Oracle® Database

Platform Guide

11*g* Release 2 (11.2) for Microsoft Windows

E10845-03

July 2010

ORACLE®

Oracle Database Platform Guide, 11*g* Release 2 (11.2) for Microsoft Windows

E10845-03

Copyright © 1996, 2010, Oracle and/or its affiliates. All rights reserved.

Primary Author: Namrata Bhakthavatsalam

Contributing Author: Reema Khosla, Lance Ashdown

Contributors: Beldalker Anand, Adam Bentley, Ricky Chen, David Collelo, David Friedman, Janelle Simmons, Sue K. Lee, Rich Long, Satish Panchumarthy, Ravi Thammaiah, Michael Verheij

This software and related documentation are provided under a license agreement containing restrictions on use and disclosure and are protected by intellectual property laws. Except as expressly permitted in your license agreement or allowed by law, you may not use, copy, reproduce, translate, broadcast, modify, license, transmit, distribute, exhibit, perform, publish, or display any part, in any form, or by any means. Reverse engineering, disassembly, or decompilation of this software, unless required by law for interoperability, is prohibited.

The information contained herein is subject to change without notice and is not warranted to be error-free. If you find any errors, please report them to us in writing.

If this software or related documentation is delivered to the U.S. Government or anyone licensing it on behalf of the U.S. Government, the following notice is applicable:

U.S. GOVERNMENT RIGHTS Programs, software, databases, and related documentation and technical data delivered to U.S. Government customers are "commercial computer software" or "commercial technical data" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, the use, duplication, disclosure, modification, and adaptation shall be subject to the restrictions and license terms set forth in the applicable Government contract, and, to the extent applicable by the terms of the Government contract, the additional rights set forth in FAR 52.227-19, Commercial Computer Software License (December 2007). Oracle USA, Inc., 500 Oracle Parkway, Redwood City, CA 94065.

This software is developed for general use in a variety of information management applications. It is not developed or intended for use in any inherently dangerous applications, including applications which may create a risk of personal injury. If you use this software in dangerous applications, then you shall be responsible to take all appropriate fail-safe, backup, redundancy, and other measures to ensure the safe use of this software. Oracle Corporation and its affiliates disclaim any liability for any damages caused by use of this software in dangerous applications.

Oracle is a registered trademark of Oracle Corporation and/or its affiliates. Other names may be trademarks of their respective owners.

This software and documentation may provide access to or information on content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services.

Contents

Preface xiii

Audience xiii
Documentation Accessibility xiv
Related Documents xiv
Conventions xiv

What's New in Oracle Database for Windows xvii

1 Oracle Database Architecture on Windows

Oracle Database on Windows Architecture 1-1
Automatic Storage Management 1-1
Thread-Based Architecture 1-1
File I/O Enhancements 1-4
Raw File Support 1-4
Oracle Database Scalability on Windows 1-5
Support for Very Large Memory (VLM) Configurations 1-5
Windows 4 GB RAM Tuning (4GT) 1-7
Large User Populations 1-8
Oracle Database Integration with Windows 1-8
Oracle PKI Integration with Windows 1-8
Oracle Services for Microsoft Transaction Server 1-8
Oracle Fail Safe Integration with Windows 1-9
Other Sources of Information 1-9

2 Database Tools on Windows

Choosing a Database Tool 2-1
Database Tools and Operating System Compatibility 2-2
Preferred Database Tools 2-2
Starting Database Tools 2-4
Starting Database Tools in Multiple Oracle Homes 2-4
Starting Tools from Oracle8*i* Release 8.1.3 and Later Multiple Oracle Homes 2-4
Running Tools with Windows User Account Control 2-4
Starting Database Tools from the Start Menu 2-5
Starting Database Tools from the Command Line 2-7
Starting Windows Tools 2-8

Using SQL*Loader 2-9
Windows Processing Options 2-9
Default (No Processing Option) or "str terminator_string" 2-10
Control File Conventions 2-10
Using Windows Tools 2-11
Using Event Viewer to Monitor a Database 2-11
Using Microsoft Management Console to Administer a Database 2-11
Using Oracle Counters for Windows Performance Monitor 2-12
Using Registry Editor to Modify Configuration Information 2-12
Using Task Manager to Monitor Applications and Processes 2-13
Using Local Users and Groups to Manage Users and Groups 2-13
Optional Windows Diagnostic and Tuning Utilities 2-13

3 Postinstallation Database Creation on Windows

Naming Conventions for Oracle Database 3-1
Creating a Database on Windows Using Database Configuration Assistant 3-1
Creating a Database on Windows Using Command-Line Tools 3-2
Exporting an Existing Database 3-3
Deleting Database Files 3-5
Modifying the Initialization Parameter File 3-5
Creating and Starting an Oracle Database Service 3-6
Starting an Oracle Database Instance 3-7
Putting the CREATE DATABASE Statement in a Script 3-7
Running the CREATE DATABASE Script 3-8
Importing a Database 3-9
Updating ORACLE_SID in the Registry 3-9
Backing Up the New Database 3-10
Using ORADIM to Administer an Oracle Database Instance 3-11
Creating an Instance 3-12
Starting an Instance and Services 3-13
Stopping an Instance and Services 3-14
Editing an Instance 3-14
Deleting an Instance 3-15
Database Migration from a 32-bit Windows Computer 3-15
Backing Up a 32-Bit Oracle Database 3-16
Migrating an Oracle Database 11*g* Release 2 (11.2) 3-16
Migrating an Oracle Database 10*g* Release 2 (10.2) or Earlier Database 3-19

4 Postinstallation Configuration Tasks on Windows

Windows Firewall 4-1
Oracle Executables Requiring Firewall Exceptions 4-2
Firewall Exceptions for Oracle Database 4-3
Firewall Exceptions for Oracle Database Examples 4-3
Firewall Exceptions for Oracle Gateways 4-3
Firewall Exceptions for Oracle Clusterware and Oracle ASM 4-4
Firewall Exceptions for Other Oracle Products 4-4
Configuring the Windows Firewall 4-4

Troubleshooting Windows Firewall Exceptions 4-5
Resetting Passwords for Default Accounts 4-6
NTFS File System and Windows Registry Permissions 4-6
File Permissions 4-6
File Permissions Set by Oracle Universal Installer 4-6
File Permissions Set by Database Configuration Assistant 4-7
File Permissions Set by Database Upgrade Assistant 4-7
Setting NTFS File System Security 4-8
Setting Windows Registry Security 4-8
Configuring External Job Support for the Scheduler on Windows 4-9
Configuring Oracle Multimedia on Windows 4-9
Configuring Oracle Text on Windows 4-10
Configuring Oracle Spatial on Windows 4-11
Configuring Advanced Replication on Windows 4-12
Checking Tablespace and Rollback Segment Requirements 4-12
Adding and Modifying Initialization Parameters 4-13
Monitoring Data Dictionary Tables 4-13

5 Administering a Database on Windows

Managing Oracle Database Services 5-1
Oracle Database Service Naming Conventions for Multiple Oracle Homes 5-1
Starting Oracle Database Services 5-2
Stopping Oracle Database Services 5-2
Auto-starting Oracle Database Services 5-3
Starting and Shutting Down a Database with SQL*Plus 5-4
Starting and Shutting Down a Database Using Services 5-6
Starting Multiple Instances 5-8
Creating and Populating Password Files 5-9
Viewing and Hiding the Password File 5-10
Connecting Remotely to the Database as SYS 5-11
Automatically Encrypted Database Passwords 5-11
Accessing Database Files on Remote Computers 5-12
Archiving Redo Log Files 5-12

6 Monitoring a Database on Windows

Database Monitoring Overview 6-1
Using Oracle Counters for Windows Performance Monitor 6-2
Registry Information 6-2
Accessing Oracle Counters for Windows Performance Monitor 6-3
Modifying Views 6-3
Understanding Oracle Database Performance Objects 6-4
Oracle Counters for Windows Performance Monitor Troubleshooting Information 6-5
Using Event Viewer 6-6
Reading Event Viewer 6-7
Managing Event Viewer 6-8
Trace Files 6-8

Alert Logs 6-9
Viewing Threads 6-9

7 Tuning Windows to Optimize Oracle Database

Windows Tuning Overview 7-1
Large Page Support 7-2
Reduce Priority of Foreground Applications on Server Console 7-4
Configure Windows Server to Be an Application Server 7-4
Disable Unnecessary Services 7-5
Remove Unused Network Protocols 7-5
Reset Network Protocol Bind Order 7-5
Setting the Order of Multiple Network Interface Cards 7-6
Apply Latest Reliable Windows Server Service Pack 7-6
Use Hardware or Operating System Striping 7-7
Multiple Striped Volumes for Sequential and Random Access 7-8
Multiplex Windows Server Virtual Memory Paging File 7-8
Close All Unnecessary Foreground Applications 7-9

8 Performing Database Backup and Recovery with VSS

Overview of Database Backup and Recovery with VSS 8-1
Purpose of Database Backup and Recovery with VSS 8-1
Scope of This Chapter 8-1
Basic Concepts of Database Backup and Recovery with VSS 8-2
Component-Based Shadow Copies 8-2
Volume-Based Shadow Copies 8-2
Oracle VSS Backup Types 8-3
Basic Steps of Backup and Recovery with VSS 8-3
Installing and Uninstalling the Oracle VSS Writer Service 8-4
Backing Up a Database 8-5
About Component-Based Backups 8-5
Backing Up a Database in ARCHIVELOG Mode 8-7
Making Component-Based Backups of an ARCHIVELOG Database 8-7
Making Volume-Based Backups of an ARCHIVELOG Database 8-7
Backing Up a Database in NOARCHIVELOG Mode 8-7
Making Component-Based Backups of a NOARCHIVELOG Database 8-8
Making Volume-Based Backups of a NOARCHIVELOG Database 8-8
Restoring and Recovering a Database 8-8
Restoring and Recovering a Database in ARCHIVELOG Mode 8-8
Restoring the Server Parameter File 8-9
Recovering from the Loss of All Control Files 8-9
Recovering Tablespaces or Datafiles 8-10
Recovering All Tablespaces 8-10
Performing Disaster Recovery 8-10
Restoring a Database in NOARCHIVELOG Mode 8-11
Restoring Component-Based Backups of a NOARCHIVELOG Database 8-11
Restoring Volume-Based Backups of a NOARCHIVELOG Database 8-11
Integrating VSS with Third-Party Requester Applications 8-11

Writer Control Commands 8-11
Control Commands for Database or All Tablespaces Component 8-12
Duplicating a Database 8-12
Creating a Nonstandby Database from Shadow Copies 8-12
Creating a Standby Database From Shadow Copies 8-13

9 Authenticating Database Users with Windows

Windows Native Authentication Overview 9-1
Windows Authentication Protocols 9-2
User Authentication and Role Authorization Methods 9-2
Authentication and Authorization Methods To Use 9-3
Operating System Authentication Enabled at Installation 9-3

10 Administering External Users and Roles on Windows

Oracle Administration Assistant for Windows 10-1
Managing a Remote Computer 10-2
Adding a Computer and Saving Your Configuration 10-2
Granting Administrator Privileges for All Databases on a Computer 10-3
Granting Operator Privileges for All Databases on a Computer 10-4
Connecting to a Database 10-5
Troubleshooting Connection Problems 10-6
Viewing Database Authentication Parameter Settings 10-8
Creating an External Operating System User 10-9
Creating a Local Database Role 10-13
Creating an External Operating System Role 10-15
Granting Administrator Privileges for a Single Database 10-18
Granting Operator Privileges for a Single Database 10-19
Manually Administering External Users and Roles 10-20
Manually Creating an External Operating System User 10-21
External User Authentication Tasks on the Oracle Database Server 10-21
External User Authentication Tasks on the Client Computer 10-24
Manually Granting Administrator and Operator Privileges for Databases 10-25
SYSDBA/SYSOPER/SYSASM Authentication Tasks on the Oracle Database Server 10-25
SYSDBA/SYSOPER/SYSASM Authentication Tasks on the Client Computer 10-26
Manually Creating an External Role 10-26
External Role Authorization Tasks on the Oracle Database Server 10-27
External Role Authorization Tasks on the Client Computer 10-28
Manually Migrating Users 10-29

11 Storing Oracle Wallets in the Windows Registry

Storing Private Keys and Trust Points 11-1
Storing User's Profile 11-1
Registry Parameters for Wallet Storage 11-1
Oracle Wallet Manager 11-2
Sharing Wallets and sqlnet.ora Files Among Multiple Databases 11-2

12 Oracle PKI Integration with Windows

Oracle Public Key Infrastructure 12-1
Windows Public Key Infrastructure 12-1
Microsoft Certificate Stores 12-2
Microsoft Certificate Services 12-2
Using Microsoft Certificate Stores with Oracle PKI Applications 12-2

13 Using Oracle Database with Microsoft Active Directory

Microsoft Active Directory Support 13-1
About Microsoft Active Directory 13-1
Accessing Active Directory 13-1
Oracle Components That Integrate with Active Directory 13-2
Directory Naming 13-2
Automatic Discovery of Directory Servers 13-2
Integration with Windows Tools 13-2
User Interface Extensions for Oracle Net Directory Naming 13-3
Enhancement of Directory Object Type Descriptions 13-3
Integration with Windows Login Credentials 13-3
Oracle Directory Objects in Active Directory 13-4
Requirements for Using Oracle Database with Active Directory 13-5
Directory Naming Software Requirements 13-5
Creating an OracleContext 13-5
Network Configuration Assistant (NetCA) 13-6
Oracle Schema Objects Creation 13-7
Configuring Oracle Database to Use Active Directory 13-8
Testing Connectivity 13-9
Testing Connectivity from Client Computers 13-9
Testing Connectivity from Microsoft Tools 13-10
Access Control List Management for Oracle Directory Objects 13-12
Security Groups 13-12
OracleDBCreators 13-13
OracleNetAdmins 13-13
NetService Objects 13-13
Setting ACLs on NetService Entries 13-13
Adding and Deleting Security Group Members 13-14

14 Oracle Database Specifications for Windows

Initialization Parameter File Overview 14-1
Location of the Initialization Parameter File 14-2
Editing The Initialization Parameter File 14-2
Database Configuration Assistant Renames init.ora 14-2
Sample File 14-2
SGA_MAX_SIZE Parameter 14-3
Initialization Parameters Without Windows-Specific Values 14-3
Displaying Initialization Parameter Values 14-4
Uneditable Database Initialization Parameters 14-4

Calculating Database Limits 14-5

15 Configuration Parameters and the Registry

About Configuration Parameters 15-1
Registry Overview 15-1
Registry Parameters 15-2
HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_HOME_NAME 15-2
MSHELP_TOOLS 15-2
NLS_LANG and Other Globalization Parameters 15-3
ORA_CWD 15-3
ORA_SID_AUTOSTART 15-3
ORA_SID_PFILE 15-3
ORA_SID_SHUTDOWN 15-3
ORA_SID_SHUTDOWN_TIMEOUT 15-4
ORA_SID_SHUTDOWNTYPE 15-4
ORA_TZFILE 15-4
ORACLE_AFFINITY 15-4
ORACLE_BASE 15-5
ORACLE_GROUP_NAME 15-5
ORACLE_HOME 15-5
ORACLE_HOME_KEY 15-5
ORACLE_HOME_NAME 15-5
ORACLE_PRIORITY 15-5
ORACLE_SID 15-5
OSAUTH_PREFIX_DOMAIN 15-6
RDBMS_ARCHIVE 15-6
RDBMS_CONTROL 15-6
SQLPATH 15-6
HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE 15-6
INST_LOC 15-6
OO4O 15-6
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services 15-6
Parameters for Oracle Counters for Windows Performance Monitor 15-6
Parameters for Oracle Database Services 15-8
Oracle RAC Registry Parameters 15-8
HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\OCR 15-8
Managing Registry Parameters with regedit 15-8
Modifying a Parameter Value with regedit 15-8
Adding a Registry Parameter with regedit 15-9
Managing Registry Parameters with Oracle Administration Assistant for Windows 15-11
Starting Oracle Administration Assistant for Windows 15-11
Adding Oracle Home Parameters 15-12
Editing Oracle Home Parameters 15-13
Deleting Oracle Home Parameters 15-14
Modifying Oracle Counters for Windows Performance Monitor Parameters 15-14
Using operfcfg 15-14
Using Oracle Administration Assistant for Windows 15-15

16 Developing Applications for Windows

Finding Information on Application Development for Windows 16-1
Java Enhancements 16-1
ODP.NET 16-1
Oracle Developer Tools for Visual Studio 16-1
Oracle Providers for ASP.NET 16-2
XML Support 16-2
Support for Internet Applications 16-2
Oracle Services For Microsoft Transaction Server 16-2
Oracle Objects for OLE 16-3
Oracle Provider for OLE DB 16-3
Oracle COM Automation Feature 16-3
Pro*C/C++ and Pro*COBOL Applications 16-3
Building External Procedures 16-3
External Procedures Overview 16-3
Installing and Configuring 16-4
Installing Oracle Database 16-4
Configuring Oracle Net Services 16-5
Writing an External Procedure 16-5
Building a DLL 16-6
Registering an External Procedure 16-6
Executing an External Procedure 16-8
Multithreaded Agent Architecture 16-8
Debugging External Procedures 16-9
Using Package DEBUG_EXTPROC 16-9
Accessing Text Files with UTL_FILE 16-9
Accessing Web Data with Intercartridge Exchange 16-10
Configuring Intercartridge Exchange 16-10
Using Intercartridge Exchange 16-11
Packaged Function UTL_HTTP.REQUEST 16-11
Packaged Function UTL_HTTP.REQUEST_PIECES 16-12
UTL_HTTP Exception Conditions 16-13
UTL_HTTP.REQUEST 16-13
UTL_HTTP.REQUEST_PIECES 16-13
Exception Conditions and Error Messages 16-13

A Getting Started with Your Documentation

B Storing Tablespaces on Raw Partitions

Raw Partition Overview B-1
Physical Disk B-1
Logical Partition B-2
Physical Disk and Logical Partition Considerations B-2
Compatibility Issues B-3
Creating a Raw Partition and a Mount Point B-3
Creating a Tablespace in a Raw Partition B-4

Configuring Disks for Automatic Storage Management B-4

C Oracle Net Services Configuration on Windows

Configuring Oracle Database to Communicate with ASM C-1
Understanding Oracle Net Services Registry Parameters and Subkeys C-1
Oracle Net Service Subkeys C-1
Listener Requirements C-2
Understanding Optional Configuration Parameters C-2
LOCAL C-2
TNS_ADMIN C-3
USE_SHARED_SOCKET C-3
Advanced Network Configuration C-3
Configuring Authentication Method C-3
Configuring Security for Named Pipes Protocol C-3
Modifying Configuration of External Procedures for Higher Security C-3

D Error Messages on Windows

ORA-09275: CONNECT INTERNAL No Longer Supported D-1
OSD-04000 to OSD-04599: Windows-Specific Oracle Database Messages D-1
File I/O Errors: OSD-04000 to OSD-04099 ..... D-4
Memory Errors: OSD-04100 to OSD-04199 ..... D-7
Process Errors: OSD-04200 to OSD-04299 ..... D-8
Loader Errors: OSD-04300 to OSD-04399 ..... D-10
Semaphore Errors: OSD-04400 to OSD-04499 ..... D-11
Miscellaneous Errors: OSD-04500 to OSD-04599 ..... D-11
DIM-00000 to DIM-00039: ORADIM Command Syntax Errors D-12
Database Connection Issues D-19

E Oracle Database Windows/UNIX Differences

Automatic Startup and Shutdown E-1
Background Processing and Batch Jobs E-2
Diagnostic and Tuning Utilities E-2
Direct Writes to Disk E-2
Dynamic Link Libraries (DLLs) E-3
Hot Backups E-3
Initialization Parameters: Multiple Database Writers E-3
Install Accounts and Groups E-3
Installation E-4
Memory Resources E-4
Microsoft Transaction Server E-4
Multiple Oracle Homes and OFA E-4
Processes and Threads E-5
Raw Partitions E-5
Services E-6

Glossary

Index

Preface

This guide provides platform-specific information about administering and configuring Oracle Database 11*g* Release 2 (11.2) on the Microsoft Windows 32-Bit and 64-bit platforms:

- Windows XP Professional
- Windows Server 2003 - all editions
- Windows Server 2003 R2 - all editions
- Windows Vista - Business, Enterprise, and Ultimate editions
- Windows Server 2008 - all editions. The specific operating system components that are not supported are Hyper-V and Server Core.
- Windows Server 2008 R2 (64-bit)
- Windows 7

Note: Windows Multilingual User Interface Pack is supported on all Windows operating systems.

This Preface contains these topics:

- Audience
- Documentation Accessibility
- Related Documents
- Conventions

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

Documentation Accessibility

Our goal is to make Oracle products, services, and supporting documentation accessible to all users, including users that are disabled. To that end, our documentation includes features that make information available to users of assistive technology. This documentation is available in HTML format, and contains markup to facilitate access by the disabled community. Accessibility standards will continue to evolve over time, and Oracle is actively engaged with other market-leading technology vendors to address technical obstacles so that our documentation can be accessible to all of our customers. For more information, visit the Oracle Accessibility Program Web site at `http://www.oracle.com/accessibility/`.

Accessibility of Code Examples in Documentation

Screen readers may not always correctly read the code examples in this document. The conventions for writing code require that closing braces should appear on an otherwise empty line; however, some screen readers may not always read a line of text that consists solely of a bracket or brace.

Accessibility of Links to External Web Sites in Documentation

This documentation may contain links to Web sites of other companies or organizations that Oracle does not own or control. Oracle neither evaluates nor makes any representations regarding the accessibility of these Web sites.

Access to Oracle Support

Oracle customers have access to electronic support through My Oracle Support. For information, visit `http://www.oracle.com/support/contact.html` or visit `http://www.oracle.com/accessibility/support.html` if you are hearing impaired.

Related Documents

For more information, see the following documents in the Oracle Database documentation set:

- *Oracle Database Installation Guide for Microsoft Windows*
- *Oracle Database Concepts*
- *Oracle Database Platform Guide for Microsoft Windows*
- *Oracle Database Concepts*

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

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.

Convention	Meaning
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.

What's New in Oracle Database for Windows

This section describes new features of Oracle Database and provides pointers to additional information.

> **See Also:** *Oracle Database New Features Guide* for information on new features in Oracle Database 11*g* Release 2 (11.2) that are not platform-specific

The following are the Windows specific new features:

- Secure Database Services
- Active Directory Security Enhancements
- Volume Shadow Copy Service (VSS) Writer
- Windows Operating System Support
- Support for Online Patching

Secure Database Services

In Oracle Database 11*g*, you can secure the Database Services data in the active directory, which is considered to be public. You can control the access to Database Services data by setting Access Control List (ACL) on it and allow only the authenticated users to access the data.

To use enhanced security in Oracle Database 11*g*, clients for Oracle Database 11*g* or later, must configure for authentication binds. However, clients of the earlier releases cannot access Database Services after setting restricted ACLs.

Active Directory Security Enhancements

This feature enhances security through better integration with the default Active Directory configuration, adding support for operating system authentication with Active Directory.

This feature improves Net Naming support for Microsoft Active Directory.

Volume Shadow Copy Service (VSS) Writer

The Oracle VSS writer allows Oracle Database to participate in VSS-initiated backup and recovery on Windows 2003 and above. VSS is a Windows infrastructure composed of three participants:

- Requesters - management applications that initiate backup and recovery
- Writers - applications that own the data

- Providers - storage/hardware applications that coordinate the reading and writing of the data to appropriate storage

Several leading backup and storage vendors currently provide requester and provider applications. With the Oracle VSS writer, customers can reliably back up and recover Oracle data in a VSS environment, which inter operates with these vendors' components.

This feature provides full inter operability with Volume Shadow Copy Service (VSS) infrastructure on Windows 2003 and above.

Note: Windows data access client features are not included in this section.

Windows Operating System Support

Starting with Oracle Database 11*g* Release 2, the following Windows operating systems are supported:

- Windows Server 2008 R2
- Windows 7

See Also: "Running Tools with Windows User Account Control"

Support for Online Patching

An online patch is a special kind of patch that can be applied to a live, running database instance. Installing an online patch does not require shutting down the database instance. An online patch can be installed or uninstalled using `OPatch` command. Starting with Oracle Database 11*g* Release 2, Online Patching is supported on 32-bit and 64-bit Windows platforms.

1

Oracle Database Architecture on Windows

This chapter describes how Oracle Database architecture takes advantage of some more advanced **services** in Windows operating systems.

This chapter contains these topics:

- Oracle Database on Windows Architecture
- Oracle Database Scalability on Windows
- Oracle Database Integration with Windows
- Other Sources of Information

Oracle Database on Windows Architecture

Oracle Database on Windows is a stable, reliable, and high performing system upon which to 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 other platforms. The architecture offers several advantages on Windows, such as:

- Automatic Storage Management
- Thread-Based Architecture
- File I/O Enhancements
- Raw File Support

Automatic Storage Management

Automatic Storage Management (ASM) is an integrated file system and volume manager expressly built for Oracle Database files. 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 does this by enabling you to divide all available storage into disk groups. You manage a small set of disk groups, and ASM automates the placement of the database files within those disk groups.

> **See Also:** "Using Automatic Storage Management" in *Oracle Database Administrator's Guide*

Thread-Based Architecture

The internal **process** architecture of Oracle Database is **thread**-based. Threads are objects within a process that run program instructions. Threads allow concurrent

operations within a 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
- Simpler **System Global Area** allocation routine, because it does not require use of shared memory
- 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 and routines track and de-allocate resources. They add robustness, with no downtime because of resource leaks or an ill-behaved program.

Oracle Database is not a typical Windows process. On Windows, an Oracle Database or 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 Automatic Storage Management instances on Windows, each instance runs its own Windows service with multiple component threads. Each thread may be required for the database to be available, or it may be optional and specific to certain platforms. The background processes read and write from various datafiles, 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

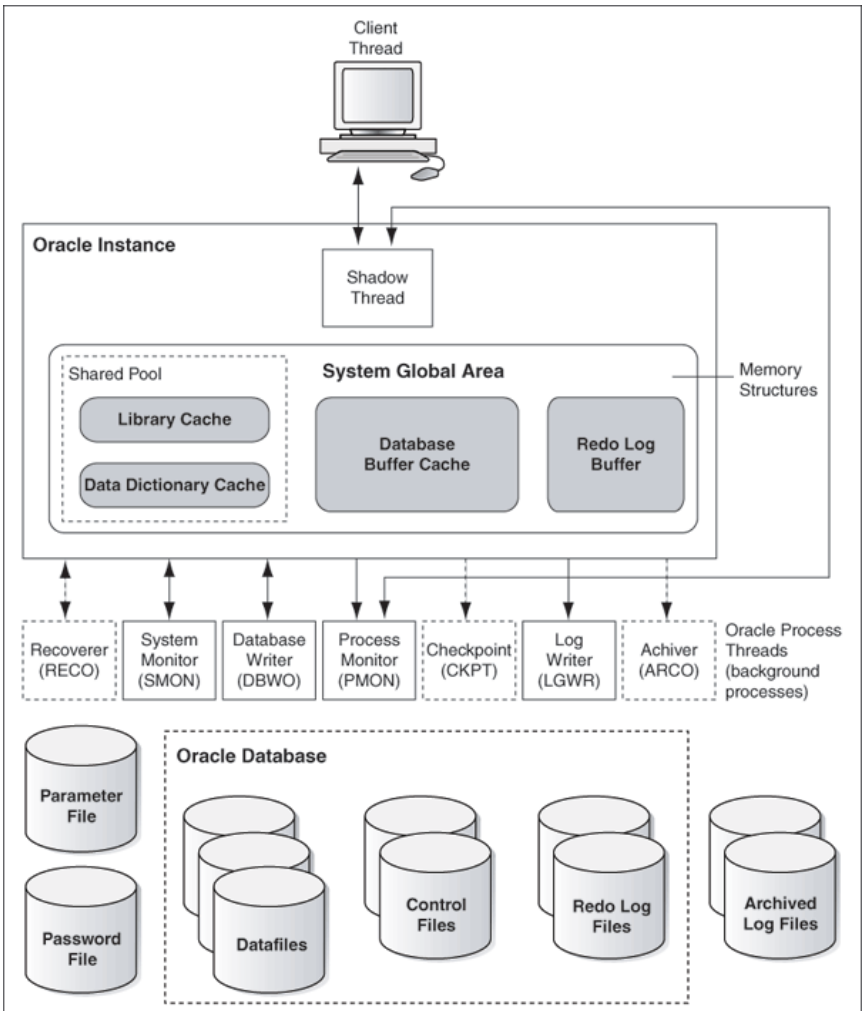


Table 1–1 Oracle Database Threads

Oracle Database Thread	Description	Required/Optional
DBW0	database writer	Required
LGWR	log writer	Required
MMAN	memory manager process	Required
PMON	process monitor	Required
PSPO	process spawner process	Required
SMON	system monitor	Required
CKPT	checkpoint process (thread on Windows) that runs by default on Windows	Required
ARCH0	archive process (or thread on Windows)	Required
RECO	distributed recovery background process	Required

Note: You can view running background processes by issuing the following query:

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

Oracle Database for 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 you use this tool only under the guidance of Oracle Support Services.

File I/O Enhancements

Oracle Database supports 64-bit file I/O to allow 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 needs to be maximized.

With Oracle Database 11*g*, 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 providing significantly superior performance. In addition, Direct NFS client simplifies and optimizes the NFS client configuration for database workloads.

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

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

Raw File Support

Oracle recommends that you use Automatic Storage Management instead of raw files. It provides the performance benefits of raw files with much better manageability. Automatic Storage Management is available for both single instance and Oracle RAC databases.

Raw files are unformatted disk partitions that can be used as one large file. Raw files have the benefit of no file system overhead, because they are unformatted partitions. Windows supports raw files, similar to UNIX. Using raw files for database or log files can have a slight performance gain. Windows XP has a disk manager (`diskmgmt.msc`) to manage all volumes. Windows 2003 and later includes command line utilities (`diskpart.exe`) to manage volumes including raw. Oracle recommends that you use Windows volume mount points for addressing raw volumes.

To Oracle Database, raw files are no different from other Oracle Database files. They are treated in the same way by Oracle Database as any other file and can be backed up and restored through Recovery Manager or `OCOPY`.

Note:

- You must be logged on either as Administrator or a user name that is a member of the Administrators group.
- To open Disk Management console, click **Start**, **Run**, and then type: diskmgmt.msc.

See Also:

- Appendix B, "Storing Tablespaces on Raw Partitions"
- "Using Automatic Storage Management" in *Oracle Database Administrator's Guide*

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. These features include:

- Support for Very Large Memory (VLM) Configurations
- Windows 4 GB RAM Tuning (4GT)
- Large User Populations

Support for Very Large Memory (VLM) Configurations

Oracle Database for Windows 32-Bit supports Very Large Memory (VLM) configurations, which allows Oracle Database to access more than the 4 gigabyte (GB) of RAM traditionally available to Windows applications. Specifically, Oracle Database uses Address Windowing Extensions (AWE) to access more than 4 GB of RAM.

Note: This feature is available on Windows with Intel Pentium II and later processors.

The requirements for taking advantage of this support are:

1. The computer on which Oracle Database is installed must have more than 4 GB of memory.
2. The operating system must be configured to take advantage of Physical Address Extensions (PAE) by adding the `/PAE` switch in `boot.ini`. See Microsoft Knowledge Base article 268363 for instructions on modifying `boot.ini` to enable PAE.
3. It is advisable (though not necessary) to enable 4GT support by adding the `/3GB` parameter in `boot.ini`. See Microsoft Knowledge Base article Q171793 for additional requirements and instructions on modifying `boot.ini` to enable 4GT.
4. The user account under which Oracle Database runs (typically the `LocalSystem` account), must have the "Lock memory pages" privilege.
5. `USE_INDIRECT_DATA_BUFFERS=TRUE` must be present in the initialization parameter file for the database instance that uses VLM support. If this parameter is not set, then Oracle Database 10*g* Release 1 (10.1) or later behaves in same way as previous releases.

6. Initialization parameters DB_BLOCK_BUFFERS and DB_BLOCK_SIZE must be set to values you have chosen for Oracle Database.

   Note: The total number of bytes of database buffers (that is, DB_BLOCK_BUFFERS multiplied by DB_BLOCK_SIZE) is no longer limited to 3 GB.

   Dynamic SGA and multiple block size are not supported with VLM. When VLM is enabled, the following new buffer cache parameters are not supported:

   - DB_CACHE_SIZE
   - DB_2K_CACHE_SIZE
   - DB_4K_CACHE_SIZE
   - DB_8K_CACHE_SIZE
   - DB_16K_CACHE_SIZE
   - DB_32K_CACHE_SIZE

   To select the block size for the instance, use the initialization parameter DB_BLOCK_SIZE. The buffer cache size is set by the initialization parameter DB_BLOCK_BUFFERS.

7. Registry parameter AWE_WINDOW_MEMORY must be created and set in the appropriate key for your Oracle home. This parameter is specified in bytes and has a default value of 1 GB. AWE_WINDOW_MEMORY tells Oracle Database how much of its 2 GB (3 GB if you enabled 4 GT) address space to reserve for mapping in database buffers.

   This memory comes from the 2 GB (3 GB if you enabled 4 GT) virtual address space in Oracle Database, so its value must be less than 3 GB. Setting this parameter to a large value has the effect of using more of the address space for buffers and using less AWE memory for buffers. However, since accessing AWE buffers is somewhat slower than accessing virtual address space buffers, Oracle recommends that you tune these parameters to be as large as possible without adversely limiting database operations.

   In general, the higher AWE_WINDOW_MEMORY is set, the fewer connections and memory allocations are possible for Oracle Database. The lower AWE_WINDOW_MEMORY is set, the lower the performance.

8. Once this parameter is set, Oracle Database can be started and it functions the same as before except that more database buffers are available to the instance. In addition, disk I/O may be reduced because more Oracle Database data blocks can be cached in the **System Global Area** (SGA).

   Note: Registry parameter VLM_BUFFER_MEMORY, which enabled VLM configurations in earlier releases, is not supported in Oracle Database 10*g* Release 1 (10.1) or later.

VLM Instance Tuning

VLM configurations improve database performance by caching more database buffers in memory. This reduces disk I/O compared to configurations without VLM. VLM support in Oracle Database 10*g* Release 1 (10.1) or later has been re-written to integrate

very closely with Windows. Compared to Oracle8*i* Release 2 (8.1.6), VLM users should see better performance with the newer implementation.

Tuning for VLM is no different than tuning for configurations without VLM. It is an iterative task that begins by selecting appropriate DB_BLOCK_SIZE and DB_BLOCK_BUFFERS initialization parameters for the application being supported.

> **Note:** VLM configurations do not support multiple database block sizes.

AWE_WINDOW_MEMORY, a new registry parameter specific to VLM, tells Oracle Database how much of its address space to reserve for mapping in database buffers. It defaults to a value of 1 GB, which should be suitable for most installations. If DB_BLOCK_SIZE is large, however, the default AWE_WINDOW_MEMORY value of 1 GB may not be sufficient to start the database.

Increasing the value of AWE_WINDOW_MEMORY improves performance, but it also limits the amount of memory available for other Oracle Database threads (like foreground threads). Clients may see "out of memory" errors if this value is set too large. As a general guideline, increase the AWE_WINDOW_MEMORY registry value by 20 percent.

For example, if DB_BLOCK_SIZE is set to 8 KB, AWE_WINDOW_MEMORY is set to 1 GB, and the number of LRU latches is set to 32 (16 processor computer), then database startup fails with out of memory errors 27102 and 34. Increasing the value of AWE_WINDOW_MEMORY to 1.2 GB fixes the problem.

Having a large cache in a VLM configuration may also slow down database writer (DBWR) threads. Having more DBWR threads will distribute work required to identify and write buffers to disk and will distribute I/O loads among threads. Initialization parameter DB_WRITER_PROCESSES enables you to configure multiple database writer threads.

A large cache can also introduce contention on the LRU (least recently used) **latch**. On symmetric multiprocessor (SMP) systems, Oracle Database sets the number of LRU latches to a value equal to one half the number of processors on the system. You can reduce contention on such configurations by increasing the number of LRU latches to twice (or four times) the number of processors on the system.

> **See Also:** *Oracle Database Performance Tuning Guide* for more information on instance tuning

Windows 4 GB RAM Tuning (4GT)

The following 32-Bit Windows operating systems include a feature called 4 GB RAM Tuning (4GT):

- Windows Server 2003 R2
- Windows Server 2003
- Windows Vista
- Windows Server 2008
- Windows 7

This feature allows memory-intensive applications running on Oracle Database Enterprise Edition to access up to 3 GB of memory, as opposed to the standard 2 GB in previous operating system versions. 4GT provides a tremendous benefit: 50 percent more memory is available for database use, increasing SGA sizes or connection counts.

Large User Populations

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

- Oracle Database **Shared Server Process**, which limits the number of threads needed in the Oracle Database process, 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, also increasing throughput.

Note: Oracle RAC is not supported on Windows XP and Windows Vista.

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. Integration features in Oracle Database include:

- Oracle PKI Integration with Windows
- Oracle Services for Microsoft Transaction Server
- Oracle Fail Safe Integration with Windows

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. It is also called COM+ and Enterprise Services. 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 Objects for OLE (OO4O), **Oracle Call Interface** (OCI), ActiveX Data Objects (ADO), OLE DB, and Open Database Connectivity (ODBC). The Oracle APIs, Oracle Data Provider for .NET, OO4O and OCI, offer greatest efficiency.

Oracle Fail Safe Integration with Windows

Oracle Fail Safe ensures that Oracle Database (and also other Oracle and third-party applications) can be configured and managed for high availability on Windows clusters. An instance runs on only one node at a time.

A cluster is a group of independent computing systems that operates as a single virtual system, eliminating individual host systems as points of failure. Oracle Fail Safe works with Microsoft Cluster Server to ensure that if a failure occurs on one cluster system, then workloads running on that system fail over quickly and automatically to a surviving system. Oracle Database combined with Oracle Fail Safe on a Windows cluster ensures protection from both hardware and software failures.

For well-configured solutions, Oracle Fail Safe ensures a surviving system to be operational in less than a minute, even for heavily-used databases.

Note: Windows operating systems, Windows XP, Windows Vista, and Windows 7 do not support the clustering technology found in Microsoft Cluster Server. Therefore, Oracle Fail Safe Server, which integrates with Microsoft Cluster Server, is not supported on these operating systems.

See Also: Oracle Fail Safe documentation set is available on separate media in the Oracle Database media pack

Other Sources of Information

See the following sources for additional information:

- Appendix E, "Oracle Database Windows/UNIX Differences"
- Chapter 2, "Database Tools on Windows" for more information about Oracle Database integration with Windows tools
- Chapter 16, "Developing Applications for Windows" for more information about Oracle Database integration with Windows features

2

Database Tools on Windows

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

Unless otherwise noted, features described in this guide are common to Oracle Database Enterprise Edition, Oracle Database Standard Edition, Oracle Database Standard Edition One and Oracle Database Personal Edition.

This chapter contains these topics:

- Choosing a Database Tool
- Starting Database Tools
- Using SQL*Loader
- Using Windows Tools
- Optional Windows Diagnostic and Tuning Utilities

See Also:

- Chapter 5, "Administering a Database on Windows" for OracleService*SID* configuration tasks
- Chapter 6, "Monitoring a Database on Windows" for thread management tasks
- Chapter 9, "Authenticating Database Users with Windows" for authentication tasks
- Chapter 15, "Configuration Parameters and the Registry" and Chapter 6, "Monitoring a Database on Windows" for Oracle Counters for Windows Performance Monitor tasks
- *Oracle Database Installation Guide for Microsoft Windows* for components available for installation

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 database administration tasks. The following sections indicate which database tools can be used on particular operating systems and preferred tools to use for common database administration tasks.

- Database Tools and Operating System Compatibility
- Preferred Database Tools

Database Tools and Operating System Compatibility

Almost all database tools are available on all supported versions of Windows. The exceptions are:

- Oracle Migration Workbench is available only at Oracle Technology Network (OTN). See

  http://www.oracle.com/technology/tech/migration/workbench/index.html

- Oracle Enterprise Manager and its optional management packs have additional integrated tools to assist in managing databases. See *Oracle Enterprise Manager Concepts* for more information.

Preferred Database Tools

Table 2–1 lists various database tools you can use to perform common database administration tasks. Oracle recommends you use tools listed in the "Preferred Database Tool" column of the table. After choosing a tool to perform a task, go to Table 2–2, on page 2-6 for instructions on how to start the tool.

Note: The `VOLSIZE` parameter for 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 a database	Database Configuration Assistant	SQL*Plus or SQL*Plus Worksheet
Create database **services**	Database Configuration Assistant	ORADIM
Delete database **services**	Database Configuration Assistant	ORADIM
Start a database	Oracle Enterprise Manager Database Control	SQL*Plus or SQL*Plus Worksheet Or `srvctl` for database managed by Oracle Clusterware.
Shut down a database	Oracle Enterprise Manager Database Control	Control Panel SQL*Plus or SQL*Plus Worksheet
Change passwords in the database password file	ORAPWD	ORADIM
Migrate database users to a directory	User Migration Utility	None
Migrate a database	Oracle Database Upgrade Assistant	Upgrade Information Tool
Upgrade a database	Oracle Database Upgrade Assistant	Run provided scripts in SQL*Plus
Export data	Data Pump Export (EXPDP)	Export (EXP)

Table 2–1 (Cont.) Preferred Database Tools

Administration Task	Preferred Tool	Other Tools
Import data	Data Pump Import (IMPDP)	Import (IMP)
Load data	Oracle Enterprise Manager Load Wizard	SQL*Loader (SQLLDR)
Back up database	Oracle Enterprise Manager Backup Wizard	Recovery Manager (RMAN) OCOPY
Recover database	Oracle Enterprise Manager Recovery Wizard	Recovery Manager (RMAN) OCOPY
Authenticate database administrators and users	Oracle Enterprise Manager Database Control	SQL*Plus or SQL*Plus Worksheet Windows operating system Oracle Administration Assistant for Windows
Store encrypted and decrypted Oracle Wallet (Oracle Advanced Security and **Oracle PKI** integration)	Oracle Wallet Manager	None
Grant database roles	Oracle Enterprise Manager Database Control	Local Users and Groups SQL*Plus
Create database objects	Oracle Enterprise Manager Database Control	SQL*Plus

The following points refer to tools listed in Table 2–1, " Preferred Database Tools":

- SQL*Plus Worksheet is part of Oracle Enterprise Manager and is only supported on Windows 32-Bit.
- ORADIM can only set a password 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.
- 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 Upgrade Assistant can upgrade the following databases to the current release: Oracle9*i* Release 2 (9.2), Oracle Database 10*g* Release 1 (10.1), and 2 (10.2). Oracle Database Upgrade Assistant can also be used to apply patch sets.

  See Also: *Oracle Database Upgrade Guide* for more information about upgrading single instance and cluster databases

- 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 will be 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 Database Configuration Assistant automatically generates during database registration can only be used with an Oracle Database 10*g* Release 1 (10.1) or later server. 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.

- For guidelines on creating database objects, see *Oracle Database Administrator's Guide*.

Starting Database Tools

This section describes how to start each of the database tools in the following categories:

- Starting Database Tools in Multiple Oracle Homes
- Running Tools with Windows User Account Control
- Starting Database Tools from the Start Menu
- Starting Database Tools from the Command Line
- Starting Windows Tools

Starting 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 Oracle8*i* Release 8.1.3 and Later Multiple Oracle Homes

Beginning in Oracle8*i* release 8.1.3, each Oracle home, including the first Oracle home you create on your computer, has a unique *HOME_NAME*. To start Oracle Administration Assistant for Windows from any Oracle home, from the **Start** menu, select **Programs**, then select **Oracle - *HOME_NAME***, then select **Configuration and Migration Tools** and then select **Administration Assistant for Windows**

Running Tools with Windows User Account Control

To ensure that only trusted applications run on your computer, Windows Vista, Windows Server 2008, Windows Server 2008 R2, and Windows 7 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 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 Administration Assistant for Windows. This tool is available as a Configuration and Migration Tool.

- 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.

To run any command with Administrator privileges:

1. Click the **Start** menu option.
2. Navigate to Programs, then to Oracle - *HOME_NAME*.
3. Right-click the name of the command or application you want to run, then select **Run as administrator**.

To create a Windows shortcut with Administrator privileges:

1. On your desktop, create a shortcut for the command prompt window. 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 run from within this window are run with Administrator privileges.

Starting Database Tools from the Start Menu

Table 2–2 describes how to start assistants and other tools from the Start Menu. It also tells where to go for 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 will be moved or created. To create an Oracle Database, you must have an administrative **privilege**. If you run Database Configuration Assistant from an account that is not part of the Administrators group, then the tool exits without completing the operation.

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

Table 2–2 Starting Database Tools from the Start Menu

Tool	Start Menu Path	More Information
Oracle Administration Assistant for Windows	From **Configuration and Migration Tools**, select **Administration Assistant for Windows**	Chapter 9, "Authenticating Database Users with Windows"
Database Configuration Assistant	From **Configuration and Migration Tools**, select **Database Configuration Assistant**	"Creating a Database on Windows Using Database Configuration Assistant" on page 3-1
Oracle Locale Builder	From **Configuration and Migration Tools**, select **Locale Builder**	*Oracle Database Globalization Support Guide*
Microsoft ODBC Administrator	From **Configuration and Migration Tools**, select **Microsoft ODBC Administration**	Microsoft ODBC Administration online help
Oracle Migration Workbench	From **Configuration and Migration Tools**, select **Migration Workbench**	Oracle Migration Workbench software and documentation are available at `http://www.oracle.com/technology/tech/migration/workbench/index.html`
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 Directory Manager	From **Integrated Management Tools**, select **Oracle Directory Manager**	*Oracle Internet Directory Administrator's Guide*
Oracle Counters for Windows Performance Monitor	From **Configuration and Migration Tools**, select **Oracle Counters for Windows Performance Monitor**	To install Oracle Counters for Windows Performance Monitor, choose Advanced Installation and then the Custom installation type. "Using Oracle Counters for Windows Performance Monitor" on page 6-2
SQL*Plus	From **Application Development**, select **SQL*Plus**	*SQL*Plus User's Guide and Reference* "Starting and Shutting Down a Database with SQL*Plus" on page 5-4
SQL*Plus Worksheet	From **Application Development**, select **SQL*Plus Worksheet** From **Integrated Management Tools**, select **SQL*Plus Worksheet**	SQL*Plus Worksheet is available from the Start Menu only with Oracle Database Client.
Oracle Wallet Manager	From **Integrated Management Tools**, select **Wallet Manager**	*Oracle Database Advanced Security Administrator's Guide*
User Migration Utility	No GUI. Command line must be used.	*Oracle Database Enterprise User Security Administrator's Guide*

Note: After installing Oracle Database 11*g* Companion Products, Oracle Wallet Manager is not available from the Start menu. See Table 2–3, " Starting Database Tools from the Command Line" on page 2-7 for instructions on starting Oracle Wallet Manager from the command line.

Starting Database Tools from the Command Line

Table 2–3 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

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

Data Pump Export	`C:\> exp username`
	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 for information on error messages

Data Pump Import	`C:\> imp username`
	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`
	DBCA wizard starts in interactive mode. For silent options and other command line options enter:
	`C:\> dbca -help`
		"Using DBCA" in *Oracle Database 2 Day DBA*

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

Export	`C:\> exp username`
	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

Net Services Configuration	`C:\> netca`
	NETCA wizard starts in interactive mode. For silent options and other command line options enter:
	`C:\> netca -help`
		"Configuring the Network Environment" in *Oracle Database Upgrade Guide*

Import	`C:\> imp username`
	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

operfcfg	`C:\> operfcfg`	"Modifying Oracle Counters for Windows Performance Monitor Parameters" on page 15-14
Oracle Wallet Manager	`C:\> cd` *ORACLE_HOME*`\bin` `C:\`*ORACLE_HOME*`\bin> launch.exe` *ORACLE_HOME*`\bin owm.cl`	Chapter 11, "Storing Oracle Wallets in the Windows Registry"

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

Tool	Enter at Prompt	More Information

ORADIM	`C:\> oradim` *`options`*
	To get a list of ORADIM options, enter either of the following:
	`C:\> oradim`
	`C:\> oradim -? | -h | -help`
		"Using ORADIM to Administer an Oracle Database Instance" on page 3-11

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**	"Creating and Populating Password Files" on page 5-9
Recovery Manager (RMAN)	`C:\> rman` *`parameters`*	*Oracle Database Backup and Recovery Basics*
SQL*Plus (SQLPLUS)	`C:\> sqlplus`	*SQL*Plus User's Guide and Reference* "Starting and Shutting Down a Database with SQL*Plus" on page 5-4
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" on page 2-8
TKPROF	`C:\> tkprof`	*Oracle Database Performance 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 will 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 Control is another database tool for managing the database. For more information, see "Logging in to Enterprise Manager Database Control" in *Oracle Database Installation Guide for Microsoft Windows*.

Starting Windows Tools

Table 2–4 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 **Programs**, then select **Administrative Tools** and then select **Event Viewer**	"Using Event Viewer to Monitor a Database" on page 2-11 Your operating system documentation
Microsoft Management Console (MMC)	From the **Start** menu, select **Programs**, then select **Oracle - *HOME_NAME***, then select **Configuration and Migration Tools** and then select **Administration Assistant for Windows**	Your operating system documentation
Oracle Counters for Windows Performance Monitor	From the **Start** menu, select **Programs**, then select **Oracle - *HOME_NAME***, then select **Configuration and Migration Tools** and then select **Oracle Counters for Windows Performance Monitor**	"Using Oracle Counters for Windows Performance Monitor" on page 6-2 Your operating system documentation
Registry Editor	At the command prompt, enter: `C:\> regedit`	"Using Registry Editor to Modify Configuration Information" on page 2-12 Chapter 15, "Configuration Parameters and the Registry" Your operating system documentation
Task Manager	Right-click the Task Bar and select **Task Manager**	"Using Task Manager to Monitor Applications and Processes" on page 2-13 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**.	"Using Local Users and Groups to Manage Users and Groups" on page 2-13 Chapter 9, "Authenticating Database Users with Windows" Your operating system documentation

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

Using SQL*Loader

This section describes Windows-specific information for using SQL*Loader (`SQLLDR`).

- Windows Processing Options
- Control File Conventions

Windows Processing Options

This section discusses possible values for the operating system dependent file processing specifications string option (`os_file_proc_clause`), referred to in "Specifying Datafile Format and Buffering" in Chapter 8, "SQL*Loader Control File Reference", in *Oracle Database Utilities.*

Default (No Processing Option) or "str terminator_string"

Stream record format in which each record is terminated by a record terminator. If "str terminator_string" is not specified, then the record terminator defaults to either the Windows-style record terminator (the two-character sequence carriage return, \r, followed by line feed, \n) or the UNIX-style record terminator (single-character line feed, \n). Maximum record size is 48 KB.

When processing stream format datafiles, SQL*Loader can usually recognize record terminators automatically, whether they are Windows-style or UNIX-style. So you usually do not need to specify which record terminator you are using.

For external table loads, however, only Windows-style record terminators are recognized automatically. If your datafile contains UNIX-style record terminators, you must specify the record terminator. If you are using SQL*Loader (with `external_table` option), then specify the UNIX-style record terminator by specifying `"str '\n'"` on the `INFILE` line in the SQL*Loader control file. For example:

```
INFILE mydata.dat "str '\n'"
```

You can also specify the record terminator in hex, by specifying `"str x'0a'"` (assuming an ASCII-based character set). For example:

```
INFILE mydata.dat "str x'0a'"
```

Note that the "0" (zero) before the "a" is required. If you are using SQL with an access parameter list to create the external table, then you must specify `'\n'` in a `RECORDS DELIMITED BY` clause. For example:

```
RECORDS DELIMITED BY '\n'
```

You can also use a hex string in this case. For example:

```
RECORDS DELIMITED BY 0x'0a'
```

Note that in this case, the "0" (zero) before the "x" and the "0" (zero) before the "a" are both required.

Control File Conventions

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

In full path descriptions, backslashes do not require escape characters or other special treatment. When embedding a single or 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 Table 2–5 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

Table 2–5 (Cont.) Default Sizes of Native Data types

Native Data Types	Default Field Length
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

Using Windows Tools

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

- Using Event Viewer to Monitor a Database
- Using Microsoft Management Console to Administer a Database
- Using Oracle Counters for Windows Performance Monitor
- Using Registry Editor to Modify Configuration Information
- Using Task Manager to Monitor Applications and Processes
- Using Local Users and Groups to Manage Users and Groups

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 not requiring 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 active instance
- Connection to Oracle Database using `AS SYSDBA`

In addition, the operating system audit trail is logged in the Event Log, which is viewable with the Event Viewer.

See Also: Chapter 6, "Monitoring a Database on Windows" for specific instructions on accessing and using Event Viewer to monitor Oracle Database events

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, **username**, and password for the database being monitored by Oracle Counters for Windows Performance Monitor
- View and terminate an Oracle Database **thread**

Using Oracle Counters for Windows Performance Monitor

Oracle Counters for Windows Performance Monitor is integrated into Windows Performance Monitor. This tool enables you to view performance of processors, memory, cache, threads, and processes. Performance information provided includes device usage, queue lengths, delays, throughput measurements, and internal congestion measurements. This information is provided as charts, alerts, and reports.

You can use Oracle Counters for Windows Performance Monitor to monitor key Oracle Database information, such as:

- Library cache
- Buffer cache
- Data dictionary cache
- Redo log buffer cache
- Thread activity

You can use your findings to improve database performance.

> **See Also:** "Using Oracle Counters for Windows Performance Monitor" on page 6-2 for specific instructions on accessing and using Oracle Counters for Windows Performance Monitor to monitor Oracle Database performance

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 should 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

> **See Also:** Chapter 15, "Configuration Parameters and the Registry" for definitions of Oracle Database configuration parameters and specific instructions on using the registry to modify Oracle Database configuration parameters

Using Task Manager to Monitor Applications and Processes

Task Manager has four 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 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 enables 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

Optional Windows Diagnostic and Tuning Utilities

Windows Resource Kit includes several diagnostic and tuning utilities.

Process Viewer summarizes resource usage by a process.

Process Monitor displays real-time file systems, registry and process-thread activity. It combines `Filemon` and `Regmon` utilities and provides reliable process information.

Process Explorer provides a detailed display of resource usage by a process.

Task List displays resource usage and other details of a process when its processor identifier or process name is given as an argument. This tool also displays a list of executables and DLLs associated with a process.

3

Postinstallation Database Creation on Windows

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

This chapter contains these topics:

- Naming Conventions for Oracle Database
- Creating a Database on Windows Using Database Configuration Assistant
- Creating a Database on Windows Using Command-Line Tools
- Using ORADIM to Administer an Oracle Database Instance
- Database Migration from a 32-bit Windows Computer

Naming Conventions for Oracle Database

All 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.

Creating a Database on Windows Using Database Configuration Assistant

Oracle recommends you use Database Configuration Assistant to create a database, because it is easier. It offers the same interface and operates the same way on all supported platforms, so no step-by-step procedures or screen shots are included here.

> **See Also:** *Oracle Database 2 Day DBA* for instructions on using Database Configuration Assistant

Database Configuration Assistant 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 Database Configuration Assistant, 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 Database Configuration Assistant 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 file name is `spfile`*`SID`*`.ora`.

> **See Also:** "Managing Initialization Parameters Using a Server Parameter File" in *Oracle Database Administrator's Guide*

Creating a Database on Windows Using Command-Line Tools

This section describes how to create a new database manually. As part of its database software files, Oracle Database provides a sample initialization parameter file, which can be edited to suit your needs. You can choose to create database creation scripts using DBCA.

Database creations are of three types:

- 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.

Table 3–1 summarizes 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 3–1 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
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

Table 3–1 (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
Creating and Starting an Oracle Database Service	No	Yes	Yes
Putting the CREATE DATABASE Statement in a Script	Yes	Yes	Yes
Running the CREATE DATABASE Script	Yes	Yes	Yes
Importing a Database	Yes	Note 2	Not applicable
Updating ORACLE_SID in the Registry	No	Only if you change the default *SID*	Yes
Backing Up the New Database	Yes	Yes	Yes

Note 1

Yes if you copy data from the existing database to the new database; no otherwise.

Note 2

Yes if you import tables and other objects exported from the existing database; not otherwise.

We use an example in the following sections to demonstrate 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`*`\product\11.2.0\oradata\orcl`. You will copy `orcl` to a new database with a database name and `SID` of `prod` located in directory `C:\app\`*`username`*`\product\11.2.0\oradata\prod`. You will then delete starter database `orcl`.

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 parameter mode or interactive mode, Oracle recommends parameter mode. Interactive mode provides less functionality than 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 parameter mode, then Data Pump Export considers file names and 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 interactive mode, then the file name or 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 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 parameter mode, then Export considers file names and 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 interactive mode, then the file name or directory name can contain a space without quotation marks.

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

To export all data from an existing database to a new database:

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 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 starter database `orcl` in file `myexp.dmp`. All messages from Data Pump Export are logged in file `myexp.log`.

3. If the existing database is before 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 starter database `orcl` in file `myexp.dmp`. All messages from Export are logged in 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 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 directory `C:\app\`*`username`*`\product\11.2.0\oradata\orcl:`

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

Modifying the Initialization Parameter File

To use starter database `orcl` as the basis for your new database, first copy *`ORACLE_BASE`*`\admin\orcl\pfile\init.ora`. Second, put the copy in *`ORACLE_BASE`*`\admin\prod\pfile\init.ora`. Third, modify the file as described in this section.

Note: Beginning with Oracle9*i* Release 2 (9.2), nesting of quotation marks using the backslash (\) escape character is no longer supported. This may affect how Oracle Database interprets 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 would be interpreted as `ctlfile'1.ora`. Starting with release 9.2, the file name would be interpreted as `ctlfile\'1.ora`.

Oracle highly recommends modifying your parameter files to remove such references. See *Oracle Database Reference* for other methods of nesting quotation marks in initialization parameter values.

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`

as the basis for the initialization parameter file for database `prod`.

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

- `DB_NAME=prod.domain`

  Parameter `DB_NAME` indicates the database name and must match the name used in the `CREATE DATABASE` statement in "Putting the CREATE DATABASE Statement in a Script" on page 3-7. You give a unique database name to each database. You can use up to 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`*`\product\11.2.0\oradata\prod\control01.ctl",`
  `"C:\app\`*`username`*`\product\11.2.0\oradata\prod\control02.ctl",`
  `"C:\app\`*`username`*`\product\11.2.0\oradata\prod\control03.ctl")`

  Parameter `CONTROL_FILES` lists database control files. You do not have 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 file name, including drive letter.

- `DB_FILES=100`

  Modifying 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.

  > **See Also:** *Oracle Database Reference* for information on other initialization parameters that you can add or modify

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.

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

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

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

Creating and Starting an Oracle Database Service

You are required to create and start an Oracle Database service only if you do one of the following:

- 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. After it has been created, the service starts automatically. See "Using ORADIM to Administer an Oracle Database Instance" on page 3-11 for information on how to use ORADIM.

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\oracle\product\11.2.0\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.

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

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

Starting an Oracle Database Instance

Start an instance without mounting a database.

```
SQL> STARTUP NOMOUNT
```

You are not required to 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 SGA is created and background processes are started in preparation for the creation of a new database.

Putting 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 may have the following parameters:

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

When you run a `CREATE DATABASE` statement, Oracle Database performs several operations depending upon clauses that you specified in the `CREATE DATABASE` statement or 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. For more information on using Oracle-managed files see *Oracle Database Administrator's Guide*.

To create 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\oracle\product\11.2.0\oradata\prod\system01.dbf' SIZE 325M REUSE
AUTOEXTEND ON NEXT 10240K MAXSIZE UNLIMITED
UNDO TABLESPACE "UNDOTBS" DATAFILE
'app\oracle\product\11.2.0\oradata\prod\undotbs01.dbf'
SIZE 200M REUSE AUTOEXTEND ON NEXT 5120K MAXSIZE UNLIMITED
CHARACTER SET WE8MSWIN1252
logfile 'C:\app\username\product\11.2.0\oradata\prod\redo01.log' size 100M reuse,
        'C:\app\username\product\11.2.0\oradata\prod\redo02.log' size 100M reuse,
        'C:\app\username\product\11.2.0\oradata\prod\redo03.log' size 100M reuse
EXTENT MANAGEMENT LOCAL;
```

Running 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 choose 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 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 script *script_name*`.sql` that you created in "Putting the CREATE DATABASE Statement in a Script" on page 3-7:

   ```
   SQL> C:\app\oracle\product\11.2.0\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`

Importing a Database

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 in "Exporting an Existing Database" on page 3-3 into the new database. Although you can start Data Pump Import or Import using either parameter mode or interactive mode, Oracle recommends 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 parameter mode, then Data Pump Import considers file names and 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 interactive mode, then the file name or directory name can contain a space without 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 datafiles.

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

See Also: *Oracle Database Utilities* for more information on using Data Pump Import or Import

Updating ORACLE_SID in the Registry

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

1. Start Registry Editor at the command prompt:

   ```
   C:\> regedit
   ```

   The Registry Editor window appears.

2. Choose 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.

> **See Also:** Chapter 15, "Configuration Parameters and the Registry" for more information on subkey locations for **multiple Oracle homes**

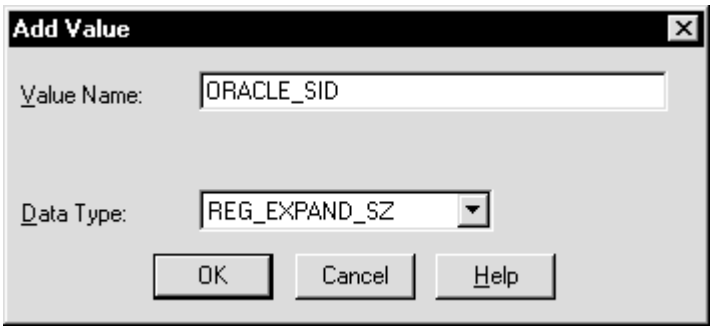
3. Locate parameter `ORACLE_SID` on the right side of the Registry Editor window.
4. Double-click the parameter name and change the data to the new *`SID`*, which is `prod` in this example.

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

To create parameter `ORACLE_SID`:

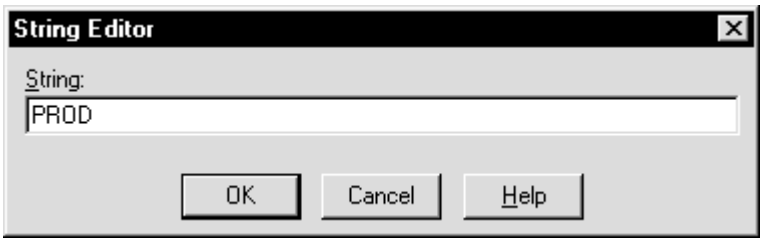
1. Choose **Add Value** from the **Edit** menu.

   The Add Value dialog appears:



2. Enter `ORACLE_SID` in the **Value Name** field.
3. Select **REG_EXPAND_SZ** (for an expandable string) in the **Data Type** list.
4. Click **OK**.

   A string editor dialog appropriate for the data type appears:



5. Enter **prod** in the **String** field.
6. Click **OK**.

   Registry Editor adds parameter `ORACLE_SID`.
7. Choose **Exit** from the **Registry** menu.

   Registry Editor exits.

Backing Up the New Database

> **Caution:** 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
```

> **Caution:** 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 may be useless because it was taken while data was being written to datafiles.

2. Using the tool of your choice, back up database files.

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

   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.

   Be sure to back up the database after making any significant changes, such as switching archiving mode or adding a tablespace or datafile.

   > **See Also:** For more information on archiving, backup, and **recovery**
   >
   > - *Oracle Database Concepts*
   > - *Oracle Database Backup and Recovery Basics*
   > - *Oracle Database 2 Day DBA*

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

Using ORADIM to Administer an Oracle Database Instance

ORADIM is a command-line tool that is available with Oracle Database. You are required to use ORADIM only if you are manually creating, deleting, or modifying databases. Database Configuration Assistant is an easier tool to use for this purpose.

The following sections describe ORADIM commands and parameters. Note that each command is preceded by a dash (–). To get a list of 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 SYSTEM user (LocalSystem), with 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 file `ORADIM.LOG` in directory *ORACLE_HOME*`\database`:

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

Oracle Enterprise Management Agent, Oracle Enterprise Manager Management Server and Oracle Internet Directory may also fail, because they cannot connect to the database for the same reason. The workarounds are:

- Modify `SQLNET.ORA`

  You can modify `SQLNET.ORA`, either by removing the line

  ```
  sqlnet.authentication_services=(NTS)
  ```

  or by changing it to

  ```
  sqlnet.authentication_services=(NONE)
  ```

- 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`.

- Start the service as a specific user

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

Creating an Instance

To use ORADIM to create an instance, enter:

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

where

- `-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 Automatic Storage Management instance to create.
- `-ASMSRVC` *service_name* is the name of the Automatic Storage Management service to create.
- `-SYSPWD` *password* is the system password.
- `-STARTMODE auto | manual` indicates whether to start the instance when the Oracle Database service is started. Default is `manual`.
- `-SRVCSTART system | demand` indicates whether to start the Oracle Database service on 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 drive letter.
- `-SPFILE` indicates that a server parameter file (SPFILE) be used during startup instead of a PFILE.
- `-SHUTMODE normal|immediate|abort` specifies how to stop an instance. This is an optional parameter. If you do not specify how to stop an instance, then `normal` is the default mode.

  `-SHUTMODE` 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 shutdown.
- `-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") sets the operating system user with which the Oracle service logs on to the system. You supply an operating system user name and password, and the service logs on and runs with the privileges of that user. If omitted, the service logs on to the system using the Local system account, which is a privileged user.

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

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

```
C:\> oradim -NEW -SID prod -STARTMODE auto -PFILE
C:\app\oracle\product\11.2.0\admin\prod\pfile\init.ora
```

Starting an Instance and Services

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]
```

where

- `-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 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 equivalent to running `net start oracleservice<sid>` from the command line.

`-STARTTYPE inst` is 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, you can enter:

```
C:\> oradim -STARTUP -SID puma -STARTTYPE inst -PFILE
C:\app\oracle\product\11.2.0\admin\prod\pfile\init.ora
```

Stopping an Instance and Services

The Enterprise Database Control service (`OracleDBConsole`*`SID`*) is dependent on the Oracle Database service (`OracleService`*`SID`*). You must stop the dependent Enterprise Database Control service (if installed) before running `ORADIM` to stop the database instance service.

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]
```

where

- `-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 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 `normal` is the default mode.

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

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

Editing an Instance

You can edit an existing instance to change such values as instance name, startup mode, shutdown mode, and shutdown type. 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]
```

where

- `-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 Automatic Storage Management instance to modify.
- `-STARTMODE` indicates whether to start the instance when the Oracle Database service is started. Default is `manual`.
- `-SRVCSTART system | demand` indicates whether to start the Oracle Database service on computer restart. 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 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 `normal` 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, you can enter:

```
C:\> oradim -EDIT -SID prod -PFILE
C:\app\oracle\product\11.2.0\admin\lynx\pfile\init.ora
```

Deleting an Instance

The Enterprise Database Control service (`OracleDBConsole`*`SID`*) is dependent on the Oracle Database service (`OracleService`*`SID`*). You must stop the dependent Enterprise Database Control service (if installed) before running `ORADIM` to delete the database instance.

To use ORADIM to delete an instance, enter:

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

where

- `-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 (OracleServiceSID). User should specify either *`SID`* or SRVC.
- `-ASMSID` *`SID`* is the name of the Automatic Storage Management instance to delete.
- `-ASMSRVC` *`service_name`* is the name of the Automatic Storage Management service to delete.

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

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

Database Migration from a 32-bit Windows Computer

This section contains these topics:

- Backing Up a 32-Bit Oracle Database
- Migrating an Oracle Database 11g Release 2 (11.2)
- Migrating an Oracle Database 10g Release 2 (10.2) or Earlier Database

See Also: *Oracle Database Upgrade Guide* for information about upgrading an earlier release of Oracle Database to Oracle Database 11*g* Release 2 (11.2)

Backing Up a 32-Bit Oracle Database

To back up a 32-bit Oracle home database:

1. Start SQL*Plus:

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

2. Connect to the database instance as `SYSDBA`:

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

3. Create a `.trc` file to use as a template to re-create the control files on the 64-bit computer:

```
SQL> ALTER DATABASE BACKUP CONTROLFILE TO TRACE;
```

4. Shut down the database:

```
SQL> SHUTDOWN IMMEDIATE;
```

5. Perform a full offline backup of the database.

See Also: *Oracle Database Backup and Recovery Quick Start Guide*

Migrating an Oracle Database 11*g* Release 2 (11.2)

To migrate an Oracle Database 11*g* Release 2 (11.2) for 32-bit Windows to an Oracle Database 11*g* Release 2 (11.2) for 64-bit Windows:

1. Install Oracle Database 11*g* Release 2 (11.2) for 64-bit Windows.

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

2. Create the new Oracle Database 11*g* Release 2 (11.2) service at the command prompt:

```
C:\> ORADIM -NEW -SID SID [-INTPWD PASSWORD ]-MAXUSERS USERS
-STARTMODE AUTO -PFILE ORACLE_HOME\DATABASE\INITSID.ORA
```

The following table provides more information on the values you must supply.

Parameter	Description
SID	*SID* of the database you are migrating
PASSWORD	Password for the new Oracle Database 11*g* Release 2 (11.2) for 64-bit Windows database. This is the password for the user connected with `SYSDBA` privileges. The `-INTPWD` option is not required. If you do not specify it, then operating system authentication is used, and no password is required.

Parameter	Description
USERS	Maximum number of users who can be granted SYSDBA and SYSOPER privileges
ORACLE_HOME	Oracle home directory. Ensure that you specify the full path name with the -PFILE option, including drive letter of the Oracle home directory.

3. Copy the 32-bit datafiles to the new 64-bit Oracle home.
4. Copy the 32-bit configuration files to the 64-bit Oracle home.
   a. If your 32-bit initialization parameter file has an IFILE (include file) entry, then copy the file specified by the IFILE entry to the 64-bit Oracle home and edit the IFILE entry in the initialization parameter file to point to its new location.
   b. If you have a password file that resides in the 32-bit Oracle home, then copy the password file to the 64-bit Oracle home. The default 32-bit password file is located in *ORACLE_HOME*\database\pwd*SID*.ora., where *SID* is your Oracle instance ID.
5. In the 64-bit Oracle home, add the _SYSTEM_TRIG_ENABLED = false parameter to the *ORACLE_HOME*\database\ORACLE_*SID* \init.ora file before changing the word size.
6. Remove this parameter from the initialization file after the word size change is complete.

   See Also: *Oracle Database Upgrade Guide* for more information on changing word size

7. Go to the 64-bit *ORACLE_HOME*\rdbms\admin directory from the command prompt.
8. Start SQL*Plus:

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

9. Connect to the database instance as SYSDBA:

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

10. Re-create the 64-bit control files using the CREATE CONTROLFILE command. Edit the trace file created in "Backing Up a 32-Bit Oracle Database" on page 3-16 to change the paths to the datafiles, log files and control files to point to the Oracle home on the 64-bit computer. This creates the new control file in *ORACLE_HOME*\database.

    Here is an example of a database named orcl32 on a 32-bit computer migrating to orcl64 on a 64-bit computer:

```
CREATE CONTROLFILE REUSE DATABASE "T1" NORESETLOGS NOARCHIVELOG
    MAXLOGFILES 32
    MAXLOGMEMBERS 2
    MAXDATAFILES 32
    MAXINSTANCES 16
    MAXLOGHISTORY 1815
LOGFILE
    GROUP 1 'C:\app\oracle\product\11.2.0\oradata\orcl64\REDO03.LOG'  SIZE 1M,
    # was   'C:\app\oracle\product\11.2.0\oradata\orcl32\...LOG'
    # on the 32-bit computer
```

```
    GROUP 2 'C:\app\oracle\product\11.2.0\oradata\orcl64\REDO02.LOG'  SIZE 1M,
    GROUP 3 'C:\app\oracle\product\11.2.0\oradata\orcl64\REDO01.LOG'  SIZE 1M
DATAFILE
   'C:\app\oracle\product\11.2.0\oradata\orcl64\SYSTEM01.DBF',
    # was 'C:\app\oracle\product\11.2.0\oradata\orcl32\...DBF'
    # on the 32-bit computer
   'C:\app\oracle\product\11.2.0\oradata\orcl64\RBS01.DBF',
   'C:\app\oracle\product\11.2.0\oradata\orcl64\USERS01.DBF',
   'C:\app\oracle\product\11.2.0\oradata\orcl64\TEMP01.DBF',
   'C:\app\oracle\product\11.2.0\oradata\orcl64\TOOLS01.DBF',
   'C:\app\oracle\product\11.2.0\oradata\orcl64\INDX01.DBF',
   'C:\app\oracle\product\11.2.0\oradata\orcl64\DR01.DBF'
CHARACTER SET WE8ISO8859P1;
```

11. Alter the `init` file from the 32-bit computer to include the new control file generated in the preceding step.
12. Shut down the database:

    ```
    SQL> SHUTDOWN IMMEDIATE;
    ```

13. Start the database in `UPGRADE` mode to run `utlirp.sql`:

    ```
    SQL> STARTUP UPGRADE;
    ```

    You must use the `PFILE` option to specify the location of your initialization parameter file.
14. Set the system to spool results to a log file for later verification of success. For example:

    ```
    SQL> SPOOL mig32-64.log;
    ```

15. Enter the following command to view the output of the script on-screen:

    ```
    SQL> SET ECHO ON;
    ```

16. Recompile existing PL/SQL modules in the format required by the 64-bit Oracle Database:

    ```
    SQL> @utlirp.sql;
    ```

17. Turn off the spooling of script results to the log file:

    ```
    SQL> SPOOL OFF;
    ```

18. Check the spool file and verify that the packages and procedures compiled successfully. Correct any problems you find in this file.
19. Shut down the database:

    ```
    SQL> SHUTDOWN IMMEDIATE;
    ```

20. Start the database:

    ```
    SQL> STARTUP;
    ```

21. Recompile existing PL/SQL modules in the format required by the 64-bit Oracle Database:

    ```
    SQL> @utlrp.sql;
    ```

Migrating an Oracle Database 10*g* Release 2 (10.2) or Earlier Database

To migrate an Oracle Database 10*g* Release 2 (10.2) to an Oracle Database 11*g* Release 2 (11.2) for 64-bit Windows:

1. Perform steps 1 - 11 in "Migrating an Oracle Database 11g Release 2 (11.2)" on page 3-16.
2. Shut down the database on the 64-bit computer:

   ```
   SQL> SHUTDOWN IMMEDIATE;
   ```

3. Start the database migration:

   ```
   SQL> STARTUP MIGRATE;
   ```

4. Migrate the database as described in Chapter 3, "Upgrading to the New Release" in *Oracle Database Upgrade Guide*.
5. Shut down the database:

   ```
   SQL> SHUTDOWN IMMEDIATE;
   ```

6. Restart the database:

   ```
   SQL> STARTUP OPEN;
   ```

4

Postinstallation Configuration Tasks on Windows

This chapter describes configuration tasks you can perform to increase security and other configuration tasks you must perform before using Oracle Multimedia and other Oracle options. Where appropriate, the chapter provides references to other guides for those configuration tasks.

This chapter contains these topics:

- Windows Firewall
- Resetting Passwords for Default Accounts
- NTFS File System and Windows Registry Permissions
- Configuring External Job Support for the Scheduler on Windows
- Configuring Oracle Multimedia on Windows
- Configuring Oracle Text on Windows
- Configuring Oracle Spatial on Windows
- Configuring Advanced Replication on Windows

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 will differ. See Appendix B, "Optimal Flexible Architecture", in *Oracle Database Installation Guide for Microsoft Windows* for more information.

Windows Firewall

By default, all newer Windows operating systems enable the Windows Firewall to block virtually all TCP network ports to incoming connections. As a result, any Oracle products that listen for incoming connections on a TCP port will not receive any of those connection requests, and the clients making those connections will report errors.

Depending upon which Oracle products are installed and how they are used, some postinstallation configuration of the Windows Firewall might be required for the products to be functional on these operating systems.

This section contains these topics:

- Oracle Executables Requiring Firewall Exceptions
- Configuring the Windows Firewall

- Troubleshooting Windows Firewall Exceptions

Oracle Executables Requiring Firewall Exceptions

Table 4–1 lists the Oracle Database 10*g* Release 1 (10.1) or later executables that listen on TCP ports on Windows. If they 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, they can be found in *ORACLE_HOME*\bin.

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

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 2003, Windows Server 2003 R2, Windows Server 2008, or Windows 2008 R2 system. The list of components includes the 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 will be connecting to the Windows system to access the Oracle software, then no postinstallation configuration steps are required and the Oracle software will function 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 of the above 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 needs to be configured by either opening up specific static TCP ports in the firewall or by creating exceptions for specific executables so they can receive connection requests on any ports they choose. This firewall configuration can be done by one of the following methods:

- From the Control Panel, select **Windows Firewall**. In the Windows Firewall application, select the **Exceptions** tab and then click either **Add Program or Add Port** 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 the create the exception in this way, the effect is the same as creating an exception for the executable either through Control Panel or from the command line.

The following sections list the Oracle Database 11*g* Release 2 executables that listen on TCP ports on Windows, along with a brief description of the executable. It is recommended 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, firewall exceptions may need to be created for the same executable, for example, oracle.exe, multiple times, once for each Oracle home from which that executable loads.

- Firewall Exceptions for Oracle Database
- Firewall Exceptions for Oracle Database Examples
- Firewall Exceptions for Oracle Gateways
- Firewall Exceptions for Oracle Clusterware and Oracle ASM
- Firewall Exceptions for Other Oracle Products

Firewall Exceptions for Oracle Database

For basic database operation and connectivity from remote clients (SQL*Plus, OCI, ODBC, OLE DB applications, and so on), the following executables must be added 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

Firewall Exceptions for Oracle Database Examples

After installing the Oracle Database Examples, the following executables must be added to the Windows Firewall exception list:

- *Oracle_home*\opmn\bin\opmn.exe - Oracle Process Manager
- *Oracle_home*\jdk\bin\java.exe - Java Virtual Machine

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 4–1 table lists the gateway executables used to access non-Oracle software.

Table 4–1 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

Firewall Exceptions for Oracle Clusterware and Oracle ASM

If you installed the Oracle grid infrastructure software 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

Firewall Exceptions for Other Oracle Products

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

Table 4–2 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

Postinstallation configuration for the Windows Firewall must be undertaken if *all* of the following conditions are met:

- Oracle server-side components are installed.

  These components include the Oracle Database, network listeners, and any Web servers or services.
- The computer services 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 will function as expected.

- The Windows Firewall is enabled.

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

You can configure Windows Firewall 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. To configure the firewall, from the **Control Panel**, select **Windows Firewall** and then select **Exceptions** or enter `netsh firewall add...` at the command line.

Alternatively, Windows will inform you if a foreground application is attempting to listen on a port, and it will ask you if you want 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 2008 and later operating systems do not provide any information on applications attempting to listen on a port. Instead, a security audit event is logged to signal that an application is blocked.

Troubleshooting Windows Firewall Exceptions

If you cannot establish certain connections even after granting exceptions to the executables listed in Table 4–1, then follow these steps to troubleshoot the installation:

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 may contain useful error codes or troubleshooting information for failed connection attempts. The Windows Firewall log file on the server may contain useful information as well.
4. If the preceding troubleshooting steps do not resolve a specific configuration issue on Windows XP Service Pack 2, then provide the output from command `netsh firewall show state verbose=enable` to Oracle Support for diagnosis and problem resolution.

See Also:

- http://www.microsoft.com/downloads/details.aspx?FamilyID=a7628646-131d-4617-bf68-f0532d8db131&displaylang=en

  for information on Windows Firewall troubleshooting
- http://support.microsoft.com/kb/875357 for more information on Windows Firewall configuration

Resetting Passwords for Default Accounts

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

> **See Also:** *Oracle Database Administrator's Guide* for more information on default database accounts and passwords

NTFS File System and Windows Registry Permissions

Oracle recommends that you configure Oracle Database files, directories, and registry settings to allow only authorized database administrators (DBAs) to have full control. If you created a database using Database Configuration Assistant or upgraded a database using Oracle Database Upgrade Assistant, then no further action is required.

This section describes the permissions automatically set by Oracle Universal Installer, Database Configuration Assistant, and Oracle Database Upgrade Assistant and the steps to set these permissions manually.

This section contains these topics:

- File Permissions
- Setting NTFS File System Security
- Setting Windows Registry Security

> **See Also:** Your operating system documentation for more information about modifying NTFS file system and Windows registry settings

File Permissions

Beginning with Oracle9*i* Release 2 (9.2), Oracle Universal Installer, Database Configuration Assistant, and Database Upgrade Assistant set file permissions when Oracle Database software is installed or upgraded.

This section contains these topics:

- File Permissions Set by Oracle Universal Installer
- File Permissions Set by Database Configuration Assistant
- File Permissions Set by Database Upgrade Assistant

File Permissions Set by Oracle Universal Installer

During Oracle Database installation, by default Oracle Universal Installer installs software in *ORACLE_HOME*. Oracle Universal Installer sets the following permissions to this directory, and all files and directories under this directory:

- `Administrators` - Full control
- `System` - Full control
- `Authenticated Users` - Read, Execute, and List Contents

Important: If these accounts already exist and possess more restrictive permissions, then the most restrictive permissions are retained. If accounts other than `Administrators`, `System`, and `Authenticated Users` already exist, then the permissions for these accounts are removed.

File Permissions Set by Database Configuration Assistant

During database configuration, 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`)

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

- `Administrators` - Full Control
- `System` - Full Control

Important: If these accounts already exist and possess more restrictive permissions, then the most restrictive permissions are retained. If accounts other than `Administrators` and `System` already exist, then the permissions for these accounts are removed.

File Permissions Set by Database Upgrade Assistant

When an older version of the database is upgraded to Oracle Database 10*g* Release 1 (10.1) or later, 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`)

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

- `Administrators` - Full Control
- `System` - Full Control

Important: If these accounts already exist and possess more restrictive permissions, then the most restrictive permissions are retained. If accounts other than `Administrators` and `System` already exist, then the permissions for these accounts are removed.

Beginning with Oracle Database 11*g* Release 2 (11.2), Database Upgrade Assistant can also configure Enterprise Manager. If the "Enable daily backup" option is selected

while configuring Enterprise Manager, then Database Upgrade Assistant shows a separate screen asking for Fast Recovery Area. Database Upgrade Assistant will try to create the directory structure in whatever file system location is specified if it does not exist. It will put the same set of file permissions to this location. The default location shown by DBUA for fast recovery area is:

- *ORACLE_BASE*\recovery_area

Setting 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:

Directory	Group and Permissions
ORACLE_HOME	▪ Administrators - Full Control ▪ System - Full Control ▪ Authenticated Users - Read, Execute and List Contents
ORACLE_BASE\admin*database_name*	▪ Administrators - Full Control ▪ System - Full Control
ORACLE_BASE\oradata*database_name*	▪ Administrators - Full Control ▪ System - Full Control
ORACLE_HOME\database\spfile*SID*.ora	▪ Administrators - Full Control ▪ System - Full Control

Note: Oracle Database uses the Windows LocalSystem built-in security account. Therefore, file permissions must be granted to the System account of the local computer running Oracle Database.

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 HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE 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 Security main menu.

   The Registry Key Permissions dialog appears.
4. Remove write permissions from any users who are not Oracle Database DBAs or system administrators. Note that the SYSTEM account must have Full Control, since this is the account with which Oracle Database runs.

5. Ensure that user accounts that must run Oracle applications have read privileges.
6. Choose OK.
7. Exit the registry.

Configuring External Job Support for the Scheduler on Windows

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.

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* for more information about external jobs

Configuring Oracle Multimedia on Windows

Oracle Multimedia (formerly interMedia) is a feature that enables Oracle Database to store, manage, and retrieve images. It 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, Standard Edition One, or Enterprise Edition, then Database Configuration Assistant starts automatically at the end of installation. If you choose any 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 Database Configuration Assistant will guide you through configuration of 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 script `ordinst.sql`:

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

5. Run 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 **external routine** calls to work and Oracle Multimedia to function properly. Follow the procedure in *Oracle Net Services Administrator's Guide*.

Configuring Oracle Text on Windows

Oracle Text enables text queries through SQL and **PL/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 Database Configuration Assistant in standalone mode, and selected Typical database creation type.
- The database is a **starter database** that you created by performing the following sequence of steps:
  1. Select Oracle Database 11*g* in the **Select a Product to Install** window.
  2. Select **Typical Installation** in the **Select Installation Method** window.

     See Also:

     - Chapter 3, "Postinstallation Database Creation on Windows"
     - *Oracle Database Installation Guide for Microsoft Windows* for more information about creating a starter database

If none of these is true, then you must configure Oracle Database for use with Oracle Text by using "Configuring Oracle Text Using Database Configuration Assistant".

Upgrading Oracle Text from a Previous Release

If you install Oracle Text from the 11.2 media and have a previous release of Oracle Text (formerly called *inter*Media Text) already installed, then the executables for USER_FILTER are now executed from *ORACLE_HOME*`\ctx\bin`. Therefore, after the upgrade, you must issue the following sql command as database user `SYS`, `SYSTEM`,

or `CTXSYS`, to get a list of USER_FILTER executables. These executables must be copied from *ORACLE_HOME*`\bin` to *ORACLE_HOME*`\ctx\bin`:

```
SQL> SELECT IXV_VALUE FROM CTXSYS.CTX_INDEX_VALUES WHERE IXV_CLASS='FILTER'
AND IXV_OBJECT='USER_FILTER' AND IXV_ATTRIBUTE='COMMAND';
```

See Also: *Oracle Text Application Developer's Guide*

Configuring Oracle Text Using Database Configuration Assistant

To use Database Configuration Assistant to configure Oracle Database for use with Oracle Text at the time you create the database, simply 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 **Programs**, then select **Oracle - *HOME_NAME*,** then select **Configuration and Migration Tools** and then select **Database Configuration Assistant**.

2. Select **Configure database options in a database**.
3. Select the database to modify when prompted.
4. Select **Oracle Text** as the option to configure when prompted.

Configuring Oracle Spatial on Windows

Oracle Spatial 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.

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

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

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

To configure Oracle Spatial manually:

1. Start SQL*Plus at the command prompt:

   ```
   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 script `ordinst.sql`:

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

5. Connect to the database as user **SYSTEM**:

```
SQL> CONNECT SYSTEM
Enter password: system_password
```

6. Run script `mdinst.sql`:

```
SQL> ORACLE_HOME\md\admin\mdinst.sql
```

7. Exit SQL*Plus:

```
SQL> EXIT
```

> **Note:** Script `mdinst.sql` has a variable `%MD_SYS_PASSWORD%` that Oracle Universal Installer will **instantiate** at installation time. Therefore, if you have changed the mdsys user's password, then during a manual installation remember to update script mdinst.sql with that password.

Configuring Advanced Replication on Windows

Oracle Database installs **replication** packages and procedures automatically rather than as a separate manual process. There are many configuration and usage possibilities with Advanced Replication.

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.

> **See Also:** *Oracle Database Advanced Replication* for more information about Advanced Replication and for definitions of master sites and materialized view sites

Configuring Advanced Replication consists of the following steps:

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

Checking Tablespace and Rollback Segment Requirements

Recommended tablespace and rollback segment requirements for Advanced Replication are shown in Table 4–3.

Table 4–3 Advanced Replication Tablespace/Rollback Segment Requirements

Tablespace/Rollback Segment	Minimum Free Space
SYSTEM	20 MB
UNDO TABLESPACE	10 MB
RBS	5 MB

Table 4–3 (Cont.) Advanced Replication Tablespace/Rollback Segment Requirements

Tablespace/Rollback Segment	Minimum Free Space
TEMP	10 MB
USERS	No specific requirement

Note: Replication triggers and procedures are stored here.

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. Parameter names and values for the master site and materialized view sites are shown in Table 4–4.

Table 4–4 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
JOB_QUEUE-PROCESSES	2 **Note**	master
JOB_QUEUE_PROCESSES	2	materialized view

Note

Depends on 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` command:

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

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

5

Administering a Database on Windows

This chapter describes how to administer Oracle Database for Windows.

This chapter contains these topics:

- Managing Oracle Database Services
- Starting and Shutting Down a Database with SQL*Plus
- Starting and Shutting Down a Database Using Services
- Starting Multiple Instances
- Creating and Populating Password Files
- Connecting Remotely to the Database as SYS
- Automatically Encrypted Database Passwords
- Accessing Database Files on Remote Computers
- Archiving Redo Log Files

Managing Oracle Database Services

This section tells you how to manage the services that Oracle Database installs on your computer.

This section provides information on the following:

- Oracle Database Service Naming Conventions for Multiple Oracle Homes
- Starting Oracle Database Services
- Stopping Oracle Database Services
- Auto-starting Oracle Database Services

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

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 from three different locations:

- Control Panel
- Command Prompt
- Oracle Administration Assistant for Windows

Note: You can start Oracle Database when you start `OracleService`*`SID`*. See "Starting and Shutting Down a Database Using Services" on page 5-6 for information on **registry** parameters that enable you to do this.

Control Panel

To start Oracle Database services from the Control Panel:

1. Access your Windows Services dialog.

   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.

Command Prompt

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

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

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

Oracle Administration Assistant for Windows

To start Oracle Database services from Oracle Administration Assistant for Windows:

1. From the **Start** menu, select **Programs**, then select **Oracle - *HOME_NAME***, then select **Configuration and Migration Tools** and then select **Administration Assistant for Windows**.

2. Right-click the *`SID`*.

   where *`SID`* is a specific instance name, such as `orcl`.

3. Click **Start Service**.

   This starts service `OracleServiceORCL`.

Stopping Oracle Database Services

On occasion (for example, when re-installing Oracle Database), you must stop Oracle Database services. You can stop Oracle Database services from three different locations:

- Control Panel
- Command Prompt

- Oracle Administration Assistant for Windows

> **Note:** You can stop Oracle Database in normal, immediate, or abort mode when you stop `OracleService`*`SID`*. See "Starting and Shutting Down a Database Using Services" on page 5-6 for information on registry parameters that enable you to do this.

Control Panel

To stop Oracle Database services from the Control Panel:

1. Access your Windows Services dialog.

   See Also: Your operating system documentation for instructions

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

   `Oracle`*`HOME_NAME`*`TNSListener` is stopped.

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

   `OracleService`*`SID`* is stopped.

Command Prompt

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

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

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

Oracle Administration Assistant for Windows

To stop Oracle Database services from Oracle Administration Assistant for Windows:

1. From the **Start** menu, select **Programs**, then select **Oracle -** ***HOME_NAME***, then select **Configuration and Migration Tools** and then select **Administration Assistant for Windows**.
2. Right-click the ***SID***.

   where *`SID`* is a specific instance name, such as `orcl`.

3. Click **Stop Service**.

   This stops service OracleServiceORCL.

Auto-starting Oracle Database Services

Oracle Database services can be set to start automatically whenever the Windows computer is restarted. You can turn auto-start on or off from two different locations:

- Control Panel
- Oracle Administration Assistant for Windows

Control Panel

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

1. Access your Windows Services dialog.

See Also: Your operating system documentation for instructions

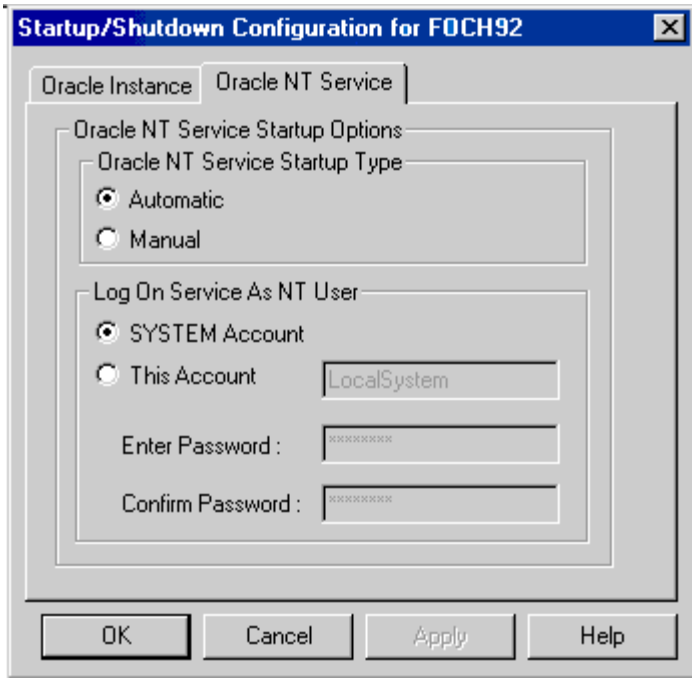
2. Select service **OracleServiceSID** and click **Startup**.
3. Choose **Automatic** from the **Startup Type** field.
4. Click **OK**.
5. Click **Close** to exit the Services dialog.

Oracle Administration Assistant for Windows

To automatically start Oracle Database services from Oracle Administration Assistant for Windows:

1. From the **Start** menu, select **Programs**, then select **Oracle -** ***HOME_NAME***, then select **Configuration and Migration Tools** and then select **Administration Assistant for Windows**.
2. Right-click the ***SID***.

   where *SID* is a specific instance name, such as `orcl`.
3. Choose **Startup/Shutdown Options**.
4. Choose the **Oracle Service** tab.
5. Choose **Automatic** in **Oracle Service Startup Type**.
6. Click **Apply**.
7. Click **OK**.



Starting and Shutting 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 non-OFA compliant directories during installation, then your directory paths will differ. See Appendix B, "Optimal Flexible Architecture", in *Oracle Database Installation Guide for Microsoft Windows* for more information.

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\oracle\product\11.2.0\admin\orcl\pfile
   ```

   you would enter:

   ```
   SQL> STARTUP PFILE=C:\app\oracle\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]
   ```

   where 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: Chapter 2, "Database Tools on Windows" for a list of other tools that can start Oracle Database and this guide for information on options you can specify when starting your database.

Starting and Shutting Down a Database Using Services

You can start or shut down Oracle Database by starting or stopping 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`* two different ways:

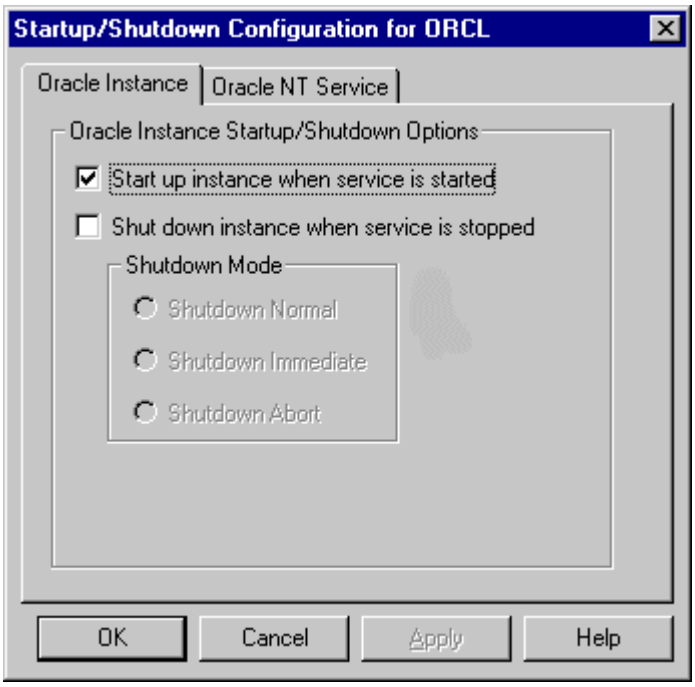
- Oracle Administration Assistant for Windows
- Setting Registry Parameters

Oracle Administration Assistant for Windows

To start or stop a database using Oracle Database services from Oracle Administration Assistant for Windows:

1. From the **Start** menu, select **Programs**, then select **Oracle -** ***HOME_NAME***, then select **Configuration and Migration Tools** and then select **Administration Assistant for Windows**.
2. Right-click the ***SID***.

   where *`SID`* is a specific instance name, such as `ORCL`.
3. Choose **Startup/Shutdown Options**.
4. Choose the **Oracle Instance** tab.
5. Select **Start up instance when service is started**, **Shut down instance when service is stopped**, or both.



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 will try 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. 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.

  > **Caution:** If `ORA_SHUTDOWN` or `ORA_SID_SHUTDOWN` is set to `false`, then manually shutting down OracleService*SID* will still shut down Oracle Database. But it will be 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`). Default mode is `i` (`immediate`) if you do not set this parameter.

- `ORA_`*`SID`*`_SHUTDOWN_TIMEOUT`

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

The registry location of these required and optional parameters is 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
```

where *`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.

See Also: Chapter 15, "Configuration Parameters and the Registry" for instructions on adding and editing registry parameters

Starting or Stopping OracleService*SID* from the Control Panel

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

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

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

   This automatically starts ORADIM, which issues 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.

Starting Multiple Instances

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
   ```

   where *`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
   ```

   where *ORACLE_BASE* is `c:\app\oracle\product\11.2.0` (unless you changed it during installation) and *db_name* is the name of the instance.

6. Repeat Steps 2-5 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 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 the Password Utility:

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

   where

   - `FILE` specifies the password file name.
   - *SID* identifies the database instance.
   - `ENTRIES` sets maximum number of entries in 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 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 parameter `ORA_SID_PWFILE`. If no value is specified, then it looks in the registry for the value of parameter `ORA_PWFILE`, which points to a file containing usernames, passwords, and privileges. If that is not set, then it 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 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, would be granted privilege `SYSDBA`:

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

For an ASM instance:

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

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

```
Statement Processed.
```

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

Caution: Copying or manually moving password files may result in ORADIM being unable to find a password to start an instance.

Viewing and Hiding the Password File

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

- Command Prompt
- Windows Explorer

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

Command Prompt

1. To see the password file, enter:

```
ORACLE_BASE\ORACLE_HOME\database> attrib
```

The password file is displayed as `PWDsid.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
```

Windows Explorer

To make the password file invisible or visible again:

1. Navigate to directory *ORACLE_HOME*\database.
2. Right-click **PWD*sid*.ora**.
3. Choose **Properties**.

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

To view or hide an invisible password file:

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

Connecting Remotely to the Database as SYS

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.

Automatically Encrypted Database 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: Configuration parameter `ORA_ENCRYPT_LOGIN` is retained for backward compatibility and is set to `true` by default. See Chapter 15, "Configuration Parameters and the Registry" for instructions on adding and setting configuration parameters in the registry.

Accessing Database Files on Remote Computers

Oracle Database can access database files on a **remote computer** using Universal Naming Convention (UNC), but it may degrade database performance and network reliability. UNC is a PC format for specifying locations of resources on a local area network. UNC uses the following format:

```
\\server-name\shared-resource-path-name
```

For example, UNC specification for file `system01.dbf` in directory `C:\app\oracle\product\11.2.0\oradata\orcl` on shared server `argon` would be:

```
\\argon\app\oracle\product\11.2.0\oradata\orcl\system01.dbf
```

Locations of archive log files cannot be specified using Universal Naming Convention (UNC). Always set initialization parameter `LOG_ARCHIVE_DEST_`*n* to a local drive. If you set it to a UNC specification, then Oracle Database does not start and you receive the following errors:

```
ORA-00256: error occurred in translating archive text string '\meldell\rmdrive'
ORA-09291: sksachk: invalid device specified for archive destination
OSD-04018: Unable to access the specified directory or device
O/S-Error: (OS 2) The system cannot find the file specified
```

An ORA-00256 error also occurs if you enter `\\\meldell\rmdrive` or `\\\meldell\\rmdrive`. Control files required the additional backslashes for Oracle8 release 8.0.4, but **redo log files** and datafiles did not.

Note: When you use Universal Naming Convention path with external tables, you must ensure that Universal Naming Convention share names do not match with the local share names on which the database server runs. If the Universal Naming Convention share names and the local share names match, then it will result in an error.

Archiving Redo Log Files

If you installed Oracle Database through the Typical installation, then it is created in `NOARCHIVELOG` mode. If you created your database through the Custom option of 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: "Managing Archived Redo Logs" in *Oracle Database Administrator's Guide* for more information about the archiving modes and the archiving process.

6

Monitoring a Database on Windows

This chapter describes how to monitor Oracle Database for Windows.

This chapter contains these topics:

- Database Monitoring Overview
- Using Oracle Counters for Windows Performance Monitor
- Using Event Viewer
- Trace Files
- Alert Logs
- Viewing Threads

Database Monitoring Overview

Table 6–1 describes tools that enable you to monitor Oracle Database.

Table 6–1 Database Monitoring Tools

Tool	Functionality
Oracle Counters for Windows Performance Monitor	Monitor database objects, such as CPU usage, buffer cache, or a background **process**.
Event Viewer	Monitor database events.
Trace Files	Record occurrences and exceptions of 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 real-time graphical performance information. **See Also**: Your Oracle Enterprise Manager documentation set for more information
Oracle Administration Assistant for Windows	View information on or terminate any Oracle **thread**.

See Also: *Oracle Database Performance Tuning Guide* for general tuning information

Using Oracle Counters for Windows Performance Monitor

Oracle Counters for Windows Performance Monitor is a graphical tool for measuring the performance of Oracle Database for Windows objects on a local server or other servers on a network. This tool is the same in appearance and operation as Windows Performance Monitor, except it has been loaded with Oracle Database performance elements.

On each computer, you can view behavior of objects, such as buffer cache, **data dictionary** cache, datafiles, threads, and processes. An object is a graphical representation of an element in your system. Every element, resource, and device in your system can be represented as an object.

Note: Before using Oracle Counters for Windows Performance Monitor to view Oracle-specific counters, you must specify the `SYSTEM` password using `operfcfg.exe` or Oracle Administration Assistant for Windows. See "Using operfcfg" on page 15-14 or "Using Oracle Administration Assistant for Windows" on page 15-15 for instructions.

A set of counters is associated with each object. A counter is a unit of measurement used by Performance Monitor to display activity. The type of activity the counter measures depends on the type of object.

Certain types of objects and their respective counters are present on all systems. Other counters, such as application-specific counters, appear only if the computer is running the associated software.

Each of these objects has an associated set of counters that provide information about device usage, queue lengths, delays, and information used to measure throughput and internal congestion.

Registry Information

When you install Oracle Counters for Windows Performance Monitor, values are automatically set in the **registry** as described in Chapter 15, "Configuration Parameters and the Registry".

Oracle Counters for Windows Performance Monitor lets you monitor only one database **instance** at a time. For this reason, the registry contains the following values:

- `Hostname`
- `Username`
- `Password`

Use `operfcfg` to change these values. Oracle recommends setting the security level on each of these registry values.

> **See Also:** Chapter 15, "Configuration Parameters and the Registry" for instructions on how to use `operfcfg`

To use Oracle Counters for Windows Performance Monitor for another database instance on the same computer or a UNIX computer, change the values appropriately in the registry. You can also monitor non-Windows installations of Oracle Database by changing `Hostname` registry value so it points to another computer specified in file `tnsnames.ora`.

Accessing Oracle Counters for Windows Performance Monitor

To access Oracle Counters for Windows Performance Monitor:

From the **Start** menu, select **Programs**, then select **Oracle -** ***HOME_NAME***, then select **Configuration and Migration Tools** and then select **Oracle Counters for Windows Performance Monitor**.

Oracle Counters for Windows Performance Monitor has four views you can choose from the View menu:

- Chart view displays database activity as it occurs.
- Alert view lets you know when certain minimum performance criteria are not being met, or maximum criteria are being exceeded.
- Log view maintains continuous records on performance.
- Report view saves information about specific criteria.

> **See Also:** Your operating system documentation for complete information about the four views

Modifying Views

For each view you can decide objects to monitor, what counters to use for each object, and graphical attributes of the view. When an object is chosen, it is assigned a counter, a color, and added to the status bar at the bottom of Oracle Counters for Windows Performance Monitor.

To add objects to a view:

1. Choose **Add To** (Chart, Alert, Log, Report) from the **Edit** menu. (This example uses Add to Chart, but other dialogs are similar.)

   The Add to Chart dialog appears.
2. In the **Computer** list, select the computer to monitor.
3. In the **Object** list, select the object or objects to monitor, then click **Add**.

   If no data or Oracle Database objects appear, then either Oracle Database is not running or an invalid host string or password has been entered. If the database is not started, then exit Oracle Counters for Windows Performance Monitor, start the database, and restart Oracle Counters for Windows Performance Monitor.
4. In the **Counter** list, select one or more counters for each object you have selected. Note that the contents of the Counter list change depending upon your selection in the Object list. For details on how a counter works, highlight the counter and click **Explain**.
5. In the **Instance** list, select an instance for this counter.
6. In the **Color** list, choose a color for the display of the selected counter.
7. In the **Scale** list, choose the scale at which to display the counter.
8. In the **Width** list, specify the width of the line on the graph.
9. In the **Style** list, choose a style for your graph line.
10. Click **Done** when you are finished.

    The selections you have chosen to monitor are displayed.

Understanding Oracle Database Performance Objects

All Oracle Database system resources that can be monitored through Oracle Counters for Windows Performance Monitor begin with 'Oracle Database'. This section lists Oracle Database objects and describes their associated counters. These measures are defined in:

ORACLE_HOME\dbs\PERF*ver*.ora

> **See Also:** *Oracle Database Performance Tuning Guide* for additional information on these objects

---

> **Note:** You can monitor only one instance at a time using Oracle Counters for Windows Performance Monitor on a given computer.

Oracle Database Buffer Cache

The counter is phyrds/gets %. The percentage of phyrds/gets is calculated as a Miss ratio. The lower the Miss counter, the better. To improve performance, increase the number of buffers in the buffer cache, if memory is available on the computer. This value is not time-derived.

Oracle Database Redo Log Buffer

The counter is redo log space requests. The value of this counter must be near zero. If this value increments consistently, then processes have had to wait for space in the **redo log buffer**. In this case, it may be necessary to increase the size of the redo log buffer.

Oracle Database Data Dictionary Cache

The counter is getmisses/gets %. The value of this counter must be less than 10 or 15% for frequently accessed data dictionary caches. If the ratio continues to increase over this threshold while your application is running, then increase the amount of memory available to the data dictionary cache.

To increase the memory available to the cache, increase the value of initialization parameter `SHARED_POOL_SIZE`. This value is not time-derived.

> **See Also:** *Oracle Database Performance Tuning Guide* for more detailed information on tuning memory allocation in Oracle Database

Oracle Database Library Cache

The counter is reloads/pins %. This is the percentage of SQL statements, **PL/SQL** blocks, and object definitions that required reparsing. Total Reloads must be near zero. If the ratio of Reloads to Pins is greater than 1%, then reduce the library cache misses. This value is not time-derived.

Oracle Database Datafiles

The counters are phyrds/sec and phywrts/sec. These values are time-derived. Disk contention occurs when multiple processes try to access the same disk simultaneously. Depending on results from monitoring disk activity, corrective actions could include:

- Distributing I/O
- Separating datafiles and **redo log files**

- Separating tables and indexes
- Striping table data

Oracle Database DBWR stats1

The two counters available, buffers scanned/sec and LRU scans/sec, are helpful in tuning Buffer Cache. Buffers scanned/sec is the number of buffers DBWR scanned in each second. The buffers scanned are on the LRU (Least Recently Used) list. LRU scans/sec is the number of times DBWR scanned the (Least Recently Used) buffer list in each second.

Oracle Database DBWR stats2

The two counters available, timeouts/sec and checkpoints/sec, are helpful in determining how much work DBWR has been requested to perform. Timeouts/sec is the number of times DBWR timed-out in each second. DBWR is on a three second timeout interval. If DBWR has not been posted within a three second interval, then it times out.

Checkpoints/sec is the number of checkpoint messages processed by database writer in each second. Whenever a checkpoint occurs, DBWR must be messaged (posted) to "write dirty buffers to disk".

Oracle Database Dynamic Space Management

The counter is recursive calls/sec. Dynamic extension causes Oracle Database to execute SQL statements in addition to those SQL statements issued by user processes. These SQL statements are called recursive calls.

If Oracle Database makes excessive recursive calls while an application is running, then it may be necessary to determine the cause. Examine the recursive calls statistic through dynamic performance table `V$SYSSTAT`.

Oracle Database Free List

The counter is free list waits/requests %. Contention for free lists is reflected by contention for free data blocks in buffer cache. You can determine if contention for free lists is reducing performance by querying `V$WAITSTAT`.

If the number of free list waits for free blocks is greater than 1% of the total number of requests, then consider adding more free lists to reduce contention.

Oracle Database Sorts

The available counters are sorts in memory/sec and sorts on disk/sec. The default sort area size is adequate to hold all data for most sorts. However, if your application often performs large sorts on data that does not fit into the sort area, then you may increase sort area size.

Oracle Counters for Windows Performance Monitor Troubleshooting Information

If no data or Oracle Database objects appear in the Objects list of the Add to (Chart, Alert, Log, Report) dialog, then:

1. Ensure that Oracle Database is running. If it is not running, then exit Oracle Counters for Windows Performance Monitor, and start the database.
2. If the database is running but no data or Oracle Database objects appear, then check the error file for Oracle Counters for Windows Performance Monitor:

   ORACLE_HOME`\dbs\OPERF`*ver*`.log`

If the log file indicates an invalid host string or password, then check the registry for correct values for `Hostname`, `Password`, and `Username`. See "HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services" on page 15-6 for further information about these values.

3. Restart Oracle Counters for Windows Performance Monitor.

Using 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.

To access Event Viewer:

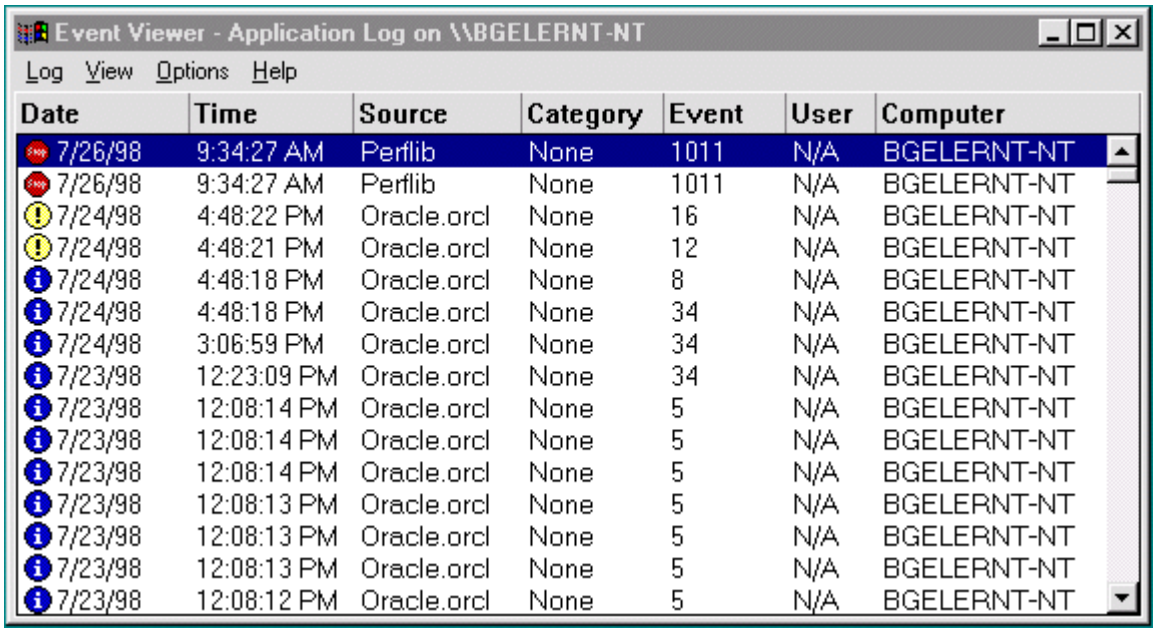
1. From the **Start** menu, select **Programs**, then select **Administrative Tools** and then select **Event Viewer**.

   The Event Viewer window appears.

2. Choose **Application** from the **Log** menu.

Figure 6–1 displays the Application view window, Table 6–2 shows what is recorded in each column, and Table 6–3 interprets icons that appear at the left edge of the viewer.

Figure 6–1 Application View Window



Date	Time	Source	Category	Event	User	Computer
7/26/98	9:34:27 AM	Perflib	None	1011	N/A	BGELERNT-NT
7/26/98	9:34:27 AM	Perflib	None	1011	N/A	BGELERNT-NT
7/24/98	4:48:22 PM	Oracle.orcl	None	16	N/A	BGELERNT-NT
7/24/98	4:48:21 PM	Oracle.orcl	None	12	N/A	BGELERNT-NT
7/24/98	4:48:18 PM	Oracle.orcl	None	8	N/A	BGELERNT-NT
7/24/98	4:48:18 PM	Oracle.orcl	None	34	N/A	BGELERNT-NT
7/24/98	3:06:59 PM	Oracle.orcl	None	34	N/A	BGELERNT-NT
7/23/98	12:23:09 PM	Oracle.orcl	None	34	N/A	BGELERNT-NT
7/23/98	12:08:14 PM	Oracle.orcl	None	5	N/A	BGELERNT-NT
7/23/98	12:08:14 PM	Oracle.orcl	None	5	N/A	BGELERNT-NT
7/23/98	12:08:14 PM	Oracle.orcl	None	5	N/A	BGELERNT-NT
7/23/98	12:08:13 PM	Oracle.orcl	None	5	N/A	BGELERNT-NT
7/23/98	12:08:13 PM	Oracle.orcl	None	5	N/A	BGELERNT-NT
7/23/98	12:08:13 PM	Oracle.orcl	None	5	N/A	BGELERNT-NT
7/23/98	12:08:12 PM	Oracle.orcl	None	5	N/A	BGELERNT-NT

Table 6–2 Application View Definitions

Column Name	Definition
Date	Date event took place
Time	Time event took place
Source	Application that recorded event
Category	Classification of event

Table 6–2 (Cont.) Application View Definitions

Column Name	Definition
Event	Unique number assigned to event
Computer	Computer name on which event occurred

Table 6–3 Event Viewer Icons

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

Reading Event Viewer

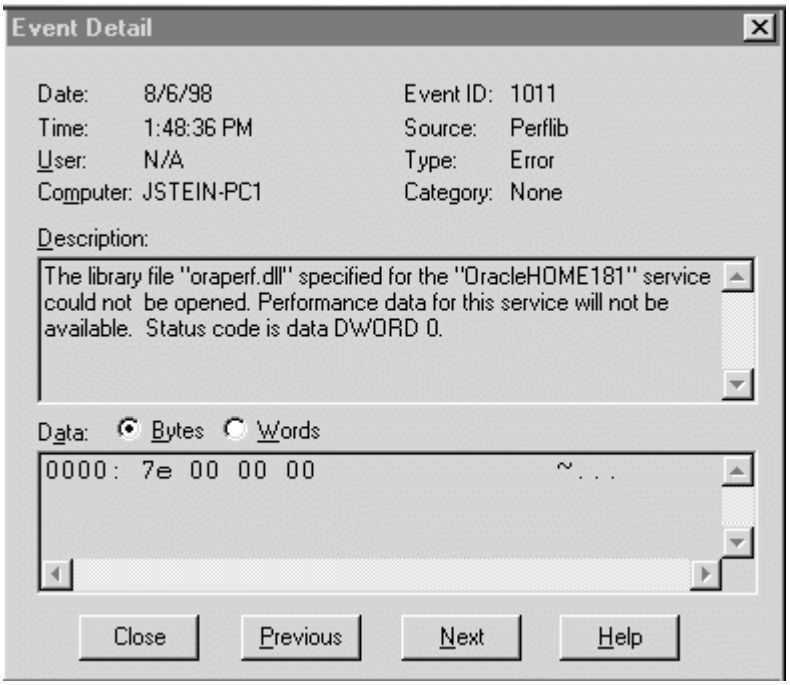
Oracle Database for Windows events display with a source of Oracle.*SID*.

Event number 34 specifies an audit trail event. These events are recorded if parameter `AUDIT_TRAIL` is set to `db` (`true`) or `os` in the initialization parameter file. Option `os` enables system wide auditing and causes audited records to be written to Event Viewer. Option `db` enables system wide 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 Detail dialog appears with more information about the selected event. Figure 6–2, for example, shows details about EventID 1011. In the Description field you will find a text description of the event. In the Data field you can choose Bytes to see the information in hexadecimal format or Words to see DWORDS for the same data.

Figure 6–2 Event Detail Dialog



See Also: Microsoft operating system documentation for more information on using Event Viewer

Managing 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. Choose **Log Settings** from the **Log** menu.

   The Event Log Settings dialog appears.

2. Adjust the setting in the **Maximum Log Size** field to an appropriate level.

3. Click **OK**.

   You are returned to Event Viewer.

Caution: Audit information cannot be spooled to a file. Parameter `AUDIT_FILE_DEST` is not supported in Windows and should not be added to the initialization parameter file.

Trace Files

Oracle Database for Windows background threads use trace files to record occurrences and exceptions of database operations, and errors. Background thread trace files are created and stored in the ADR directory specified by parameter `DIAGNOSTIC_DEST` in the initialization parameter file.

Oracle Database creates a different **trace file** for each foreground and background thread. The name of the trace file contains the name of the thread, followed by the extension `".trc"`. The following are examples of foreground trace file names:

- `ops_ora_5804.trc`
- `ops_ora_4160.trc`

The following are examples of background trace file names:

- `ops_pmon_1556.trc`
- `ops_mmon_3768.trc`
- `ops_lgwr_2356.trc`
- `ops_dbw0_132.trc`

Trace files are also created for user threads and stored in the ADR directory specified by parameter `DIAGNOSTIC_DEST` in the initialization parameter file. Trace files for user threads have the form `ora`*xxxxx*`.trc`, where *xxxxx* is a 5-digit number indicating the Windows thread `ID`.

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 parameter `DIAGNOSTIC_DEST` in the initialization parameter file. Alert logs should be deleted or archived periodically.

See Also:

- "Modifying the Initialization Parameter File" on page 3-5
- "ADMIN Directory" section in *Oracle Database Installation Guide for Microsoft Windows*

Viewing Threads

To view information on Oracle Database threads using Oracle Administration Assistant for Windows, you must either enable Windows native authentication for the database or run utility `ocfgutil.exe` with arguments *`username`* and *`password`*. The utility stores the user name and password in the following registry location:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\OracleOraConfig
```

When Windows native authentication is not enabled, Oracle Remote Configuration Agent retrieves the user name and password from this registry key to log in to the database.

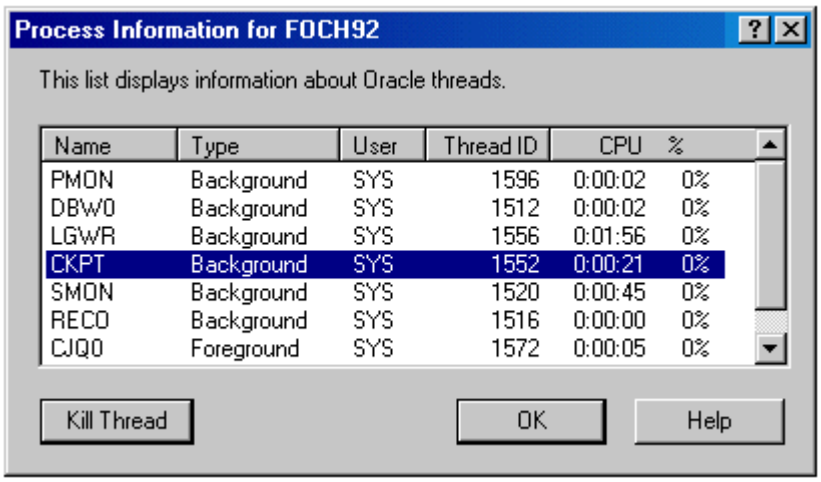
To view information on Oracle Database threads using Oracle Administration Assistant for Windows:

1. From the **Start** menu, select **Programs**, then select **Oracle -** ***HOME_NAME***, then select **Configuration and Migration Tools** and then select **Administration Assistant for Windows**.
2. Right-click the ***SID***, where *`SID`* is a specific instance name, such as `orcl`.

3. Choose **Process Information**.

   The Process Information dialog appears, listing name, type, user, thread ID, and CPU usage for each Oracle Database thread.

4. To terminate a thread, select it and click **Kill Thread**.



7

Tuning Windows to Optimize Oracle Database

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

This chapter contains these topics:

- Windows Tuning Overview
- Large Page Support
- Reduce Priority of Foreground Applications on Server Console
- Configure Windows Server to Be an Application Server
- Disable Unnecessary Services
- Remove Unused Network Protocols
- Reset Network Protocol Bind Order
- Setting the Order of Multiple Network Interface Cards
- Apply Latest Reliable Windows Server Service Pack
- Use Hardware or Operating System Striping
- Multiplex Windows Server Virtual Memory Paging File
- Close All Unnecessary Foreground Applications

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

Windows Tuning Overview

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

There are still ways, however, to 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 should 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.

Large Page Support

Large page support is a feature of Oracle Database 10*g* Release 1 (10.1) or later. It provides a performance boost for memory-intensive database instances running on Windows Server 2003. By taking advantage of newly introduced operating system support, Oracle Database 10*g* Release 1 (10.1) or later can now make more efficient use of processor memory addressing resources. Specifically, when large page support is enabled, the CPUs in the system will be able to 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.

> **See Also:** "Support for Very Large Memory (VLM) Configurations" on page 1-5 for instructions on setting Physical Address Extension mode

This feature is particularly useful when the Oracle buffer cache is several gigabytes. Smaller-sized configurations will 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.

To enable large page support, set `ORA_LPENABLE` to `1` in the Oracle key of the Windows Server 2003 registry.

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. To grant this privilege:

1. From the **Start** menu, select **Settings** and then 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 Settings window opens.

4. In the left pane of the Local Security Settings window, expand Local Policies and select **User Rights Assignment**.

5. In the right pane of the Local Security Settings window, select **Lock pages in memory** and select **Action** and then **Security...**.

   The Local Security Policy Setting dialog opens.

6. Click **Add...**

   The Select Users or Groups dialog opens.

7. Select the `oracle` user from the **Name** list.

8. Click **Add**.

9. Click **OK** to close the Select Users or Groups dialog.

10. Click **OK** to close the Local Security Policy Setting dialog.

To take advantage of large pages on Windows Server 2003, the amount of physical memory must be greater than the amount of System Global Area (SGA) specified in the parameter file.

Large pages may not be allocated always during instance startup; either all of the SGA is allocated using large pages or all of SGA is allocated using regular pages.

> **Note:** Large page usage locks the entire SGA into physical memory. Physical memory is not released during a shrink operation.

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

To enable large page support:

1. Go to *ORACLE_HOME*`\bin\oracle.key`.

2. Open `oracle.key` in a text editor and record the value found. It is set by Oracle Universal Installer. The default is:

   ```
   SOFTWARE\ORACLE\KEY_HOME_NAME
   ```

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 normally are not required to do so. In fact, you can render your system useless if you make incorrect changes. Therefore, only advanced users should edit the registry! Back up your system before making any changes in the registry.

4. Go to `HKEY_LOCAL_MACHINE`.

   Find the key corresponding to the value found in `oracle.key`. In the default case, for example, you would look for:

   ```
   HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_HOME_NAME
   ```

5. Create *one* of the following, depending on where you want to enable large page support:

   - `ORA_LPENABLE=1` to enable large page support on all instances
   - `ORA_`*SID*`_LPENABLE=1` to enable large page support on a specific instance

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.

> **Caution:** Do not set initialization parameter `lock_sga` when large pages are enabled. Large page usage locks the entire SGA into physical memory. When used with 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.

Reduce Priority of Foreground Applications on Server Console

One of the settings provided by default during installation of Windows Server gives interactive foreground applications 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 priority for foreground applications.

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

Configure Windows Server to Be an Application Server

Windows memory manager divides up system memory into three different pools described in Table 7–1.

Table 7–1 Windows Server Memory Shares

Pool	Percent of Total Memory
Kernel and other system services	9%
File Cache	41%
Paged Memory	50%

Windows Server memory manager tries to balance each application's usage of memory by dynamically paging memory between 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 may exceed physical memory capacity.

The large proportion of memory reserved for file caching (41%) can be quite beneficial to file and print servers. But it may not be advantageous to 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 **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

Disable Unnecessary Services

After you have significantly reduced the file cache as described in "Configure Windows Server to Be an Application Server" on page 7-4, 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*HOME_NAME*TNSListener
- OracleStart*SID* (Oracle8 release 8.0.6 and earlier)
- Remote Procedure Call (RPC) Service
- Server
- Spooler
- TCP/IP NetBIOS Helper
- Workstation

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

Remove Unused Network Protocols

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

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

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 highest priority by resetting the network protocol bind order.

See Also: Your operating system documentation for instructions on resetting 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 will return the host name of the private interconnect. Whichever tool is calling `gethostname` will have configuration or connectivity problems stemming from this non-public network information.

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

1. From the **Start** menu, select **Settings** and then select **Network and Dial-up Connections**.
2. Select **Advanced** and then select **Advanced Settings**.
3. The **Connections:** field lists your public and private Local Area Connections. To change the order in which Windows accesses them, select one of them and click the **Arrow** options to move it up or down.
4. When the public and private NICs are in the order you want, click **OK**.
5. The change in priority takes effect immediately. Restarting your computer is not necessary.

Apply Latest Reliable Windows Server Service Pack

Microsoft releases operating system patches, called Service Packs, on a quarterly basis. Service Packs are collections 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, since 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 SP release.

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

Unless there are assurances that the Service Pack works without flaws on Windows Server, choose to 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 printer driver usually requires copying files from original Windows Server installation media. When Service Pack files are comprehensively or selectively overwritten, the Service Pack must be re-applied.

Use Hardware or Operating System Striping

Compared to CPU and memory speeds, hard disk drives are extremely slow. Now that hard disk drives are relatively inexpensive, Oracle recommends that Windows Server use logical volumes comprised 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 Automatic Storage Management (ASM), which does its own striping. Hardware striping is allowed with ASM, but it is not necessary.

See Also: "Using Automatic Storage Management" in *Oracle Database Administrator's Guide*

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 follow Table 7–2, which shows each level's read and write penalties.

Table 7–2 RAID Levels in Oracle Database Installations

RAID Level	Read PenaltyNote	Write PenaltyNote
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

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

Note

Write penalty is ratio of I/O operations to write requests.

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**.

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 faulted drive is replaced, the mirror configuration can be reestablished.

The read penalty for RAID level 1 is nominally 1:1, but it may benefit from split reads on some controllers. When the controller knows which mirror can be accessed fastest, for example, it can lower seek times by directing I/O operations to that disk.

Disk Striping + 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.

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.

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 reduced head movement, hard disks perform best when reading or writing sequential data.

Oracle Database datafiles, 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 datafiles (at physical device level), undo file I/O contention may result, increasing access times for both types of files.

Multiplex Windows Server Virtual Memory Paging File

Some virtual memory paging is likely even if Oracle Database is the only network application running on Windows Server, because Windows Server memory manager will attempt 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 should be corrected by adding more RAM to the server.

General Page File Sizing Tip

Oracle recommends that total combined size of your page files be at least equal to physical RAM on your computer. 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.

Close All Unnecessary Foreground Applications

Once procedures in previous sections have been applied, remember to close any unnecessary foreground applications. First, remove all applications from Startup folders of Windows Server console operators. Second, minimize 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. Third, disable 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.

8

Performing Database Backup and Recovery with VSS

This chapter explains how to use Volume Shadow Copy Service (VSS) applications to back up and recover an Oracle database. This chapter contains the following topics:

- Overview of Database Backup and Recovery with VSS
- Installing and Uninstalling the Oracle VSS Writer Service
- Backing Up a Database
- Restoring and Recovering a Database
- Integrating VSS with Third-Party Requester Applications
- Duplicating a Database

Overview of Database Backup and Recovery with VSS

This section explains the basic concepts and tasks involved in backup and recovery with **component-based shadow copies**. The following topics are described:

- Purpose of Database Backup and Recovery with VSS
- Scope of This Chapter
- Basic Concepts of Database Backup and Recovery with VSS
- Basic Steps of Backup and Recovery with VSS

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.

Scope of This Chapter

This chapter assumes that you are familiar both with VSS applications and the Oracle Database backup and recovery principles and techniques described in *Oracle Database Backup and Recovery User's Guide*. This chapter does not attempt to provide an

introduction to backup and recovery: it only explains how to perform database backup and recovery in the VSS infrastructure.

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 service that writes data to 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. 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 datafiles 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: 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

The Oracle VSS writer is installed automatically as part of the database. If you must install or uninstall it manually, see "Installing and Uninstalling the Oracle VSS Writer Service" on page 8-4.

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 datafile component for restore, then the writer automatically recovers the datafile by using RMAN.

See Also:

- "Backing Up a Database" on page 8-5 to learn about the components that you can back up and the procedures for making component-based and volume-based backups
- "Restoring and Recovering a Database" on page 8-8 to learn about the components that you can restore and the procedures for performing restore and recovery

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.

The Oracle VSS writer provides command-line options to install and uninstall the writer service. 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.

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] [/d]
```

Note: You can change the userid and password using the Services snapin.

Table 8–1 describes the options for the Oracle VSS writer.

Table 8–1 Oracle VSS Writer Options

Option	Description
SID	*SID* of the Oracle instance to which the service connects.
/i	Installs the 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.
/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 a Oracle VSS writer for a specified *SID*.
/tf	Specifies the trace file name for Oracle VSS writer for a specified *SID*.
/d	Uninstalls the service for a specified *SID*.

In Example 8–1, you install the service so that it connects to the `prod1` instance.

Example 8–1 Installing Oracle VSS Writer

```
oravssw prod1 /i
```

Note:

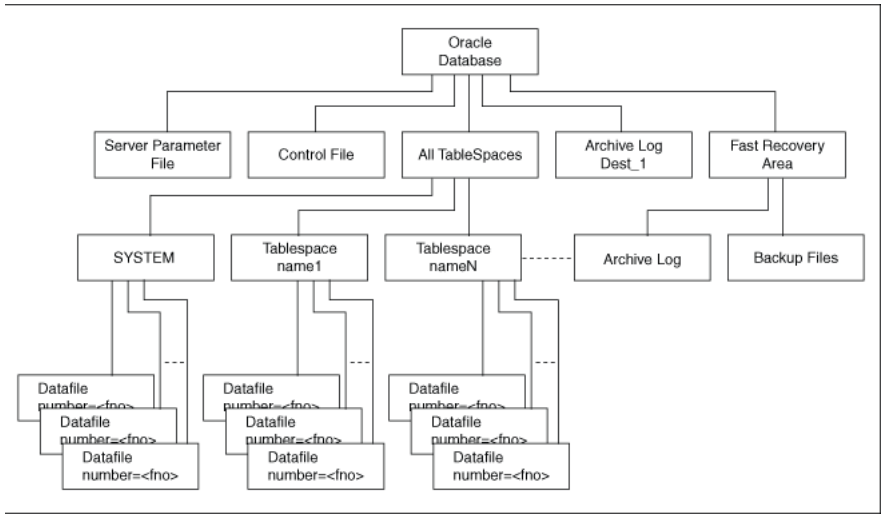
- Any errors during operation of the Oracle VSS writer are reported by means of Windows System Event logging APIs. You can view these errors with the Windows Event Viewer.
- Oracle Database 10*g* Release 2 (10.2.0.3) supports Oracle VSS snapshots only when Oracle VSS writer 11*g* is configured to manage the 10.2.0.3 database. See My Oracle Support (formerly Oracle*MetaLink)* `https://support.oracle.com` Note 580558.1 for more information about installing Oracle VSS writer for use with 9*i* and 10*g* databases.

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 volume-based backup. Oracle recommends shadow copies taken in 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 Figure 8–1.

Figure 8–1 Oracle VSS Writer Component Hierarchy



"About Component-Based Backups" on page 8-5 explains which components you can select when making component-based backups.

About Component-Based Backups

The components supported by the Oracle VSS writer are listed in Table 8–2. 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 8–2 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
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
Datafile number=*n*	Selects individual datafiles. The metadata will contain `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 Table 8–2 may depend on the database state. For example, if the database is in `NOARCHIVELOG` mode, the `Archived Logs` component will not be returned. Likewise, if the instance is not started with a server parameter file, the `Server Parameter File` component will not be 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 should backup files from these components only when creating a log for incremental or differential backup. Likewise, the requester should 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 should backup files from these components only when creating a full or copy backup. Likewise, the

requester should restore files from these components only when restoring from full or copy backup.

Backing Up a Database in ARCHIVELOG Mode

The procedures in this section assume that the database is open read/write. You can also make closed, consistent backups by following the procedures in "Backing Up a Database in NOARCHIVELOG Mode" on page 8-7.

Making Component-Based Backups of an ARCHIVELOG Database

This section explains how to back up the whole database. You can back up only `Oracle Database`, `ArchiveLogDest_n`, and `Fast Recovery Area`, listed in Table 8–2, " Components Backed Up by the Oracle VSS Writer" on page 8-6.

To back up the whole 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 datafiles in the snapshot. The online redo logs will not be 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 datafiles, 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 datafiles, 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 datafiles in the snapshot. The online redo logs will not be included in the snapshot. Note that you can restore the server parameter file individually, but the control files and datafiles 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.

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.

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 datafiles in the snapshot. The online redo logs will not be included in the snapshot.

Making 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 datafiles, 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 datafiles in the snapshot. The online redo logs will not be included in the snapshot. Note that you can restore the server parameter file individually, but the control files and datafiles must be always restored together.

Restoring and Recovering a Database

This section explains 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. The following topics are described:

- Restoring and Recovering a Database in ARCHIVELOG Mode
- Restoring a Database in NOARCHIVELOG Mode

Restoring and Recovering a Database in ARCHIVELOG Mode

You can select the components listed in Table 8–3, " 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 8–3 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" on page 8-9
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" on page 8-9
Tablespace or datafile component	Verifies that the database must be mounted or the specified datafiles or tablespaces must be offline.	Performs complete recovery of these tablespaces or datafiles. The requester application can override the default recovery behavior.	"Recovering Tablespaces or Datafiles" on page 8-10
All Tablespaces	Verifies that the database is mounted.	Extracts redo from the backup writer metadata document and performs incomplete recovery on all the restored datafiles up to the time of snapshot creation. The requester application can override the default recovery behavior.	"Recovering All Tablespaces" on page 8-10
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" on page 8-10 and "Restoring Component-Based Backups of a NOARCHIVELOG Database" on page 8-11
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

This section explains how 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 section 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 needs to 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 Datafiles

This section explains how to recover from the loss of one or more tablespaces or datafiles. This procedure assumes that not all datafiles are lost.

To recover from the loss of all tablespaces or datafiles:

1. Ensure that the database is either mounted or open. If the database is open, then take the datafiles or tablespaces needing recovery offline with the `ALTER DATABASE ... OFFLINE` statement.

2. If the archived redo logs are required for recovery of the datafiles or tablespaces, then restore the archived redo logs.

3. Select the components from the VSS snapshot that contains the lost datafiles, or all datafiles in the lost tablespaces.

4. Restore the component containing the lost datafiles.

   The Oracle VSS writer automatically recovers the restored datafiles. If some archived logs are missing, then you can restore the logs and recover the datafiles with SQL*Plus or RMAN.

5. Bring the offline datafiles or tablespaces back online.

Recovering All Tablespaces

This section explains how to recover from the loss of all tablespaces.

To recover all datafiles:

1. Ensure that the database is mounted.

2. If the archived redo logs are required for recovery of the datafiles 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 datafiles. If some archived logs are missing, then you can restore the logs and recover the datafiles with SQL*Plus or RMAN.

5. Open the database.

Performing Disaster Recovery

This section explains how to recover from the loss of the server parameter file, control file, and all datafiles.

To perform disaster recovery:

1. Ensure that the instance is not started.

2. If the archived redo logs are required for recovery of the datafiles 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 datafiles. If some archived logs are missing, then you can restore the logs and recover the datafiles 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, no archived redo logs have been generated so no media recovery is possible. The database files must be in consistent state and require no additional recovery.

Restoring Component-Based Backups of a NOARCHIVELOG Database

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 datafiles and mounts the database.
2. Open the database with the `RESETLOGS` option.

Restoring Volume-Based Backups of a NOARCHIVELOG Database

To restore a volume-based backup:

1. Use a third-party VSS requester to select the volumes where the datafiles, control files, and server parameter file are physically located.
2. Restore all volumes where datafiles and logs are located.
3. Open the database with the `RESETLOGS` option.

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.

The following are the protocols to follow to exploit the flexibility of recovery operations provided by the writer:

- Writer Control Commands
- Control Commands for Database or All Tablespaces Component

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.

Control Commands for Database or All Tablespaces Component

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.

Duplicating a Database

If your VSS shadow copies are transportable, then you can use these shadow copies to duplicate the primary database. In this 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.

This section covers the following topics:

- Creating a Nonstandby Database from Shadow Copies
- Creating a Standby Database From Shadow Copies

Creating 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 by following the procedure in "Performing Disaster Recovery" on page 8-10.

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.

   Oracle Database Utilities explains how to use DBNEWID.

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;
   ```

Creating a Standby Database From Shadow Copies

This section assumes that you are create 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 by following the procedure in "Performing Disaster Recovery" on page 8-10.

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.

9

Authenticating Database Users with Windows

This chapter describes authentication of Oracle Database users with Windows operating systems.

This chapter contains these topics:

- Windows Native Authentication Overview
- Windows Authentication Protocols
- User Authentication and Role Authorization Methods
- Operating System Authentication Enabled at Installation

Windows Native Authentication Overview

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.
- This chapter describes using Windows native authentication methods with Windows XP and later. For information on Secure Sockets Layer (SSL) protocol and Oracle Internet Directory, see *Oracle Database Advanced Security Administrator's Guide* and *Oracle Internet Directory Administrator's Guide*.

Windows Authentication Protocols

The Windows native authentication adapter works with Windows authentication protocols to enable access to Oracle Database.

NTLM and Kerberos are the authentication mechanisms used by the NTS adapter.

Client computers do not need to specify an authentication protocol when attempting a connection to Oracle Database. Instead, Oracle Database determines the protocol to use, completely transparent to the user. The only Oracle Database requirement is to ensure that parameter `SQLNET.AUTHENTICATION_SERVICES` contains `nts` in the following file on both the client and database server:

ORACLE_HOME`\network\admin\sqlnet.ora`

This is the default setting for both after installation. For Oracle8 release 8.0.x releases, you must manually set this value.

> **See Also:** "Configuring Oracle Database to Communicate with ASM" on page C-1

If typical, your Oracle Database network includes client computers and database servers, and computers on this network may use different Oracle Database software releases on different Windows operating systems on different domains. This combination of different releases means that the authentication protocol being used can vary.

> **See Also:** Your operating system documentation for more information on authentication protocol

User Authentication and Role Authorization Methods

This section describes how user login credentials are authenticated and database roles are authorized in Windows domains. User authentication and role authorization are defined in Table 9–1.

Table 9–1 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. Table 9–2 describes these basic features.

Table 9–2 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.

Table 9–2 (Cont.) Basic Features of User Authentication and Role Authorization

Feature	Description
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.

Authentication and Authorization Methods To Use

Table 9–3 describes user authentication and role authorization methods to use based on your Oracle Database environment:

Table 9–3 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

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 your Windows user name is automatically added to it. Members of local group `ORA_DBA` automatically receive the **SYSDBA privilege**.

Note: If you use a domain account for database installation, then the domain user must be explicitly granted local administrative privileges and `ORA_DBA` membership. It is not sufficient if the domain user has inherited membership privileges from another group. You must ensure that, the user performing the installation must be in the same domain, if not it results in an NTS authetication 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

10

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.

This chapter describes **external user** and **external role** creation and management using either Oracle Administration Assistant for Windows or by a combination of Oracle Database command line tools, Registry Editor, and other Windows tools.

> **See Also:** See *Oracle Database Enterprise User Security Administrator's Guide* for more information on tools available for administering enterprise users and roles.

This chapter contains these topics:

- Oracle Administration Assistant for Windows
- Manually Administering External Users and Roles

Oracle Administration Assistant for Windows

Oracle Administration Assistant for Windows runs from **Microsoft Management Console** and enables you to configure the following Oracle Database users and roles so that the Windows operating system can **authenticate** them, and they can access Oracle Database without a password:

- Regular Windows domain users and **global groups** as external users
- Windows database administrators (with the **SYSDBA privilege**)
- Windows database operators (with the **SYSOPER** privilege)

In addition, Oracle Administration Assistant for Windows can create and grant local and external database roles to Windows domain users and global groups.

With Oracle Administration Assistant for Windows, none of the following need be done manually:

- Create **local groups** that match the database **system identifier** and **role**
- Assign domain users to these local groups
- Authenticate users in SQL*Plus with

```
SQL> CREATE USER username IDENTIFIED EXTERNALLY
```

This section describes how to perform the following tasks with Oracle Administration Assistant for Windows:

- Managing a Remote Computer
- Adding a Computer and Saving Your Configuration
- Granting Administrator Privileges for All Databases on a Computer
- Granting Operator Privileges for All Databases on a Computer
- Connecting to a Database
- Viewing Database Authentication Parameter Settings
- Creating an External Operating System User
- Creating a Local Database Role
- Creating an External Operating System Role
- Granting Administrator Privileges for a Single Database
- Granting Operator Privileges for a Single Database

Managing a Remote Computer

If you want to use Oracle Administration Assistant for Windows to manage a **remote computer**, you must have administrator privileges for the remote computer. Oracle Administration Assistant for Windows always creates users in Oracle Database with the domain name as the prefix. If you are managing Oracle7 release 7.*x* or later databases remotely, you must set registry parameter `OSAUTH_PREFIX_DOMAIN` to `true` on the remote computer. This parameter is located in

```
HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_HOME_NAME
```

If a computer is not identified with a Domain Name System (DNS) domain name, you will receive the following error message:

```
Calling query w32RegQueries1.7.0.17.0  RegGetValue
Key = HKEY_LOCAL_MACHINE
SubKey = SYSTEM\CurrentControlSet\Services\Tcpip\Parameters
Value = Domain
Query Exception: GetValueKeyNotFoundException
Query Exception Class: class oracle.sysman.oii.oiil.OiilQueryException
...
```

To assign a DNS name:

1. From the **Start** menu, select **Settings**, then select **Control Panel**, then select **System**, then **Computer Name**, and then click **Change.**
2. Enter the new computer name and a domain name, such as, `US.ORACLE.COM`.
3. Click **More** if you want to change the primary DNS suffix.

Adding a Computer and Saving Your Configuration

When you use Oracle Administration Assistant for Windows for the first time, it adds the local computer to its navigation tree. You can then add other computers.

To add a computer to the Microsoft Management Console tree:

1. From the **Start**, select **Programs**, then select **Oracle - *HOME_NAME***, then select **Configuration and Migration Tools** and then select **Administration Assistant for Windows**.

   Microsoft Management Console starts.

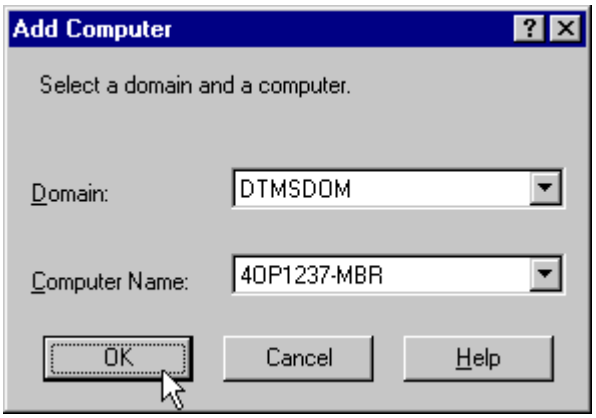
2. Double-click **Oracle Managed Objects**.

   The Computer icon appears.

3. Right-click **Computers**.

4. Select **New** and then select **Computer**.

   The Add Computer dialog appears.



5. Specify the domain and computer name for the computer on which Oracle Database is installed.

6. Click **OK**.

7. Double-click **Computers** to display the computer you added.

8. Double-click the computer you added. Several nodes for authenticating database administrators and operators appear.

   The **OS Database Administrators - Computer** node creates an operating system-authenticated database administrator with `SYSDBA` privileges for every database **instance** on the computer. The **OS Database Operators - Computer** node creates an operating system-authenticated database operator with `SYSOPER` privileges for every database instance on the computer.

9. Save your configuration in a console file by choosing **Save** in the Console main menu. You can now authenticate database administrators and operators for all instances on the computer.

Granting Administrator Privileges for All Databases on a Computer

To grant database administrator (`SYSDBA`) privileges to database administrators (DBAs) for *all* databases on a computer:

Note: If you use a domain account for database installation, then the domain user must be granted local administrative privileges. It is not sufficient if the domain user has inherited membership privileges from another group. You must ensure that, the user performing the installation must be in the same domain, if not it results in an NTS authentication failure.

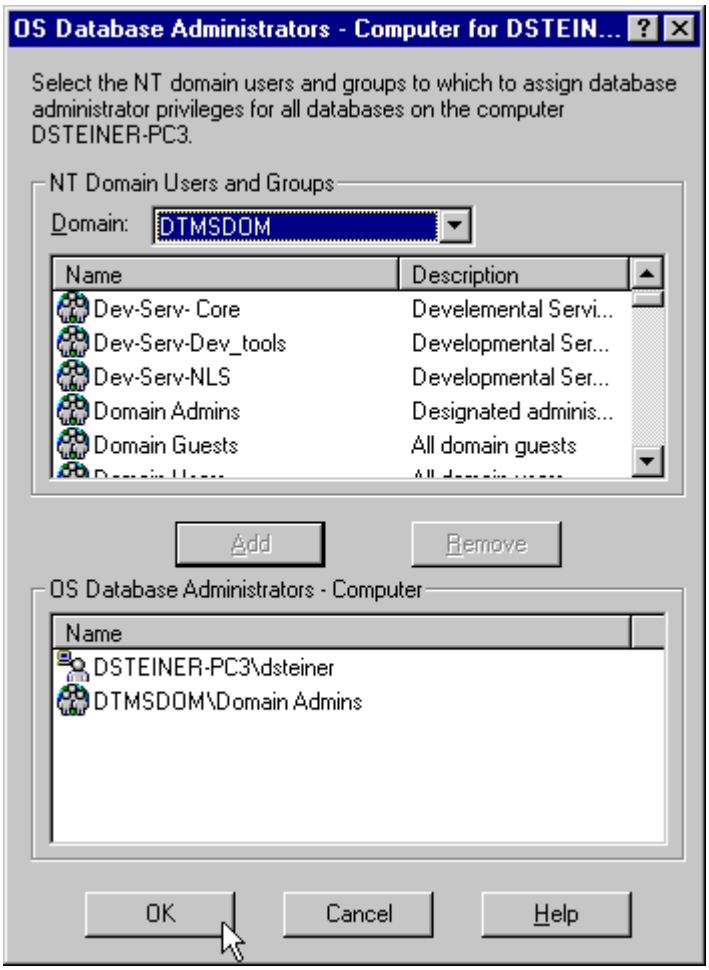
---

1. From the **Start**, select **Programs**, then select **Oracle -** ***HOME_NAME***, then select **Configuration and Migration Tools**, and then select **Administration Assistant for Windows**.

Oracle Administration Assistant for Windows starts.

2. Right-click **OS Database Administrators - Computer**.
3. Click **Add/Remove**.

   The OS Database Administrators - Computer for *hostname* dialog appears.



4. Select the domain of the user to which to grant SYSDBA privileges from the **Domain** list.
5. Select the user.
6. Click **Add**.

   The user now appears in the OS Database Administrators - Computer window.
7. Click **OK**.

Granting Operator Privileges for All Databases on a Computer

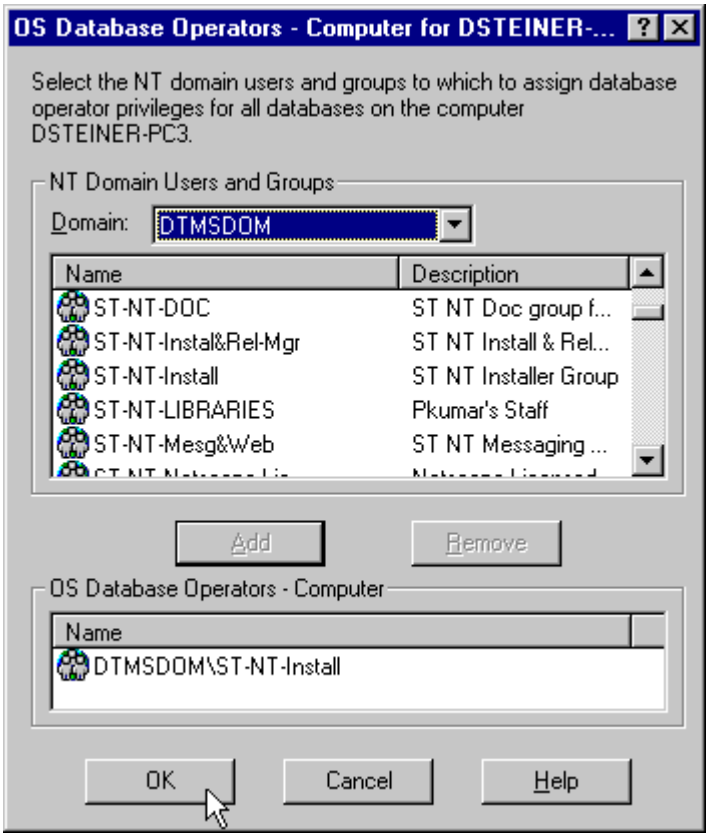
To grant database operator (SYSOPER) privileges to DBAs for *all* databases on a computer:

1. From the **Start**, select **Programs**, then select **Oracle - *HOME_NAME***, then select **Configuration and Migration Tools** and then select **Administration Assistant for Windows**.

   Oracle Administration Assistant for Windows starts.

2. Right-click **OS Database Operators - Computer**.
3. Click **Add/Remove**.

   The OS Database Operators - Computer for *hostname* dialog appears.



4. Select the domain of the user to which to grant `SYSOPER` privileges from the Domain list.
5. Select the user.
6. Click **Add**.

   The user now appears in the OS Database Operators - Computer window.
7. Click **OK**.

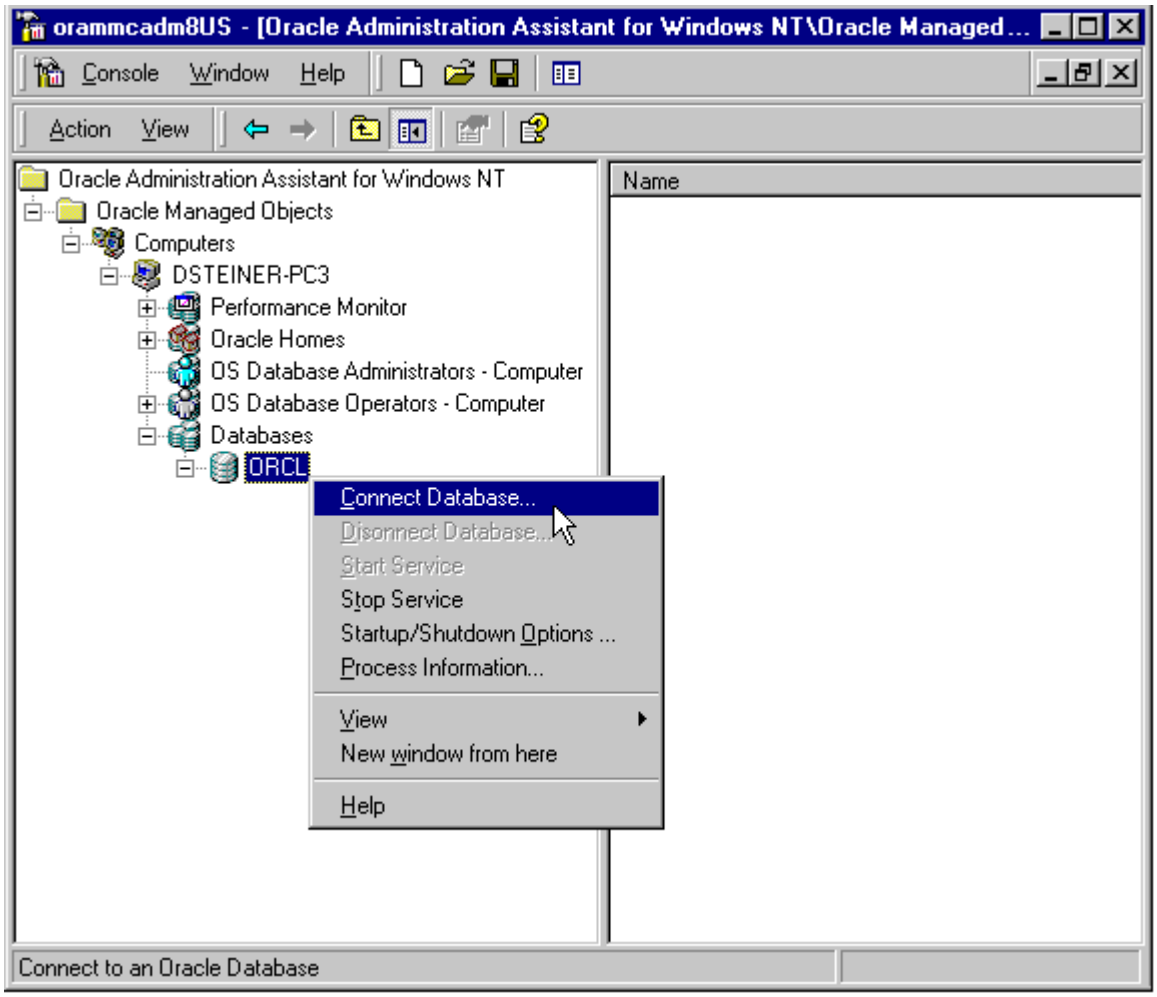
Connecting to a Database

To enable Secure Sockets Layer (SSL) when connecting to Oracle Database, start the Oracle Database service and the **listener** service in the same user account as the wallet created in Oracle Wallet Manager. Do not use the default user account in the Windows Services dialog. If the Oracle Database service and the listener service are started in the default user accounts, then SSL does not work, and the listener does not start. Support for SSL is an Oracle Advanced Security feature. Oracle Wallet Manager is also an Oracle Advanced Security feature.

> **See Also:** *Oracle Database Advanced Security Administrator's Guide* for more information on SSL support

To connect to a database:

1. Right-click the database instance you want to access in the Microsoft Management Console scope pane. In the example here, a connection is to be made to `ORCL`:



2. Choose **Connect Database**.

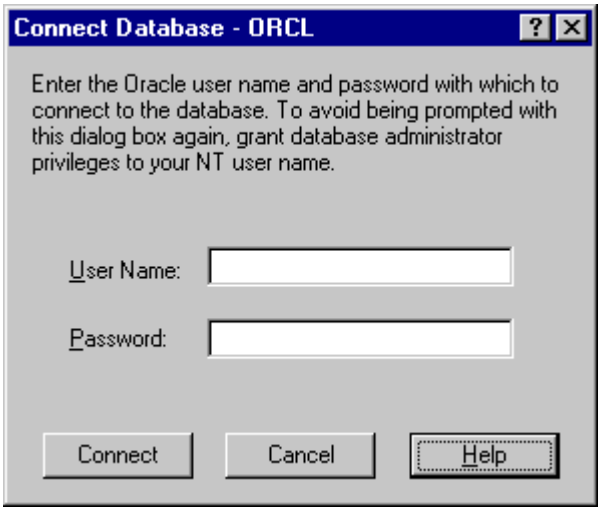
   If you connect to Oracle Database, the following Windows nodes appear beneath the instance. If these nodes do not appear, double-click the instance.

   - External OS Users
   - Local Roles
   - External OS Roles
   - OS Database Administrators
   - OS Database Operators

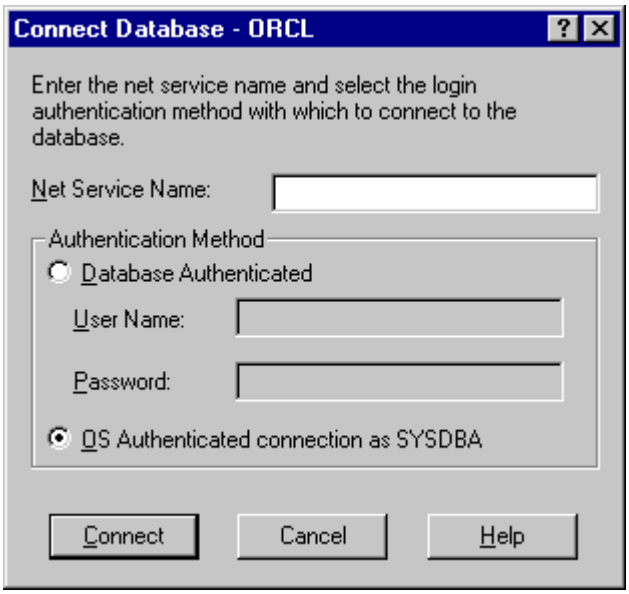
Troubleshooting Connection Problems

When connecting to a local computer, Oracle Administration Assistant for Windows first tries to connect to the database as a `SYSDBA`, using the Bequeath networking protocol. When connecting to a remote computer, Oracle Administration Assistant for Windows first tries to connect to the database using Windows native authentication as a `SYSDBA`, using the TCP/IP networking protocol (port 1521 or the deprecated 1526). If it is unsuccessful, one or more dialogs appear and prompt you to enter information to connect to the database.

The dialog shown here appears because the Windows domain user with which you are attempting to connect to Oracle Database is not recognized as an authenticated user with SYSDBA privileges. Enter an Oracle Database **username** and password to access the database. To avoid being prompted with this dialog again, configure your domain user to be a database administrator authenticated by the Windows operating system.



The next dialog appears either because you are not using the TCP/IP networking protocol to connect to a remote installation of Oracle Database or because Oracle Database is not running. Using a protocol other than TCP/IP (Named Pipes for example) causes this dialog to appear each time you attempt a remote connection.



If you do not want this dialog to appear each time, then change to the TCP/IP protocol and make sure the **Oracle Net Services** listener for the database is listening on the default port 1521 (or the deprecated default port 1526). Otherwise, this dialog appears every time. Ensure also that Oracle Database is started.

1. Enter the **net service name** with which to connect to Oracle Database. You must enter a net service name regardless of the authentication method you select.

2. If you want to access the database with an Oracle Database user name and password, select the Database Authenticated option. This user name and password must exist in Oracle Database and have the `SYSDBA` privilege.
3. If you want to access the database with the Windows domain user with which you are currently logged in, select the OS Authenticated Connection as SYSDBA option. This domain user must already be recognized by Windows as an authenticated user with `SYSDBA` privileges. Otherwise, your logon fails.

> **Note:** Oracle Net Services provides a Trace Assistant tool that helps diagnose connection problems by converting existing trace file text into a more readable format. See "Using the Trace Assistant to Examine Trace Files" in *Oracle Database Net Services Administrator's Guide*.

Viewing Database Authentication Parameter Settings

To view database authentication parameter settings:

1. Right-click the database.
2. Choose **Properties**.
3. The Properties dialog appears displaying the following parameter values:
   - `OS_AUTHENT_PREFIX`
   - `OS_ROLES`

`OS_AUTHENT_PREFIX` is an `init.ora` file parameter that authenticates external users attempting to connect to Oracle Database with the user's Windows user name and password. The value of this parameter is attached to the beginning of every user's Windows username.

By default, the parameter is set to none ("") during Oracle Database creation. Therefore, a Windows domain user name of `frank` is authenticated as user name `frank`. If you set this parameter to `xyz`, then Windows domain user `frank` is authenticated as user `xyzfrank`.

`OS_ROLES` is an `init.ora` file parameter that, if set to `true`, enables the Windows operating system to manage **authorization** of an **external role** for a database user. By default, `OS_ROLES` is set to `false`. You must set `OS_ROLES` to `true` and restart Oracle Database before you can create external roles. If `OS_ROLES` is set to `false`, Oracle Database manages granting and revoking of roles for database users.

If `OS_ROLES` is set to `true`, and you assign an external role to a Windows global group, then it is granted only at the Windows global group level, and not at the level of the individual user in this global group. This means that you cannot revoke or edit the external role assigned to an individual user in this global group through the Roles tab of the User Name Properties dialog at a later time. Instead, you must use the field in the Assign External OS Roles to a Global Group dialog to revoke the external role from this global group (and therefore all its individual users).

External roles assigned to an individual domain user or **local roles** (with `OS_ROLES` set to `false`) assigned to an individual domain user or Windows global group are not affected by this issue. They can be edited or revoked.

If `OS_ROLES` is set to `true`, you cannot grant local roles in the database to any database user. You must grant roles through Windows. See "Creating a Local Database

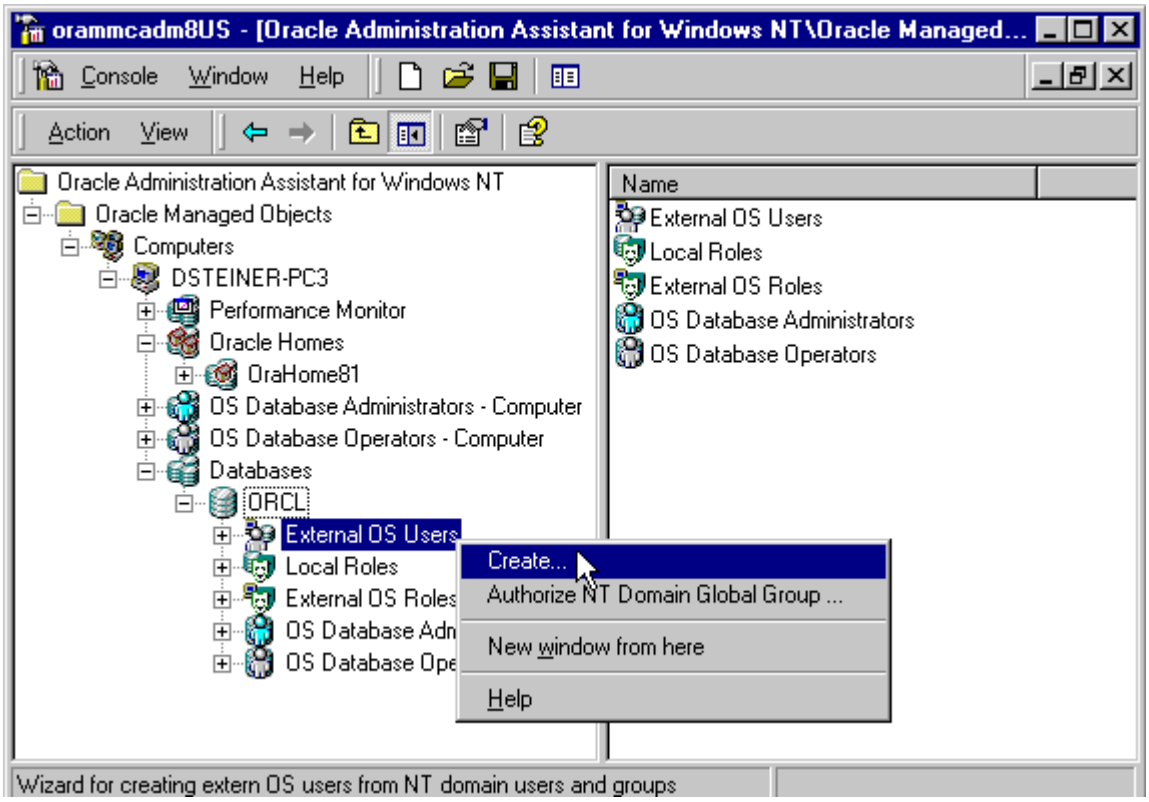
Role" on page 10-13 and "Creating an External Operating System Role" on page 10-15 for more information.

Creating an External Operating System User

The External OS Users node of Oracle Administration Assistant for Windows enables you to authenticate a Windows user to access Oracle Database as an external user without being prompted for a password. External users are typically regular database users (not database administrators) to which you assign standard database roles (such as `DBA`), but do not want to assign `SYSDBA` (database administrator) or `SYSOPER` (database operator) privileges.

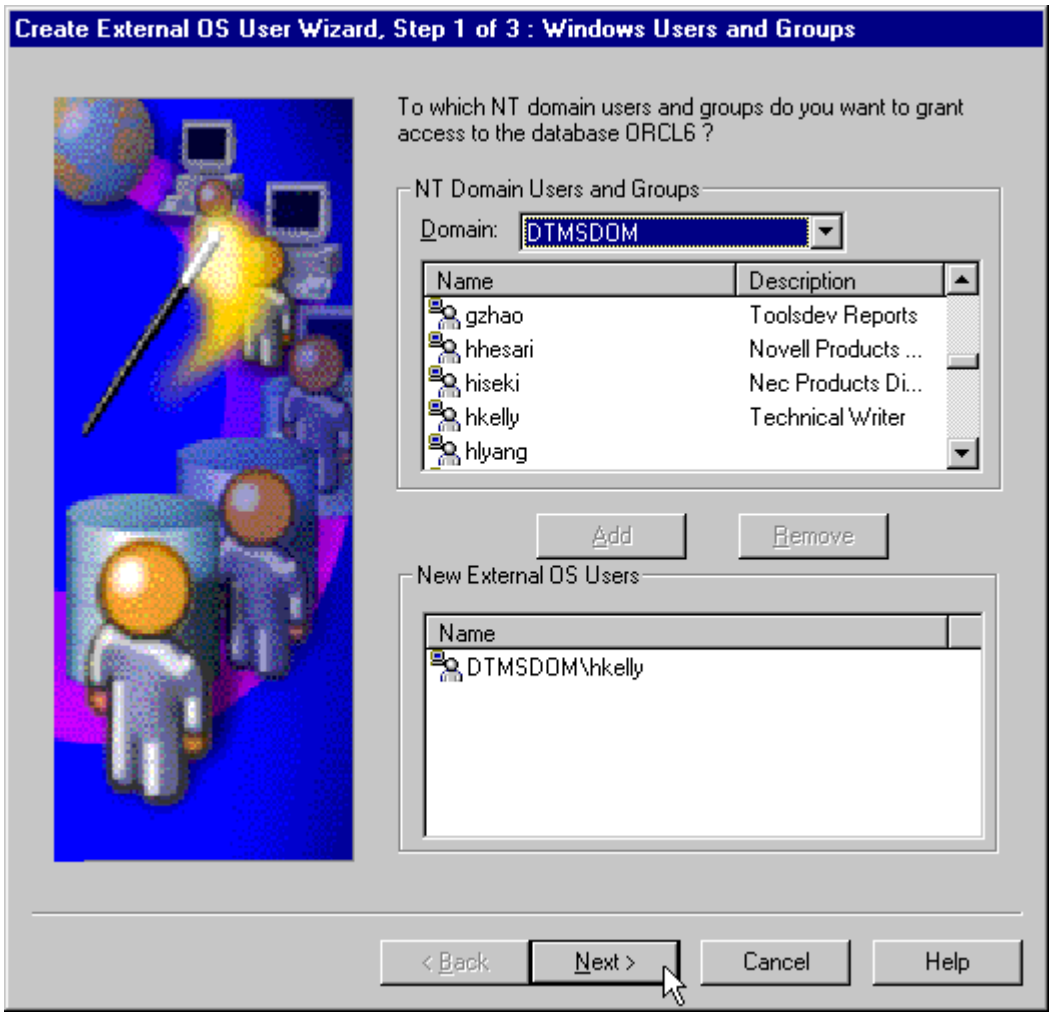
To create an external operating system user:

1. Follow the steps in "Connecting to a Database" on page 10-5 to connect to a database.
2. Right-click **External OS Users**. A contextual menu appears.

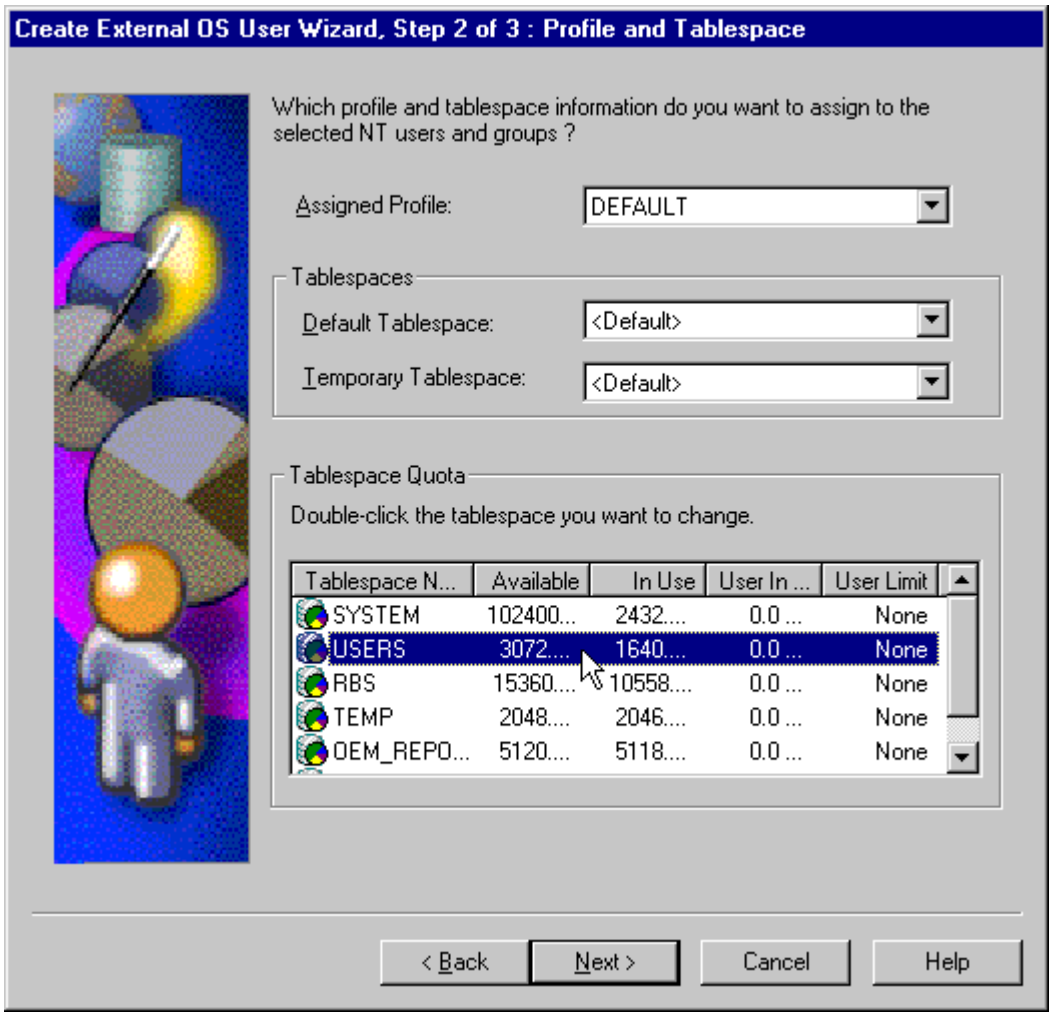


3. Choose **Create**.

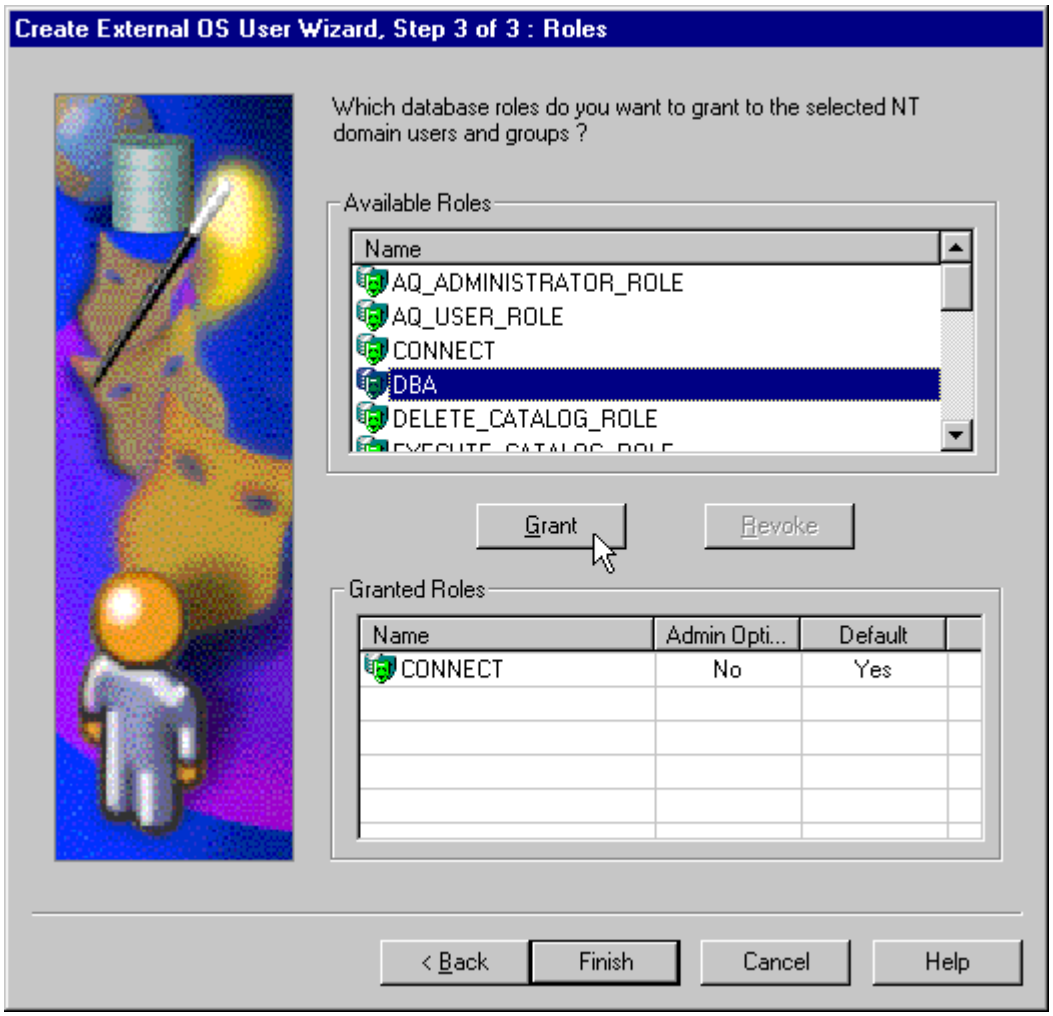
   Create External OS User Wizard starts, and the first of three wizard dialogs appears. The first dialog is for Windows Users and Groups.



4. In **Domain Users and Groups** select the domain in which your Windows domain users and global groups are located.
5. Select the Windows domain users and global groups to which to grant access to the database.
6. Click **Add**. The selected users and groups now appear in the New External OS Users list.
7. Click **Next**. The Profile and Tablespace dialog appears.



8. In the **Assigned Profile** list, select a profile for the new external users. A profile is a named set of resource limits. If resource limits are enabled, Oracle Database limits database usage and instance resources to whatever is defined in the user's profile. You can assign a profile to each user and a default profile to all users who do not have specific profiles.
9. In **Tablespace Quota** double-click the **tablespace** to assign a tablespace **quota**.
10. Click **Next**. The Roles dialog appears.



11. In **Available Roles** select the database roles to grant to the new external users.
12. Click **Grant**.
13. Click **Finish**.
14. Right-click the external user for which you want to view information and select **Properties**.

    The assigned properties appear.

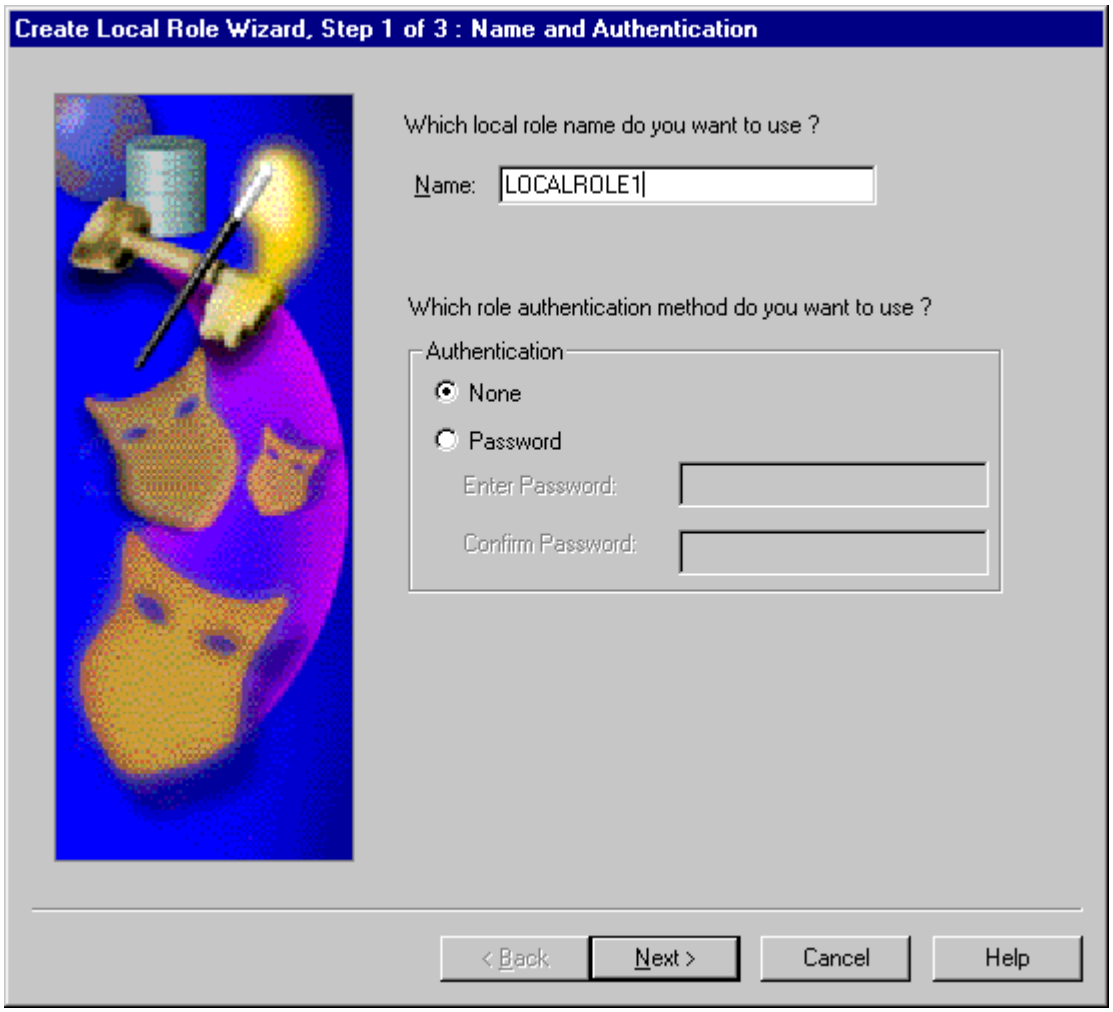
Note: If you select a Windows global group for authentication when using Oracle Administration Assistant for Windows, all users currently in the group are added to Oracle Database. If at a later time, you use a Windows tool to add or remove users in this Windows global group, these updates are not reflected in Oracle Database. The newly added or removed users must be explicitly added or removed in Oracle Database with Oracle Administration Assistant for Windows.

Creating a Local Database Role

The Local Roles node of Oracle Administration Assistant for Windows enables you to create a role and have it managed by the database. Once a local role is created, you can grant or revoke that role to a database user. To create a local database role:

1. Follow the steps in "Connecting to a Database" on page 10-5 to connect to a database.
2. Right-click **Local Roles** for the database for which you want to create a local role.
3. Choose **Create**.

   Create Local Role Wizard starts, and the first of three wizard dialogs appears. The first dialog is for Name and Authentication.



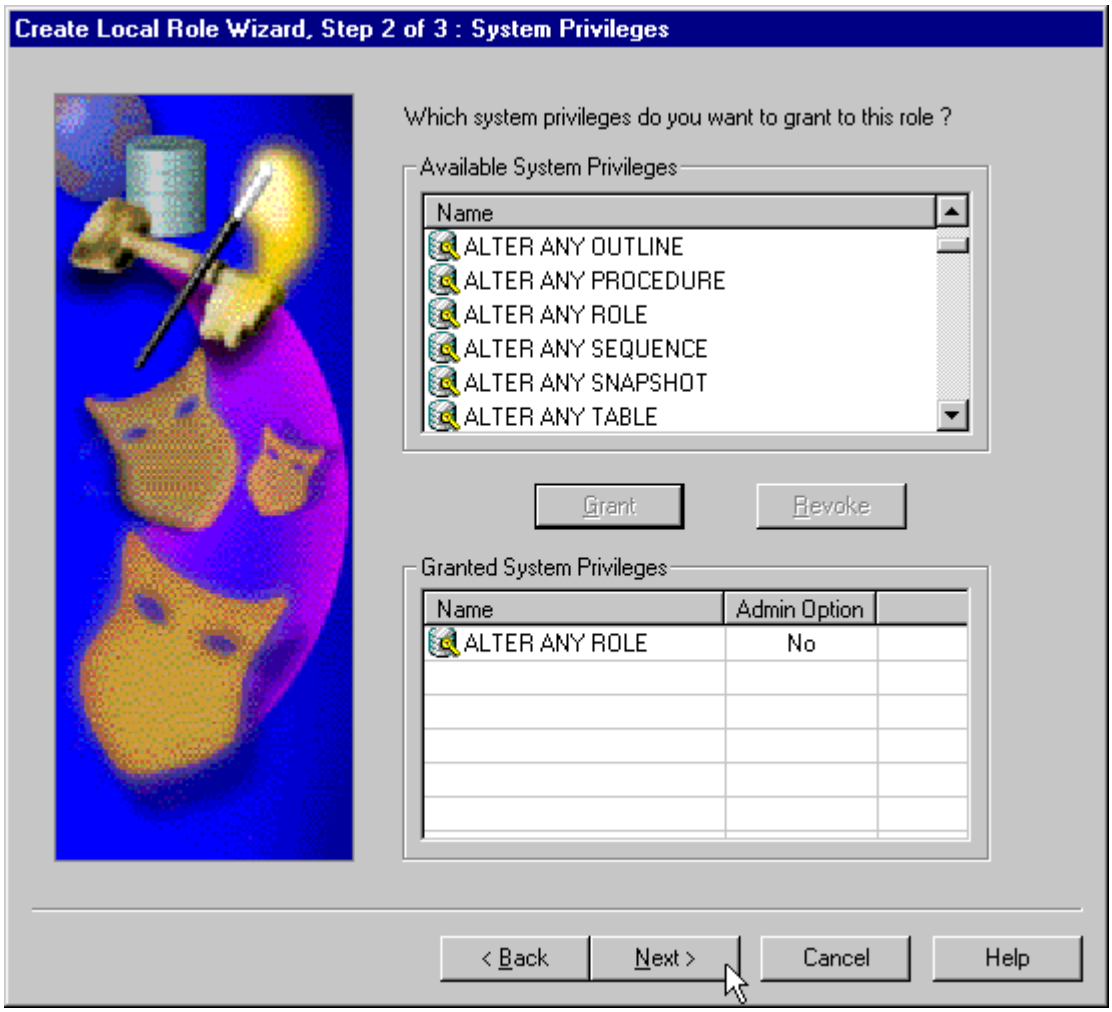
4. Enter a local role name to use.
5. In **Authentication** select **None** if you want a user to use this local role without being required to enter a password.

   Select **Password** if you want use of this role to be protected by a password. These roles can only be used by supplying an associated password with the `SET ROLE` command. See *Oracle Database 2 Day DBA* for additional information.

   Enter the password to use with this role.

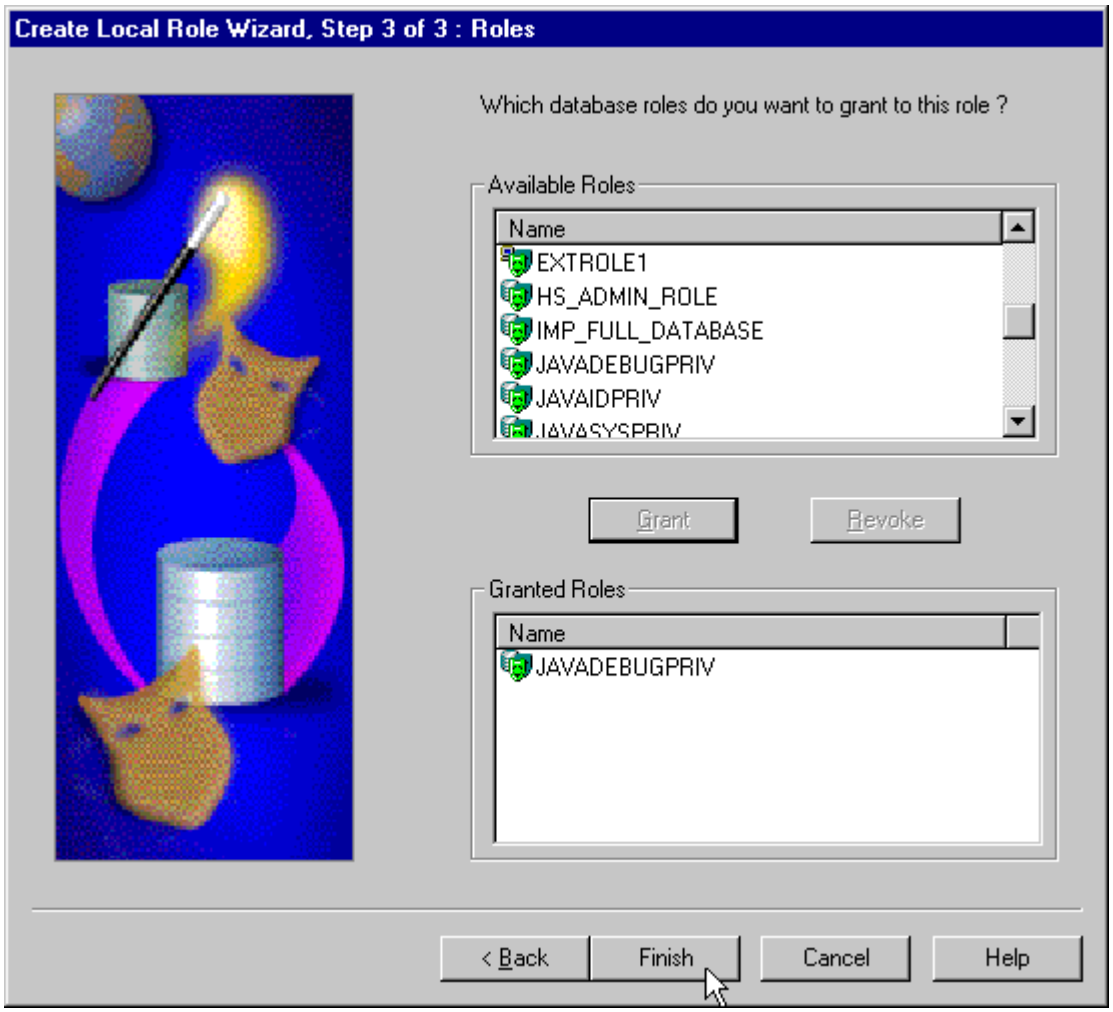
   Confirm the password by entering it a second time.

6. Click **Next**. The System Privileges dialog appears.



7. In **Available System Privileges** select the system privileges you want to assign to the local role.
8. Click **Grant** to grant the selected system privileges to the local role.

   The Granted System Privileges field displays the list of system privileges granted to the local role. To revoke a system privilege, make an appropriate selection, then choose **Revoke**.
9. If you want to grant Admin Option to this role, click the value in the **Admin Option** column to display a list. This enables you to select Yes.
10. Click **Next**. The Roles dialog appears.



11. In **Available Roles** select the roles you want to assign to the local role. Both local roles and external roles appear in this list.
12. Click **Grant** to grant the selected roles to the role.

    The Granted Roles field displays the list of roles granted to the role. Both local roles and external roles can appear in this list. To revoke roles, make appropriate selections, then choose **Revoke**.
13. Click **Finish**.

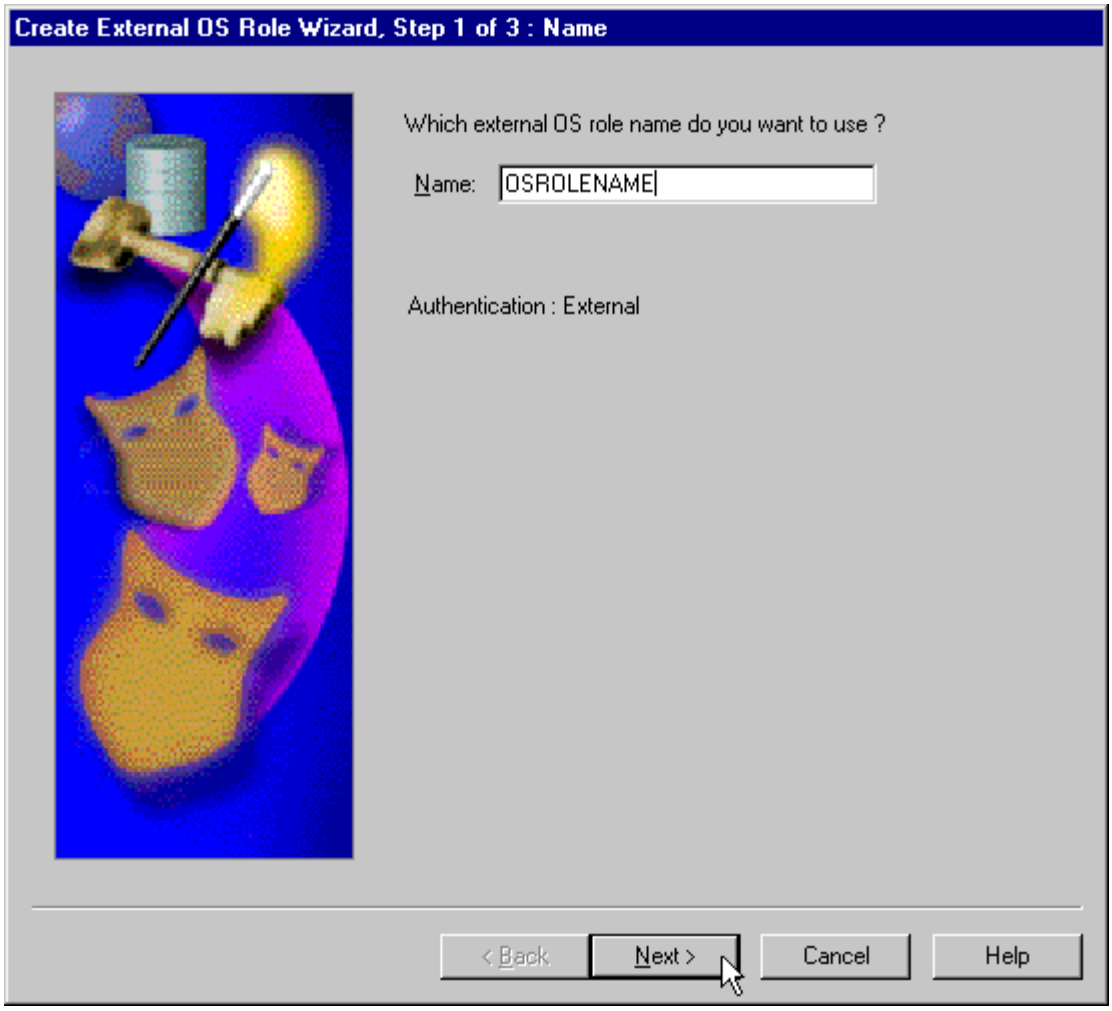
Creating an External Operating System Role

The External OS Roles node of Oracle Administration Assistant for Windows enables you to create an external role and have it managed by the Windows operating system. Once an external role is created, you can grant or revoke that role to a database user. To create an external role:

1. Follow the steps in "Connecting to a Database" on page 10-5 to connect to a database.
2. Right-click **External OS Roles** for the database for which to create an external role.
3. Choose **Create**.

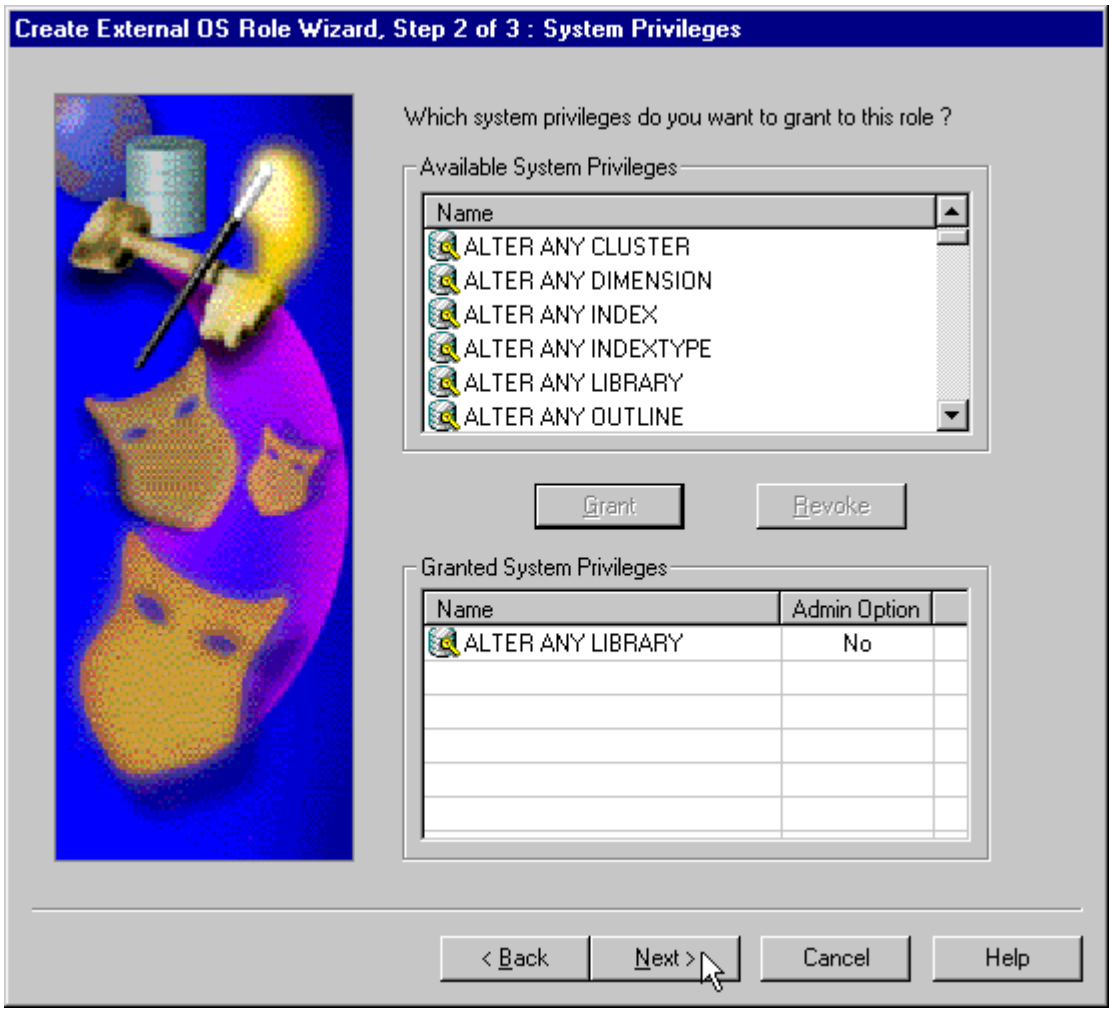
Create External OS Role Wizard starts, and the first of three wizard dialogs appears. The first dialog is for Name. Authentication: External appears in this dialog to indicate that only external roles can be created.

Note: Create External OS Role Wizard is available only if `init.ora` parameter `OS_ROLES` is set to `true`. If it is set to `false`, then you must first change it to `true` and then restart Oracle Database.



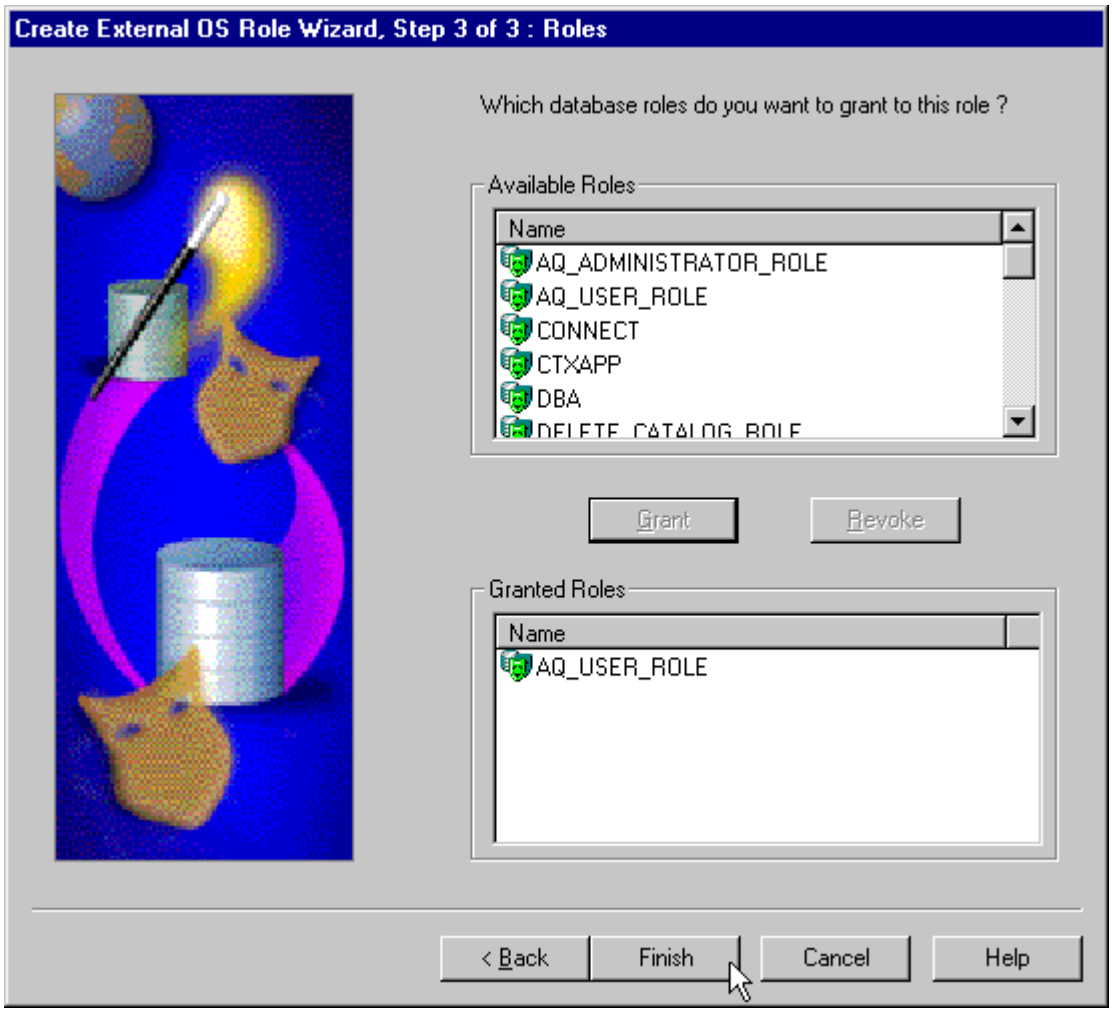
4. Enter an external role name to use. An external role is a role that is managed by the Windows operating system.
5. Click **Next**.

   The System Privileges dialog appears.



6. In **Available System Privileges** select the system privileges you want to assign to the external role.
7. Choose **Grant** to grant the selected system privileges to the external role.
8. The **Granted System Privileges** field displays the list of system privileges granted to the external role. To revoke a system privilege, make an appropriate selection, then click **Revoke**.
9. If you want to grant Admin Option to this role, choose the value in the **Admin Option** column to display a list. This enables you to select Yes.
10. Click **Next**.

    The Roles dialog appears.



11. In **Available Roles** select the roles you want to assign to the external role. Both local roles and external roles appear in this list.
12. Click **Grant** to grant the selected roles to the external role.

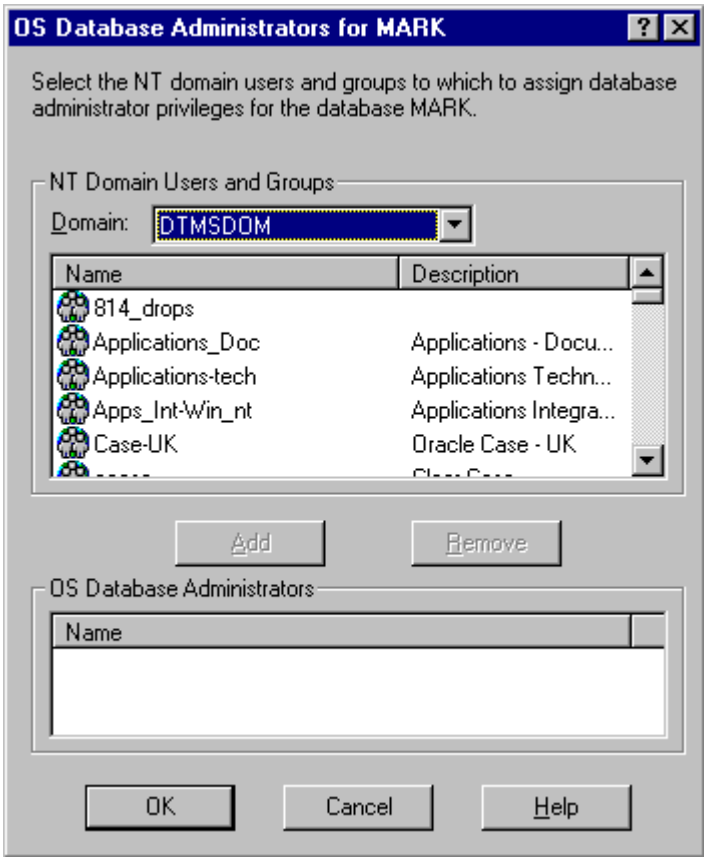
    The Granted Roles field displays the list of roles granted to the external role.
13. Click **Finish**.

Granting Administrator Privileges for a Single Database

The OS Database Administrators node of Oracle Administration Assistant for Windows enables you to authorize a Windows user with `SYSDBA` privileges for a specific instance on a computer. To grant administrator `(SYSDBA)` privileges for a single database:

1. Follow the steps in "Connecting to a Database" on page 10-5 to connect to a database.
2. Right-click **OS Database Administrators**.
3. Choose **Add/Remove**.

   The OS Database Administrators for *`instance`* dialog appears. In the example shown here, the instance is `MARK`:



4. In **Domain Users and Groups** select the domain of the user to which to grant `SYSDBA` privileges from the **Domain** list.
5. Select the user.

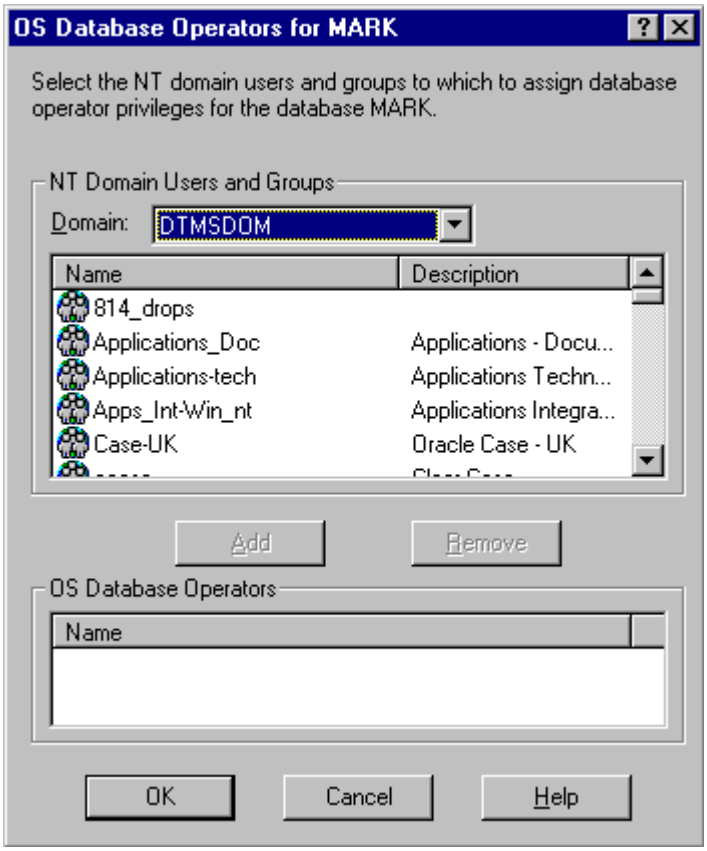
   The user now appears in OS Database Administrators.
6. Click **OK**.

Granting Operator Privileges for a Single Database

The OS Database Operators node of Oracle Administration Assistant for Windows enables you to authorize a Windows user with SYSOPER privileges for a specific instance on a computer. To grant operator (SYSOPER) privileges for a single database:

1. Follow the steps in "Connecting to a Database" on page 10-5 to connect to a database.
2. Right-click **OS Database Operators**.
3. Choose **Add/Remove**.

   The OS Database Operators for *`instance`* dialog appears. In the example shown here, the instance is `MARK`:



4. In **Domain Users and Groups** select the domain of the user to which to grant `SYSOPER` privileges from the **Domain** list.
5. Select the user.
6. Click **Add**.

   The user now appears in OS Database Operators.
7. Click **OK**.

Manually Administering External Users and Roles

Instead of using Oracle Administration Assistant for Windows, you can manually configure administrators, operators, users, and roles to be authenticated by the operating system. Manual configuration involves using Oracle Database command line tools, editing the registry, and creating local groups in Active Directory Users and Computers.

All of the following can be manually configured to access Oracle Database without a password:

- External operating system users
- Windows database administrators (with `SYSDBA` privilege)
- Windows database operators (with `SYSOPER` privilege)

In addition, you can manually create and grant local and external database roles to Windows domain users and global groups.

This section describes:

- Manually Creating an External Operating System User
- Manually Granting Administrator and Operator Privileges for Databases
- Manually Creating an External Role
- Manually Migrating Users

Note: Use extreme care when manually configuring administrators, operators, users, and roles to be authenticated by the operating system. If possible, use Oracle Administration Assistant for Windows to perform configuration procedures.

Manually Creating an External Operating System User

This section 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 usernames.

In the following procedure, two Windows usernames are authenticated:

- Local user `frank`
- Domain user `frank` on domain `sales`

Local user `frank` 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 `frank` 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.

The procedure is divided into two sets of tasks performed on different computers:

- External User Authentication Tasks on the Oracle Database Server
- External User Authentication Tasks on the Client Computer

External User Authentication Tasks on the Oracle Database Server

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 usernames attempting to connect to the server with the user's operating system name and password. The prefixed user name is compared with Oracle Database usernames 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, `xyzfrank` for local user `frank` or `xyzsales\frank` for domain user `frank` 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 usernames (for example, `frank` for local user `frank` or `sales\frank` for domain user `frank` on domain `sales`).

- No value specified

  If you do not specify a value for `OS_AUTHENT_PREFIX`, it defaults to `OPS$` (for example, `OPS$frank` for local user `frank` or `OPS$sales\frank` for domain user `frank` on domain `sales`).

3. Create a Windows local user name for `frank` with the Computer Management tool, or create a domain user name for `frank` with Active Directory Users and Computers (if the appropriate name does not currently exist). See your operating system documentation for detailed instructions.

4. Do this step *only* if you are *not* authenticating a domain name with a user (for example, just `frank` instead of `frank` on domain `sales`). Otherwise, go to step 8.

   a. Start Registry Editor from the command prompt:

   ```
   C:\> regedit
   ```

   b. Go to `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\HOME`*`ID`*, where *`ID`* is the Oracle home directory you want to edit.

   c. Select **Edit** and then select **Add Value**.

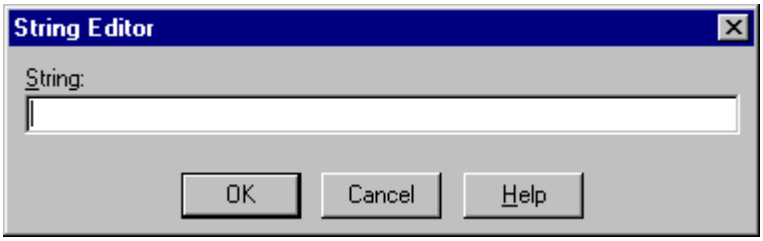
   The Add Value dialog appears:

   d. Enter `OSAUTH_PREFIX_DOMAIN` in the **Value Name** field.

   e. Choose `REG_EXPAND_SZ` from the **Data Type** list.

   f. Click **OK**.

   The String Editor dialog appears:



5. Enter `true` in the **String** field to enable authentication at the domain level.

   There may be multiple `frank` usernames on your network, including local user `frank`, domain user `frank` on `sales`, and possibly several domain users `frank` on other domains. Entering `true` enables the server to differentiate among them. Entering `false` causes the domain to be ignored and local user `frank` to become the default value of the operating system user returned to the server.

6. Click **OK**.

   Registry Editor adds the parameter.

7. Choose **Exit** from the **Registry** menu.

   Registry Editor exits.

8. Ensure that parameter `SQLNET.AUTHENTICATION_SERVICES` in file `sqlnet.ora` contains `nts`.

9. Start SQL*Plus:

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

10. 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.

11. Create a local external user by entering:

    ```
    SQL> CREATE USER xyzfrank IDENTIFIED EXTERNALLY;
    ```

    where `xyz` is the value you chose for initialization parameter `OS_AUTHENT_PREFIX`, and `frank` is the Windows local username.

12. Grant a local external user database roles by entering:

    ```
    SQL> GRANT DBA TO xyzfrank;
    ```

13. Create a domain external user by entering:

    ```
    SQL> CREATE USER "XYZSALES\FRANK" IDENTIFIED EXTERNALLY;
    ```

    where `XYZ` is the value you chose for initialization parameter `OS_AUTHENT_PREFIX`, and `SALES\FRANK` is the domain name and Windows domain username. Double quotes are required and the entire syntax must be in uppercase.

14. Grant a domain external user database roles by entering:

    ```
    SQL> GRANT DBA TO "XYZSALES\FRANK";
    ```

    Double quotes are required and the entire syntax must be in uppercase.

15. Connect to the database with the `SYSDBA` name:

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

16. Shut down the database:

    ```
    SQL> SHUTDOWN
    ```

17. Restart the database:

    ```
    SQL> STARTUP
    ```

This causes the change to parameter `OS_AUTHENT_PREFIX` to take effect.

External User Authentication Tasks on the Client Computer

Perform the following external user authentication tasks on the client computer:

1. Create Windows local or domain user name `frank` with the same user name and password that exist on the Windows server (if the appropriate name does not currently exist).
2. Ensure that parameter `SQLNET.AUTHENTICATION_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. See *Oracle Database Net Services Administrator's Guide* for instructions.
4. Start SQL*Plus:

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

5. 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 username, verifies it, and enables connection as `xyzfrank` or `xyzsales\frank`.

6. Verify that you have connected to Oracle Database as local or domain user `frank` by viewing the roles assigned in steps 12 or 14 of "External User Authentication Tasks on the Oracle Database Server".

   ```
   SQL> SELECT * FROM USER_ROLE_PRIVS;
   ```

   which outputs for local user `frank`:

   ```
   USERNAME                       GRANTED_ROLE                   ADM DEF OS_
   ------------------------------ ------------------------------ --- --- ---
   XYZFRANK                       DBA                            NO  YES NO
   1 row selected.
   ```

   or, for domain user `frank`:

   ```
   USERNAME                       GRANTED_ROLE                   ADM DEF OS_
   ------------------------------ ------------------------------ --- --- ---
   XYZSALES\FRANK                 DBA                            NO  YES NO
   1 row selected.
   ```

   Because the Oracle Database user name is the whole name `xyzfrank` or `xyzsales\frank`, each object created by `xyzfrank` or `xyzsales\frank` (that is, table, **view**, index, and so on) is prefixed by this name. For another user to reference the table `shark` owned by `xyzfrank`, for example, the user must enter:

   ```
   SQL> SELECT * FROM xyzfrank.shark
   ```

Note: Automatic authorization is supported for all Oracle Net protocols.

Manually Granting Administrator and Operator Privileges for Databases

This section describes how to enable Windows to grant the database administrator (SYSDBA), database operator (SYSOPER) and database administrator for ASM (SYSASM) privileges to database administrators. With this privilege, database administrators 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
```

To enable this feature, the Windows local or domain user name of the database administrator must belong to one of the Windows local groups listed in Table 10–1.

Table 10–1 Windows Local Groups with SYSDBA, SYSOPER, and SYSASM Privileges

Local Group	Privileges
ORA_OPER	SYSOPER privileges for all databases on a computer
ORA_DBA**Note**	SYSDBA privileges for all databases on a computer
ORA_DBA	SYSASM 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_SID_DBA	SYSASM privileges for a single database (identified by *SID*)

Note

ORA_DBA is automatically created during installation. See section "Operating System Authentication Enabled at Installation" on on page 9-3 for information.

The manual procedure for enabling database administrators to connect as SYSOPER or SYSDBA or SYSASM without a password is divided into two sets of tasks performed on different computers:

- SYSDBA/SYSOPER/SYSASM Authentication Tasks on the Oracle Database Server
- SYSDBA/SYSOPER/SYSASM Authentication Tasks on the Client Computer

SYSDBA/SYSOPER/SYSASM Authentication Tasks on the Oracle Database Server

1. Create a Windows local group corresponding to the privileges you want Windows to grant (see Table 10–1).
2. Add your database administrator usernames to this group.

   See Also: Your operating system documentation for instructions on managing users and groups

3. Ensure that parameter SQLNET.AUTHENTICATION_SERVICES in file sqlnet.ora contains nts.
4. Start Registry Editor from the command prompt:

   ```
   C:\>regedit
   ```

5. Go to HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\HOME*ID*

   where *ID* is the Oracle home that you want to edit.

6. Set parameter `OSAUTH_PREFIX_DOMAIN` to `true`.

SYSDBA/SYSOPER/SYSASM Authentication Tasks on the Client Computer

1. Create a Windows local or 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.AUTHENTICATION_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. See *Oracle Database Net Services Administrator's Guide* for instructions.
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. If you specified `ORA_DBA` or `ORA_SID_DBA` in step 1 of "SYSDBA/SYSOPER/SYSASM Authentication Tasks on the Oracle Database Server", then enter either of the following:

   ```
   SQL> CONNECT / AS SYSOPER
   SQL> CONNECT / AS SYSDBA
   SQL> CONNECT / AS SYSASM
   ```

   If you specified `ORA_OPER` or `ORA_`*`SID`*`_OPER` in step 1, then enter:

   ```
   SQL> CONNECT / AS SYSOPER
   ```

   You are now connected to the Windows server. If you connect with `SYSDBA`, you are given DBA privileges.

Manually Creating an External Role

This section 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\frank` (`sales` is the domain name and `frank` is the domain username). You then connect to Oracle Database as Oracle Database user `scott`. In this case, you receive the roles granted to `sales\frank` but *not* the roles granted to `scott`.

The procedure for manually creating an external role is divided into two sets of authorization tasks performed on different computers:

- External Role Authorization Tasks on the Oracle Database Server
- External Role Authorization Tasks on the Client Computer

External Role Authorization Tasks on the Oracle Database Server

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.AUTHENTICATION_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 OPTION;
   ```
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]
    ```

    where

    - *`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 OPTION`

    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 usernames to this group.

    > **See Also:** Your operating system documentation for instructions on managing users and groups

    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 will have 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.

External Role Authorization Tasks on the Client Computer

1. Create a Windows local or 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.AUTHENTICATION_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. See *Oracle Database Net Services Administrator's Guide* for instructions.
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 SCOTT
   Enter password: password
   ```

   You are connected to the Windows server over net service with Oracle Database user name scott. Roles applied to Oracle Database user name scott 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 generic names for two special operating system groups that control database administrator logins when using operating system authentication. Windows-specific names for OSDBA and OSOPER are described in "Manually Granting Administrator and Operator Privileges for Databases" on page 10-25. See *Oracle Database Administrator's Guide* for more information on OSDBA and OSOPER.

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: "Using the User Migration Utility" in *Oracle Database Enterprise User Security Administrator's Guide*

11

Storing Oracle Wallets in the Windows Registry

This chapter describes storing and retrieving of Oracle Wallets in the Windows **registry**.

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.

> **Note:** Oracle Wallet Manager is a feature of Oracle Advanced Security, a separately licensable option to Oracle Database.

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 domain user or local user always has the most recent user profile version.

Registry Parameters for Wallet Storage

Parameter `WALLET_LOCATION` in file `sqlnet.ora` specifies the location of the obfuscated Oracle Wallet for use by Oracle PKI applications. For example, the `WALLET_LOCATION` parameter for storing an Oracle Wallet in the registry in:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS\SALESAPP
```

would be:

```
WALLET_LOCATION =  (SOURCE= (METHOD=REG) (METHOD_DATA= (KEY=SALESAPP)))
```

Continuing the example, the encrypted Oracle Wallet would be stored in the registry in:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS\SALESAPP\EWALLET.P12
```

and the obfuscated Oracle Wallet would be stored in:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS\SALESAPP\CWALLET.SSO
```

On Windows operating systems, if there is no value specified for parameter `WALLET_LOCATION`, then Oracle PKI applications first look for the obfuscated 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.

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 will be stored in:

```
\\HKEY_CURRENT_USER\SOFTWARE\ORACLE\WALLETS\KEY1\EWALLET.P12
```

The obfuscated wallet will be 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 obfuscated wallet in the selected directory or creates the directory if it does not exist.

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.

12

Oracle PKI Integration with Windows

This chapter describes integration of Oracle public key infrastructure (PKI) with public key infrastructure (Windows PKI) on Windows operating systems.

This chapter contains the following topics:

- Oracle Public Key Infrastructure
- Windows Public Key Infrastructure

Oracle Public Key Infrastructure

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 Application Server.

Note: Oracle Security Manager is installed only with Oracle Database Client.

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.

Windows Public Key Infrastructure

This section describes Windows public key infrastructure.

This section contains these topics:

- Microsoft Certificate Stores
- Microsoft Certificate Services
- Using Microsoft Certificate Stores with Oracle PKI Applications

> **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 will be used for Oracle SSL.

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 **registry** 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.

Microsoft Certificate Services

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_LOCATION` in file `sqlnet.ora` identifies a particular PKI. You can choose between using Oracle Wallet or Microsoft Certificate Stores by setting parameter `WALLET_LOCATION` in `sqlnet.ora`. To use **credentials** from Microsoft Certificate Stores, set parameter `WALLET_LOCATION` in `sqlnet.ora` to:

```
WALLET_LOCATION = (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.

13

Using Oracle Database with Microsoft Active Directory

This chapter describes how to configure and use Microsoft Active Directory as the LDAP directory.

This chapter contains these topics:

- Microsoft Active Directory Support
- Oracle Components That Integrate with Active Directory
- Requirements for Using Oracle Database with Active Directory
- Configuring Oracle Database to Use Active Directory
- Testing Connectivity
- Access Control List Management for Oracle Directory Objects

Microsoft Active Directory Support

This section describes how Microsoft Active Directory is used as an LDAP directory server by Oracle Database.

This section contains these topics:

- About Microsoft Active Directory
- Accessing Active Directory

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).

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.

Oracle Components That Integrate with Active Directory

The following Oracle Database features support or have been specifically designed to integrate with Active Directory:

- Directory Naming
- Automatic Discovery of Directory Servers
- Integration with Windows Tools
- User Interface Extensions for Oracle Net Directory Naming
- Enhancement of Directory Object Type Descriptions
- Integration with Windows Login Credentials
- Oracle Directory Objects in Active Directory

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.

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.

> **See Also:** "Configuring Oracle Database to Use Active Directory" on page 13-8 for more information on Active Directory configuration

Integration with Windows Tools

Oracle Database services, net service names, and enterprise role entries in Active Directory can be displayed and tested in two 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.

See Also:

- "Testing Connectivity from Microsoft Tools" on page 13-10
- "Access Control List Management for Oracle Directory Objects" on page 13-12

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 username, 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.

See Also: "Testing Connectivity from Microsoft Tools" on page 13-10

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 Figure 13–1 on page 13-4, for example, the Type column reveals that `sales` is an Oracle Net Service name.

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 re-enter 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.
- In Oracle Database 11*g*, enhancements are made to 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 will 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
```

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 Figure 13–1:

Figure 13–1 Oracle Directory Objects in Active Directory Users and Computers

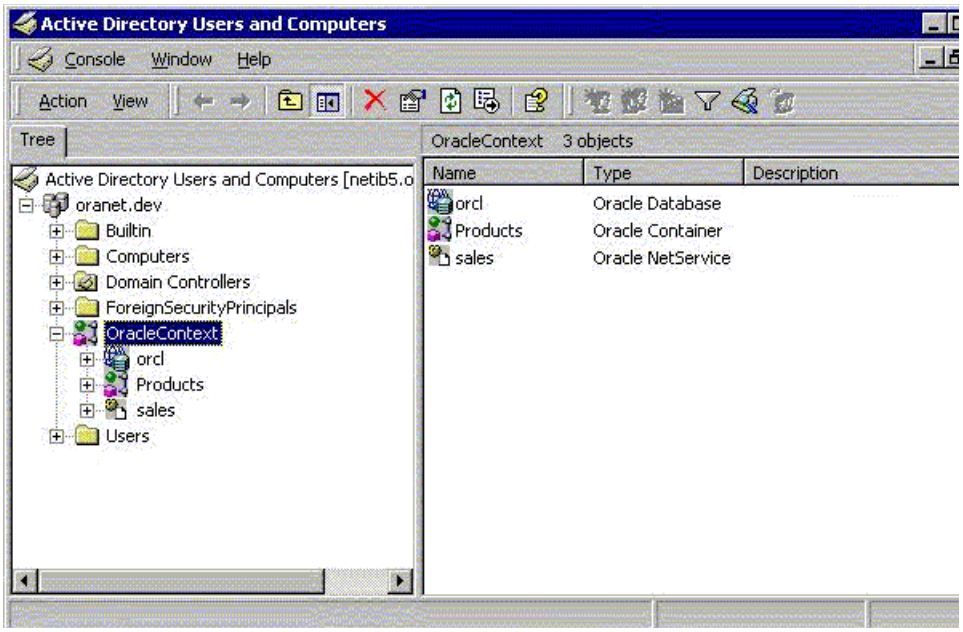


Table 13–1 describes the Oracle directory objects appearing in Figure 13–1.

Table 13–1 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.

Table 13–1 (Cont.) Oracle Directory Objects

Object	Description
`Users`	Folder for the Oracle security groups. See "Access Control List Management for Oracle Directory Objects" on page 13-12 for more information. Enterprise users and roles created with Oracle Enterprise Security Manager also appear in this folder.

Requirements for Using Oracle Database with Active Directory

To use Net Directory Naming with Active Directory, you must have certain Microsoft and Oracle software releases, and you must create Oracle schema objects and an Oracle Context. These requirements are discussed in the following sections:

- Directory Naming Software Requirements
- Creating an OracleContext
- Oracle Schema Objects Creation

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 2003, or Windows Server 2008, or Windows Server 2008 R2 (X64) domain to integrate Net Directory Naming with Active Directory.

Directory Naming Software Requirements

For client computers from which you want to manage Oracle Database enterprise users, roles and domains, you must have Oracle8*i* Client release 8.1.6 or later and one of the supported Windows operating systems.

For the database, you must have Oracle8*i* Database release 8.1.6 or later. This is required for registering the database service as an object in Active Directory. The database can use any of the supported Windows operating systems.

Both the client computers and the database must be members of a Windows server domain.

Directory Naming adaptor connects anonymously to directory by default.

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 right 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.

See Also:

- *Oracle Database Installation Guide for Microsoft Windows* for installation procedures
- *Oracle Database Net Services Administrator's Guide* for configuration procedures

Network Configuration Assistant (NetCA)

Oracle Net Configuration Assistant (NetCA) is a graphical, wizard-based tool used to configure and manage Oracle Network configurations.

Run the Network Configuration Assistant (NetCA).

To start NetCA:

1. Click **Start,** then click **All Programs.**
2. Click **Oracle, 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 NetCA.

5. Select the option to configure the directory for Oracle usage and create 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 should 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 re-run NetCA using the originally supplied values.

    The wizard should 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.**

Oracle Schema Objects Creation

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 the Schema Administrator group. Domain administrators are in the Schema Administrator group 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
```

where:

- *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 will indicate that Oracle schema object creation failed, rather than simply reporting that display specifiers for some languages were not created.

Display Specifiers Not Created

When 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.

See Also: "Automatic Discovery of Directory Servers" on page 13-2

Configuring 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 then 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)

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 will report that the Oracle Context does not exist. Ignore this and choose to create the Oracle Context anyway. Directory access configuration will complete 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 in a Windows Server 2003 domain, or Windows Server 2003 R2 domain, or Windows Server 2008 domain, or Windows Server 2008 R2 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.

See Also:

- "Oracle Schema Objects Creation" on page 13-7 for information about possible failures during configuration
- "Requirements for Using Oracle Database with Active Directory" on page 13-5
- "Automatic Discovery of Directory Servers" on page 13-2
- *Oracle Database Net Services Administrator's Guide* for configuration procedures

Testing Connectivity

This section describes how to connect to an Oracle Database server through Active Directory.

This section contains these topics:

- Testing Connectivity from Client Computers
- Testing Connectivity 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 which we call **simplified naming,** which will attempt 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 SCOTT@hr.example.com
Enter password: password
```

The following values for default_admin_context will result 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 left-hand-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:

- "Configuration Management Concepts" in *Oracle Database Net Services Administrator's Guide* for more information about X.500 naming conventions
- "Unlocking and Changing Passwords" in *Oracle Database Installation Guide for Microsoft Windows*

Testing Connectivity from Microsoft Tools

Oracle directory objects in Active Directory are integrated with two Microsoft tools:

- Windows Explorer
- Active Directory Users and Computers

You can test connectivity to an Oracle Database server from within these Microsoft tools by actually 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 **Programs**, then select **Accessories** and then select **Windows Explorer**.

b. Expand **My Network Places**.

c. Expand **Entire Network**.

d. Expand **Directory**.

To start Active Directory Users and Computers:

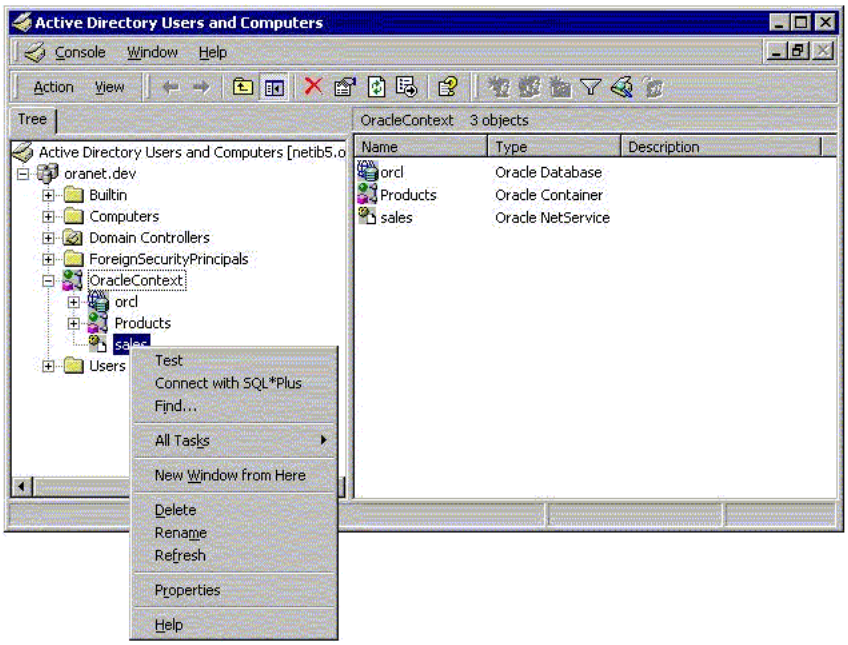
From the **Start** menu, select **Programs**, then select **Administrative Tools**, and then select **Active Directory Users and Computers**.

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 will not be configured to require authentication for name lookup, then clients must be able to authenticate anonymously with Active Directory. With Windows Server 2003, Windows Server 2003 R2, and Windows Server 2008 domain, this will require changing the Active Directory default setting so that anonymous access will be 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 which allow clients to read them as appropriate.

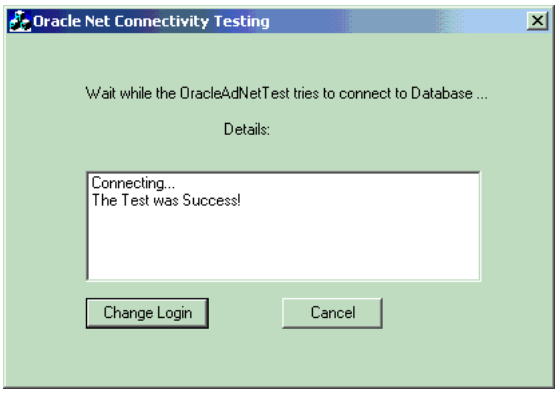
See also: *Oracle Database Net Services Administrator's Guide* for more information

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.

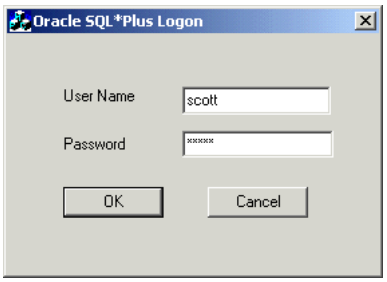
   A menu appears with several options. This section covers only the **Test** and **Connect with SQL*Plus** options.



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.

Access Control List Management for Oracle Directory Objects

This section identifies security groups specific to Oracle directory objects within Active Directory and explains how to add and delete security group members.

This section contains these topics:

- Security Groups
- Adding and Deleting Security Group Members

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. The relevant groups are:

- OracleDBCreators
- OracleNetAdmins
- NetService Objects

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.

OracleNetAdmins

Users in the `OracleNetAdmins` group can:

- Create, modify, and read Oracle Net Services objects and attributes.
- Read the group membership of this group.

NetService Objects

In 11*g*, directory clients may optionally be configured to authenticate with the directory while resolving DB names to connect strings. This makes it possible for NetService 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 supplies no pre-defined groups, and has no procedures in the config tools for defining read-access restrictions on this data, so 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.

Because 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 NetService objects into a directory-wide policy and security implementation.

Note: Pre-11g clients can only bind to the directory as **anonymous,** so any ACL protection on NetServices will disable older clients. Access Control can only be implemented if all clients requiring access to these objects are 11*g* or later.

Setting ACLs on NetService Entries

Use `Dsacls` tool to set ACLs on Directory Object.

`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 will be included in Support Tools on the product media.

Examples:

To enable anonymous generic read on `orcl` service, run the following command:

```
dsacls "CN=orcl,CN=OracleContext,OU=Example,O=Com" /G "anonymous logon":GR
```

To enable generic read on `orcl` service for the user `scott` in EXAMPLE domain, run the following command:

```
dsacls "CN=orcl,CN=OracleContext,OU=Example,O=Com" /G example\scott:GR
```

To disable anonymous generic read on `orcl` service, run following command:

```
dsacls "CN=orcl,CN=OracleContext,OU=Example,O=Com" /R "anonymous logon"
```

To disable generic read on `orcl` service for the user `scott` in EXAMPLE domain, run the following command:

```
dsacls "CN=orcl,CN=OracleContext,OU=Example,O=com" /R example\scott
```

> **See Also:** http://support.microsoft.com/kb/281146 for complete description of the dsacls tool

Adding and Deleting Security Group Members

You can add or remove users in the security groups with Active Directory Users and Computers.

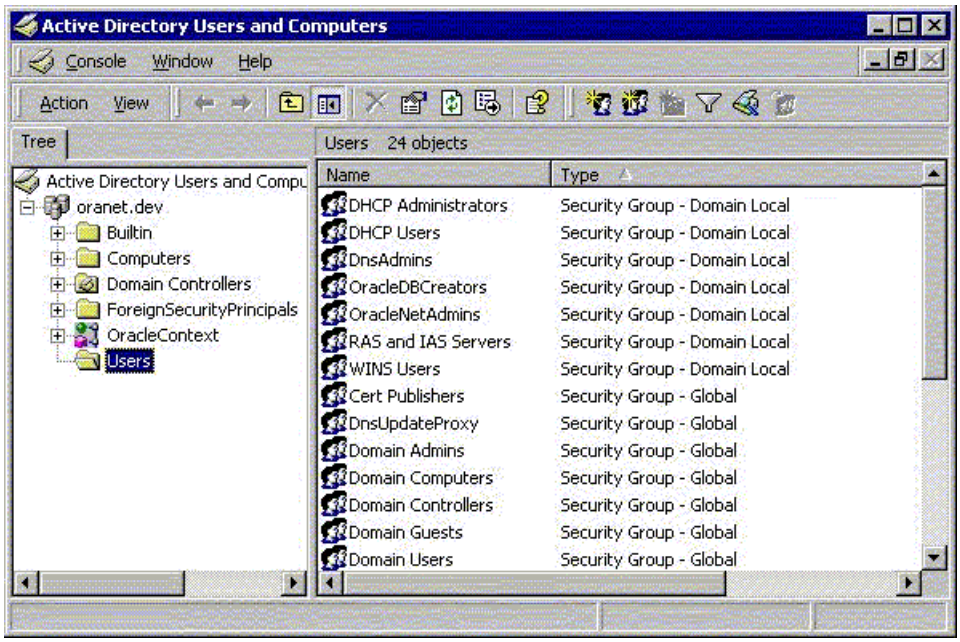
> **Note:** Use Active Directory Users and Computers to perform the procedures described in this section. Windows Explorer does not provide the necessary functionality.

To add or remove users:

1. From the **Start** menu, select **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 normally 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.



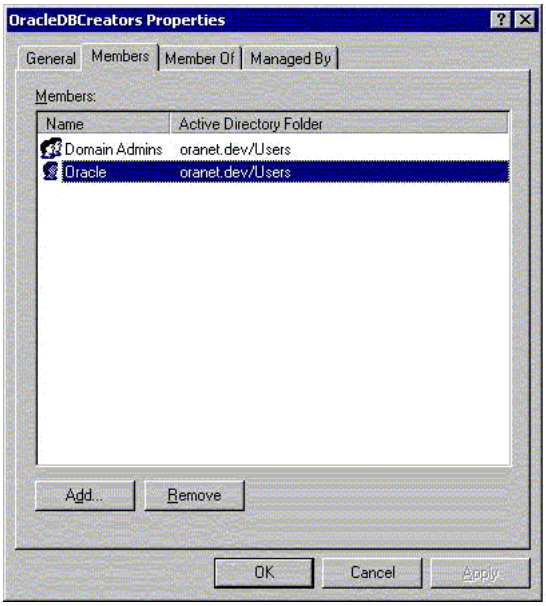
5. Right-click the Oracle security group that you want to view or modify.

   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, Contacts, Computers, or Groups dialog appears.

9. Select the users or groups you want to add and click **Add**.

   Your selections appear in the Select Users, Contacts, Computers, 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**.

14

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.

This chapter contains these topics:

- Initialization Parameter File Overview
- Sample File
- SGA_MAX_SIZE Parameter
- Initialization Parameters Without Windows-Specific Values
- Displaying Initialization Parameter Values
- Uneditable Database Initialization Parameters
- Calculating Database Limits

Initialization Parameter File Overview

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. For descriptions of all initialization parameters and instructions for setting and displaying their values, see *Oracle Database Reference*.

Location of the Initialization Parameter File

If you do not specify a different initialization file with 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 a 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.

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.

Database Configuration Assistant Renames init.ora

When you create a database using Database Configuration Assistant, 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 Database Configuration Assistant 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 file name is `spfile`*SID*`.ora`.

> **See Also:** "Managing Initialization Parameters Using a Server Parameter File" in *Oracle Database Administrator's Guide*

Sample File

Oracle Database provides an annotated sample initialization parameter file with alternative values for initialization parameters. These values and annotations are preceded by comment signs (`#`), which prevent them from being processed. To activate a particular parameter, remove the preceding `#` sign. To de-activate 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**, 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 sample file `initsmpl.ora` as part of 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
```

SGA_MAX_SIZE Parameter

Parameter `SGA_MAX_SIZE` holds the maximum size that System Global Area (SGA) can reach for a particular instance. Beginning with Oracle9*i* Release 1 (9.0.1), Oracle Database can change its SGA configuration while the instance is running. This allows sizes of buffer cache, shared pool, and large pool to be changed without instance shutdown.

Oracle Database can start instances underconfigured 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.

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

Memory allocated for the SGA of an instance is displayed on 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.

Initialization Parameters Without Windows-Specific Values

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. Table 14–1 describes these initialization parameters:

Table 14–1 Initialization Parameters Without Windows-Specific Values

Parameter	Description
AUDIT_FILE_DEST	Not supported on Windows and should not be added to the initialization parameter file
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 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

Windows-specific parameter values can be viewed by using 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.

Uneditable Database Initialization Parameters

Check the initialization parameters in Table 14–2 when creating a new database. They cannot be modified after you have created the database. See Chapter 3, "Postinstallation Database Creation on Windows" for details on creating a new database, including the part of the procedure where you modify these parameters.

Table 14–2 Uneditable Database Initialization Parameters

Parameter	Description
CHARACTER SET	Specifies database **Globalization Support** character set to use. This parameter can be set only when you create the database.

Table 14–2 (Cont.) Uneditable 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.

Note: Not an initialization parameter, but rather a clause in the CREATE DATABASE statement. See Chapter 3, "Postinstallation Database Creation on Windows" for an example of using this clause.

Calculating Database Limits

Use size guidelines in this section to calculate Oracle Database limits.

Table 14–3 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 14–4 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 14–5 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

Table 14–6 Shadow Process Memory

Release Number	Memory
Oracle9*i* Release (9.2)	444 KB
Oracle9*i* Release 1 (9.0.1)	444 KB
Oracle8*i* Release 8.1.7	335 KB

Table 14–6 (Cont.) Shadow Process Memory

Release Number	Memory
Oracle8*i* Release 8.1.6	335 KB
Oracle8 Release 8.1.3	265 KB
Oracle8 Release 8.0.5	254 KB
Oracle8 Release 8.0.4	254 KB

15

Configuration Parameters and the Registry

This chapter describes use of the **registry** for various Oracle Database for Windows components. It also lists recommended values and ranges for configuration parameters.

This chapter contains these topics:

- About Configuration Parameters
- Registry Overview
- Registry Parameters
- Oracle RAC Registry Parameters
- Managing Registry Parameters with regedit
- Managing Registry Parameters with Oracle Administration Assistant for Windows
- Modifying Oracle Counters for Windows Performance Monitor 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 application requires a 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.

Caution: Although Registry Editor lets you view and modify registry keys and parameter values, you normally are not required to do so. In fact, you can render your system useless if you make incorrect changes. Therefore, only advanced users should edit the registry. Back up your system before making any changes in the registry.

Parameters in 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_DWORD` prefix to identify a value entry as a `dword` (hexadecimal data) entry

Most Oracle Database for Windows parameter values are string types. Use Oracle Universal Installer defaults when a type is not given.

Registry Parameters

This section 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 in this chapter.

- HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_HOME_NAME
- HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE
- HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services

To modify these registry values, see "Managing Registry Parameters with regedit" on page 15-8.

HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_HOME_NAME

Each time you install Oracle products into a new Oracle home on your computer, `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOME_NAME`* is created. This subkey contains parameter values for most Oracle products.

> **Note:** See Appendix B, "Optimal Flexible Architecture", in *Oracle Database Installation Guide for Microsoft Windows* for details on the PATH variable and registry values when you are working with **multiple Oracle homes**.

`HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOME_NAME`* 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. 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 *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 location of time zone file. Each file contains:

- Valid time zone names
- Offset from UTC
- Abbreviation for standard time
- Abbreviation for daylight savings time

In previous releases, the default value for `ORA_TZFILE` was

```
ORACLE_BASE\ORACLE_HOME\oracore\zoneinfo\timezlrg.dat
```

Beginning with Oracle Database 11*g* Release 2 (11.2), the default value is

```
ORACLE_HOME\oracore\zoneinfo\timezlrg_11.dat
```

The `timezone_`*`version_number`*`.dat` datafiles 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

Specifies Windows processor affinity of each **thread** within the Oracle Database **process**. This parameter must be manually added. Oracle recommends consulting Oracle Support Services before changing this parameter. The format is:

```
name1:cpumask1;name2:cpumask2
```

Each `name` setting must be the name of a background thread, `user` for non-background (shadow) threads, or `def` for any thread type not handled specifically.

The `name` mask sets the affinity mask of the Oracle Database process. 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**.

Each affinity setting must be a valid affinity mask (or its numeric equivalent) for the corresponding 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).

ORACLE_BASE

Specifies the top-level Oracle directory (for example, `C:\app\oracle\product\11.2.0`) 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 -` *HOME_NAME*.

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_NAME

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_PRIORITY

Determines Windows scheduling priorities of 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 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`, `J000` through `J999SNP0`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_PRIORITY` 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`.

HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE

This subkey contains the following parameters:

INST_LOC

Specifies the location of Oracle Universal Installer files. The default value is *System Drive*`:\program files\oracle\inventory`.

OO4O

Specifies the location of Oracle Objects for OLE message files. The default value is *ORACLE_HOME*`\oo4o\mesg`.

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services

`HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet` contains four 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 Counters for Windows Performance Monitor
- Parameters for Oracle Database Services

Parameters for Oracle Counters for Windows Performance Monitor

Oracle Counters for Windows Performance Monitor parameters appear in:

`HKEY_LOCAL_MACHINE\SYSTEM\CURRENTCONTROLSET\SERVICES\ORACLE`*ver*`\PERFORMANCE`

where `ORACLE`*ver* refers to whatever version of Oracle Database is installed.

For multiple Oracle homes compliance starting with Oracle Database 10*g* Release 1 (10.1), parameters `Hostname`, `Username`, `Password`, `LOGFILE`, and `PERF_FILE_NAME` have been moved to

`HKEY_LOCAL_MACHINE\SYSTEM\CURRENTCONTROLSET\SERVICES\ORACLEver\PERFORMANCE\KEY_HOME_NAME.`

Note: Modify only the `Hostname`, `Password`, and `Username` values to point to any database. Oracle recommends that you use `operfcfg`. See "Using operfcfg" on page 15-14.

For Oracle Counters for Windows Performance Monitor to display information for Oracle Database performance objects, it must log in to the database. Modify the following parameters if the default information is not applicable or if you want to access another database:

- `Hostname` displays the *`SID`* of the database that Oracle Counters for Windows Performance Monitor will connect to. The default value is blank, causing Oracle Counters for Windows Performance Monitor to connect to the default database on the computer.

  If you specify a different *`SID`*, you must also add a connect descriptor for that *`SID`* to your `tnsnames.ora` file. Oracle recommends that you use Oracle Net Configuration Assistant, but you can also copy, paste, and modify the following example:

  ```
  SERVICE_NAME =
    (DESCRIPTION =
      (ADDRESS_LIST =
        (ADDRESS = (PROTOCOL = TCP)(HOST = HOST_NAME)(PORT = 1521))
      )
      (CONNECT_DATA =
        (SERVER = DEDICATED)
        (SERVICE_NAME = SERVICE_NAME)
      )
    )
  ```

- `Password` displays the encrypted password for the user name to access the database. The default value is `MANAGER` (encrypted).
- `Username` displays the user name to access the database. The default value is `SYSTEM`.

Oracle Counters for Windows Performance Monitor requires the following parameters as entry points:

- `Close` specifies the close entry point for the DLL. The default value is `CloseOracle`*`ver`*`PerformanceData`.
- `Collect` specifies the collect entry point for the DLL. The default value is `CollectOracle`*`ver`*`PerformanceData`.
- `Library` specifies the name of the Oracle Counters for Windows Performance Monitor DLL. The default value is `ORAPERF`*`ver`*`.dll`
- `Open` specifies the open entry point for the DLL. The default value is `OpenOracle`*`ver`*`PerformanceData`.

The following parameters specify Oracle Counters for Windows Performance Monitor log file and object configuration files:

- `LOGFILE` specifies the name of the Oracle Counters for Windows Performance Monitor log file. This log file reports any errors, such as Oracle Database objects not appearing or database access problems. The default value is *ORACLE_HOME*\dbs\operf*ver*.log.
- `PERF_FILE_NAME` specifies the location of the PERF*ver*.ora file, which contains all performance objects displayed by Oracle Counters for Windows Performance Monitor. The default value is *ORACLE_HOME*\dbs\perf*ver*.ora

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 should log on. The default value is `LocalSystem`.

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 not supported on Windows XP, Windows Vista, Windows 7, and any 32-bit Windows operating system.

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

> **Caution:** 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

To edit Oracle-related settings:

1. Start Registry Editor in one of two ways:

- From the command prompt, enter:

  ```
  C:\> regedit
  ```

- From the **Start** menu, select **Run**, enter `regedit` in the **Open** field, and click **OK**.

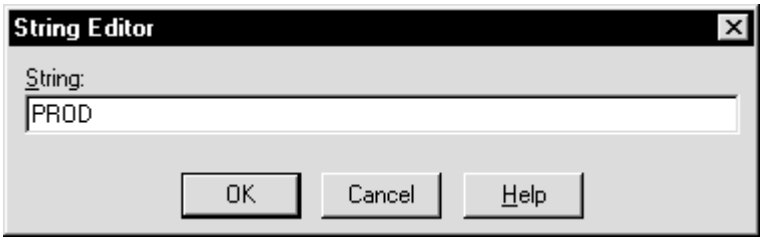
The Registry Editor window appears.

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 registry keys, and the right-hand side of the window shows various values associated with a key.

3. Double-click the parameter to edit.

   The String Editor dialog appears:



Screen shot of the **String Editor** dialog, where parameters are edited. The dialog contains a user-entry field labeled **String** and three options labeled **OK**, **Cancel**, and **Help**.

****

4. Make any necessary edits.
5. Click **OK**.
6. Choose **Exit** from the **Registry** menu.

Adding a Registry Parameter with regedit

To add a parameter to the registry:

1. Start Registry Editor in one of two ways:

   - From the command prompt, enter:

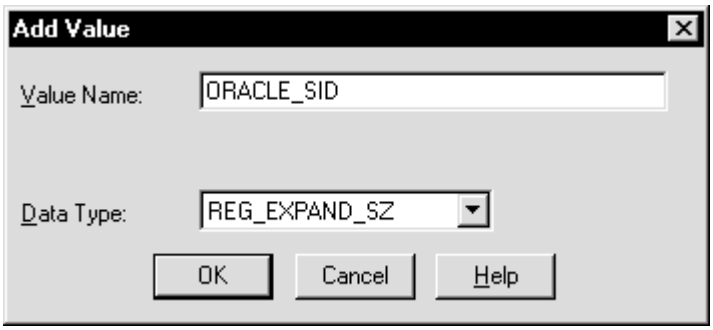
     ```
     C:\> regedit
     ```

   - From the **Start** menu, select **Run**, enter `regedit` in the **Open** field, and click **OK**.

   The Registry Editor window appears.

2. Navigate to the key to which you want to add the new value.
3. Choose **Add Value** from the **Edit** menu.

   The Add Value dialog appears:



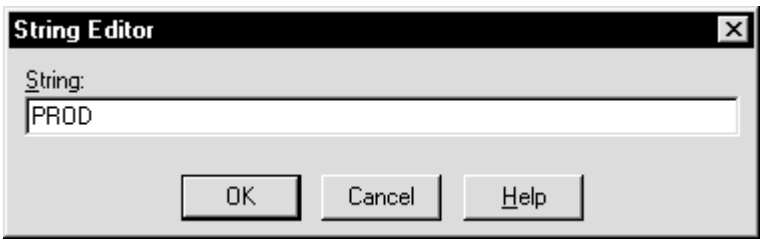
Screen shot of the **Add Value** dialog. The window has two fields. The first is a user-entry field and is labeled **Value Name:** The second is a pull-down list and is labeled **Data Type:**

At the bottom of the window are three options labeled **OK**, **Cancel**, and **Help**.

****

4. In the **Value Name** field, type the name of the value that you want to add to the currently selected key.
5. In the **Data Type** list, select the data type that you want to assign to the added value:
   - `REG_SZ`, `REG_EXPAND_SZ` (for an expandable string), or `REG_MULTI_SZ` (for multiple strings) for a data string
   - Binary value with a `REG_DWORD` prefix to identify a value entry as a `DWORD` (hexadecimal data) entry
6. Click **OK**.

   The String Editor dialog appears:



Screen shot of the **String Editor** dialog, where parameters are edited. The dialog contains a user-entry field labeled **String** and three options labeled **OK**, **Cancel**, and **Help**.

****

7. Type the value for the parameter.
8. Click **OK**.

   Registry Editor adds the parameter.
9. Choose **Exit** from the **Registry** menu.

Managing Registry Parameters with Oracle Administration Assistant for Windows

Instead of using `regedit` to add, edit, and delete parameters for an Oracle home, you can use the Oracle Home Configuration snap-in, one of several **snap-ins** included as part of Oracle Administration Assistant for Windows. You must have **Microsoft Management Console** on your computer to use this product.

See "HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_HOME_NAME" on page 15-2 for more information about Oracle home parameters.

Starting Oracle Administration Assistant for Windows

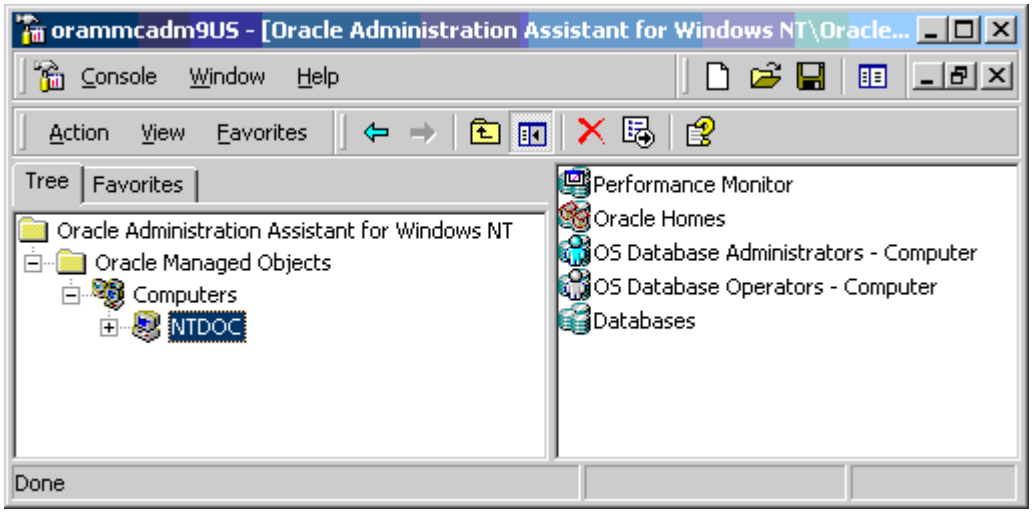
To start Oracle Administration Assistant for Windows:

1. From the **Start** menu, select **Programs**, then select **Oracle - *HOME_NAME***, then select **Configuration and Migration Tools**, and then select **Administration Assistant for Windows**.

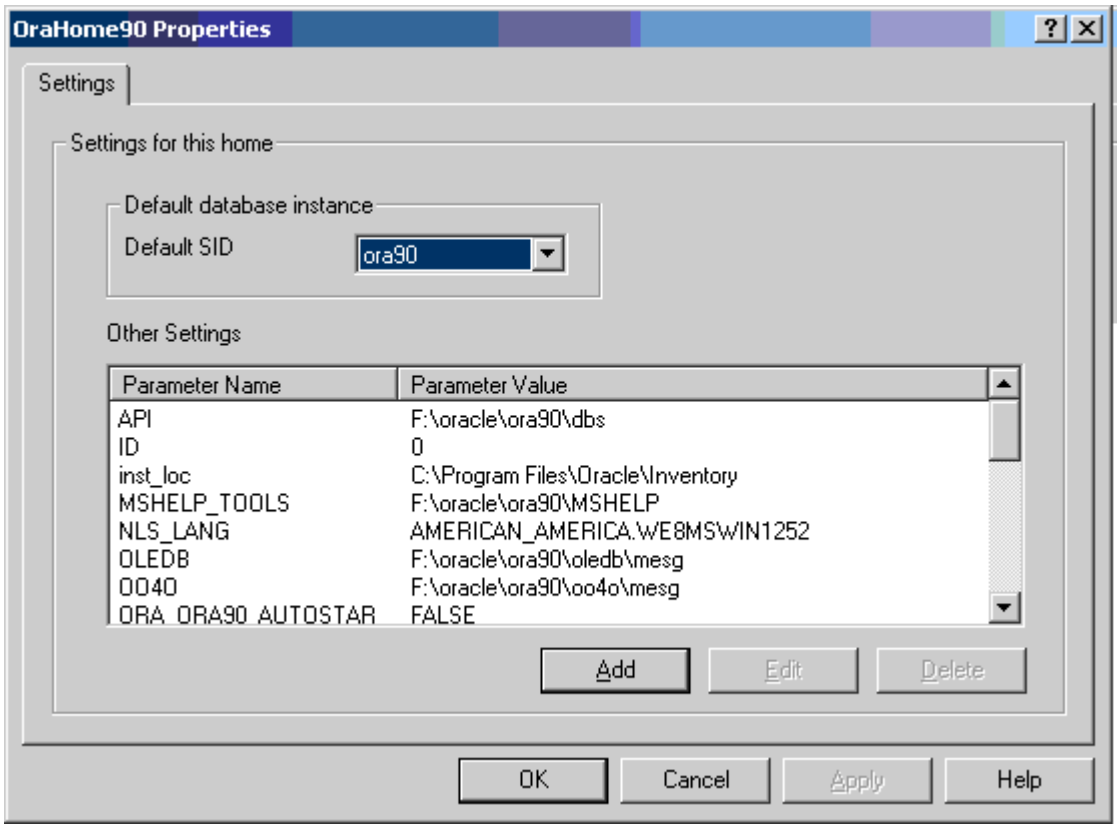
   Oracle Administration Assistant for Windows starts.

2. Expand **Oracle Homes**.

3. Right-click the Oracle home that you want to modify.



4. Click **Properties**. The Properties dialog appears.

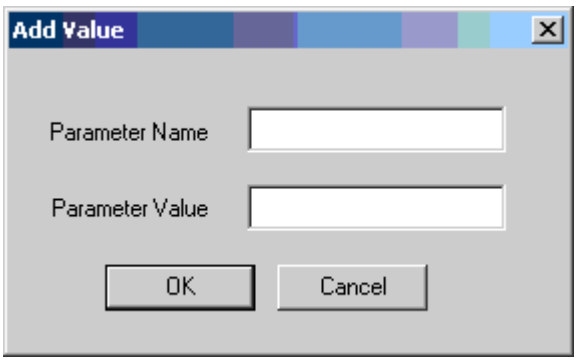


Adding Oracle Home Parameters

To add an Oracle home parameter:

1. Click **Add** in the Properties dialog.

   The Add Value dialog appears.



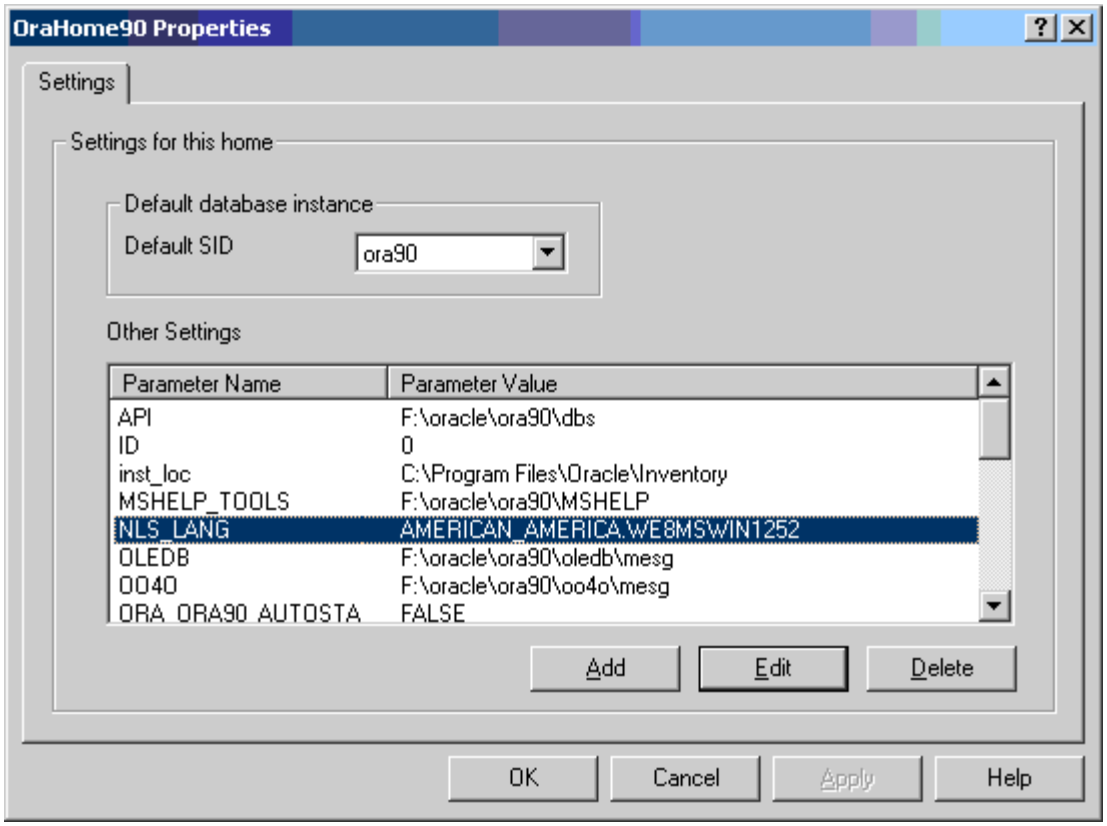
2. Enter the name in the **Parameter Name** field.
3. Enter the value in the **Parameter Value** field.
4. Click **OK**.
5. Click **Apply**.

Note: With Oracle Administration Assistant for Windows, you can add parameters only with a data type of `REG_SZ`. Use `regedit` to add parameters with a data type of `REG_EXPAND_SZ`, `REG_MULTI_SZ`, or `REG_DWORD`.

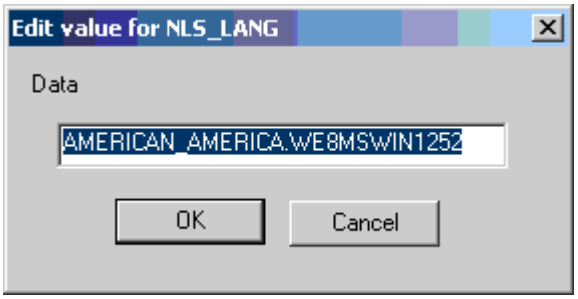
Editing Oracle Home Parameters

To change the default *SID*, select the *SID* from the Default *SID* list in the Properties dialog. To edit one of the other parameters:

1. Select the parameter in the **Other Settings** list in the Properties dialog.
2. Click **Edit**.



The Edit Value dialog appears.



3. Modify the value.
4. Click **OK**.

5. Click **Apply**.

Deleting Oracle Home Parameters

To delete an Oracle home parameter:

1. Select the parameter in the **Other Settings** list in the Properties dialog.
2. Click **Delete**.

Modifying Oracle Counters for Windows Performance Monitor Parameters

Instead of using `regedit` to modify Oracle Counters for Windows Performance Monitor's `Hostname`, `Password`, and `Username` parameters, you can use `operfcfg` or Oracle Administration Assistant for Windows.

> **See Also:** "Parameters for Oracle Counters for Windows Performance Monitor" on page 15-6 for more information about `Hostname`, `Password`, and `Username` parameters

Using operfcfg

`operfcfg` is an Oracle Database tool that you run from the command prompt. Use this syntax:

```
operfcfg.exe -U SYSTEM -P Password -D TNS_Alias_for_database
```

where:

- `SYSTEM` is the `username` registry parameter value that Oracle Counters for Windows Performance Monitor uses to log in to the database. You must have a `DBA` **privilege** on this database.
- *`Password`* is the password registry parameter value for username.
- *`TNS_Alias_for_database`* is the **net service name** that Oracle Counters for Windows Performance Monitor uses to connect to the database. It affects the `Hostname` registry parameter. The net service name corresponds to the *`SID`* of the database that you want to monitor. The `-D` command can be specified without providing a database name value.

The `-U` and `-D` commands are optional.

The following examples illustrate use of `operfcfg`. First, to change user name to `dba_admin` and leave database name at its current value, you would enter:

```
C:\> operfcfg -U dba_admin
```

To change user name to `dba_admin` and database name to `prod`, you would enter:

```
C:\> operfcfg -U dba_admin -D prod
```

To change password to `frank` for the current user name and database name, you would enter:

```
C:\> operfcfg -P frank
```

In the final example, you change `Hostname` to a blank value, causing Oracle Counters for Windows Performance Monitor to connect to the default database on the computer. The current user name and password must be valid user accounts on this database. Enter:

```
C:\> operfcfg -D
```

Using Oracle Administration Assistant for Windows

Oracle Counters for Windows Performance Monitor snap-in is part of Oracle Administration Assistant for Windows. You must have Microsoft Management Console on your computer to use this product.

To use Oracle Counters for Windows Performance Monitor snap-in:

1. From the **Start** menu, select **Programs**, then select **Oracle - *HOME_NAME***, then select **Configuration and Migration Tools**, and then select **Administration Assistant for Windows**.

   Oracle Administration Assistant for Windows starts.

2. Right-click **Performance Monitor**.
3. Click **Properties**.

   The Performance Monitor Properties dialog appears.

4. Modify the text in the **Username**, **Password**, or **Database** fields.
5. Click **Apply**.

16

Developing Applications for Windows

This chapter points to sources of information on developing applications for Windows and outlines a procedure for building and debugging external procedures.

This chapter contains these topics:

- Finding Information on Application Development for Windows
- Building External Procedures
- Multithreaded Agent Architecture
- Debugging External Procedures
- Accessing Text Files with UTL_FILE
- Accessing Web Data with Intercartridge Exchange

Finding Information on Application Development for Windows

This section describes where to find information on developing applications specifically for Windows. These products are included on your Oracle Database Server media.

Java Enhancements

Oracle Database includes an integrated Java Virtual Machine and JIT Compiler. Oracle Database also provides Oracle Java Database Connectivity (JDBC) Drivers. For more information, see *Oracle Database Java Developer's Guide* and *Oracle Database JDBC Developer's Guide*.

ODP.NET

Oracle Data Provider for .NET (ODP.NET) is an implementation of a data provider for Oracle Database. ODP.NET uses Oracle native APIs to offer fast and reliable access to Oracle data and features from any .NET application. ODP.NET also uses and inherits classes and interfaces available in the Microsoft .NET Framework Class Library. For more information, refer to *Oracle Data Provider for .NET Developer's Guide for Microsoft Windows*.

Oracle Developer Tools for Visual Studio

The Oracle Developer Tools for Visual Studio (ODT) is a tightly integrated "Add-in" for Microsoft Visual Studio 2008, 2005, and 2003. ODT integrates with Visual Studio to make it easy to browse and edit Oracle schema objects using integrated visual designers and can automatically generate .NET code through a simple drag and drop.

Developers can modify table data, execute Oracle SQL statements, edit and debug PL/SQL code, generate and edit SQL scripts, and develop and deploy .NET stored procedures. There are many more features included with these tools. For more information, visit the ODT Web home at

http://www.oracle.com/technology/tech/dotnet/tools/index.html

Oracle Providers for ASP.NET

Beginning with .NET Framework 2.0, ASP.NET includes service providers that store state in databases. By storing this state in a database, applications can ensure high availability of data, while making the data equally available to all Web servers. For more information, refer to *Oracle Providers for ASP.NET Developer's Guide for Microsoft Windows*.

XML Support

Oracle XML products include XML Developer's Kit (XDK) and Oracle XML SQL Utility. For more information:

- *Oracle XML Developer's Kit Programmer's Guide*
- *Oracle XML DB Developer's Guide*
- *Oracle Database XML Java API Reference*
- *Oracle Database XML C API Reference*
- *Oracle Database XML C++ API Reference*
- *Oracle Database SQL Language Reference*
- *Oracle Database PL/SQL Packages and Types Reference*

Support for Internet Applications

Oracle Database support for internet applications includes Oracle Portal, which enables you to publish your data to the Web, Oracle HTTP Server, and PL/SQL Embedded Gateway, which offers **PL/SQL** procedures stored in Oracle Database that can be started through browsers. For more information:

- *Oracle Portal Installation Guide and Tutorial*
- *Oracle Enterprise Manager Grid Control Installation and Basic Configuration*

Note: Oracle Portal is available on a separate media and included with Oracle Database for Windows.

Oracle Database provides built-in mechanisms that address the requirements of the largest PHP, Ruby, Python Web, and Rich Internet Applications. The features include extreme connectivity, scalability, caching, nonintrusive performance acceleration, advanced security, and high-availability.

Oracle Services For Microsoft Transaction Server

Oracle Database for Windows permits enhanced deployment of COM/COM+ components in **Microsoft Transaction Server**, using Oracle Database as the resource manager. For more information, refer to *Oracle Services for Microsoft Transaction Server Developer's Guide for Microsoft Windows*.

Oracle Objects for OLE

Oracle Objects for OLE (OO4O) provides easy access to data stored in Oracle Database servers with any programming or scripting language that supports the Microsoft COM Automation and ActiveX technology. These include Visual Basic, Visual C++, Visual Basic For Applications (VBA), IIS Active Server Pages (VBScript and JavaScript), and others. For more information, refer to *Oracle Objects for OLE Developer's Guide for Microsoft Windows.*

Oracle Provider for OLE DB

Refer to *Oracle Provider for OLE DB Developer's Guide for Microsoft Windows* for information on OLE DB.

Note: Oracle ODBC Driver is updated on a regular basis. The newest release available is included on your media. To download the latest release, visit:
`http://www.oracle.com/technology/index.html`

Select Oracle ODBC Drivers from the Select a Utility or Driver list.

Oracle COM Automation Feature

Oracle **COM** automation feature enables PL/SQL and Java stored procedure developers and COM/COM+ developers to load COM/COM+ objects from Oracle Database. For more information, refer to *Oracle COM Automation Feature Developer's Guide for Microsoft Windows.*

Pro*C/C++ and Pro*COBOL Applications

Refer to the following guides for more information on Pro*C/C++ and Pro*COBOL applications:

- *Pro*C/C++ Programmer's Guide*
- *Pro*COBOL Programmer's Guide*
- *Oracle Call Interface Programmer's Guide*

Building External Procedures

This section 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. 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

> **Caution:** Special security precautions are warranted when configuring a listener to handle external procedures. See "Modifying Configuration of External Procedures for Higher Security" on page C-3 and *Oracle Database Net Services Administrator's Guide* for more information.

To create and use an external procedure, perform the following sequential steps:

- Installing and Configuring
- Writing an External Procedure
- Building a DLL
- Registering an External Procedure
- 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.

Installing and Configuring

This section describes installation and configuration of Oracle Database and **Oracle Net**.

Installing Oracle Database

Follow the steps in *Oracle Database Installation Guide for Microsoft Windows* to install these products on your Windows server:

- Oracle Database Enterprise Edition, Oracle Database Standard Edition, or Oracle Database Personal Edition. Each type contains PL/SQL, from which external procedures are called, and the PL/SQL external procedure program (EXTPROC), which runs external procedures.
- Oracle Net Services
- **Oracle Protocol Support**

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. 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`

> **Caution:** Additional security may be required for the listener in a production environment. See *Oracle Database Net Services Administrator's Guide* for more information.

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 will start 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 procedure(s) 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" on page 16-5, 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.

Starting with Oracle9*i* Release 2, however, 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 of 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 Advanced Application Developer's Guide* for more information on EXTPROC

Registering an External Procedure

Once you have built a DLL containing your external procedure(s), you must register your external procedure(s) with Oracle Database:

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\11.2.0\dbhome_
1\rdbms\extproc\extern.dll)
   (ORACLE_HOME=C:\app\oracle\product\11.2.0\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:

```
SQL> CREATE LIBRARY externProcedures AS 'C:\app\oracle\product\11.2.0\dbhome_
1\rdbms\ extproc\extern.dll';
```

   where `externProcedures` is an alias library (essentially a schema object in the database), and

```
C:\app\oracle\product\11.2.0\dbhome_1\rdbms\extproc\extern.dll
```

   is the path to the Windows operating system `dllextern.dll`. This example uses `C:\app\oracle\product\11.2.0` 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.

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 will be defined as:
    -- long max(long x, short x_indicator,
```

```
-- long y, short y_indicator, short * ret_indicator)
```

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;
```

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 running concurrently. The agent processes operate regardless of whether each individual agent process is actually active at the moment. 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:

- Part III of *Oracle Database Advanced Application Developer's Guide*
- "Multithreaded Agents" in *Oracle Database Heterogeneous Connectivity User's Guide*

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 will result in a mismatch.

In such cases, you might 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. To avoid errors when declaring C prototype parameters, refer to *Oracle Database Data Cartridge Developer's Guide.*

Using Package DEBUG_EXTPROC

To help you debug external procedures, PL/SQL provides utility package DEBUG_EXTPROC. To install the package, run 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*
- "Calling External Procedures" in *Oracle Database Advanced Application Developer's Guide*
- *Oracle Database Data Cartridge Developer's Guide*

Accessing Text Files with UTL_FILE

Package `UTL_FILE` allows your PL/SQL programs to read and write operating system text files. It provides a restricted version of 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.

> **See Also:** *Oracle Database PL/SQL Packages and Types Reference* for more information on `UTL_FILE`

`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 platform-specific line terminator characters. On Windows platforms the correct line terminator characters are `<CR><LF>`.

Accessing Web Data with Intercartridge Exchange

This section discusses the following topics:

- Configuring Intercartridge Exchange
- Using Intercartridge Exchange
- UTL_HTTP Exception Conditions
- Exception Conditions and Error Messages

Configuring Intercartridge Exchange

You must add a parameter to the **registry** before using Intercartridge Exchange.

1. Start Registry Editor from the command prompt:

   ```
   C:\> regedit
   ```

   The Registry Editor window appears.

   > **Note:** For another way to configure your registry, see "Managing Registry Parameters with regedit" on page 15-8

2. Add `HTTP_PROXY` to the registry subkey of the Oracle home directory that you are using. The location of this parameter is determined by how many Oracle home directories are on your computer. If you have only one home directory, add `HTTP_PROXY` to

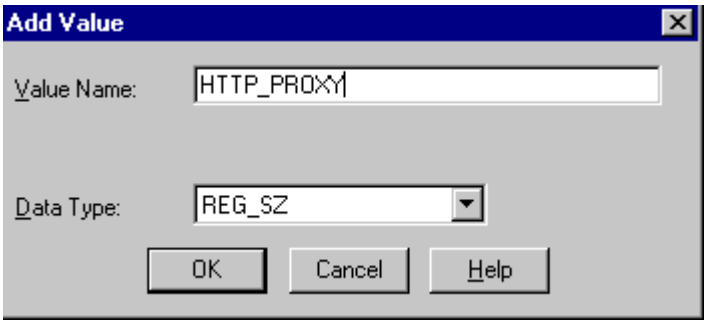
   `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\HOME0.`

   If you have multiple home directory, add it to

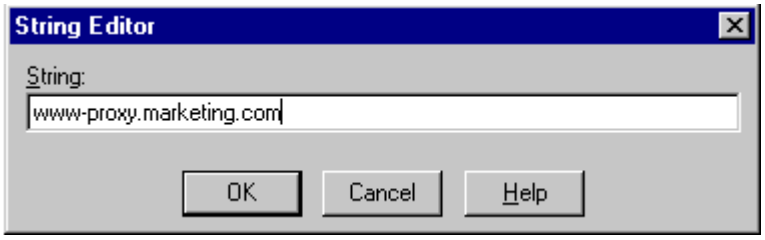
   `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\KEY_`*`HOME_NAME`*

3. Choose **Add Value** from the **Edit** menu.

   The Add Value dialog appears.



4. Type `HTTP_PROXY` in the **Value Name** field and `REG_SZ` in the **Data Type** field.
5. Click **OK**.
6. Type `www-proxy.`*`your-site`* in the **String** field.



In this example, the Web site is `marketing.com`. You will enter the domain name of your actual Web site.

Using Intercartridge Exchange

Intercartridge Exchange enables you to use a stored package called `UTL_HTTP` to make Hypertext Transfer Protocol (HTTP) calls from PL/SQL, SQL, and SQL*Plus statements.

`UTL_HTTP` can do both of the following:

- Access data on the Internet
- Call Oracle Web Application Server cartridges

`UTL_HTTP` contains two similar entry points, known as packaged functions, that turn PL/SQL and SQL statements into HTTP callouts:

- `UTL_HTTP.REQUEST`
- `UTL_HTTP.REQUEST_PIECES`

Both packaged functions perform the following tasks:

- Take a string universal resource locator (URL) of a site
- Contact that site
- Return data (typically HTML) obtained from that site

Declarations to use with both packaged functions are described in the following subsections.

Packaged Function UTL_HTTP.REQUEST

`UTL_HTTP.REQUEST` uses a URL as its argument and returns up to the first 2000 bytes of data retrieved from that URL. Specify `UTL_HTTP.REQUEST` as follows:

```
FUNCTION REQUEST (URL IN VARCHAR2) RETURN VARCHAR2;
```

To use `UTL_HTTP.REQUEST` from SQL*Plus, enter:

```
SQL> SELECT UTL_HTTP.REQUEST('HTTP://WWW.ORACLE.COM/') FROM DUAL;
```

which returns:

```
UTL_HTTP.REQUEST('HTTP://WWW.ORACLE.COM/')
------------------------------------------------------
<html>
<head><title>Oracle Home Page</title>
```

```
<!--changed Jan. 16, 19
1 row selected.
```

Packaged Function UTL_HTTP.REQUEST_PIECES

UTL_HTTP.REQUEST_PIECES uses a URL as its argument and returns a PL/SQL table of 2000 bytes of data retrieved from the given URL. The final element can be shorter than 2000 characters. The UTL_HTTP.REQUEST_PIECES return type is a PL/SQL table of type UTL_HTTP.HTML_PIECES.

UTL_HTTP.REQUEST_PIECES, which uses type UTL_HTTP.HTML_PIECES, is specified as:

```
type html_pieces is table of varchar2(2000) index by binary_integer;
function request_pieces (url in varchar2,
  max_pieces natural default 32767)
return html_pieces;
```

A call to REQUEST_PIECES can look like this example. Note the use of PL/SQL table method COUNT to discover the number of pieces returned; it can be zero or more:

```
declare pieces utl_http.html_pieces;
begin
  pieces := utl_http.request_pieces('http://www.oracle.com/');
   for i in 1 .. pieces.count loop
     .... -- process each piece
   end loop;
end;
```

The second argument to UTL_HTTP.REQUEST_PIECES (MAX_PIECES) is optional. MAX_PIECES is the maximum number of pieces (each 2000 characters in length, except for the last, which can be shorter) that UTL_HTTP.REQUEST_PIECES returns. If provided, that argument is usually a positive integer.

For example, the following block retrieves up to 100 pieces of data (each 2000 bytes, except perhaps the last) from the URL. The block prints the number of pieces retrieved and the total length, in bytes, of the data retrieved.

```
set serveroutput on

declare
  x utl_http.html_pieces;
begin
  x := utl_http.request_pieces('http://www.oracle.com/', 100);
  dbms_output.put_line(x.count || ' pieces were retrieved.');
  dbms_output.put_line('with total length ');
  if x.count < 1
  then dbms_output.put_line('0');
  else dbms_output.put_line
((2000 * (x.count - 1)) + length(x(x.count)));
  end if;
end;

which displays:
Statement processed.
4 pieces were retrieved.
with total length
7687
```

Elements of the PL/SQL table returned by UTL_HTTP.REQUEST_PIECES are successive pieces of data obtained from the HTTP request to that URL.

UTL_HTTP Exception Conditions

This subsection describes exceptions (errors) that can be raised by packaged functions UTL_HTTP.REQUEST and UTL_HTTP.REQUEST_PIECES.

UTL_HTTP.REQUEST

PRAGMA RESTRICT_REFERENCES enables display of exceptions:

```
create or replace package utl_http is
function request (url in varchar2) return varchar2;
pragma restrict_references (request, wnds, rnds, wnps, rnps);
```

UTL_HTTP.REQUEST_PIECES

PRAGMA RESTRICT_REFERENCES enables display of exceptions:

```
create or replace package utl_http is
type html_pieces is table of varchar2(2000) index by binary_integer;
function request_pieces (url in varchar2,
   max_pieces natural default 32767)
return html_pieces;
pragma restrict_references (request_pieces, wnds, rnds, wnps, rnps);
```

Exception Conditions and Error Messages

If initialization of the HTTP callout subsystem fails for environmental reasons (such as lack of available memory), then exception UTL_HTTP.INIT_FAILED is raised:

```
init_failed exception;
```

If the HTTP call fails due to failure of the HTTP daemon or because the argument to REQUEST or REQUEST_PIECES cannot be interpreted as a URL (because it is NULL or has non-HTTP syntax), then exception UTL_HTTP.REQUEST_FAILED is raised :

```
request_failed exception;
```

Unless explicitly caught by an exception handler, these first two exceptions are reported by a generic message that shows them as "user-defined" exceptions, even though they are defined in this system package:

```
ORA-06510: PL/SQL: unhandled user-defined exception
```

If any other exception is raised during processing of the HTTP request (for example, an out-of-memory error), then function UTL_HTTP.REQUEST or UTL_HTTP.REQUEST_PIECES reraises that exception.

If no response is received from a request to the given URL, because the function made no contact with a site corresponding to that URL, then a formatted HTML error message may be returned:

```
<HTML>
<HEAD>
<TITLE>Error Message</TITLE>
</HEAD>
<BODY>
<H1>Fatal Error 500</H1>
Can't Access Document: http://home.nothing.comm.
<P>
<B>Reason:</B> Can't locate remote host:  home.nothing.comm.
<P>
<P><HR>
```

```
<ADDRESS><A HREF="http://www.w3.org">
CERN-HTTPD3.0A</A></ADDRESS>
</BODY>
</HTML>
```

If `UTL_HTTP.REQUEST` or `UTL_HTTP.REQUEST_PIECES` raises an exception or returns an HTML-formatted error message, yet you believe that the URL argument is correct, try contacting that same URL with a browser to verify network availability from your computer.

A

Getting Started with Your Documentation

The Oracle Database documentation set is provided in both HTML and PDF formats on the software product media. Use this media to browse the library or copy files directly to a local system.

The library includes a Web-based search tool that enables you to search for information about a particular product, parameter, file name, procedure, error message, or other area of interest. The search tool also makes it possible to construct a "virtual book" drawn from the complete documentation library, but consisting only of topics and procedures relevant to your needs. The library also includes a comprehensive Master Index, and lists of SQL and PL/SQL keywords, initialization parameters, catalog views, and data dictionary views.

Instructions for installing the library and viewing its contents are in three README files at the root level of the documentation media:

- `README.htm`
- `README.pdf`
- `README.txt`

> **Note:** The `readme.txt` file contains UNIX line breaks. If you simply double-click it, it will open in Notepad by default, and Notepad does not recognize UNIX line breaks. Use `write.exe` or `edit.com` instead.

The contents of the three files are identical; only the format differs.

The following guides are not included on the Oracle Database Online Documentation Library media for Windows:

- *Oracle Database Installation Guide for Microsoft Windows* and *Oracle Database Release Notes for Microsoft Windows*

  To access these documents, open `welcome.htm` in the `\doc` directory on the component media.

- Oracle Migration Workbench documentation

Note: Oracle Migration Workbench is available only at Oracle Technology Network (OTN). See:

http://www.oracle.com/technology/tech/migration/workbench/index.html

Oracle Migration Workbench is only supported on Windows 32-bit operating systems. They are not supported on any Windows 64-bit platforms.

- Oracle Fail Safe documentation

  This document is on the Oracle Fail Safe product media pack.

B

Storing Tablespaces on Raw Partitions

This appendix describes how to configure your system to store datafiles for a **tablespace** on **raw partitions**.

This appendix contains these topics:

- Raw Partition Overview
- Creating a Raw Partition and a Mount Point
- Creating a Tablespace in a Raw Partition
- Configuring Disks for Automatic Storage Management

> **Note:** Oracle RAC requires additional configuration tools. See *Oracle Real Application Clusters Administration and Deployment Guide* for information on creating logical partitions and assigning symbolic links. Do not use this appendix to create partitions for Oracle RAC.

Raw Partition Overview

Datafiles 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.

Physical Disk

A physical disk represents the entire disk and points to the following:

```
\Device\Harddiskx\Partition0
```

Symbolic link name `\\.\PhysicalDrivex` is automatically defined by Windows for every hard disk in the computer. For example, a computer with three hard disks will 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 datafile.

> **Note:** Although you can use physical disks, Oracle recommends that you use logical partitions.

Logical Partition

Logical partitions point to drives other than `\Device\Harddiskx\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 datafile.

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 should never be defined by the user.
- Logical partitions must be defined by the user to represent a specific partition in a disk. These partitions should be logical partitions or drives contained in an extended partition. They should never be defined as `Partition0`.
- Using an entire disk (`Partition0`) for an Oracle Database datafile and using a partition that occupies the entire disk for an Oracle Database datafile 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 datafile (`Partition0`), then use the pre-defined 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.

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 datafiles using the physical disk convention even though it really is a logical partition. This will 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 datafile 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 on creating extended and logical partitions

Creating a Raw Partition and a Mount Point

To create a raw partition, you must first generate an extended partition and a logical partition. An extended partition points to raw space on the disk that can be assigned multiple logical partitions for database files. An extended partition also avoids the four-partition limit by letting you define large numbers of logical partitions to accommodate applications using the Oracle Database server. Logical partitions can then be given symbolic link names to free up drive letters.

On Windows Vista, Windows Server 2008, and Windows Server 2008 R2, 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 will convert the volume to a dynamic disk. Automatic Storage Management does not support dynamic disks.

You can use `diskpart.exe` for disk management from the command line. It can increase the disk volume capacity dynamically and create, delete, and resize partitions and volumes.

Volume mount point offers additional storage space on a volume. Different partitions appear as a single logical volume and that is why it surpasses the 26-drive letter limitation. Use mount points as an alternative to drive letters.

> **See Also:** The Microsoft Web site for more information about raw partitions and volume mount points
>
> http://www.microsoft.com/en/us/default.aspx

Creating a Tablespace in a Raw Partition

To create a tablespace using a datafile located in a raw partition:

1. Start SQL*Plus:

   ```
   C:\> sqlplus
   ```

2. Connect to the Oracle Database repository database:

   ```
   SQL> CONNECT SYSTEM
   Enter password: password
   ```

   where *`password`* for user account **SYSTEM** is `MANAGER` by default. If you have changed this password, substitute the correct password for `MANAGER`.

3. Create the tablespace:

   ```
   SQL> CREATE TABLESPACE tablespace DATAFILE '\\.\datafile' SIZE xm;
   ```

   where:

   - *`tablespace`* is the tablespace name
   - `'\\.\'` is the drive letter or symbolic link name assigned to the raw partition
   - *x* is the tablespace size in megabytes (Twenty megabytes is a good starting place.)

For example, to create a tablespace named `accounting_1` that was assigned a symbolic link name of `accounting_1`, enter the following:

```
SQL> CREATE TABLESPACE accounting_1 DATAFILE '\\.\accounting_1' SIZE 502M;
```

> **Note:** If you are creating a database with the `SQL` script, modify datafiles that are stored on raw partitions with a naming convention of `\\.\drive_letter:` or `\\.\symbolic link name`.

Configuring Disks for Automatic Storage Management

To use 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:** "Manually Configuring Disks for Automatic Storage Management" in *Oracle Database Installation Guide for Microsoft Windows* for instructions on using `asmtool` or `asmtoolg`

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 Automatic Storage Management. 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.

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:** "Initialization Parameters for ASM Instances" in *Oracle Database Administrator's Guide*

C

Oracle Net Services Configuration on Windows

This appendix describes Oracle Net Services configuration for Windows. For more generic information on Oracle Net Services configuration, see *Oracle Database Net Services Administrator's Guide.*

This appendix contains these topics:

- Configuring Oracle Database to Communicate with ASM
- Understanding Oracle Net Services Registry Parameters and Subkeys
- Listener Requirements
- Understanding Optional Configuration Parameters
- Advanced Network Configuration

Configuring Oracle Database to Communicate with ASM

Oracle Database for Windows installations that use Automatic Storage Management (ASM) 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: "Windows Authentication Protocols" on page 9-2

Understanding 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.

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`*`HOME_NAME`*`ClientCache`
- `Oracle`*`HOME_NAME`*`CMAdmin`
- `Oracle`*`HOME_NAME`*`CMan`

- `Oracle`*`HOME_NAME`*`TNSListener`

Each service subkey contains the parameters shown in Table C–1.

Table C–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 should log on.

Listener Requirements

In Oracle Database 10*g* Release 1 (10.1) or later, the listener is set to start automatically at system restart. If you intend to use only the listener for all of your databases, ensure that only the Windows service for the listener, as listed in the Control Panel, is set to start automatically.

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, you might expect that the second and subsequent listeners would fail to bind. Instead, Windows allows them all to listen on the same IP address and port, resulting in unexpected behavior of the listeners. This is a suspected Windows operating system problem with TCP/IP and has been reported to Microsoft.

Understanding Optional Configuration Parameters

You can use the following parameters on Windows:

- LOCAL
- TNS_ADMIN
- USE_SHARED_SOCKET

Oracle Net Service first checks for the parameters as environment variables, and uses the values defined. If environment variables are not defined, it searches for these parameters in the registry.

LOCAL

You can use parameter `LOCAL` to connect to Oracle Database without specifying a connect identifier in the connect string. The value of parameter `LOCAL` is any connect identifier, such as a net service name. For example, if parameter `LOCAL` is specified as `finance`, you can connect to a database from SQL*Plus with:

```
SQL> CONNECT SCOTT
Enter password: password
```

rather than

```
SQL> CONNECT SCOTT@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, Oracle Net connects.

TNS_ADMIN

You can add 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`, the configuration files are used from *ORACLE_HOME*`\test\admin`.

USE_SHARED_SOCKET

You can set parameter `USE_SHARED_SOCKET` to `true` to enable 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 need to 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 dedicated server mode in a TCP/IP environment. If this parameter is set, you cannot use the Oracle database listener to spawn Oracle7 release 7.*x* databases. 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.

Advanced Network Configuration

The following sections describe advanced configuration procedures specifically for Oracle Net Services on Windows operating systems:

- Configuring Authentication Method
- Configuring Security for Named Pipes Protocol
- Modifying Configuration of External Procedures for Higher Security

Configuring Authentication Method

Oracle Net Services provides authentication methods for Windows operating systems using Windows Native Authentication.

Configuring Security for Named Pipes Protocol

The network listener service may be unable to open the Named Pipe created by Oracle Names unless service `Oracle`*HOME_NAME*`TNSListener` has a valid user ID 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 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 `OracleHOME_NAMETNSListener`*`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" 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 should not have permission to read or write to database files or to the Oracle Database server address space. In addition, this user should have read access to the `listener.ora` file, but must not have write access to it.

2. Stop service `OracleHOME_NAMETNSListener`*`extproc_listener_name`*.

   See Also: Your operating system documentation for instructions on accessing the Services dialog and stopping services

   Note: If the `OracleHOME_NAMETNSListener`*`extproc_listener_name`* service does not exist, issue the following command from the command prompt:

   ```
   lsnrctl start extproc_listener_name
   ```

   This creates the `OracleHOME_NAMETNSListener`*`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 `OracleHOME_NAMETNSListener`*`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 OracleHOME_NAMETNSListener`*`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.

D

Error Messages on Windows

This appendix lists error messages, causes, and corrective actions that are specific to operation of Oracle Database for Windows. This appendix also includes database connection issues.

This appendix contains these topics:

- ORA-09275: CONNECT INTERNAL No Longer Supported
- OSD-04000 to OSD-04599: Windows-Specific Oracle Database Messages
- DIM-00000 to DIM-00039: ORADIM Command Syntax Errors
- Database Connection Issues

Note: The `ora.hlp` file, which was shipped in previous releases, is no longer available. See this Appendix, *Oracle Database Error Messages*, and *Oracle Enterprise Manager Messages Manual* for information on 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.

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
- Memory Errors: OSD-04100 to OSD-04199
- Process Errors: OSD-04200 to OSD-04299

- Loader Errors: OSD-04300 to OSD-04399
- Semaphore Errors: OSD-04400 to OSD-04499
- Miscellaneous Errors: OSD-04500 to OSD-04599

File I/O Errors:	OSD-04000 to OSD-04099
4000	Logical block size mismatch
4001	Invalid logical block size
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
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 datafile
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
4506	Unable to spawn process through system()
4510	Operating system roles are not supported

Miscellaneous Errors:	OSD-04500 to OSD-04599
4511	Unable to get date and time from the operating system
4512	Unable to translate the 'USERNAME' config.ora variable on server
4513	'remote_os_authent' init.ora variable not set to true
4514	The Windows Group name is too long for internal buffer
4515	This command is not implemented at this time

File I/O Errors: OSD-04000 to OSD-04099

OSD-04000

Logical block size mismatch

Cause: Database block size specified in **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

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

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

OSD-04300

Unable to read complete record from datafile

Cause: Datafile ended in the middle of a record. This error occurs when loading files with a fixed record length.

Action: Verify that 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

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

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

'remote_os_authent' init.ora variable not set to TRUE

Cause: For remote operating system logon to function, '`REMOTE_OS_AUTHENT`' parameter must be set to `TRUE`.

Action: Shut down and start up instance with '`REMOTE_OS_AUTHENT = TRUE`' in initialization parameter file.

OSD-04514

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-00039: 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-0039
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
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.

Oradim Errors	DIM-0000 to DIM-0039
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.
00023	Create an instance by specifying the following options:
00024	-NEW -SID sid | -SRVC srvc | -ASMSID sid | -ASMSRVC srvc [-SYSPWD pass]
00025	[-STARTMODE auto | manual] [-SRVCSTART system | demand] [-PFILE file | -SPFILE]
00026	[-SHUTMODE normal | immediate | abort] [-TIMEOUT secs] [-RUNAS osusr/ospass]
00027	Edit an instance by specifying the following options:
00028	-EDIT -SID sid | -ASMSID sid [-SYSPWD pass]
00029	[-STARTMODE auto | manual] [SRVCSTART system | demand] [-PFILE file | -SPFILE]
00030	[-SHUTMODE normal | immediate | abort] [-SHUTTYPE srvc | inst] [-RUNAS osusr/ospass]
00031	Delete instances by specifying the following options:
00032	-DELETE -SID sid | -ASMSID sid | -SRVC srvc | -ASMSRVC srvc
00033	Startup services and instance by specifying the following options:
00034	-STARTUP -SID sid | -ASMSID sid [-SYSPWD pass]
00035	[-STARTTYPE srvc | inst | srvc,inst] [-PFILE filename | -SPFILE]
00036	Shutdown services and instance by specifying the following options:
00037	-SHUTDOWN -SID sid | -ASMSID sid [-SYSPWD pass]
00038	[-SHUTTYPE srvc | inst | srvc,inst] [-SHUTMODE normal | immediate | abort]
00039	Query for help by specifying the following parameters: -? | -h | -help
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.

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-00023

Create an instance by specifying the following options:

Cause: n/a

Action: n/a

DIM-00024

-NEW -SID sid | -SRVC srvc | -ASMSID sid | -ASMSRVC srvc [-SYSPWD pass]

Cause: n/a

Action: n/a

DIM-00025

[-STARTMODE auto | manual] [-SRVCSTART system | demand] [-PFILE file | -SPFILE]

Cause: n/a

Action: n/a

DIM-00026

[-SHUTMODE normal | immediate | abort] [-TIMEOUT secs] [-RUNAS osusr/ospass]

Cause: n/a

Action: n/a

DIM00027

Edit an instance by specifying the following options:

Cause: n/a

Action: n/a

DIM-00028

-EDIT -SID sid | -ASMSID sid [-SYSPWD pass]

Cause: n/a

Action: n/a

DIM-00029

[-STARTMODE auto | manual] [-SRVCSTART system | demand] [-PFILE file | -SPFILE]

Cause: n/a

Action: n/a

DIM-00030

[-SHUTMODE normal | immediate | abort] [-SHUTTYPE srvc | inst] [-RUNAS osusr/ospass]

Cause: n/a

Action: n/a

DIM-00031

Delete instances by specifying the following options:

Cause: n/a

Action: n/a

DIM-00032

-DELETE -SID sid | -ASMSID sid | -SRVC srvc | -ASMSRVC srvc

Cause: n/a

Action: n/a

DIM-00033

Start up services and instance by specifying the following options:

Cause: n/a

Action: n/a

DIM-00034

-STARTUP -SID sid | -ASMSID sid [-SYSPWD pass]

Cause: n/a

Action: n/a

DIM-00035

[-STARTTYPE srvc | inst | srvc,inst] [-PFILE filename | -SPFILE]

Cause: n/a

Action: n/a

DIM-00036

Shut down services and instance by specifying the following options:

Cause: n/a

Action: n/a

DIM-00037

-SHUTDOWN -SID sid | -ASMSID sid [-SYSPWD pass]

Cause: n/a

Action: n/a

DIM-00038

[-SHUTTYPE srvc | inst | srvc,inst] [-SHUTMODE normal | immediate | abort]

Cause: n/a

Action: n/a

DIM-00039

Query for help by specifying the following parameters: -? | -h | -help

Cause: n/a

Action: n/a

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.

Database Connection Issues

The following are common Oracle Database connection error codes, their causes, and suggested remedies.

TNS-12203

TNS: unable to connect to destination

Cause: Oracle*Service*SID service, Oracle*HOME_NAME*TNSListener service, or both are not running.

Action: Ensure that both services are started.

ORA-12560

TNS: lost contact

Cause: Oracle*Service*SID service, Oracle*HOME_NAME*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 Windows/UNIX Differences

This chapter lists major 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.

This chapter contains these topics:

- Automatic Startup and Shutdown
- Background Processing and Batch Jobs
- Diagnostic and Tuning Utilities
- Direct Writes to Disk
- Dynamic Link Libraries (DLLs)
- Hot Backups
- Initialization Parameters: Multiple Database Writers
- Install Accounts and Groups
- Installation
- Memory Resources
- Microsoft Transaction Server
- Multiple Oracle Homes and OFA
- Processes and Threads
- Raw Partitions
- Services

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:

- Chapter 5, "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 Oracle Counters for Windows Performance Monitor, Task Manager, Control Panel, Event Viewer, and **Microsoft Management Console**.

Oracle Database is integrated with several of these tools. For example:

- Oracle Counters for Windows Performance Monitor displays key Oracle Database information. This tool is the same in appearance and operation as Windows Performance Monitor, except it has been loaded with Oracle Database performance elements.
- 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:

- Chapter 2, "Database Tools on Windows"
- Chapter 6, "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 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 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 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 normal 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: Chapter 14, "Oracle Database Specifications for Windows"

Install 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.

See Also: Chapter 5, "Administering a Database on Windows"

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

UNIX does not support **Microsoft Transaction Server**.

Windows supports Microsoft Transaction Server beginning with Oracle8. Using Oracle Services for Microsoft Transaction Server, you can develop and deploy applications based on **COM**. Microsoft Transaction Server coordinates application transactions for Oracle Database.

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, although Microsoft has announced the intention to support them.

See Also: Appendix B, "Optimal Flexible Architecture" in *Oracle Database Installation Guide for Microsoft Windows*

Processes and Threads

On UNIX, Oracle Database uses a process to implement each of such background tasks as database writer (`DBW0`), log writer (`LGWR`), shared server process dispatchers, and shared servers. Each dedicated connection made to the database causes another operating system process to be spawned on behalf of that session.

On Windows, each background process is implemented as a thread inside a single, large process. For each Oracle Database instance or **system identifier**, there is one corresponding process for Oracle Database. For example, 100 Oracle Database processes for a database instance on UNIX are handled by 100 threads inside one process on Windows.

All Oracle Database background, dedicated server, and client processes are threads of the master Oracle Database Windows process, and all threads of the Oracle Database process share resources. This multithreaded architecture is highly efficient, allowing fast context switches with low overhead.

To view processes or end individual threads, use Oracle Administration Assistant for Windows. From the **Start** menu, select **Programs**, then select **Oracle -** ***HOME_NAME***, then select **Configuration and Migration Tools** and then select **Administration Assistant for Windows**. Right-click the `SID` and choose **Process Information**.

Note: Microsoft Management Console (MMC) is started when Oracle Administration Assistant for Windows is started. Oracle Database has integrated several database administration **snap-ins** into Microsoft Management Console.

See Also:

- Oracle Administration Assistant for Windows online help
- Chapter 1, "Oracle Database Architecture on Windows"

Raw Partitions

Datafiles 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 Windows Vista, Windows Server 2008, and Windows Server 2008 R2, 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 will convert the volume to a dynamic disk. Automatic Storage Management does not support dynamic disks.

Note: Oracle RAC is not supported on Windows XP, Windows Vista, Winodws 7, and any 32-bit Windows operating system.

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.

By default, services run under the **SYSTEM** account. From the **Start** menu, select **Settings**, then select **Control Panel** and then select **Services** to access the Services dialog.

See Also: Chapter 5, "Administering a Database on Windows"

Glossary

alert log

A file that contains important information and error messages that are generated during database operations.

authenticate

To verify the identity of a user, device, or other entity in a computer system, often as a prerequisite for allowing access to resources in a system.

authorization

Permission given to a user, program, or **process** to access an object or set of objects. In Oracle Database, authorization is done through the **role** mechanism. A single person or a group of people can be granted a role or a group of roles. A role, in turn, can be granted other roles.

backup

A representative copy of data. This copy includes important parts of your database such as **control files**, **redo log files**, and datafiles.

A backup is a safeguard against unexpected data loss; if you lose your original data, then you can use the backup to make the data available again. A backup is also a safeguard against an application error; if an application makes incorrect changes, then you can restore the backup.

certificate authority

A certificate authority (CA) is a trusted third party that certifies the identity of other entities such as users, databases, administrators, clients, and servers. The certificate authority verifies the user's identity and grants a certificate, signing it with one of the certificate authority's **private keys**.

COM

Microsoft's Component Object Model is an object-oriented programming architecture and a set of operating system services. These services notify running application components of significant events and ensure that they are authorized to run. COM is intended to make it relatively easy to create business applications that work well with **Microsoft Transaction Server**.

component-based shadow copies

VSS snapshots of Oracle database components. Examples of components include tablespaces or archived redo logs.

connect descriptor

A specially formatted description of the destination for a network connection. A connect descriptor contains destination **services** and network route information. The destination service is indicated by using its service name for Oracle9*i* or Oracle8*i* databases or its Oracle **system identifier** for Oracle8 Release 8.0 databases. The network route provides, at a minimum, the location of the **listener** through use of a network address.

connect identifier

A **net service name** or service name, that maps to a **connect descriptor**. Users initiate a connect request by passing a **username** and password along with a connect identifier in a **connect string** for the **services** to which they want to connect, for example:

```
CONNECT username/password@connect_identifier
```

connect string

See **net service name**.

control files

Files that record the physical structure of a database and contain the database name, the names and locations of associated databases and online **redo log files**, the time stamp of the database creation, the current log sequence number, and checkpoint information.

credentials

A **username**, password, or certificate used to gain access to the database.

data dictionary

A set of read-only tables that provide information about a database.

database alias

See **net service name**.

decryption

Process of converting contents of a message that has gone through **encryption** (ciphertext) back into its original readable format (plaintext).

digital certificates

ITU X.509 v3 standard data structures that securely bind an identity to a **public key**. A certificate is created when an entity's public key is signed by a trusted identity, a **certificate authority**. The certificate ensures that the entity's information is correct and that the public key actually belongs to that entity.

digital signature

Digital signatures are created when a **public key** algorithm is used to sign messages with senders' **private keys**. A digital signature assures that a document is authentic, has not been forged by another entity, has not been altered, and cannot be repudiated by the sender.

DLL

See **dynamic link library**.

downgrade

To convert the data in Oracle Database to an earlier Oracle release. See **upgrade** and **migrate**.

dynamic link library

An executable file that a Windows application can load when needed.

encryption

Process of disguising a message, rendering it unreadable to any but the intended recipient.

enterprise domains

Directory constructs consisting of Oracle Database and enterprise users and roles.

enterprise role

A directory structure which contains global roles on multiple databases, and which can be granted to an **enterprise user**.

enterprise user

A user that has a unique identity across an enterprise. An enterprise user connects to individual databases through a **schema** and is assigned an **enterprise role** that determines the user's access privileges on databases.

external procedures

Functions written in a third-generation language (C, for example) and callable from within **PL/SQL** or SQL as if they were PL/SQL functions or procedures.

external role

Roles created and managed by Windows operating systems. Once an external role is created, you can grant or revoke that **role** to a database user. You must set **init.ora** parameter `OS_ROLES` to `true` and restart Oracle Database before you can create an external role. You cannot use both Windows operating systems and Oracle Database to grant roles concurrently.

external routine

A function written in a third-generation language (3GL), such as C, and callable from within **PL/SQL** or SQL as if it were a PL/SQL function or procedure.

external user

A user authenticated by the Windows operating system who can access Oracle Database without being prompted for a password. External users are typically regular database users (non-database administrators) to which you assign standard database roles (such as `DBA`), but do not want to assign **SYSDBA** (database administrator) or **SYSOPER** (database operator) **privilege**.

external user

The Windows operating system can **authenticate** a user, who can then access Oracle Database without being prompted for a password. External users are typically regular database users (non-database administrators) to whom you assign standard database roles (such as `DBA`), but do not want to assign the **SYSDBA** (database administrator) or **SYSOPER** (database operator) **privilege**.

global groups

See **Windows global groups**.

global role

A role whose privileges are contained within a single database, but which is managed in a directory.

Globalization Support

The Oracle Database architecture that ensures that database utilities, error messages, sort order, date, time, monetary, numeric, and calendar conventions automatically adapt to the native language and locale.

HOME_NAME

Represents the name of an Oracle home. In Oracle Database 11*g* Release 2 (11.2), all Oracle homes have a unique *HOME_NAME*.

init.ora

See **initialization parameter file**.

initialization parameter file

An ASCII text file that contains information needed to initialize a database and **instance**.

instance

Every running Oracle Database is associated with an Oracle Database or Automatic Storage Management instance. When a database is started on a database server (regardless of the type of computer), Oracle Database allocates a memory area called the **System Global Area** and starts one or more Oracle Database processes. This combination of the System Global Area and Oracle Database processes is called an instance. The memory and processes of an instance manage the associated database's data efficiently and serve the users of the database.

instantiate

Produce a more defined version of some object by replacing variables with values (or other variables).

latch

A simple, low-level serialization mechanism to protect shared data structures in the System Global Area.

LDAP

See **Lightweight Directory Access Protocol (LDAP)**.

Lightweight Directory Access Protocol (LDAP)

A standard, extensible directory access protocol. It is a common language that LDAP clients and servers use to communicate. LDAP is a framework of design conventions supporting industry-standard directory products, such as **Oracle Internet Directory**.

listener

The Oracle Database server **process** that listens for and accepts incoming connection requests from client applications. The listener process starts Oracle Database processes to handle subsequent communications with the client; then it goes back to listening for new connection requests.

listener.ora

A configuration file that describes one or more Transparent Network Substrate (TNS) listeners on a server.

local groups

See **Windows local groups**.

local roles

Roles created and managed by the database. Once a local role is created, you can grant or revoke that **role** to a database user. You cannot use Windows (for **external role** management) and Oracle Database (for local role management) concurrently.

Microsoft Management Console

An application that serves as a host for administrative tools called **snap-ins**. By itself, Microsoft Management Console does not provide any functionality.

Microsoft Transaction Server

A transaction processing system based on **COM** that runs on an Internet or network server.

migrate

To **upgrade** or **downgrade** an Oracle Database or convert the data in a non-Oracle database into an Oracle Database.

mount

To associate a database with an **instance** that has been started.

MTS

See **Microsoft Transaction Server**

multiple Oracle homes

The capability of having multiple Oracle home on a computer.

net service name

The name used by clients to identify an Oracle Net server and the specific **system identifier** or database for the **Oracle Net** connection. A net service name is mapped to a port number and protocol. Also known as a connect string, database alias, host string, or service name.

This also identifies the specific system identifier or database to which the connection is attaching, not just the Oracle Net server.

network listener

A listener on a server that listens for connection requests for one or more databases on one or more protocols. See **listener**.

network service

In an Oracle application network, a service performs tasks for its service consumers. For example, a Names Server provides name resolution services for clients.

obfuscated

Protected by a process often used by companies for intellectual property written in the form of Java programs. The obfuscation process mixes up Java symbols found in the

code. It leaves the original program structure intact, allowing the program to run correctly, while changing the names of the classes, methods, and variables to hide the intended behavior. Although it is possible to decompile and read non-obfuscated Java code, obfuscated Java code is sufficiently difficult to decompile to satisfy U.S. government export controls.

OCI

See **Oracle Call Interface**.

OFA

See **Optimal Flexible Architecture**.

Optimal Flexible Architecture

A set of file naming and placement guidelines for Oracle Database software and databases.

ORACLE_BASE

ORACLE_BASE is the root of the Oracle Database directory tree. If you install an OFA-compliant database using Oracle Universal Installer defaults, then *ORACLE_BASE* is `X:\app\oracle\product\11.2.0` where `X` is any hard drive.

Oracle Call Interface

An application programming interface that enables you to manipulate data and **schema** in an Oracle Database. You compile and link an Oracle Call Interface application in the same way that you compile and link a non-database application. There is no need for a separate preprocessing or precompilation step.

ORACLE_HOME

Corresponds to the environment in which Oracle Database products run. This environment includes the location of installed product files, the PATH variable pointing to the binary files of installed products, **registry** entries, **net service name**s, and program groups.

If you install an OFA-compliant database, using Oracle Universal Installer defaults, then Oracle home (known as *ORACLE_HOME* in this guide) is located beneath *ORACLE_BASE*. It contains subdirectories for Oracle Database software executables and network files.

Oracle Internet Directory

An Oracle Database-based LDAP V3 directory server, used for centralizing database user, **Oracle Net** network connector, and database **listener** parameters. Oracle Internet Directory ships only with Oracle Application Server, not the Oracle Database 11g product set.

Oracle Net

A component of **Oracle Net Services** that enables a network session from a client application to an Oracle Database server. Once a network session is established, Oracle Net acts as a data courier for the client application and the database server. It is responsible for establishing and maintaining the connection between the client application and database server, and exchanging messages between them. Oracle Net can perform these jobs because it is located on each computer in the network.

Oracle Net Services

A suite of networking components that provide enterprise-wide connectivity solutions in distributed, heterogeneous computing environments. Oracle Net Services are comprised of **Oracle Net**, **listener**, Oracle Connection Manager, Oracle Net Configuration Assistant, and Oracle Net Manager.

Oracle PKI

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

Oracle Protocol Support

A product that maps the functions of a given network protocol into Oracle Transparent Network Substrate (TNS) architecture. This process translates TNS function calls into requests to the underlying network protocol. This allows TNS to act as an interface among all protocols. **Oracle Net** requires Oracle Protocol Support.

Oracle services

Windows **services** that are associated with particular Oracle Database components.

Oracle VSS writer

A service on Windows systems that acts as coordinator between an Oracle database instance and other VSS components, enabling data providers to create a shadow copy of files managed by the Oracle instance. For example, the Oracle VSS writer can place datafiles in hot backup mode to provide a recoverable copy of these datafiles in a shadow copy set.

PL/SQL

Procedural language extension to SQL that is part of Oracle Database.

PL/SQL enables you to mix SQL statements with procedural constructs. You can define and run PL/SQL program units such as procedures, functions, and packages.

precompiler

A programming tool that enables you to embed SQL statements in a high-level source program.

private keys

In **public key cryptography**, these are the secret keys. They are used primarily for **decryption** but also for **encryption** with a **digital signature**.

privilege

A right to run a particular type of SQL statement or to access another user's object.

process

A mechanism in an operating system that can run an executable. (Some operating systems use the terms job or task.) A process normally has its own private memory area in which it runs. On Windows a process is created when an application runs (such as Oracle Database or Microsoft Word). In addition to an executable program, all processes consist of at least one **thread**. The Oracle Database master process contains hundreds of threads.

provider

Software or hardware that creates shadow copies on demand. Typically, a provider is a disk storage system. In response to a request from a requester, a provider responds to VSS COM messages to create and maintain shadow copies.

public key

In **public key cryptography**, this key is made public to all. It is primarily used for **encryption** but can also be used for verifying signatures.

public key cryptography

Public key cryptography involves information **encryption** and **decryption** using a shared **public key** paired with **private keys**. Provides for secure, private communications within a public network.

quota

A limit on a resource, such as a limit on the amount of database storage used by a database user. A database administrator can set **tablespace** quotas for each Oracle Database **username**.

raw partitions

Portions of a physical disk that are accessed at the lowest possible disk (block) level.

recovery

To restore a physical **backup** is to reconstruct it and make it available to the Oracle Database server. To recover a restored backup is to update it using redo records (that is, records of changes made to the database after the backup was taken). Recovering a backup involves two distinct operations: rolling forward the backup to a more current time by applying redo data, and rolling back all changes made in uncommitted transactions to their original state.

redo log buffer

A circular buffer in the **System Global Area** that contains information about changes made to the database.

redo log files

Files that contain a record of all changes made to data in the database buffer cache. If an instance failure occurs, then the redo log files are used to recover the modified data that was in memory.

registry

A Windows repository that stores configuration information for a computer.

remote computer

A computer on a network other than the local computer.

remote database

A database on a computer other than the local database.

requester

An application that uses the VSS API to create shadow copies. Requester applications communicate with VSS writers to gather information on the system and to signal writers to prepare data for backup. The requester maintain control over VSS backup and restore operations by generating COM events through calls in the VSS API.

replication

The process of copying and maintaining database objects in multiple databases that make up a distributed database system.

role

A named groups of related privileges. You can grant a role to users or to another role.

schema

A named collection of objects, such as tables, views, clusters, procedures, and packages, associated with one or more particular users.

services

Executable processes installed in the Windows **registry** and administered by Windows. Once services are created and started, they can run even when no user is logged on to the computer.

service name

See **net service name**.

SGA

See **System Global Area**.

shadow copy

A consistent snapshot of a component or volume.

shadow copy set

A collection of shadow copies that are all taken at the same time.

Shared Server Process

A server configuration which allows many user processes to share very few server processes. The user processes connect to a dispatcher background process, which routes client requests to the next available shared server process.

SID

See **system identifier**.

snap-ins

Administrative tools that run within **Microsoft Management Console**.

snapshot

(1) Information stored in rollback segments provide transaction **recovery** and read consistency. Use Rollback segment information to re-create a snapshot of a row before an update.

(2) A point-in-time copy of a master table located on a remote site. Read-only snapshots can be queried, but not updated. Updateable snapshots can be queried and updated. They are periodically refreshed to reflect changes made to the master table, and at the snapshot site.

starter database

A preconfigured, ready-to-use database that requires minimal user input to create.

SYSDBA

A special database administration role that contains all system privileges with the `ADMIN OPTION`, and the **SYSOPER** system privilege. `SYSDBA` also permits `CREATE DATABASE` actions and time-based recovery.

SYSOPER

A special database administration role that permits a database administrator to perform `STARTUP`, `SHUTDOWN`, `ALTER DATABASE OPEN/MOUNT`, `ALTER DATABASE BACKUP`, `ARCHIVE LOG`, and `RECOVER`, and includes the `RESTRICTED SESSION` privilege.

System Global Area

A group of shared memory structures that contain data and control information for an Oracle Database **instance**.

system identifier

A unique name for an Oracle Database **instance**. To switch between instances of Oracle Database, users must specify the desired system identifier. The system identifier is included in the `CONNECT DATA` parts of the connect descriptors in a tnsnames.ora file, and in the definition of the **network listener** in a tnsnames.ora file.

SYSTEM

One of two standard database administrator usernames automatically created with each database. (The other user name is `SYS`.). The `SYSTEM` user name is the preferred user name for database administrators to use for database maintenance.

tablespace

A database is divided into one or more logical storage units called tablespaces. Tablespaces are divided into logical units of storage called segments, which are further divided into extents.

thread

An individual path of execution within a **process**. Threads are objects within a process that run program instructions. Threads allow concurrent operations within a process so that a process can run different parts of its program simultaneously on different processors. A thread is the most fundamental component that can be scheduled on Windows.

tnsnames.ora

A file that contains connect descriptors mapped to net service names. The file can be maintained centrally or locally, for use by all or individual clients.

trace file

Each server and background **process** can write to an associated trace file. When a process detects an internal error, it dumps information about the error to its trace file. Some information written to a trace file is intended for the database administrator, while other information is intended for Oracle Support Services. Trace file information is also used to tune applications and instances.

trust points

Trust points or trusted certificates are third party identities that are qualified with a level of trust. A trusted certificate is used when an identity is being validated as the entity it claims to be. Certificate authorities you trust are called trusted certificates. If

there are several levels of trusted certificates, a trusted certificate at a lower level in the certificate chain does not need to have all its higher level certificates reverified.

universal groups

Universal groups are available in Windows. They can contain other groups, including other universal groups, **local groups**, and **global groups**.

upgrade

To convert the data in an Oracle Database into a later release. See **downgrade** and **migrate**.

username

A name that can connect to and access objects in a database.

view

A selective presentation of the structure and data of one or more tables. Views can also be based on other views.

volume-based shadow copies

VSS snapshots of complete drives or volumes.

Volume Shadow Copy Service (VSS)

An infrastructure on Windows server platforms that enables requesters, writers and providers to participate in creation of consistent snapshots called Shadow Copies. The VSS service uses well-defined COM interfaces.

Windows global groups

Groups that can be granted permissions and rights in their own domain, member servers and workstations of their domain, and in trusted domains. They can also become members of **Windows local groups** in all these places. But global groups can contain user accounts only from their own domains.

Windows local groups

Groups that can be granted permissions and rights only for its own computer or, if part of a domain, to the domain controllers of that domain. Local groups can, however, contain user accounts and **Windows global groups** from both their own domain and from trusted domains

writer

An application or service that stores persistent information on disk and cooperates with providers and requesters within the VSS infrastructure.

Index

A

Access Control Lists
  adding and deleting members, 13-14
  available security groups, 13-12
Active Directory
  adding and deleting security group members, 13-14
  automatic discovery of directory servers, 13-2
  connecting to a database, 13-9
  how Oracle directory objects appear, 13-4
  integration with directory servers, 13-9
  managing Access Control Lists, 13-12
  managing security groups, 13-12
  requirements for using Oracle, 13-9
  testing connectivity from client computers, 13-9
  testing connectivity with SQL*Plus, 13-3
  testing database connectivity, 13-3
  user interface extensions, 13-3
Active Directory Users and Computers
  integration with Oracle objects in Active Directory, 13-2
Advanced Replication support
  data dictionary tables, 4-13
  initialization parameter requirements, 4-13
  tablespace requirements, 4-12, 4-13
alert logs
  monitoring a database, 6-1
  using, 6-8
application development
  finding information, 16-1
architecture
  thread-based, 1-1
archiving mode
  controlling, 5-12
  custom database, 5-12
  starter database, 5-12
archiving procedures
  for redo log files, 5-12
  UNC not allowed, 5-12
audit trail
  managing, 6-8
  operating system, 2-11
AUDIT_FILE_DEST, 6-8, 14-3
authentication
  automatically enabling during installation, 9-3
  enhancements, 9-2
  OSAUTH_PREFIX_DOMAIN parameter, 10-21
  overview, 9-1, 13-8
  using a password file, 5-9
  using Windows native authentication methods, 13-8
  using Windows native methods, 9-1
  viewing parameter settings, 10-8
Automatic Storage Management
  about, 1-1
auto-starting
  Oracle Database services, 5-3

B

background processes
  querying, 1-4
Backing up Database, 8-5
backup
  control files, 15-6
  databases, 3-10
Backup Wizard
  preferred tools, 2-2
block size
  maximum, 14-5
blocks for each file, maximum, 14-5

C

commands
  CREATE DATABASE, 3-7
  NET START, 3-8
  REGEDT32, 3-9
configuration parameters
  defined, 15-1
  LOCAL, C-2
  registry, defined, 15-1
  TNS_ADMIN, C-3
  USE_SHARED_SOCKET, C-3
configuring
  Named Pipes Protocol Adapter, C-3
  Oracle Spatial, 4-11
  Oracle Text, 4-10
CONNECT /AS SYSDBA
  connecting without a password, 9-3
  using, 5-4

connecting
LOCAL parameter, C-2
to a database, 5-4
control files
maximum size, 14-5
CREATE DATABASE command, 3-7
CREATE LIBRARY command, 16-6
custom database
archiving mode, 5-12

D

data dictionary
Advanced Replication tables, 4-13
Data Pump Export
starting, 2-7
Data Pump Import
starting, 2-7
database administrator privileges
for a single database on a computer, 10-18
for all databases on a computer, 10-3
Database Configuration Assistant
preferred tools, 2-2
registering a database object in a directory server, 13-3
starting, 2-6
database connection
error messages, D-19
database files
deleting, 3-5
database monitoring
using Oracle Counters for Windows Performance Monitor, 6-2
with alert logs, 6-8
with Event Viewer, 6-6
with trace files, 6-8
database operator privileges
for a single database on a computer, 10-19
for all databases on a computer, 10-4
database privileges
in Windows local groups, 10-27
database tools
operating system compatibility, 2-2
starting from the command line, 2-7
starting from the Start Menu, 2-5
starting in multiple Oracle Homes, 2-4
databases
backing up, 3-10
connecting to, 5-4
creating manually, 3-2
deleting, 3-5
exporting, 3-3
importing, 3-9
monitoring, 6-1
naming conventions, 3-1
password encryption, 5-11
shutting down, 5-4, 5-6
starting, 5-4
DBVERIFY
starting, 2-7
debugging external procedures, 16-9
developing applications
for Windows, 16-1
diagnostic and tuning utilities
for Windows, 2-13
directory servers
automatic discovery of directory servers, 13-2
features integrated with Oracle11*g*, 13-2
how Oracle directory objects display in Active Directory, 13-4
integration with Active Directory, 13-9
managing Access Control Lists, 13-12
requirements for using Oracle with Active Directory, 13-9
user interface extensions, 13-3
DisplayName parameter, C-2
DLLs
compared to UNIX shared libraries, E-3
displaying with Task List, 2-13
external procedures, 16-6
Oracle Counters for Windows Performance Monitor, 15-7
Oracle Real Application Clusters, 15-8
DNS-style naming convention, 13-9
Duplicating a Database, 8-12

E

encrypting, database passwords, 5-11
enhanced security, 4-6 to 4-9
error messages
DIM-00000 to DIM-00039, D-12
Intercartridge Exchange, 16-13
ORA-00256, 5-12
ORA-01102, 3-1
ORA-09275, D-1
ORA-09291, 5-12
ORA-12560, D-19
OSD-04000 to OSD-04099, D-4
OSD-04018, 5-12
OSD-04100 to OSD-04199, D-7
OSD-04200 to OSD-04299, D-8
OSD-04300 to OSD-04399, D-10
OSD-04400 to OSD-04499, D-11
OSD-04500 to OSD-04599, D-11
Event Viewer
blue (informational) icon, 6-6
defined, 2-11
for monitoring a database, 6-1
integration with Oracle Database, 2-11
logging operating system audit trail, 2-11
managing, 6-8
reading, 6-7
red (stop sign) icon, 6-6
starting, 2-9
using, 6-6
yellow (exclamation point) icon, 6-6
exception conditions, Intercartridge Exchange, 16-13
executable images
modifying, 1-4

EXECUTE privileges, on a PL/SQL library, 16-7
Export
  databases, 3-3
  interactive mode, 3-3
  parameter mode, 3-3, 3-4
  preferred tools, 2-2
  starting, 2-7
Export Wizard
  preferred tools, 2-2
extended partition
  defined, B-1
EXTERNAL clause, 16-7
external operating system users
  administering, 10-1, 10-20
  creating, 10-9, 10-21
external procedures
  building a DLL, 16-6
  creating a PL/SQL library, 16-6
  debugging, 16-9
  EXTERNAL clause, 16-7
  granting EXECUTE privileges, 16-7
  registering with Oracle Database, 16-6
  using EXTPROC, 16-5
  writing, 16-5
external roles
  administering, 10-1, 10-20
  creating, 10-15
external users
  administering, 10-1, 10-20
  creating, 10-9, 10-21
EXTPROC
  example, 16-5
  explained, 16-5
  responsibilities, 16-5

F

features
  4GT tuning, 1-7
  large user populations, 1-8
  Oracle PKI, 1-8
file I/O enhancements, 1-4
file permissions, 4-6 to 4-9
files
  maximum number for each database, 14-5
  maximum size possible, 14-5
  sample init.ora, 14-2
  trace, 6-8
FSEEK
  line terminators, 16-9

H

Hostname parameter, 6-2

I

ICX. *See* Intercartridge Exchange
ImagePath parameter, C-2
Import
  databases, 3-9
  parameter mode, 3-9
  preferred tools, 2-2
Import Wizard
  preferred tools, 2-2
initialization parameter file
  defined, 14-1
  editing, 14-2
  location, 14-2
initialization parameter requirements
  Advanced Replication Support, 4-13
initialization parameters
  OS_ROLES, 9-2
  path in registry, 15-3
instances
  modifying, 3-14
  Oracle Database, 1-2
  running multiple instances, 5-8
integration with Windows
  4GT tuning, 1-7
  Oracle Fail Safe, 1-9
  Oracle PKI, 1-8
  Oracle Services for MTS, 1-8
Intercartridge Exchange
  accessing Web data, 16-10
  configuring, 16-10
  error messages, 16-13
  exception conditions, 16-13
  packaged functions, 16-11
  stored packages, 16-11
  using, 16-11

K

keys
  defined, 15-1

L

Load Wizard
  preferred tools, 2-2
local database role
  creating, 10-13
local groups
  with database privileges, 10-27
LOCAL networking parameter, C-2
LOG_ARCHIVE_DEST_n, 5-12
logs
  alert, 6-8

M

mapped drives, 5-12
MAXDATAFILES, 3-6
memory usage, 7-4
Microsoft Certificate Services, 12-2
Microsoft Certificate Stores, 12-2
Microsoft Management Console
  defined, 2-11
  integration with Oracle Database, 2-11
  starting, 2-9
Microsoft ODBC Administration

starting, 2-6
Migration Utility
preferred tools, 2-2
MMC. *See* Microsoft Management Console
monitoring
alert logs, 6-1
Event Viewer, 6-1
Management Pack, 6-1
Oracle Counters for Windows Performance Monitor, 6-1
Oracle Database events, 2-12
trace files, 6-1
multiple instances, running, 5-8
multiple Oracle homes
service naming conventions, 5-1
multithreaded agent architecture, 16-8

N

Named Pipes Protocol Adapter
with an Oracle Names Server, C-3
naming conventions for multiple Oracle homes, 5-1
NET START command, 3-8
networking parameters
LOCAL, C-2
TNS_ADMIN, C-3
USE_SHARED_SOCKET, C-3
NTFS
file system permission setting, 4-6
NTS. *See* Windows native authentication

O

ObjectName parameter, C-2
OCOPY
and raw files, 1-4
preferred tools, 2-2
operating system authentication
automatically enabling during installation, 9-3
connecting as SYSDBA without a password, 9-3
OSAUTH_PREFIX_DOMAIN parameter, 10-21
operating systems
audit trail, 2-11
authentication overview, 9-1, 13-8
operfcfg
starting, 2-7
syntax examples, 15-14
ORA_DBA local group
adding users to, 9-3
Oracle Administration Assistant for Windows
adding a computer to the navigation tree, 10-2
connecting to a database, 10-5
creating a local database role, 10-13
creating an external operating system user, 10-9
creating an external role, 10-15
database connection issues, 10-6
defined, 2-12
granting administrator privileges, 10-18
granting operator privileges, 10-19
integration with Oracle Database, 2-12
managing remote computers, 10-2
saving a navigation tree configuration, 10-2
setting OS_AUTHENT_PREFIX, 10-8
starting, 2-6
using, 10-1, 15-11, 15-15
using the Oracle Counters for Windows Performance Monitor snap-in, 15-15
using the Oracle Home Configuration snap-in, 15-11
viewing authentication settings, 10-8
Oracle Counters for Windows Performance Monitor
accessing, 6-3
for monitoring a database, 6-1
Hostname parameter, 6-2
integration with Windows, E-2
parameters, 15-6
Password parameter, 6-2
registry information, 6-2
starting, 2-6, 2-9
troubleshooting information, 6-5
Username parameter, 6-2
using, 2-12, 6-2, 15-15
Oracle Database
connecting to, 5-4
password encryption, 5-11
shutting down, 5-4, 5-6
specifications, 14-5
starting, 5-4
Oracle Database services
auto-starting, 5-3
naming conventions for multiple Oracle homes, 5-1
shutting down a database, 5-6
starting, 5-2
stopping, 5-2
Oracle Database Upgrade Assistant
preferred tools, 2-2
Oracle Directory Manager
starting, 2-6
Oracle Enterprise Manager
Management Pack, 6-1
Oracle Enterprise Manager Console
preferred tools, 2-2
Oracle Home Configuration snap-in
using, 15-11
Oracle Locale Builder
starting, 2-6
Oracle Managed Files, 3-7
Oracle Migration Workbench
starting, 2-6
Oracle Names
Named Pipes Protocol Adapter, C-3
Oracle Net
configuring for external procedures, 16-5
Oracle Net Configuration Assistant
configuring Oracle software with a directory server, 13-2, 13-3
creating the Oracle schema, 13-5
starting, 2-6
Oracle Net directory naming

connecting to a database through a directory server, 13-9
Oracle Net Manager
starting, 2-6
Oracle public key infrastructure, 12-1
Oracle Real Application Clusters
registry values, 15-8
Oracle schema
creating with Oracle Net Configuration Assistant, 13-5
Oracle Spatial
configuring, 4-11
Oracle Text
configuring, 4-10
Oracle Wallet Manager, 11-2
starting, 2-6
Oracle Wallets, 11-1
storing in the registry, 11-1
storing private keys and trust points, 11-1
ORACLE_*SID*, 3-9, 5-8
OracleDBCreator security group
defined, 13-13
Oracle*HOME_NAME*ClientCache, C-1
Oracle*HOME_NAME*CMAdmin, C-1
Oracle*HOME_NAME*CMan, C-1
Oracle*HOME_NAME*TNSListener, C-2
Oracle*HOME_NAME*TNSListener service, C-3
OracleNetAdmins security group
defined, 13-13
ORADIM
command syntax errors, D-12
modifying an instance, 3-14
moving or copying password files, 5-10
preferred tools, 2-2
starting, 2-8
ORAPWD
creating password files, 5-9
starting, 2-8
OS_AUTHENT_PREFIX parameter
case insensitivity, 10-21
defined, 10-8
using, 10-21
OS_ROLES parameter
defined, 10-8
using with external roles, 9-2
OSAUTH_PREFIX_DOMAIN, 10-2, 10-21
OSAUTH_PREFIX_DOMAIN parameter, 10-21
Overview of Database Backup and Recovery with VSS, 8-1

P

packaged functions
Intercartridge Exchange, 16-11
UTL_HTTP.REQUEST, 16-11
UTL_HTTP.REQUEST_PIECES, 16-12
parameter mode
Export, 3-3, 3-4
Import, 3-9
parameters
AUDIT_FILE_DEST, 6-8
DisplayName, 15-8, C-2
Hostname, 6-2, 15-7
ImagePath, 15-8, C-2
INST_LOC, 15-6
LOCAL, C-2
LOG_ARCHIVE_DEST_n, 5-12
LOGFILE, 15-8
MSHELP_TOOLS, 15-2
NLS_LANG and Other Globalization Parameters, 15-3
ObjectName, 15-8, C-2
OO4O, 15-6
ORA_AFFINITY, 15-4
ORA_CWD, 15-3
ORA_*SID*_AUTOSTART, 15-3
ORA_*SID*_PFILE, 15-3
ORA_*SID*_SHUTDOWN, 15-3
ORA_*SID*_SHUTDOWN_TIMEOUT, 15-4
ORA_*SID*_SHUTDOWNTYPE, 15-4
Oracle Counters for Windows Performance Monitor, 15-14
ORACLE_BASE, 15-5
ORACLE_GROUP_NAME, 15-5
ORACLE_HOME, 15-5
ORACLE_HOME_KEY, 15-5
ORACLE_HOME_NAME, 15-5
ORACLE_PRIORITY, 15-5
ORACLE_*SID*, 3-9, 5-8, 15-5
OS_AUTHENT_PREFIX, 10-8
OS_ROLES, 10-8
OSAUTH_PREFIX_DOMAIN, 10-2, 10-21, 15-6
Password, 6-2
PERF_FILE_NAME, 15-8
RDBMS_ARCHIVE, 15-6
RDBMS_CONTROL, 15-6
REMOTE_LOGIN_PASSWORDFILE, 5-9
SQLPATH, 15-6
TNS_ADMIN, C-3
USE_SHARED_SOCKET, C-3
Username, 6-2, 15-7
partitions
extended, B-1
logical partition, B-2
physical disk, B-1
raw, B-1
password
encryption, 5-11
not needed with SYSDBA, 9-3
utility, 5-9
password file
authenticating database administrators, 5-9
creating, 5-9
hiding, 5-9
viewing, 5-10
Password parameter, 6-2, 15-7
PERFORMANCE key, 15-6
Performance Monitor
See Oracle Counters for Windows Performance Monitor

Performance Pack, monitoring a database, 6-1
PhysicalDrive, B-1
PL/SQL Embedded Gateway, 16-2
postinstallation
  setting NTFS file system permissions, 4-6
  setting Windows registry security, 4-8
PRAGMA RESTRICT_REFERENCES, with
    Intercartridge Exchange, 16-13
privileges
  in Windows local groups, 10-27
Process Explode, 2-13
Process Viewer, 2-13
PWD*SID*.ORA file, 5-9

R

raw files
  using, 1-4
raw partition
  defined, B-1
  logical partition, B-2
  overview, B-1
  physical disk, B-1
Recovery Manager
  preferred tools, 2-2
  starting, 2-8
Recovery Wizard
  preferred tools, 2-2
redo log files
  archiving, 5-12
REGEDT32 command, 3-9
registering an external procedure, 16-6
registry
  adding parameters, 15-9
  and Oracle Real Application Clusters, 15-8
  configuration parameters, defined, 15-1
  DisplayName, 15-8, C-2
  editor, 15-1
  editor, starting, 2-9
  Hostname, 6-2, 15-7
  ImagePath, 15-8, C-2
  INST_LOC, 15-6
  keys, defined, 15-1
  LOGFILE, 15-8
  modifying values, 15-8
  MSHELP_TOOLS, 15-2
  NLS_LANG and Other Globalization
      Parameters, 15-3
  ObjectName, 15-8, C-2
  OO4O, 15-6
  ORA_AFFINITY, 15-4
  ORA_CWD, 15-3
  ORA_*SID*_AUTOSTART, 15-3
  ORA_*SID*_PFILE, 15-3
  ORA_*SID*_SHUTDOWN, 15-3
  ORA_*SID*_SHUTDOWN_TIMEOUT, 15-4
  ORA_*SID*_SHUTDOWNTYPE, 15-4
  ORACLE_BASE, 15-5
  ORACLE_GROUP_NAME, 15-5
  ORACLE_HOME, 15-5
  ORACLE_HOME_KEY, 15-5
  ORACLE_HOME_NAME, 15-5
  ORACLE_PRIORITY, 15-5
  ORACLE_*SID*, 15-5
  Oracle*HOME_NAME*ClientCache, C-1
  Oracle*HOME_NAME*CMAdmin, C-1
  Oracle*HOME_NAME*CMan, C-1
  Oracle*HOME_NAME*TNSListener, C-2
  OSAUTH_PREFIX_DOMAIN, 10-21, 15-6
  Password, 6-2, 15-7
  PERF_FILE_NAME, 15-8
  PERFORMANCE key, 15-6
  RDBMS_ARCHIVE, 15-6
  RDBMS_CONTROL, 15-6
  REG_DWORD, 15-2, 15-10
  REG_EXPAND_SZ, 15-2, 15-10
  REG_MULTI_SZ, 15-2, 15-10
  REG_SZ, 15-2, 15-10
  REGEDT32, 15-8, 15-9
  setting security, 4-8
  SQLPATH, 15-6
  update ORACLE_SID, 3-9
  Username, 6-2, 15-7
  using operfcfg, 15-14
remote computers
  accessing database files, 5-12
  managing with Oracle Administration Assistant
      for Windows, 10-2
REMOTE_LOGIN_PASSWORDFILE, 5-9
requirements
  for using Oracle with Active Directory, 13-9
Restoring and Recovering a Database, 8-8
role authorization
  description, 9-2
  method enhancements, 9-2
roles
  creating, 10-15
  creating a local database role, 10-13

S

security groups
  adding and deleting members, 13-14
services, 5-1
  auto-starting, 5-3
  shutting down a database, 5-6
  starting, 3-6, 5-2
  stopping, 5-2
SET INSTANCE command, 10-26, 10-27
SET ORACLE_SID=SID, 5-8
Shared Server Process, 1-8
shutting down
  databases, 5-4, 5-6
snap-ins
  Oracle Counters for Windows Performance
      Monitor, 15-15
  Oracle Home Configuration, 15-11
SQL*Loader
  control file conventions, 2-10
  preferred tools, 2-2

starting, 2-8
SQL*Plus
connecting to a database through Active Directory, 13-3
preferred tools, 2-2
shutting down the database, 5-4
starting, 2-6, 2-8, 5-4
starting the database, 5-4
SQL*Plus Worksheet
preferred tools, 2-2
starting, 2-6
sqlnet.ora file
and Windows native authentication, 10-26, 10-27
location of, 10-26, 10-27
starter database
archiving mode, 5-12
starting
databases, 5-4
Oracle Counters for Windows Performance Monitor, 6-3
Oracle Database services, 5-2
SQL*Plus, 5-4
Steps of Backup and Recovery with VSS, 8-3
stopping, Oracle Database services, 5-2
stored packages, Intercartridge Exchange, 16-11
storing private keys and trust points
Oracle Wallets, 11-1
symbolic links
creating, B-4
SYSDBA privileges
connecting without a password, 9-3
for a single database on a computer, 10-18
for all databases on a computer, 10-3
SYSOPER privileges
for a single database on a computer, 10-19
for all databases on a computer, 10-4

T

tablespaces
Advanced Replication support, 4-12, 4-13
Task List, 2-13
Task Manager
starting, 2-9
using, 2-13
threads
and Microsoft Management Console, 2-11
and multiple Oracle Database instances, 1-2
and ORASTACK, 1-4
and shared server process, 1-8
and UNIX processes, E-5
defined, 1-1
optional and required, 1-2
process errors, D-3
processor affinity, 15-4
scheduling priority, 15-5
TKPROF
starting, 2-8
TNS_ADMIN networking parameter, C-3
tools, starting
Data Pump Export, 2-7
Data Pump Import, 2-7
Database Configuration Assistant, 2-6
DBVERIFY, 2-7
Event Viewer, 2-9
Export, 2-7
Microsoft Management Console, 2-9
Microsoft ODBC Administration, 2-6
operfcfg, 2-7
Oracle Administration Assistant for Windows, 2-6
Oracle Counters for Windows Performance Monitor, 2-6, 2-9
Oracle Directory Manager, 2-6
Oracle Locale Builder, 2-6
Oracle Migration Workbench, 2-6
Oracle Net Configuration Assistant, 2-6
Oracle Net Manager, 2-6
Oracle Wallet Manager, 2-6
ORADIM, 2-8
ORAPWD, 2-8
Recovery Manager, 2-8
Registry Editor, 2-9
SQL*Loader, 2-8
SQL*Plus, 2-6, 2-8
SQL*Plus Worksheet, 2-6
Task Manager, 2-9
TKPROF, 2-8
trace files
for monitoring a database, 6-1
using, 6-8
troubleshooting
ORA-12560 error, D-19
ORA-28575 error, D-19
TNS-12203 error, D-19
tuning Windows Server operating system, 7-1

U

UNC, 5-12
Universal Naming Convention, 5-12
UNIX
and Windows, Oracle Database differences, E-1
USE_SHARED_SOCKET networking parameter, C-3
user authentication
description, 9-2
enhancement methods, 9-2
Username parameter, 6-2
UTL_FILE
using, 16-9
UTL_HTTP.REQUEST, Intercartridge Exchange, 16-11
UTL_HTTP.REQUEST_PIECES, Intercartridge Exchange, 16-12

V

viewing
password file, 5-10

W

Wallet Resource Locator, 12-2
Web data, Intercartridge Exchange, 16-10
Windows
  and UNIX, Oracle Database differences, E-1
  diagnostic and tuning utilities, 2-13
Windows domains
  administering external users and roles, 10-1, 10-20
  basic features, 9-2
Windows local groups
  with database privileges, 9-3, 10-27
Windows native authentication
  benefits, 9-1, 13-8
  enhancements, 9-2
  installation of, 9-1, 13-8
  methods and use of, 9-1, 13-8
  overview, 9-1, 13-8
  role authorization enhancements, 9-2
  setting the sqlnet.ora file, 10-26, 10-27
  user and role requirements, 9-2
  user authentication enhancements, 9-2
Windows tuning
  applying latest service packs, 7-6
  closing unnecessary foreground applications, 7-9
  configuring server to be an application server, 7-4
  disable unnecessary services, 7-5
  foreground applications, 7-4
  multiple striped volumes for sequential and random access, 7-8
  overview, 7-1
  removing unused network protocols, 7-5
  resetting the network protocol bind order, 7-5
  using hardware and operating system striping, 7-7
Windows-specific
  audit trail, 6-7
  automatic database startup after restart, 5-3
  initialization parameter file, 14-1
  parameter file location, 14-2
  parameter filename and location, 14-1
  password filename and location, 5-9
  role syntax, 10-27
  trace file names, 6-8

X

X.500 naming convention, 13-9