARTUP -SID SID [-STARTTYPE srvc | inst | srvc,inst] [-PFILE
filename | -SPFILE]
```

Stopping `OracleService`*`SID`* is equivalent to using the `SHUTDOWN` command or manually entering:

```
C:\> oradim -SHUTDOWN -SID SID [-SHUTTYPE srvc | inst | srvc,inst] [-SHUTMODE
normal | immediate | abort]
```

You can enable starting and stopping Oracle Database through `OracleService`*`SID`* by setting registry parameters.

Setting Registry Parameters

To start or stop Oracle Database through Oracle Database services, set the following registry parameters to the indicated values:

- `ORA_`*`SID`*`_AUTOSTART`

  When set to `true`, the default value, this parameter causes Oracle Database to start when `OracleService`*`SID`* is started.

- `ORA_`*`SID`*`_PFILE`

  This parameter sets the full path to the initialization parameter file. If this entry is not present, then ORADIM tries to start the database with an `SPFILE` or `PFILE` from *`ORACLE_HOME`*`\database`.

- `ORA_SHUTDOWN`

  When set to `true`, this parameter enables the selected instance of Oracle Database to be shut down when `OracleService`*`SID`* is stopped. This includes any database in the current Oracle home. The default value is `false`.

- ORA_*SID*_SHUTDOWN

  When set to `true`, the default value, this parameter causes the instance of Oracle Database identified by the *SID* value to shut down when `OracleService`*SID* is stopped manually—using either the Control Panel or Net stop command.

> **Note:**
>
> If `ORA_SHUTDOWN` or `ORA_SID_SHUTDOWN` is set to `false`, then manually shutting down `OracleService`*SID* still shuts down Oracle Database. But it is an abnormal shutdown, and Oracle does not recommend it.

The following two registry parameters are optional:

- ORA_*SID*_SHUTDOWNTYPE

  This parameter controls database shutdown mode. Set it to `a` (`abort`), `i` (`immediate`), or `n` (`normal`). The default mode is `i` (`immediate`) if you do not set this parameter.

- ORA_*SID*_SHUTDOWN_TIMEOUT

  This parameter sets the maximum time to wait before the service for a particular *SID* stops.

The registry location of these required and optional parameters are determined by the number of Oracle home directories on your computer. If you have only one Oracle home directory, then these parameters belong in:

```
HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\HOME0
```

If you have multiple Oracle home directories, then these parameters belong in:

```
HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\HOMEID
```

The variable *ID* is incremented for each additional Oracle home directory on your computer.

> **Note:**
>
> If you use ORADIM to create or edit instances, then it automatically sets the relevant registry parameters to their appropriate values.

Starting or Stopping OracleServiceSID from the Control Panel

1. To start the database, start **OracleService*SID***.

   This automatically starts ORADIM and enters the `-STARTUP` command using the initialization parameter file identified by ORA_*SID*_PFILE.

2. To stop the database, stop **OracleService*SID***.

   This automatically stops ORADIM, which enters the `-SHUTDOWN` command in the mode indicated by ORA_*SID*_SHUTDOWNTYPE, and shuts down Oracle Database.

> **See Also:**
>
> Your operating system documentation for instructions on starting and stopping services.

Related Topics

- Configuration Parameters and the Registry

Starting Multiple Instances

Learn about how to start multiple database instances.

Perform the following steps to start service for multiple Oracle Database instance:

1. Start the service for each instance using ORADIM or the Services dialog of the Control Panel.
2. At the command prompt, set the `ORACLE_SID` configuration parameter to the *`SID`* for the first instance to run:

   ```
   C:\> SET ORACLE_SID=SID
   ```

   The variable *`SID`* is the name of the Oracle Database instance.
3. Start SQL*Plus:

   ```
   C:\> sqlplus /NOLOG
   ```
4. Connect AS SYSDBA:

   ```
   SQL> CONNECT / AS SYSDBA
   ```
5. Start up the first instance:

   ```
   SQL> STARTUP PFILE=ORACLE_BASE\admin\db_name\pfile\init.ora
   ```

   The variable *`ORACLE_BASE`* is `c:\app\`*`username`* (unless you changed it during installation) and *`db_name`* is the name of the instance.
6. Repeat Step 2 through Step 5 for the other instances to run.

Creating and Populating Password Files

Use Password Utility to create password files. Password Utility is automatically installed with Oracle Database utilities.

Password files are located in the directory *`ORACLE_HOME`*`\database` and are named `PWD`*`sid`*`.ora`, where *`SID`* identifies the Oracle Database instance. Password files can be used for local or remote connections to Oracle Database.

To create and populate a password file:

1. Create a password file with Password Utility:

   ```
   C:\> orapwd FILE=PWDsid.ora ENTRIES=max_users
   ```

   - `FILE` specifies the password file name.

- *SID* identifies the database instance.
- ENTRIES sets the maximum number of entries in the password file. This corresponds to maximum number of distinct users allowed to connect to the database simultaneously with either the SYSDBA or the SYSOPER DBA privilege.

2. Set the initialization parameter file parameter REMOTE_LOGIN_PASSWORDFILE to exclusive, shared, or none.

   The value exclusive specifies that only one instance can use the password file and that the password file contains names other than SYS. In search of the password file, Oracle Database looks in the registry for the value of the parameter ORA_SID_PWFILE. If no value is specified, then Oracle Database looks in the registry for the value of the parameter ORA_PWFILE, which points to a file containing user names, passwords, and privileges. If that is not set, then Oracle Database uses the default:

   ORACLE_HOME\DATABASE\PWDsid.ORA.

   The default value is shared. It specifies that multiple instances (for example, an Oracle RAC environment) can use the password file. However, the only user recognized by the password file is SYS. Other users cannot log in with SYSOPER or SYSDBA privileges even if those privileges are granted in the password file. The shared value of this parameter affords backward compatibility with earlier Oracle releases. Oracle Database looks for the same files as it does when the value is exclusive.

   The value none specifies that Oracle Database ignores the password file and that authentication of privileged users is handled by the Windows operating system.

3. Start SQL*Plus:

   ```
   C:\> sqlplus /NOLOG
   ```

4. Connect AS SYSDBA:

   ```
   SQL> CONNECT / AS SYSDBA
   ```

   For an Oracle ASM instance, connect AS SYSASM:

   ```
   SQL> CONNECT / AS SYSASM
   ```

5. Start Oracle Database:

   ```
   SQL> STARTUP
   ```

6. Grant appropriate privileges to each user. Users who must perform database administration, for example, are granted the SYSDBA privilege:

   ```
   SQL> GRANT SYSDBA TO db_administrator;
   ```

   For an Oracle ASM instance:

   ```
   SQL> GRANT SYSASM TO SYS;
   ```

   If the grant is successful, then the following message is displayed:

   ```
   Statement Processed.
   ```

   This adds smith to the password file and enables smith to connect to the database with SYSDBA privileges. Use SQL*Plus to add or delete user names, user passwords, and user privileges in password files.

> **Note:**
>
> Copying or manually moving password files might result in ORADIM being unable to find a password to start an instance.

- Viewing and Hiding the Password File
  Use this procedure to make the password file visible or invisible from different locations.

Viewing and Hiding the Password File

Use this procedure to make the password file visible or invisible from different locations.

The password file is not automatically hidden. It can be made invisible and visible again from two different locations:

- Using Command Prompt
- Using Windows Explorer

> **Note:**
>
> The password file must be visible before it can be moved, copied, or deleted.

Using Command Prompt

1. To see the password file, enter:

   ```
   ORACLE_HOME\database> attrib
   ```

   The password file is displayed as `PWD`*`sid`*`.ora`:

   ```
   A       ORACLE_HOME\database\oradba.exe
   A       ORACLE_HOME\database\oradim.log
   A       ORACLE_HOME\database\PWDsid.ora
   A       ORACLE_HOME\database\SPFILEsid.ora
   ```

2. To make the password file invisible, enter:

   ```
   ORACLE_HOME\database> attrib +H PWDsid.ora
   ```

3. To see the effect of the change, enter:

   ```
   ORACLE_HOME\database> attrib
   ```

   The password file is now hidden:

   ```
   A       ORACLE_HOME\database\oradba.exe
   A       ORACLE_HOME\database\oradim.log
   A   H   ORACLE_HOME\database\PWDsid.ora
   A       ORACLE_HOME\database\SPFILEsid.ora
   ```

4. To make the password file visible again, enter:

   ```
   ORACLE_HOME\database> attrib -H PWDsid.ora
   ```

Using Windows Explorer

To make the password file invisible or visible again:

1. Go to the directory *ORACLE_HOME*\database.
2. Right-click **PWDsid.ora**.
3. Select **Properties**.

   The PWDsid.ora Properties dialog box opens.
4. In **Attributes**, check or clear the check box next to **Hidden**.
5. Click **OK**.

To view or hide an invisible password file:

1. Go to the directory *ORACLE_HOME*\database.
2. Select **Folder Options** from the **Tools** main menu.
3. In the Folder Options window, select the **View** tab.
4. To view an invisible password file, select **Show hidden files and folders**.
5. To hide a visible password file, select **Do not show hidden files and folders**.
6. Click **OK**.

Connecting Remotely to the Database

Learn how to connect to Oracle Database remotely.

There are many steps you must remember while connecting to the database remotely.

- Connecting to a Database Using SYSDBA Privileges
  When connecting to the starter database from a remote computer as SYS, you must use a different password from the one described in *Oracle Database Installation Guide for Microsoft Windows* when logging on with SYSDBA privileges.
- About Verifying a Remote Database Using Encrypted Passwords
  Learn how to verify a remote database using encrypted passwords.

Connecting to a Database Using SYSDBA Privileges

When connecting to the starter database from a remote computer as SYS, you must use a different password from the one described in *Oracle Database Installation Guide for Microsoft Windows* when logging on with SYSDBA privileges.

This is because the password file enables database access in this situation and it requires the password oracle for this purpose.

About Verifying a Remote Database Using Encrypted Passwords

Learn how to verify a remote database using encrypted passwords.

With Oracle Database, the password used to verify a remote database connection is automatically encrypted. Whenever a user attempts a remote login, Oracle Database encrypts the password before sending it to the remote database. If the connection fails, then the failure is noted in the operating system audit log.

> **Note:**
>
> The configuration parameter `ORA_ENCRYPT_LOGIN` is retained for backward compatibility and is set to `true` by default.

Related Topics

- Configuration Parameters and the Registry

About Archiving Redo Log Files

If you installed Oracle Database through the Typical installation, then it is created in the `NOARCHIVELOG` mode. If you created your database through the Custom option of Oracle Database Configuration Assistant, then you had the choice of either `ARCHIVELOG` or `NOARCHIVELOG`.

In `NOARCHIVELOG` mode, redo logs are not archived. Setting your archive mode to `ARCHIVELOG` and enabling automatic archiving causes redo log files to be archived. This protects Oracle Database from both instance and disk failure.

> **See Also:**
>
> *Oracle Database Administrator's Guide* for more information about “Managing Archived Redo Logs."

7

Monitoring a Database on Windows

Learn how to monitor Oracle Database for Windows.

- Overview of Database Monitoring Tools
  Database Monitoring Tools describes tools that enable you to monitor Oracle Database.
- About Event Viewer
  Oracle Database for Windows problems and other significant occurrences are recorded as events in an application event log.
- About Trace Files
  Oracle Database for Microsoft Windows background threads use trace files to record occurrences and exceptions of database operations, and errors.
- About Alert Logs
  Alert logs contain important information about error messages and exceptions that occur during database operations.

Overview of Database Monitoring Tools

Database Monitoring Tools describes tools that enable you to monitor Oracle Database.

Table 7-1 Database Monitoring Tools

Tool	Functionality
Event Viewer	Monitor database events.
Trace Files	Record occurrences and exceptions of the database operations.
Alert Logs	Record important information about error messages and exceptions during database operations.
Oracle Enterprise Manager Database Management Packs	Monitor and tune using tools with a real-time graphical performance information. **See Also**: Your Oracle Enterprise Manager documentation set for more information
Oracle Administration Assistant for Windows	View information about or terminate any Oracle thread.

> **Note:**
>
> A 64-bit version of Oracle Enterprise Manager Database Express is available on 64-bit Windows. Oracle Enterprise Manager Database Express can manage a 32-bit Windows database from a remote Linux or Windows 64-bit computer.

> **See Also:**
>
> *Oracle Database Performance Tuning Guide*

About Event Viewer

Oracle Database for Windows problems and other significant occurrences are recorded as events in an application event log.

View and manage these recorded events in Event Viewer.

- Using Event Viewer
  Learn how to use Event Viewer.
- Managing Event Viewer
  Learn how to manage Event Viewer.
- Reading Event Viewer
  Learn how to read an Event Viewer.

Using Event Viewer

Learn how to use Event Viewer.

To access Event Viewer:

1. From the **Start** menu, select **All Programs**, then select **Administrative Tools**, and then select **Event Viewer**.

   The Event Viewer window appears.
2. Select **Windows Logs**.
3. Double-click **Application** to open the Application view window.

Application View Window displays the Application view window, Application View Definitions shows what is recorded in each column, and Event Viewer Icons interprets icons that appear on the left hand side of the viewer.

Figure 7-1 Application View Window

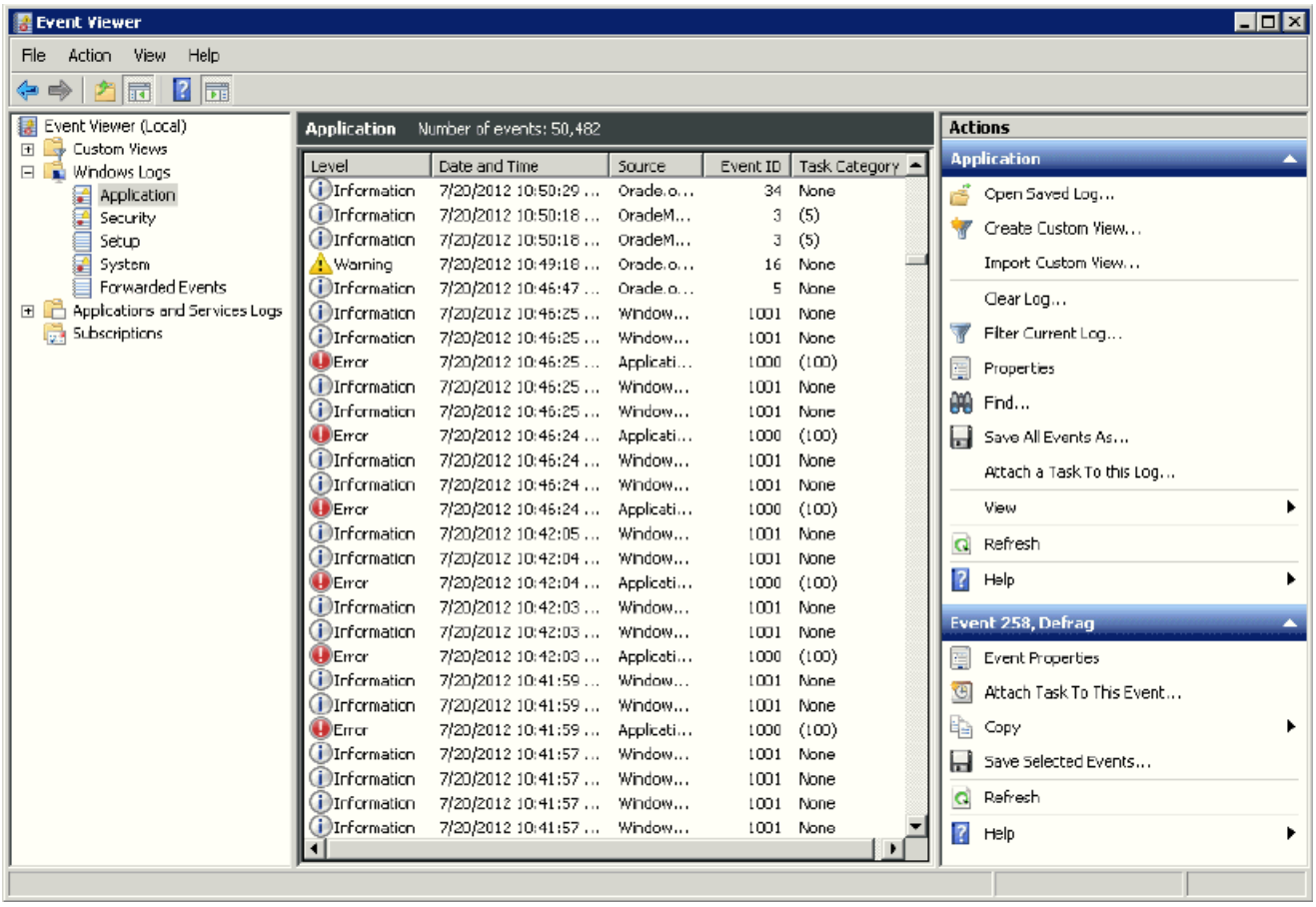


Table 7-2 Application View Definitions

Column Name	Definition
Date and Time	Date and time at which an event took place
Source	Application that recorded an event
Event ID	Unique number assigned to an event
Task Category	Classification of events

Table 7-3 Event Viewer Icons

Icon	Event Type	Suggested Action
Exclamation Point in Red Circle	Error	Error identification. Always check these icons.
Lowercase "i" in Blue Circle	Information	Noncritical system events. Check these icons only to track a specific event.
Exclamation Point in Yellow Triangle	Warning	Special events, such as instance termination or services shutdown. Investigate these icons, but they are usually noncritical.

Managing Event Viewer

Learn how to manage Event Viewer.

Setting `AUDIT_TRAIL` to `db` or `os` causes more records to be written to Event Viewer. This can fill up the Event Viewer log file. Follow these procedures to increase log file size:

1. Right-click the event log in which you want to set size, and select **Properties**.

   The event Log Properties window appears.
2. Use the up and down arrow keys to set the size you want in the **Maximum log size** box.
3. Under **When maximum event log size is reached**, select one of the options that you want. The options are as follows:
   - Overwrite events as needed (oldest events first)
   - Archive the log when full, do not overwrite events
   - Do not overwrite events (clear log manually)
4. If you want to clear the log contents, click **Clear Log**.
5. Click **OK**.

   You return to Event Viewer.

> **Note:**
>
> Audit information cannot be spooled to a file. `AUDIT_FILE_DEST` is supported on Windows to write XML format audit files when `AUDIT_TRAIL` is set to `XML` or `XML,EXTENDED` format and thus must be added to the initialization parameter file.

Reading Event Viewer

Learn how to read an Event Viewer.

Oracle Database for Windows events are displayed with a source of Oracle.*SID*.

Event number 34 specifies an audit trail event. These events are recorded if the parameter `AUDIT_TRAIL` is set to `db` (`true`) or `os` in the initialization parameter file. Option `os` enables systemwide auditing and causes audited records to be written to Event Viewer. Option `db` enables systemwide auditing and causes audited records to be written to the database audit trail (table `SYS.AUD$`). Some records, however, are written to Event Viewer.

Event numbers other than 34 specify general database activities, such as an instance being started or stopped.

When you double-click an icon in Event Viewer, the Event Properties dialog box appears with more information about the selected event. Event Properties General Tab, for example, shows details about Event ID 4112. In the **General** tab, you find a text description of the event. In the **Details** tab, you can select **Friendly View** to see

the System and Event Data in words or **XML View** to see the same information in XML format, as shown in Event Properties Details Tab.

Figure 7-2 Event Properties General Tab

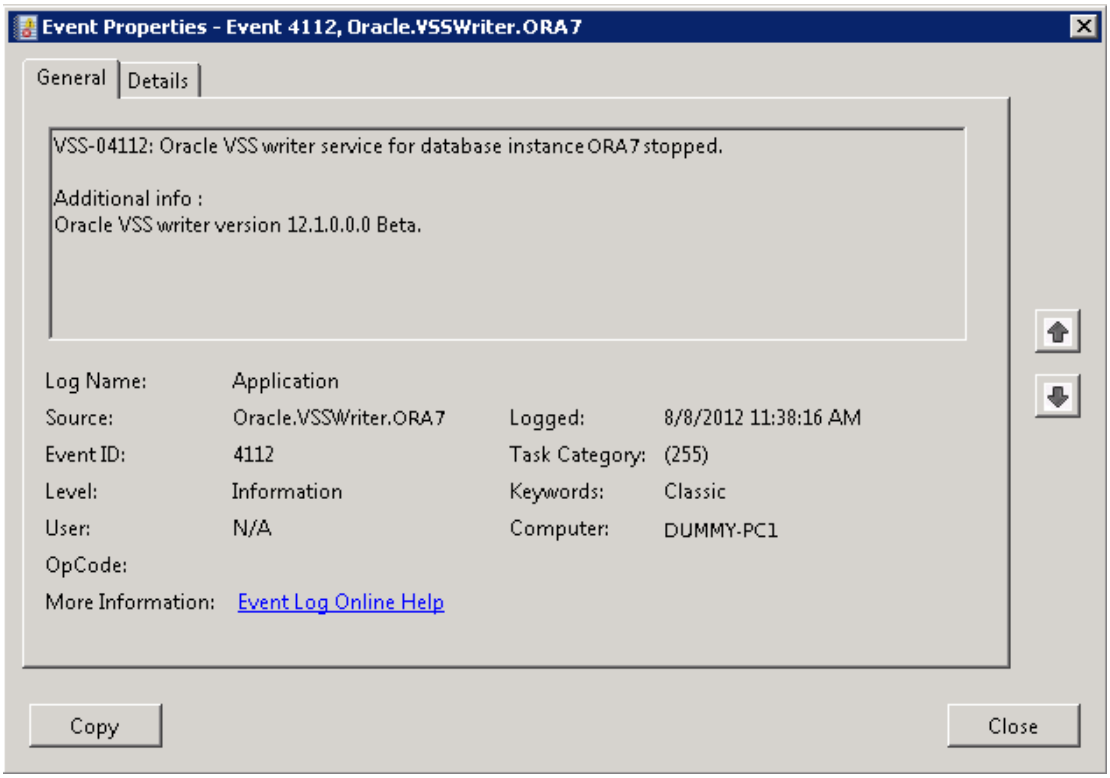
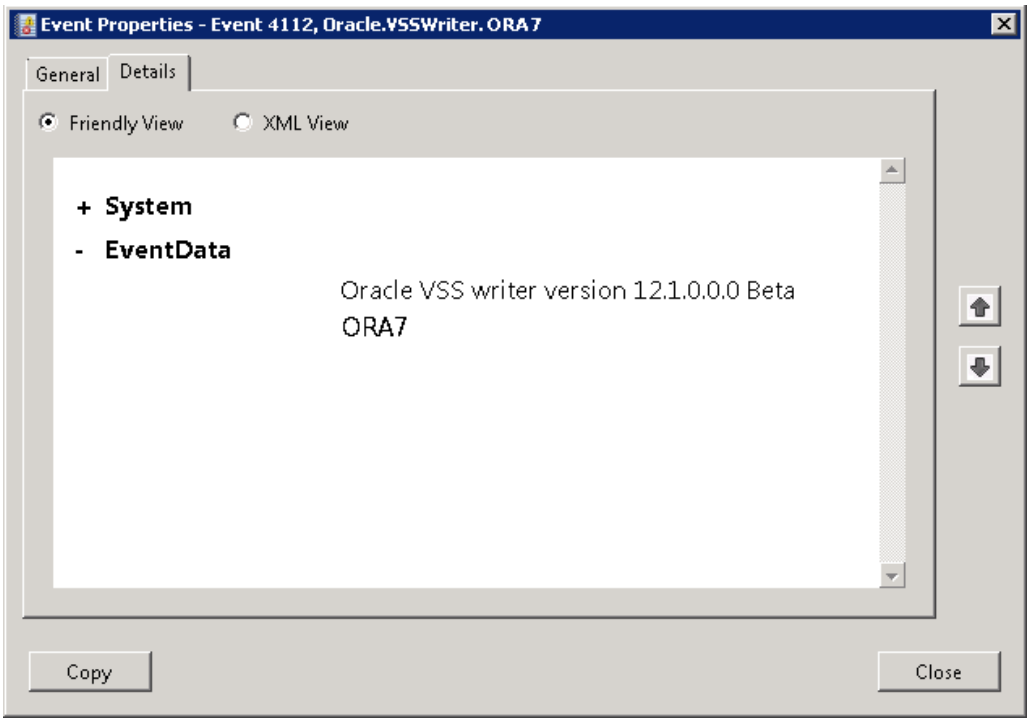


Figure 7-3 Event Properties Details Tab



> **See Also:**
>
> Microsoft operating system documentation for more information about using Event Viewer

About Trace Files

Oracle Database for Microsoft Windows background threads use trace files to record occurrences and exceptions of database operations, and errors.

Starting with Oracle Database 21c, the multithreaded Oracle Database model is enabled by default on Oracle Database.

In the multithreaded Oracle Database model mode, there are two types of foreground threads: static, and dynamic. The trace file name of a static foreground thread contains the name of the thread and the operating system thread ID followed by the extension ."trc" .

The following are the examples of the foreground trace file names:

- `r01_ora_4537.trc`
- `r01_ora_6578.trc`

The trace file of a dynamic thread additionally contains the operating system process ID of the Oracle Database instance such as:

- `r01_ora_4568_5804.trc`
- `r01_ora_4568_4160.trc`

The background threads in the multithreaded Oracle Database model mode are always dynamic. The following are the examples of the background trace file names:

- `r01_pmon_4568_1556.trc`
- `r01_mmon_4568_3768.trc`

When multithreaded Oracle Database model is turned off explictly, then the foreground and background threads are static. In this mode, the trace file names do not contain the OS process ID.

About Alert Logs

Alert logs contain important information about error messages and exceptions that occur during database operations.

Each Oracle Database for Windows instance has one alert log; information is appended to the file each time you start the instance. All threads can write to the **alert log**.

For example, when automatic archiving of redo logs is halted because no disk space is available, a message is placed in the alert log. The alert log is the first place to check if something goes wrong with the database and the cause is not immediately obvious.

The alert log is named `alert_`*`SID`*`.log` and is found in the ADR directory specified by the parameter `DIAGNOSTIC_DEST` in the initialization parameter file. Alert logs must be deleted or archived periodically.

Related Topics

- Modifying the Initialization Parameter File
  Describes how to modify the initialization parameter file.

> **See Also:**
>
> *Oracle Database Installation Guide for Microsoft Windows* in the "ADMIN Directory" section.

8

Tuning Windows to Optimize Oracle Database

Learn how to tune the Windows Server operating system to ensure that Oracle Database is running in the best possible environment.

> **Note:**
>
> For the sake of brevity, this discussion uses the collective term *Windows Server* when a statement applies to all supported Windows operating systems.

- Overview of Windows Tuning
  Learn about tuning Windows Server operating system.
- Overview of Large Page Support
  Large page support is a feature of Oracle Database.
- About Reducing Priority of Foreground Applications on Server Console
  One of the settings provided by default during the installation of a Windows Server gives the interactive foreground applications a priority over every background process.
- About Configuring Windows Server to Be an Application Server
  Windows memory manager divides up system memory into three different pools, described in Windows Server Memory Shares.
- About Disabling Unnecessary Services
  After you have significantly reduced the file cache, you can retrieve additional physical memory for Oracle Database by disabling services not needed for core operating system functionality.
- About the Necessity to Remove Unused Network Protocols
  Remove all unnecessary network protocols on Windows so that the processing time can be concentrated on servicing only critical protocols.
- About the Necessity to Reset Network Protocol Bind Order
  If multiple protocols must be installed on the server, you can give the protocol most frequently used by Oracle Database the highest priority by resetting the network protocol bind order.
- Setting the Order of Multiple Network Interface Cards
  If you have public and private network interface cards (NICs) on a single Windows computer and they are not in the correct order, then you might experience problems with any configuration (Oracle Enterprise Manager, for example) that uses `gethostname`.
- Overview of the Latest Reliable Windows Server Service Pack
  Microsoft releases operating system patches, called Service Packs, on a quarterly basis. Service Packs are a collection of bug fixes and product enhancements to the basic Windows Server release.
- Overview of Hardware or Operating System Striping
  Learn about data striping, which is an effective means of reducing the impact of slow hard drives.

- About Multiplex Windows Server Virtual Memory Paging File
  Discusses about Multiplexing the Windows Server virtual memory paging file to boost system performance.
- Closing All Unnecessary Foreground Applications
  Learn about closing all unnecessary foreground applications.

Overview of Windows Tuning

Learn about tuning Windows Server operating system.

Windows Server operating systems offer considerably fewer tuning adjustments than UNIX systems. This difference constrains system administrators when they try to optimize Windows Server performance, but it also makes Windows Server easier to use.

You can make Windows Server a better application server environment for Oracle Database. Most of the operating system specific procedures described in this chapter enable Oracle Database to reserve more system resources, such as CPU, memory, and disk I/O.

In addition, because Oracle Database is a high-performance database management system that effectively uses resources of your Windows computer, it must not also serve as any of the following:

- Primary or backup domain controller
- File or print server
- Remote access server
- Router

These configurations consume network, memory, and CPU resources. In addition, the Windows computer that is running Oracle Database should not be locally accessed with a high frequency or intensively used for local user processing, unless it has enough resources to accommodate all this activity.

Overview of Large Page Support

Large page support is a feature of Oracle Database.

It provides a performance boost for memory-intensive database instances running on Windows Server. By taking advantage of newly introduced operating system support, Oracle Database can now make more efficient use of processor memory addressing resources. Specifically, when large page support is enabled, the CPUs in the system access the Oracle Database buffers in RAM more quickly. Instead of addressing the buffers in 4KB increments, the CPUs are told to use 2 MB page sizes in Physical Address Extension (PAE) mode and 4MB page sizes in non-PAE mode when addressing the database buffers.

This feature is particularly useful when the Oracle buffer cache is several gigabytes. Smaller-sized configurations still see a gain when using large pages, but the gain will not be as great as when the database is accessing large amounts of memory.

If the service is running as a user instead of the default `SYSTEM` user, then the administrator must grant the "Lock pages in memory" privilege to the user. This privilege is not enabled by default when Windows is installed.

- Granting Lock Pages in Memory Privilege
  Use this procedure to grant lock pages in memory privilege.
- Enabling Large Page Support
  To take advantage of large pages, the amount of physical memory must be greater than the amount of System Global Area (SGA) specified in the parameter file.

Granting Lock Pages in Memory Privilege

Use this procedure to grant lock pages in memory privilege.

To grant`SeLockMemoryPrivilege` , perform the following steps:

1. From the **Start** menu, select **Control Panel**.

   The Control Panel window opens.
2. Double-click **Administrative Tools**.

   The Administrative Tools window opens.
3. Double-click **Local Security Policy**.

   The Local Security Policy window opens.
4. In the left pane of the Local Security Policy window, expand **Local Policies** and select **User Rights Assignment**.
5. In the right pane of the Local Security Policy window, double-click **Lock pages in memory**.

   The Lock pages in memory Properties window opens.
6. Click **Add User or Group.**

   The Select Users, Computers, Service Accounts, or Groups dialog box opens.
7. Enter Oracle Home User name in **Enter the object names to select** field and click **Check Names**.
8. Click **OK** to close the Select Users, Computers, Service Accounts, or Groups dialog box.
9. Click **OK** to close the Lock pages in memory Properties window.

Enabling Large Page Support

To take advantage of large pages, the amount of physical memory must be greater than the amount of System Global Area (SGA) specified in the parameter file.

Large pages might not be allocated always during instance startup. Large pages are supported in 2 modes:

- Regular mode: All of the SGA is attempted to be allocated in large pages. If the required amount of large pages are not available, then the instance does not come up.
- Mixed mode: All of the SGA is attempted to be allocated in large pages. If no more large pages are available, then the subsequent allocations are done using regular pages. So the SGA allocation can be a mixed set of large pages and regular pages.

  The mixed mode also supports a time parameter (in `msecs`). If a large page allocation took more time than the msecs specified by this time parameter, then subsequent allocations are made using regular pages. This parameter is helpful when the database startup time might be too long due to the entire SGA being allocated using large pages.

> **Note:**
>
> In regular mode, large page usage locks the entire SGA into physical memory. Physical memory is not released during a shrink operation. In mixed mode, only the large pages from the SGA are locked in physical memory, not released during a shrink operation and regular pages remain pageable.

> **See Also:**
>
> Your operating system documentation for restrictions on allocating large pages

To enable large page support:

1. Go to the directory *ORACLE_HOME*\bin\oracle.key.
2. Open the oracle.key in a text editor and record the value found. It is set by Oracle Universal Installer. The default is:

   SOFTWARE\ORACLE\KEY_*HOMENAME*
3. Start Registry Editor at the command prompt:

   ```
   C:\> regedit
   ```

   > **Note:**
   >
   > Although Registry Editor lets you view and modify registry keys and parameter values, you usually are not required to do so. In fact, you can render your system useless if you make incorrect changes. Therefore, only advanced users must edit the registry. Back up your system before making any changes in the registry.
   >
   > oracle.key file must not be modified or removed. Oracle binaries open it to determine the location in the registry where their variables are stored.
4. Go to the HKEY_LOCAL_MACHINE file.

   Locate the key corresponding to the value found in the oracle.key file. In the default case, for example, locate:

   HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_*HOMENAME*
5. Create *one* of the following, depending on where you want to enable large page support:
   - ORA_LPENABLE to enable large page support on all instances. Its value decides the mode of large pages for all Oracle database instances on the computer.
   - ORA_*SID*_LPENABLE to enable large page support on a specific instance. Its value decides the mode of large pages for the specific database instance.

     Set the value of the above registry entry to 1 for regular mode and 2 for mixed mode.

The time parameter for mixed mode is optional. To specify this time parameter which is instance specific, create `ORA_SID_LPMAXTIME` and set the value to the desired number of millisecs.

When this time parameter is specified for an instance and the large pages allocation takes more than the specified millisecs, then the rest of the SGA is allocated using regular pages.

6. Exit Registry Editor.

By default, Oracle allocates the minimum available large page size when using large pages. The minimum available large page size, 16 MB, is obtained by using the `GetLargePageMinumum` function.

> **Note:**
>
> Do not set the initialization parameter `lock_sga` when large pages are enabled. Large page usage locks the entire SGA into physical memory. When used with the parameter `lock_sga`, database startup fails with an error because the operating system automatically locks. That is, it prevents memory from being paged to disk when large pages are requested. Physical memory is not released during a shrink operation.

About Reducing Priority of Foreground Applications on Server Console

One of the settings provided by default during the installation of a Windows Server gives the interactive foreground applications a priority over every background process.

To prevent foreground applications on the server console from taking excessive processor time away from Oracle Database, you can reduce the priority for foreground applications.

> **See Also:**
>
> Your operating system documentation for instructions on reducing priority of foreground applications

About Configuring Windows Server to Be an Application Server

Windows memory manager divides up system memory into three different pools, described in Windows Server Memory Shares.

Table 8-1 Windows Server Memory Shares

Pool	Percent of Total Memory
Kernel and other system services	9%
File cache	41%

Table 8-1 (Cont.) Windows Server Memory Shares

Pool	Percent of Total Memory
Paged memory	50%

Windows Server memory manager tries to balance each application's usage of memory by dynamically paging memory between a physical RAM and a virtual memory paging file. If an application is particularly memory-intensive (like Oracle Database) or if a large number of applications run concurrently, then combined memory requirements of the applications might exceed physical memory capacity.

The large proportion of memory reserved for file caching (41%) can be quite beneficial to the file and print servers. But it might not be advantageous to the application servers that often run memory-intensive network applications. A Windows Server file cache is particularly unnecessary for Oracle Database, which performs its own caching through the System Global Area.

You can reset the Windows Server memory model from the default file and print server, with its large file cache, to a network applications model, with a reduced file cache and more physical memory available for Oracle Database.

See Also:

Your operating system documentation for instructions

About Disabling Unnecessary Services

After you have significantly reduced the file cache, you can retrieve additional physical memory for Oracle Database by disabling services not needed for core operating system functionality.

Unnecessary services include:

- License Logging Service
- Plug and Play
- Remote Access Autodial Manager
- Remote Access Connection Manager
- Remote Access Server
- Telephony Service

Consult with your systems administrator to identify other unnecessary services.

Do *not* disable any of the following services:

- Alerter
- Computer Browser
- EventLog

- Messenger
- `OracleService`*`SID`*
- `Oracle`*`HOMENAME`*`TNSListener`
- Remote Procedure Call (RPC) Service
- Server
- Spooler
- TCP/IP NetBS Helper
- Workstation

Related Topics

- About Configuring Windows Server to Be an Application Server
  Windows memory manager divides up system memory into three different pools, described in Windows Server Memory Shares.

> **See Also:**
>
> Your operating system documentation for instructions on disabling unnecessary services

About the Necessity to Remove Unused Network Protocols

Remove all unnecessary network protocols on Windows so that the processing time can be concentrated on servicing only critical protocols.

> **See Also:**
>
> Your operating system documentation for instructions on removing unnecessary network protocols

About the Necessity to Reset Network Protocol Bind Order

If multiple protocols must be installed on the server, you can give the protocol most frequently used by Oracle Database the highest priority by resetting the network protocol bind order.

> **See Also:**
>
> Your operating system documentation for instructions on resetting the network protocol bind order

Setting the Order of Multiple Network Interface Cards

If you have public and private network interface cards (NICs) on a single Windows computer and they are not in the correct order, then you might experience problems with any configuration (Oracle Enterprise Manager, for example) that uses `gethostname`.

If the private NIC is seen first by Windows, then a `gethostname` call returns the host name of the private interconnect. Whichever tool is calling `gethostname` has configuration or connectivity problems stemming from this nonpublic network information.

You can determine the current order of your NICs, and change it if necessary, as follows:

1. From the **Start** menu, select **Control Panel**.
2. Select **Network and Internet**, and then select **Network and Sharing Center**.
3. Change the network adapter settings, depending on your operating system:
   - For Windows Server 2008, select **Manage adapter settings**.
   - For Windows Server 2008 R2, select **Change adapter settings**.
4. Click **Organize**, then **Layout**, and then select **Menu bar**.
5. From the **Advanced** menu, click **Advanced Settings**. The Advanced Settings window opens.
6. From the Connections window in the Adapters and Binding tab, select the network adapter that you want.
7. Move this network adapter to the top or the bottom of the list by using the up and down arrow buttons.
8. Click **OK**.

Overview of the Latest Reliable Windows Server Service Pack

Microsoft releases operating system patches, called Service Packs, on a quarterly basis. Service Packs are a collection of bug fixes and product enhancements to the basic Windows Server release.

In general, apply Service Packs as soon as it is safe to do so, because they fix bugs and can improve Windows Server performance or functionality.

While Service Packs are supposed to fix bugs, they sometimes introduce new problems as well. In general, it is safest to wait a few weeks after a Service Pack is released before implementing it. This allows time for other field sites to report any problems with the Service Pack release.

The latest Windows Server Service Packs can be downloaded as self-extracting archives from `http://support.microsoft.com`

Unless you can be certain that the Service Pack works without flaws on Windows Server, create an `Uninstall` directory. This enables the Service Pack to be removed and the original configuration to be restored.

Service Pack files overwrite similarly-named files in the previous Windows Server configuration. However, Service Pack files can be overwritten in turn by setup programs that copy files from the original installation media.

For example, installing a new network protocol or a printer driver usually requires copying files from the original Windows Server installation media. When Service Pack files are comprehensively or selectively overwritten, the Service Pack must be reapplied.

Overview of Hardware or Operating System Striping

Learn about data striping, which is an effective means of reducing the impact of slow hard drives.

Compared to CPU and memory speeds, hard disk drives are extremely slow. Now that the hard disk drives are relatively inexpensive, Oracle recommends that Windows Server use logical volumes composed of striped physical disks. Data striping is an effective means of reducing the impact of relatively slow hard drives by distributing file I/O across a number of hard drives simultaneously.

> **Note:**
>
> Data striping through the operating system is not permitted with Oracle Automatic Storage Management (Oracle ASM), which does its own striping. Hardware striping is allowed with Oracle ASM, but it is not necessary.

Striping data across a number of disks is one example of a redundant array of inexpensive disks (RAID). There are several different types of RAID, also referred to as RAID levels, ranging from high performance to high reliability. The three most common RAID levels in Oracle Database installations are RAID-0, RAID-1, and RAID-5. Descriptions of each RAID level are in RAID Levels in Oracle Database Installations, which shows each level's read and write penalties.

Table 8-2 RAID Levels in Oracle Database Installations

RAID Level	Read Penalty Note 1	Write Penalty Note 2
0 (Disk Striping)	1:1	1:1
1 (Disk Mirroring)	1:1	2:1
0 + 1	1:1	2:1
5 (Distributed Data Gathering)	1:1	4:1

Note 1

Read penalty is the ratio of I/O operations to read requests.

Note 2

Write penalty is the ratio of I/O operations to write requests.

About Disk Striping

RAID level 0 enables high-performance, fault-intolerant disk striping. Multiple physical hard disks are aggregated into a logical whole, either by a disk controller or through the operating system. Data operations against the logical volume are broken down into as many chunks as there are physical drives in the array, making simultaneous use of all disks. Given identical hard disks, if one hard disk has a throughput rate of `DISKRATE` operations/second, then a RAID 0 logical volume has a rate of:

```
(DISKRATE * [number of physical  drives in array]) operations/second
```

The downside of RAID 0 is its lack of fault tolerance. If one disk in the logical volume fails, the whole volume fails and must be restored from a backup.

About Disk Mirroring

RAID level 1 enables fault-tolerant disk mirroring with some chance of a performance penalty. Essentially, every write to a mirrored disk is duplicated on another drive dedicated to this purpose (the mirror drive). If the mirrored disk fails, the mirror drive is brought online in real time. After the faulty drive is replaced, the mirror configuration can be reestablished.

The read penalty for RAID level 1 is nominally 1:1, but it might benefit from split reads on some controllers. When the controller knows which mirror can be accessed fastest, for example, it can lower search times by directing I/O operations to that disk.

About Disk Striping Plus Mirroring

RAID level 0+1 enables mirroring of an array of striped hard disks. This is a blend of RAID 0 and RAID 1, offering high-performing fault tolerance.

About Distributed Data Guarding

RAID level 5, also known as disk striping with parity, eliminates the costly requirement to mirror. In RAID 5, multiple hard disks are aggregated into a striped logical volume, similar to RAID 0, but each drive contains parity information such that any single drive failure is tolerated. With one failed drive, a RAID-5 system can allow continued access to data, although access times are greatly reduced due to on-the-fly rebuilding of bytes from parity information. RAID-5 solutions usually allow hot-swapping of faulty drives with replacements, triggering a rebuild of the failed drive's data onto the replacement from parity information.

The write penalty of 4:1 results from 2 reads and 2 writes during parity calculation.

- About Multiple Striped Volumes for Sequential and Random Access
  If there are enough physical disks in Windows Server, create at least two striped volumes (in addition to a standalone hard disk or striped volume for the operating system).

> **See Also:**
>
> *Oracle Database Administrator's Guide* in "Using Automatic Memory Management."

About Multiple Striped Volumes for Sequential and Random Access

If there are enough physical disks in Windows Server, create at least two striped volumes (in addition to a standalone hard disk or striped volume for the operating system).

One striped volume can be used for sequential data access, and the other can be used for random data access.

Oracle Database redo logs and archived redo logs, for example, are written in sequential order. Because of a reduced head movement, hard disks perform best when reading or writing sequential data.

Oracle Database data files, however, are usually accessed in random order. Random access in a hard disk results in significant head movement, translating to slower data access.

Unless redo logs are separated from data files (at physical device level), undo file I/O contention may result, increasing access times for both types of files.

About Multiplex Windows Server Virtual Memory Paging File

Discusses about Multiplexing the Windows Server virtual memory paging file to boost system performance.

Some virtual memory paging is likely even if Oracle Database is the only network application running on Windows Server, because Windows Server memory manager attempts to move seldom-used pages to disk to free up more physical memory for hot pages.

Multiplexing the Windows Server virtual memory paging file is a good strategy to boost overall system performance. Splitting the paging file onto at least two different physical volumes (or logical volumes as long as underlying physical volumes do not overlap) provides a significant performance boost to virtual memory swapping operations.

Even though this is a good technique to increase speed of virtual memory paging, too much paging activity is still a performance hit and must be corrected by adding more RAM to the server.

About General Page File Sizing Tip

Oracle recommends setting virtual memory to one times the size of RAM, if physical memory is between 2GB and 16GB. If physical memory is more than 16 GB, then set virtual memory to 16 GB.

Configurations where combined size is two to four times the size of physical RAM are not uncommon. Minimize paging as much as possible. But situations in which the operating system runs out of or low on paging space are to be avoided at all costs. Adequately-sized paging files spaced across physical disks spread out I/O most efficiently, because the operating system spreads paging evenly across page files.

> **Note:**
>
> Internal read/write batch size for Windows is 4K.

Closing All Unnecessary Foreground Applications

Learn about closing all unnecessary foreground applications.

After applying procedures from the previous sections, remember to close any unnecessary foreground applications by:

- Removing all applications from Startup folders of Windows Server console operators
- Minimizing the window when executing long-running scripts from a command prompt, so that Windows Server can focus on the operation and not on a flood of window repaint messages
- Disabling screen savers, which can quickly saturate the CPU. If a screen saver must be run, choose Blank Screen, which uses the least amount of processing time

9

Performing Database Backup and Recovery with VSS

Learn how to use Volume Shadow Copy Service (VSS) applications to back up and recover an Oracle Database.

- Overview of Database Backup and Recovery with VSS
  Learn about the basic concepts and tasks involved in backup and recovery with component-based shadow copies.
- Basic Concepts of Database Backup and Recovery with VSS
  VSS is an infrastructure on Windows server platforms that enables applications to create shadow copies.
- Basic Steps of Backup and Recovery with VSS
  Learn how to perform the basic steps of backup and recovery with VSS.
- About Installing and Uninstalling the Oracle VSS Writer Service
  The Oracle VSS writer runs separately from the Oracle database instance. From the perspective of the database, the VSS writer is simply an OCI client.
- About Backing Up a Database
  The technique for backing up a database depends on the archiving mode of the database and whether you are making a component-based or a volume-based backup.
- About Restoring and Recovering a Database
  Learn how to restore and recover VSS snapshots. As in the case of backups, the procedure depends on the archiving mode of the database and the type of snapshot that you are restoring.
- About Integrating VSS with Third-Party Requester Applications
  Oracle VSS writer allows third-party requester applications to control the behavior of recovery and backup sessions.
- About Duplicating a Database
  If your VSS shadow copies are transportable, then you can use these shadow copies to duplicate the primary database.

Overview of Database Backup and Recovery with VSS

Learn about the basic concepts and tasks involved in backup and recovery with component-based shadow copies.

- Purpose of Database Backup and Recovery with VSS
  VSS provides a Windows-specific interface that enables coordination between requesters that back up data, writers that update data on disk, and providers that manage storage.
- Scope of This Chapter
  Learn how to perform database backup and recovery in the VSS infrastructure.

Scope of This Chapter

Learn how to perform database backup and recovery in the VSS infrastructure.

This chapter assumes that you are familiar with VSS applications and the Oracle Database backup and recovery principles and techniques. This chapter does not attempt to provide an introduction to backup and recovery.

> **See Also:**
>
> *Oracle Database Backup and Recovery User's Guide*

Purpose of Database Backup and Recovery with VSS

VSS provides a Windows-specific interface that enables coordination between requesters that back up data, writers that update data on disk, and providers that manage storage.

Oracle Database functions as a writer that is integrated with VSS-enabled applications.

You can use VSS-enabled software and storage systems on Windows to back up and restore an Oracle Database. A key benefit is the ability to use a VSS-enabled application to make an online backup of the whole database.

Basic Concepts of Database Backup and Recovery with VSS

VSS is an infrastructure on Windows server platforms that enables applications to create shadow copies.

A shadow copy is a consistent snapshot of the data held on a volume or component at a well-defined point in time. A shadow copy set is a collection of shadow copies that are all taken at the same time. VSS identifies each shadow copy and shadow copy set by a persistent Global Unique Identifier (GUID).

VSS provides the following infrastructure for running VSS applications:

- Coordinates activities of requesters, providers, and writers in the creation and use of shadow copies
- Furnishes the default system provider
- Implements low-level driver functionality necessary for any provider to work

A VSS requester is an application that requests VSS services to create shadow copies. Typically, VSS requesters are backup applications. Requesters communicate with writers to gather system data and signal writers to prepare data for backup.

A VSS provider manages storage volumes and creates shadow copies on demand. In response to a requester, a provider generates COM events to signal applications of an impending shadow copy and creates and maintains this copy until it is no longer

needed. During the life cycle of the shadow copy, the provider effectively supports two independent copies: the disk that is actively updated and a fixed copy that is stable for backup.

A VSS writer is an application or a service that writes data to a disk and cooperates with VSS providers and requesters. During backups, writers ensure that data is in the proper state for a shadow copy.

The Oracle VSS writer is a Windows service that coordinates an Oracle Database instance and other VSS components. The writer service, which is started under the user account with `SYSDBA` privileges, runs separately from the database instance. You must use third-party requesters to perform backup and recovery within the VSS infrastructure.

As explained in the following sections, the Oracle VSS writer supports both volume-based and component-based shadow copies. You can use these shadow copies in a backup and recovery strategy or to create a copy of your original database. You can use the duplicate database for testing or as a standby database.

- Component-Based Shadow Copies
  The Oracle VSS writer supports component-based shadow copies, which are sets of database files.
- Volume-Based Shadow Copies
  The Oracle VSS writer supports volume-based shadow copies, which are snapshots of complete drive or volumes.
- Oracle VSS Backup Types
  Oracle VSS writer supports log, copy, full, differential, and incremental backups.

Component-Based Shadow Copies

The Oracle VSS writer supports component-based shadow copies, which are sets of database files.

The recommended technique for backing up an Oracle Database with VSS writer is to create shadow copies of components. During a backup, the Oracle VSS writer saves the redo generated during snapshot creation in a metadata document. During a restore operation, the writer automatically extracts the redo from the metadata document and applies it to files restored from a snapshot.

Volume-Based Shadow Copies

The Oracle VSS writer supports volume-based shadow copies, which are snapshots of complete drive or volumes.

Oracle Database places the files that it manages in a state suitable to create shadow copies. For example, the data files are placed in hot backup mode and a new snapshot control file is created for a database in `ARCHIVELOG` mode. Oracle VSS writer excludes files such as the current control file and online redo logs from the shadow copies. The writer also returns an error if the snapshot cannot be taken. For example, if a `NOARCHIVELOG` database is open in read/write mode, then the writer returns an error indicating that the snapshot is not possible.

> **Note:**
>
> Oracle Automatic Storage Management files and raw files are not supported for Oracle VSS snapshots.

Oracle VSS Backup Types

Oracle VSS writer supports log, copy, full, differential, and incremental backups.

The VSS writer uses time stamp mechanism for incremental and differential backups and stores a time stamp in the backup document using `SetBackupStamp()` API. This backup stamp is used by Oracle VSS writer during incremental or differential backups to specify changed files since the last full or incremental backup using `AddDifferencedFilesByLastModifyTime()` API.

Oracle VSS writer also stores backup metadata and restore metadata, which must be available during restore operations so that the VSS writer can perform intelligent postrestore operations. In case of full or copy backup, the restore metadata contains important redo information to make the restored files consistent. Hence, it is imperative that Oracle VSS writer is called during restore operations to perform the recovery operations.

Basic Steps of Backup and Recovery with VSS

Learn how to perform the basic steps of backup and recovery with VSS.

The Oracle VSS writer is installed automatically as part of the database.

In the most typical backup scenario, you select the `Oracle Database` component in your VSS-enabled application and create a shadow copy. The shadow copy contains the database files, control files, and server parameter file. If the database is in `ARCHIVELOG` mode, then you can create the shadow copy when the database is open or closed; otherwise, only when closed.

In a typical recovery scenario, you select the `Oracle Database` component in your VSS-enabled application and restore it. Afterward, you can open the database either in read-only mode or with the `RESETLOGS` option. The Oracle VSS writer also supports applications that perform point-in-time recovery.

To restore a subset of database files, you can select individual components and restore them. The Oracle VSS writer performs the appropriate actions automatically in the postrestore phase so that the file can be used (or brought online) at the end of restore operation. For example, if you select a data file component for restore, then the writer automatically recovers the data file by using RMAN.

Related Topics

- About Installing and Uninstalling the Oracle VSS Writer Service
  The Oracle VSS writer runs separately from the Oracle database instance. From the perspective of the database, the VSS writer is simply an OCI client.

- About Backing Up a Database
  The technique for backing up a database depends on the archiving mode of the database and whether you are making a component-based or a volume-based backup.
- About Restoring and Recovering a Database
  Learn how to restore and recover VSS snapshots. As in the case of backups, the procedure depends on the archiving mode of the database and the type of snapshot that you are restoring.

About Installing and Uninstalling the Oracle VSS Writer Service

The Oracle VSS writer runs separately from the Oracle database instance. From the perspective of the database, the VSS writer is simply an OCI client.

Oracle VSS writer instances are created automatically during the setup of an instance. `oradim.exe` utility that sets up an instance, also starts Oracle's VSS writer utility to setup VSS writer instance for managing the given Oracle instance. In addition, the Oracle VSS writer provides command-line options to install and uninstall the writer service. If `/user` option is used but `/password` option not used, then `oravssw` waits for password through `stdin`. During installation, you can specify the Windows account under which the service must be started. The writer uses operating system authentication when connecting to a database instance. Thus, the Windows user must be able to log in as `SYSDBA` to the Oracle database instances managed by the writer service.

Oracle VSS is supported on the same operating systems that are supported by Oracle Database. See *Oracle Database Installation Guide for Microsoft Windows* for the list of supported operating systems.

The command-line syntaxes for the Oracle VSS writer are as follows:

```
oravssw {/q [/start | /stop | /status]}|
oravssw {SID [/tl trace_level] [/tf trace_file]}|
oravssw {SID [/i {/user:userid /password:password}]}|
oravssw {SID [/d]}
```

> **Note:**
>
> You can change the user ID and password using the Services snap-in.

Table 9-1 Oracle VSS Writer Options

Option	Description
SID	*SID* of the Oracle instance to which the service connects.
/i {/user:*userid*/ password:*password*}	Installs Oracle VSS writer service for a specified *SID*.
/q	Queries the Oracle VSS writer services. But when not used with options like `/start` or `/status` or `/stop`, it just displays the list of Oracle VSS writer services.
/status	Displays the current status of all Oracle writer services and can be used only with the `/q` option.

Table 9-1 (Cont.) Oracle VSS Writer Options

Option	Description
`/start`	Starts all Oracle VSS writer services and can be used only with the `/q` option.
`/stop`	Stops all Oracle VSS writer services and can be used only with the `/q` option.
`/tl`	Specifies the trace level for Oracle VSS writer for a specified *`SID`*.
`/tf`	Specifies the trace file name for Oracle VSS writer for a specified *`SID`*.
`/d`	Uninstalls Oracle VSS writer service for a specified *`SID`*.

In Installing Oracle VSS Writer, you install the service so that it connects to the `prod1` instance.

Note:

- Any errors during operation of the Oracle VSS writer are reported by means of Windows System Event logging APIs. You can view these errors with the Windows Event Viewer.
- Oracle Database 10*g* Release 2 supports Oracle VSS snapshots only when Oracle VSS writer 11*g* or later is configured to manage the 10.2 database. See My Oracle Support Note 580558.1 at https://support.oracle.com for more information about installing Oracle VSS writer for use with 9*i* and 10*g* databases.

Example 9-1 Installing Oracle VSS Writer

```
oravssw prod1 /i
```

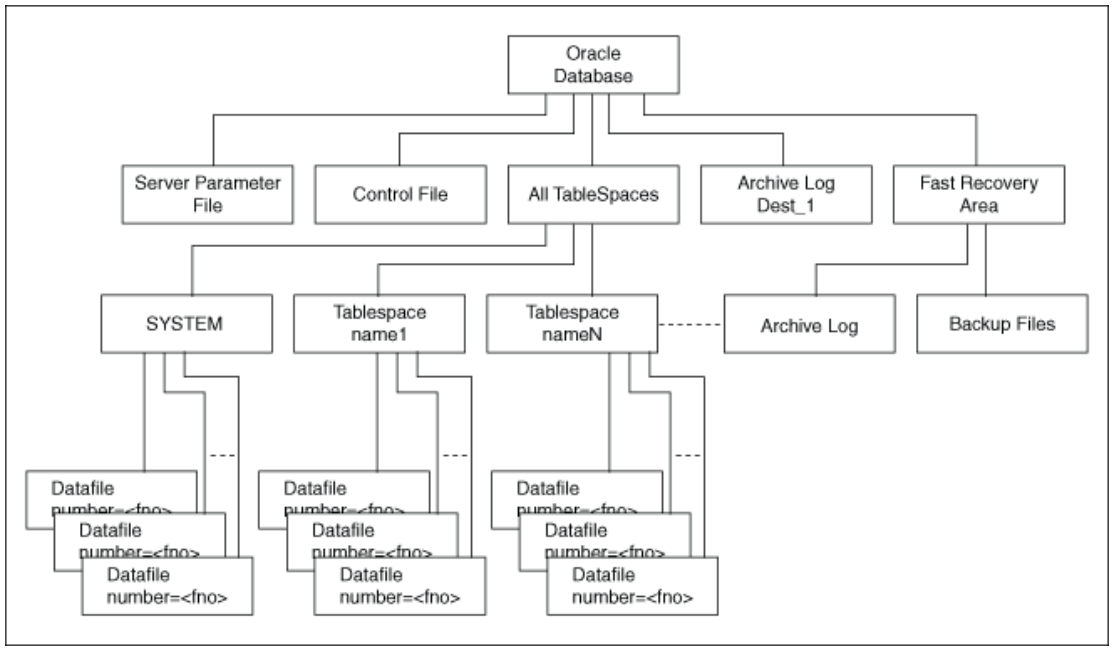
About Backing Up a Database

The technique for backing up a database depends on the archiving mode of the database and whether you are making a component-based or a volume-based backup.

Oracle recommends shadow copies taken in a component mode for backing up the Oracle Database using VSS writer. The Oracle VSS writer defines the components that include the set of database files. The Oracle VSS writer then saves the redo generated during hot backup mode when the snapshot was created in the backup writer metadata document.

The component hierarchy defined by the Oracle VSS writer is illustrated in Oracle VSS Writer Component Hierarchy.

Figure 9-1 Oracle VSS Writer Component Hierarchy



- About Component-Based Backups
  The components supported by the Oracle VSS writer are listed in Components Backed Up by the Oracle VSS Writer.
- About Backing Up a Database in ARCHIVELOG Mode
  Learn about backing up a database in ARCHIVELOG mode.
- About Backing Up a Database in NOARCHIVELOG Mode
  Learn about backing up a database in NOARCHIVELOG mode.

Related Topics

- About Component-Based Backups
  The components supported by the Oracle VSS writer are listed in Components Backed Up by the Oracle VSS Writer.

About Component-Based Backups

The components supported by the Oracle VSS writer are listed in Components Backed Up by the Oracle VSS Writer.

The name of the component is the value returned by an `OnIdentify` VSS message. The Selectable for Backup column indicates whether a component is eligible to be selected in VSS shadow copies.

Table 9-2 Components Backed Up by the Oracle VSS Writer

Component	Description	Selectable for Backup
Oracle Database	Contains the database files, control files, and server parameter file.	Yes

Table 9-2 (Cont.) Components Backed Up by the Oracle VSS Writer

Component	Description	Selectable for Backup
Control File	Contains the snapshot location of the control file for a database running in `ARCHIVELOG` mode, or the current control file locations when all database files are recovered to a consistent SCN. **Note:** The files included in the Control File component determine whether current control files or snapshot control files are excluded. For example, if the database is opened in read-only mode, then the snapshot control file location is excluded from the snapshot.	No
Server Parameter File	Contains the location of the server parameter file, if the instance is using one.	No
All TableSpaces	Includes all tablespaces in a snapshot.	No
*tablespace_name*s	Selects individual TableSpaces.	No
Data file number=*n*	Selects individual data files. The metadata contains `RESETLOGS` information, tablespace number, tablespace name, and DBID.	No
ArchiveLogDest_*n*	Selects individual local archiving destinations other than the fast recovery area.	Yes
Fast Recovery Area	Includes all backup files and archived logs in the Fast Recovery Area in the VSS snapshot. Files backed up by VSS from the Fast Recovery Area can be subjected to deletion under space constraints.	Yes
Archived Logs	Logs in Fast Recovery Area	No
Backup Files	Backs up from Fast Recovery Area	No

You can select only `Oracle Database`, `ArchiveLogDest_`*n*, and `Fast Recovery Area`, exposed by the Oracle VSS writer during a backup. The availability of the components in Components Backed Up by the Oracle VSS Writer may depend on the database state. For example, if the database is in `NOARCHIVELOG` mode, then the `Archived Logs` component is not returned. Likewise, if the instance is not started with a server parameter file, then the `Server Parameter File` component is not returned.

> **Note:**
>
> The components that are not marked as Selectable for Backup are implicitly included by components marked as Selectable for Backup.

When you select `Oracle Database` component for backup or restore, all other components are implicitly selected for backup or restore. This implies that all files that are part of the selected component are candidates for backup or restore.

`ArchiveLogDest_n` and `Fast Recovery Area` components are defined to contain only log or incremental files. This means that the requester must backup files from these components only when creating a log for incremental or differential backup. Likewise,

the requester must restore files from these components only when restoring from log or incremental or differential backups.

The files in all other components other than `ArchiveLogDest_n` and `Fast Recovery Area` define database files. This means that the requester must backup files from these components only when creating a full or copy backup. Likewise, the requester must restore files from these components only when restoring from full or copy backup.

About Backing Up a Database in ARCHIVELOG Mode

Learn about backing up a database in ARCHIVELOG mode.

The procedures assume that the database is open read/write. You can also make closed and consistent backups.

- Making Component-Based Backups of an ARCHIVELOG Database
  Explains how to back up the entire database. You can back up only `Oracle Database`, `ArchiveLogDest_`*n*, and `Fast Recovery Area`, listed in Components Backed Up by the Oracle VSS Writer.
- Making Volume-Based Backups of an ARCHIVELOG Database
  To make volume-based shadow copies of Oracle database when the database is open in read/write mode, the archived redo logs must be physically located on a separate volume from the volume containing the Oracle data files, control files, server parameter file, and online redo logs.

Related Topics

- About Backing Up a Database in NOARCHIVELOG Mode
  Learn about backing up a database in NOARCHIVELOG mode.

Making Component-Based Backups of an ARCHIVELOG Database

Explains how to back up the entire database. You can back up only `Oracle Database`, `ArchiveLogDest_`*n*, and `Fast Recovery Area`, listed in Components Backed Up by the Oracle VSS Writer.

To back up the entire database:

1. Start a SQL*Plus session on the target database and make sure the database is open `READ WRITE`.
2. Use a third-party VSS requester to select the `Oracle Database` component.
3. Create a snapshot of the database.

   Oracle VSS writer includes the server parameter file, control file, and data files in the snapshot. The online redo logs are not included in the snapshot.

Making Volume-Based Backups of an ARCHIVELOG Database

To make volume-based shadow copies of Oracle database when the database is open in read/write mode, the archived redo logs must be physically located on a separate volume from the volume containing the Oracle data files, control files, server parameter file, and online redo logs.

To back up the database and archived redo logs by volume:

1. Start a SQL*Plus session on the target database and make sure the database is open `READ WRITE`.
2. Use a third-party VSS requester to select the volumes where the data files, control files, and server parameter file are physically located.
3. Create a snapshot of the database files.

   Oracle VSS writer includes the server parameter file, control file, and data files in the snapshot. The online redo logs are not included in the snapshot. Note that you can restore the server parameter file individually, but the control files and data files must be always restored together.
4. Use a third-party VSS requester to select the volumes where all of the archived redo logs (or the fast recovery area) are physically located.
5. Create a snapshot of the archived redo logs.

About Backing Up a Database in NOARCHIVELOG Mode

Learn about backing up a database in NOARCHIVELOG mode.

For an Oracle database running in `NOARCHIVELOG` mode, the database must be in a consistent state when you create a VSS snapshot. Backups made while the database is open read/write are not supported.

- Making Component-Based Backups of a NOARCHIVELOG Database
  For an Oracle database in `NOARCHIVELOG` mode, the only supported component-based VSS snapshot is of `Oracle Database` when the type is full, default, or copy.
- Making Volume-Based Backups of a NOARCHIVELOG Database
  Learn how to make volume-based backups of a NOARCHIVELOG database.

Making Component-Based Backups of a NOARCHIVELOG Database

For an Oracle database in `NOARCHIVELOG` mode, the only supported component-based VSS snapshot is of `Oracle Database` when the type is full, default, or copy.

To back up the database by component:

1. Start a SQL*Plus session on the target database and place the database in a consistent state. For example, enter the following commands:

   ```
   SHUTDOWN
   STARTUP MOUNT
   ```
2. Use a third-party VSS requester to select the `Oracle Database` component.
3. Create a volume-based VSS snapshot.

   Oracle VSS writer includes the server parameter file, control file, and data files in the snapshot. The online redo logs are not included in the snapshot.

Making Volume-Based Backups of a NOARCHIVELOG Database

Learn how to make volume-based backups of a NOARCHIVELOG database.

To back up the database by volume:

1. Start a SQL*Plus session on the target database and place the database in a consistent state. For example, enter the following commands:

```
SHUTDOWN
STARTUP MOUNT
```

2. Use a third-party VSS requester to select the volumes where the data files, control files, and server parameter file are physically located.
3. Create a volume-based VSS snapshot.

   Oracle VSS writer includes the server parameter file, control file, and data files in the snapshot. The online redo logs are not included in the snapshot. Note that you can restore the server parameter file individually, but the control files and data files must be always restored together.

About Restoring and Recovering a Database

Learn how to restore and recover VSS snapshots. As in the case of backups, the procedure depends on the archiving mode of the database and the type of snapshot that you are restoring.

- About Restoring and Recovering a Database in ARCHIVELOG Mode
  You can select the components listed in Components Usable in a Restore Operation in a restore and recovery operation.
- Restoring a Database in NOARCHIVELOG Mode
  For an Oracle Database running in `NOARCHIVELOG` mode, archived redo logs are not generated. So, media recovery is not possible.

About Restoring and Recovering a Database in ARCHIVELOG Mode

You can select the components listed in Components Usable in a Restore Operation in a restore and recovery operation.

The table describes the validations that Oracle VSS writer performs for the components during the pre-restore phase, and the actions that it performs after the restore completes.

Table 9-3 Components Usable in a Restore Operation

Component	Pre-Restore Phase	PostRestore Phase	Section
Server Parameter File	Verifies that the database instance is not started. Otherwise, the writer returns a pre-restore failure.	Ensures that the database is started `NOMOUNT`. If the server parameter file is restored to the default location for the Oracle home, then the instance starts `NOMOUNT` automatically. Otherwise, you must set `ORA_SID_PFILE` to the location of the text-based initialization parameter file that points to the location of the server parameter file.	"Restoring the Server Parameter File "

Table 9-3 (Cont.) Components Usable in a Restore Operation

Component	Pre-Restore Phase	PostRestore Phase	Section
Control File	Verifies that the instance is either started `NOMOUNT` or not started. If the instance is not started, the writer either starts the instance with the `ORA_SID_PFILE` instance parameter file, or uses the initialization parameter file or server parameter file in the default location.	Mounts control file after replicating control file to all the current control file locations pointed to by the instance.	"Recovering from the Loss of All Control Files"
Tablespace or data file component	Verifies that the database must be mounted or the specified data files or tablespaces must be offline.	Performs complete recovery of these tablespaces or data files. The requester application can override the default recovery behavior.	"Recovering Tablespaces or Data Files"
All Tablespaces	Verifies that the database is mounted.	Extracts redo from the backup writer metadata document and performs incomplete recovery on all the restored data files up to the time of snapshot creation. The requester application can override the default recovery behavior.	"Recovering All Tablespaces"
Oracle Database	Verifies that the instance is not started.	Starts the database instance, mounts the control file, and performs recovery. See the descriptions of postrestore behavior for Server Parameter File, Control File, and All Tablespaces.	"Performing Disaster Recovery" and "Restoring Component-Based Backups of a NOARCHIVELOG Database"
Archived redo log or fast recovery area	None.	Does not perform default recovery of this component. Nevertheless, the requester application can run required RMAN commands.	

- Restoring the Server Parameter File
  Use this procedure to restore the server parameter file.
- Recovering from the Loss of All Control Files
  This procedure explains how to recover from the loss of all multiplexed control files.
- Recovering Tablespaces or Data Files
  This procedure explains how to recover from the loss of one or more tablespaces or data files. This procedure assumes that not all data files are lost.
- Recovering All Tablespaces
  This procedure explains how to recover from the loss of all tablespaces.
- Performing Disaster Recovery
  This procedure explains how to recover from the loss of the server parameter file, control file, and all data files.

Restoring the Server Parameter File

Use this procedure to restore the server parameter file.

To restore the server parameter file:

1. Select the component named `Server Parameter File` from a VSS snapshot.
2. Restore the server parameter file.

   Oracle VSS writer restores the server parameter file to the original location from where it was copied. You can also restore it to a new location.

Recovering from the Loss of All Control Files

This procedure explains how to recover from the loss of all multiplexed control files.

To recover from the loss of all control files:

1. Ensure that the database is in `NOMOUNT` state or can be started in `NOMOUNT` state by the Oracle VSS writer.
2. Select the component named `Control File` from a VSS snapshot.
3. Restore the component containing the lost control file.

   The Oracle VSS writer automatically mounts the database with the restored control files. If only the control file must be recovered, then the VSS requester application can ask the Oracle writer to perform complete recovery.
4. Restore and recover other database components if necessary.
5. Open the database with the `RESETLOGS` option.

Recovering Tablespaces or Data Files

This procedure explains how to recover from the loss of one or more tablespaces or data files. This procedure assumes that not all data files are lost.

To recover from the loss of all tablespaces or data files:

1. Ensure that the database is either mounted or open. If the database is open, then take the data files or tablespaces needing recovery offline with the `ALTER DATABASE ... OFFLINE` statement.
2. If the archived redo logs are required for recovery of the data files or tablespaces, then restore the archived redo logs.
3. Select the components from the VSS snapshot that contains the lost data files, or all data files in the lost tablespaces.
4. Restore the component containing the lost data files.

   The Oracle VSS writer automatically recovers the restored data files. If some archived logs are missing, then you can restore the logs and recover the data files with SQL*Plus or RMAN.
5. Bring the offline data files or tablespaces back online.

Recovering All Tablespaces

This procedure explains how to recover from the loss of all tablespaces.

To recover all data files:

1. Ensure that the database is mounted.
2. If the archived redo logs are required for recovery of the data files or tablespaces, then restore the archived redo logs.
3. Select the component named `All Tablespaces` from a VSS snapshot.
4. Restore the tablespaces.

   The Oracle VSS writer automatically recovers the restored data files. If some archived logs are missing, then you can restore the logs and recover the data files with SQL*Plus or RMAN.
5. Open the database.

Performing Disaster Recovery

This procedure explains how to recover from the loss of the server parameter file, control file, and all data files.

To perform disaster recovery:

1. Ensure that the instance is not started.
2. If the archived redo logs are required for recovery of the data files or tablespaces, then restore the archived redo logs.
3. Select the component named `Oracle Database` from a VSS snapshot.
4. Restore the database.

   The Oracle VSS writer automatically starts the instance, mount the database, and recovers the restored data files. If some archived logs are missing, then you can restore the logs and recover the data files with SQL*Plus or RMAN.
5. Open the database with the `RESETLOGS` option.

Restoring a Database in NOARCHIVELOG Mode

For an Oracle Database running in `NOARCHIVELOG` mode, archived redo logs are not generated. So, media recovery is not possible.

- Restoring Component-Based Backups of a NOARCHIVELOG Database
  Use this procedure to restore a component-based backup.
- Restoring Volume-Based Backups of a NOARCHIVELOG Database
  Use this procedure to restore a volume-based backup.

Restoring Component-Based Backups of a NOARCHIVELOG Database

Use this procedure to restore a component-based backup.

To restore a component-based backup:

1. Use a third-party VSS requester to select the `Oracle Database` component.

   The Oracle VSS writer automatically restores the data files and mounts the database.
2. Open the database with the `RESETLOGS` option.

Restoring Volume-Based Backups of a NOARCHIVELOG Database

Use this procedure to restore a volume-based backup.

To restore a volume-based backup:

1. Use a third-party VSS requester to select the volumes where the data files, control files, and server parameter file are physically located.
2. Restore all volumes where data files and logs are located.
3. Open the database with the `RESETLOGS` option.

About Integrating VSS with Third-Party Requester Applications

Oracle VSS writer allows third-party requester applications to control the behavior of recovery and backup sessions.

Third-party requester applications use VSS API `setBackupOptions` or `setRestoreOptions` to pass an appropriate string to the writer. The writer uses `getBackupOptions` or `getRestoreOptions` to get the string set from the requester to perform the pre or post backup and restore actions.

- Running Writer Control Commands
  The writer control commands are applicable to all the restored components during the postrestore phase.
- Controlling Commands for Database or All Tablespaces Component
  The `POST_WTRCMD=UNTIL_SNAPSHOT` command instructs the writer to perform recovery to the snapshot creation time.

Running Writer Control Commands

The writer control commands are applicable to all the restored components during the postrestore phase.

The format is as follows:

```
OP1=CMD1, OP2=CMD2, . . .
```

Run the commands in the following sequence:

1. `POST_WTRCMD=NORECOVER`

   This command instructs the writer to not perform any postrestore recovery activities defined in the default postrestore recovery operations for the restored component. Otherwise, the postrestore phase default actions are performed.
2. `POST_RMANCMD=`*`cmdstr`*

   This command instructs the writer to run specific RMAN commands, instead of the default operations, after the current operation.
3. `PRE_SQLCMD=`*`cmdstr`*

This command instructs the writer to run specific SQL commands in `OnPrepareBackup` or `OnPreRestore` callback, before performing any other validations. The command is used to stop MRP on a standby database before VSS snapshot is created or to shut down database instance creating a cold backup of the database.

4. `POST_SQLCMD=`*`cmdstr`*

   This command instructs the writer to run specific SQL commands in PostSnapshot or PostRestore callback. This command is used to restart MRP on standby database after VSS snapshot is created or to restart the database instance after the cold backup of the database is performed.

Controlling Commands for Database or All Tablespaces Component

The `POST_WTRCMD=UNTIL_SNAPSHOT` command instructs the writer to perform recovery to the snapshot creation time.

Run the following command:

```
POST_WTRCMD=UNTIL_SNAPSHOT
```

This command instructs the writer to perform recovery to the snapshot creation time. The writer extracts the system change number of the redo logs stored in the database component and performs recovery until the system change number.

About Duplicating a Database

If your VSS shadow copies are transportable, then you can use these shadow copies to duplicate the primary database.

In the context of this chapter, duplication refers to the creation of a new database out of the shadow copies for a different database. A duplicate database created from shadow copies can either be a nonstandby database or a standby database for use in a Data Guard environment. Note that RMAN duplication, which makes use of the `DUPLICATE` command, is a different procedure.

- Creating a Nonstandby Database from Shadow Copies
  Use this procedure to create a nonstandby database from shadow copies.
- Creating a Standby Database From Shadow Copies
  Use this procedure to create a standby database from shadow copies.

Creating a Nonstandby Database from Shadow Copies

Use this procedure to create a nonstandby database from shadow copies.

This section assumes that you are duplicating the database on a host with the same file system structure as the primary database.

To create a nonstandby database from shadow copies:

1. Restore the database on the new host.
2. Start a SQL*Plus session on the duplicate database and obtain the DBID. You can query the DBID as follows:

   ```
   SELECT DBID FROM V$DATABASE;
   ```

3. Shut down the database consistently. You can shut down the database as follows:

   ```
   SHUTDOWN;
   ```

4. Use the DBNEWID utility to change the DBID.
5. Open the database.
6. Start a SQL*Plus session on the duplicate database and query the DBID. You can query the DBID as follows:

   ```
   SELECT DBID FROM V$DATABASE;
   ```

> **See Also:**
>
> *Oracle Database Utilities* for information about how to use DBNEWID

Related Topics

- Performing Disaster Recovery
  This procedure explains how to recover from the loss of the server parameter file, control file, and all data files.

Creating a Standby Database From Shadow Copies

Use this procedure to create a standby database from shadow copies.

This section assumes that you have created a standby database on a host with the same file system structure as the primary database. This section also assumes that you have read *Oracle Data Guard Concepts and Administration* and are familiar with standby database creation and maintenance.

To create a standby database from shadow copies:

1. Restore the database on the standby host.
2. Start a SQL*Plus session on the new database and a new standby control file must be obtained from primary database. You can create the control file with the SQL statement `ALTER DATABASE CREATE STANDBY CONTROLFILE`.
3. Start the instance and mount the standby control file.

Related Topics

- Performing Disaster Recovery
  This procedure explains how to recover from the loss of the server parameter file, control file, and all data files.

> **See Also:**
>
> *Oracle Data Guard Concepts and Administration*

10

Authenticating Database Users with Windows

Learn about the authentication of Oracle Database users with Windows operating systems.

- Overview of Windows Native Authentication
  Oracle Database can use Windows user login credentials to authenticate database users.
- About Windows Authentication Protocols
  The Windows native authentication adapter works with Windows authentication protocols to enable access to Oracle Database.
- About User Authentication and Role Authorization Methods
  Describes how user login credentials are authenticated and database roles are authorized in Windows domains.
- Overview of Operating System Authentication Enabled at Installation
  When you install Oracle Database, a special Windows local group called `ORA_DBA` is created (if it does not already exist from an earlier Oracle Database installation) and the Oracle Installation User is automatically added to it.

Overview of Windows Native Authentication

Oracle Database can use Windows user login credentials to authenticate database users.

Benefits include:

- Enabling users to connect to Oracle Database without supplying a username or password
- Centralizing Oracle Database user authentication and role authorization information in Windows, which frees Oracle Database from storing or managing user passwords or role information

The Windows native authentication adapter (automatically installed with Oracle Net Services) enables database user authentication through Windows. This enables client computers to make secure connections to Oracle Database on a Windows server. The server then permits the user to perform database actions on the server.

> **Note:**
>
> Current user database links are not supported with Windows native authentication.

See Also:

- *Oracle Database Security Guide*
- *Oracle Internet Directory Administrator's Guide*

About Windows Authentication Protocols

The Windows native authentication adapter works with Windows authentication protocols to enable access to Oracle Database.

The NTS authentication adapter no longer supports the use of NTLM to authenticate Windows domain users. Thus the NTS cannot be used to authenticate users in old Windows NT domains or domains with old Windows NT domain controllers. However, local connections and Oracle Database services running as a Windows Local User continues to be authenticated using NTLM.

If you use the Windows Local User Account as the Oracle Home User for an Oracle Database home, then Windows Native Authentication (NTS) cannot be used for authenticating Windows domain users or users from remote computers.

Client server must not specify an authentication protocol while trying to connect to Oracle Database. Instead, Oracle Database determines the protocol to use which is completely transparent to the user. The only Oracle Database requirement is to ensure that the parameter `SQLNET.AUTHENTICATION_SERVICES` in client and database server contains `nts` in the following file:

`ORACLE_HOME``\network\admin\sqlnet.ora`

This is the default setting for both client computer and database server after installation.

In a typical installation, Oracle Database network includes client computers and database servers, and computers on this network may use different Oracle Database software releases on different domains of Windows operating systems. This combination of different releases means that the authentication protocol being used can vary.

Related Topics

- About Configuring Oracle Database to Communicate with Oracle ASM
  Oracle Databases that use Oracle Automatic Storage Management (Oracle ASM) and the databases that are managed by Oracle Grid infrastructure must use Windows native authentication, which is enabled by default.

See Also:

Your operating system documentation for more information on authentication protocol

About User Authentication and Role Authorization Methods

Describes how user login credentials are authenticated and database roles are authorized in Windows domains.

User authentication and role authorization are defined in User Authentication and Role Authorization Defined.

Table 10-1 User Authentication and Role Authorization Defined

Feature	Description	More Information
User authentication	Process by which the database uses the user's Windows login credentials to authenticate the user.	*Oracle Database 2 Day DBA*
Role authorization	Process of granting an assigned set of roles to authenticated users.	*Oracle Database 2 Day DBA*

Oracle Database supports user authentication and role authorization in Windows domains. Basic Features of User Authentication and Role Authorization describes these basic features.

Table 10-2 Basic Features of User Authentication and Role Authorization

Feature	Description
Authentication of external users	Users are authenticated by the database using the user's Windows login credentials enabling them to access Oracle Database without being prompted for additional login credentials.
Authorization of external roles	Roles are authorized using Windows local groups. Once an external role is created, you can grant or revoke that role to a database user. Initialization parameter `OS_ROLES` is set to `false` by default. You must set `OS_ROLES` to `true` to authorize external roles.

- About Using Authentication and Authorization Methods
  User Authentication and Role Authorization Methods describes user authentication and role authorization methods to use based on your Oracle Database environment:

About Using Authentication and Authorization Methods

User Authentication and Role Authorization Methods describes user authentication and role authorization methods to use based on your Oracle Database environment:

Table 10-3 User Authentication and Role Authorization Methods

Method	Database Environment
Enterprise users and roles	You have many users connecting to multiple databases. Enterprise users have the same identity across multiple databases. Enterprise users require use of a directory server. Use enterprise roles in environments where enterprise users assigned to these roles are located in many geographic regions and must access multiple databases. Each enterprise role can be assigned to multiple enterprise user in the directory. If you do not use enterprise roles, then you must assign database roles manually to each database user. Enterprise roles require use of a directory server.
External users and roles	You have a smaller number of users accessing a limited number of databases. External users must be created individually in each database and do not require use of a directory server. External roles must also be created individually in each database, and do not require use of a directory server. External roles are authorized using group membership of the users in local groups on the system.

See Also:

Oracle Database Enterprise User Security Administrator's Guide for more information on Enterprise users and roles

Overview of Operating System Authentication Enabled at Installation

When you install Oracle Database, a special Windows local group called `ORA_DBA` is created (if it does not already exist from an earlier Oracle Database installation) and the Oracle Installation User is automatically added to it.

Members of local group `ORA_DBA` automatically receive the SYSDBA privilege. The `ORA_DBA` group is also created for each Oracle home called `ORA_`*`HOMENAME`*`_DBA` group. This group is automatically populated with the Oracle Home User for the Oracle home.

Note:

If you use a domain account for database administration, then that domain account must be granted local administrative privileges and ORA_DBA membership explicitly. It is not sufficient for the domain account to inherit these memberships from another group. You must ensure that the user performing the installation is in the same domain as this domain account. If not, it results in an NTS authentication failure.

Membership in `ORA_DBA` enables you to:

- Connect to local Oracle Database servers without a password with the command

  ```
  SQL> CONNECT / AS SYSDBA
  ```

- Connect to remote Oracle Database servers without a password with the command

  ```
  SQL> CONNECT /@net_service_name AS SYSDBA
  ```

  where *`net_service_name`* is the net service name of the remote Oracle Database server

- Perform database administration procedures such as starting and shutting down local databases
- Add additional Windows users to `ORA_DBA`, enabling them to have the `SYSDBA` privilege

11

Administering External Users and Roles on Windows

External users and roles are in general defined by something external to Oracle Database.

In a Windows environment, they are defined by the operating system.

Learn about the external user and external role creation and management using a combination of Oracle Database command-line tools, Registry Editor, and other Windows tools.

- Overview of Manually Administering External Users and Roles
  Manually configure administrators, operators, users, and roles to be authenticated by the operating system.

> **See Also:**
>
> *Oracle Database Enterprise User Security Administrator's Guide* for more information about tools available for administering enterprise users and roles

Overview of Manually Administering External Users and Roles

Manually configure administrators, operators, users, and roles to be authenticated by the operating system.

- About Manually Creating an External Operating System User
  Describes how to authenticate external operating system users (not database administrators) using Windows, so that a password is not required when accessing the database.
- Overview of Manually Granting Administrator, Operator, and Task-Specific Privileges for Databases
  Describes how to enable Windows to grant the database administrator (`SYSDBA`), database operator (`SYSOPER`), database administrator for ASM (`SYSASM`), and new task-specific and less privileged than the `ORA_DBA`/`SYSDBA` system privileges to administrators.
- Overview of Manually Creating an External Role
  Describes how to grant Oracle Database roles to users directly through Windows (known as external roles).
- About Manually Migrating Users
  You can migrate local or external users to enterprise users with User Migration Utility.

About Manually Creating an External Operating System User

Describes how to authenticate external operating system users (not database administrators) using Windows, so that a password is not required when accessing the database.

When you use Windows to authenticate external operating system users, your database relies solely on the operating system to restrict access to database user names.

Note that if a Windows Local User is used as the Oracle Home User for an Oracle home, then external user authentication of the Windows Local users is only supported from the same computer. Oracle recommends using Windows Domain User or Windows built-in user as the Oracle Home User to support external authentication of the Windows Domain User from the same computer or a different computer.

In the following procedure, two Windows user names are authenticated:

- Local user `jones`
- Domain user `jones` on domain `sales`

Local user `jones` logs into its local Windows client computer to access an Oracle Database server, which can be on a different computer. To access other databases and resources on other computers, the local user must provide a user name and password each time.

Domain user `jones` on domain `sales` logs into a `sales` domain that includes many other Windows computers and resources, one of which contains an Oracle Database server. The domain user can access all the resources the domain provides with a single user name and password.

- Performing External User Authentication Tasks on the Oracle Database Server
  Use this procedure to perform external user authentication tasks.
- Performing External User Authentication Tasks on the Client Computer
  Use this procedure to perform external user authentication tasks on the client computer.

Performing External User Authentication Tasks on the Oracle Database Server

Use this procedure to perform external user authentication tasks.

Perform the following external user authentication tasks on the Oracle Database server:

1. Add parameter `OS_AUTHENT_PREFIX` to your `init.ora` file.

   The `OS_AUTHENT_PREFIX` value is prefixed to local or domain user names attempting to connect to the server with the user's operating system name and password. The prefixed user name is compared with Oracle Database user names in the database when a connection request is attempted. Using parameter `OS_AUTHENT_PREFIX` with Windows native authentication methods is the recommended method for performing secure, trusted client connections to your server.

2. Set a value for `OS_AUTHENT_PREFIX`. Your choices are:

   - Any character string

     If you specify `xyz`, as in this procedure's example, then `xyz` is prefixed to the beginning of the Windows user name (for example, `xyzjones` for local user `jones` or `xyzsales\jones` for domain user `jones` on domain `sales`). String values are case insensitive.

   - `""` (two double quotes with no space between)

This option is recommended, because it eliminates the need for any prefix to Windows user names (for example, `jones` for local user `jones` or `sales\jones` for domain user `jones` on domain `sales`).

- No value specified

  If you do not specify a value for `OS_AUTHENT_PREFIX`, it defaults to `OPS$` (for example, `OPS$jones` for local user `jones` or `OPS$sales\jones` for domain user `jones` on domain `sales`).

> **Note:**
>
> On Windows and Linux, create a database user name with characters in upper case for successful authentication. Authentication fails when you use characters with lower case. For example, authentication fails when creating a database user name with characters in lower case `ops$sales\jones`, but is successful when creating a database user name with upper case characters such as `OPS$SALES\JONES`.

3. Create a Windows local user name for `jones` with the Computer Management tool, or create a Windows domain user name for `jones` with Active Directory Users and Computers (if the appropriate name does not currently exist). See your operating system documentation for detailed instructions.
4. Ensure that parameter `SQLNET.AUTHENTICATN_SERVICES` in file `sqlnet.ora` contains `nts`.
5. Start SQL*Plus:

   ```
   C:\> sqlplus /NOLOG
   ```

6. Connect to the database with the SYSTEM database administrator (DBA) name:

   ```
   SQL> CONNECT SYSTEM
   Enter password: system_password
   ```

   Unless you have changed it, the `SYSTEM` password is `MANAGER` by default.

7. Create a local external user by entering:

   ```
   SQL> CREATE USER xyzjones IDENTIFIED EXTERNALLY;
   ```

   where `xyz` is the value you chose for initialization parameter `OS_AUTHENT_PREFIX`, and `jones` is the Windows local user name.

8. Grant a local external user database roles by entering:

   ```
   SQL> GRANT DBA TO xyzjones;
   ```

> **Note:**
>
> External authentication of Windows Local users is supported from the same computer only. While external authentication of Windows Domain user is supported from the same computer or a different computer.

9. Create a domain external user by entering:

   ```
   SQL> CREATE USER "XYZSALES\JONES" IDENTIFIED EXTERNALLY;
   ```

where XYZ is the value you chose for initialization parameter OS_AUTHENT_PREFIX, and SALES\JONES is the domain name and Windows domain user name. Double quotes are required and the entire syntax must be in uppercase.

10. Grant a domain external user database roles by entering:

```
SQL> GRANT DBA TO "XYZSALES\JONES";
```

Double quotes are required and the entire syntax must be in uppercase.

11. Log on to the Windows system using the Windows local user jones or domain user SALES\JONES.
12. Connect to the database with the SYSDBA name:

```
SQL> CONNECT / AS SYSDBA
```

13. Shut down the database:

```
SQL> SHUTDOWN
```

14. Restart the database:

```
SQL> STARTUP
```

This causes the change to parameter OS_AUTHENT_PREFIX to take effect.

Performing External User Authentication Tasks on the Client Computer

Use this procedure to perform external user authentication tasks on the client computer.

Perform the following external user authentication tasks on the client computer:

1. Ensure that parameter SQLNET.AUTHENTICATN_SERVICES in file sqlnet.ora contains nts.
2. Use Oracle Net Configuration Assistant to configure a network connection from your client computer to the Windows server on which Oracle Database is installed.
3. Start SQL*Plus:

```
C:\> sqlplus /NOLOG
```

4. Connect to your Windows server:

```
SQL> CONNECT /@connect_identifier
```

where *connect_identifier* is the net service name for Oracle Database.

Oracle Database searches the data dictionary for an automatic login user name corresponding to the Windows local or domain user name, verifies it, and enables connection as xyzjones or xyzsales\jones.

5. Verify that you have connected to Oracle Database as domain user jones by viewing the roles assigned.

```
SQL> SELECT * FROM USER_ROLE_PRIVS;
```

which outputs for local user jones:

```
USERNAME                       GRANTED_ROLE                   ADM DEF OS_
------------------------------ ------------------------------ --- --- ---
XYZJONES                       DBA                            NO  YES NO
1 row selected.
```

or, for domain user jones:

```
USERNAME                       GRANTED_ROLE                   ADM DEF OS_
------------------------------ ------------------------------ --- --- ---
XYZSALES\JONES                 DBA                            NO  YES NO
1 row selected.
```

Because the Oracle Database user name is the whole name xyzjones or xyzsales\jones, each object created by xyzjones or xyzsales\jones (that is, table, view, index, and so on) is prefixed by this name. For another user to reference the table shark owned by xyzjones, for example, the user must enter:

```
SQL> SELECT * FROM xyzjones.shark
```

> **Note:**
>
> Automatic authorization is supported for all Oracle Net protocols.

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

Related Topics

- Performing External User Authentication Tasks on the Oracle Database Server
  Use this procedure to perform external user authentication tasks.

Overview of Manually Granting Administrator, Operator, and Task-Specific Privileges for Databases

Describes how to enable Windows to grant the database administrator (SYSDBA), database operator (SYSOPER), database administrator for ASM (SYSASM), and new task-specific and less privileged than the ORA_DBA/SYSDBA system privileges to administrators.

With these privileges, the administrator can issue the following commands from a client computer and connect to Oracle Database without entering a password:

```
SQL> CONNECT / AS SYSOPER
SQL> CONNECT / AS SYSDBA
SQL> CONNECT / AS SYSASM
SQL> CONNECT / AS SYSBACKUP
SQL> CONNECT / AS SYSDG
SQL> CONNECT / AS SYSKM
```

To enable this feature, a Windows local or a domain user name of the administrator must belong to one of the Windows local groups listed in Windows Local Groups with SYSDBA, SYSOPER, SYSASM, SYSDG, SYSBACKUP, and SYSKM Privileges.

Table 11-1 Windows Local Groups with SYSDBA, SYSOPER, SYSASM, SYSDG, SYSBACKUP, and SYSKM Privileges

Local Group	System Privileges
ORA_OPER	SYSOPER privileges for all databases on a computer
ORA_DBA Note	SYSDBA privileges for all databases on a computer
ORA_*SID*_OPER	SYSOPER privileges for a single database (identified by *SID*)
ORA_*SID*_DBA	SYSDBA privileges for a single database (identified by *SID*)
ORA_*HOMENAME*_DBA	SYSDBA privileges for all database instances of the specified Oracle home.
ORA_*HOMENAME*_OPER	SYSOPER privileges for starting up and shutting down all databases instances that run from a specified Oracle home.
ORA_*HOMENAME*_SYSDG	SYSDG privilege for all database instances that run from the particular Oracle home
ORA_*HOMENAME*_SYSBACKUP	SYSBACKUP privilege for all database instances that run from the particular Oracle home
ORA_*HOMENAME*_SYSKM	SYSKM privilege for all database instances that run from the particular Oracle home
ORA_ASMADMIN	SYSASM privileges for all ASM instances on a computer
ORA_ASMDBA	SYSDBA privileges for all ASM instances on a computer
ORA_ASMOPER	SYSOPER privileges for all ASM instances on a computer

Note

All the groups mentioned in the table above are automatically created during installation and the Oracle Home User is automatically added to ORA_*HOMENAME*_DBA group. See section "Overview of Operating System Authentication Enabled at Installation" for information.

See Also:

- *Oracle Database Administrator's Guide*
- *Oracle Automatic Storage Management Administrator's Guide*

The manual procedure for enabling administrators to connect as SYSOPER, SYSDBA, SYSASM, SYSDG, SYSKM, or SYSBACKUP without a password is divided into two sets of tasks performed on different computers:

- Running System Privilege Authentication Tasks on the Oracle Database Server
  Learn about running system privilege authentication tasks on the Oracle Database server.
- Running System Privilege Authentication Tasks on the Client Computer
  Learn about running system privilege authentication tasks on the client computer.

Running System Privilege Authentication Tasks on the Oracle Database Server

Learn about running system privilege authentication tasks on the Oracle Database server.

Perform the following steps:

1. Add your administrator user names to this group. The client logs in using one of these user names so that it is granted the required system privilege.

   > **See Also:**
   >
   > Your operating system documentation for instructions on managing users and groups

2. Ensure that parameter `SQLNET.AUTHENTICATN_SERVICES` in file `sqlnet.ora` contains `nts`.

Running System Privilege Authentication Tasks on the Client Computer

Learn about running system privilege authentication tasks on the client computer.

Perform the following steps:

1. Log in as a Windows domain user who is a member of one of the Windows local group on the server, according to the system privilege that you want Windows to grant. The administrator must add this domain user to the required Windows local group. Windows local group membership is created on the server system where Oracle Database runs.
2. Ensure that the parameter `SQLNET.AUTHENTICATN_SERVICES` in file `sqlnet.ora` contains `nts`.
3. Use Oracle Net Configuration Assistant to configure a network connection from your client computer to the Windows server on which Oracle Database is installed.
4. Start SQL*Plus:

   ```
   C:\> sqlplus /NOLOG
   ```

5. Connect to Oracle Database:

   ```
   SQL> SET INSTANCE net_service_name
   ```

   where *net_service_name* is the Oracle Net net service name for Oracle Database.

6. Enter either of the following SQL*Plus commands so that you connect to the database with the required system privilege:

   ```
   SQL> CONNECT / AS SYSOPER
   SQL> CONNECT / AS SYSDBA
   SQL> CONNECT / AS SYSASM
   SQL> CONNECT / AS SYSDG
   SQL> CONNECT / AS SYSKM
   SQL> CONNECT / AS SYSBACKUP
   ```

   You are now connected to the Windows server. If you connect with `SYSDBA`, you are given DBA privileges.

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

Related Topics

- Running System Privilege Authentication Tasks on the Oracle Database Server
  Learn about running system privilege authentication tasks on the Oracle Database server.

Overview of Manually Creating an External Role

Describes how to grant Oracle Database roles to users directly through Windows (known as external roles).

When you use Windows to authenticate users, Windows local groups can grant these users external roles.

All privileges for these roles are active when the user connects. When using external roles, all roles are granted and managed through the operating system. You cannot use both external roles and Oracle Database roles at the same time.

Consider the following example. With external roles enabled, you log on to a Windows domain with domain user name `sales\jones` (`sales` is the domain name and `jones` is the domain user name). You then connect to Oracle Database as Oracle Database user `smith`. In this case, you receive the roles granted to `sales\jones` but *not* the roles granted to `smith`.

The procedure for manually creating an external role is divided into two sets of authorization tasks performed on different computers:

- Performing External Role Authorization Tasks on the Oracle Database Server
  Learn how to perform external role authorization tasks on the Oracle Database server.
- Performing External Role Authorization Tasks on the Client Computer
  Learn how to perform external role authorization tasks on the client computer.

Performing External Role Authorization Tasks on the Oracle Database Server

Learn how to perform external role authorization tasks on the Oracle Database server.

Perform the following steps:

1. Add initialization parameter `OS_ROLES` to the `init.ora` file.
2. Set `OS_ROLES` to `true`.

   The default setting for this parameter is `false`.
3. Ensure that parameter `SQLNET.AUTHENTICATN_SERVICES` in file `sqlnet.ora` contains `nts`.
4. Start SQL*Plus:

   ```
   C:\> sqlplus /NOLOG
   ```
5. Connect to your Windows server:

   ```
   SQL> CONNECT / AS SYSDBA
   ```

6. Create a new database role. You can give this new role whatever name you want. In this example the role is named DBSALES3:

```
SQL> CREATE ROLE DBSALES3 IDENTIFIED EXTERNALLY;
```

7. Grant to DBSALES3 whatever Oracle Database roles are appropriate to your database environment:

```
SQL> GRANT DBA TO DBSALES3 WITH ADMIN OPTN;
```

8. Connect to the database as SYSDBA:

```
SQL> CONNECT / AS SYSDBA
```

9. Shut down the database:

```
SQL> SHUTDOWN
```

10. Restart the database:

```
SQL> STARTUP
```

11. Create a Windows local group with the following syntax:

```
ORA_sid_rolename[_D][_A]
```

For this command, note the following:

- *sid* identifies the database instance
- *rolename* identifies the database role granted
- D indicates that this database role is to be a default role of the database user
- A indicates that this database role includes ADMIN OPTN

Characters D and A are optional. If specified, they must be preceded by an underscore.

For this example, ORA_orcl_dbsales3_D is created.

12. Add one or more Windows local or domain user names to this group.

You can create multiple database roles and grant them to several possible Windows groups with differing options, as shown in the following table. Users connecting to the ORCL instance and authenticated by Windows as members of all four of these Windows local groups has the privileges associated with dbsales3 and dbsales4 by default (because of option _D). If these users first connect as members of dbsales3 or dbsales4 and use the SET ROLE command, then they can also gain access to database roles dbsales1 and dbsales2. But if these users try to connect with dbsales1 or dbsales2 without first connecting with a default role, they are unable to connect. Finally, these users can grant dbsales2 and dbsales4 to other roles (because of option _A).

Database Roles	Windows Groups
dbsales1	ORA_ORCL_dbsales1
dbsales2	ORA_ORCL_dbsales2_a
dbsales3	ORA_ORCL_dbsales3_d
dbsales4	ORA_ORCL_dbsales4_da

> **Note:**
>
> When Oracle Database converts the group name to a role name, it changes the name to uppercase.

> **See Also:**
>
> Your operating system documentation for instructions on managing users and groups

Performing External Role Authorization Tasks on the Client Computer

Learn how to perform external role authorization tasks on the client computer.

Perform the following steps:

1. Create a Windows local or a domain user name with the same user name and password that exist on the Windows server (if the appropriate user name does not currently exist).
2. Ensure that parameter `SQLNET.AUTHENTICATN_SERVICES` in file `sqlnet.ora` contains `nts`.
3. Use Oracle Net Configuration Assistant to configure a network connection from your client computer to Oracle Database.
4. Start SQL*Plus:

   ```
   C:\> sqlplus /NOLOG
   ```

5. Connect to the correct instance:

   ```
   SQL> SET INSTANCE connect_identifier
   ```

   where *connect_identifier* is the net service name for the Oracle Database connection that you created in Step 3.

6. Connect to Oracle Database:

   ```
   SQL> CONNECT SMITH
   Enter password: password
   ```

   You are connected to the Windows server over net service with Oracle Database user name `smith`. Roles applied to Oracle Database user name `smith` consist of all roles defined for the Windows user name that were previously mapped to the database roles (in this case, `ORA_DBSALES3_D`). All roles available under an authenticated connection are determined by the Windows user name and the Oracle-specific Windows local groups to which the user belongs (for example, `ORA_`*SID*`_DBSALES1` or `ORA_`*SID*`_DBSALES4_DA`).

> **Note:**
>
> OSDBA and OSOPER are the generic names for the two special operating system groups that control database administrator logins when using operating system authentication.

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

Related Topics

- Overview of Manually Granting Administrator, Operator, and Task-Specific Privileges for Databases
  Describes how to enable Windows to grant the database administrator (SYSDBA), database operator (SYSOPER), database administrator for ASM (SYSASM), and new task-specific and less privileged than the ORA_DBA/SYSDBA system privileges to administrators.

About Manually Migrating Users

You can migrate local or external users to enterprise users with User Migration Utility.

Migrating from a database user model to an enterprise user model provides solutions to administrative, security, and usability challenges in an enterprise environment. In an enterprise user model, all user information is moved to an LDAP directory service, which provides the following benefits:

- Centralized storage and management of user information
- Centralized user authentication
- Enhanced security

User Migration Utility is a command-line tool. Its syntax is of the form:

```
C:\ umu parameters
```

To get a list of User Migration Utility parameters, enter:

```
C:\ umu help=yes
```

> **See Also:**
>
> *Oracle Database Enterprise User Security Administrator's Guide* in "Using the User Migration Utility."

12

Storing Oracle Wallets in the Windows Registry

Learn about storing and retrieving of Oracle Wallets in the Windows registry.

About Storing Private Keys and Trust Points

Oracle Wallets store private keys, trust points, and digital certificates used in public key applications for authentication and encryption.

Oracle Wallet Manager creates and manages Oracle Wallets. Oracle public key applications use obfuscated Oracle Wallets for authentication and encryption.

About Storing User's Profile

In Windows domain, a user's profile is stored on the local computer.

When a local user logs on to that computer, that user's profile on the local computer is uploaded into the user profile in that computer's registry. When a user logs out, that user's profile stored on the local file system is updated, ensuring that the Windows Domain user or the Windows Local user always has the most recent user profile version.

About Registry Parameters for Wallet Storage

Parameter `WALLET_LOCATN` in file `sqlnet.ora` specifies the location of the obfuscated Oracle Wallet for use by Oracle PKI applications.

For example, the `WALLET_LOCATN` parameter for storing an Oracle Wallet in the registry in:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS\SALESAPP
```

is located in:

```
WALLET_LOCATN =  (SOURCE= (METHOD=REG) (METHOD_DATA= (KEY=SALESAPP)))
```

Continuing the example, the encrypted Oracle Wallet is stored in the registry in:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS\SALESAPP\EWALLET.P12
```

and the changed Oracle Wallet stored in:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS\SALESAPP\CWALLET.SSO
```

On Windows operating systems, if there is no value specified for parameter `WALLET_LOCATN`, then Oracle PKI applications first look for the changed wallet in registry key:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS\DEFAULT
```

If no obfuscated wallet is found there, Oracle PKI applications look for it in the file system of the local computer at location:

```
%USERPROFILE%\ORACLE\WALLETS
```

Regardless of location, wallets are always stored in the same format. All functionality is the same except for the location of the wallets.

- About Oracle Wallet Manager
  Oracle Wallet Manager creates and manages Oracle Wallets.

About Oracle Wallet Manager

Oracle Wallet Manager creates and manages Oracle Wallets.

If you want to use the Windows registry for Oracle Wallets, then you must select the Use Windows System Registry check box. If Windows System Registry is selected, then the tool shows a list of existing keys when it opens a wallet or saves a new wallet. The list appears in:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS
```

You can select one of the existing locations or enter the name for a new location (registry key). If you enter a new key called `key1`, for example, then the tool creates the following registry key:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS\KEY1
```

The encrypted wallet is stored in:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS\KEY1\EWALLET.P12
```

The obfuscated wallet is stored in:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS\KEY1\CWALLET.SSO
```

If you do not select the Use Windows System Registry check box, then the tool displays all the available drives and directories on the local computer. You can select one of the existing directories or enter a new directory. The tool stores the encrypted or the obfuscated wallet in the selected directory or creates the directory if it does not exist.

> **Note:**
>
> Oracle Wallet Manager (OWM) is deprecated with Oracle Database 21c.

- About Sharing Wallets and sqlnet.ora Files Among Multiple Databases
  Multiple nonreplicated databases cannot share wallets.

> **See Also:**
>
> *Oracle Database Enterprise User Security Administrator's Guide* for more information about using Oracle Wallet Manager

About Sharing Wallets and sqlnet.ora Files Among Multiple Databases

Multiple nonreplicated databases cannot share wallets.

If `sqlnet.ora` files contain wallet location information, then databases also cannot share `sqlnet.ora` files.

The only exception to this rule is password-authenticated or Kerberos-authenticated enterprise user security with default database-to-directory connection configuration that uses passwords. This configuration keeps database wallets in the default location, where Database Configuration Assistant creates them. In this situation, no wallet location information is stored in the `sqlnet.ora` file, and the wallet can be shared among multiple databases.

> **Note:**
>
> If SSL is used for enterprise user authentication, then the wallet location must be specified in the `sqlnet.ora` file. So, `sqlnet.ora` files cannot be shared by multiple databases for SSL-authenticated enterprise users.

13

Oracle PKI Integration with Windows

Describes Windows public key infrastructure.

Learn about the integration of Oracle public key infrastructure (PKI) with public key infrastructure (Windows PKI) on Windows operating systems.

- About Oracle Public Key Infrastructure
  Learn about Oracle public key infrastructure (PKI).
- About Windows Public Key Infrastructure
  Learn about Windows public key infrastructure.

About Oracle Public Key Infrastructure

Learn about Oracle public key infrastructure (PKI).

Oracle public key infrastructure (PKI) is used by Oracle Enterprise Security Manager, LDAP-enabled Oracle Enterprise Manager, Oracle's Secure Socket Layer (SSL) authentication, Oracle Database, and Oracle WebLogic Server.

> **Note:**
>
> - Oracle Security Manager is installed only with Oracle Database Client.
> - Microsoft Windows does not support an SSL key length of less than 1024 bits any longer. Attempting to use these smaller key lengths with Oracle software on Windows returns an error.

Oracle PKI includes the following components:

- Oracle Wallets
- Oracle Wallet Manager (OWM)

Oracle Wallets store digital certificates, trust points, and private keys used in public key applications for encryption, decryption, digital signature, and verification.

Related Topics

- https://support.microsoft.com/en-us/help/2868626

About Windows Public Key Infrastructure

Learn about Windows public key infrastructure.

> **Note:**
>
> Microsoft Certificate Store integration works only with digital certificates that use Microsoft Enhanced Cryptographic Provider. To create these certificates, you must install Windows High Encryption Pack and select Microsoft Enhanced Cryptographic Provider. Also, when there are multiple certificates available for the same key usage (signature/key exchange), the first certificate retrieved is used for Oracle SSL.

- About Microsoft Certificate Stores
  Microsoft Certificate Stores are repositories for storing digital certificates and their associated properties.
- About Microsoft Certificate Services
  Learn about Microsoft Certificate Services (MCS) and its associated modules.
- Using Microsoft Certificate Stores with Oracle PKI Applications
  Wallet Resource Locator (WRL) specifies that parameter `WALLET_LOCATN` in file `sqlnet.ora` identifies a particular PKI.

About Microsoft Certificate Stores

Microsoft Certificate Stores are repositories for storing digital certificates and their associated properties.

Windows operating systems store digital certificates and certificate revocation lists in logical and physical stores. Logical stores contain pointers to public key objects in physical stores. Logical stores enable public key objects to be shared between users, computers, and services without requiring storage of duplicates of objects for each user, computer, or services. Public key objects are physically stored in the certificate authority of the local computer or, for some user certificates, in Active Directory. Standard system certificate stores defined by Microsoft include:

- MY or Personal
- CA
- ROOT

MY or Personal holds a user's certificates for which the associated private key is available. The MY certificate store maintains certificate properties that indicate the Cryptographic Service Provider (CSP) associated with the private key. An application uses this information to obtain the private key from the CSP for the associated certificate. CA holds issuing or intermediate certificate authority (CA) certificates. ROOT holds only self-signed CA certificates for trusted root CAs.

About Microsoft Certificate Services

Learn about Microsoft Certificate Services (MCS) and its associated modules.

Microsoft Certificate Services (MCS) consists of the following modules:

- Server Engine
- Intermediary

- Policy

Server Engine handles all certificate requests. It interacts with other modules at each processing stage to ensure that the proper action is taken based on the state of the request. The Intermediary module receives requests for new certificate from clients and then submits them to Server Engine. The Policy module contains the set of rules controlling the issuance of certificates. This module may be upgraded or customized as needed.

Using Microsoft Certificate Stores with Oracle PKI Applications

Wallet Resource Locator (WRL) specifies that parameter `WALLET_LOCATN` in file `sqlnet.ora` identifies a particular PKI.

You can choose between using Oracle Wallet or Microsoft Certificate Stores by setting parameter `WALLET_LOCATN` in `sqlnet.ora`. To use credentials from Microsoft Certificate Stores, set parameter `WALLET_LOCATN` in `sqlnet.ora` to:

```
WALLET_LOCATN = (SOURCE = (METHOD=MCS))
```

The Oracle application uses Oracle's TCP/IP with SSL protocol (TCPS) to connect to Oracle Server. The SSL protocol uses X.509 certificates and trust points from the user's Microsoft Certificate Store for SSL authentication.

14

Using Oracle Database with Microsoft Active Directory

Learn how to configure and use Microsoft Active Directory as the LDAP directory.

- Overview of Microsoft Active Directory Support
  Describes how Microsoft Active Directory is used as an LDAP directory server by Oracle Database.
- Overview of Oracle Components That Integrate with Active Directory
  The following Oracle Database features support or have been specifically designed to integrate with Active Directory:
- Overview of Requirements for Using Oracle Database with Active Directory
  To use Net Directory Naming with Active Directory, you must have a supported Windows operating system and Oracle software releases, and you must create Oracle schema objects and an Oracle Context.
- Configuring Client Computers and Oracle Database to Use Active Directory
  Oracle Net Configuration Assistant enables you to configure client computers and Oracle Database to access a directory server.
- About Testing Connectivity
  Describes how to connect to an Oracle Database server through Active Directory.
- Overview of Access Control List Management for Oracle Directory Objects
  Identifies the security groups specific to Oracle directory objects within Active Directory and explains how to add and delete security group members.

Overview of Microsoft Active Directory Support

Describes how Microsoft Active Directory is used as an LDAP directory server by Oracle Database.

- About Microsoft Active Directory
  Active Directory is the LDAP-compliant directory server included with Windows server operating systems.
- About Accessing Active Directory
  When using Oracle features that support Active Directory, ensure that the Active Directory computer can be successfully reached using all possible TCP/IP host name forms to reach the domain controller.

About Microsoft Active Directory

Active Directory is the LDAP-compliant directory server included with Windows server operating systems.

Active Directory stores all Windows operating system information, including users, groups, and policies. Active Directory also stores information about network resources (such as databases) and makes this information available to application users and network

administrators. Active Directory enables users to access network resources with a single login. The scope of Active Directory can range from storing all the resources of a small computer network to storing all the resources of several wide areas networks (WANs).

About Accessing Active Directory

When using Oracle features that support Active Directory, ensure that the Active Directory computer can be successfully reached using all possible TCP/IP host name forms to reach the domain controller.

For example, if the host name of the domain controller is `server1` in the domain `example.com`, then ensure that you can ping that computer using all of the following:

- `server1.example.com`
- `example.com`
- `server1`

Active Directory often issues referrals back to itself in one or more of these forms, depending upon the operation being performed. If any of the forms cannot reach the Active Directory computer, then some LDAP operations may fail.

Overview of Oracle Components That Integrate with Active Directory

The following Oracle Database features support or have been specifically designed to integrate with Active Directory:

- About Directory Naming
  Oracle Database provides Oracle Net Services directory naming, which makes use of a directory server.
- About Automatic Discovery of Directory Servers
  Oracle Net Configuration Assistant provides automatic discovery of directory servers.
- About Integration with Windows Tools
  Describes about the Windows integration tools.
- About User Interface Extensions for Oracle Net Directory Naming
  The property menus of Oracle Database service and net service name objects in Windows Explorer and Active Directory Users and Computers have been enhanced.
- About Enhancement of Directory Object Type Descriptions
  Oracle directory object type descriptions in Active Directory have been enhanced to make them easier to understand.
- About Integration with Windows Login Credentials
  Oracle Database and configuration tools can use the login credentials of the Windows user currently logged on to connect to Active Directory without having to reenter the login credentials.
- Overview of Oracle Directory Objects in Active Directory
  Learn about Oracle directory objects in Active Directory.

About Directory Naming

Oracle Database provides Oracle Net Services directory naming, which makes use of a directory server.

This feature has been enabled to work with Microsoft Active Directory. Directory Naming enables clients to connect to the database making use of information stored centrally in an LDAP-compliant directory server such as Active Directory. For example, any net service name previously stored in the `tnsnames.ora` file can now be stored in Active Directory.

About Automatic Discovery of Directory Servers

Oracle Net Configuration Assistant provides automatic discovery of directory servers.

When you select Active Directory as the directory server type, Oracle Net Configuration Assistant automatically discovers the directory server location and performs related tasks.

Related Topics

- Configuring Client Computers and Oracle Database to Use Active Directory
  Oracle Net Configuration Assistant enables you to configure client computers and Oracle Database to access a directory server.

About Integration with Windows Tools

Describes about the Windows integration tools.

Oracle Database services, net service names, and enterprise role entries in Active Directory can be displayed and tested in the following Windows tools:

- Windows Explorer
- Active Directory Users and Computers

Windows Explorer displays the hierarchical structure of files, directories, and local and network drives on your computer. It can display and test Oracle Database service and net service name objects.

Active Directory Users and Computers is an administrative tool installed on Windows servers configured as domain controllers. This tool enables you to add, modify, delete, and organize Windows accounts and groups, and publish resources in the directory of your organization. Like Windows Explorer, it can display and test Oracle Database service and net service name objects. Additionally, it can manage access control.

Related Topics

- Testing Connectivity from Microsoft Tools
  Learn how you can test connectivity to an Oracle Database server from Microsoft tools.
- Overview of Access Control List Management for Oracle Directory Objects
  Identifies the security groups specific to Oracle directory objects within Active Directory and explains how to add and delete security group members.

About User Interface Extensions for Oracle Net Directory Naming

The property menus of Oracle Database service and net service name objects in Windows Explorer and Active Directory Users and Computers have been enhanced.

When you right-click these Oracle directory objects, you now see two new options for testing connectivity:

- Test
- Connect with SQL*Plus

The Test option tests whether the user name, password, and net service name you initially entered can actually connect to Oracle Database. The Connect with SQL*Plus option starts SQL*Plus, which enables you to perform database administration, run scripts, and so on.

Related Topics

- Testing Connectivity from Microsoft Tools
  Learn how you can test connectivity to an Oracle Database server from Microsoft tools.

About Enhancement of Directory Object Type Descriptions

Oracle directory object type descriptions in Active Directory have been enhanced to make them easier to understand.

In the right pane of Oracle Directory Objects in Active Directory Users and Computers, for example, the Type column reveals that `sales` is an Oracle Net Service name.

About Integration with Windows Login Credentials

Oracle Database and configuration tools can use the login credentials of the Windows user currently logged on to connect to Active Directory without having to reenter the login credentials.

This feature has the following benefits:

- Oracle clients and databases can securely connect to Active Directory and retrieve the net service name.
- Oracle configuration tools can connect automatically to Active Directory and configure Oracle Database and net service name objects. The enabled tools include Oracle Net Configuration Assistant and Database Configuration Assistant.
- Oracle clients can make secure access over the internet to avoid anonymous binds to the directory. The enhanced security enables the sites to restrict access to Database Service by setting access control (ACL) on Database Service DN in Directory Server. The enhancement gives clients the option to use authenticated binds for LDAP name lookup. Clients have access to Database Service object if the object (DN of Database Service Entry) has been configured with restrictive access control.

Configuration on machines that require authenticated name lookups

Add the following entry in `sqlnet.ora` to enable authenticated name lookup:

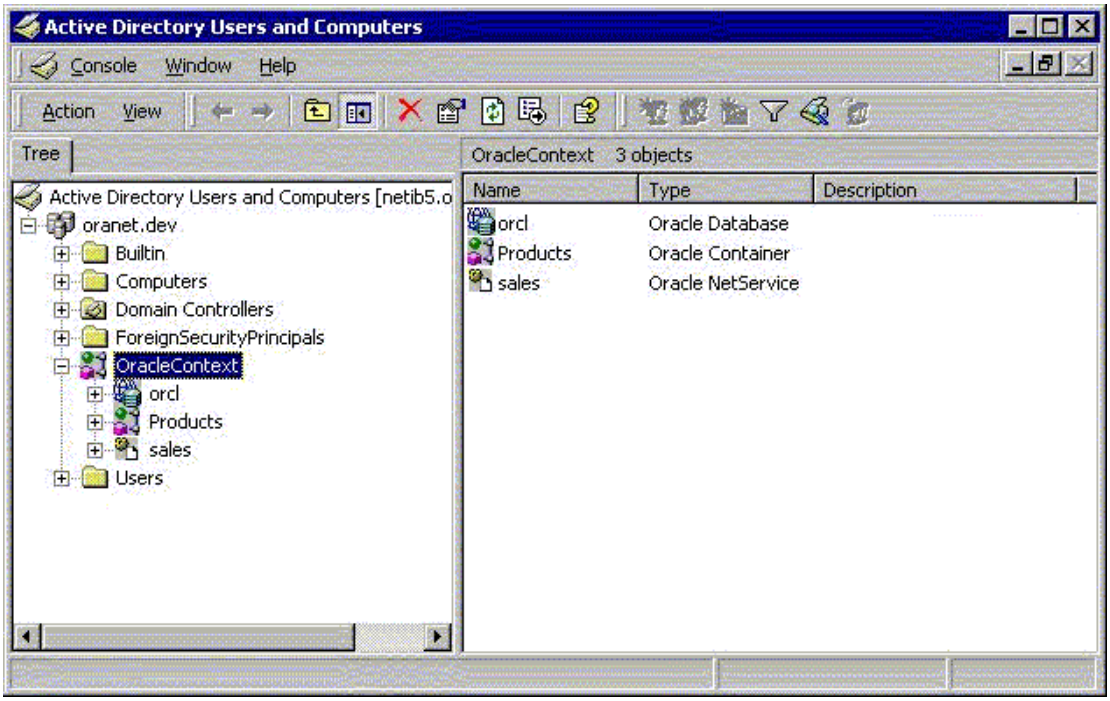
```
names.ldap_authenticate_bind = TRUE
```

Overview of Oracle Directory Objects in Active Directory

Learn about Oracle directory objects in Active Directory.

If Oracle Database and Oracle Net Services are installed and configured to access Active Directory, then Active Directory Users and Computers displays Oracle directory objects, as illustrated in Oracle Directory Objects in Active Directory Users and Computers:

Figure 14-1 Oracle Directory Objects in Active Directory Users and Computers



Oracle Directory Objects describes the Oracle directory objects appearing in Oracle Directory Objects in Active Directory Users and Computers.

Table 14-1 Oracle Directory Objects

Object	Description
`oranet.dev`	The domain in which you created your Oracle Context. This domain (also known as the administrative context) contains various Oracle entries to support directory naming. Oracle Net Configuration Assistant automatically discovers this information during Oracle Database integration with Active Directory.
`OracleContext`	The top-level Oracle entry in the Active Directory tree. It contains Oracle Database service and net service name object information. All Oracle software information is placed in this folder.
`orcl`	The Oracle Database service name used in this example.
`Products`	Folder for Oracle product information.
`sales`	The net service name object used in this example.
`Users`	Folder for the Oracle security groups. Enterprise users and roles created with Oracle Enterprise Security Manager also appear in this folder.

Related Topics

- Overview of Access Control List Management for Oracle Directory Objects
  Identifies the security groups specific to Oracle directory objects within Active Directory and explains how to add and delete security group members.

Overview of Requirements for Using Oracle Database with Active Directory

To use Net Directory Naming with Active Directory, you must have a supported Windows operating system and Oracle software releases, and you must create Oracle schema objects and an Oracle Context.

> **Note:**
>
> - The Oracle schema objects and Oracle Context can both be created by running Oracle Net Configuration Assistant.
> - Regardless of the Oracle Database Client and Oracle Database releases you are using, you must be running in a Windows Server domain to integrate Net Directory Naming with Active Directory.

- Creating Oracle Schema Objects
  You must create Oracle schema objects to use net directory naming features with Active Directory.
- Creating an OracleContext
  You must create an Oracle Context to use net directory naming features with Active Directory.
- About Directory Naming Software Requirements
  Directory naming method maps connect identifiers to connect descriptors contained in Microsoft Active Directory server.

Creating Oracle Schema Objects

You must create Oracle schema objects to use net directory naming features with Active Directory.

Schema objects are sets of rules for Oracle Net Services and Oracle Database entries and their attributes stored in Active Directory. The following restrictions apply to creating Oracle schema objects to use with Active Directory:

- Only one Oracle schema object can be created for each forest.
- The Windows server domain controller must be the operations master that allows schema updates. See your operating system documentation for instructions.

To create an Oracle schema object:

1. Log in as a member of Schema Administrator group or as a member who has rights to update the schema into schema master domain. The logged in client computer must be a part of the schema master domain. Schema master domain administrators are schema administrators by default.

2. Use Oracle Net Configuration Assistant to create the Oracle schema object. You can create your schema object during or after database installation.

If the Active Directory display is not configured to accept all 24 default languages, then Oracle schema object creation can fail while Oracle Net Configuration Assistant is configuring Active Directory as the directory server. Before running Oracle Net Configuration Assistant to complete directory access configuration, verify that the display specifiers for all 24 languages are populated by entering the following at the command prompt:

```
ldifde -p OneLevel -d cn=DisplaySpecifiers,cn=Configuration,domain context -f
temp file
```

For this command, note the following:

- *domain context* is the domain context for this Active Directory server.

  For example, `dc=example,dc=com`.

- *temp file* is a file where you want to put the output.

If the command reports that fewer than 24 entries were found, then you can still use Oracle Net Configuration Assistant. However, the report indicates that the Oracle schema object creation failed, rather than simply reporting that display specifiers for some languages were not created.

When the Oracle Net Configuration Assistant report shows failure due to less than 24 entries found, create display specifiers manually.

Creating Display Specifiers Manually

When Oracle Net Configuration Assistant creates the Oracle schema object in Active Directory, the display specifiers for Oracle entries are not created. This means you cannot view Oracle database entries in Active Directory interfaces.

You can manually add these entries into Active Directory after the Oracle schema object has been created by doing the following, using the same Windows user identification you used when creating the Oracle schema object with Net Configuration Assistant:

1. Open a command shell.
2. Change directory to *ORACLE_HOME*`\ldap\schema\ad`.
3. Copy `adDisplaySpecifiers_us.sbs` to `adDisplaySpecifiers_us.ldif`.
4. Copy `adDisplaySpecifiers_other.sbs` to `adDisplaySpecifiers_other.ldif`.
5. Edit each of these `.ldif` files, replacing all occurrences of `%s_AdDomainDN%` with the domain DN for the specific Active Directory into which you want to load the display specifiers (for example, `dc=example,dc=com`).
6. Run the following commands:

   ```
   ldapmodify -h ad hostname -Z -f adDisplaySpecifiers_us.ldif
   ldapmodify -h ad hostname -Z -f adDisplaySpecifiers_other.ldif
   ```

   where `ad hostname` is the host name of the Active Directory domain controller to which you want to load the display specifiers.

Related Topics

- About Automatic Discovery of Directory Servers
  Oracle Net Configuration Assistant provides automatic discovery of directory servers.

Creating an OracleContext

You must create an Oracle Context to use net directory naming features with Active Directory.

Oracle Context is the top-level Oracle entry in the Active Directory tree. It contains Oracle Database service and Oracle Net service name object information.

- You can create only one Oracle Context for each Windows server domain (administrative context).
- You must have the necessary permissions to create domain and enterprise objects to create the Oracle Context in Active Directory with Oracle Net Configuration Assistant.
- Use Oracle Net Configuration Assistant to create your Oracle Context. You can create the Oracle Context during or after Oracle Database Custom installation.

- Running Oracle Network Configuration Assistant
  Oracle Net Configuration Assistant is a graphical, wizard-based tool used to configure and manage Oracle Network configurations.

> **See Also:**
>
> - *Oracle Database Installation Guide for Microsoft Windows* for installation procedures
> - *Oracle Database Net Services Administrator's Guide* for configuration procedures

Running Oracle Network Configuration Assistant

Oracle Net Configuration Assistant is a graphical, wizard-based tool used to configure and manage Oracle Network configurations.

To start Oracle Net Configuration Assistant:

1. Click **Start,** then click **All Programs.**
2. Click **Oracle - HOMENAME, Configuration and Migration Tools,** then **Net Configuration Assistant.**
3. Select the **Directory Usage Configuration** option, then click **Next.**
4. Select Directory Type **Microsoft Active Directory,** then click **Next.**

> **Note:**
>
> The Microsoft Active Directory configuration option is only available in the Windows version of Oracle Net Configuration Assistant.

5. Select the option to configure the directory server for Oracle usage and to create or upgrade the Oracle Schema and Context, then click **Next.**

6. Enter the Active Directory host name, then click **Next.**
7. Select the option to upgrade the Oracle Schema, then click **Next.**

   The next page must denote successful Directory configuration.

   ```
   Directory usage configuration complete!
   The distinguished name of your default Oracle Context is:
   cn=OracleContext,DC=home,DC=com
   ```

8. Click **Next,** then click **Finish.**
9. The earlier message may only denote partial success:

   ```
   The Assistant is unable to create or upgrade the Oracle Schema
   for the following reason: ConfigException: Oracle Schema creation
   was successful, but Active Directory Display Specifier creation
   failed.oracle.net.config.ConfigException; TNS-04420: Problem
   running LDAPMODIFY
   ```

   Click **OK,** then click **Finish.**
10. If you receive the preceding error, disregard the message and rerun Oracle Net Configuration Assistant using the originally supplied values.

    The wizard must complete denoting successful Directory configuration:

    ```
    Directory usage configuration complete!
    The distinguished name of your default Oracle Context is:
    cn=OracleContext,DC=home,DC=com
    ```

    Click **Next,** then click **Finish.**

About Directory Naming Software Requirements

Directory naming method maps connect identifiers to connect descriptors contained in Microsoft Active Directory server.

A directory server provides central administration of database services and net service names, making it easier to add or relocate services.

Use Oracle Enterprise Manager or Oracle Net Manager to create net service names. To use Microsoft Active Directory naming method, the Oracle Database Client must run on supported Windows operating systems. You must have Oracle Database that is required for registering the database service as an object in Active Directory. The database server can run on any of the supported operating system, not necessarily Windows operating system.

By default, directory naming adaptor connects anonymously to active directory. Authenticated naming method requires client computer to be a part of the active directory domain to resolve a database service or net service name to a connect descriptor stored in a central directory server of its domain.

`NAMES.LDAP_AUTHENTICATE_BIND=`*`true`* parameter in `sqlnet.ora` file enables authenticated naming method.

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

Configuring Client Computers and Oracle Database to Use Active Directory

Oracle Net Configuration Assistant enables you to configure client computers and Oracle Database to access a directory server.

When you choose directory access configuration from Oracle Net Configuration Assistant, it prompts you to specify a directory server type to use. When you select Active Directory as the directory server type, the Automatic Discovery of Directory Servers feature of Oracle Net Configuration Assistant automatically:

- Discovers the Active Directory server location
- Configures access to the Active Directory server
- Creates the Oracle context (also known as your domain)

> **Note:**
>
> Oracle Net Configuration Assistant does not configure `DIRECTORY_SERVERS` parameter in `ldap.ora`, in which case, clients automatically discover the Active Directory server for Net Naming.

If the Active Directory server already has an Oracle Context, then select the following nondefault option:

Select the directory server you want to use, and configure the directory server for Oracle usage. (Create or upgrade Oracle schema objects and Oracle Context as necessary.)

Oracle Net Configuration Assistant reports that the Oracle Context does not exist. Ignore this and choose to create the Oracle Context anyway. Directory access configuration completes without trying to re-create the existing Oracle Context.

> **Note:**
>
> Regardless of the Oracle Database Client and Oracle Database releases you are using, you must be running a Windows Server domain to take advantage of the automatic directory server discovery features of Oracle Net Configuration Assistant. Oracle Net Configuration Assistant does not automatically discover your directory server, and instead prompts you for additional information, such as the Active Directory location.

Related Topics

- Creating Oracle Schema Objects
  You must create Oracle schema objects to use net directory naming features with Active Directory.

- Overview of Requirements for Using Oracle Database with Active Directory
  To use Net Directory Naming with Active Directory, you must have a supported Windows operating system and Oracle software releases, and you must create Oracle schema objects and an Oracle Context.
- About Automatic Discovery of Directory Servers
  Oracle Net Configuration Assistant provides automatic discovery of directory servers.

> **See Also:**
>
> *Oracle Database Net Services Administrator's Guide* for configuration procedures

About Testing Connectivity

Describes how to connect to an Oracle Database server through Active Directory.

- Testing Connectivity from Client Computers
  When using Oracle Net directory naming, client computers connect to a database by specifying the database or net service name entry that appears in the Oracle Context.
- Testing Connectivity from Microsoft Tools
  Learn how you can test connectivity to an Oracle Database server from Microsoft tools.

Testing Connectivity from Client Computers

When using Oracle Net directory naming, client computers connect to a database by specifying the database or net service name entry that appears in the Oracle Context.

For example, if the database entry under the Oracle Context in Active Directory is `orcl`, and the client and the database are in the same domain, then a user connects to the database through SQL*Plus by entering the following connect string:

```
SQL> CONNECT username@orcl
Enter password: password
```

If the client and the database are in different domains, then a user connects to the database through SQL*Plus by entering:

```
SQL> CONNECT username@orcl.domain
Enter password: password
```

where *`domain`* is the domain in which the Oracle Database server is located.

The LDAP naming adapter has an internal function called **simplified naming,** which attempts to translate a DNS-style name into an x500 (LDAP) style name (DN) based on the naming convention used in `ldap.ora:DEFAULT_ADMIN_CONTEXT.`

It relies on `ldap.ora:default_admin_context` using either an **org** form or a **domain component (dc)** form. This cues the mechanism to use either of the following conventions to convert the domain name to an x500 DN:

- 'dc=, dc='
- 'ou=, o='
- 'ou=, o=, c='

For example,

```
SQL> CONNECT SMITH@hr.example.com
Enter password: password
```

The following values for default_admin_context results in the associated DN:

```
DEFAULT_ADMIN_CONTEXT="o=stdev"
```

The resulting DN is

```
cn=HR,cn=OracleContext,ou=EXAMPLE,o=COM
```

```
DEFAULT_ADMIN_CONTEXT="dc=oracle, dc=com"
```

The resulting DN is

```
cn=HR,cn=OracleContext,dc=EXAMPLE,dc=COM
```

```
DEFAULT_ADMIN_CONTEXT="o=oracle,c=us"
```

The resulting DN is

```
cn=HR,cn=OracleContext,o=EXAMPLE,c=COM
```

Note:

The value of the `default_admin_context` is not used literally, since the queried-name is given in a fully qualified form. The `default_admin_context` determines which style DN is produced, or which side to use when converting each domain in the given DN component.

DNS-style conventions enable client users to access an Oracle Database server through a directory server by entering minimal connection information, even when the client computer and Oracle Database server are in separate domains. Names following the X.500 convention are longer, especially when the client and Oracle Database server are located in different domains (also known as administrative contexts).

See Also:

- *Oracle Database Net Services Administrator's Guide* for more information about Configuration Management Concepts
- *Oracle Database Installation Guide for Microsoft Windows* for more information about Minimum Requirements for Passwords

Testing Connectivity from Microsoft Tools

Learn how you can test connectivity to an Oracle Database server from Microsoft tools.

Oracle directory objects in Active Directory are integrated with the following Microsoft tools:

- Windows Explorer
- Active Directory Users and Computers

You can test connectivity to an Oracle Database server from within these Microsoft tools by connecting to it, or you can just test the connection with actually connecting. To test connectivity:

1. Start Windows Explorer or Active Directory Users and Computers.

   To start Windows Explorer:

   a. From the **Start** menu, select **All Programs**, then select **Accessories**, and then select **Windows Explorer**.

   b. Expand **Network**.

   c. Expand **Directory**.

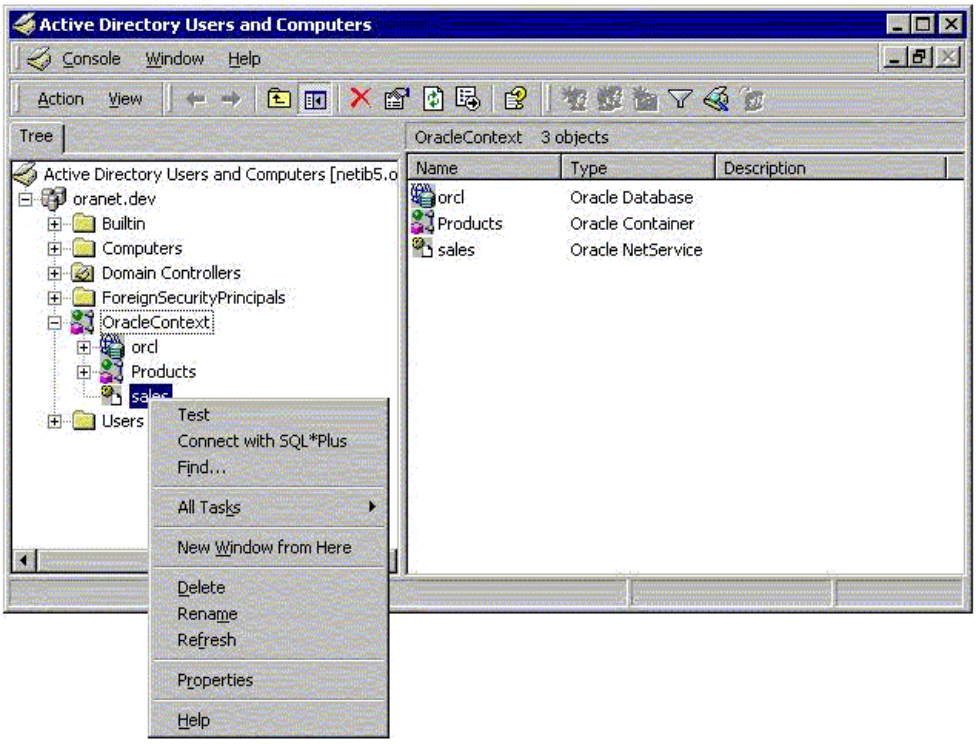
   To start Active Directory Users and Computers:

   From the **Start** menu, select **All Programs**, then select **Administrative Tools**, and then select **Active Directory Users and Computers**.

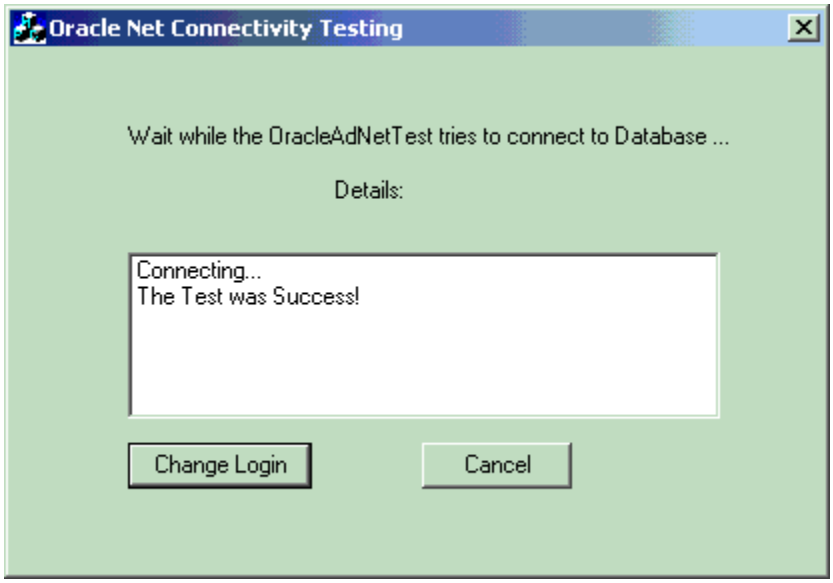
   > **Note:**
   >
   > All clients accessing an Oracle Database server through Active Directory require read access on all net service name objects in the Oracle Context. If Oracle Net is not configured to require authentication for name lookup, then clients must be able to authenticate anonymously with Active Directory. With Windows Server domain, this requires changing the Active Directory default setting so that anonymous access is allowed. If anonymous access is not going to be allowed to this directory the clients must be configured to authenticate and net service objects must have access control definitions that allow clients to read them as appropriate.

2. Expand the domain in which your Oracle Context is located.
3. Expand your Oracle Context.
4. Right-click a database service or Oracle Net Service name object.

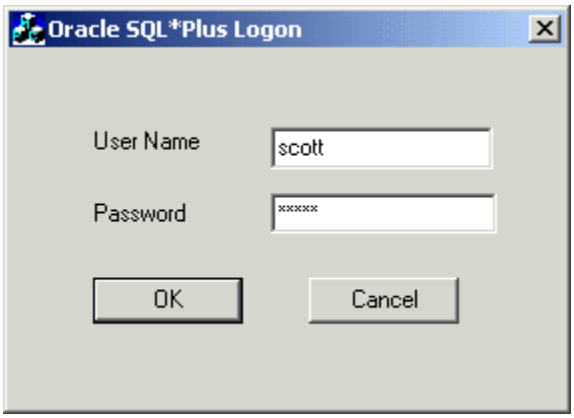
   A menu appears with several options. This section covers only the **Test** and **Connect with SQL*Plus** options.



5. If you want to test the database connection without actually connecting to it, then choose **Test**. A status message appears describing the status of your connection attempt.



6. If you want to test the database connection by actually connecting to it, then choose **Connect with SQL*Plus**. The Oracle SQL*Plus Logon dialog appears.



7. Enter your user name and password, then click **OK**. A status message appears describing the status of your connection attempt.

> **See also:**
>
> *Oracle Database Net Services Administrator's Guide* for more information

Overview of Access Control List Management for Oracle Directory Objects

Identifies the security groups specific to Oracle directory objects within Active Directory and explains how to add and delete security group members.

- Overview of Security Groups
  Security groups are automatically created when the Oracle Context is created in Active Directory.
- Setting ACLs on Net Service Entries
  Use the Microsoft `Dsacls.exe` tool to set ACLs on directory objects.
- Adding and Deleting Security Group Members
  Learn how to add or remove users in the security groups with Active Directory Users and Computers.

Overview of Security Groups

Security groups are automatically created when the Oracle Context is created in Active Directory.

The user configuring access (and thus creating the Oracle Context) is automatically added to each group.

- About OracleDBCreators
  The `OracleDBCreators` group is for the person registering the Oracle Database server.
- About OracleNetAdmins
  Describes the various tasks that the users in this group can perform.

- About Oracle Net Services Objects
  In Oracle Database Client or later, directory clients may optionally be configured to authenticate with the directory while resolving DB names to connect strings.

About OracleDBCreators

The `OracleDBCreators` group is for the person registering the Oracle Database server.

The domain administrator is automatically a member of this group. Users in this group can:

- Create new Oracle Database objects in the Oracle Context.
- Modify the Oracle Database objects that they create.
- Read, but not modify, the membership for this group.

About OracleNetAdmins

Describes the various tasks that the users in this group can perform.

Users in the `OracleNetAdmins` group can:

- Create, modify, and read Oracle Net Services objects and attributes.
- Read the group membership of this group.

About Oracle Net Services Objects

In Oracle Database Client or later, directory clients may optionally be configured to authenticate with the directory while resolving DB names to connect strings.

This makes it possible for Oracle Net Services objects to be protected using ACLs.

There are many ways in which the identities of users may be defined in the directory, and how those users or certain groups of users may be given access to some or all Net Services. Oracle Database supplies no predefined groups, and has no procedures in the config tools for defining read-access restrictions on this data. Therefore, administrators must use standard object management tools from their directory system to manually create any necessary groups and ACLs. Existing identity structures may be referred to by Net Service ACLs.

The access definitions for objects are complex and may involve security properties which are inherited from parent nodes in the Directory Information Tree (DIT).

Oracle recommends that the administrators should refer to the relevant tools and documentation for the directory system they are using, and formulate or integrate access management for Oracle Net Services objects into a directory-wide policy and security implementation.

Setting ACLs on Net Service Entries

Use the Microsoft `Dsacls.exe` tool to set ACLs on directory objects.

The `Dsacls.exe` command-line tool displays and changes permissions (access control entries) in the Access Control List (ACL) of objects in Active Directory. This command-line tool is included with the support tools on the CD-ROM.

Examples:

To enable an anonymous generic read on the `orcl` service, run the following command:

```
dsacls "CN=orcl,CN=OracleContext,OU=Example,O=Com" /G "anonymous logon":GR
```

To enable a generic read on the `orcl` service for the user `smith` in the EXAMPLE domain, run the following command:

```
dsacls "CN=orcl,CN=OracleContext,OU=Example,O=Com" /G example\smith:GR
```

To disable an anonymous generic read on the `orcl` service, run the following command:

```
dsacls "CN=orcl,CN=OracleContext,OU=Example,O=Com" /R "anonymous logon"
```

To disable a generic read on the `orcl` service for the user `smith` in the EXAMPLE domain, run the following command:

```
dsacls "CN=orcl,CN=OracleContext,OU=Example,O=com" /R example\smith
```

Adding and Deleting Security Group Members

Learn how to add or remove users in the security groups with Active Directory Users and Computers.

You can add or remove users in the security groups with Active Directory Users and Computers.

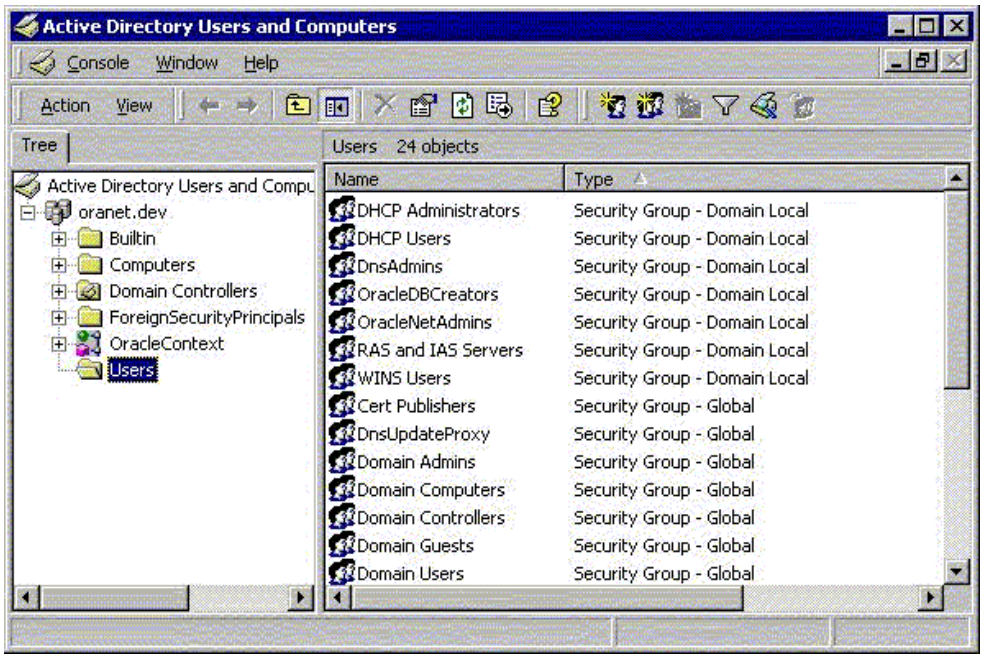
> **Note:**
>
> Use Active Directory Users and Computers to perform the procedures described in this section. Windows Explorer does not provide the necessary functionality.

To add or remove users:

1. From the **Start** menu, select **All Programs**, then select **Administrative Tools**, and then select **Active Directory Users and Computers**.
2. Choose **Advanced Features** from the **View** main menu.

   This enables you to view and edit information that is usually hidden.
3. Expand the domain (administrative context) in which your Oracle Context is located.
4. Expand **Users**.

   The security groups appear in the right window pane.



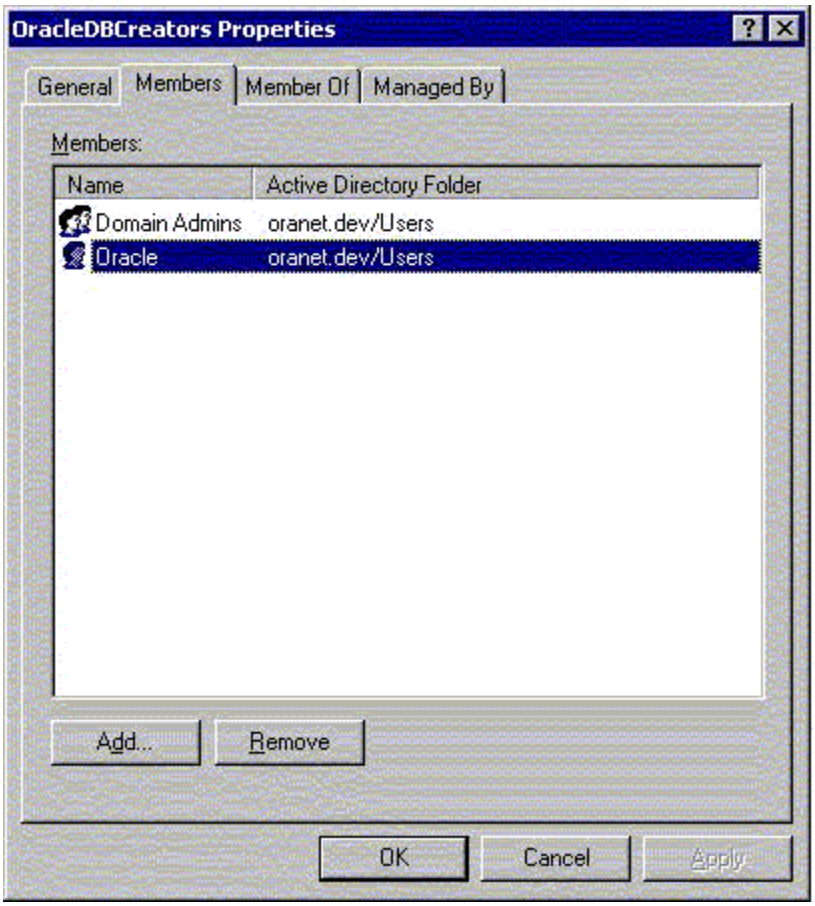
5. Right-click the Oracle security group that you want to view or modify.

   A menu appears with several options.

6. Choose **Properties**.

7. Choose the **Members** tab.

   The Properties dialog for the group you selected appears (in this example, `OracleDBCreators`).



8. To add users, click **Add**.

   The Select Users, Computers, Service Accounts, or Groups dialog appears.

9. Select the users or groups you want to add and click **Add**.

   Your selections appear in the Select Users, Computers, Service Accounts, or Groups dialog.

10. To remove a user, select the user name from the Members list and click **Remove**.

11. When you are finished adding and removing users, click **OK**.

15

Oracle Database Specifications for Windows

Oracle Database for Windows uses initialization parameters to enable various features of the database every time an instance is started.

- Overview of Initialization Parameter File
  An initialization parameter file is an ASCII text file containing parameters.
- Using Sample File for Database Creation
  Oracle Database provides an annotated sample initialization parameter file with alternative values for initialization parameters.
- About SGA_MAX_SIZE Parameter
  Parameter `SGA_MAX_SIZE` holds the maximum size that System Global Area (SGA) can reach for a particular instance.
- Overview of Initialization Parameters Without Windows-Specific Values
  Describes the overview of initialization parameters.
- Displaying Initialization Parameter Values
  Learn how you can view Windows-specific parameter values.
- About Unmodifiable Database Initialization Parameters
  Check the initialization parameters in the Unmodifiable Database Initialization Parameters when creating a new database.
- About Calculating Database Limits
  Use the size guidelines in this section to calculate Oracle Database limits.

Overview of Initialization Parameter File

An initialization parameter file is an ASCII text file containing parameters.

By changing parameters and values in an initialization parameter file, you can specify, for example:

- Amount of memory Oracle Database uses
- Whether to archive filled online redo logs
- Which control files currently exist

Every database instance has a corresponding initialization parameter file and an `ORACLE_SID` registry parameter that points to the system identifier for the instance.

The initialization parameter file name takes the form `init.ora`. A single instance might have several initialization parameter files, each having some differences that affect system performance.

> **Note:**
>
> Your `init.ora` file for initialization parameters is set by Oracle Universal Installer during database installation. These parameter settings may vary depending on your hardware configuration.

- About the Location of the Initialization Parameter File
  Describes the location of the initialization parameter file.
- About Editing The Initialization Parameter File
  To customize Oracle Database functions, you may be required to edit the initialization parameter file.
- About Oracle Database Configuration Assistant Renaming init.ora
  When you create a database using Oracle Database Configuration Assistant (Oracle DBCA), a Server Parameter File (SPFILE) is created from the initialization parameter file, and the initialization parameter file is renamed.

> **See Also:**
>
> *Oracle Database Reference* for descriptions of all initialization parameters and instructions for setting and displaying their values

About the Location of the Initialization Parameter File

Describes the location of the initialization parameter file.

If you do not specify a different initialization file with the option `PFILE` at database startup, then by default Oracle Database uses initialization parameter files located in

`ORACLE_HOME``\Database\init.ora`

> **Note:**
>
> If you create a database manually using an SQL script, then you are required to create an initialization parameter file or copy an existing initialization parameter file and modify the contents. If you use Database Configuration Assistant to create a database, then the initialization parameter file is automatically created for you.

About Editing The Initialization Parameter File

To customize Oracle Database functions, you may be required to edit the initialization parameter file.

Use only an ASCII text editor to modify the file.

About Oracle Database Configuration Assistant Renaming init.ora

When you create a database using Oracle Database Configuration Assistant (Oracle DBCA), a Server Parameter File (SPFILE) is created from the initialization parameter file, and the initialization parameter file is renamed.

Oracle does not recognize the renamed file as an initialization parameter file, and it is not used after the instance is started.

If you want to modify an instance created with Oracle DBCA after it starts, you must use the`ALTER SYSTEM` statement. You cannot change the Server Parameter File itself, because it is a binary file that cannot be browsed or edited using a text editor. The location of the newly-created Server Parameter File is *`ORACLE_HOME`*`\database`. The Server Parameter File file name is `spfile`*`SID`*`.ora`.

> **See Also:**
>
> *Oracle Database Administrator's Guide*

Using Sample File for Database Creation

Oracle Database provides an annotated sample initialization parameter file with alternative values for initialization parameters.

These values and annotations are preceded by the comment signs (#), which prevent them from being processed. To activate a particular parameter, remove the preceding # sign. To clear a particular parameter, edit the initialization parameter file to add a comment sign. The sample file is called `initsmpl.ora` and is located in

`ORACLE_HOME``\admin\sample\pfile.`

If you installed a starter database, then the initialization parameter file used by the starter database is located in the same directory. You can use either `initsmpl.ora` or the starter database `init.ora` as a basis for creating a new Oracle Database initialization parameter file.

To use the sample file `initsmpl.ora` as part of the database creation:

1. Rename the sample file `init.ora`.
2. Edit this file to reflect the correct location of your database control files and the name of your database, as a minimum.

Here are two examples of activation and de-activation of alternative parameters. Several initialization parameters are specified with three different values to create a small, medium, or large System Global Area, respectively. The parameter that creates a small SGA is active in this first example:

```
  db_block_buffers = 200  # SMALL
# db_block_buffers = 550  # MEDIUM
# db_block_buffers = 3200 # LARGE
```

To create a medium-sized SGA, comment out the small parameter definition and activate the medium parameter definition. Edit the initialization parameter file as in this second example:

```
# db_block_buffers = 200  # SMALL
  db_block_buffers = 550  # MEDIUM
# db_block_buffers = 3200 # LARGE
```

About SGA_MAX_SIZE Parameter

Parameter `SGA_MAX_SIZE` holds the maximum size that System Global Area (SGA) can reach for a particular instance.

Oracle Database can change its SGA configuration while the instance is running. This allows sizes of the buffer cache, shared pool, and the large pool to be changed without an instance shutdown.

Oracle Database can start the instances unconfigured and allow the instance to use more memory by growing SGA up to a maximum of `SGA_MAX_SIZE`. If no `SGA_MAX_SIZE` value is specified, then Oracle Database selects a default value that is the sum of all components specified or defaulted at initialization time. If `SGA_MAX_SIZE` specified in the initialization parameter file is less than the sum of all components specified or defaulted to at initialization time, then the setting of `SGA_MAX_SIZE` in the initialization parameter file serves as an upper bound.

Memory allocated for the SGA of an instance is displayed on an instance startup when using Oracle Enterprise Manager (or SQL*Plus). You can also display the SGA size of the current instance by using the SQL*Plus `SHOW` statement with the SGA clause.

See Also:

- *Oracle Database Performance Tuning Guide* for more information about SGA initialization parameters
- *Oracle Database Concepts* for more information about SGA and its components

Overview of Initialization Parameters Without Windows-Specific Values

Describes the overview of initialization parameters.

Oracle Database Reference describes default values for many initialization parameters as being operating system-specific. However, not all parameters that it describes as having operating system-specific values affect Windows. In these cases, Windows uses either the default value set in the Oracle Database kernel or does not use the parameter. Initialization Parameters Without Windows-Specific Values describes these initialization parameters:

Table 15-1 Initialization Parameters Without Windows-Specific Values

Parameter	Description
AUDIT_FILE_DEST	Supported on Windows to write XML format audit files
DB_WRITER_PROCESSES	Supported, but typically unnecessary due to Windows asynchronous I/O capabilities
COMPATIBLE_NO_RECOVERY	Uses default value set in Oracle Database kernel (no Windows-specific value)
BACKGROUND_CORE_DUMP	Specifies whether Oracle Database includes SGA in core file for Oracle Database background processes
SHADOW_CORE_DUMP	Specifies whether Oracle Database includes SGA in core file for foreground (client) processes
CORE_DUMP_DEST	Specifies directory where Oracle Database dumps core files
CPU_COUNT	Oracle Database automatically sets value to the number of processors available for your Oracle Database instance
HI_SHARED_MEMORY_ADDRESS	Not applicable to Windows
SHARED_MEMORY_ADDRESS	Not applicable to Windows
LARGE_POOL_SIZE	Uses maximum value limited by available memory
LOG_BUFFER	Starter database uses value set in Oracle Database kernel (no Windows-specific value). The Custom database creation option of Database Configuration Assistant enables you to customize the value for this parameter.
SPIN_COUNT	Uses default value set in Oracle Database kernel (no Windows-specific value)

Displaying Initialization Parameter Values

Learn how you can view Windows-specific parameter values.

To view Windows-specific parameter values, use an ASCII editor to open the initialization parameter file:

ORACLE_HOME\admin*db_name*\pfile\init.ora

To display any parameter value whether set in the initialization parameter file or the Oracle Database kernel, enter the following command at the SQL*Plus command prompt:

```
SQL> SHOW PARAMETER parameter_name
```

where *parameter_name* is the name of a specific initialization parameter.

About Unmodifiable Database Initialization Parameters

Check the initialization parameters in the Unmodifiable Database Initialization Parameters when creating a new database.

They cannot be modified after you have created the database.

Table 15-2 Unmodifiable Database Initialization Parameters

Parameter	Description
DB_BLOCK_SIZE	Specifies size in bytes of standard Oracle Database blocks.
DB_NAME	Specifies name of the database to be created. Database name is a string of eight characters or less. You cannot change the name of a database.

Related Topics

- Postinstallation Database Creation on Windows
  Learn how to create a database after installing Oracle Database, using either Oracle Database Configuration Assistant or command-line tools.

About Calculating Database Limits

Use the size guidelines in this section to calculate Oracle Database limits.

Table 15-3 Block Size Guidelines

Type	Size
Maximum block size	16,384 bytes or 16 kilobytes (KB)
Minimum block size	2 kilobytes (KB)
Maximum blocks for each file	4,194,304 blocks
Maximum possible file size with 16 K sized blocks	64 Gigabytes (GB) (4,194,304 * 16,384) = 64 gigabytes (GB)

Table 15-4 Maximum Number of Files for Each Database

Block Size	Number of Files
2 KB	20,000
4 KB	40,000
8 KB	65,536
16 KB	65,536

Table 15-5 Maximum File Sizes

Type	Size
Maximum file size for a FAT file	4 GB
Maximum file size in NTFS	16 Exabytes (EB)
Maximum database size	65,536 * 64 GB equals approximately 4 Petabytes (PB)
Maximum control file size	20,000 blocks

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Configuration Parameters and the Registry

Learn how to use Windows Registry for various Oracle Database for Windows components. The recommended values and ranges for configuration parameters are listed.

> **Note:**
>
> Windows Registry is referred to as registry.

- About Configuration Parameters
  Oracle Database for Windows uses configuration parameters to locate files and specify run-time parameters common to all Oracle products.
- Registry Overview
  Oracle Database for Windows stores its configuration information in a repository (the registry) that is organized in a tree format.
- Registry Parameters Overview
  Describes Oracle Database for Windows registry parameters for the following keys.
- Overview of Oracle RAC Registry Parameters
  Oracle RAC registry values are based on the clusterware.
- Managing Registry Parameters with regedit
  Learn how to manage registry parameters.

About Configuration Parameters

Oracle Database for Windows uses configuration parameters to locate files and specify run-time parameters common to all Oracle products.

When an Oracle program or an application requires translation for a particular configuration variable, Oracle Database for Windows uses the associated parameter. All Oracle parameters are stored in the registry.

Registry Overview

Oracle Database for Windows stores its configuration information in a repository (the registry) that is organized in a tree format.

The tree format consists of keys in the registry and parameter values for the keys. Keys and parameter values can be viewed and modified in Registry Editor.

Keys are folders that appear in the left pane of a Registry Editor window. A key contains subkeys or parameters.

> **Note:**
>
> Although Registry Editor lets you view and modify registry keys and parameter values, you typically are not required to do so. In fact, you can render your system useless if you make incorrect changes. Therefore, only advanced users must edit the registry. Back up your system before making any changes in the registry.

Parameters in the Registry Editor appear as a string, consisting of three components:

- Parameter name
- Value class or type of entry
- Value itself

For example, parameter `ORACLE_SID` can have the following entry in the registry:

```
ORACLE_SID:reg_sz:orcl1
```

Value classes for Oracle Database for Windows parameters are:

- String value with a `REG_SZ`, `REG_EXPAND_SZ` (for an expandable string), or a `REG_MULTI_SZ` (for multiple strings) prefix to identify a parameter value entry as a data string
- Binary value with a `REG_BINARY`, `REG_DWORD` or `REG_QWORD` prefix to identify a value entry as a `dword` or `qword` (hexadecimal data) entry

Most Oracle Database for the Windows parameter values are string types. Use Oracle Universal Installer defaults when a type is not given.

Registry Parameters Overview

Describes Oracle Database for Windows registry parameters for the following keys.

Other products, such as Oracle Enterprise Manager, have additional keys and parameters that are not described.

- About HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_HOMENAME
  Each time you install Oracle products into a new Oracle home on your computer, `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`* is created.
- About HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE
  This subkey contains the following parameter:
- About HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services
  `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet` contains the following keys:

About HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_HOMENAME

Each time you install Oracle products into a new Oracle home on your computer, `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`* is created.

This subkey contains parameter values for most Oracle products.

`HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOMENAME`* includes the following parameters for an Oracle home directory. Depending on products you install, additional parameters can also be created. See your Windows development manuals.

- MSHELP_TOOLS
  Specifies the location of Windows help files.
- NLS_LANG and Other Globalization Parameters
  Specifies supported language, territory, and character set.
- ORA_CWD
  Specifies current working directory.
- ORA_SID_AUTOSTART
  Starts Oracle Database when `OracleService`*`SID`* service is started.
- ORA_SID_PFILE
  Specifies full path to initialization parameter file.
- ORA_SID_SHUTDOWN
  When set to `true`, the default value, this parameter shuts down the instance of Oracle Database identified by *`SID`* when `OracleService`*`SID`* is stopped manually—using either the Control Panel or Net stop command.
- ORA_SID_SHUTDOWN_TIMEOUT
  Sets maximum time (in seconds) to wait for shutdown to complete before the service for a particular *`SID`* stops.
- ORA_SID_SHUTDOWNTYPE
  Specifies mode in which Oracle Database is shut down when you stop `OracleService`*`SID`*.
- ORA_TZFILE
  Specifies the location of time zone file.
- ORACLE_AFFINITY
  Enables the scheduling of class threads on more than one processor group for systems with more than 64 CPUs.
- ORACLE_BASE
  Specifies the top-level Oracle directory (for example, `C:\app\username\product\21.0.0`) that contains *`ORACLE_HOME`*, `admin`, and `oradata`.
- ORACLE_GROUP_NAME
  Specifies the name of the group containing icons of the Oracle products installed.
- ORACLE_HOME
  Specifies Oracle home directory in which Oracle products are installed.
- ORACLE_HOME_KEY
  The `HKEY_LOCAL_MACHINE` location of Oracle parameters.
- ORACLE_HOME_USER
  A string type entry that holds the Oracle Home User value.
- ORACLE_HOMENAME
  Specifies home name of Oracle home directory in which Oracle products are installed.
- ORACLE_PRRITY
  Determines Windows scheduling priorities of the threads within the Oracle Database management system process.

- ORACLE_SID
  Specifies the name of the Oracle Database instance on the host computer.
- OSAUTH_PREFIX_DOMAIN
  Enables user authentication.
- RDBMS_ARCHIVE
  Specifies the location of backup database files.
- RDBMS_CONTROL
  Specifies the location of backup database control files.
- SQLPATH
  Specifies the location of SQL scripts.

> **See Also:**
>
> *Oracle Database Installation Guide for Microsoft Windows* Appendix B, "Optimal Flexible Architecture" for details on the PATH variable and registry values when you are working with multiple Oracle homes.

MSHELP_TOOLS

Specifies the location of Windows help files.

The default value is:

ORACLE_HOME\mshelp

NLS_LANG and Other Globalization Parameters

Specifies supported language, territory, and character set.

This parameter specifies the language in which messages appear, the territory and its conventions for calculating week and day numbers, and the character set displayed. Oracle Universal Installer sets this value during installation based on the language setting of the operating system.

The default value for *NLS_LANG*, if not set, is AMERICAN_AMERICA.US7ASCII.

There are other globalization parameters that can be set along *NLS_LANG* to override some values implicitly determined by *NLS_LANG*. These parameters are:

```
NLS_DATE_FORMAT
NLS_TIMESTAMP_FORMAT
NLS_TIMESTAMP_TZ_FORMAT
NLS_DATE_LANGUAGE
NLS_NUMERIC_CHARACTERS
NLS_CURRENCY
NLS_ISO_CURRENCY
NLS_DUAL_CURRENCY
NLS_SORT
```

The following parameters can also be set along *NLS_LANG* to determine globalization behavior that is independent from the value of *NLS_LANG:*

```
NLS_CALENDAR
NLS_COMP
NLS_NCHAR_CONV_EXCP
NLS_LENGTH_SEMANTICS
```

> **Note:**
>
> All globalization parameters set in the environment and Registry for a database client are ignored if *NLS_LANG* is not set.

> **See Also:**
>
> *Oracle Database Globalization Support Guide* for more information about NLS_LANG and other globalization parameters

ORA_CWD

Specifies current working directory.

For example, if you set this parameter and then use ORADIM, a log file called `oradim.log` is created in this directory. This parameter must be manually set.

ORA_SID_AUTOSTART

Starts Oracle Database when `OracleService`*SID* service is started.

The default value is `true`.

ORA_SID_PFILE

Specifies full path to initialization parameter file.

The default value is *ORACLE_BASE*`\admin\DB_NAME\pfile\init.ora`

ORA_SID_SHUTDOWN

When set to `true`, the default value, this parameter shuts down the instance of Oracle Database identified by *SID* when `OracleService`*SID* is stopped manually—using either the Control Panel or Net stop command.

ORA_SID_SHUTDOWN_TIMEOUT

Sets maximum time (in seconds) to wait for shutdown to complete before the service for a particular *SID* stops.

The default value is `30`.

ORA_SID_SHUTDOWNTYPE

Specifies mode in which Oracle Database is shut down when you stop `OracleService`*`SID`*.

Valid values are `a` (abort), `i` (immediate), and `n` (normal). The default value is `i`.

ORA_TZFILE

Specifies the location of time zone file.

Each file contains:

- Valid time zone names
- Offset from UTC
- Abbreviation for standard time
- Abbreviation for daylight savings time

The default value is

`ORACLE_HOME``\oracore\zoneinfo\timezlrg_11.dat`

The `timezone_`*`version_number`*`.dat` data files contain most commonly used time zones and are smaller for better database performance. The new default, `timezlrg_`*`version_number`*`.dat`, includes time zones not defined in the smaller file.

> **See Also:**
>
> *Oracle Database Globalization Support Guide* for additional details about time zone files

ORACLE_AFFINITY

Enables the scheduling of class threads on more than one processor group for systems with more than 64 CPUs.

This parameter must be manually added. Oracle recommends consulting Oracle Support Services before changing this parameter. The format is:

```
name[n]:[[processorgroup0][processorgroup1][..2][..3],]{cpumask0[ cpumask1
cpumask2 cpumask3] | ALL};
name1:[[0][1][2][3],]{cpumask0[ cpumask1 cpumask2 cpumask3] | ALL};
name2:[[0][1][2][3],]{cpumask0[ cpumask1 cpumask2 cpumask3] | ALL};
```

Where, `processorgroup` is an optional parameter designating Windows CPU group. On systems with 64+ logical CPUs, Windows divides all available CPUs into 4 groups (0,1,2,3) with each group containing no more than 64 logical CPUs. By default, a process utilizes single processor group. The `processorgroup` parameter enables Oracle to use more than 64 logical CPUs. Refer to the specific hardware configuration to determine the valid processor groups.

> **Note:**
>
> You should not use the ORACLE_AFFINITY parameter with multiple processor groups on a system with fewer than 64 logical cores. On production servers any system with fewer than 64 logical CPUs can have only one processor group.

Each name*n* setting must be the name of a background thread, USER for non-background (shadow) threads, or DEF for any thread type not handled specifically. Valid background thread names include DBW0, LGWR, PMON, SMON, ARCH, RECO, CKPT, TRWR, J000 through J999, P000 through P481, and any other name found in the NAME column of the v$bgprocess data dictionary view.

The cpumask sets the affinity mask of the Oracle Database process. Each affinity setting must be a valid affinity mask or its numeric equivalent for the corresponding thread name. Process affinity masks are used only when Oracle Services are first started. Each thread's affinity is set only when the individual thread is started (for example, at database startup time for the background threads).

Few examples, to use multiple processor groups in a system with 160 logical CPUs, ORACLE_AFFINITY registry key in HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_HOMENAME may be defined as follows:

The following examples show how set the ORACLE_AFFINITY registry key in HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_HOMENAME to use multiple processor groups in a system with 160 logical CPUs. In the following examples, it is assumed that: USER, DEF are thread class names; 0,1,2,3 are valid CPU groups in the system; and 4294967295 is a valid affinity mask in the corresponding CPU group.

- Affinitize USER (foreground) threads to all CPUs in processorgroup1 or to all CPUs in processorgroup2 or to all CPUs in processorgroup3 while alternating between the processor groups for each new foreground thread. Also, affinitize DEF class threads to CPUs *0-31* in processorgroup0.

  ```
  USER:123,ALL;DEF:0,4294967295;
  ```

- Affinitize USER class threads either to CPUs *0-19* in processorgroup0 or to CPUs *16-31* in processorgroup2. Also, affinitize DEF class threads to CPUs 0-19 in processorgroup1.

  ```
  USER:02,1048575 4294901760;DEF:1,1048575;
  ```

- Affinitize USER class threads to all the CPUs of all processor groups while alternating between the processor groups for each new foreground thread. Also, affinitize DEF class threads to CPUs *0-31* in all the processor groups while alternating between the processor groups for each new DEF class thread.

  ```
  USER:0123,ALL;DEF:0123,4294967295;
  ```

- Affinitize USER class threads to CPUs *0-31* in processorgroup0, CPUs *0-19* in processorgroup1 and CPUs *0-19* in processorgroup2 while alternating between the processor groups for each new foreground thread.

  ```
  USER:012,4294967295 1048575 1048575;
  ```

ORACLE_BASE

Specifies the top-level Oracle directory (for example, C:\app\username\product\21.0.0) that contains *ORACLE_HOME*, admin, and oradata.

The default is ORACLE_BASE.

ORACLE_GROUP_NAME

Specifies the name of the group containing icons of the Oracle products installed.

The parameter is added to your registry when you first install Oracle products, even if Oracle Universal Installer does not create a program group for Oracle products you have installed (for example, if you have installed only Oracle Net software). The default value is Oracle - *HOMENAME*.

ORACLE_HOME

Specifies Oracle home directory in which Oracle products are installed.

This directory is immediately beneath the Oracle base directory in the Oracle directory hierarchy. The default value is the drive letter and name that you specify during installation.

ORACLE_HOME_KEY

The HKEY_LOCAL_MACHINE location of Oracle parameters.

The default value is software\oracle\HOME*ID.*

ORACLE_HOME_USER

A string type entry that holds the Oracle Home User value.

If Windows built-in account is used as the Oracle Home User, then the string holds NT Authority\System and the user is not supposed to specify it explicitly.

ORACLE_HOMENAME

Specifies home name of Oracle home directory in which Oracle products are installed.

The default value is the name that you specify during installation.

ORACLE_PRRITY

Determines Windows scheduling priorities of the threads within the Oracle Database management system process.

The format is:

```
name1:priority1;name2:priority2 . . .
```

The name class sets the priority class of the Oracle Database process. Threads can be assigned a priority either collectively or individually. The collective name user designates non-background (shadow) threads; the collective name def designates any thread type not handled specifically. Valid individual background thread names include DBW0, LGWR, PMON, SMON, ARCH0, RECO, CKPT, TRWR, SNP0 through SNP9, and any other name found in the NAME column of the v$bgprocess data dictionary view.

The default value is class:normal; def:normal.

> **Note:**
>
> `ORACLE_PRRITY` is not automatically created for you in the registry. When it is not defined in the registry, Windows default values are used for thread priorities.

ORACLE_SID

Specifies the name of the Oracle Database instance on the host computer.

The value of this parameter is the *`SID`* for the instance. The default value is specified by the entry in the Database Identification window of Oracle Universal Installer.

OSAUTH_PREFIX_DOMAIN

Enables user authentication.

When it is set to `true`, it enables the server to differentiate between one username and another, whether they are local users, domain users, or domain users on another domain in your network. When it is set to `false`, the domain is ignored, and the local user becomes the default value of the operating system user returned to the server. The default value is `true`.

RDBMS_ARCHIVE

Specifies the location of backup database files.

The default value is *`ORACLE_HOME`*`\database\archive`.

RDBMS_CONTROL

Specifies the location of backup database control files.

The default value is *`ORACLE_HOME`*`\database`.

SQLPATH

Specifies the location of SQL scripts.

The default value is *`ORACLE_HOME`*`\dbs`.

About HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE

This subkey contains the following parameter:

- INST_LOC
  Specifies the location of Oracle Universal Installer files.

INST_LOC

Specifies the location of Oracle Universal Installer files.

The default value is *`System Drive`*`:\program files\oracle\inventory`.

About HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services

`HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet` contains the following keys:

- Control
- Enum
- HardwareProfiles
- Services

The first three are used by the operating system. You can edit only the `Services` subkey, which contains Parameters for Oracle Database Services.

- Parameters for Oracle Database Services
  `HKEY_LOCAL_MACHINE\SYSTEM\CURRENTCONTROLSET\SERVICES` subkey contains additional subkeys that correspond to each Oracle Database service.

Parameters for Oracle Database Services

`HKEY_LOCAL_MACHINE\SYSTEM\CURRENTCONTROLSET\SERVICES` subkey contains additional subkeys that correspond to each Oracle Database service.

Each service subkey contains the following parameters:

- `DisplayName` specifies the service name of the instance whose *`SID`* is *`SID`*. The default value is the name of the service. For example, `OracleServiceORCL1`, where `ORCL1` is the *`SID`*.
- `ImagePath` specifies the fully qualified path name of the executable started by the service and any command-line arguments passed into the executable at run time. The default value is the path to the executable file of the product.
- `ObjectName` specifies the logon user account and computer to which the service must log on. The default value is `LocalSystem`.

Overview of Oracle RAC Registry Parameters

Oracle RAC registry values are based on the clusterware.

If you are not using the clusterware, then some of this information may not be applicable to your particular cluster environment.

> **Note:**
>
> Oracle RAC is only supported on 64-bit Windows server operating systems.

- About HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\OCR
  This subkey contains the following values:

About HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\OCR

This subkey contains the following values:

- `OCRROOT` points to the location of the Oracle Cluster Registry file
- `LOCAL_ONLY` which is set to `False` for a cluster installation and `True` for a single-instance database installation

Managing Registry Parameters with regedit

Learn how to manage registry parameters.

> **Note:**
>
> Do not edit your registry unless absolutely necessary. If an error occurs in your registry, then Oracle Database for Windows can stop functioning, and the registry itself can become unusable.

- Modifying a Parameter Value with regedit
  Use this procedure to modify a parameter value with regedit.
- Adding a Registry Parameter with regedit
  Use this procedure to add a registry parameter with regedit.

Modifying a Parameter Value with regedit

Use this procedure to modify a parameter value with regedit.

To edit Oracle-related settings:

1. Start Registry Editor in one of the two ways:
   - From the command prompt, enter:

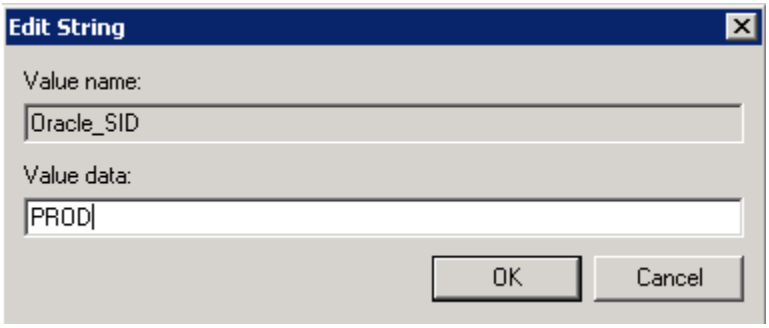
     ```
     C:\> regedit
     ```

   - From the **Start** menu, select **Run**, enter `regedit` in the **Open** field, and click **OK**.

   The Registry Editor window appears.
2. Navigate to the values you want to view or modify by double-clicking appropriate keys.

   The left-hand side of the window shows the hierarchy of the registry keys, and the right-hand side of the window shows the various values associated with a key.
3. Double-click the parameter to change the value data to the new `SID`.

   The Edit String dialog appears:



4. Make any necessary edits.
5. Click **OK**.
6. Choose **Exit** from the **Registry Editor** menu.

Adding a Registry Parameter with regedit

Use this procedure to add a registry parameter with regedit.

To add a parameter to the registry:

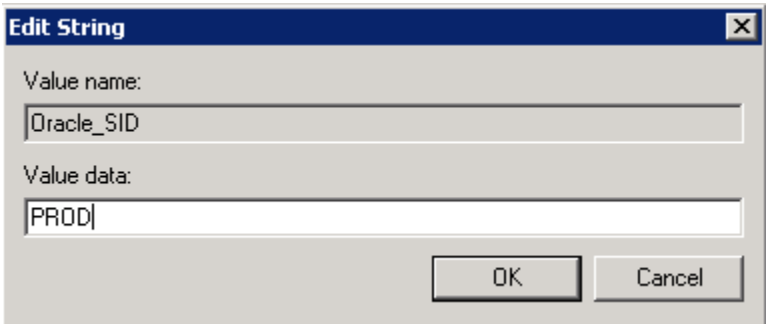
1. Start Registry Editor in one of the two ways:
   - From the command prompt, enter:

     ```
     C:\> regedit
     ```

   - From the **Start** menu, select **Run**, enter `regedit` in the **Open** field, and click **OK**.

   The Registry Editor window appears.
2. Navigate to the registry key to which you want to add the new value.
3. Choose **New** from the **Edit** menu.
4. From the list, select the data type that you want to edit:
   - String Value
   - Binary value
   - DWORD (32-bit) Value
   - QWORD (64-bit) Value
   - Multi-String Value
   - Expandable String Value
5. A *`New Value #1`* string value name is created on the right pane of the Registry Editor window of the chosen data type. Example, `REG_EXPAND_SZ` and so on.
6. Right-click the parameter, select **Rename** and press **Enter** to rename it.
7. Double-click the parameter to change the value data to the new `SID`.
8. Click **OK**.

   The Edit String dialog appears:



9. Type the value for the parameter.
10. Click **OK**.

    Registry Editor adds the parameter.
11. Choose **Exit** from the **Registry** menu.

17

Developing Applications for Windows

Describes about the sources of information on developing applications for Windows and outlines a procedure for building and debugging external procedures.

- About Building External Procedures
  Describes how to create and use external procedures on Windows.
- Overview of Multithreaded Agent Architecture
  An agent process is started for each session to access a system at the same time leading to several thousand agent processes concurrently.
- About Debugging External Procedures
  Usually, when an external procedure fails, its C prototype is faulty.
- About Accessing Text Files with UTL_FILE
  Package `UTL_FILE` allows your PL/SQL programs to read and write the operating system text files.

About Building External Procedures

Describes how to create and use external procedures on Windows.

The following files are located in *`ORACLE_HOME`*`\rdbms\extproc`:

- **`extern.c`** is the code example shown in "Writing an External Procedure"

  `make.bat` is the batch file that builds the dynamic link library
- **`extern.sql`** automates the instructions described in "Registering an External Procedure" and "Executing an External Procedure"
- External Procedures Overview
  External procedures are functions written in a third-generation language (C, for example) and callable from within PL/SQL or SQL as if they were a PL/SQL routine or function.
- Configuring Oracle Net Services
  During database server installation, Oracle Net Configuration Assistant configures `listener.ora` and `tnsnames.ora` files for external procedure calls.
- Writing an External Procedure
  Using a third-generation programming language, you can write functions to be built into DLLs and started by `EXTPROC`.
- Building a DLL
  After writing your external procedures in a third-generation programming language, use the appropriate compiler and linker to build a DLL, making sure to export the external procedures as noted previously.
- Registering an External Procedure
  Once you have built a DLL containing your external procedures, you must register your external procedures with Oracle Database.

- Restricting Library-Related Privileges to Trusted Users Only
  The `CREATE LIBRARY`, `CREATE ANY LIBRARY`, `ALTER ANY LIBRARY`, and `EXECUTE ANY LIBRARY` privileges, and grants of `EXECUTE ON` *`library_name`* convey a great deal of power to users.
- Executing an External Procedure
  To run an external procedure, you must call the PL/SQL program unit (that is, the alias for the external function) that registered the external procedure.

External Procedures Overview

External procedures are functions written in a third-generation language (C, for example) and callable from within PL/SQL or SQL as if they were a PL/SQL routine or function.

External procedures let you take advantage of strengths and capabilities of a third-generation programming language in a PL/SQL environment.

> **Note:**
>
> Oracle Database also provides a special purpose interface, the call specification, that lets you call external procedures from other languages, as long as they are callable by C.

The main advantages of external procedures are:

- Performance, because some tasks are performed more efficiently in a third-generation language than in PL/SQL, which is better suited for SQL transaction processing
- Code re-usability, because dynamic link libraries (DLLs) can be called directly from PL/SQL programs on the server or in client tools

You can use external procedures to perform specific processes:

- Solving scientific and engineering problems
- Analyzing data
- Controlling real-time devices and processes

> **Note:**
>
> Special security precautions are warranted when configuring a listener to handle external procedures.

To create and use an external procedure, perform the following steps:

1. Writing an External Procedure
2. Building a DLL
3. Registering an External Procedure
4. Restricting Library-Related Privileges to Trusted Users Only

5. Executing an External Procedure

> **Note:**
>
> - You must have a C compiler and linker installed on your system to build DLLs.
> - You can combine the instructions described in the fourth and fifth tasks into one SQL script that automates the task of registering and executing your external procedure. See *ORACLE_HOME*\rdbms\extproc\extern.sql for an example of a SQL script that combines these steps.

Related Topics

- *Oracle Database Net Services Administrator's Guide*

Configuring Oracle Net Services

During database server installation, Oracle Net Configuration Assistant configures listener.ora and tnsnames.ora files for external procedure calls.

When an application calls an external procedure, Oracle Net Listener starts an external procedure agent called EXTPROC. By default, the extproc process communicates directly through the server process. Using a network connection established by the listener, the application passes the following information to EXTPROC:

- DLL name
- External procedure name
- Parameters (if necessary)

EXTPROC then loads the DLL, runs the external procedure, and passes back any values returned by the external procedure.

If you overwrite default listener.ora and tnsnames.ora files, then you must manually configure the following files for the external procedure behavior described previously to occur:

- *ORACLE_HOME*\network\admin\listener.ora
- *ORACLE_HOME*\network\admin\tnsnames.ora

> **Note:**
>
> Additional security may be required for the listener in a production environment.

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

Writing an External Procedure

Using a third-generation programming language, you can write functions to be built into DLLs and started by `EXTPROC`.

The following is a simple Microsoft Visual C++ example of an external procedure called `FIND_MAX`:

> **Note:**
>
> Because external procedures are built into DLLs, they must be explicitly exported. In this example, the `DLLEXPORT` storage class modifier exports the function `FIND_MAX` from a dynamic link library.

```
#include <windows.h>
#define NullValue -1
/*
  This function tests if x is at least as big as y.
*/
long __declspec(dllexport) find_max(long     x,
                short     x_indicator,
long     y,
short y_indicator,
                short *ret_indicator)
{
   /* It can be tricky to debug DLL's that are being called by a process
      that is spawned only when needed, as in this case.
      Therefore try using the DebugBreak(); command.
      This starts your debugger.  Uncomment the line with DebugBreak();
      in it and you can step right into your code.
   */
   /* DebugBreak();  */

   /* First check to see if you have any nulls. */
   /* Just return a null if either x or y is null. */

   if ( x_indicator==NullValue || y_indicator==NullValue) {
      *ret_indicator = NullValue;
      return(0);
   } else {
      *ret_indicator = 0;       /* Signify that return value is not null. */
      if (x >= y) return x;
      else return y;
   }
}
```

Building a DLL

After writing your external procedures in a third-generation programming language, use the appropriate compiler and linker to build a DLL, making sure to export the external procedures as noted previously.

See your compiler and linker documentation for instructions on building a DLL and exporting its functions.

You can build the external procedure FIND_MAX, created in "Writing an External Procedure", into a DLL called extern.dll by going to *ORACLE_HOME*\rdbms\extproc and typing make. After building the DLL, you can move it to any directory on your system.

The default behavior of EXTPROC is to load DLLs only from *ORACLE_HOME*\bin or *ORACLE_HOME*\lib. To load DLLs from other directories, you must set environment variable EXTPROC_DLLS to a colon (:) separated list (semicolon-separated on Windows systems) of the DLL names qualified with their complete paths. The preferred way to set this environment variable is through the ENVS parameter in listener.ora.

> **See Also:**
>
> *Oracle Database Development Guide* for more information on EXTPROC

Registering an External Procedure

Once you have built a DLL containing your external procedures, you must register your external procedures with Oracle Database.

Now, you can configure the EXTPROC process to be authenticated through a CREDENTIAL for better security.

Oracle Database supports two new extensions to the CREATE LIBRARY command. This includes a CREDENTIAL clause and a DIRECTORY object option. The CREDENTIAL clause defines the user the EXTPROC runs as while the DIRECTORY object option specifies the directory where the DLL can be located.

To create a PL/SQL library to map to the DLL:

1. Set environment variable EXTPROC_DLLS in the ENVS parameter in listener.ora. For example:

```
SID_LIST_LISTENER =
 (SID_LIST =
  (SID_DESC =
   (SID_NAME=PLSExtProc)

(ENVS=EXTPROC_DLLS=C:\app\oracle\product\21.0.0\dbhome_1\rdbms\extproc\extern.dll)
   (ORACLE_HOME=C:\app\oracle\product\21.0.0\dbhome_1)
   (PROGRAM=extproc)
  )
 )
```

2. Start SQL*Plus:

```
C:\> sqlplus
```

3. Connect to the database with appropriate username and password.
4. Create the PL/SQL library using the CREATE LIBRARY command:

```
DBMS_CREDENTIAL.CREATE_CREDENTIAL(...);
CREATE DIRECTORY DLL_LOC as ...;
CREATE LIBRARY externProcedures as 'extern.dll' in DLL_LOC credential
the_credential;
```

where `the_credential` is the name chosen during the `DBMS_CREDENTIAL.CREATE_CREDENTIAL` invocation

```
SQL> CREATE LIBRARY externProcedures AS
'C:\app\oracle\product\21.0.0\dbhome_1\rdbms\ extproc\extern.dll';
```

where `externProcedures` is an alias library (essentially a schema object in the database), and

```
C:\app\oracle\product\21.0.0\dbhome_1\rdbms\extproc\extern.dll
```

is the path to the Windows operating system `dllextern.dll`. This example uses `C:\app\oracle\product\21.0.0` as your Oracle base and `dbhome_1` as your Oracle home.

> **Note:**
>
> The DBA must grant the `EXECUTE` privilege on the PL/SQL library to users who want to call the library's external procedure from PL/SQL or SQL. Separate `EXECUTE` privilege on credential and directory object extensions are required for them to function properly.

5. Create a PL/SQL program unit specification.

   Do this by writing a PL/SQL subprogram that uses the `EXTERNAL` clause instead of declarations and a `BEGIN...END` block. The `EXTERNAL` clause is the interface between PL/SQL and the external procedure. The `EXTERNAL` clause identifies the following information about the external procedure:

   - Name
   - DLL alias
   - Programming language in which it was written
   - Calling standard (defaults to C if omitted)

   In the following example, `externProcedures` is a DLL alias. You need the `EXECUTE` privilege for this library. The external procedure to call is `find_max`. If enclosed in double quotation marks, it becomes case-sensitive. The `LANGUAGE` term specifies the language in which the external procedure was written.

```
CREATE OR REPLACE FUNCTION PLS_MAX(
  x BINARY_INTEGER,
  y BINARY_INTEGER)
RETURN BINARY_INTEGER AS EXTERNAL
  LIBRARY externProcedures
  NAME "find_max"
  LANGUAGE C
  PARAMETERS (
    x long,                  -- stores value of x
    x_INDICATOR short,       -- used to determine if x is a NULL value
    y long,                  -- stores value of y
    y_INDICATOR short,        -- used to determine if y is a NULL value
  RETURN INDICATOR short );  -- need to pass pointer to return value's
                             -- indicator variable to determine if NULL
-- This means that my function is defined as:
    -- long max(long x, short x_indicator,
    -- long y, short y_indicator, short * ret_indicator)
```

Restricting Library-Related Privileges to Trusted Users Only

The `CREATE LIBRARY`, `CREATE ANY LIBRARY`, `ALTER ANY LIBRARY`, and `EXECUTE ANY LIBRARY` privileges, and grants of `EXECUTE ON` *`library_name`* convey a great deal of power to users.

If you plan to create PL/SQL interfaces to libraries, only grant the `EXECUTE` privilege to the PL/SQL interface. Do not grant `EXECUTE` on the underlying library. You must have the `EXECUTE` privilege on a library to create the PL/SQL interface to it. However, users have this privilege implicitly on libraries that they create in their own schemas. Explicit grants of `EXECUTE ON` *`library_name`* are rarely required. Only make an explicit grant of these privileges to trusted users, and never to the `PUBLIC` role.

Executing an External Procedure

To run an external procedure, you must call the PL/SQL program unit (that is, the alias for the external function) that registered the external procedure.

These calls can appear in any of the following:

- Anonymous blocks
- Standalone and packaged subprograms
- Methods of an object type
- Database triggers
- SQL statements (calls to packaged functions only)

In “Registering an External Procedure”, PL/SQL function `PLS_MAX` registered external procedure `find_max`**.** Follow these steps to run `find_max`:

1. Call PL/SQL function `PLS_MAX` from a PL/SQL routine named `UseIt`:

```
SET SERVER OUTPUT ON
CREATE OR REPLACE PROCEDURE UseIt AS
             a integer;
             b integer;
             c integer;
BEGIN
             a := 1;
             b := 2;
             c := PLS_MAX(a,b);
             dbms_output.put_line('The maximum of '||a||' and '||b||' is  '||c);
END;
```

2. Run the routine:

```
SQL> EXECUTE UseIt;
```

Related Topics

- Registering an External Procedure
  Once you have built a DLL containing your external procedures, you must register your external procedures with Oracle Database.

Overview of Multithreaded Agent Architecture

An agent process is started for each session to access a system at the same time leading to several thousand agent processes concurrently.

The agent processes operation regardless of whether each individual agent process is currently active. Agent processes and open connections can consume a disproportionate amount of system resources. This problem is addressed by using multithreaded agent architecture.

The multithreaded agent architecture uses a pool of shared agent threads. The tasks requested by the user sessions are put in a queue and are picked up by the first available multithreaded agent thread. Because only a small percentage of user connections are active at a given moment, using a multithreaded architecture allows for more efficient use of system resources.

See Also:

- *Oracle Database Development Guide*
- *Oracle Database Heterogeneous Connectivity User's Guide*

About Debugging External Procedures

Usually, when an external procedure fails, its C prototype is faulty.

That is, the prototype does not match the one generated internally by PL/SQL. This can happen if you specify an incompatible C data type. For example, to pass an `OUT` parameter of type `REAL`, you must specify `float *`. Specifying `float`, `double *`, or any other C data type results in a mismatch.

In such cases, you get a `lost RPC connection to external procedure agent` error, which means that agent `extproc` terminated abnormally because the external procedure caused a core dump.

- Using Package DEBUG_EXTPROC
  To help you debug external procedures, PL/SQL provides the utility package `DEBUG_EXTPROC`.

See Also:

Oracle Database Data Cartridge Developer's Guide. for information on how to avoid errors when declaring C prototype parameters

Using Package DEBUG_EXTPROC

To help you debug external procedures, PL/SQL provides the utility package `DEBUG_EXTPROC`.

To install the package, run the script `dbgextp.sql`, which you can find in the PL/SQL demo directory.

To use the package, follow instructions in `dbgextp.sql`. Your Oracle Database account must have `EXECUTE` privileges on the package and `CREATE LIBRARY` privileges.

To debug external procedures:

1. From Windows Task Manager, in the Processes dialog, select **ExtProc.exe**.
2. Right click, and select **Debug**.
3. Click **OK** in the message window.

   If you have built your DLL in a debug fashion with Microsoft Visual C++, then Visual C++ is activated.
4. In the Visual C++ window, select **Edit** > **Breakpoints**.

   Use the breakpoint identified in `dbgextp.sql` in the PL/SQL demo directory.

> **See Also:**
>
> - *ORACLE_HOME*`\rdbms\extproc\readme.doc` (explains how to run the sample and provides debugging advice)
> - *Oracle Database PL/SQL Language Reference*
> - *Oracle Database Java Developer's Guide*
> - *Oracle Database Development Guide* for more information about "Calling External Procedures"
> - *Oracle Database Data Cartridge Developer's Guide*

About Accessing Text Files with UTL_FILE

Package `UTL_FILE` allows your PL/SQL programs to read and write the operating system text files.

It provides a restricted version of the standard operating system stream file I/O, including open, put, get, and close operations. When you want to read or write a text file, you call the function `fopen`, which returns a file handle for use in subsequent procedure calls. For example, the procedure `put_line` writes a text string and line terminator to an open file, and the procedure `get_line` reads a line of text from an open file into an output buffer.

`FSEEK`, a `UTL_FILE` subprogram, adjusts the file pointer forward or backward within the file by the number of bytes specified. In order for `UTL_FILE.FSEEK` to work correctly, the lines in the file must have the platform-specific line terminator characters. On Windows platform, the correct line terminator characters are `<CR><LF>`.

See Also:

- *Oracle Database PL/SQL Packages and Types Reference* for more information about `UTL_FILE`
- *Oracle Database Development Guide* for information about "Retrieving HTTP URL Contents from PL/SQL"

A

Storing Tablespaces on Raw Partitions

Learn how to configure your system to store data files for a tablespace on raw partitions.

> **Note:**
>
> Oracle RAC requires additional configuration tools.

- Raw Partition Overview
  Data files for tablespaces can be stored on a file system or on raw partitions. A raw partition is a portion of a physical disk that is accessed at the lowest possible level.
- Configuring Disks for Oracle Automatic Storage Management
  To use Oracle Automatic Storage Management with direct attached storage (DAS) or storage area network (SAN) storage, the disks must be stamped with a header by `asmtool` or `asmtoolg` (GUI version).

> **See Also:**
>
> *Oracle Real Application Clusters Administration and Deployment Guide* for information about creating logical partitions and assigning symbolic links. Do not use this appendix to create partitions for Oracle RAC.

Raw Partition Overview

Data files for tablespaces can be stored on a file system or on raw partitions. A raw partition is a portion of a physical disk that is accessed at the lowest possible level.

Input/output (I/O) to a raw partition offers approximately a 5% to 10% performance improvement over I/O to a partition with a file system on it.

- About Physical Disk
  A physical disk represents the entire disk and points to the following:
- About Logical Partition
  Logical partitions point to drives other than `\Device\Harddiskx\Partition0`.
- About Physical Disk and Logical Partition Considerations
  Consider the following when deciding which raw partition to use:
- About Compatibility Issues
  You can create logical partitions, but define physical disk convention names for them. For example:

About Physical Disk

A physical disk represents the entire disk and points to the following:

```
\Device\Harddiskx\Partition0
```

Symbolic link name `\\.\PhysicalDrive`*x* is automatically defined by Windows for every hard disk in the computer. For example, a computer with three hard disks have the following symbolic links:

```
\\.\PhysicalDrive0
\\.\PhysicalDrive1
\\.\PhysicalDrive2
```

Internally, these names expand to the following:

```
\\.\PhysicalDrive0 =\Device\Harddisk0\Partition0
\\.\PhysicalDrive1 =\Device\Harddisk1\Partition0
\\.\PhysicalDrive2 =\Device\Harddisk2\Partition0
```

`Partition0` is special, because it represents the entire physical disk regardless of any partitioning scheme on that disk. Windows writes a signature on the first block of all disks it recognizes. To avoid overwriting that block, Oracle Database skips the first block of a physical raw partition that is used for an Oracle Database data file.

> **Note:**
>
> Although you can use physical disks, Oracle recommends that you use logical partitions.

About Logical Partition

Logical partitions point to drives other than `\Device\Harddisk`*x*`\Partition0`.

They are initially assigned names with drive letters (`\\.\`*drive_letter*:) and typically re-assigned symbolic link names (`\\.\`*symbolic link name*). For example, `\\.\D:` may be assigned a symbolic link name of `\\.\ACCOUNTING_1`. Regardless of whether a drive letter or symbolic link name is used, logical partitions are defined to represent a specific partition in a disk rather than the entire disk. Internally, these names can expand to:

```
\\.\D:= \Device\Harddisk2\Partition1
\\.\ACCOUNTING_1= \Device\Harddisk3\Partition2
```

> **Note:**
>
> Oracle Database does not skip the first block of a logical raw partition used for an Oracle Database data file.

About Physical Disk and Logical Partition Considerations

Consider the following when deciding which raw partition to use:

- Physical disks are automatically defined by Windows to represent the entire disk, and must never be defined by the user.
- Logical partitions must be defined by the user to represent a specific partition in a disk. These partitions must be logical partitions or drives contained in an extended partition. They must never be defined as `Partition0`.
- Using an entire disk (`Partition0`) for an Oracle Database data file and using a partition that occupies the entire disk for an Oracle Database data file are not the same thing. Even when a partition occupies the entire disk, there is still a small space on the disk that is not part of the partition.
- If you are using an entire disk for an Oracle Database data file (`Partition0`), then use the predefined physical raw names that Windows provides.
- If you are using a specific partition and it occupies the entire disk, then use a logical partition.
- If you are using a specific partition created with Windows disk-management tools, then define and use a symbolic link name rather than a logical partition number (even if it occupies the entire disk).

> **Note:**
>
> For both physical and logical raw conventions, use OCOPY to transfer the contents of a raw partition to a standard file system for backup purposes.

About Compatibility Issues

You can create logical partitions, but define physical disk convention names for them. For example:

```
\\.\PhysicalDriveACCOUNTING_1 = \Device\Harddisk2\Partition1
\\.\PhysicalDriveACCOUNTING_2 = \Device\Harddisk3\Partition1
```

Oracle Database then handles data files using the physical disk convention even though it really is a logical partition. This does not cause any data corruption or loss as long as you continue to use physical disk naming conventions. Oracle recommends that you convert to the logical partition at your earliest convenience.

You can also create logical names representing `Partition0`, but this is definitely not recommended. For example:

```
\\.\ACCOUNTING_1 = \Device\Harddisk1\Partition0
```

This poses severe problems, because Disk Management typically writes a signature into the first block of every disk, and consequently may overwrite a portion of the data file header. It can also cause data loss. Never use `Partition0` with the logical partition convention.

Physical and logical partition conventions are not compatible with one another because of the extra block that is skipped for physical raw conventions. This also means you cannot simply

use OCOPY to copy from a physical disk to a logical partition, because contents of these partitions are incompatible.

To convert from a physical convention to a logical convention, you must:

1. Perform a full database export to a (local) file system.
2. Create logical partitions and define logical names for these partitions.
3. Recreate the database by using the new logical partitions.
4. Perform the full database import to the newly-created database.

If your database installation uses physical disk conventions with logical partitions, Oracle recommends converting to the logical partition conventions at your earliest convenience, using the preceding steps.

> **See Also:**
>
> Your operating system documentation for information about creating extended and logical partitions

Configuring Disks for Oracle Automatic Storage Management

To use Oracle Automatic Storage Management with direct attached storage (DAS) or storage area network (SAN) storage, the disks must be stamped with a header by `asmtool` or `asmtoolg` (GUI version).

Each DAS or SAN disk must have a partition table. Oracle recommends creating exactly one partition for each disk containing the entire disk. Use Microsoft Computer Management or the command-line tool `diskpart` to create the partition. Once the partitions have been created, run `asmtoolg` or `asmtool`. These tools associate meaningful, persistent names with disks to facilitate using those disks with Oracle Automatic Storage Management. Oracle Automatic Storage Management uses disk strings to more easily operate on groups of disks at once, so the names created by `asmtool` make this easier than using Windows drive letters. All disk names created by `asmtool` begin with the prefix `ORCLDISK` for identification purposes.

Oracle Automatic Storage Management uses the value of initialization parameter `ASM_DISKSTRING` as its search path when it discovers disks. The default value of `ASM_DISKSTRING` is `\\.\ORCLDISK`*n*. If you want a different search path, then you must specify a different value for this parameter.

See Also:

- *Oracle Database Installation Guide for Microsoft Windows* "Step 3: Manually Configuring Disks for Oracle Automatic Storage Management" for instructions on using `asmtool` or `asmtoolg`
- *Oracle Automatic Storage Management Administrator's Guide*

  for information about "Initialization Parameter Files for an Oracle ASM Instance"

B

Oracle Net Services Configuration on Windows

Learn about Oracle Net Services configuration for Windows.

- About Configuring Oracle Database to Communicate with Oracle ASM
  Oracle Databases that use Oracle Automatic Storage Management (Oracle ASM) and the databases that are managed by Oracle Grid infrastructure must use Windows native authentication, which is enabled by default.
- About Modifying Oracle Net Services Registry Parameters and Subkeys
  The registry contains entries for Oracle Net Services parameters and subkeys.
- About Listener Requirements
  In Oracle Database, the listener is set to start automatically at system restart.
- Overview of Optional Configuration Parameters
  You can use the Windows parameters listed here with Oracle Net Services.
- Overview of Advanced Network Configuration
  Describes the advanced configuration procedures specifically for Oracle Net Services on Windows operating systems.

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

About Configuring Oracle Database to Communicate with Oracle ASM

Oracle Databases that use Oracle Automatic Storage Management (Oracle ASM) and the databases that are managed by Oracle Grid infrastructure must use Windows native authentication, which is enabled by default.

To ensure that it is, check that the `sqlnet.ora` file, by default located in *`ORACLE_HOME`*`\network\admin`, has NTS enabled. For example:

```
sqlnet.authentication_services=(NTS)
```

> **See Also:**
>
> About Windows Authentication Protocols

About Modifying Oracle Net Services Registry Parameters and Subkeys

The registry contains entries for Oracle Net Services parameters and subkeys.

To successfully add or modify Oracle Net Services configuration parameters, you must understand where they are located and the rules that apply to them.

- About Oracle Net Service Subkeys
  `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services` contains subkeys that correspond to services.

About Oracle Net Service Subkeys

`HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services` contains subkeys that correspond to services.

Depending on what is installed, your Oracle Net Services consist of all or a subset of the following:

- `Oracle`*`HOMENAME`*`ClientCache`
- `Oracle`*`HOMENAME`*`CMAdmin`
- `Oracle`*`HOMENAME`*`CMan`
- `Oracle`*`HOMENAME`*`TNSListener`

Each service subkey contains the parameters shown in Service Subkey Parameters.

Table B-1 Service Subkey Parameters

Parameter	Description
`DisplayName`	Specifies service name.
`ImagePath`	Specifies fully qualified path name of the executable started by service and any command line arguments passed to executable at run time.
`ObjectName`	Specifies logon user account and computer to which service must log on.

About Listener Requirements

In Oracle Database, the listener is set to start automatically at system restart.

You can verify the listener status by choosing the Windows **Control Panel**, then **Administrative Tools**, and then viewing the status of **Services**.

Oracle usually recommends that you only have a single net listener service running on a Windows computer at any one time. This single listener can support multiple databases. If you must have two different net listener services running on a Windows computer at the same time, ensure that they are configured to listen on different TCP/IP port numbers.

If the same IP address and port are used for different listeners, then you expect that the second and subsequent listeners fail to bind, instead, Windows allows them all to

listen on the same IP address and port, resulting in an unexpected behavior of the listeners. This is a suspected Windows operating system problem with TCP/IP and has been reported to Microsoft.

- Running Oracle Net Services
  Oracle Net Services such as Oracle Listener, CMADMIN, and CMAN Proxy Listener run under the specified Oracle Home User account (Windows User Account) specified during the installation.

Running Oracle Net Services

Oracle Net Services such as Oracle Listener, CMADMIN, and CMAN Proxy Listener run under the specified Oracle Home User account (Windows User Account) specified during the installation.

Oracle recommends that you specify the standard Windows User Account (not an Administrator) as the Oracle Home User. Oracle Universal Installer also has an option to create a new Windows User Account with limited privileges. When the Windows built-in account is used as the Oracle Home User, then Oracle Listener service runs under an high-privileged Local System Account (LSA) for database installation. For CMAN installation, if a Windows built-in account is used as the Oracle Home User, then CMADMIN and CMAN Proxy Listener runs under a low privileged LocalService Account.

Note:

The lsnrctl start command or CMAN proxy start command may prompt for password when relevant service does not exist. This happens for the first time for a given alias. Once the service is created, all subsequent start commands do not prompt for password. However, there is no prompt for password if you select Use Built-in Account as Oracle Home User.

See Also:

- *Oracle Database Net Services Administrator's Guide* for more information about User Accounts and Security
- *Oracle Database Net Services Reference* for more information about START

Overview of Optional Configuration Parameters

You can use the Windows parameters listed here with Oracle Net Services.

Oracle Net Service first checks for the parameters as environment variables, and uses the values defined. If environment variables are not defined, then Oracle Net Services searches for these parameters in the registry.

- About LOCAL Parameter
  You can use the parameter `LOCAL` to connect to Oracle Database without specifying a connect identifier in the connect string.

- About TNS_ADMIN Parameter
  You can add the parameter TNS_ADMIN to change the directory path of Oracle Net Services configuration files from the default location of *ORACLE_HOME*\network\admin.
- About USE_SHARED_SOCKET Parameter
  You can set the parameter USE_SHARED_SOCKET to true to enable the use of shared sockets.

About LOCAL Parameter

You can use the parameter LOCAL to connect to Oracle Database without specifying a connect identifier in the connect string.

The value of the parameter LOCAL is any connect identifier, such as a net service name. For example, if the parameter LOCAL is specified as finance, you can connect to a database from SQL*Plus with:

```
SQL> CONNECT SMITH
Enter password: password
```

rather than

```
SQL> CONNECT SMITH@finance
Enter password: password
```

Oracle Net checks if LOCAL is defined as an environment variable or as a parameter in the registry, and uses finance as the service name. If it exists, then Oracle Net connects.

About TNS_ADMIN Parameter

You can add the parameter TNS_ADMIN to change the directory path of Oracle Net Services configuration files from the default location of *ORACLE_HOME*\network\admin.

For example, if you set TNS_ADMIN to *ORACLE_HOME*\test\admin, then the configuration files are used from *ORACLE_HOME*\test\admin.

About USE_SHARED_SOCKET Parameter

You can set the parameter USE_SHARED_SOCKET to true to enable the use of shared sockets.

If this parameter is set to true, the network listener passes the socket descriptor for client connections to the database thread. As a result, the client does not establish a new connection to the database thread and database connection time improves. Also, all database connections share the port number used by the network listener, which can be useful if you are setting up third-party proxy servers.

This parameter only works in the dedicated server mode in a TCP/IP environment. If this parameter is set, you cannot use the Oracle database listener to spawn Oracle Database. To spawn a dedicated server for an instance of Oracle Database not associated with the same Oracle home as the listener and have shared socket enabled, you must also set parameter USE_SHARED_SOCKET for both Oracle homes.

Overview of Advanced Network Configuration

Describes the advanced configuration procedures specifically for Oracle Net Services on Windows operating systems.

About Configuring Authentication Method

Oracle Net Services provides authentication methods for Windows operating systems using Windows Native Authentication.

About Configuring Security for Named Pipes Protocol

The network listener service may be unable to open the Named Pipes created by Oracle Names unless service `Oracle`*`HOMENAME`*`TNSListener` has a valid user name and password associated with it.

> **See Also:**
>
> Your operating system documentation for instructions on setting up network listener permissions

Modifying Configuration of External Procedures for Higher Security

This section supplements the generic information provided in *Oracle Database Net Services Administrator's Guide* to configure a listener on Windows operating systems to exclusively handle external procedures. For a higher level of security, you are instructed to start the listener for external procedures from a user account with lower privileges than the `oracle` user. For Windows operating systems, this requires that you change the user account from LocalSystem to a local, unprivileged user for the `Oracle`*`HOMENAME`*`TNSListener`*`extproc_listener_name service`*.

> **Note:**
>
> The following instructions assume that you have performed steps 1 through 5 in the section "Modifying Configuration of External Procedures for Higher Security" and the procedure described in Default Configuration for External Procedures section in *Oracle Database Net Services Administrator's Guide*.

To change the listener account:

1. Create a new user account and grant it Log on as a Service privilege.

> **Note:**
>
> Ensure that this user account does not have general access to files owned by `oracle`. Specifically, this user must not have permission to read or write to database files or to the Oracle Database server address space. In addition, this user must have read access to the `listener.ora` file, but must not have the write access.

2. Stop service `Oracle`*`HOMENAME`*`TNSListener`*`extproc_listener_name`*.

   If the `Oracle`*`HOMENAME`*`TNSListener`*`extproc_listener_name`* service does not exist, issue the following command from the command prompt:

   ```
   lsnrctl start extproc_listener_name
   ```

   This creates the `Oracle`*`HOMENAME`*`TNSListener`*`extproc_listener_name`* service. When you return to the list of services, stop this service before proceeding to the next step of this procedure.

3. Select `Oracle`*`HOMENAME`*`TNSListener`*`extproc_listener_name`* service in the Services dialog and then display the properties of the service.
4. Select **This Account** and enter the user name and password.
5. Start the listener by clicking **Start**. You must start the listener in this way because you cannot use the Listener Control utility to start the listener running as an unprivileged local user.

> **Note:**
>
> You can also use NET START `Oracle`*`HOMENAME`*`TNSListener`*`extproc_listener_name`* to start the listener from the command prompt. Running the listener with lower privileges prevents you from using Listener Control utility `SET` commands to alter the configuration of this listener in file `listener.ora`. You can perform other administrative tasks on this listener with the Listener Control utility, including stopping the listener. Oracle recommends that you complete `listener.ora` file configuration before running the listener.

> **See Also:**
>
> - Your operating system documentation for instructions on accessing the Services dialog and stopping services
> - *Oracle Database Net Services Administrator's Guide*

C

Running Windows Services

Oracle Database supports Windows services to run under low-privileged, non-administrative accounts such as the LocalService, or an authenticated Windows User Account instead of the high-privileged Local System Account (LSA) for better security.

- About Windows Services for Oracle Database
  ORADIM creates Oracle Database service, Oracle VSS Writer service, and Oracle Scheduler service to run under the Oracle Home User account.

About Windows Services for Oracle Database

ORADIM creates Oracle Database service, Oracle VSS Writer service, and Oracle Scheduler service to run under the Oracle Home User account.

Oracle Home User is the standard Windows User Account (not an Administrator), specified during installation, that runs most of the Windows services required by Oracle for Oracle home.

If this Oracle Home User is a Windows Local User Account or a Windows Domain User Account, then ORADIM prompts for a password for that account and accepts the same through `stdin`.

All Oracle administration tools that create Windows services have been modified to prompt for the password of Oracle Home User when the Oracle Home User is a Windows Local User Account or a Windows Domain User Account, and the password for Oracle Home User is not stored in the Oracle Wallet.

- About Running Windows Services in Oracle Home
  Depending on the type of database installation and user account used as the Oracle Home User, Windows services run under low-privileged, non-administrative accounts such as a LocalService, or an authenticated Windows User Account, or as a high-privileged Local System Account (LSA) in Oracle home.
- Additional Privileges Required by Oracle Database Services
  Certain functions performed by the Oracle Database service require additional privileges.
- Granting Additional Operating System Privileges Manually
  To grant an operating system privilege to a specific user, perform the following steps:

Related Topics

- About Creating and Starting an Oracle Database Service
  Learn how to create and start an Oracle Database service.
- About Ways to Manage Oracle Database Services
  Learn how to manage the services that Oracle Database installs on your computer.

About Running Windows Services in Oracle Home

Depending on the type of database installation and user account used as the Oracle Home User, Windows services run under low-privileged, non-administrative accounts such as a

LocalService, or an authenticated Windows User Account, or as a high-privileged Local System Account (LSA) in Oracle home.

Table C-1 Running Windows Services

Type of Installation	Oracle Home User	Windows Service User for the Services
Oracle Database Server	Windows User Account	Windows User Account
Oracle Database Server	Built-in Account	Local System Account
Oracle Database Client	Windows User Account	Windows User Account
Oracle Database Client	Built-in Account	LocalService
Oracle Grid Infrastructure (with the Grid Infrastructure Management Repository)	Windows User Account	Grid Listeners using LocalService Database services using Windows User Account [1]Clusterware services using Local System Account
Oracle Grid Infrastructure (without the Grid Infrastructure Management Repository)	Built-in Account	Grid Listeners using LocalService Clusterware services using Local System Account

[1] Clusterware requires administrative privileges so it always uses Local System Account to run Windows services.

Additional Privileges Required by Oracle Database Services

Certain functions performed by the Oracle Database service require additional privileges.

Oracle Universal Installer and other Oracle tools automatically grant the following privileges to the Windows services `SID` of the respective services during the creation of these services:

- `SeIncreaseBasePriorityPrivilege`: A process requires this privilege to change the priority of its threads. This privilege is granted to Windows service `SIDs` of Oracle Automatic Storage Management (Oracle ASM) or Oracle Database services.
- `SeBackupPrivilege`: This privilege is required to perform backup operations. It is granted to the Windows service `SIDs` of Oracle VSS Writer service.
- `SeBatchLogonRight`: This privilege is required for an account to log on using the batch logon type. It is granted to the Windows service `SIDs` of Oracle Scheduler service.

To enable Oracle Database to use Large Pages or working set features, the following additional operating system privileges must be manually granted by the operating system administrator to either the Oracle Home User or to the Windows service `SIDs` of the specified Oracle Database service during the creation of these services.

Oracle recommends granting privileges to the Windows service `SID` of Oracle Database service instead of the Oracle Home User. The Windows service `SID` of the database service follows this syntax, `NT AUTHORITY\OracleService`*`SID`*.

- `SeLockMemoryPrivilege`: This privilege is required to lock pages in memory. Oracle Database requires this privilege to use Large Pages.
- `SeIncreaseQuotaPrivilege`: This privilege is required to change the memory quota for a process. This is needed while setting the `max` and `min` working set sizes for the database.

Related Topics

- Overview of Large Page Support
  Large page support is a feature of Oracle Database.

Granting Additional Operating System Privileges Manually

To grant an operating system privilege to a specific user, perform the following steps:

1. From the **Start** menu, select **Control Panel**.
2. Double-click **Administrative Tools**.
3. Double-click **Local Security Policy**.
4. In the left pane of the Local Security Policy window, expand **Local Policies** and select **User Rights Assignment**.
5. In the right pane of the Local Security Policy window, double-click the relevant user privilege. For example, select **Adjust memory quotas for a process** to change the memory quota for a process or select **Lock pages in memory** to use Large Pages.
6. Click **Add User or Group**.
7. Enter the Oracle Home User name in **Enter the object names to select** field and click **Check Names**.
8. Click **OK** to close the Select Users, Computers, Service Accounts, or Groups dialog box.
9. Click **OK** to close the Properties window for the privilege.

D

Error Messages on Windows

Learn about the various error messages, causes, and corrective actions that are specific to the operation of Oracle Database for Windows. You can also learn about the database connection issues.

> **Note:**
>
> The `ora.hlp` file, which was shipped in the previous releases, is no longer available.

- ORA-09275: CONNECT INTERNAL No Longer Supported
- ORA-15252 to ORA-15266: User Replacement Failure on Windows
  The following error messages are displayed when the SQL statement or the ASMCMD command for user replacement fails on Windows:
- ORA-15301 to ORA-15302: Failure to Modify Ownership, Group, and Permission of Opened Files
  Review the error messages that are displayed when trying to modify the ownership, group membership, or permission of a file fails while changing a file's owner.
- OSD-04000 to OSD-04599: Windows-Specific Oracle Database Messages
  Error messages in this section are Oracle Database operating system-dependent (OSD) messages displayed in response to an error condition in Windows.
- DIM-00000 to DIM-00228: ORADIM Command Syntax Errors
  `ORADIM` is a command-line tool for starting and stopping database instances that is only available on Oracle Database for Windows.
- Database Connection Issues
  Review database connection issues.

> **See Also:**
>
> *Oracle Database Error Messages* for information about error messages.

ORA-09275: CONNECT INTERNAL No Longer Supported

ORA-09275
Connect internal is not a valid DBA connection

Cause: `CONNECT INTERNAL` is no longer supported for DBA connections.

Action: If NTS is enabled, you can connect to the database as `CONNECT / AS SYSDBA` or `CONNECT / AS SYSOPER`. If NTS is not enabled, you can connect as `CONNECT SYS AS SYSDBA`. You can also connect as an existing user with the appropriate password.

ORA-15252 to ORA-15266: User Replacement Failure on Windows

The following error messages are displayed when the SQL statement or the ASMCMD command for user replacement fails on Windows:

ORA-15252
user name '%s' does not exist in OS user dictionary

Cause: The specified user name was not a valid operating system user.

Action: Specify a valid operating system user.

ORA-15260
permission denied on ASM disk group

Cause: An attempt was made to perform an operation on an ASM disk group without the appropriate privileges.

Action: Ask the ASM administrator to perform the operation or grant the required privileges.

ORA-15261
user '%s' already exists in disk group '%s'

Cause: The specified UID already existed in the disk group.

Action: Specify a different UID.

ORA-15262
user '%s' does not exist in disk group '%s'

Cause: The specified UID did not exist in the disk group.

Action: Specify a user with a valid UID.

ORA-15263
user name '%s' exceeds limit of %s characters

Cause: The length of the specified user name exceeded the maximum limit.

Action: Reduce the length of the user name to a value within the limit.

ORA-15264
Operating system function returned error %s

Cause: An operating system error occurred.

Action: Correct the operating system error and retry the operation.

ORA-15265
user identification number not in range of [%s,%s]

Cause: The operating system user identification number exceeded the maximum value.

Action: Change the user identification number to a value within the accepted range.

ORA-15266
user identification number '%s' is not allowed

Cause: This user identification number is used internally by ASM.

Action: Please choose a different user identification number.

ORA-15301 to ORA-15302: Failure to Modify Ownership, Group, and Permission of Opened Files

Review the error messages that are displayed when trying to modify the ownership, group membership, or permission of a file fails while changing a file's owner.

The following error messages are displayed:

ORA-15301
cannot change %s of the open file '%s'

Cause: A SET OWNERSHIP or SET PERMISSION command was attempted on an open file.

Action: Close the file and retry the SQL command.

ORA-15302
active use of files owned by user '%s' precludes its drop

Cause: A DROP USER command specified a user owning files that were in use.

Action: Close all files owned by this user.

OSD-04000 to OSD-04599: Windows-Specific Oracle Database Messages

Error messages in this section are Oracle Database operating system-dependent (OSD) messages displayed in response to an error condition in Windows.

Each message in this section triggers an Oracle Database error message.

Error messages appear first in summary tables consisting of error numbers and the corresponding error message. Following the tables is a more detailed discussion of errors, including causes and corrective actions.

File I/O Errors:	OSD-04000 to OSD-04099
4000	Logical block size mismatch
4001	Invalid logical block size

File I/O Errors:	OSD-04000 to OSD-04099
4002	Unable to open file
4003	Unable to read file header block
4004	Invalid file header
4005	SetFilePointer() failure, unable to read from file
4006	ReadFile() failure, unable to read from file
4007	Truncated read
4008	WriteFile() failure, unable to write to file
4009	Truncated write
4010	<create> option specified, file already exists
4011	GetFileInformationByHandle() failure, unable to obtain file info
4012	File size mismatch
4013	Unable to read line from file
4014	Unable to close file
4015	An asynchronous I/O request returned an error
4016	Error queuing an asynchronous I/O request
4017	Unable to open the specified RAW device
4018	Unable to access the specified directory or device
4019	Unable to set file pointer
4020	Unable to set eof file marker
4021	Unable to read file
4022	Unable to write file
4023	SleepEx() failure, unable to Sleep
4024	Unable to delete file
4025	Invalid question asked
4026	Invalid parameter passed

Memory Errors:	OSD-04100 to OSD-04199
4100	malloc() failure, unable to allocate memory
4101	Invalid SGA: SGA not initialized
4102	Unable to open/create file for shared memory object
4103	Unable to attach to SGA: SGA does not exist
4104	Unable to map shared memory (SGA) into the address space
4105	Shared memory (SGA) mapped to wrong address
4106	Unable to allocate memory with VirtualAlloc
4107	Unable to deallocate memory with VirtualFree
4108	Unable to protect memory with VirtualProtect

Process Errors:	OSD-04200 to OSD-04299
4200	Unable to begin another thread

Process Errors:	OSD-04200 to OSD-04299
4201	No pid structure supplied to spdcr()
4202	DosSetPriority() failure, unable to set process priority
4203	DosKillProcess() failure, unable to kill process
4204	Invalid pid
4205	CreateProcess() failure, unable to spawn process
4207	Invalid priority specified in CONFIG parameter ORACLE_PRIORITY
4208	OpenProcess() failure, unable to open process handle
4209	Incorrect or unknown background image name given to spdcr()
4210	Timeout waiting for thread semaphore
4211	Thread information not found
4212	Maximum number of ORACLE threads reached
4213	ORACLE thread unable to DuplicateHandle()
4214	ORACLE thread unable to CreateEvent()
4215	Bad function code supplied to ssthreadop
4216	Unable to find file handle for that thread
4217	Unable to retrieve system username for current user
4218	Cannot post thread
4219	Bad thread list semaphore
4221	Target thread is currently busy
4222	Unable to get the threads context
4223	Unable to set the threads context
4224	Unable to suspend the target thread
4225	Unable to resume the target thread

Loader Errors:	OSD-04300 to OSD-04399
4300	Unable to read complete record from data file
4301	Record size too large
4302	Invalid record type, load options, or both

Semaphore Errors:	OSD-04400 to OSD-04499
4400	Unable to acquire internal semaphore for process
4401	WaitForSingleObject() failure, unable to obtain semaphore

Miscellaneous Errors:	OSD-04500 to OSD-04599
4500	Illegal option specified
4501	Internal buffer overflow
4502	Translations nested too deep
4503	Text contains no translatable elements
4505	stdin not responding

Miscellaneous Errors:	OSD-04500 to OSD-04599
4506	Unable to spawn process through system()
4510	Operating system roles are not supported
4511	Unable to get date and time from the operating system
4512	Unable to translate the 'USERNAME' config.ora variable on server
4513	The Windows Group name is too long for internal buffer
4514	This command is not implemented at this time

File I/O Errors: OSD-04000 to OSD-04099

Review File I/O errors.

OSD-04000
Logical block size mismatch

Cause: Database block size specified in the initialization parameter file does not match block size of actual database files.

Action: Use matching logical block sizes.

OSD-04001
Invalid logical block size

Cause: Logical block size is not a multiple of 512 bytes, or it is too large.

Action: Change the value of `DB_BLOCK_SIZE` in the initialization parameter file.

OSD-04002
Unable to open file

Cause: Specified path or file name is invalid, or destination device is full. This error can also be caused by insufficient Windows file handles.

Action: Make sure path and file exist, and device has free space. If this fails, then increase number of Windows file handles.

OSD-04003
Unable to read file header block

Cause: Media has been damaged.

Action: Recover file, if necessary, and verify that Windows is functioning correctly.

OSD-04004
Invalid file header

Cause: File is damaged.

Action: Recover file.

OSD-04005
SetFilePointer() failure, unable to read from file

Cause: Unexpected return from Windows system service SetFilePointer().

Action: Check operating system error code and operating system documentation.

OSD-04006
ReadFile() failure, unable to read from file

Cause: Unexpected return from Windows system service ReadFile().

Action: Check operating system error code and operating system documentation.

OSD-04007
Truncated read

Cause: System encountered an unexpected end-of-file, which is due to damaged media.

Action: Verify that file is not damaged.

OSD-04008
WriteFile() failure, unable to write to file

Cause: Unexpected return from Windows system service WriteFile().

Action: Check operating system error code and operating system documentation.

OSD-04009
Truncated write

Cause: Destination device is full, or media is damaged.

Action: Verify that device has free space and that file is not damaged.

OSD-04010
<create> option specified, file already exists

Cause: File you attempted to create already exists.

Action: Delete existing file or use `REUSE` option in SQL statement.

OSD-04011
GetFileInformationByHandle() failure, unable to obtain file info

Cause: Unexpected return from Windows system service GetFileInformationByHandle().

Action: Check operating system error code and operating system documentation.

OSD-04012
File size mismatch

Cause: File to be re-used is either too large or too small.

Action: Specify correct file size or delete existing file.

OSD-04013
Unable to read line from file

Cause: This error is caused by an operating system error or by damaged media.

Action: Check operating system error code (if available) and operating system documentation. If no operating system error code is presented, then verify that media is not damaged.

OSD-04014
Unable to close file

Cause: Media has been damaged.

Action: Recover file, if necessary, and verify that Windows is functioning correctly.

OSD-04015
Asynchronous I/O request returned an error

Cause: Unexpected return from Windows system service.

Action: Check operating system error code and operating system documentation.

OSD-04016
Error queuing an asynchronous I/O request

Cause: Unexpected return from Windows system service.

Action: Check operating system error code and operating system documentation.

OSD-04017
Unable to open the specified RAW device

Cause: An invalid path or file name was specified, or device is full.

Action: Make sure file exists and device is not full; verify that operating system is functioning correctly.

OSD-04018
Unable to access the specified directory or device

Cause: An invalid path name was specified.

Action: Make sure directory or device exists and is accessible.

OSD-04019
Unable to set file pointer

Cause: This error is caused by an operating system error or by damaged media.

Action: Check operating system error code (if available) and operating system documentation. If no operating system error code is presented, then verify that media is not damaged.

OSD-04020
Unable to set eof file marker

Cause: This error is caused by an operating system error or by damaged media.

Action: Check operating system error code (if available) and operating system documentation. If no operating system error code is presented, then verify that media is not damaged.

OSD-04021
Unable to read file

Cause: This error is caused by an operating system error or by damaged media.

Action: Check operating system error code (if available) and operating system documentation. If no operating system error code is presented, then verify that media is not damaged.

OSD-04022
Unable to write file

Cause: This error is caused by an operating system error or by damaged media.

Action: Check operating system error code (if available) and operating system documentation. If no operating system error code is presented, then verify that media is not damaged.

OSD-04023
SleepEx() failure, unable to Sleep

Cause: Unexpected return from Windows system service.

Action: Check operating system error code and operating system documentation.

OSD-04024
Unable to delete file

Cause: This error is caused by an operating system error or by damaged media.

Action: Check operating system error code (if available) and operating system documentation. If no operating system error code is presented, then verify that media is not damaged.

OSD-04025
Invalid question asked

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

OSD-04026
Invalid parameter passed

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

Memory Errors: OSD-04100 to OSD-04199

Review memory errors.

OSD-04100
Malloc() failure, unable to allocate memory

Cause: Program is out of memory.

Action: Shut down all unnecessary processes or install more memory in the computer.

OSD-04101
Invalid SGA: SGA not initialized

Cause: System Global Area (SGA) has been allocated but not initialized.

Action: Wait until STARTUP has completed before attempting to connect.

OSD-04102
Unable to open/create file for shared memory object

Cause: Unexpected return from Windows system service CreateFile().

Action: Check operating system error code and operating system documentation.

OSD-04103
Unable to attach to SGA: SGA does not exist

Cause: SGA does not exist.

Action: Start up an Oracle Database instance.

OSD-04104
Unable to map shared memory (SGA) into the address space

Cause: Unexpected return from Windows system service MapViewOfFileEx().

Action: Check operating system error code and operating system documentation.

OSD-04105
Shared memory (SGA) mapped to wrong address

Cause: Unexpected return from Windows system service MapViewOfFileEx().

Action: Check operating system error code and operating system documentation.

OSD-04106
Unable to allocate memory with VirtualAlloc

Cause: Program is out of memory.

Action: Shut down all unnecessary processes or install more memory in the computer.

OSD-04107
Unable to deallocate memory with VirtualFree

Cause: Unexpected return from Windows system service VirtualFree().

Action: Check operating system error code and operating system documentation.

OSD-04108
Unable to protect memory with VirtualProtect

Cause: Unexpected return from Windows system service VirtualProtect().

Action: Check operating system error code and operating system documentation.

Process Errors: OSD-04200 to OSD-04299

Review process errors.

OSD-04200
Unable to begin another thread

Cause: Program has run out of system resources.

Action: Shut down all unnecessary processes; install more memory in the computer.

OSD-04201
No pid structure supplied to spdcr()

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

OSD-04202
DosSetPriority() failure, unable to set process priority

Cause: Unexpected return from Windows system service DosSetPriority().

Action: Check operating system error code and operating system documentation.

OSD-04203
DosKillProcess() failure, unable to kill process

Cause: Unexpected return from Windows system service DosKillProcess().

Action: Check operating system error code and operating system documentation.

OSD-04204
Invalid pid

Cause: Process ID not recognized by system; process previously terminated.

Action: Verify that process ID is correct and that process is active.

OSD-04205
CreateProcess() failure, unable to spawn process

Cause: Unexpected return from Windows system service CreateProcess().

Action: Check operating system error code and operating system documentation.

OSD-04207
Invalid priority specified in CONFIG parameter *ORACLE_PRIORITY*

Cause: Priority specified is invalid or out of range.

Action: Specify a valid setting for ORACLE_PRIORITY.

OSD-04208
OpenProcess() failure, unable to open process handle

Cause: Unexpected return from Windows system service OpenProcess().

Action: Check operating system error code and operating system documentation.

OSD-04209
Incorrect or unknown background image name given to spdcr()

Cause: Unexpected background name given to spdcr().

Action: Contact Oracle Support Services.

OSD-04210
Timeout waiting for thread semaphore

Cause: An Oracle Database thread died holding the semaphore.

Action: Restart Oracle Database instance.

OSD-04211
Thread information not found

Cause: An Oracle Database thread died without deleting its information.

Action: Restart Oracle Database instance.

OSD-04212
Maximum number of Oracle threads reached

Cause: Maximum number of Oracle Database threads for the instance is reached.

Action: Wait until some connections exit before trying again.

OSD-04213
Oracle thread unable to DuplicateHandle()

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

OSD-04214
Oracle thread unable to CreateEvent()

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

OSD-04215
Bad function code supplied to ssthreadop

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

OSD-04216
Unable to find file handle for that thread

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

OSD-04217
Unable to retrieve system username for current user

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

OSD-04218
Cannot post thread

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

OSD-04219
Bad thread list semaphore

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

OSD-04221
Target thread is currently busy

Cause: Target thread is processing an Oracle Database utility command.

Action: Wait and resend command.

OSD-04222
Unable to get the threads context

Cause: Check operating system error code.

Action: Remedy operating system error.

OSD-04223
Unable to set the threads context

Cause: Check operating system error code.

Action: Remedy operating system error.

OSD-04224
Unable to suspend the target thread

Cause: Check operating system error code.

Action: Remedy operating system error.

OSD-04225
Unable to resume the target thread

Cause: Check operating system error code.

Action: Remedy operating system error.

Loader Errors: OSD-04300 to OSD-04399

Review loader errors.

OSD-04300
Unable to read complete record from the datafile

Cause: Datafile ended in the middle of a record. This error occurs when loading files with a fixed record length.

Action: Verify that the datafile is of correct length and contains complete records.

OSD-04301
Record size too large

Cause: Specified record size is too large to load.

Action: Reduce record size and reload data.

OSD-04302
Invalid record type, load options, or both

Cause: Control file's Windows file processing options string contains an invalid option or keyword.

Action: Set Windows file processing options string to an acceptable value.

Semaphore Errors: OSD-04400 to OSD-04499

Review Semaphore errors.

OSD-04400
Unable to acquire internal semaphore for process

Cause: Oracle Database has exceeded the maximum number of connections.

Action: Delete any unused connections and try again.

OSD-04401
WaitForSingleObject() failure, unable to obtain semaphore

Cause: Unexpected return from Windows system service WaitForSingleObject().

Action: Check operating system error code and operating system documentation.

Miscellaneous Errors: OSD-04500 to OSD-04599

Review miscellaneous errors.

OSD-04500
Illegal option specified

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

OSD-04501
Internal buffer overflow

Cause: This is an internal error, not normally expected to occur.

Action: Contact Oracle Support Services.

OSD-04502
Translations nested too deep

Cause: Program encountered too many intermediate translations while attempting to translate a configuration variable.

Action: Simplify values of configuration parameters to include fewer intermediate translations.

OSD-04503
Text contains no translatable elements

Cause: Program cannot recognize variables in text to be translated.

Action: Check and, if necessary, correct text to be translated.

OSD-04505
stdin not responding

Cause: System cannot receive input from standard input stream.

Action: Verify that process has access to an input device.

OSD-04506
Unable to spawn process through system()

Cause: System is out of memory or executable is invalid.

Action: Shut down unnecessary processes; install more memory in the computer. Verify name of executable.

OSD-04510
Operating system roles are not supported

Cause: An attempt was made to use an operating system role.

Action: Only use roles that were created '`IDENTIFIED BY` *`PASSWORD`*' as opposed to '`IDENTIFIED EXTERNALLY`'.

OSD-04511
Unable to get date and time from the operating system

Cause: Unexpected return from GetLocalTime() call.

Action: Verify that system time is correct on the computer.

OSD-04512
Unable to translate the '*`USERNAME`*' config.ora variable on server

Cause: '`USERNAME`' configuration parameter variable on host is not properly set.

Action: Verify '`USERNAME`' variable is set.

OSD-04513
The Windows Group name is too long for internal buffer

Cause: Windows Group name is too long.

Action: Use a shorter Windows group name.

DIM-00000 to DIM-00228: ORADIM Command Syntax Errors

`ORADIM` is a command-line tool for starting and stopping database instances that is only available on Oracle Database for Windows.

It is not available on any other platform.

Oradim Errors	DIM-0000 to DIM-00228
00000	ORADIM completed with no errors
00001	ORADIM: <command> [options]. Refer to manual.
00002	The specified command was invalid.
00003	An argument is missing for the parameter
00004	SID or service name was not specified.
00005	SID with more than 64 characters specified.
00006	Missing SID
00007	Missing or invalid -STARTMODE parameter. Valid -STARTMODE parameter is AUTO or MANUAL.
00008	A valid service name is OracleService appended with a SID

Oradim Errors	DIM-0000 to DIM-00228
00009	SID name is mandatory.
00010	`SYSTEM\CurrentControlSet\Services\OracleService` key does not exist.
00011	The specified service does not exist.
00012	A PFILE is necessary for AUTOSTART option.
00013	Service start mode could not be set in the registry.
00014	Cannot open the Windows Service Control Manager.
00015	Cannot start already-running ORACLE - shut it down first.
00016	Missing or invalid -SHUTTYPE parameter. A valid -SHUTTYPE parameter is SRVC or INST.
00017	Instance shutdown mode must be one of the following: a for abort, i for immediate or n for normal.
00018	Failed to stop Oracle Service.
00019	Create Service Error.
00020	A service for this name exists.
00021	Registry open failed.
00040	Invalid option for the -NEW command.
00041	Invalid option for the -EDIT command.
00042	Invalid option for the -DELETE command.
00043	Invalid option for the -STARTUP command.
00044	Invalid option for the -SHUTDOWN command.
00045	Internal error in ORADIM.
00046	Invalid Pfile.
00050	Instance deleted.
00051	Instance created.
00075	Failed to control service.
00076	Failed to delete service.
00077	Failed to change service configuration.
00078	Failed to start service.
0090	SID name is invalid.
0092	Unable to determine Oracle service user.
0093	Invalid option for the -ACL command.
0094	Failed to change ACLs on the object.
00200	Enter one of the following commands:
00201	Create an instance by specifying the following options:
00202	-NEW -SID sid | -ASMSID sid | -MGMTDBSID sid | -IOSSID sid | -APXSID sid|
00203	-SRVC srvc | -ASMSRVC srvc | -MGMTDBSRVC srvc | -IOSSRVC srvc |
00204	-APXSRVC srvc [-SYSPWD pass] [-STARTMODE auto|manual]
00205	[-SRVCSTART system|demand] [-PFILE file | -SPFILE]
00206	[-SHUTMODE normal|immediate|abort] [-TIMEOUT secs] [-RUNAS osusr/ospass]
00207	Edit an instance by specifying the following options:

Oradim Errors	DIM-0000 to DIM-00228
00208	-EDIT -SID sid | -ASMSID sid | -MGMTDBSID sid | -IOSSID sid | -APXSID sid
00209	[-SYSPWD pass] [-STARTMODE auto|manual] [-SRVCSTART system|demand]
00210	[-PFILE file | -SPFILE] [-SHUTMODE normal|immediate|abort]
00211	[-SHUTTYPE srvc|inst] [-RUNAS osusr/ospass]
00212	Delete instances by specifying the following options:
00213	-DELETE -SID sid | -ASMSID sid | -MGMTDBSID sid | -IOSSID sid |
00214	-APXSID sid| -SRVC srvc | -ASMSRVC srvc | -MGMTDBSRVC srvc |
00215	-IOSSRVC srvc | -APXSRVC srvc
00216	Startup services and instance by specifying the following options:
00217	-STARTUP -SID sid | -ASMSID sid | -MGMTDBSID sid | -IOSSID sid
00218	| -APXSID sid [-SYSPWD pass] [-STARTTYPE srvc|inst|srvc,inst]
00219	[-PFILE filename | -SPFILE]
00220	Shutdown service and instance by specifying the following options:
00221	-SHUTDOWN -SID sid | -ASMSID sid | -MGMTDBSID sid | -IOSSID sid |
00222	-APXSID sid [-SYSPWD pass] [-SHUTTYPE srvc|inst|srvc,inst]
00223	[-SHUTMODE normal|immediate|abort]
00224	Manipulate ACLs by specifying the following options:
00225	-ACL -setperm|-addperm|-removeperm dbfiles|diag|registry
00226	-USER username -OBJTYPE file|dir|registry -OBJPATH object-path
00227	-RECURSE true|false [-HOST hostname]
00228	Query for help by specifying the following parameters: -? | -h | -help

DIM-00000
ORADIM completed with no errors.

Cause: The specified operation completed successfully.

Action: None.

DIM-00001
ORADIM: <command> [options]. Refer to manual.

Cause: The specified options were invalid or no arguments were supplied.

Action: Usage: ORADIM <command> [options]

DIM-00002
The specified command was invalid.

Cause: Valid commands are: -DELETE, -EDIT, -NEW, -STARTUP, and -SHUTDOWN.

Action: Use valid command.

DIM-00003
An argument is missing for the parameter.

Cause: Missing or invalid argument.

Action: Use a valid argument and run the program again.

DIM-00004
SID or service name was not specified.

Cause: Either a SID or service name is mandatory.

Action: Enter a valid *SID* of 64 characters and retry.

DIM-00005
SID with more than 64 characters specified.

Cause: SID with more than 64 characters specified.

Action: Change SID to 64 unique characters and ensure that there is no other service with this name.

DIM-00006
Missing SID.

Cause: SID was not specified in the arguments.

Action: Specify a SID.

DIM-00007
Missing or invalid -STARTMODE parameter. Valid -STARTMODE parameter is AUTO or MANUAL.

Cause: An argument for STARTMODE is missing.

Action: Enter a valid start mode and retry.

DIM-00008
A valid service name is OracleService appended with a SID

Cause: The Oracle service name specified is invalid.

Action: Correct the name of service and retry.

DIM-00009
SID name is mandatory.

Cause: SID was not specified.

Action: Enter the SID and retry.

DIM-00010
SYSTEM\CurrentControlSet\Services\OracleService key does not exist.

Cause: Specified registry key was not found.

Action: Try reinstalling. If the problem persists, contact Oracle Support Services.

DIM-00011
The specified service does not exist.

Cause: An attempt to edit a service failed.

Action: Make sure the service exists or user has enough privileges.

DIM-00012
A PFILE is necessary for AUTOSTART option.

Cause: A parameter file {PFILE} was not specified.

Action: Specify a parameter file.

DIM-00013
Service start mode could not be set in the registry.

Cause: The start mode entry in the registry for the service could not be set.

Action: Check if the user has privileges to modify registry.

DIM-00014
Cannot open the Windows Service Control Manager.

Cause: The Service Control Manager could not be opened.

Action: Check for user privileges.

DIM-00015
Cannot start already-running ORACLE - shut it down first.

Cause: The instance is already started.

Action: Stop the database before restarting.

DIM-00016
Missing or invalid -SHUTTYPE parameter. A valid -SHUTTYPE parameter is SRVC or INST.

Cause: An option for SHUTTYPE was missing or invalid.

Action: Enter parameter to shut down the instance or the service and retry.

DIM-00017
Instance shutdown mode must be one of the following: a for abort, i for immediate or n for normal.

Cause: Invalid option to shut down the instance was specified.

Action: Enter the correct mode and retry.

DIM-00018
Failed to stop Oracle Service.

Cause: An attempt to stop the service failed.

Action: Retry, check for user privileges.

DIM-00019
Create service error.

Cause: Service could not be created.

Action: Check for user privileges and retry.

DIM-00020
A service for this name exists.

Cause: An attempt was made to create a service name when it already existed.

Action: Retry with a different service name or SID.

DIM-00021
Registry open failed

Cause: An attempt to open the registry failed.

Action: Check for user privileges and retry the operation.

DIM-00040
Invalid option for the -NEW command.

Cause: One or more arguments for creating new service is invalid.

Action: Specify required option and retry.

DIM-00041
Invalid option for the -EDIT command.

Cause: One or more arguments for editing existing service is invalid.

Action: Specify required option and retry.

DIM-00042
Invalid option for the -DELETE command.

Cause: One or more arguments for deleting service is invalid.

Action: Specify required option and retry.

DIM-00043
Invalid option for the -STARTUP command.

Cause: One or more arguments for starting the instance is invalid.

Action: Specify required option and retry.

DIM-00044
Invalid option for the -SHUTDOWN command.

Cause: One or more arguments for shutting down the instance is invalid.

Action: Specify required option and retry.

DIM-00045
Internal error in ORADIM

Cause: Unknown.

Action: Contact Oracle Support Services.

DIM-00046
Invalid Pfile.

Cause: The parameter file name is invalid.

Action: Check that the path name is correct.

DIM-00050
Instance deleted

Cause: The request for deleting instance was successful.

Action: None.

DIM-00051
Instance created.

Cause: The request for creating new instance was successful.

Action: None.

DIM-00075
Failed to control service.

Cause: An attempt to control the service failed.

Action: Check additional error, ensure that user has enough privileges.

DIM-00076
Failed to delete service.

Cause: The request for service deletion failed.

Action: Check additional error, ensure that user has enough privileges.

DIM-00077
Failed to change service configuration.

Cause: An attempt to change configuration failed.

Action: Check additional error, ensure that user has enough privileges.

DIM-00078
Failed to start service.

Cause: The request to start service failed.

Action: Check additional error, ensure that user has enough privileges.

DIM-00090
SID name is invalid.

Cause: An invalid SID name was provided.

Action: Enter a valid SID name with no more that 64 characters (alphanumeric) and retry.

DIM-00092
Unable to determine Oracle service user.

Cause: This is an internal Error. The Oracle service user could not be determined for this Oracle home.

Action: Contact Oracle Support Services.

DIM-00093
Invalid option for the -ACL command.

Cause: One or more options for setting ACLs was invalid.

Action: Specify the required option and retry.

DIM-00094
Failed to change ACLs on the object.

Cause: An attempt to change the ACLs on the object failed.

Action: Check additional errors. Make sure that the user has enough privileges.

DIM-00200
Enter one of the following commands:

Cause: Unknown.

Action: None.

DIM-00201
Create an instance by specifying the following options:

Cause: Unknown.

Action: None.

DIM-00202
-NEW -SID sid | -ASMSID sid | -MGMTDBSID sid | -IOSSID sid | -APXSID sid|

Cause: Unknown.

Action: None.

DIM-00203
-SRVC srvc | -ASMSRVC srvc | -MGMTDBSRVC srvc | -IOSSRVC srvc |

Cause: Unknown.

Action: None.

DIM-00204
-APXSRVC srvc [-SYSPWD pass] [-STARTMODE auto|manual]

Cause: Unknown.

Action: None.

DIM-00205
[-SRVCSTART system|demand] [-PFILE file | -SPFILE]

Cause: Unknown.

Action: None.

DIM-00206
[-SHUTMODE normal|immediate|abort] [-TIMEOUT secs] [-RUNAS osusr/ospass]

Cause: Unknown.

Action: None.

DIM-00207
Edit an instance by specifying the following options:

Cause: Unknown.

Action: None.

DIM-00208
-EDIT -SID sid | -ASMSID sid | -MGMTDBSID sid | -IOSSID sid | -APXSID sid

Cause: Unknown.

Action: None.

DIM-00209
[-SYSPWD pass] [-STARTMODE auto|manual] [-SRVCSTART system|demand]

Cause: Unknown.

Action: None.

DIM-00210
[-PFILE file | -SPFILE] [-SHUTMODE normal|immediate|abort]

Cause: Unknown.

Action: None.

DIM-00211
[-SHUTTYPE srvc|inst] [-RUNAS osusr/ospass]

Cause: Unknown.

Action: None.

DIM-00212
Delete instances by specifying the following options:

Cause: Unknown.

Action: None.

DIM-00213
-DELETE -SID sid | -ASMSID sid | -MGMTDBSID sid | -IOSSID sid |

Cause: Unknown.

Action: None.

DIM-00214
-APXSID sid| -SRVC srvc | -ASMSRVC srvc | -MGMTDBSRVC srvc |

Cause: Unknown.

Action: None.

DIM-00215
-IOSSRVC srvc | -APXSRVC srvc

Cause: Unknown.

Action: None.

DIM-00216
Startup services and instance by specifying the following options:

Cause: Unknown.

Action: None.

DIM-00217
-STARTUP -SID sid | -ASMSID sid | -MGMTDBSID sid | -IOSSID sid

Cause: Unknown.

Action: None.

DIM-00218
| -APXSID sid [-SYSPWD pass] [-STARTTYPE srvc|inst|srvc,inst]

Cause: Unknown.

Action: None.

DIM-00219
[-PFILE filename | -SPFILE]

Cause: Unknown.

Action: None.

DIM-00220
Shutdown service and instance by specifying the following options:

Cause: Unknown.

Action: None.

DIM-00221
-SHUTDOWN -SID sid | -ASMSID sid | -MGMTDBSID sid | -IOSSID sid |

Cause: Unknown.

Action: None.

DIM-00222
-APXSID sid [-SYSPWD pass] [-SHUTTYPE srvc|inst|srvc,inst]

Cause: Unknown.

Action: None.

DIM-00223
[-SHUTMODE normal|immediate|abort]

Cause: Unknown.

Action: None.

DIM-00224
Manipulate ACLs by specifying the following options:

Cause: Unknown.

Action: None.

DIM-00225
-ACL -setperm|-addperm|-removeperm dbfiles|diag|registry

Cause: Unknown.

Action: None.

DIM-00226
-USER username -OBJTYPE file|dir|registry -OBJPATH object-path

Cause: Unknown.

Action: None.

DIM-00227
-RECURSE true|false [-HOST hostname]

Cause: Unknown.

Action: None.

DIM-00228
Query for help by specifying the following parameters: -? | -h | -help

Cause: None.

Action: None.

Database Connection Issues

Review database connection issues.

The following are the common Oracle Database connection error codes, their causes, and suggested remedies.

TNS-12203
TNS: unable to connect to destination

Cause: OracleService*SID* service, Oracle*HOMENAME*TNSListener service, or both are not running.

Action: Ensure that both services are started.

ORA-12560
TNS: lost contact

Cause: OracleService*SID* service, Oracle*HOMENAME*TNSListener service, or both are not running. You receive this error if you attempt to use any Oracle Database utilities, such as SQL*Plus. This error is analogous to the following Oracle7 error: `ORA-09352: Windows 32-bit Two-Task driver unable to spawn new ORACLE task`.

Action: Ensure that both services are started.

ORA-28575
unable to open RPC connection to external procedure agent

Cause: `tnsnames.ora` and `listener.ora` files have not been correctly configured to use external procedures.

Action: Reconfigure services.

ORA-06512
at "APPLICATIONS.OSEXEC", line 0

Cause: `tnsnames.ora` and listener.ora files have not been correctly configured to use external procedures.

Action: Reconfigure services.

ORA-06512
at "APPLICATIONS.TEST", line 4

Cause: `tnsnames.ora` and `listener.ora` files have not been correctly configured to use external procedures.

Action: Reconfigure services.

ORA-06512
at line 2

Cause: `tnsnames.ora` and `listener.ora` files have not been correctly configured to use external procedures.

Action: Reconfigure services.

ORA-01031 and LCC-00161
Both codes appear at startup

Cause: Parameter file (init.ora) or Windows services are damaged. These errors usually appear when the parameter file cannot be read by Oracle Database at database startup.

Action: Delete and re-create the SID and services. Make sure you are logged on as the user Administrator, or a user within the Windows Administrator's Group with full administrative rights. At the command prompt, enter: `oradim -delete -sid sid` where *sid* is the name of your database (for example, `orcl`). Re-create the SID and services by entering: `oradim -new -sid sid -startmode auto -pfile full_path_to_init.ora`

E

Oracle Database Differences on Windows and UNIX

Learn about the differences between Oracle Database on Windows and UNIX. For Oracle Database developers and database administrators moving from a UNIX platform to Windows, this information can be helpful in understanding Windows features that are relevant to Oracle Database.

- Automatic Startup and Shutdown
  On UNIX, several files and scripts in different directories are used to start an instance automatically.
- Background Processing and Batch Jobs
  UNIX provides sophisticated control mechanisms for background processing and batch jobs.
- Diagnostic and Tuning Utilities
  On UNIX, utilities such as `sar` and `vmstat` are used to monitor Oracle Database background and shadow processes.
- Direct Writes to Disk
  On both UNIX and Windows platforms, bypassing the file system buffer cache ensures data is written to disk.
- Dynamic Link Libraries (DLLs)
  Shared libraries on UNIX are similar to shared DLLs on Windows.
- Hot Backups
  A (manual) hot backup is equivalent to backing up a tablespace that is in an offline backup mode.
- Initialization Parameters: Multiple Database Writers
  On UNIX, you can specify many database writer process with initialization parameter `DB_WRITERS`.
- Installation Accounts and Groups
  UNIX uses the concept of a DBA group. The `root` account cannot be used to install Oracle Database.
- Oracle Database Installation
  The following manual setup tasks, all required on UNIX, are *not* required on Windows:
- Memory Resources
  The resources provided by the UNIX default kernels are often inadequate for a medium or large instance of Oracle Database.
- Microsoft Transaction Server
  Windows coordinates distributed transactions through the Microsoft Distributed Transaction Coordinator (DTC), one of the components of Microsoft Transaction Server.
- Multiple Oracle Homes and OFA
  The goal of OFA is to place all Oracle Database software under one *`ORACLE_HOME`* directory and to spread database files across different physical drives as databases increase in size.

- Oracle Home User and Oracle User
  On Linux and UNIX systems, you must create and use a software owner user account (`oracle`), and this user must belong to the Oracle Inventory group (`oinstall`) and also must be a member of the appropriate OSDBA, OSOPER, OSBACKUPDBA, OSDGDBA, and OSKMDBA groups.
- Raw Partitions
  Data files for tablespaces may be stored on a file system or on raw partitions.
- Windows Services
  Windows services are similar to UNIX daemons.

Automatic Startup and Shutdown

On UNIX, several files and scripts in different directories are used to start an instance automatically.

Other scripts are run on computer shutdown, allowing applications such as Oracle Database to shut down cleanly.

For automatic startup on Windows, set registry parameter `ORA_`*`SID`*`_AUTOSTART` to `true` using an Oracle Database tool such as ORADIM. Enter the following with parameters at the command prompt:

```
C:\> oradim options
```

To start the listener automatically, set services startup type to automatic.

For automatic shutdown on Windows, set registry parameters `ORA_SHUTDOWN` and `ORA_`*`SID`*`_SHUTDOWN` to stop the relevant `OracleService`*`SID`* and shut down. Set registry parameter `ORA_`*`SID`*`_SHUTDOWNTYPE` to control shutdown mode (default is `i`, or `immediate`).

> **See Also:**
>
> - Administering a Database on Windows
> - *Oracle Database 2 Day DBA*

Background Processing and Batch Jobs

UNIX provides sophisticated control mechanisms for background processing and batch jobs.

For similar functionality on Windows, use the AT command or a GUI version in the Microsoft Resource Kit.

Diagnostic and Tuning Utilities

On UNIX, utilities such as `sar` and `vmstat` are used to monitor Oracle Database background and shadow processes.

These utilities are not integrated with Oracle Database.

Performance utilities available on Windows include Task Manager, Control Panel, Event Viewer, and Microsoft Management Console.

Oracle Database is integrated with several of these tools. For example:

- Event Viewer displays system alert messages, including Oracle Database startup/shutdown messages and audit trail.
- Task Manager on Windows displays currently running processes and their resource usage, similar to the UNIX `ps -ef` command or HP OpenVMS `SHOW SYSTEM`. But Task Manager is easier to interpret and the columns can be customized.

> **See Also:**
>
> – Database Tools on Windows
> – Monitoring a Database on Windows

Direct Writes to Disk

On both UNIX and Windows platforms, bypassing the file system buffer cache ensures data is written to disk.

On UNIX, Oracle Database uses the `O_SYNC` flag to bypass the file system buffer cache. The flag name depends on the UNIX port.

On Windows, Oracle Database bypasses the file system buffer cache completely.

Dynamic Link Libraries (DLLs)

Shared libraries on UNIX are similar to shared DLLs on Windows.

Object files and archive libraries are linked to generate the Oracle Database executables. Relinking is necessary after certain operations, such as installation of a patch.

On Windows, Oracle Database DLLs form part of the executable at run time and are therefore smaller. DLLs can be shared between multiple executables. Relinking by the user is not supported, but the executable images can be modified using ORASTACK.

Modifying executable images on Windows reduces the chances of running out of virtual memory when using a large SGA or when supporting thousands of connections. However, Oracle recommends doing this only under the guidance of Oracle Support Services.

Hot Backups

A (manual) hot backup is equivalent to backing up a tablespace that is in an offline backup mode.

Backup strategy on UNIX is as follows: put the tablespace into backup mode, copy the files to the backup location, and bring the tablespace out of backup mode.

Windows supports the same backup strategy, but you cannot copy files in use with the usual Windows utilities. Use OCOPY to copy open database files to another disk location. Then use a utility to copy the files to tape.

Initialization Parameters: Multiple Database Writers

On UNIX, you can specify many database writer process with initialization parameter `DB_WRITERS`.

Multiple database writers can help, for example, when a UNIX port does not support asynchronous I/O.

`DB_WRITERS` is supported but typically unnecessary on Windows, which has its own asynchronous I/O capabilities.

> **See Also:**
>
> Oracle Database Specifications for Windows

Installation Accounts and Groups

UNIX uses the concept of a DBA group. The `root` account cannot be used to install Oracle Database.

A separate Oracle Database account must be created manually.

On Windows, Oracle Database must be installed by a Windows username in the Administrators group. The user name is automatically added to the Windows local group `ORA_DBA`, which receives the SYSDBA privilege. This allows the user to log in to the database using `CONNECT / AS SYSDBA` and not be prompted for a password.

You can also create an `ORA_OPER` group to grant `SYSOPER` privileges to the other Windows users.

Password files are located in the *`ORACLE_HOME`*`\database` directory and are named `pwd`*`SID`*`.ora`, where *`SID`* identifies the Oracle Database instance.

Related Topics

- Administering a Database on Windows

> **See Also:**
>
> *Oracle Database Installation Guide for Microsoft Windows* about "Operating System Groups Created During Oracle Database Installation"

Oracle Database Installation

The following manual setup tasks, all required on UNIX, are *not* required on Windows:

- Set environment variables
- Create a DBA group for database administrators

- Create a group for users running Oracle Universal Installer
- Create an account dedicated to installing and upgrading Oracle Database components

> **See Also:**
>
> *Oracle Database Installation Guide for Microsoft Windows*

Memory Resources

The resources provided by the UNIX default kernels are often inadequate for a medium or large instance of Oracle Database.

The maximum size of a shared memory segment (`SHMMAX`) and maximum number of semaphores available (`SEMMNS`) may be too low for Oracle Database recommendations.

On Windows, fewer resources are needed for interprocess communication (IPC), because the Oracle Database relational database management system is thread-based and not process-based. These resources, including shared memory and semaphores, are not adjustable by the user.

Microsoft Transaction Server

Windows coordinates distributed transactions through the Microsoft Distributed Transaction Coordinator (DTC), one of the components of Microsoft Transaction Server.

With Oracle Services for Microsoft Transaction Server, you can develop and deploy distributed transaction applications using .NET, COM, or COM+ and Oracle Database can be a resource manager in DTC transactions.

Microsoft Transaction Server is a Windows component that does not run on any other operating systems. However, Oracle Databases on any operating system can participate in Microsoft DTC transactions on Windows.

> **See Also:**
>
> *Oracle Services for Microsoft Transaction Server Developer's Guide for Microsoft Windows*

Multiple Oracle Homes and OFA

The goal of OFA is to place all Oracle Database software under one *`ORACLE_HOME`* directory and to spread database files across different physical drives as databases increase in size.

OFA is implemented on Windows and UNIX in the same way, and main subdirectory and file names are the same on both operating systems. Windows and UNIX differ, however, in their OFA directory tree top-level names and in the way variables are set.

On UNIX, *ORACLE_BASE* is associated with a user's environment. *ORACLE_HOME* and *ORACLE_SID* must be set in system or user login scripts. Symbolic links are supported. Although everything seems to be in one directory on the same hard drive, files may be on different hard drives if they are symbolically linked or have that directory as a mount point.

On Windows, *ORACLE_BASE* is defined in the registry (for example, in `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\HOME0`). *ORACLE_HOME* and *ORACLE_SID* are variables defined in the registry. Symbolic links like those on UNIX are not supported.

> **See Also:**
>
> *Oracle Database Installation Guide for Microsoft Windows* in the section Appendix B, "Optimal Flexible Architecture"

Oracle Home User and Oracle User

On Linux and UNIX systems, you must create and use a software owner user account (`oracle`), and this user must belong to the Oracle Inventory group (`oinstall`) and also must be a member of the appropriate OSDBA, OSOPER, OSBACKUPDBA, OSDGDBA, and OSKMDBA groups.

On Windows, you use an existing Windows User Account or create a new standard Windows User Account (not an administrator account) as the Oracle Home User. The various Oracle services on Windows run with the privileges of the Oracle Home User. This user is automatically added to various groups as required.

Related Topics

- Supporting Oracle Home User on Windows
  Oracle Database supports the use of Oracle Home User, specified at the time of Oracle Database installation. Oracle Home User is used to run the Windows services for the Oracle home.

Raw Partitions

Data files for tablespaces may be stored on a file system or on raw partitions.

A raw partition is a portion of a physical disk that is accessed at the lowest possible level.

UNIX supports raw partitions (logical drives). There is no limitation on the number of disk drives.

Windows is limited to using drive letters A-Z, but creating raw partitions lets you bypass the disk drive limitation and divide disks into smaller sections.

Use Windows disk management tools to create an extended partition on a physical drive. An extended partition points to raw space on the disk that can be assigned multiple logical partitions for database files.

An extended partition avoids the four-partition limit on Windows by allowing you to define large numbers of logical partitions to accommodate applications using Oracle

Database. Logical partitions can then be given symbolic link names to free up drive letters.

On supported Windows operating systems, create primary partitions and logical drives in extended partitions by selecting the **New Simple Volume** option. To create a raw device, select **Do not assign a drive letter or drive path.** To mount the raw device, assign and remove a drive letter. Do not use spanned volumes or striped volumes. These options convert the volume to a dynamic disk. Oracle Automatic Storage Management does not support dynamic disks.

> **Note:**
>
> Oracle RAC is only supported on 64-bit Windows server operating systems.

Windows Services

Windows services are similar to UNIX daemons.

Oracle Database registers a database instance as a service (`OracleService`*`SID`*). Services start background processes.

To connect to and use an Oracle Database instance, an Oracle Database service is created during database creation and associated with Oracle Database. Once a service is created with Oracle Database, the service can run even while no user is logged on.

From the **Start** menu, select **Control Panel**, then select **Administrative Tools**, and then select **Services** to access the Services dialog.

> **See Also:**
>
> Administering a Database on Windows

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